The Sizewell C Project

9.11 Responses to the ExA's First Written Questions (ExQ1)
Volume 3 - Appendices
Part 3 of 7

Revision: 1.0

Applicable Regulation: Regulation 5(2)(o)

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Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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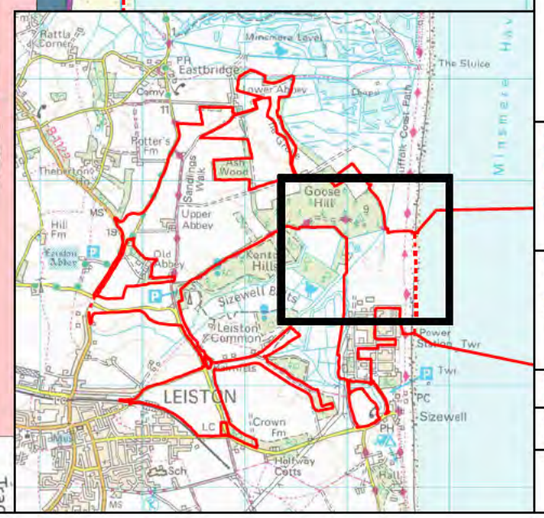
Walk Barn
Track
Dunwich Forest
Hilltop Covert
Goose Hill
9m
12m
Drain
FB
FBs
FR
Grimseys
LEISTON
Sizewell



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KEY

- SIZEWELL C MAIN DEVELOPMENT SITE BOUNDARY
- DEMARCATION LINE
- SIZEWELL MARSHES SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI) - CROSSING

NATIONAL VEGETATION COMMUNITIES

- M22 - JUNCUS SUBNODULOSUS-CIRSIUM PALUSTRE FEN-MEADOW
- M22B - JUNCUS SUBNODULOSUS-CIRSIUM PALUSTRE FEN-MEADOW, TYPICAL SUB-COMMUNITY
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- M23 - JUNCUS EFFUSES/ACUTIFLORUS – GALIUM PALUSTRE RUSH-PASTURE
- M23B - JUNCUS EFFUSUS/ACUTIFLORUS – GALIUM PALUSTRE RUSH PASTURE, JUNCUS EFFUSUS SUB-COMMUNITY
- MG10A - HOLCUS LANATUS-JUNCUS EFFUSUS RUSH-PASTURE, TYPICAL SUB-COMMUNITY
- S26 - PHRAGMITES AUSTRALIS-URTICA DIOICA TALL-HERB FEN
- S4A - PHRAGMITES AUSTRALIS-PEUCEDANUM PALUSTRIS TALL-HERB FEN, CAREX PANICULATA SUB-COMMUNITY
- SD12 - CAREX ARENARIA-FESTUCA OVINA-AGROSTIS CAPILLARIS DUNE GRASSLAND
- SD1A - RUMEX CRISPUS-GLAUCIUM FLAVUM SHINGLE COMMUNITY, TYPICAL SUB-COMMUNITY
- SD7 - AMMOPHILA ARENARIA-FESTUCA RUBRA SEMI-FIXED DUNE COMMUNITY
- SD8 - FESTUCA RUBRA-GALIUM VERUM FIXED DUNE GRASSLAND
- SCRUB
- U1D - FESTUCA OVINA-AGROSTIS CAPILLARIS-RUMEX ACETOSELLA GRASSLAND, ANTHOXANTHUM ODORATUM-LOTUS CORNICULATUS SUB-COMMUNITY
- VG1
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- W6A - ALNUS GLUTINOSA-URTICA DIOICA WOODLAND, TYPICAL SUB-COMMUNITY

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DOCUMENT:
SIZEWELL C PROJECT
RESPONSES TO EXAMINING AUTHORITY'S WRITTEN QUESTIONS ISSUED ON 21st APRIL 2021
CHAPTER 7: BIODIVERSITY AND ECOLOGY

DRAWING TITLE:
DISTRIBUTION OF VEGETATION COMMUNITIES FROM NVC SURVEY
SIZEWELL MARSHES SSSI CROSSING

DRAWING NO:
FIGURE 7.10

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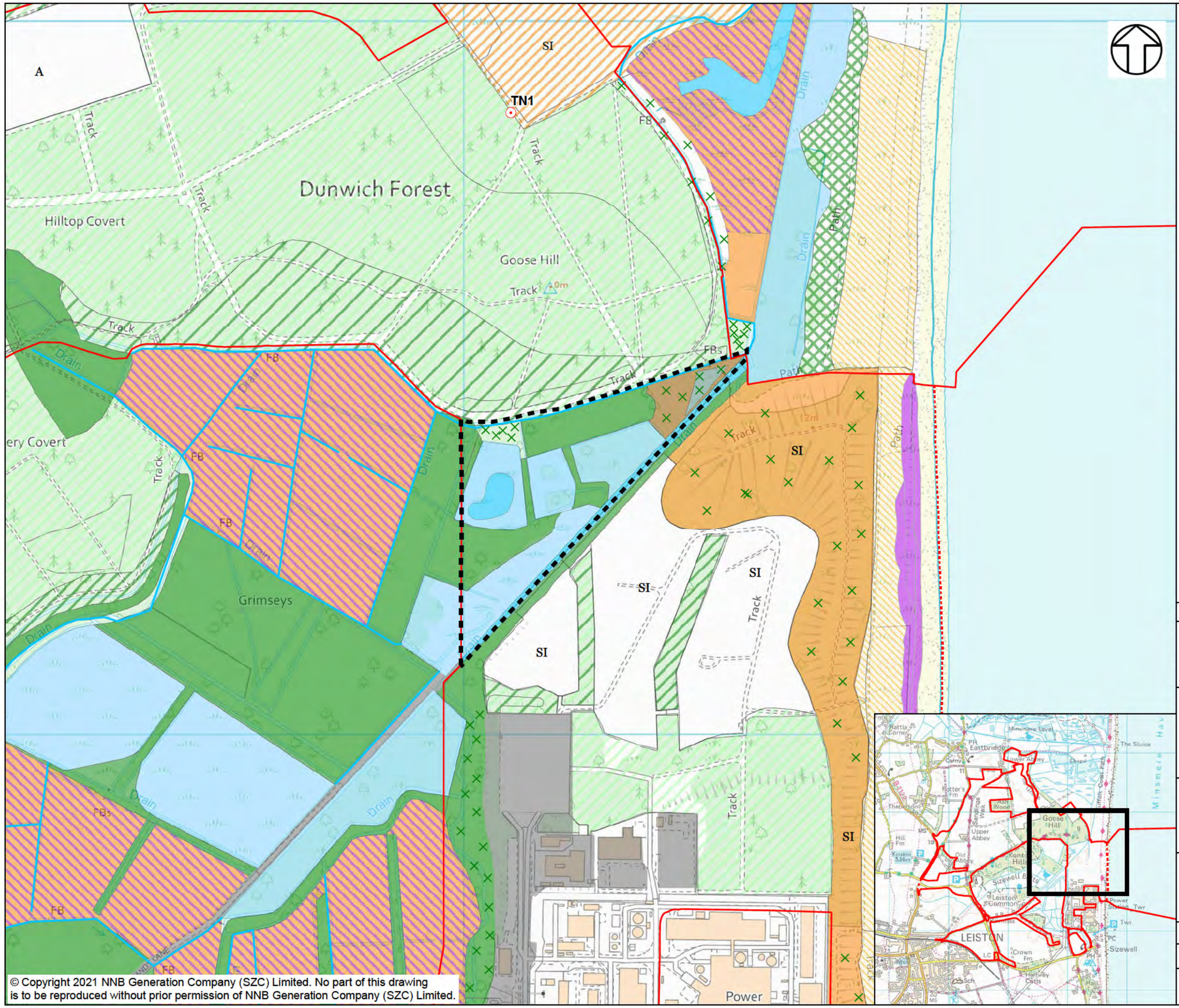

NOTES

KEY

- SIZEWELL C MA N DEVELOPMENT SITE BOUNDARY
- DEMARCATION LINE
- SIZEWELL MARSHES SITE OF SPECIAL SC ENTIFIC INTEREST (SSSI) - CROSSING
- SCATTERED SCRUB
- RUNNING WATER
- HARDSTANDING
- BROADLEAVED WOODLAND - SEMI-NATURAL
- BROADLEAVED WOODLAND - PLANTATION
- CON FEROUS WOODLAND - PLANTATION
- MIXED WOODLAND - PLANTATION
- SCRUB - DENSE/CONTINUOUS
- SI AC D GRASSLAND - SEMI-IMPROVED
- SI SEMI-IMPROVED NEUTRAL GRASSLAND
- MARSH/MARSHY GRASSLAND
- SI POOR SEMI-IMPROVED GRASSLAND
- BRACKEN - CONT NUOUS
- SWAMP
- STANDING WATER
- DUNE GRASSLAND
- A CULTIVATED/DISTURBED LAND - ARABLE
- VEGETATED SHINGLE

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SIZEWELL C PROJECT
RESPONSES TO EXAMINING AUTHORITY'S WRITTEN QUESTIONS ISSUED ON 21st APRIL 2021
CHAPTER 7: BIODIVERSITY AND ECOLOGY

DRAWING TITLE:
PHASE 1 HABITAT SURVEY
SIZEWELL MARSHES SSSI CROSSING

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FIGURE 7.11

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Southern Minsmere Levels (CWS)

Minsmere-Wa berswick Heaths and Marshes (SSSI)

Minsmere-Wa berswick (SPA)

Minsmere-Wa berswick (RAMSAR)

Minsmere to Walberswick Heaths & Marshes (SAC)

Outer Thames Estuary (SPA)

Sizewell Levels and Associated Areas (CWS)

Hilltop Covert

Goose Hill

Nursery Covert

Grimseys

Suffo k Shingle Beaches (CWS)

Sizewell Marshes (SSSI)

Reckham Pits wood (CWS)

Track

Drain

FB

FBs

12m

Path

Power

LEISTON

Sizewell

NOTES

KEY

- SIZEWELL C MAIN DEVELOPMENT SITE BOUNDARY
- DEMARCATION LINE
- SIZEWELL MARSHES SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI) - CROSSING
- COUNTY WILDLIFE SITE (CWS)
- SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)
- SPECIAL PROTECTION AREA (SPA)
- SPECIAL AREA OF CONSERVATION (SAC)
- RAMSAR SITE

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DOCUMENT:
SIZEWELL C PROJECT
RESPONSES TO EXAMINING AUTHORITY'S WRITTEN QUESTIONS ISSUED ON 21st APRIL 2021
CHAPTER 7: BIODIVERSITY AND ECOLOGY

DRAWING TITLE:
LOCATION OF INTERNATIONAL, NATIONAL STATUTORY AND NON-STATUTORY DESIGNATED SITES
SIZEWELL MARSHES SSSI CROSSING

DRAWING NO:
FIGURE 7.12

DATE:	DRAWN:	SCALE :	REV:
JUNE 2021	Y.G.	1:5,000 @A3	01

SCALE BAR
0 0.25 KM

APPENDIX 7F DETAILED RESPONSE TO QUESTION EXA REF. BIO.1.48

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1 RESPONSE TO QUESTION BIO. 1.48

1.1 Introduction

1.1.1 This paper sets out the SZC Co. Response to question ExA Ref. 1.48. This question is as follows:

"[APP-224], para 14.4.11, bullet 1. Marsh harrier foraging habitat.

Please will the Applicant set out the following in one document:

(a) The significance of the marsh harrier –this should cover policy, legal, ecological and any other relevant aspects

(b) How it is affected by the Proposed Development?

(c) the areas over which it forages over the Minsmere South Levels and Sizewell Marshes SSSI and any other areas where its foraging, breeding or other activities are likely to be affected by the proposed development

(d) where the permanent foraging habitat referred to in this bullet "is being established and enhanced within the northern part of the EDF Energy estate"

(e) the need for and role of any other areas for marsh harriers which are proposed (including Westleton)

(f) state clearly whether the fen meadow compensation areas at Halesworth and Benhall (and if the change request is accepted also at Pakenham) play any role in relation to the marsh harrier.

(g) How the SofS should decide whether the area at Westleton is required and whether its compulsory acquisition is justified. (In this regard the Applicant is also referred to the Secretary of State's decision letter on Hornsea Three, Section 6.)

(g) Any uncertainties over the success of replacement foraging (or other) areas for the marsh harrier and the probabilities of success

(h) conclusions in relation to the marsh harrier and the relevant policy, legal and ecological aspects.

(i) For the avoidance of doubt, this document should cover but not be limited to s.40 of the Natural Environment and Rural Communities Act 2008, s.28G

of the Wildlife and Countryside Act 1981, environmental assessment and the Habitats Regulations, EN-1 and EN-6".

1.2 SZC Co. Response

1.2.1 The following responses are provided in relation to each of the points raised by the ExA.

a) The significance of marsh harrier

1.2.2 Marsh harrier is a migrant or resident breeder in the UK, and also a passage visitor. The species has the following conservation designations and classifications:

- Listed on Annex I of the EU Birds Directive.
- Listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).
- Amber listed on the UK's Birds of Conservation Concern (due to recovery from historical decline and having a localised breeding population) (Eaton et al. 2015).
- Global status of Least Concern (BirdLife International 2021).

1.2.3 As a consequence of being an Annex I (of the EU Birds Directive) species, breeding marsh harrier is a qualifying feature of the following Special Protection Areas (SPAs) which have been screened into the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] for appropriate assessment:

- Minsmere-Walberswick SPA.
- Alde-Ore Estuary SPA.
- Benacre to Easton Bavents SPA.

1.2.4 Breeding marsh harrier is also part of the assemblages integral to certain of the qualification criteria for the following Ramsar sites:

- Minsmere-Walberswick Ramsar site – which qualifies under Ramsar criterion 2 on basis of supporting an important assemblage of rare breeding birds associated with marshland and reedbeds, including marsh harrier.

- Alde-Ore Estuary Ramsar site – which qualifies under Ramsar criterion 3 on basis of supporting a notable assemblage of breeding and wintering waterbirds.

1.2.5 Breeding marsh harrier is one of the species listed as forming part of the Minsmere to Walberswick Heaths and Marshes Site of Special Scientific Interest (SSSI) qualification.

1.2.6 The above designations and classifications mean that for the purposes of the EIA, breeding marsh harrier is classed as a receptor of International and High importance (under CIEEM guidelines and EIA-specific methodology, respectively), whilst wintering marsh harrier is classed as National and High importance. As a SPA qualifying feature, breeding marsh harrier is also considered within the Shadow HRA.

1.2.7 In terms of the population status of marsh harrier in the UK, it had disappeared as a breeding species by 1899 due to a combination of habitat loss (largely from drainage of the favoured wetland habitats) and persecution. Recolonisation began in the early twentieth century, with numbers increasing slowly to approximately 15 pairs by 1958. However, between 1959 and 1971 numbers declined again to a single breeding pair. After this, further recolonisation by birds from the Netherlands coupled with a reduction in persecution and in the use of organochlorine pesticides led to a rapid increase in the breeding population, with this continuing to current times (Underhill-Day 1984, Holloway 1996). Between 320 to 380 pairs were estimated to be breeding in the UK by 2006 – 2010, and between 590 – 695 pairs by 2016 (Musgrove et al. 2013, Woodward et al. 2020).

1.2.8 The recolonisation of the UK by marsh harrier has been centred on coastal habitats in Suffolk and Norfolk and, although now more widespread, these two counties remain a core part of the species' UK breeding distribution (Gibbons et al. 1993, Balmer et al. 2013). The species is strongly associated with wetland habitats for nesting and foraging, particularly reedbeds and coastal grazing marsh in the context of the UK population. However, the population increase and range expansion in the UK has been associated with an increasing use of arable habitats for both nesting and foraging (Underhill-Day 1998).

1.2.9 All three of the SPA populations of breeding marsh harrier considered in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] are in favourable condition (with each having 'maintain' objectives in relation to the SPA population size). Overall, these three SPA populations represent approximately 5% of the UK population of breeding marsh harrier. Of these three SPAs, the Minsmere-Walberswick SPA (and Ramsar site) holds the

largest population, with 17 breeding pairs in 2018. This population has shown small to moderate fluctuations in size over the last 10 – 15 years, with details provided in Table 6.6 of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145].

b) Effects of the proposed development

1.2.10 Potential effects of the proposed development are identified in relation to the Minsmere-Walberswick SPA (and Ramsar site) population of breeding marsh harrier.

1.2.11 Section 8.8 d) v. (at paragraph 8.8.557) of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] concludes that the possibility of an adverse effect on this SPA population resulting from noise and visual disturbance associated with the construction activities at the main development site cannot be discounted. The potential for this effect on the SPA population arises from precautionary predictions concerning the displacement (and exclusion as a result of a possible barrier effect) of marsh harrier from foraging habitat that is functionally linked to the Minsmere-Walberswick SPA. No displacement of foraging marsh harrier from habitat within the SPA itself is predicted, nor are there any predicted effects on birds at the nesting areas within the SPA.

1.2.12 The foraging habitat potentially 'lost' to the SPA marsh harrier population occurs within the likely foraging range of those birds which use the nesting area at the RSPB Minsmere Reserve (as opposed to the Hen Reedbed and Walberswick National Nature Reserve nesting areas). This represents approximately 50% of the SPA population. Based on the Project survey data and associated calculations, approximately 23% of the foraging habitat available to these birds is predicted to be potentially 'lost' (including c.20% of the wetland habitat). The value of the foraging resource is higher for wetland habitats than for arable habitats, and also declines with increasing distance from the nesting area. Consequently, this 'loss' of foraging habitat equates to c.19 – 20% of the total foraging resource (and c.15% of the foraging resource on wetland habitats) available to the birds which use the Minsmere nesting area.

1.2.13 On a precautionary basis, it is considered possible that a 'loss' of this scale in the foraging resource could lead to a reduction in the breeding productivity of the marsh harriers which use the Minsmere nesting area, and that over the full duration of the construction period (c.10 years) this decreased breeding productivity could, conceivably, lead to a reduction in the SPA population size. The potential for this reduction in breeding productivity is limited to the construction period.

1.2.14 Importantly, these conclusions are based upon the modelled (peak instantaneous) noise levels for the worst-case phases of construction, but these will not actually extend over the full duration of the construction period. In addition, the conclusions with regard to the 'loss' of the foraging resource assume exclusion of foraging marsh harrier from the entire extent of the Sizewell Marshes SSSI due to the operation of a barrier effect (see paragraph 1.2.16), which again is a highly precautionary assumption. Thus, the likelihood that the predicted adverse effect on the Minsmere-Walberswick SPA (and Ramsar site) breeding marsh harrier population will actually occur is considered to be low.

c) Foraging areas predicted to be affected by noise and visual disturbance

1.2.15 The development is predicted to have potential impacts on the Minsmere-Walberswick SPA (and Ramsar site) population of marsh harrier only via effects on the foraging birds using functionally linked habitat (as described in (b) above). No effects are predicted on any other activities beyond foraging.

i. The Minsmere South Levels and Sizewell Marshes SSSI

1.2.16 The Minsmere South Levels and Sizewell Marshes SSSI comprise largely coastal grazing marsh and (in the case of the Sizewell Marshes) also reedbed habitats that are regarded as being of high suitability to foraging marsh harrier. It is assumed that marsh harrier forage over all of the coastal grazing marsh and reedbed habitats within the Minsmere South Levels and the Sizewell Marshes SSSI, all of which occur within 4km of the Minsmere nesting area (and hence are likely to be within the foraging range of these birds). The baseline survey data on marsh harrier flight activity support this assumption, showing flight activity over most of the Minsmere South Levels, and within all of sample plots in the Sizewell Marshes SSSI (see Figures 6.3 to 6.5 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]).

1.2.17 The noise threshold and zone of potential visual impact at which displacement of foraging marsh harrier is predicted to potentially occur each extend over a small part of the southern area of the Minsmere South Levels and over a more substantial part of the Sizewell Marshes SSSI (see Figure 8.10 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]). However, it is assumed (on a precautionary basis) that the high noise levels occurring within the main development site during construction will act as a barrier effect and prevent marsh harrier from the Minsmere nesting area from accessing any parts of the Sizewell Marshes SSSI. Therefore, all of the coastal grazing marsh and reedbed habitats within the Sizewell Marshes

SSSI are assumed to be 'lost' to foraging marsh harrier during the construction period.

1.2.18 Overall, adopting a highly precautionary approach to assessment, it is predicted that marsh harrier would be displaced (or excluded due to the barrier effect) from a total of approximately 104ha of coastal grazing marsh and reedbed habitats (see Table 8.12 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]), of which 78ha occurs in the Sizewell Marshes SSSI. This 104ha is estimated to represent approximately 20% of the wetland habitat (i.e. coastal grazing marsh and reedbed) within the likely foraging range of marsh harrier using the Minsmere nesting area.

ii. Arable habitats

1.2.19 Marsh harrier will also forage over arable habitats although these are generally regarded as a 'secondary' foraging habitat and are considered less suitable for foraging than the wetland habitats described above (and as found in the Minsmere South Levels and Sizewell Marshes SSSI). This position is supported by the baseline survey data on marsh harrier flight activity, with the levels of flight activity recorded over sample plots of arable habitat in the vicinity of the main development site being lower than the those recorded over the Minsmere South Levels and (overall) the Sizewell Marshes SSSI (see Tables 6.7 and 6.8 and paragraph 6.3.87 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]).

1.2.20 The noise threshold and zone of potential visual impact at which displacement of foraging marsh harrier is predicted to occur each extend over areas of arable habitats that are within the vicinity of the main development site. Consequently, it is predicted that marsh harrier would potentially be displaced from a total of approximately 260ha of arable habitats, representing c.24% of the arable habitats within the likely foraging range (i.e. 4km) of the Minsmere marsh harrier nesting area (see Table 8.12 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]).

d) Location of the permanent foraging habitat that is to be established

1.2.21 The permanent foraging habitat for marsh harrier within the EDF Energy estate is an area of 48.7ha that lies immediately to the north-east of the main development site. This habitat is also well located adjacent to the western boundary of the Minsmere South Levels (as defined by the Minsmere-Walberswick Heaths and Marshes SSSI), which is the part of the Minsmere South Levels in which highest levels of marsh harrier flight activity tended to be recorded during the baseline surveys (see Figures 6.3 – 6.5 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]).

1.2.22 The location of this permanent foraging area within the EDF Energy estate is shown in Figures 8.2 to 8.6, 8.9 and 8.10 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]). Additional details of this area, including the establishment to date and the inclusion of new wetlands, are provided in the answers to Bio 1.105, Bio 1.106, Bio 1.107 and Bio 1.108.

1.2.23 The permanent foraging habitat within the EDF Energy estate was taken out of agricultural production approximately 4 years ago and some habitat management – for the purposes of creating compensatory foraging habitats for marsh harriers – has been implemented in the intervening period and is ongoing. Further habitat enhancement, including scrub and hedgerow planting was undertaken in early 2020, and further enhancement and management is proposed.

1.2.24 The habitat proposals were revised as part of the changes to the application in January 2021 to include transforming 10% of the compensation area to wetland, which represents a positive enhancement given the high suitability of wetland habitats for foraging marsh harriers. Therefore, the wetland creation will augment the previously proposed management that was focussed solely on enhancing prey abundance and availability on 'dry' habitats. The high suitability of wetland habitats for foraging marsh harriers is a point recognised throughout the discussions on the design of the permanent compensation area within the EDF Energy estate and acknowledged by Natural England in its relevant representation.

1.2.25 The **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] is highly precautionary in assessing the extent of the foraging resource which could be 'lost', both in terms of the area affected and the assumed duration over the entire construction period. This is because the conclusions are based on modelled noise levels for the worst-case phases of construction which will not actually extend over the full (approximately) 10 year period. The potential displacement and barrier effect occur on habitats which are functionally linked to the SPA, as opposed to any habitats within the Minsmere-Walberswick SPA and Ramsar site itself.

1.2.26 The area of permanent compensatory foraging habitat within the EDF Energy estate is relatively close to the Minsmere nesting area (<1 – 2km) and adjacent to those parts of the Minsmere South Levels most heavily used by foraging marsh harrier (as determined from the baseline surveys on marsh harrier flight activity – see Figures 6.3 – 6.5 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]). The permanent foraging habitat within the EDF Energy estate is also substantially closer to the Minsmere nesting area than the foraging areas on Sizewell Marshes SSSI. Therefore, provided the habitat management which is imposed within this area is

successful in increasing prey abundance and availability (which, as noted above, SZC Co. believes will be the case), the area is likely to be heavily used by foraging marsh harrier (and hence would compensate for the losses which could occur on the basis of the conclusions of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] (see paragraphs 8.8.245 – 8.8.260)).

e) The need for, and role of, any other areas for marsh harrier

1.2.27 Calculations undertaken and described in paragraphs 8.8.247 – 8.8.255 of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] provide an indication of the foraging resource that needs to be available from the permanent foraging habitat within the EDF estate in order to compensate for the potential 'loss' of the key wetland foraging habitats. *If* the displacement and barrier effects operate to the full extent assumed within the Shadow HRA, it is estimated that an approximate fourfold increase in the foraging resource on the permanent foraging habitat within the EDF estate is required. As indicated in the response to d) above, the assessment is considered highly precautionary and the scale of this requirement obviously declines if the potential displacement and barrier effects are assumed to operate only partially (see Table 8.15 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]).

1.2.28 As outlined in the response to d) above, the permanent foraging habitat within the EDF estate is adjacent to those parts of the Minsmere South Levels where the highest levels of marsh harrier flight activity tended to be recorded during the baseline surveys. These levels of flight activity tend to be greater than what is estimated to be required on the permanent foraging habitat within the EDF estate (as detailed in paragraphs 8.8.247 – 8.8.255 of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]). Therefore, on the basis that the habitat management which is being implemented on the permanent foraging habitat within the EDF estate is expected to substantially increase prey abundance and availability, it is considered that this will provide sufficient compensatory habitat for the 'loss' of the foraging resource which is predicted (under highly precautionary assumptions) to occur on the key wetland habitats.

1.2.29 As set out in the **Shadow HRA Report Volume 4: Compensatory Measures** (Doc Ref. 5.10) [APP-152], the permanent foraging habitat within the EDF Energy estate is considered to represent sufficient and appropriate compensation and meets the criteria defined in NPS EN-6, namely that it must be:

- appropriate for the area and the loss caused by the project;

- capable of protecting the overall coherence of the Natura 2000 [national site] network;
- capable of implementation;
- capable of ensuring that the Natura 2000 [national site] site is not irreversibly affected by the project before the compensation is in place;
- directed in measurable proportions to the habitats and species negatively affected;
- related to the same biogeographical region (within the UK);
- serves functions that are comparable to those that motivated the original area's submission for designation; and
- clearly defined, with implementation goals and managed so that the compensatory measures can achieve the goal of maintaining or improving the overall coherence of the Natura 2000 [national site] network.

1.2.30 Given the position set out above, SZC Co. does not consider that there is a need for any other areas of habitat in order to provide sufficient compensatory measures for breeding marsh harrier. Nevertheless, some Interested Parties have expressed a view that the 48.7ha of permanent foraging habitat may not be sufficient and, therefore, that additional foraging habitat is required.

1.2.31 Whilst for the reasons summarised above the Applicant considers that the 48.7ha of permanent foraging habitat provides sufficient compensatory habitat, the Applicant is mindful of the position of certain Interested Parties on this matter and has therefore included in its Application (on a "without prejudice" basis) Work No. 8 (Marsh Harrier Habitat, Westleton) which would provide further compensatory habitat if required. This additional compensation area has been included in the Application in order that the ExA has evidence of *possible* further compensatory habitat measures which can be secured and delivered via the DCO if required.

1.2.32 Should the Secretary of State agree with the Applicant's position that whilst an adverse effect on integrity on the Minsmere-Walberswick SPA cannot be excluded, the 48.7ha of permanent foraging habitat within the EDF Energy estate constitutes sufficient and appropriate compensatory measures, the additional land at Westleton would not be required. In those circumstances the Applicant would expect the Secretary of State to omit

Work No. 8 (Marsh Harrier Habitat, Westleton) from the DCO, and not to include powers for the compulsory acquisition of that land. However, if – notwithstanding the assessment provided by the Applicant - the Secretary of State finds that the 48.7ha of permanent foraging habitat within the EDF Energy estate does not constitute sufficient compensation, the inclusion of the additional land at Westleton would ensure that the DCO provides adequate compensatory habitat provision.

1.2.33 The above approach is in accordance with the Secretary of State's guidance set out in the Hornsea Three Offshore Wind Farm decision letter of 31 December 2020 which is set out in further detail below in the response to part (g) of this question.

1.2.34 The proposed role of the Secretary of State in determining whether there is a requirement for additional areas of habitat to be provided for foraging marsh harrier is explained in (g) below.

1.2.35 While not proposed specifically as a habitat for marsh harrier, and not taken into account in the conclusions of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145], the new Aldhurst Farm reedbeds are relevant in the EIA context and have supported breeding marsh harriers since 2019 and the new habitats have helped to increase the local population. This is likely to increase the resilience of the local population to any possible adverse impacts of construction of Sizewell C.

f) Role of the fen meadow compensation areas at Halesworth, Benhall and (potentially) Pakenham

1.2.36 The fen meadow compensation areas do not play a role in relation to compensatory habitats for marsh harrier.

g) SoS decision on requirement for the Westleton area and compulsory acquisition justification

1.2.37 As explained in response to point e) above and in the answer to Bio. 1.189, the Westleton area is only included within the application to cater for the possibility that the Secretary of State might conclude that further marsh harrier compensatory habitat is required in addition to the permanent foraging habitat within the EDF Energy estate as described above in the response to point (d) and in the **Shadow HRA Report Volume 4: Compensatory Measures** (Doc Ref. 5.10) [APP-152].

1.2.38 The Applicant's position is that sufficient compensatory habitat is provided within the EDF Energy estate, particularly with the inclusion of the wetland component (see response to point (e) above), such that adequate

compensation is proposed and will be in place to offset any potential effect on breeding marsh harrier population. If the Secretary of State agrees with the Applicant, it would follow that the area of additional land at Westleton is not required. In those circumstances the Applicant would expect the Secretary of State to omit Work No. 8 (Marsh Harrier Habitat, Westleton) from the DCO and not to include powers for the compulsory acquisition of that land.

1.2.39 However, the Applicant has also taken appropriate steps to address the possibility that the Secretary of State may ultimately take a different view, namely by including within the dDCO the option of creating additional compensatory habitat at Westleton and the powers of compulsory acquisition needed to obtain control of the necessary land. Provisions are also included in the Draft Deed of Obligation (REP1-007) to secure the delivery of the additional compensatory habitat at Westleton which are conditional on a conclusion by the Secretary of State that the land is required. In doing so it has sought to avoid the difficulty that arose in the Hornsea Three Offshore Wind Farm case where the Applicant argued that it was not necessary to identify compensatory measures and that *"if the Secretary of State were to conclude that compensatory measures were required, there would be a legitimate expectation that it would have an opportunity to make submissions on the matter and to enter into discussions with Natural England and the Secretary of State before a decision was made"* (Decision Letter paragraph 6.2).

1.2.40 As the Secretary of State explained in the Decision Letter in that case, that is not an appropriate assumption to make and instead it should be assumed he will make decisions on such evidence as is in front of him following his receipt of the ExA's report (paragraph 6.3).

1.2.41 In that context, the Secretary of State offered the following helpful guidance to Applicants:

"[…] 6.4 This does not mean that it is necessary for Applicants to agree with SNCBs if SNCBs consider that there would be significant adverse impacts on designated sites. The final decision on such matters remains for the Secretary of State (though the Secretary of State reserves the right not to request further evidence from Applicants following the examination). Applicants should be assured that where they disagree with SNCBs and maintain a position that there are no significant adverse impacts, but provide evidence of possible compensatory measures for consideration at the examination on a "without prejudice" basis, both the ExA in the examination and the Secretary of State in the decision period will give full and proper consideration to the question of whether there are or are not

significant adverse impacts. It will not be assumed that the provision of information regarding possible compensatory measures signifies agreement as to the existence of significant adverse impacts. The ExA will be required to provide an opinion on the sufficiency of the proposed compensation even if it considers that compensation is not required (in case the Secretary of State disagrees with that conclusion), but such measures would only be required if the Secretary of State were to find that there would be significant adverse impacts (and that the proposed compensatory measures are appropriate)."

1.2.42 The approach adopted by the Applicant in this case is fully in accordance with that guidance. In summary, the Applicant considers it prudent to include the area at Westleton in the Application on a "without prejudice" basis to enable both the ExA in the examination and the Secretary of State in the decision period to give full and proper consideration to the question of whether sufficient compensatory habitat is provided within the EDF Energy estate, and to secure the delivery of additional compensatory habitat if it is judged to be required.

1.2.43 Should the Secretary of State, having considered all of the evidence included in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] and associated documents (e.g. **Shadow HRA Report Volume 4: Compensatory Measures** (Doc Ref. 5.10) [APP-152]), agree with the Applicant's position on this matter then there is no need for the additional compensation land at Westleton and compulsory acquisition would not be required (nor justified).

1.2.44 However, if the Secretary of State considers that this additional compensation land is required to address the precautionary predictions in the Shadow HRA concerning the potential 'loss' of the foraging resource available to the Minsmere to Walberswick SPA and Ramsar site breeding marsh harrier population, the Applicant considers that compulsory acquisition is justified. The Applicant sets out the reasons why in those circumstances it considers compulsory acquisition would be justified on a without prejudice basis below.

1.2.45 Under Section 122 of the Planning Act 2008, a DCO which includes compulsory acquisition powers may be granted only if the conditions in Sections 122(2) and 122(3) of the Act are met. The conditions to be met are:

a) Section 122(2): that the land is required for the development to which the DCO relates or is required to facilitate the development to which the

DCO relates, or is replacement land which is to be given in exchange for the order land; and.

b) Section 122(3): there is a compelling case in the public interest for the land to be acquired compulsorily.

1.2.46 The Statement of Reasons [APP-062] sets out the factors that the Applicant considers demonstrate that the conditions in Section 122 of the Planning Act 2008, having regard to the Compulsory Acquisition Guidance, are satisfied (including in respect of the additional compensation land at Westleton).

1.2.47 In summary, the following reasons demonstrate the additional compensation land at Westleton is required to facilitate the Sizewell C Project and there is a compelling case in the public interest for the land to be acquired compulsorily:

a) The additional compensation land at Westleton would have been found to be necessary to provide the additional foraging habitat to compensate for the impacts of the Sizewell C Project;

b) The Sizewell C Project would deliver substantial public interest benefits at a national level to meet the urgent need for energy generation. The public benefits derived as a result of providing adequate marsh harrier foraging habitat in order to facilitate the Sizewell C Project would outweigh the adverse impacts on the interests of those who would be affected by the proposed use of compulsory acquisition powers. Appropriate compensation would be available to those entitled to claim it under the relevant provisions of the national Compensation Code;

c) The proposed interference with the rights of those with an interest in the land would be for a legitimate purpose and both necessary and proportionate;

d) The Applicant has a clear idea of how it intends to use the land which it is proposed to acquire;

e) There is a reasonable prospect that the requisite funds for the acquisition will become available and the purposes for which compulsory acquisition of land powers are included in the DCO are legitimate and are sufficient to justify interfering with the human rights of those with an interest in the land affected;

f) The Applicant has undertaken a detailed site selection process (Appendix 8.4A Site Selection Report to the Planning Statement (Doc Ref.

8.4AD) which demonstrates that the land included in the Application best meets the site selection criteria in respect of the ability to provide foraging marsh harrier habitat.

1.2.48 For the reasons set out in Statement of Reasons [APP-062] and above, the Applicant considers that the public benefits of the scheme, particularly the delivery of new nuclear power generating capacity, could only be realised with the use of compulsory acquisition powers. The public benefits are overwhelmingly greater than the private loss that would be suffered by those whose land is to be acquired, and there is a compelling case in the public interest for the land to be acquired compulsorily, if in fact the Secretary of State considers that this additional compensation land is required to address the precautionary predictions in the Shadow HRA concerning the potential 'loss' of the foraging resource available to the Minsmere to Walberswick SPA and Ramsar site breeding marsh harrier population

g) Uncertainties over success of replacement foraging areas for marsh harrier and the probabilities of success [Noting that both this and the above question are identified as point 'g' in the ExA's question]

1.2.49 There is a high level of confidence that the permanent foraging habitat within the EDF Energy estate as described above in the response to point (d) would be successful (i.e. sufficient to compensate for the potential 'loss' of the marsh harrier foraging resource). There are two main reasons for this conclusion which are set out below.

1.2.50 Firstly, on the basis of the established habitat preferences of small mammals, rabbits and breeding birds (i.e. the marsh harrier prey-types which are targeted by the management of the 'dry' habitats on the compensation area), the habitat management within the permanent foraging habitat within the EDF Energy estate is likely to increase both the abundance and availability of marsh harrier prey. The predicted effect on these aspects is detailed in sections 3.2 and 3.3 of the **Shadow HRA Report: Compensatory Measures** (Doc Ref. 5.10) [APP-152], which indicate that the abundance of these different prey-types is expected to increase several fold whilst the selected habitat management options are those which are expected to maximise the availability of these prey-types.

1.2.51 In addition, as described in response to HRA.1.8, 10% of the compensation area would be transformed to wetland, which adds further to the confidence in the delivery of increased prey abundance and availability within the compensation area. This is a positive enhancement of the previously proposed design reported in **ES Chapter 14 Terrestrial Ecology and**

Ornithology Appendix 14C5 Marsh Harrier Mitigation Area Feasibility Report (Doc Ref. 6.3) [APP-259] given the high suitability of wetland habitats for foraging marsh harriers (as detailed in the response to point (c) above). Therefore, the wetland creation will augment the previously proposed management that was focussed solely on enhancing prey abundance and availability on 'dry' habitat. This is shown on Figure 3.1 of the **Marsh Harrier Compensation Area Design Update** report (Doc Ref. 9.19), submitted at Deadline 2 and explained further in the answer to Bio 1.105.

1.2.52 Secondly, the compensation area is located in close proximity to the Minsmere nesting area and is adjacent to those parts of the Minsmere South Levels which are most heavily used by foraging marsh harriers. The effect of proximity of foraging areas to the nesting area at Minsmere on marsh harrier flight activity is detailed in section 3.4 b) of the **Shadow HRA Report: Compensatory Measures** (Doc Ref. 5.10) [APP-152] and can be determined by examination of the baseline survey data on marsh harrier flight activity - see Figures 6.3 – 6.5 in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145]).

1.2.53 A suite of monitoring is proposed, including monitoring of key prey species and marsh harrier flight activity within the compensation area and these are defined in the terrestrial Ecology Monitoring and Mitigation Plan (TEMMP), secured in Requirement 4. The monitoring is expected to verify the predictions made in the **Shadow HRA Report: Compensatory Measures** (Doc Ref. 5.10) [APP-152] and the **Marsh Harrier Compensation Area Design Update** report (Doc Ref. 9.19).

h) Conclusions in relation to marsh harrier

1.2.54 An adverse effect on the Minsmere-Walberswick SPA and Ramsar site breeding marsh harrier population as a result of noise and visual disturbance from construction activities at the main development site cannot be discounted. As outlined above (paragraph 1.2.13 and as set out in response to point (c)), this conclusion is based upon a highly precautionary assessment of the potential effects of this disturbance on foraging marsh harrier using habitat that is functionally linked to the SPA and Ramsar site.

1.2.55 As a consequence of this conclusion, compensation is proposed in the form of habitat management to increase the abundance and availability of marsh harrier prey species on a 48.7ha area of land within the EDF Energy estate. This 'habitat improvement' area is relatively close to the marsh harrier nesting area at Minsmere and adjacent to areas of wetland habitat which

are already heavily used by foraging marsh harrier. Therefore, the proximity and the increases in prey abundance and availability in this area are highly likely to result in a response from foraging marsh harrier. This supports the conclusion that the foraging resources available to breeding marsh harrier will not become limited as a result of the Project and, consequently, that appropriate compensatory measures can be provided.

1.2.56 **Table 1.1** draws conclusions on the relevant policy, legal and ecological aspects in relation to marsh harrier, including those areas referred in point (i).

Table 1.1 Conclusions Regarding Policy, Legal And Ecological Assessment Of Relevance To Marsh Harrier

Policy, Legal or Ecological Test	Concluding Statement
Section 40 of the Natural Environment and Rural Communities (NERC) Act 2008	Section 40 of the NERC Act 2008 (specifically sub-section 1) requires that *"The public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity"*. Sub-section 3 of Section 40 notes that *"Conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat"*. All three of the SPA populations of breeding marsh harrier are in favourable condition and have 'maintain' objectives in relation to the SPA population size. The approach taken to the assessment of potential effects of the Sizewell C Project on marsh harrier (including the highly precautionary basis of the assessment) and the provision of sufficient and appropriate permanent compensatory habitat within the EDF Energy estate will assist in conserving biodiversity. As such, they are matters to which the Secretary of State should have regard in complying with the duties of Section 40 of the NERC Act 2008.

Policy, Legal or Ecological Test	Concluding Statement
	In addition to providing compensatory measures in accordance with the requirements of the Habitats Regulations, the new Aldhurst Farm reedbeds are relevant in the EIA context and the new habitats have helped to increase the local breeding marsh harrier population.
Section 28G of the Wildlife and Countryside Act 1981	The duty on the Secretary of State in accordance with Section 28G of the Wildlife and Countryside Act 1981 is *"to take reasonable steps, consistent with the proper exercise of the authority's functions, to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is of special scientific interest".* Breeding marsh harrier is one of the species listed as forming part of the Minsmere to Walberswick Heaths and Marshes SSSI qualification. The provision of compensatory habitat as proposed would (at least) further the conservation of that species, consistent with this duty.
EN-1	The policy expectations with regard to EIA and HRA are set out in Sections 4.2 and 4.3 respectively. Section 4.2 of EN-1 refers to satisfying the requirements of the EIA Directive and *"ensuring that likely significant effects, including any significant residual effects taking account of any proposed mitigation measures or any adverse effects of those measures, have been adequately assessed".* Section 4.3 of EN-1 refers to the need to ensure that the assessment process as required by the Habitats Regulations is appropriately followed. Paragraphs 5.3.3 and 5.3.4 set out procedural requirements of the Applicant's assessment. Of

Policy, Legal or Ecological Test	Concluding Statement
	relevance to marsh harrier, Paragraph 5.3.3 states that *"...the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity".* Paragraph 5.3.4 adds that *"The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests".* EN-1 sets out a number of substantive policy requirements that are relevant to marsh harrier, notably at paragraphs 5.3.7, 5.3.9, 5.3.17, 5,3,18 and 5.3.19. The approach adopted to the assessment of marsh harrier in the EIA and HRA is in accordance with these policy requirements. It is concluded that the policy expectations of EN-1 have been satisfied in respect of marsh harrier.
EN-6	With respect to biodiversity, EN-6 largely refers to the generic requirements of EN-1 (see above). Paragraph 3.9.6 of EN-6 states that *"the Nuclear Appraisal of Sustainability (AoS) and HRA have identified possible mitigation options. These include variations to building layout to avoid ecologically sensitive areas and on-site measures to protect habitats and species and to avoid or minimise pollution and the disturbance of wildlife."* Mitigation options and seeking alternative means of reducing or avoiding adverse effects on marsh harrier have been examined through the HRA process, with approriate compensatory measures provided.

Policy, Legal or Ecological Test	Concluding Statement
	It is concluded that the policy expectations of EN-6 have been satisfied in respect of marsh harrier.
EIA Regulations and Habitats Regulations	Both the requirements of the EIA Regulations (via the EIA process) and the Habitats Regulations (via the Shadow HRA process) have been fulfilled with respect to the assessment of potential effects on marsh harrier. The policy expectations of both the EIA and HRA processes are captured within EN-1, which is analysed above insofar as it is relevant to consideration of marsh harrier as part of these assessment processes.

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APPENDIX 7G DETAILED RESPONSE TO QUESTION EXA REF. BIO.1.75

CONTENTS

TABLES

None Provided.

PLATES

FIGURES

None Provided.

APPENDICES

None Provided,

1 EXA BIO.1.75:

1.1.1 [APP-224] para 14.7.233 – effects of coastal processes on Minsmere European Site. Please will the Applicant unpack and explain this paragraph in a short note. How does the exposure of the HCDF disrupt longshore sediment transport so as to affect Minsmere? How does natural shoreline regression erode Minsmere? If the exposure of the HCDF affects the shoreline regression at Minsmere (which appears to be the case from the statement that "*shoreline regression would eventually expose the HCDF and that during the later stages of station operation this may disrupt longshore sediment transport. Additional mitigation measures (beach management practices) are likely to be required*", why should there not be continued mitigation of the Minsmere shoreline? What are the beach management practices referred to as mitigation? How does natural regression and the effects of exposing the HCDF interact? Please explain what are the proposed mitigation measures referred to and how there will be no significant adverse effects.

1.1.2 Paragraph 14.7.233 ES (**Volume 2, Chapter 14** of the **ES** (Doc Ref. 6.3) [APP-224]):

1.1.3 "***14.7.233*** *Modelling results outlined in the Plants and Habitat Synthesis (Appendix 14B1 of this volume) and detailed in ES (Doc Ref. Book 6) Chapter 20: Coastal, Geomorphology, Hydrodynamics and Chapter 22: Marine ecology indicate that shoreline regression would eventually expose the HCDF and that during the later stages of station operation this may disrupt longshore sediment transport. Additional mitigation measures (beach management practices) are likely to be required. These measures would be time limited and monitored until deemed no longer required, for example natural shoreline regression having eroded the Minsmere European Site frontage to such an extent that beach nourishment is non effective. Due to the proposed mitigation, this is considered to be a negligible adverse effect, which would be not significant. No significant effects on the Minsmere European Site are envisaged*"

1.2 Applicants Answer:

a) Unmitigated natural shoreline recession

1.2.2 Paragraph 14.7.233 refers to the projected unmitigated natural shoreline recession. Section 20.14 of **Volume 2, Chapter 20** (Coastal Geomorphology and Hydrodynamics) of the **ES** (Doc Ref. 6.3) [APP-311] and Sections 7.1 –

7.3 of **Appendix 20A, Volume 2** of the **ES** (Doc Ref. 6.3)[APP-312] conclude that without mitigation the HCDF would be exposed and would affect longshore shingle transport during the life of the station. However, as stated in paragraph 14.7.233, Sections 20.14 b) and c) of **Volume 2, Chapter 20** of the **ES** (Doc Ref. 6.3) [APP-311] and Section 2.15 g) ii) of **Volume 1, Chapter 2** of the **ES Addendum** [AS-181]), mitigation is proposed to prevent HCDF exposure and, therefore, a disruption to longshore sediment transport is not expected.

1.2.3 Paragraph 14.7.233 also refers to the time-limited aspect of the monitoring and mitigation. For clarity, and as stated in Section 20.14 c) ii) of **Volume 2, Chapter 20** of the **ES** (Doc Ref. 6.3) [APP-311] and Section 9 of the Coastal Processes MMP (**Appendix 2.15A, Volume 3, Chapter 2** of the **ES Addendum** [AS-237]), the monitoring and mitigation is planned for the operation and decommissioning phases of the station. For the period beyond decommissioning (after c. 2140), decisions regarding the HCDF, mitigation and, if required, compensation, will be addressed in the Cessation (of Monitoring and Mitigation) Report, due ten years from the end of decommissioning. This is necessary because the geomorphic setting, geomorphic impacts (of an exposed HCDF) and conservation designations cannot be known or confidently assessed at present. As shown in the response to ExA Q2 of this note, the conservation designations are expected to change before HCDF exposure as loss of the SCDF indicates widespread geomorphic regime change on the Minsmere frontage, including habitat loss and consequent changes in the conservation status of the Minsmere EMS.

b) Mitigation (to prevent disruption to longshore shingle transport arising from HCDF exposure)

1.2.4 Embedded mitigation is proposed in the form of the SCDF. Its purpose is to avoid exposure of the landward HCDF and the disruption to longshore transport that would result. The SCDF would be constructed between the HCDF and Mean High Water Spring (MHWS) level and would release sediment into the coastal system when eroded by waves. It provides a large reservoir of shingle designed to release sediment into the coastal system, prevent HCDF exposure, and thereby avoid or minimise disruption to longshore shingle transport and the potential downdrift beach erosion. It uses a "working with nature" approach where the release of sediment into the coastal system, and its re-distribution, are determined by natural coastal processes (erosion by waves).

1.2.5 Shingle eroded from the SCDF would be drawn into the intertidal beach at SZC and subsequently moved along the shoreline (longshore transport) either to the north or the south, depending on the direction from which subsequent waves arrive. Over time, the volumes of sediment arriving on immediately adjacent shores may be sufficient to reduce erosion rates there, which is a by-product of maintaining the SCDF. Accumulation of SCDF sediments immediately north of SZC may, over the station's life, increase the supra-tidal area and restore the former annual vegetated drift lines habitat, which was destroyed as a result of natural coastal erosion. Over relatively short distances (tens to a few hundred metres) SCDF sediments would prevent or reduce erosion, which was assessed as a significant beneficial effect in Section 2.15 g) iii) b) b) of **Volume 1, Chapter 2** of the **ES Addendum** [AS-181]).

1.2.6 Additional mitigation would be applied to maintain the SCDF, replacing sediments eroded from it. The primary method of replenishment would be beach recharge – the import of additional sediments to maintain the SCDF volume. In this way, the SCDF would be maintained and disruption to longshore transport (including potential adverse impacts to the southernmost few hundred metres of the Minsmere frontage) avoided.

1.2.7 SZC Co. are committed to maintaining the SCDF across the operational and decommissioning phases of the project. Section 6.3 of the Coastal Process Monitoring and Mitigation Plan (CPMMP) (**Appendix 14A**, **Volume 3, Chapter 2** of the **ES Addendum**) [AS-237] sets out a beach volume trigger for mitigation, which is being developed in three further technical Reports to be submitted to the ExA at Deadlines 2 and 3:

1) "Storm Response Modelling – Preliminary evidence toward setting volumetric thresholds for SCDF recharge" (TR531, Cefas) – Deadline 2
2) "Preliminary design and maintenance requirements for the Sizewell C Soft Coastal Defence Feature" (TR544, Cefas) – Deadline 3
3) "Storm erosion modelling of the Sizewell C Soft Coastal Defence Feature using XBeach 2D & XBeach-G" (TR545, Cefas) – Deadline 3

c) ExA Q1: **How does natural shoreline regression erode Minsmere?**

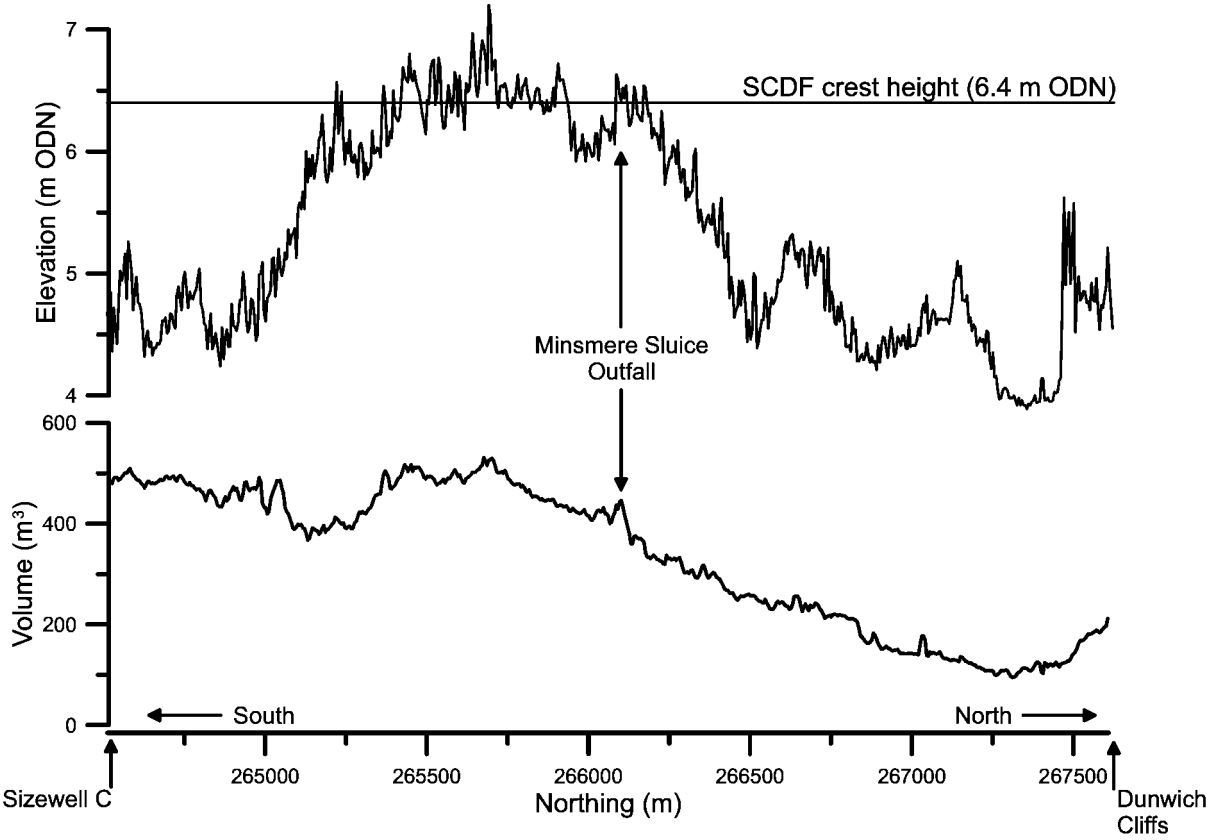
1.2.8 Natural shoreline recession on the Minsmere frontage is caused by storm events, particularly NE storms combined with storm surges. These events have higher than normal water levels that enable wave action to erode the natural shingle ridge that separates the low-lying Minsmere Levels from the sea.

1.2.9 The northern section of the Minsmere shingle ridge (adjacent to the Minsmere Reserve) is its most vulnerable section, owing to its small volume and low crest elevation (see **Plate 1**). This section has experienced a degree of roll-back, which means that the ridge has been overtopped by waves, the crest lowered, and the ridge moved landward due to deposition on the landward flank. This process will continue as sea levels rise and is exacerbated in sections where the ridge lowers. Given its low volume, it is likely to be the first section of the ridge to experience breaching.

1.2.10 In comparison the central ridge (from the sluice outfall to the south around 750 m), has a large volume and crest height, no substantial over-topping and erodes by scarping (small cliffs cut in the seaward face of the ridge) rather than rolling back. The same is true of the southern Minsmere ridge (just north of Sizewell C), except it has a low ridge elevation, similar to the northern ridge. The lower ridge height makes this section more prone to overtopping as sea level rise continues, however its large volume makes the prospect of breaching much less likely than the northern ridge. Despite the lower crest, there is no evidence of substantial overtopping or roll-back. The close proximity of this section to Sizewell C means it is likely to benefit from shingle eroding from the SCDF over the operation and decommissioning phases, which will act to reduce erosion rates there and may lead to a larger supra-tidal beach and/or increases in crest elevation (see **Volume 1**, **Chapter 2** of the **ES Addendum** (Doc ref. 6.14) [AS-181]).

1.2.11 Variations in the rate at which shingle is moved into and out of different parts of the shoreline leads to accumulation or erosion of shingle in different quantities along the shore. Sandy material from the ridge may also be lost to the subtidal beach, decreasing the overall volume, however the coarser sediments (pebbles; 1 – 6 cm diameter) are generally retained above low tide (sediment sampling shows the subtidal is almost entirely sandy and the pebble-sized sediments are confined above low tide). The main patterns of shoreline change (based on over 25 years of data) along the Minsmere frontage are persistent erosion in the north (up to 2.2 m/yr retreat); little net change in the centre and persistent erosion in the south (up to 1.1 m/yr retreat). For context, the adjoining Sizewell C shoreline fluctuates with net retreat in the north (0.4 m/yr) and seaward advance in the south (0.5 m/yr). A description of shoreline change patterns can be found in Section 2.3.6 of **Appendix 20A, Volume 2** of the **ES** (Doc Ref. 6.3) [APP-312].

Plate 1: Maximum elevation and volume above 0 m ODN of the Minsmere shingle ridge between the northern extents of Sizewell C and the Dunwich Cliffs.



d) ExA Q2: (i) How does the exposure of the HCDF disrupt longshore sediment transport so as to affect Minsmere?

1.2.12 HCDF exposure is not expected as the SCDF would be maintained by SZC Co. over the operation and decommissioning phases. However, in the very unlikely event that the HCDF is exposed as a result of a sequence of very severe storms in rapid succession without the opportunity to recharge, the HCDF would protrude partly or wholly through the beachface and introduce an artificial obstruction to longshore shingle transport until the SCDF was recharged. The obstruction to shingle movement would starve the downdrift beach for short periods of time (the duration of storms) as sediment that accumulates upstream of the blockage would not reach is natural downdrift destination, leading to shoreline retreat there. The best local example of this process in action is the Minsmere Sluice outfall pipe, which disrupts longshore transport for a few hundred metres to each side, each flank alternating between accretion and erosion as the wave directions alter. An

exposed HCDF would also briefly interfere with the longshore transport of beach shingle in a similar fashion to Minsmere Sluice, trapping shingle on one side (causing accretion), depriving the shoreline on the other side (causing erosion). Therefore, an exposed HCDF could only have an erosive impact on the southern Minsmere frontage during net northward transport (SSE storms). In the present (and known previous) wave climate, periods of net northward transport (SSE storms) past the HCDF location are short lived and so any potential erosive impacts would be confined close to the HCDF and be quickly repaired by subsequent net southward transport (NE storms). Furthermore, in mitigating against exposure, the SCDF potentially increases the resilience of the Minsmere frontage against possible future regime change, by increasing the volume of sediment in the beach over the long period before exposure (which is expected to eb after decommissioning).

1.2.13 The impacts described in the previous paragraph are not expected to occur because SZC Co. has committed to maintaining the SCDF over the station life in order to avoid exposure of the HCDF and disruption to longshore transport. However, HCDF exposure would be preceded by natural geomorphic regime change on the Minsmere frontage. As a consequence, natural geomorphic regime change would not support the habitats and conservation designations of the outer Minsmere Levels as they are today, because of erosion, breaching of the shingle ridge and saline intrusion via temporary or permanent inlets, allowing the tide to flow in and out of the levels. The impacts that SZC would have on this natural process are largely beneficial – the provision of additional (SCDF) sediment to the southern Minsmere frontage over several decades or longer and, following exposure, the trapping of (net southward moving) sediment against the HCDF, which would lead to sediment accumulation on the southern Minsmere frontage (at the expense of shorelines immediately to the south). As discuss in point 4 below, SSE storms could lead to erosion of the frontage north of SZC, however this would be limited in extent (a few hundred metres) and would be acting on a frontage that is expected to be advanced in terms of volume and seaward position relative to a natural future baseline due to accumulation of SCDF sediments.

1.2.14 The rationale behind why natural geomorphic regime change would precede HCDF exposure is explained in the indented text below. The regime change includes shingle ridge mobilisation (landward migration, i.e., roll-back), ridge lowering (which itself is a positive feedback promoting more overtopping and faster roll-back), permanent or temporary breaching (and associated disruptions to longshore shingle transport) and saline intrusion on the Minsmere Levels.

1) The conditions for HCDF exposure would require both high sea levels and strong patterns of erosion and transport of shingle away from the SZC frontage (sufficient to make SCDF recharge unsustainable, if it were still being undertaken). Furthermore, localised net transport away from the SZC frontage is unlikely to occur for several decades or more, until the adjacent shorelines (particularly to the north) have receded, causing the maintained SZC frontage to become a foreland (a localised protrusion of the shoreline).
2) HCDF exposure would require regular overtopping and roll-back of the SCDF, although the intent would be to return any eroded sediment to the crest to maintain its elevation1 and the SCDF position (effectively the process of beach recycling). Preliminary numerical model results (BEEMS Technical Report TR545) indicate that SCDF overtopping would not be experienced for UKCP18 sea levels until 2099, which is the end of the predictions.

1.2.15 Regular overtopping and mobilisation of the SCDF's 6.4 m ODN crest, which itself would precede HCDF exposure, would follow regime change on the Minsmere frontage as most of the shingle ridge is lower than the SCDF[2] and so would have experienced substantive erosion, overtopping, roll-back, breaching and saline intrusion. Overtopping would lower the Minsmere ridge further, increasing overtopping frequency (without further sea level rise), erosion and landward retreat of the ridge. Areas with reduced shingle mass will have a higher risk of breaching and tidal exchange for as long as the breach (or breaches) remain open.

3) The additional role of loss or removal of the Minsmere Sluice outfall.
    i. The sluice's capacity to function as a freshwater drainage outlet will reduce with sea level rise, leading to either regular saline intrusion through the outfall or increased freshwater flooding behind it. The latter will increase beach erosion potentially due to the effect of higher groundwater levels[3]. The loss (through natural decay without maintenance) or removal of the sluice's outfall pipe is expected to occur before the SCDF becomes difficult to maintain because the high sea levels needed for regular SCDF

[1] As an adaptable feature, the SCDF crest elevation could be raised to counter sea level rise and overtopping (were it to occur).
[2] 85% of the Minsmere shingle ridge is lower (up to 2.5 m lower) than the SCDF (6.4 m ODN). Around 500 m of the ridge, 175 m south of Minsmere Sluice, is slightly higher than the SCDF (average = 6.52 m ODN).
[3] Higher ground water levels tend to increase beach erosion rates because particles below the groundwater table are more easily mobilised due to the effect of relative buoyance (the difference between particles in air versus water).

overtopping[4] (> 0.7 m relative to 2020) would make the Minsmere Sluice inoperable as a freshwater drain.

ii. Furthermore, the outfall pipe's decay or dismantlement would remove the shingle transport blockage, releasing sediment trapped there and allowing for natural coastal realignment and potentially coastal catch up (i.e., rapid erosion following decades or centuries of human intervention; e.g., Dornbusch and Mylroie, 2017). The released sediment is expected to travel south (the net transport direction) and may reduce erosion rates on the southern shingle ridge and reduce SCDF recharge rates (for a period).

In both cases – sea level rise causing loss of the sluice's drainage function and erosion following decay or dismantlement of the sluice's outfall – the associated regime change is expected before the potential for HCDF exposure arises.

4) Net longshore transport away from the SZC frontage would increase SCDF erosion and recharge rates and increase the potential for HCDF exposure. This situation could occur several decades or more in the future once the adjacent shorelines (particularly to the north) have receded. Enhanced erosion of the protruding SCDF would be preceded by natural geomorphic regime change on the Minsmere frontage – specifically significant natural erosion of adjacent eroded shorelines to cause the protruded SZC shoreline and high sea levels. A more unidirectional wave climate5 would also be required to preferentially move sediment away from the SZC frontage because regular reversals in storm direction (e.g., in a bidirectional wave climate) would naturally restore material removed by previous storms from the opposite direction ie it would not lead to strong transport patterns away from the SZC foreland. Switches in the dominance of wave direction at Sizewell can last for a few years, but the present net pattern is a slight dominance of NE waves (historically (over 100 years ago) the wave climate is thought to have had a greater NE dominance). Only SSE waves could affect the Minsmere frontage if the HCDF is exposed, however there are no records or geomorphic evidence to indicate a persistent SSE dominance, so such periods are considered to be short and would limit the extent of HCDF impact to short distances and durations, with recovery on subsequent NE events.

[4] Note that the UKCP18 climate change evidence for Sizewell indicates no change is surge frequency and a similar or reducing wave climate across this century.

[5] There is no UKCP18 climate change evidence to support or refute a change in the wave climate directionality at Sizewell.

e) ExA Q2: (ii) Interaction between an exposed HCDF and naturally retreating shorelines would occur on two spatial scales.

1.2.16 A) In the near-field, the reversals in transport associated with changing storm directions would cause shorelines to fluctuate within a few hundred metres in both directions. On the northern (updrift; Minsmere) side of the HCDF, net accretion would reduce the erosion rate – the degree to which this occurs would depend on the HCDF's trapping efficiency (how much of the natural longshore transport it prevents).

1.2.17 B) Impacts further afield can only arise if SCDF mitigation ceases and the HCDF becomes regularly or permanently exposed. This is only expected to occur in the period after the decommissioning phase. That timescale (post-decommissioning) is too long to predict impacts with any degree of confidence, as explained in Section 20.14 d) of **Volume 2, Chapter 20** of the **ES** (Doc Ref. 6.3) [APP-311], however that same section does outline some broad possibilities (primarily impacts to the south of SZC). As the timescale is too long to predict and assess impacts, Section 9 of the CPMMP (**Appendix 14A**, **Volume 3, Chapter 2** of the **ES Addendum,** [AS-237]) proposes a final assessment to be made ten years before the end of the decommissioning phase, when the coastal configuration, the fate of the HCDF and the conservation status of the coast are known and can therefore be reliably assessed.

f) ExA Q3: **If the exposure of the HCDF affects the shoreline regression at Minsmere (which appears to be the case from the statement that "*shoreline regression would eventually expose the HCDF and that during the later stages of station operation this may disrupt longshore sediment transport. Additional mitigation measures (beach management practices) are likely to be required*", why should there not be continued mitigation of the Minsmere shoreline?**

1.2.18 The HCDF would not affect shoreline recession at Minsmere because the SCDF will prevent its exposure. See response to ExA Q2 above.

g) ExA Q4: **What are the beach management practices referred to as mitigation?**

1.2.19 The beach management practices are SCDF/beach recharge, bypassing and beach recycling (see Section 20.14 c of **Volume 2, Chapter 20** of the **ES** (Doc Ref. 6.3) [APP-311]). These activities are used to maintain the beach and SCDF volume, thereby avoiding HCDF exposure, and mitigating potentially significant adverse effects. Beach recharge refers to the import and placement of additional sediments; bypassing refers to the manual transfer of sediments from an accumulating area to an eroding downdrift

area – effectively manually bypassing the blockage; and beach recycling refers to moving sediment from accreting to eroding areas, regardless of the cause or direction of travel relative to longshore drift. Beach and SCDF recharge is expected to be the most commonly deployed method.

h) ExA Q5:**Please explain what are the proposed mitigation measures referred to and how there will be no significant adverse effects.**

1.2.20 See ExA Q4 for a description of the mitigation measures for coastal geomorphology.

APPENDIX 7H RELEVANT EXAMPLES OF RECREATION OF FEN MEADOW HABITATS

CONTENTS

1 BIO 1.86 RELEVANT EXAMPLES OF RECREATION OF FEN MEADOW HABITATS

1.1 Introduction

1.1.1 The approach to delivery of compensatory habitat proposed by SZC Co. is detailed in the SZC Fen Meadow Strategy [Section 2.9D of AS-209].

1.1.2 Whilst the term fen meadow covers more than one botanical community in the National Vegetation Classification (NVC) (Wheeler, Shaw and Tanner, 2009, Ref. 1) the target community in the context of the landtake from the Sizewell Marshes SSSI is M22 *Juncus subnodulosus –Cirsium palustre* fen meadow.

1.1.3 To manipulate site conditions on the habitat compensation sites such that conditions are suitable for M22 development it is necessary to recognise the characteristics of the community including appropriate eco-hydrological conditions. The characteristics of M22 have been described by Wheeler et al. (Chapter 18 in Ref. 1), including floristic composition, landscape situation and topography, substratum types, water supply and level requirements, wetland water supply mechanisms (WETMECS), nutrient/hydrochemistry, management requirements and the effects on M22 of environmental change (site dry or wetness).

1.1.4 Overall, M22 is a community that is botanically variable and can occur in a wide range of eco-hydrological situations. Nonetheless, the key conditions required to support M22 can be summarised as:

- A water table near to the surface, avoiding fluctuations that result in summer dryness and winter inundation;
- Appropriate soil types (ideally peat or organic gleys);
- Base-rich conditions, but relatively low fertility with limited nutrient concentrations (e.g. phosphate, nitrate);
- Management, by mowing or grazing, which are crucial to the maintenance of M22.

1.1.5 There is an extensive literature on fen meadow restoration in Europe - notably from the Netherlands, Poland and Germany. Van Diggelen & Marrs (2003, Ref. 2) in particular have categorized four essential steps for conservation and restoration of fen meadow:

- Establishing or re-establishing the necessary abiotic conditions;

- Supplying (sufficient) propagules of constituent species of the target communities;
- Creating and maintaining suitable conditions for the (re-)establishment of target species; and
- Appropriate management to keep the conditions suitable.

1.1.6 The Fen Meadow Strategy [AS-209] outlines the types of measure likely to be necessary to facilitate development of the compensatory habitat, as represented by the M22 *Juncus subnodulosus – Cirsium palustre* fen meadow community at appropriate sites. The text below provides the context.

1.2 Conditions required for recreating fen meadow

a) Abiotic conditions

1.2.2 Literature predominantly recognises three abiotic factors as essential requirements for successful fen and fen meadow restoration:

- Rewetting;
- Topsoil removal;
- Reduction in trophic status.

i. Rewetting

1.2.3 Establishing and safeguarding necessary abiotic conditions in affected wetlands almost always involves raising the water-table relative to the ground surface as contact between the root zone and groundwater is considered essential for fen meadow restoration.

1.2.4 Fen restoration is based on rewetting drained areas to slow organic matter decomposition by recovering high water tables, thus recovering peat forming conditions. Most wetland restoration projects focus on restoring anoxic conditions in the soil by rewetting and thereby attempting to reduce rates of nitrogen and phosphorus cycling in order to create favourable conditions for regrowth of typical wetland plant species.

1.2.5 Rewetting sites requires consideration of a number of factors including the source and chemical quality of the water that will rewet the site, potential for surface inundation through unpredicted changes to soil level upon rewetting, potential for release of nutrients from the soil upon rewetting,

factors beyond the control of the site (e.g. regional water tables), the condition of peat present and potential for acidification.

1.2.6 However, being aware of these potential issues ensures that the design and management of the restored site can account for, and react to, these should they occur.

ii. Topsoil removal

1.2.7 Topsoil removal lowers nutrient availability by removing the topsoil, and can result in an increase in water table relative to the surface, both important factors in successful restoration. Furthermore, a high density of long-term persistent seeds of ruderal species in the soil is a legacy of degraded meadows. Removal of this seed bank with the topsoil is an effective measure to limit non-target species re-establishment.

1.2.8 The key benefits of topsoil removal can therefore be summarised as follows:

- reducing nutrient availability (mainly phosphorus, but also excess nitrogen);
- eliminating potential competitors from the seed bank and standing vegetation; and
- exposing a bare substrate for newly establishing species and increase wetness and therefore the abiotic filter of anoxia, thereby lowering the growth rate of all species during seedling recruitment and so enhancing conditions for less competitive stress-tolerant fen species.

iii. Reduction in trophic status

1.2.9 The third essential condition for fen meadow restoration is a reduction in trophic status, as eutrophy naturally follows peat degradation or the influx of fertilized waters; (re-)establishing appropriate water sources (rainwater, groundwater and surface water) for the wetland under consideration and creating the necessary productivity level regime. However this is now achieved via providing a clear water source (where possible) and topsoil removal.

b) Biotic factors

1.2.10 Three of the four essential steps outlined by van Diggelen and Marrs (2003) are biotic:

- Supplying (sufficient) propagules of constituent species of the target communities;
- Creating and maintaining suitable conditions for the (re-)establishment of target species; and
- Appropriate management to keep the conditions suitable.

1.2.11 These three biotic factors are considered further below.

i. Supplying (sufficient) propagules of constituent species of the target communities

1.2.12 Only a small fraction of the fen meadow species can regenerate from the soil seed bank and most have a limited dispersal capacity, which means without intervention isolated sites are unlikely to develop appropriate vegetation on restoration.

1.2.13 Multi-species reintroductions are recommended, particularly in sites restored by topsoil removal, where bare soil becomes exposed to new colonisers. A high density of long-term persistent seeds of ruderal species in the soil is a legacy of degraded meadows but removal of this seed bank with the topsoil is an effective measure to limit non-target species re-establishment and to enhance conditions for less competitive stress-tolerant fen species, such as may be introduced via hay transfer.

1.2.14 Several modes of species introductions are proposed in the Fen Meadow Strategy [Section 2.9D in AS-209] e.g. direct seeding, planting or transfer of fresh biomass; however, seed addition with hay has often been shown to be an effective measure to overcome seed-bank and dispersal limitations.

1.2.15 From their review of the introduction of fen meadow vegetation, Klimkowska et al (2010, Ref. 3) make the following recommendations:

- Topsoil removal and hay addition should be conducted together and immediately at the beginning of the restoration; otherwise, the restoration might be delayed because of unanticipated establishment of ruderal or weedy species;
- Hay transfer from various mowing dates and several species-rich stands (multiple hay transfer) is advisable, in order to facilitate target community development;
- Accumulation of thick hay layers should be avoided, in order to allow the establishment of light-demanding target species.

ii. Creating and maintaining suitable conditions for the (re-)establishment of target species

1.2.16 Species establishment is dependent upon the availability of suitable micro-sites for seedling recruitment. A dense plant cover hampers colonization, whereas gap formation enhances it. Following establishment, the presence, for example, of large animals creating gaps therefore might increase species richness.

1.2.17 Additionally, whilst it is not possible to predict which species will re-establish, and whether or not these species will be invasive, some of the constraints for establishment are known. Competition for light is a major factor excluding many species. Therefore appropriate management (see below) should seek to create optimal conditions for colonisation.

iii. Appropriate management to keep the conditions suitable

1.2.18 Fen meadows must be managed. Mowing or grazing is crucial to the maintenance of M22 and it is noted by Wheeler, Shaw and Tanner (2009) that variations in historic management regime are reflected in the variations in species composition.

1.2.19 Management of the vegetation on restored sites applies similar techniques that mimic traditional agricultural management (grazing, cutting for hay, burning). Sizewell Marshes for example are managed predominantly by summer grazing by cattle, but other management tasks include cutting and baling for hay, where the grass aftermath is grazed by cattle. Additionally, some areas may need occasional topping of vegetation, typically to control rush.

1.2.20 The objective of all management techniques is to remove excessive nutrients and create recruitment gaps for low-competitive species.

1.3 Examples of recreation of fen meadow habitat

1.3.1 The efficacy of the management of fen meadow is demonstrated by the favourable condition status of Sizewell Marshes SSSI (https://designatedsites.naturalengland.org.uk/ReportConditionSummary.aspx?SiteCode=S1003416&ReportTitle=Sizewell%20Marshes%20SSSI).

1.3.2 Information on specific fen meadow recreation projects is not however readily available, as any associated data and reports belong to the commissioning organisation. However, one site in the Little Ouse headwaters between Suffolk and Norfolk does demonstrate the effectiveness of topsoil removal leading to re-wetting, and the introduction of propagules.

a) Parkers Piece

1.3.3 At Parkers Piece, Thelnetham, restoration work commenced in 2009 when degraded peat on the valley margin was removed prior to the introduction of strewn hay from a nearby fen meadow.

1.3.4 The site had a history of cultivation and pig farming, and close-set soil cores were used to identify the depth of affected peat, and dipwells were installed to assess the location and seasonal periodicity of the groundwater table. Removal of the degraded peat exposed the underlying hemic (partly decomposed) brown peat and marl, which formed the substrate for plant colonisation and introduction. The subsequent immature fen meadow is managed by a combination of cutting and mowing, steered by vegetation monitoring.

1.3.5 At Parker's Piece, topsoil removal was sufficient to bring groundwater influence into a large part of the restored area. However, development of the target vegetation has been affected by dense rush growth, which has restricted the development of low-growing fen meadow species, and by widespread colonisation of common reed and willow scrub from the surrounding ditch network. The site will require intensive management to control these species but conditions for both mowing and grazing of the thickening rush cover have themselves been affected by periodic detention of flood waters from the adjacent headwater river.

1.4 Factors affecting restoration success

1.4.1 Based on the factors discussed above, development of the abiotic and biotic conditions for fen meadow referable to the M22 *Juncus subnodulosus – Cirsium palustre* fen meadow community will have the highest chances of success if the following techniques are employed at the three fen meadow sites:

- **Topsoil removal.** Complete or partial topsoil removal should be undertaken within the context of sediment disposition, surface topography and valley flooding regimes, in order to reduce nutrient levels and increase the influence of groundwater on target species.
- **Creation of microtopography.** The ground surface should be sculpted within hydrologically significant tolerances to assist in the successful colonisation and regeneration of target groundwater-dependent species, particularly those with high light requirements, low competitive abilities and low tolerance of drought or flooding.

- **Rewetting from appropriate water sources**. Rewetting should be undertaken using groundwater-dominated sources to facilitate an appropriate hydrological regime for the target vegetation. Sufficient control is likely to be required to minimise the impact of extreme events leading to flooding by nutrient-rich waters and/or periods of drought, within acceptable limits.

- **Use of hay transfers.** The transfer of hay from suitable sites – or of turves from the FMS donor site – should be undertaken following established best practices. The conditions and timing of collection, transfer and introduction of plant propagules – and their initial establishment – should be carefully monitored to meet restoration requirements.

- **Habitat management.** An agreed annual programme of water and vegetation management should be established and undertaken at appropriate times. These operations – and their impact on the developing fen meadows – should be set with a framework of acceptable limits. Appropriate monitoring should be maintained to enable effective and timely management of the habitat management programme to meet target conditions for the restored fen meadow vegetation.

1.4.2 The Fen Meadow Strategy [Section 2.9D of AS-209] includes for implementation of these types of measures.

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2. van Diggelen R. & Marrs R.H. (2003). Restoring plant communities – Introduction. Appl. Veg. Sci. 6: pp. 105-110.

3. Klimkowska A., Kotowski W., van Diggelen R., Grootjans A.P., Dzierza P. & Brzezinska K. (2010). Vegetation re-development after fen meadow restoration by topsoil removal and hay transfer. Restoration Ecology 18 (6), pp. 924–933.

APPENDIX 7I DETAILED RESPONSE TO QUESTION EXA REF. BIO.1.126

CONTENTS

TABLES

1 INTRODUCTION

1.1 ExQ1 Question BIO.1.126

"*[APP-363] – para 7.4.20 states that the four common species of reptile recorded as potentially within the site are on the list referred to in s.41 of the NERC Act. What steps should the SofS take to further their conservation under s.41(3)(a)?*

This question applies to all other living organisms and habitat types to which the s.41(3) duty applies and which are identified as such by this chapter of the ES (such a number of species of bat in para7.4.29)"

2 APPLICANT'S RESPONSE

2.1 The Duties

2.1.1 S.41 of the Natural Environment and Rural Communities Act 2006 requires the Secretary of State to take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under s.41, or promote the taking of such steps by others.

2.1.2 This appendix has been prepared to outline in detail the measures to be implemented for every species and habitat type listed in S41 of the NERC Act.

2.1.3 The measures outlined for reptiles and bats at the northern park and ride site are outlined in **Table 1**.

Table 2.1: Mitigation for bat and reptile species at the northern park and ride site

Species and document name	Measures to be implemented
Reptiles	
Volume 3 Chapter 7: Terrestrial Ecology and Ornithology [APP-363]	Tertiary mitigation: A small proportion of habitat within the site, primarily around the field margins, was identified as having some limited potential to support a small population of reptiles. All reptile species are protected from killing or injury under the Wildlife and Countryside Act. Therefore, the following measures would be undertaken prior to the commencement of construction: • an inspection would be undertaken by a suitably experienced ecologist of any potential reptile refugia, after which the reptiles would be removed; and • a phased vegetation clearance process would be undertaken to displace any reptiles from the site, under the supervision of a suitably experienced ecologist. Removal of vegetation and of places of shelter/hibernation features would be undertaken outside of the reptile hibernating period (October to February inclusive), during periods of warm, dry weather (with due consideration of the seasonal constraints of clearance works during breeding bird season). If this is not possible, vegetation would be cut to the ground (to remove potential bird nesting habitat), but the roots would remain intact until hibernation is complete. The root system of vegetation would then be removed once the reptile hibernation season is over. Clearing of vegetation would be undertaken under the supervision of the suitably experienced ECoW.
Volume 3, Chapter 7, Appendix 7A, Annex 7A.6B RAMS Reptiles (Non-Licensable	Toolbox talk: • Prior to commencement of the vegetation clearance works, all site contractors will be briefed by the ECoW as part of the site induction to provide them with a basic overview of the life history, habitat requirements, identification and legal protection granted to reptiles. 1.3.6 Site-specific toolbox talks will also be undertaken as necessary to identify the habitats present

Species and document name	Measures to be implemented
Method Statement) [APP-363]	within the site that have the potential to be used by reptiles and outline the environmental measures to be followed in order to avoid breaches of legislation and / or adverse effects on reptiles that could occur within or in the vicinity of the working area. The toolbox talk will stress that potential reptile refugia / hibernation features should be left undisturbed; and reptiles should not be handled by contractors. There is a declaration for those present to sign to confirm they have understood the constraints and actions presented. <u>Vegetation clearance:</u> • Any vegetation clearance likely to impact vegetation below 150mm or which is likely to impact the ground layer or features which offer reptiles shelter or protection should take place during the active reptile period (March to October (inclusive), although the exact timings are weather dependant). In order to avoid disturbing reptiles during hibernation (the period where reptiles are most vulnerable). Accordingly, with respect to the proposed clearance of suitable reptile habitat, it is proposed that a staged vegetation clearance exercise is undertaken under the direct supervision of the Ecological Clerk of Works (ECoW), in order to reduce the suitability of the habitats within the site. • Where it is necessary to undertake vegetation clearance in and around suitable reptile habitat the following precautionary measures will be put in place to avoid encountering and accidentally injuring reptiles: • Vegetation clearance (below 150mm) and ground-breaking works will only be conducted in the active season (March to October inclusive seasonally dependent)1 and when the weather is suitable (i.e. it is warm, approximately 8oC should be the minimum temperature). The works should not be conducted early in the morning before reptiles have had a chance to 'warm up';

Species and document name	Measures to be implemented
	• the ECoW will work with the contractor to determine a cutting regime whereby any animals present are encouraged away from the cutting into retained habitats and not isolated in an unsuitable area. This area will be walked by the ECoW to disturb reptiles prior to works commencing; • the ECoW will also consider any impacts to ground nesting birds, if appropriate and assess any risk; • initially, vegetation is to be cleared to reduce cover for reptiles (at a minimum 150mm from the ground in the first pass); • subsequent to this, a suitable period of time as decided by the ECoW will be given to allow for any reptiles present at the time of works to move away from the cut areas; • the grassland / remaining vegetation will then be cut to as close to ground level as possible; • vegetation cuttings are to be piled within the site so as to create additional sheltering opportunities to reptiles within the site; • any suitable reptile sheltering features (e.g. log piles, compost heaps or debris) will be identified by the on-site ecologist. These will be avoided if possible, if not they will be checked by the ECoW before their removal (should this be required). Any removal of sheltering habitats will be supervised by the ECoW. These will be dismantled by hand; this should be overseen by the ecologist. If a reptile is found the ecologist will decide whether or not it is appropriate to relocate the animal; • shelter features that require removal should be reinstated near the clearance area in a quiet, sheltered location. This will ensure that no net loss of potential reptile shelter features takes place. If possible, shelter features should be dismantled by hand and moved out of the working area, supervised by the ECoW where appropriate. Such materials will be lifted (not dragged) out of the working area; and

Species and document name	Measures to be implemented
	• if reptiles are found, the ECoW will move the animals out of the way to a place of safety. The exact location would be decided on a case-by-case basis by the ECoW, with any reptiles encountered moved to a safe location within a suitable refuge or hibernation feature, surrounded by suitable foraging and basking habitat and judged to be a safe distance from the ongoing vegetation clearance works. Reptiles will not be handled by contractors, as common lizards and slow worms may shed their tails if handled inappropriately. • Should any reptiles be found on site during the works when the ECoW isn't present, the ECoW should be contacted immediately for advice. • A staged vegetation clearance exercise at a suitable time of year will be undertaken in order to safeguard any reptiles present at the time of works. Such works will take place under the supervision of the ECoW. Such an approach will minimise the potential harm caused to reptiles within the site as it will avoid disturbing this species group during the hibernation period. • Prior to commencement of the vegetation clearance works, the ECoW will liaise with the contractor to clearly demarcate the required working areas. • If shelter features are present (i.e. log and vegetation piles), those will be checked by the ECoW before their removal (should this be required). • If shelter features are present that require removal, those should be reinstated near the clearance area in a quiet, sheltered location. This will ensure that no net loss of potential reptile shelter features takes place. If possible, shelter features should be dismantled by hand and moved out of the working area, supervised by the ECoW where appropriate. Such materials will be lifted (not dragged) out of the working area. • Should works be required in winter (November to February inclusive) or in cold weather (below 8 oC overnight temperature) the ECoW will advise upon bespoke working methods.

Species and document name	Measures to be implemented
	Likely to require a hand search and a staged vegetation clearance approach under direct supervision. • The vegetation arisings will be collected and used to create habitat piles in areas adjacent to the site (which are to be retained during the development works). • The vegetation clearance contractors on site will utilise equipment specific to their clearance methods as per their reasonable avoidance measures. <u>Ground-breaking works:</u> • Given that vegetation clearance works are to take place within the site prior to the commencement of any ground-breaking works, it is likely that the risk of encountering reptiles will be reduced, due to the absence of suitable habitat within the areas proposed for ground-breaking works. • Reptiles are known to enter hibernation by burrowing underground, by settling into tree root systems or by entering voids and crevices in the ground or surrounding material. Accordingly, should the works take place during the reptile hibernation period (the dormancy period runs from November to February (inclusive) and initially should be avoided where possible), it is considered necessary for the ground-breaking works to be undertaken under direct supervision of the ECoW. Small sections of the topsoil removed and inspected by the ECoW. Hand-digging under ECoW supervision may also be required. • Contractors will utilise the equipment as per their reasonable avoidance measures method, For example: • JCB 16C-I new generation 1 tonne mini digger; spade; spill kits; and Chapter 8 barrier/ Heras fencing.

Species and document name	Measures to be implemented
Bats	
Volume 3 Chapter 7: Terrestrial Ecology and Ornithology [APP-363] **Terrestrial Ecology Monitoring and Mitigation Plan** [REP1-016]	Primary mitigation / design: • Operational lighting for the proposed development would be designed to prevent light spill to Little Nursery Wood and other habitats, and light levels would not exceed 0.1lux along the eastern side of this wood. The lighting design for the proposed development would use light fittings chosen to limit stray light. Guidance within the latest Institution of Lighting Professionals Guidance Note would be followed as far as possible. These measures would minimise impacts on nocturnal species; such as bats that use the nearby tree lines or habitats for roosting or foraging. • The woodland would be retained in its entirety, with a buffer distance of 20m between the woodland and the proposed development. There would be no direct loss of woodland habitat, and its associated species, and the buffer distance would assist in minimising impacts associated with the proposed development (such as noise, lighting and human disturbance). • In addition to the previous measures, close-boarded fencing would be erected along the inside of the security fence where it is adjacent to Little Nursery Wood to provide additional mitigation for lighting impacts (including those from vehicle headlights) and noise impacts. The close-boarded fencing would be retained during the operational phase to act as screen for lighting (from vehicle headlights) and noise impacts. • Assessment of trees with bat roost potential identified three trees within the proposed development site with potential to support roosting bats, but these three trees would be retained. Little Nursery Wood adjacent to the development site provided a greater roost resource and 41 trees within Little Nursery Wood were identified with the potential to support roosting bats, including the brown long-eared roost. All of these trees within the adjacent wood land are retained.

Species and document name	Measures to be implemented
	Tertiary mitigation: • Construction work would take place during Monday to Saturday 07:00 to 19:00 hours, and some lighting may be required during the winter months, dependent upon what construction activities are taking place. Outside of these hours, lighting would be required at night for site security. Temporary construction lighting would be controlled to minimise light spill on surrounding habitats. This would minimise impacts on nocturnal species such as bats that may use the nearby tree lines or habitats for commuting, roosts or foraging. The lighting design would use light fittings chosen to limit stray light and minimise impacts on sensitive species. The lighting would also be designed to minimise the visibility from sensitive receptors off-site.
Volume 3, Chapter 7, Appendix 7A, Annex 7A.6A RAMS Bat [APP-363]	RAMS: Toolbox talk: • Prior to commencement of the vegetation clearance works, all site contractors will be briefed by the ECoW as part of the site induction to provide them with a basic overview of the life history, habitat requirements, identification and legal protection granted to bats. Site-specific toolbox talks will also be undertaken as necessary to identify the habitats present within the site that have the potential to be used by bats and outline the environmental measures to be followed in order to avoid breaches of legislation and / or adverse effects on reptiles that could occur within or in the vicinity of the working area.

Species and document name	Measures to be implemented
	Precautionary working methods: • Little Nursery Wood would be retained in its entirety with a buffer distance of 20m between the woodland and the proposed development. • Close-boarded fencing where the proposed development site abuts Little Nursery woodland. • The three trees within the development site with the potential to support roosting bats would be retained. No trees will be felled as part of this scheme. • Construction lighting would be designed to prevent spill and exposure on to Little Nursery Wood. The lighting design for the proposed development would comply with the lighting strategy and use light fittings chosen to limit stray light. Guidance within the latest Institution of Lighting Professionals (ILP) Guidance Note would be followed as far as possible. These measures would minimise impacts on nocturnal species such as bats that may use the nearby tree lines or habitats for roosting or foraging. • In addition, although some activities may require 24 hour working, the majority of construction would take place Monday to Saturday 07:00 to 19:00 hours. This means night-time works would be avoided, which is when bats are most active. Incidental mortality associated with traffic movements would therefore not have a significant effect on the bat assemblage. • A10m buffer from the development would be maintained along the northeast, south-east and south-west borders. Vegetation clearance: • As set out above, vegetation clearance works are required in order to facilitate the development of the site. Whilst this document has been produced in relation to bats, further information has been provided to ensure legal compliance in relation to other protected species.

Species and document name	Measures to be implemented
	• Given that the works are to take place outside of the active bird breeding season (early March and late August inclusive), it is considered that no nesting bird checks are required prior to the commencement of works. Nevertheless, should vegetation clearance works take place within the core bird breeding season, a qualified ECoW will need to carry out a nesting bird check at least 48 hours before the commencement of works effecting the vegetation within the site. Once nesting birds have been confirmed absent, then the vegetation clearance contractors will carry out a habitat manipulation exercise in the form of a two stage vegetation cut, with the initial cut reducing the vegetation to a height of 150mm before a second cut subsequently reduces it to ground level, with a minimum of two hours between cuts to allow reptiles or amphibians to move out of the cutting area. • Vegetation clearance which does not disturb the ground or vegetation below 150mm can be conducted year-round with a low risk of impacting upon reptiles. Any vegetation clearance likely to impact vegetation below 150mm or the removal of places of shelter/hibernation features would be undertaken outside of the reptile and amphibian hibernating period (October to February inclusive), during periods of warm, dry weather. If this is not possible, vegetation would be cut to the ground (to remove potential bird nesting habitat), but the roots would remain intact until hibernation is complete. The root system of vegetation would then be removed once the hibernation season is over. Clearing of vegetation would be undertaken under the supervision of the suitably experienced Ecological Clerk of Works (ECoW). • The vegetation arisings will be collected and used to create habitat piles in areas adjacent to the site (which are to be retained during the development works). • The habitats present within the site are largely sub-optimal for bats, being intensively managed for arable farming purposes. The sub-optimal arable land supports few invertebrates on which bats can forage.

Species and document name	Measures to be implemented
	Works should be undertaken outside of all tree and hedgerow root protection zones that would not be removed as part of the proposed development. Tree protective fencing as described in section 6.2 of British Standard 5837:2012 should be installed (distance of fencing from tree trunk = 12x trunk diameter, distance from hedgerows =1m from the spread of hedgerow canopy), where required, prior to plant and machinery arriving on site and construction works commencing. The fencing should remain intact throughout the duration of the works and only be removed upon completion. Weather-proof notices should be attached to any protective fencing located adjacent to retained trees displaying the words 'Construction Exclusion Zone'. All personnel must be made aware of these restrictions. If works need to be undertaken within the root protection zones an Arboricultural survey would be required and any advice provided adhered to, to secure the long-term survival of the tree/hedgerow.

APPENDIX 7J DETAILED RESPONSE TO QUESTION EXA REF. BIO.1.131

CONTENTS

TABLES

1 INTRODUCTION

1.1 ExQ1 Question BIO.1.131

"[APP-394]–para 7.4.23 states that a number of bat species recorded as potentially within the site are on the list referred to in s.41 of the NERC Act. What steps should the SofS take to further their conservation under s.41(3)(a)? This question applies to all other living organisms and habitat types to which the s.41(3) duty applies and which are identified as such by this chapter of the ES."

2 APPLICANT'S RESPONSE

2.1 The Duties

2.1.1 S.41 of the Natural Environment and Rural Communities Act 2006 requires the Secretary of State to take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under s.41, or promote the taking of such steps by others.

2.1.2 This appendix has been prepared to outline in detail the measures to be implemented for every species and habitat type listed in S41 of the NERC Act.

2.1.3 The measures outlined for reptiles and bats at the southern park and ride site [APP-394] are outlined in **Table 1**.

Table 1: Mitigation for bat species at the southern park and ride site [APP-394]

Species and document name	Measures to be implemented
Bat: **Volume 4, Southern Park Chapter 7: Terrestrial Ecology and Ornithology** [APP-394] **Terrestrial Ecology Monitoring and Mitigation Plan** [REP1-016]	Primary mitigation: • Operational lighting would be designed so that light spill beyond the site boundary would be minimal (lighting levels would be less than between 1.0 lux), and there would be no substantive light spillage into adjacent habitats and woodland blocks including Whin Belt. The lighting design for the proposed development would use light fittings chosen to limit stray light. Guidance within the latest Institution of Lighting Professionals Guidance Note would be followed as far as possible. These measures would minimise impacts on nocturnal species such as bats that may use the nearby tree lines or habitats for roosts or foraging. Tertiary mitigation: • Construction work would take place during Monday to Saturday 07:00–19:00 hours, and some lighting in winter may be required dependent upon what construction activities are taking place. Outside of these hours, lighting may be required at night for safety or security. Temporary construction lighting would be controlled to minimise light spill on surrounding habitats. This would minimise impacts on nocturnal species such as bats that may use the nearby tree lines, or habitats for commuting, roosts or foraging. The lighting design would use light fittings chosen to limit stray light, and minimise impacts on sensitive species. The lighting would also be designed to minimise the visibility from sensitive receptors off-site. The proposed development includes the removal of several trees including three trees identified as having the potential to support roosting bats. Therefore, tree inspections to

	determine evidence of use as roosts would be undertaken sufficiently in advance of tree-felling to enable licence application(s) to be submitted to Natural England and develop an appropriate mitigation strategy, if required. Management measures would likely include: • A final inspection of these trees would be undertaken as close to the timing of felling as possible to take into account the regular roost-switching behaviour displaced by tree-roosting bat species. Should bats (or evidence of use by bats) be identified, the mitigation strategies laid out in the licence application(s) would be implemented (for example, the fitting of exclusion devices). • Felling of trees would generally be undertaken in September or October, to avoid both the maternity and hibernation periods during which bats are more vulnerable to disturbance (this timing also avoids the breeding bird season). • To mitigate for the loss of the tree and potential roost resources, bat boxes would be installed on retained trees in suitable locations within the site boundary, prior to felling. One bat box would be installed per tree with medium or high bat roost potential that is due to be lost, whether or not a roost has been identified. A variety of bat boxes would be used to support different species. <u>Monitoring:</u> • There would be regular checks of construction lighting to monitor and correct for any extraneous light spill into surrounding habitats. • Bat boxes would be monitored post-construction to confirm the presence/absence of bats and use of the bat boxes. If bat boxes have not been occupied by year 5 following installation, consideration would be given to moving them to alternative sites nearby, to be determined by a licensed bat ecologist. • There would also be regular checks of operational lighting to monitor and correct for any extraneous light spill into surrounding habitats.

Volume 4, Chapter 7, Appendix 7A, Annex 7A.5A RAMS Bats [APP-365]	RAMS: Toolbox talk: • Prior to commencement of the vegetation clearance works, all site contractors will be briefed by the ECoW as part of the site induction to provide them with a basic overview of the life history, habitat requirements, identification and legal protection granted to bats. Site-specific toolbox talks will also be undertaken as necessary to identify the habitats present within the site that have the potential to be used by bats and outline the environmental measures to be followed in order to avoid breaches of legislation and / or adverse effects on reptiles that could occur within or in the vicinity of the working area. Precautionary working methods: • Construction lighting would be designed so that light spill beyond the site boundary would be minimal and there would be no substantive light spillage into adjacent habitats and woodland blocks including Whin Belt. The lighting design for the proposed development would use light fittings chosen to limit stray light. Guidance within the latest Institution of Lighting Professionals Guidance Note would be followed as far as possible. These measures would minimise impacts on nocturnal species such as bats that may use the nearby tree lines or habitats for roosts or foraging. • In addition, although some activities may require 24 hour working, the majority of construction would take place Monday to Saturday 07:00 to 19:00 hours. This means night-time works would be avoided, which is when bats are most active. Incidental mortality associated with traffic movements would therefore not have a significant effect on the bat assemblage. • Close-boarded fencing where the proposed development site abuts areas of woodland to provide additional protection from vehicle headlights and noise. • Initially all trees to be removed will be reassessed for bat roosting potential.

	• Any trees identified as having low bat roosting potential will be removed using a soft felling methodology outlined below with a suitability experienced, appropriately licensed, bat worker or bat worker assistant present. It is recommended that trees are removed in October, thereby avoiding the sensitive maternity (April-September) and hibernation (November-February) periods for bats. • For any trees with moderate or high roosting potential, a thorough pre works check for roosting bats will be undertaken. The methodology and required survey effort for these pre works checks will depend upon the status of the roosting features within the trees, but may include: • a climbed or ground based tree inspection using an endoscope and / or torch; and emergence / re-entry surveys. • Should any of the trees to be removed be found to support bat roosts, an EPS licence is likely to be required. The documents associated with this licence will outline the required mitigation, and the required measures are not discussed further within this report. • Should additional emergence re-entry surveys be required these will be undertaken between April and September inclusive. If no roosts are found, the approach outlined below will be undertaken. • All trees with potential roost features for bats should be soft felled using the following precautionary measures: • trees classed as having low potential to support roosting bats, shall be felled under the watching brief of the ECoW; • where potential roost features for bats cannot be exhaustively checked they should be section felled, with each section carefully lowered to the ground. Cuts should be made at least 50 cm beyond the extent of the potential roost feature; • if limbs or large branches require felling, consideration should be given to cracks which may close (crushing any bats inside) once the weight of the limb has been removed. If the

	crack cannot be thoroughly inspected to ensure bats are not present, the crack should be wedged open prior to removal of the limb/branch; • the stems of dense ivy should be cut at ground level at least 48 hours before the tree is felled; and • once the trees have been felled the potential roost features should be re-checked on the ground by a suitably experienced bat ecologist. If any potential roost feature can still not be exhaustively checked that section should be allowed a rest period of at least 24 hours to ensure that any individual bats that may have been missed are given the opportunity to relocate. • If any bats are encountered during the felling operations all works and activity must cease immediately, until the ECoW has advised on the most appropriate manner to deal with the situation. • To mitigate for the loss of the tree and potential roost resources, bat boxes would be installed on retained trees in suitable locations within the site boundary, prior to felling. One bat box would be installed per tree with medium or high bat roost potential that is due to be lost, whether or not a roost has been identified. A variety of bat boxes would be used to support different species. <u>Facilitating work requirements</u> <u>a) Vegetation clearance methods</u> • As set out above, vegetation clearance works are required in order to facilitate the development of the site. Given that the works are to take place outside of the active bird breeding season (early March and late August inclusive), it is considered that no nesting bird checks are required prior to the commencement of works. Nevertheless, should vegetation clearance works take place within the core bird breeding season, a qualified ECoW will need to carry out a nesting bird check at least 48 hours before the

	commencement of works effecting the vegetation within the site. Once nesting birds have been confirmed absent, then the vegetation clearance contractors will carry out a habitat manipulation exercise in the form of a two stage vegetation cut, with the initial cut reducing the vegetation to a height of 150mm before a second cut subsequently reduces it to ground level, with a minimum of two hours between cuts to allow reptiles or amphibians to move out of the cutting area. • Vegetation clearance which does not disturb the ground or vegetation below 150mm can be conducted year-round with a low risk of impacting upon reptiles. Any vegetation clearance likely to impact vegetation below 150mm or the removal of places of shelter/hibernation features would be undertaken outside of the reptile hibernating period (October to February inclusive), during periods of warm, dry weather. If this is not possible, vegetation would be cut to the ground (to remove potential bird nesting habitat), but the roots would remain intact until hibernation is complete. The root system of vegetation would then be removed once the reptile and amphibian hibernation season is over. Clearing of vegetation would be undertaken under the supervision of the suitably experienced Ecological Clerk of Works (ECoW). • The vegetation arisings will be collected and used to create habitat piles in areas adjacent to the site (which are to be retained during the development works). Works should be undertaken outside of all tree and hedgerow root protection zones that would not be removed as part of the proposed development. Tree protective fencing as described in section 6.2 of British Standard 5837:2012 should be installed (distance of fencing from tree trunk = 12x trunk diameter, distance from hedgerows =1m from the spread of hedgerow canopy), where required, prior to plant and machinery arriving on site and construction works commencing. The fencing should remain intact throughout the duration of the works and only be removed upon completion. Weather-proof notices should be attached to any protective fencing located adjacent to retained trees displaying the words 'Construction

	Exclusion Zone'. All personnel must be made aware of these restrictions. If works need to be undertaken within the root protection zones an Arboricultural survey would be required and any advice provided adhered to, to secure the long-term survival of the tree/hedgerow.

APPENDIX 7K FIGURES TO SUPPORT RESPONSE TO QUESTION EXA REF. BIO.1.153

1 FIGURES

Figure 7.13: Location of Statutory Designated Sites Within 5km of Sizewell Link Road

Figure 1.4 of Volume 6 of the Environmental Statement: Existing Sizewell Link Road Site and Surrounding Context (East)

DEW'S PONDS (SAC AND SSSI)

POTTON HALL FIELDS, WESTLETON (SSSI)

MINSMERE TO WALBERSWICK HEATHS AND MARSHES (SPA, SAC, RAMSAR AND SSSI)

SOUTHERN NORTH SEA (SAC)

OUTER THAMES ESTUARY (SPA)

SIZEWELL MARSHES (SSSI)

LEISTON - ALDEBURGH (SSSI)

SANDLINGS (SPA)

NOTES

KEY

- SIZEWELL LINK ROAD DEVELOPMENT SITE BOUNDARY
- 5KM STUDY AREA
- SPECIAL PROTECTION AREA (SPA)
- SPECIAL AREA OF CONSERVATION (SAC)
- RAMSAR SITE
- SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)

NOT PROTECTIVELY MARKED

SizewellC
Doing the power of good for Britain
EDF CGN

DOCUMENT:
SIZEWELL C PROJECT
RESPONSES TO EXAMINING AUTHORITY'S WRITTEN QUESTIONS ISSUED ON 21st APRIL 2021
CHAPTER 7: BIODIVERSITY AND ECOLOGY

DRAWING TITLE:
LOCATION OF STATUTORY DESIGNATED SITES WITHIN 5KM OF SIZEWELL LINK ROAD

DRAWING NO:
FIGURE 7.13

DATE:	DRAWN:	SCALE :
JUNE 2021	R.G.	1:60,000 @A3

SCALE BAR
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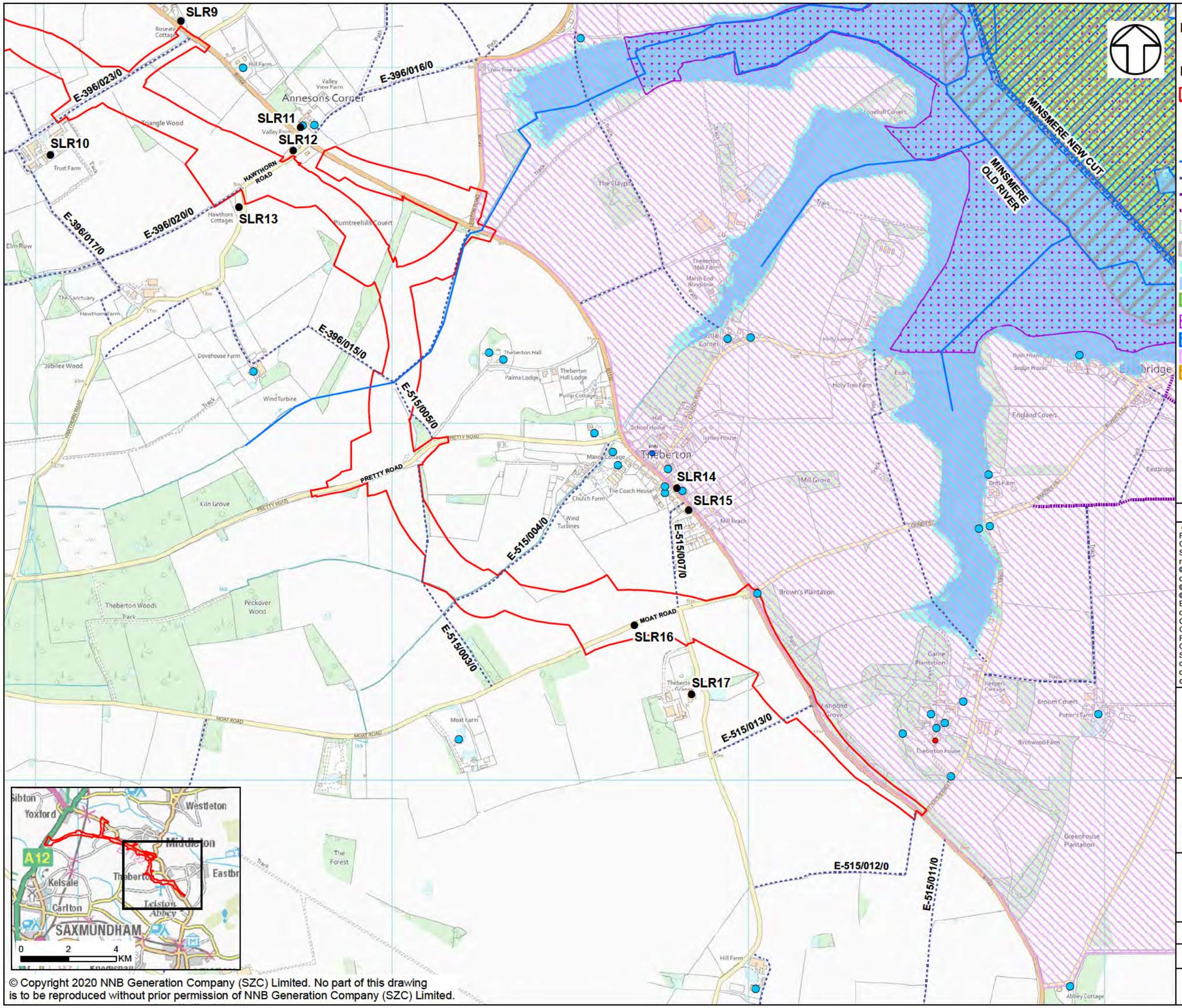

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NOTES

KEY

- SIZEWELL LINK ROAD DEVELOPMENT SITE BOUNDARY
- LISTED BUILDING GRADE I
- LISTED BUILDING GRADE II*
- LISTED BUILDING GRADE II
- WATERCOURSE (OS OPEN RIVERS)
- FOOTPATH
- BRIDLEWAY
- RESTRICTED BYWAY
- WOODLAND
- AREA OF OUTSTANDING NATURAL BEAUTY (AONB)
- FLOOD ZONE 2
- FLOOD ZONE 3
- RAMSAR
- SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)
- SPECIAL AREA OF CONSERVATION (SAC)
- SPECIAL LANDSCAPE AREA
- SPECIAL PROTECTION AREA (SPA)
- CLOSEST RECEPTORS

RECEPTOR:
SLR9 ROSEATE COTTAGE
SLR10 TRUST FARM
SLR11 VALLEY FARM HOUSE
SLR12 ANNESONS COTTAGE AND CORONATION COTTAGES
SLR13 HAWTHORN COTTAGES
SLR14 FORGE COTTAGE
SLR15 WALNUT COTTAGE
SLR16 MOAT ROAD
SLR17 THE GRANARY AND THEBERTON GRANGE

NOT PROTECTIVELY MARKED

SZC
EDF ENERGY
CGN

DOCUMENT:
SIZEWELL C
ENVIRONMENTAL STATEMENT
VOLUME 6
CHAPTER 1
INTRODUCTION

DRAWING TITLE:
EXISTING SIZEWELL LINK ROAD
SITE AND SURROUNDING CONTEXT (EAST)

DRAWING NO:
FIGURE 1.4

DATE:	DRAWN:	SCALE :
JAN 2020	J.W.	1:10,000 @A3

SCALE BAR
0 100 200 300 400 500 M

APPENDIX 7L DETAILED RESPONSE TO QUESTIONS EXA REF. BIO.1.242 AND 1.243

CONTENTS

RESPONSE TO EXQ REF BIO.1.242 & BIO.1.243

1.1 Introduction

This paper sets out the SZC Co. Response to question ExQ Ref. Bio.1.242 and Bio.1.243 in relation to Table 22.111 and Table 22.112 pertaining to unmitigated impingement predictions and impingement prediction with full mitigation in the **Marine Ecology and Fisheries ES** chapter [APP-317]. It also briefly summarises ongoing consultation with statutory stakeholders in relation to impingement predictions and provides the most concurrent predictions and provides information in support of ExA questions Bio.1.191, Bio.1.203, Bio.1.244 and Bio.1.245.

a) ExQ Ref. Bio.1.242

1.1.1 ExQ Ref. Bio.1.242 stated *"[APP-317] Section D.c.c.c Assessment of impingement losses, Table 22.111 – pre-mitigation table.*

(i) Please will the Applicant explain why eels are not in red, given that they are 1.89%SSB? Why is Twaite shad 84.6% of landings shaded red when it is only 0.05% of SSB? Why are horse mackerel and mackerel in red. They are 0.00%.

(ii) In relation to Twaite shad, why is % of landings used when SSB is available?

(iii) Why is the percentage of mean landings used for Allis shad when there is no figure for mean landings? In addition for this species, Allis Shad, the figure for %age of SSB is 0.018%.

(iv) Please will the Applicant explain, and confirm the other figures in this table are correct, or amend if necessary. If amendments are made, please re-issue the table with changes clearly shown and consequential changes elsewhere in the ES set out.

(v) Please will the MMO also comment on all of the above."

1.1.2 The shading in Table 22.111 of [APP-317] was incorrect and a revised table is provided below. The colour system reflects the same system as applied in the details impingement assessment report provided as **Appendix 22I** - Sizewell C Impingement Predictions Based Upon Specific Cooling Water System Design [APP-326].

1.1.3 In response to ExQ Ref. Bio.1.242 (i) the species above 1% of the relevant stock comparator are European eel at 1.89% of the local Anglian River Basin District (RBD), thin-lipped mullet at 2.45% of landings, and European seabass at 1.32% of SSB. No other species should have been shaded red

as they fall below the relevant comparator. In each case the estimate is considered precautionary (please see **Section 1.2**).

1.1.4 In each case the error was restricted to the shading in Table 22.111 in the **Marine Ecology and Fisheries ES** chapter [APP-317]. The assessment and conclusions for European eel (para. 22.8.620); thin-lipped mullet (para. 22.8.583), and European seabass (para. 22.8.576) was correct.

1.1.5 In response to ExQ Ref. Bio.1.242 (ii) and (iii), where SSB or a population estimate is available, it is applied as the comparator. Twaite shad and allis shad losses due to impingement were contextualised against the estimated population numbers (please see **Section 1.2**). The shading in Table 22.111 is corrected below.

1.1.6 In response to ExQ Ref. Bio.1.242 (iv) SZC Co. apologises for the lack of clarity caused by the shading error in Table 22.111. These are corrected below, with the red shading as it should have appeared in the **Marine Ecology and Fisheries ES** chapter [APP-317]. The error was restricted to the table shading and the numbers presented were correct at the time of the DCO submission. The assessments and conclusions remain unchanged.

Table 22.111 [APP-317]: Annual mean impingement predictions with no mitigation. Losses have been converted to adult equivalent value (EAV) numbers and weights (t) and calculated as a percentage of the relevant mean stock SSB (t) or mean international landings (t) where SSB information is not available. The relevant comparator is shaded, species where the impingement weight exceeds 1% of the relevant stock comparator are shaded in red. Values in red font are estimates of the population numbers (sand goby, twaite shad and allis shad) or reported catch numbers (salmon and sea trout).

Species	Mean prediction.	EAV number.	EAV weight (t).	Mean SSB (t).	% of SSB	Mean landings (t).	% of landings
Sprat	7,125,393	5,352,978	56.23	220,757	**0.03**	151,322	0.04
Herring	2,555,783	1,827,944	344.87	2,198,449	**0.02**	400,244	0.09
Whiting	1,865,492	664,261	189.86	151,881	**0.13**	17,570	1.08
Seabass	575,367	128,861	197.26	14,897	**1.32** [1]	3,051	6.47
Sand goby.	381,612	381,612	0.73	205,882,353	**0.19**	NA	NA
Sole	250,059	53,233	11.40	43,770	**0.03**	12,800	0.09
Dab	148,921	66,211	2.70	NA	NA	6,135	**0.04**
Anchovy	73,865	71,952	1.49	NA	NA	1,625	**0.09**
Thin-lipped grey mullet.	67,684	5,642	2.93	NA	NA	120	**2.45**
Flounder	38,180	17,631	1.44	NA	NA	2,309	**0.06**
Plaice	25,288	8,734	2.15	690,912	**0.00**	80,367	0.00

[1] Seabass are not uniformly distributed across the site [see response to ExQ Bio.1.244]. Evidence demonstrates that juvenile seabass are attracted to the warm water effluents of Sizewell B in Winter. Accounting for the significantly greater distribution of seabass in the inshore waters away from the Sizewell C intakes (DCO Ref. 22.402), impingement predictions reduce to **12,886** individuals (EAV number) or **0.13% of SSB**. Details are provided in **Appendix 22I** - Sizewell C Impingement Predictions Based Upon Specific Cooling Water System Design [APP-326].

Species	Mean prediction.	EAV number.	EAV weight (t).	Mean SSB (t).	% of SSB	Mean landings (t).	% of landings
Smelt	23,863	18,170	0.30	105,733,825	**0.02**	8	3.56
Cod	16,845	6,049	15.74	103,025	**0.02**	34,701	0.05
Thornback ray.	10,802	2,082	6.65	NA	NA	1,573	**0.42**
River lamprey.	6,720	6,720	0.53	62	**0.86**	1	47.65
Eel	4,516	4,516	1.49	79	**1.89**	14	10.70
Twaite shad.	3,601	3,601	1.13	7,519,986	**0.05**	1	84.60
Horse mackerel.	4,077	4,077	0.57	NA	NA	21,442	**0.00**
Mackerel	628	628	0.20	3,888,854	**0.00**	1,026,828	0.00
Tope	64	64	0.44	NA	NA	498	**0.09**
Sea trout.	10	10	0.02	NA	NA	39,795	**0.02**
Allis shad.	5	5	0.00	27,397	**0.018**	0	1.79
Sea lamprey.	5	5	0.01	NA	NA	NA	NA
Salmon	0	0	0.00	NA	NA	38,456	**0.00**

b) ExQ Ref. Bio.1.242

1.1.7 ExQ Ref. Bio.1.243 stated *"[APP-317] Section D.c.c.c Assessment of impingement losses, Table 22.112 – full mitigation table.*

(i) Should that approach be adopted for Table 22.112. If so, please re-issue the table with changes clearly shown and consequential changes elsewhere in the ES set out. Please will the Applicant clarify.

(ii) Why does this table show landings when SSB are available?

(iii) Twaite shad – 32.4% of landings are impinged. That appears to be a very large percentage. Please will the applicant explain why it is so much higher than the other species. Also how is it calculated? Mean landings are 1 tonne. EAV weight of impinged fish is 0.43 tonnes. So should the figure be 43%? Either way, please will the Applicant comment on its significance. But is the relevant figure the percentage of SSB, namely 0.02%..

(iv) Please will the MMO also comment on all of the above".

1.1.1 SZC Co. response to ExQ Ref. Bio.1.243 Table 22.112: The table as it appeared in **Marine Ecology and Fisheries ES** chapter [APP-317] was correct. It is provided below with a colour system akin to the impingement evidence report (**Appendix 22I** - Sizewell C Impingement Predictions Based Upon Specific Cooling Water System Design [APP-326]) to improve clarity.

1.1.2 In response to ExQ Ref. Bio.1.243 (ii); landings information is provided for extra context, however, whenever SSB or population estimates are available they are applied as the effect comparator.

1.1.3 In response to ExQ Ref. Bio.1.243 (iii); The relevant effect comparator for twaite shad is the estimated population size. Effects are not significant. There is no North Sea SSB available for twaite shad and no directed fishery. Landings figures therefore represent incidental recorded landings and are not an accurate reflection of catches or indeed population size. This explains the high percentage. Landings data have been provided without decimal places whereas calculations apply full decimal places. In the case of twaite shad the very low numbers concerned would require presentation at 3 d.p. (0.432 t impinged ÷ 1.333 t landing estimate = 32.4%).

Table 22.112 [APP-317]: Annual mean Sizewell C predictions of impingement with full mitigation (FRR and LVSE intake heads). Losses have been converted to adult equivalent value (EAV) numbers and weights (t) and calculated as a percentage of the relevant mean stock SSB (t) or mean international landings (t) where SSB information is not available. The relevant comparator is shaded, species where the impingement weight exceeds 1% of the relevant stock comparator are shaded in red. Values in red font are estimates of the population numbers (sand goby, twaite shad and allis shad) or reported catch numbers (salmon and sea trout).

Species	Mean Sizewell C prediction.	Sizewell C prediction after intake head adjustment.	FRR mortality.	EAV number.	EAV weight (t).	mean SSB (t).	% of SSB	Mean landings (t).	% of landings
Sprat	7,125,393	2,729,025	2,729,025	2,050,190	21.53	220,757	0.01	151,322	0.01
Herring	2,555,783	978,865	978,865	700,103	132.08	2,198,449	0.01	400,244	0.03
Whiting	1,865,492	714,484	393,295	140,044	40.03	151,881	0.03	17,570	0.23
Seabass	575,367	220,366	121,326	27,172	41.60	14,897	0.28 [2]	3,051	1.36
Sand goby.	381,612	146,157	30,108	30,108	0.06	205,882,353	0.01	NA	NA
Sole	250,059	95,773	19,729	4,200	0.90	43,770	0.00	12,800	0.01
Dab	148,921	57,037	30,715	13,656	0.56	NA	NA	6,135	0.01
Anchovy	73,865	28,290	28,290	27,558	0.57	NA	NA	1,625	0.04
Thin-lipped grey mullet.	67,684	25,923	14,273	1,190	0.62	NA	NA	120	0.52
Flounder	38,180	14,623	3,377	1,559	0.13	NA	NA	2,309	0.01

[2] Seabass are not uniformly distributed across the site [see response to ExQ Bio.1.244]. Evidence demonstrates that juvenile seabass are attracted to the warm water effluents of Sizewell B in Winter. Accounting for the significantly greater distribution of seabass in the inshore waters away from the Sizewell C intakes (DCO Ref. 22.402), impingement predictions reduce to **12,886** individuals (EAV number) or **0.13% of SSB**. Details are provided in **Appendix 22I** - Sizewell C Impingement Predictions Based Upon Specific Cooling Water System Design [APP-326].

Species	Mean Sizewell C prediction.	Sizewell C prediction after intake head adjustment.	FRR mortality.	EAV number.	EAV weight (t).	mean SSB (t).	% of SSB	Mean landings (t).	% of landings
Plaice	25,288	9,685	1,995	689	0.17	690,912	0.00	80,367	0.00
Smelt	23,863	9,139	9,139	6,959	0.12	105,733,825	0.01	8	1.36
Cod	16,845	6,451	3,884	1,395	3.63	103,025	0.00	34,701	0.01
Thornback ray.	10,802	4,137	852	164	0.52	NA	NA	1,573	0.03
River lamprey.	6,720	2,574	530	530	0.04	62	0.07	1	3.76
Eel	4,516	1,730	356	356	0.12	79	0.15	14	0.84
Twaite shad.	3,601	1,379	1,379	1,379	0.43	7,519,986	0.02	1	32.40
Horse mackerel.	4,077	1,561	1,561	1,561	0.22	NA	NA	21,442	0.00
Mackerel	628	241	241	241	0.08	3,888,854	0.00	1,026,828	0.00
Tope	64	24	5	5	0.03	NA	NA	498	0.01
Sea trout.	10	4	4	4	0.01	NA	NA	39,795	0.01
Allis shad.	5	2	2	2	0.00	27,397	0.01	0	0.68
Sea lamprey.	5	2	0	0	0.00	NA	NA	NA	NA
Salmon	0	0	0	0	0.00	NA	NA	38,456	0.00

1.2 Additional information

1.2.27 The **Marine Ecology and Fisheries ES** chapter [APP-317] was submitted in May 2020. Since the DCO Application ongoing consultation with the Environment Agency, Eastern Inshore Fisheries and Conservation Authority, MMO and Natural England has taken place.

1.2.28 A bilateral meeting with each statutory stakeholder followed submission of the Relevant Representations. In response to consultation a series of supplementary fish assessment material was produced and submitted in January 2021 as part of the ES Addendum.

1.2.29 ES Addendum material (**Volume 3, Appendix 2.17.A** [AS-238]) included:

- **TR406 (version 7): Impingement predictions based upon specific cooling water system design.** These impingement predictions superseded those provided in the Marine Ecology and Fisheries ES chapter [APP-317] and Appendix 22I [APP-326], which was version 6 of the same report.
- SPP099 - Predicted performance of the Sizewell C Low Velocity Side Entry intake heads compared with the Sizewell B intakes;
- SPP100 - Estimates of European populations of twaite shad and cucumber smelt of relevance to Sizewell;
- SPP101 - Implications of tidal elevation and temperature on smelt, *Osmerus eperlanus*, impingement at Sizewell;
- SPP102 - Use of Spawning Production Foregone Equivalent Adult Values for impingement assessment;
- SPP103 - Consideration of potential effects on selected fish stocks at Sizewell;
- SPP104 - Worst case glass eel entrainment assessment for Sizewell C;
- SPP108 - Sensitivity of the Alde & Ore Transitional Fish Classification Index (TFCI) to changes in smelt, *Osmerus eperlanus*, abundance;
- TR339 - Sizewell Comprehensive Impingement Monitoring Programme 2009 – 2017;
- TR520: Sizewell C Water quality effects of the fish recovery and return system.

1.2.30 In most cases these reports have been subject to further consultation and revisions submitted in response to comments from statutory stakeholders.

1.2.31 Impingement predictions in TR406 (version 7) (**Volume 3, Appendix 2.17.A** [AS-238]) were revised to include a bootstrapping approach for predicting mean annual impingement records that substantially improved the statistical robustness of the upper and lower confidence intervals. The submission of the associated reports also provided further context to the assessments, and a minor change in the LVSE factor was included.

1.2.32 Stepwise impingement predictions were provided as follows:

- Table 2 (page 80) Summary table of Sizewell C impingement predictions with full mitigation (FRR + LVSE) and consideration of additional ecological factors.
- Table 11 (page 129) Sizewell C impingement predictions with no mitigation.
- Table 12 (page 130) Sizewell C impingement predictions with LVSE mitigation.
- Table 13 (Page 131) Sizewell C impingement predictions with FRR mitigation.
- Table 14 (page 132) Sizewell C impingement predictions with full mitigation.

1.2.33 Providing impingement predictions for each mitigation scenario, and with no mitigation allows transparent discussion of the effectiveness of each mitigation option and the implications for overall impingement predictions.

1.2.34 The updated impingement predictions in TR406 (version 7) (**Volume 3, Appendix 2.17.A** [AS-238]) did not change the conclusions of the original assessment.

1.3 Concurrent impingement predictions

1.3.27 In parallel to the EIA, there is ongoing dialogue between SZC Co. and the Environment Agency regarding impingement predictions in the context of the WDA Permit Application.

1.3.28 It is recognised that common ground still remains to be sought with the Environment Agency on a number of issues including the most relevant population comparator, the application of equivalent adult values (EAV) and mitigation factors, notably LVSE heads.

1.3.29 It should be noted that the MMO broadly agree with the application of EAV and stock units as applied by SZC Co. [RR-0744]. Impingement predictions are provided without mitigation and with each level of mitigation applied

sequentially to illustrate the anticipated benefits individually and in-combination and to enable consideration regarding the uncertainty in the LVSE to be contextualised.

1.3.30 The objective of ongoing consultation is to arrive at the most robust impingement predictions. Through Schedule 5 requests received from the Environment Agency SZC Co. has updated impingement predictions with the evidence report (SPP111.v2[3]) and raw data provided to the Environment Agency. Furthermore, in light of the latest ICES advice estimates of spawning stock biomass and landings statistics have been revised as detailed in the evidence report submitted to statutory stakeholders (SPP103.v4[4]).

1.3.31 The consequence of the ongoing consultation means that the absolute figures for impingement in the DCO application (**Marine Ecology and Fisheries ES** chapter [APP-317]) are subject to change. However, whilst the ongoing consultation may enable refinement of the impingement predictions, the changes in absolute numbers do not change the overall conclusions in the DCO (**Marine Ecology and Fisheries ES** chapter [APP-317]).

1.3.32 Figure 1 provides a summary of the updates since the DCO application. The most concurrent impingement predictions are provided in Tables 1 to 6 below.

1.3.33 Losses due to impingement are not significant at the population level.

[3] BEEMS Scientific Position Paper SPP111.v2. Sizewell C impingement predictions corrected for Sizewell B raising factors and cooling water flow rates. Cefas, Lowestoft. May, 2021.
[4] BEEMS Scientific Position Paper SPP103.v4. Consideration of potential effects on selected fish stocks at Sizewell. Cefas, Lowestoft. April, 2021

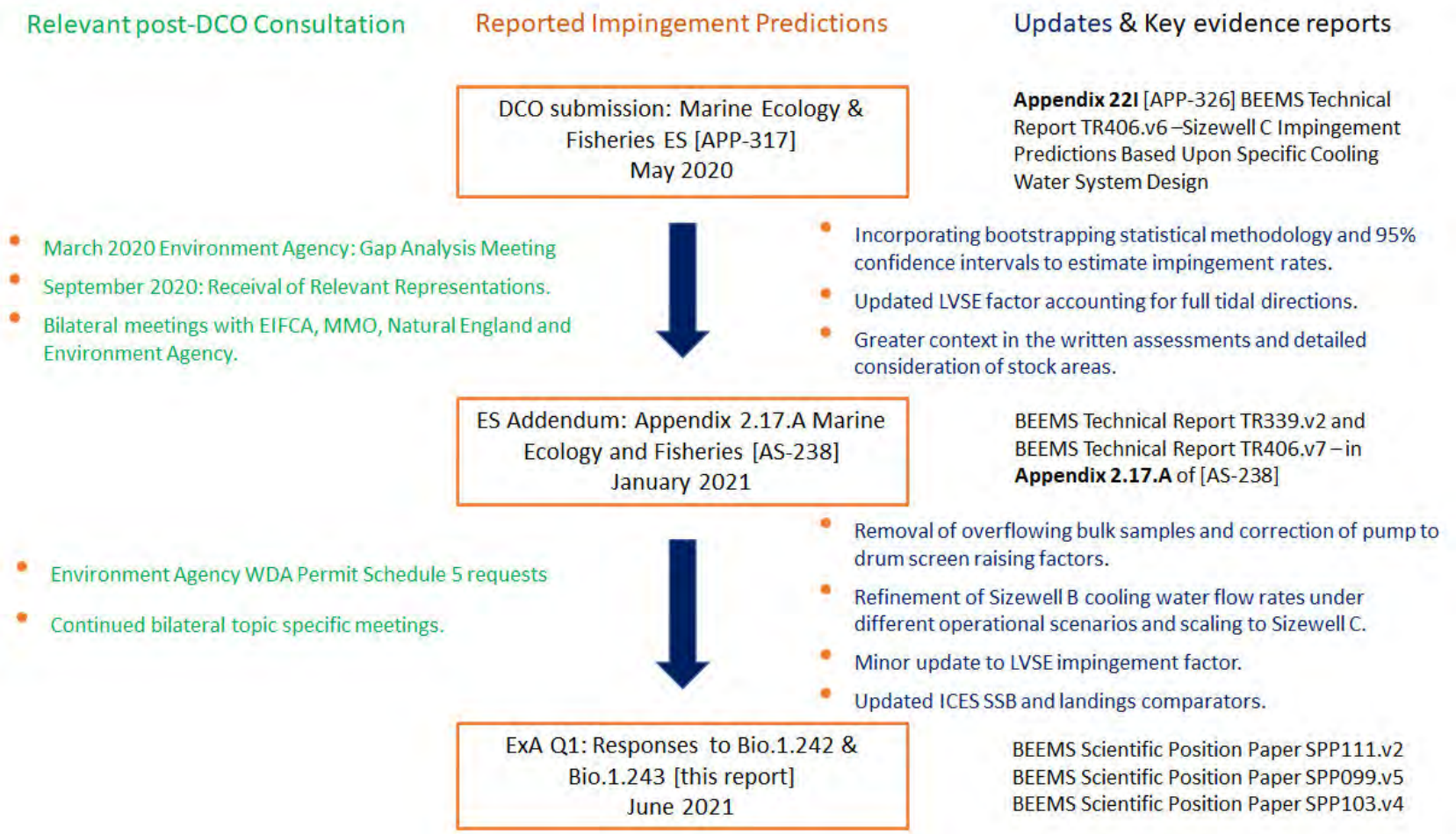
Relevant post-DCO Consultation
Reported Impingement Predictions
Updates & Key evidence reports
DCO submission: Marine Ecology & Fisheries ES [APP-317] May 2020
Appendix 22I [APP-326] BEEMS Technical Report TR406.v6 –Sizewell C Impingement Predictions Based Upon Specific Cooling Water System Design
March 2020 Environment Agency: Gap Analysis Meeting
September 2020: Receival of Relevant Representations.
Bilateral meetings with EIFCA, MMO, Natural England and Environment Agency.
Incorporating bootstrapping statistical methodology and 95% confidence intervals to estimate impingement rates.
Updated LVSE factor accounting for full tidal directions.
Greater context in the written assessments and detailed consideration of stock areas.
ES Addendum: Appendix 2.17.A Marine Ecology and Fisheries [AS-238] January 2021
BEEMS Technical Report TR339.v2 and BEEMS Technical Report TR406.v7 – in Appendix 2.17.A of [AS-238]
Environment Agency WDA Permit Schedule 5 requests
Continued bilateral topic specific meetings.
Removal of overflowing bulk samples and correction of pump to drum screen raising factors.
Refinement of Sizewell B cooling water flow rates under different operational scenarios and scaling to Sizewell C.
Minor update to LVSE impingement factor.
Updated ICES SSB and landings comparators.
ExA Q1: Responses to Bio.1.242 & Bio.1.243 [this report] June 2021
BEEMS Scientific Position Paper SPP111.v2
BEEMS Scientific Position Paper SPP099.v5
BEEMS Scientific Position Paper SPP103.v4

Figure 1 Development of the impingement predictions since the original DCO submission.

Table 1 Unmitigated impingement predictions for Sizewell C showing mean and 95% confidence intervals, EAV number and weight. The reciprocal numbers from the Environment Statement (ES) Table 22.111 [APP-317] along with the relative difference are also provided.

Species	Current SZC impingement predictions					Numbers presented in Marine Ecology and Fisheries ES [APP-317]			Difference
	Mean numbers	Lower 95% CI	Upper 95% CI	Mean EAV number	Mean EAV weight (t)	ES mean number	ES mean EAV number	ES mean EAV weight (t)	
Sprat	6,153,906	3,173,989	10,415,898	4,623,145	**48.56**	7,125,393	5,352,978	**56.23**	-13.6%
Herring	2,211,750	1,310,172	3,352,700	1,581,885	**298.45**	2,555,783	1,827,944	**344.87**	-13.5%
Whiting	1,495,192	1,095,717	1,954,416	532,405	**152.17**	1,865,492	664,260	**189.86**	-19.8%
Seabass	641,398	296,862	1,113,750	143,649	**219.90**	575,367	128,860	**197.26**	11.5%
Sand goby	483,487	205,548	916,287	483,487	**0.92**	381,612	381,612	**0.73**	26.7%
Dover sole	211,083	146,474	290,806	44,935	**9.62**	250,059	53,233	**11.40**	-15.6%
Anchovy	148,332	43,495	356,894	144,491	**3.00**	73,865	71,952	**1.49**	100.8%
Dab	128,476	76,309	214,481	57,121	**2.33**	148,921	66,211	**2.70**	-13.7%
Thin-lipped grey mullet	107,602	33,386	207,685	8,969	**4.66**	67,684	5,642	**2.93**	59.0%
Flounder	32,149	24,367	42,211	14,846	**1.21**	38,180	17,631	**1.44**	-15.8%
Plaice	21,956	14,135	32,723	7,583	**1.87**	25,288	8,734	**2.15**	-13.2%

Species	Current SZC impingement predictions					Numbers presented in Marine Ecology and Fisheries ES [APP-317]			Difference
	Mean numbers	Lower 95% CI	Upper 95% CI	Mean EAV number	Mean EAV weight (t)	ES mean number	ES mean EAV number	ES mean EAV weight (t)	
Smelt	22,165	13,867	32,370	16,877	**0.28**	23,863	18,170	**0.30**	-7.1%
Cod	16,505	5,716	30,807	5,927	**15.42**	16,845	6,049	**15.74**	-2.0%
Thornback ray	6,700	4,172	9,833	1,292	**4.12**	10,802	2,082	**6.65**	-38.0%
River lamprey	2,607	1,430	4,393	2,607	**0.21**	6,720	6,720	**0.53**	-61.2%
Eel	2,463	1,530	3,628	2,463	**0.81**	4,516	4,516	**1.49**	-45.5%
Twaite shad	2,693	1,340	4,691	2,693	**0.84**	3,601	3,601	**1.13**	-25.2%
Horse mackerel	1,560	488	3,756	1,560	**0.22**	4,077	4,077	**0.57**	-61.7%
Mackerel	277	14	916	277	**0.09**	628	628	**0.20**	-55.9%
Tope	55	0	207	55	**0.38**	64	64	**0.44**	-14.1%
Sea trout	8	0	48	8	**0.01**	10	10	**0.02**	-20.0%
Allis shad	0	0	0	0	**0.00**	5	5	**0.00**	-100.0%
Sea lamprey	4	0	26	4	**0.00**	5	5	**0.01**	-20.0%
Salmon[5]	0	0	0	0	0	0	0	0	0

[5] Salmon is not shown in the subsequent tables.

Table 2 Unmitigated impingement predictions for Sizewell C. The updated ICES spawning stock biomass (SSB), population estimate (numbers of fish) or landings are displayed. The relevant SSB or landings comparator is shown in bold. Impingement losses as a % of the relevant comparator are shown for the current predictions and as they appeared in Table 22.111 [APP-317]. Losses below 1% of the comparator are shown in green, red shading shows values above 1%.

Species	Current SZC impingement predictions						% of relevant comparator in the ES [APP-317] – Table 22.111
	Mean numbers	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator	
Sprat	6,153,906	4,623,145	48.56	**192,852**	160.4	**0.03**	0.03
Herring	2,211,750	1,581,885	298.45	**2,421,962**	390,933	**0.01**	0.02
Whiting	1,495,192	532,405	152.17	**143,759**	18,306	**0.11**	0.13
Seabass	641,398	143,649	219.90	**13,996**	3,197	**1.57** [6]	1.32
Sand goby	483,487	483,487	0.92	**205,882,353**	NA	**0.23**	0.19
Dover sole	211,083	44,935	9.62	**29,665**	12,471	**0.03**	0.03
Anchovy	148,332	144,491	3.00	NA	**3,112**	**0.10**	0.04
Dab	128,476	57,121	2.33	NA	**5,188**	**0.04**	0.09
Thin-lipped grey mullet	107,602	8,969	4.66	NA	**119.3**	**3.91** [7]	2.45
Flounder	32,149	14,846	1.21	NA	2,313	**0.05**	0.06

[6] Assumes homogeneous distribution of seabass within the GSB, see Table 3.
[7] Effects are based on landings from a small fishery, see Table 3.

Species	Current SZC impingement predictions						% of relevant comparator in the ES [APP-317] – Table 22.111
	Mean numbers	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator	
Plaice	21,956	7,583	1.87	**967,222**	82,841	**0.00**	0.00
Smelt	22,165	16,877	0.28	**23,861,520**	8.6	**0.07**	0.02
Cod	16,505	5,927	15.42	**101,647**	34,730	**0.02**	0.02
Thornback ray	6,700	1,292	4.12	NA	677	**0.61**	0.42
River lamprey	2,607	2,607	0.21	**61.9**	1.1	**0.33**	0.86
Eel	2,463	2,463	0.81	**78.6**	13.9	**1.03** [8]	1.89
Twaite shad	2,693	2,693	0.84	**5,161,183**	1.3	**0.05**	0.05
Horse mackerel	1,560	1,560	0.22	NA	**20,456**	**0.00**	0.00
Mackerel	277	277	0.09	**4,296,467**	1,017,332	**0.00**	0.00
Tope	55	55	0.38	NA	**505.8**	**0.08**	0.09
Sea trout	8	8	0.01	**39,795**	NA	**0.02**	0.02
Allis shad	0	0	0.00	**27,397**	6.6	**0.00**	0.02
Sea lamprey	4	4	0.00	NA	NA	NA	NA

[8] Effect % is in relation to the Anglian River District Basin biomass. Effects are considered to be precautionary as an EAV values of 1 is applied for eels due to a lack of necessary biological and population data to derive an EAV. All eels impinged were juvenile yellow eels therefore the EAV would be <1 (TR406.v7 **Volume 3, Appendix 2.17.A** [AS-238]).

Table 3 Unmitigated impingement predictions for Sizewell C for seabass and thin-lipped grey mullet. Seabass estimates account for differences in distribution within the GSB. Grey mullet estimates apply a calculated SSB. Further details provided in (TR406.v7 Volume 3, Appendix 2.17.A [AS-238]). The updated ICES spawning stock biomass (SSB), population estimate (numbers of fish) or landings are displayed. The relevant SSB or landings comparator is shown in bold. Impingement losses as a % of the relevant stock comparator are shown for the current predictions. Losses below 1% of the comparator are shown in green.

Species	Current SZC impingement predictions					
	Mean numbers	Mean EAV number	Mean EAV weight (t)	SSB (t)	Mean landings (t)	% of relevant comparator
Seabass (accounting for distribution)	64,140	14,365	21.99	**13,996**	3,197	**0.16**
Thin-lipped grey mullet (estimated SSB)	107,602	8,969	4.66	**597**	119.3	**0.78**

Table 4 Impingement predictions for Sizewell C with LVSE (0.394) mitigation. The updated ICES spawning stock biomass (SSB), population estimate (numbers of fish) or landings are displayed. The relevant SSB or landings comparator is shown in bold. Impingement losses as a % of the relevant stock comparator are shown for the current predictions. Losses below 1% of the comparator are shown in green, red shading shows values above 1%.

Species	Current SZC impingement predictions						
	Mean	LVSE mitigation	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator
Sprat	6,153,906	2,424,639	1,821,519	19.13	**192,852**	160.4	**0.01**
Herring	2,211,750	871,430	623,263	117.59	**2,421,962**	390,933	**0.00**
Whiting	1,495,192	589,106	209,768	59.96	**143,759**	18,306	**0.04**
Seabass	641,398	252,711	56,598	86.64	**13,996**	3,197	**0.62** [9]
Sand goby	483,487	190,494	190,494	0.36	**205,882,353**	NA	**0.09**
Dover sole	211,083	83,167	17,705	3.79	**29,665**	12,471	**0.01**
Anchovy	148,332	58,443	56,930	1.18	NA	**3,112**	**0.04**
Dab	128,476	50,620	22,506	0.92	NA	**5,188**	**0.02**
Thin-lipped grey mullet	107,602	42,395	3,534	1.84	**597**	119.3	**1.54** [10]
Flounder	32,149	12,667	5,849	0.48	NA	2,313	**0.02**

[9] Seabass effect predictions fall to **0.06%** if the distribution within the GSB is accounted for (Table 3).
[10] Thin-lipped grey mullet effect predictions fall to **0.31%** if the precautionary SSB estimate is applied (Table 3).

Species	Current SZC impingement predictions						
	Mean	LVSE mitigation	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator
Plaice	21,956	8,651	2,988	0.73	**967,222**	82,841	**0.00**
Smelt	22,165	8,733	6,650	0.11	**23,861,520**	8.6	**0.03**
Cod	16,505	6,503	2,335	6.08	**101,647**	34,730	**0.01**
Thornback ray	6,700	2,640	509	1.62	NA	677	**0.24**
River lamprey	2,607	1,027	1,027	0.08	**61.9**	1.1	**0.13**
Eel	2,463	970	970	0.32	**78.6**	13.9	**0.41**
Twaite shad	2,693	1,061	1,061	0.33	**5,161,183**	1.3	**0.02**
Horse mackerel	1,560	615	615	0.09	NA	**20,456**	**0.00**
Mackerel	277	109	109	0.03	**4,296,467**	1,017,332	**0.00**
Tope	55	22	22	0.15	NA	**505.8**	**0.03**
Sea trout	8	3	3	0.01	**39,795**	NA	**0.01**
Allis shad	0	0	0	0.00	**27,397**	6.6	**0.00**
Sea lamprey	4	2	2	0.00	NA	NA	NA

Table 5 Impingement predictions for Sizewell C with FRR mitigation. The updated ICES spawning stock biomass (SSB), population estimate (numbers of fish) or landings are displayed. The relevant SSB or landings comparator is shown in bold. Impingement losses as a % of the relevant stock comparator are shown for the current predictions. Losses below 1% of the comparator are shown in green, red shading shows values above 1%.

Species	Current SZC impingement predictions						
	Mean	FRR mitigation	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator
Sprat	6,153,906	6,153,906	4,623,145	48.56	**192,852**	160.4	**0.03**
Herring	2,211,750	2,211,750	1,581,885	298.45	**2,421,962**	390,933	**0.01**
Whiting	1,495,192	823,043	293,067	83.76	**143,759**	18,306	**0.06**
Seabass	641,398	353,132	79,088	121.07	**13,996**	3,197	**0.87** [11]
Sand goby	483,487	99,599	99,599	0.19	**205,882,353**	NA	**0.05**
Dover sole	211,083	43,483	9,257	1.98	**29,665**	12,471	**0.01**
Anchovy	148,332	148,332	144,491	3.00	NA	**3,112**	**0.10**
Dab	128,476	69,186	30,761	1.26	NA	**5,188**	**0.02**
Thin-lipped grey mullet	107,602	59,244	4,938	2.57	*597*	**119.3**	**2.15** [12]
Flounder	32,149	7,423	3,428	0.28	NA	2,313	**0.01**

[11] Seabass effect predictions fall to **0.09%** if the distribution within the GSB is accounted for (Table 3).
[12] Thin-lipped grey mullet effect predictions fall to **0.43%** if the precautionary SSB estimate is applied (Table 3).

Species	Current SZC impingement predictions						
	Mean	FRR mitigation	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator
Plaice	21,956	4,522	1,562	0.38	**967,222**	82,841	**0.00**
Smelt	22,165	22,165	16,877	0.28	**23,861,520**	8.6	**0.07**
Cod	16,505	9,938	3,569	9.29	**101,647**	34,730	**0.01**
Thornback ray	6,700	1,380	266	0.85	NA	677	**0.13**
River lamprey	2,607	537	537	0.04	**61.9**	1.1	**0.07**
Eel	2,463	507	507	0.17	**78.6**	13.9	**0.21**
Twaite shad	2,693	2,693	2,693	0.84	**5,161,183**	1.3	**0.05**
Horse mackerel	1,560	1,560	1,560	0.22	NA	**20,456**	**0.00**
Mackerel	277	277	277	0.09	**4,296,467**	1,017,332	**0.00**
Tope	55	11	11	0.08	NA	**505.8**	**0.02**
Sea trout	8	8	8	0.01	**39,795**	NA	**0.02**
Allis shad	0	0	0	0.00	**27,397**	6.6	**0.00**
Sea lamprey	4	1	1	0.00	NA	NA	NA
Salmon							

Table 6 Impingement predictions for Sizewell C with full mitigation (LVSE + FRR). The updated ICES spawning stock biomass (SSB), population estimate (numbers of fish) or landings are displayed. The relevant SSB or landings comparator is shown in bold. Impingement losses as a % of the relevant comparator are shown for the current predictions and as they appeared in Table 22.112 [APP-317]. Losses below 1% of the comparator are shown in green.

Species	Current SZC impingement predictions								% of relevant comparator in the ES [APP-317] – Table 22.112
	Mean	LVSE	FRR mitigation	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator	
Sprat	6,153,906	2,424,639	2,424,639	1,821,519	19.13	**192,852**	160.4	**0.01**	0.01
Herring	2,211,750	871,430	871,430	623,263	117.59	**2,421,962**	390,933	**0.00**	0.01
Whiting	1,495,192	589,106	324,279	115,469	33.00	**143,759**	18,306	**0.02**	0.03
Seabass	641,398	252,711	139,134	31,161	47.70	**13,996**	3,197	**0.34** [13]	0.28
Sand goby	483,487	190,494	39,242	39,242	0.07	**205,882,353**	NA	**0.02**	0.01
Dover sole	211,083	83,167	17,132	3,647	0.78	**29,665**	12,471	**0.00**	0.00
Anchovy	148,332	58,443	58,443	56,930	1.18	NA	**3,112**	**0.04**	0.04
Dab	128,476	50,620	27,259	12,120	0.49	NA	**5,188**	**0.01**	0.01
Thin-lipped grey mullet	107,602	42,395	23,342	1,946	1.01	*597*	**119.3**	**0.85** [14]	0.52
Flounder	32,149	12,667	2,925	1,351	0.11	NA	2,313	**0.00**	0.01

[13] Seabass effect predictions fall to **0.03%** if the distribution within the GSB is accounted for (Table 3).
[14] Thin-lipped grey mullet effect predictions fall to **0.17%** if the precautionary SSB estimate is applied (Table 3).

Species	Current SZC impingement predictions								% of relevant comparator in the ES [APP-317] – Table 22.112
	Mean	LVSE	FRR mitigation	Mean EAV number	Mean EAV weight (t)	SSB (t) / number	Mean landings (t)	% of relevant comparator	
Plaice	21,956	8,651	1,782	615	0.15	**967,222**	82,841	**0.00**	0.00
Smelt	22,165	8,733	8,733	6,650	0.11	**23,861,520**	8.6	**0.03**	0.01
Cod	16,505	6,503	3,915	1,406	3.66	**101,647**	34,730	**0.00**	0.00
Thornback ray	6,700	2,640	544	105	0.33	NA	677	**0.05**	0.03
River lamprey	2,607	1,027	211	211	0.02	**61.9**	1.1	**0.03**	0.07
Eel	2,463	970	200	200	0.07	**78.6**	13.9	**0.08**	0.15
Twaite shad	2,693	1,061	1,061	1,061	0.33	**5,161,183**	1.3	**0.02**	0.02
Horse mackerel	1,560	615	615	615	0.09	NA	**20,456**	**0.00**	0.00
Mackerel	277	109	109	109	0.03	**4,296,467**	1,017,332	**0.00**	0.00
Tope	55	22	4	4	0.03	NA	**505.8**	**0.01**	0.01
Sea trout	8	3	3	3	0.01	**39,795**	NA	**0.01**	0.01
Allis shad	0	0	0	0	0.00	**27,397**	6.6	**0.00**	0.01
Sea lamprey	4	2	0	0	0.00	NA	NA	NA	NA
Salmon									

APPENDIX 7M BIODIVERSITY NET GAIN REPORTS COVERING NOTE

CHAPTER 7, APPENDIX 7M

CONTENTS

TABLES

None Provided.

PLATES

None Provided.

FIGURES

None Provided

APPENDICES

None Provided

1 INTRODUCTION

1.1.1 The Biodiversity Net Gain reports submitted with the application in May 2020 for the main development site, two village bypass, Sizewell link road and Yoxford roundabout have been updated in light of design changes and stakeholder feedback. The result for the development as a whole, including four elements, i.e. the main development site and three Additional Development (AD) sites, is similar to that presented in the previously submitted reports, with an overall 19% increase in biodiversity units predicted for the development proposals as a whole, compared to an 18% increase predicted under the previous design iterations. The minor increase compared to the previous reports is due to additional habitat creation under this design iteration (primarily additional wetland habitat in the main development site and woodland and SuDS (Sustainable Drainage Systems) areas in Sizewell link road.

2 KEY LEGISLATION, POLICY AND STRATEGY

2.1.1 A summary of the key legislation, policy and strategy is presented in Table 1.

Table 1: Key legislation, policy and strategy

Legislation/ Policy /Strategy	Details
Environment Bill 2019-2021	In line with the 25 Year Plan for the Environment and the National Planning Policy Framework, new development is required to identify and pursue opportunities for securing measurable net gains for biodiversity and for the wider environment. The Environment Bill 2019-2021 which was first introduced on 15 October 2019, it was re-introduced to parliament following a general election on 30 January 2020. The Environment Bill will help deliver the government's manifesto commitment to delivering the most ambitious environmental programme of any country. The Environment Bill introduces a mandatory requirement for biodiversity net gain for new development to ensure that new developments enhance biodiversity and create new green spaces for local communities to enjoy. Integrating biodiversity net gain into the planning system will provide a step change in how planning and development is delivered.

Legislation/ Policy /Strategy	Details
	The Environment bill 2019-2021 has passed its second reading in the House of Commons and is has been at reporting stage since 26 January 2021. The Bill still needs to undergo a third reading in the House of Commons and be passed to the House of Lords. In the reporting stage amendments to the Bill can still be made. The Environment Bill in its present form includes a mandatory Biodiversity Net Gain of 10% for development and this needs to be maintained for a minimum of 30 years. National Significant Infrastructure Projects (NSIP) are excluded from mandatory Biodiversity Net Gain. Biodiversity Net Gain cannot be used to mitigate for the loss of habitats in statutory designated sites or irreplaceable habitats such as Ancient Woodland.
National Planning Policy Framework 2019	The NPPF, sets out how the planning system should protect and enhance nature conservation interests. Section 15, paragraph 170d discusses biodiversity net gain. Planning policies and decisions should contribute to and enhance the natural and local environment by: • minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures; Then paragraph 174b, to protect and enhance biodiversity and geodiversity, plans should: • promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species: and identify and pursue opportunities for securing measurable net gains for biodiversity Finally, paragraph 175d, when determining planning applications, local planning authorities should apply the following principles: • development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity.
East Suffolk Coastal Local Plan (2020)	Biodiversity is one of their Key Issues: • Need to ensure that areas of biodiversity value are protected and enhanced, and that net gains for biodiversity are delivered.

Legislation/ Policy /Strategy	Details
	Policy SCLP10.1: Biodiversity and Geodiversity states that "New development must also secure ecological enhancements as part of its design and implementation, and should provide a biodiversity net gain that is proportionate to the scale and nature of the proposal."
Suffolk's Nature Strategy 2015	Suffolk's Nature Strategy 2015 contains a short section on biodiversity offsetting: "Recommendation 22: Biodiversity offsetting must follow Government guidelines and the mitigation hierarchy, set out in the National Planning Policy Framework. Offsetting should only occur when all steps to avoid and mitigate impacts have been exhausted and should not be seen as a licence to damage sites where less damaging alternatives exist. Offsetting should not apply to internationally or nationally designated sites." "We agree with the principle of biodiversity offsetting as a means of ensuring that there is no net loss to the environment as a result of development, and that we enhance rather than diminish our natural capital. However, it is important to recognise the inherent difficulty of recreating habitats and species populations and establishing acceptable locations for compensatory habitat. Therefore, whilst in some situations biodiversity offsetting can offer an innovative means of reducing environmental loss, it does not offer a licence to remove any habitat for development in any location. In order for biodiversity offsetting to be a success it must be undertaken with the close involvement of the relevant nature conservation bodies and must ultimately recognise that some habitats are irreplaceable. Offsetting also needs to recognise the locational dependency of much of Suffolk's wildlife, for example, it is not possible to recreate heathland on the Suffolk claylands."

3 MAIN DEVELOPMENT SITE

3.1.1 The main development site changes to the Biodiversity net gain (10.2% (habitats) and 14.41% (hedgerow) compared to 18.03% (habitats) and 0.16% (hedgerow)) are due to:

- Scheme changes;
- Greater certainty around the interaction of Sizewell C with Sizewell B;
- Greater granularity of the baseline; and
- Further development of the habitat restoration/creation measures.

3.1.2 In some areas, the baseline for the main development site is a historic baseline (approximately 14 to 6 years ago, depending on the area) and prior to advance habitat creation works which have been undertaken specifically to support the Sizewell C proposals. Such an approach is in accordance with Natural England approaches which encourage habitat creation in advance of development thus improving the value of the mitigation and minimising construction impacts.

3.1.3 The main change proposed to the main development site involves the creation of new wetland habitat in the north of the site, within the Marsh Harrier Habitat Improvement Area. The on-site baseline returns similar units, although there is some change due to the exclusion of the Sizewell B (SZB) area, due to greater certainty on that recently consented scheme. A slightly higher on-site post-development unit total is predicted. This is partly due to the additional wetland creation in the north of the site providing a higher unit return. There is also greater resolution due to the progress of ongoing habitat design, and therefore an updated assessment of these areas was possible.

3.1.4 The 'off-site'[1] offsetting baseline score is greater than under the previous design iteration. Off-site offsetting retained habitats were excluded from previous calculations due to a fault (since fixed) in the Biodiversity Metric tool which meant that retained off-site habitats were treated incorrectly as losses. Woodland in the south of the Studio Fields Complex was one such area that is now included. Studio Field Complex is now species-poor semi-improved and semi-improved acid grassland. This area was historically and incorrectly thought to be an entirely arable field, as incorporated into the biodiversity baseline. However, with greater granularity of assessment, afield known as Broom Covert is now reallocated as acid grassland. This assessment has included this recategorization. This has resulted in an increase in the baseline units. A higher post-development score is predicted under this design iteration, similarly to the on-site area, this is largely driven by the progression of ongoing habitat design, so an updated assessment could be made of these areas.

[1] 'Off-site refers to the wider EDF Energy estate, beyond the application boundary

3.1.5 The factors summarised above drive the increase from a 10% increase in biodiversity units under the previous design iteration to an 18% increase.

4 SIZEWELL LINK ROAD

4.1.1 A large number of relatively minor changes are proposed to this scheme, largely consisting of expansions to the red line boundary. A significant increase in biodiversity units is still predicted for this site, with a 46% increase in biodiversity units predicted, compared to a 63% increase under the previous design iteration. The increase in size of the red line boundary results in increased baseline biodiversity units. The latest post development design involves proportionally more woodland and less grassland than previous iterations, resulting in lower biodiversity unit return per unit area due to the penalties around risk and time to target condition. This is despite the positive biodiversity impact of a mosaic of woodland and grassland.

5 TWO VILLAGE BYPASS

5.1.1 Several small changes to the red line boundary are proposed, but these have not greatly impacted on the overall results. However, a 7% decrease in biodiversity units is predicted, whereas a 13% increase was predicted under the previous design iteration. This reduction is due to the change made to the baseline calculations for habitats adjacent to the River Alde. Some areas adjacent to the River have priority habitat status on MAGIC mapping as the Section 41 priority habitat 'Coastal and Floodplain Grazing Marsh'. However, botanically, it does not match this habitat definition and distinctiveness being *Lolium perenne* dominated improved pasture with little or no aquatic flora within functional ditches. On this basis it was previously assessed as being of low quality and low distinctiveness. However, Natural England and other stakeholders considered that to fully reflect the potential of this baseline habitat it was necessary to increase its 'distinctiveness value'. This results in an increase in the baseline biodiversity units, which drives the net reduction of overall units, rather than changes to the post-development state.

6 YOXFORD ROUNDABOUT

6.1.1 A very small change in the net gain result is predicted at Yoxford (a 0.18 habitat unit value loss and an increase in hedgerow unit values of 0.86 units to a 0.97 habitat unit value and 0.85 hedgerow unit value loss) , due to a minor change to the red line boundary in the west of the site and recategorization of a previously unsurveyed area (from grassland and scattered trees to woodland). The small size of this site means that this site does not have a significant impact on the results across the entire scheme.

APPENDIX 9A CARBON FOCUSED LIFE CYCLE ASSESSMENT OF THE PROPOSED SIZEWELL C NUCLEAR POWER PLANT DEVELOPMENT

Creating a world fit for the future

RICARDO

Carbon focused Life Cycle Assessment of the proposed Sizewell C nuclear power plant development

Report for NNB Generation Company (SZC) Limited

Report for NNB Generation Company (SZC) Limited - 7721918

ED 13018102 | Issue number 1.1 | Date 24/05/2021

Customer:

NNB Generation Company (SZC) Limited

Customer reference:

ED 13018102

Contact:

Simon Gandy, Gemini Building, Fermi Avenue, Harwell, Didcot, OX11 0QR, UK

T: +44 (0) 1235 753 371

E: [redacted]

Authors:

Fei Zhang, Sam Hinton

Approved by:

Simon Gandy

Signed

Date:

2021-05-24

Ref: ED 13018102

Ricardo is certified to ISO9001, ISO14001, ISO27001 and ISO45001

Executive summary

This study presents the life cycle assessment (LCA) carried out by Ricardo Energy and Environment (Ricardo) on NNB Generation Company SZC Limited (SZC Co)'s proposed and planned new European Pressurised Reactor nuclear power plant development, Sizewell C (SZC), in Sizewell, East Suffolk. This LCA has been carried out under the Product Category Rules (PCR) most relevant to nuclear power: 'Electricity, Steam and Hot Water Generation and Distribution PCR2007:08, version 4' (Electricity PCR). PCRs lay out the product category-specific requirements for conducting and reporting LCA studies. Although the plant is not yet constructed or operational, the intention is to publish the results in a verified, first of its kind, "Design-EPD". Data used in the LCA has been drawn by EDF from the most recent available plans for the SZC development.

The full LCA and EPD will come at a later point but SZC Co wishes to use the carbon equivalent results to support a public consultation in May 2021. Hence this report is focused purely on the Global Warming Potential (GWP) results in terms of kg of CO_2 equivalents per the functional unit of 1kWh distributed to a hypothetical customer. Whilst this carbon focused LCA has been carried out in every aspect inline with the Electricity PCR it is important to note that this report only partially fulfils the requirement of the PCR to the extent that it only covers GWP and doesn't cover the seven other indicators and non-LCA impacts as required in this PCR. These will be addressed in the full LCA report and EPD to follow.

Figure 1 shows contributions to GWP associated with generating 1kWh of SZC electricity, minus the downstream impacts of distributing over the grid. The figure shows that 45% of the total GWP is linked to upstream impacts from the nuclear fuel supply chain.

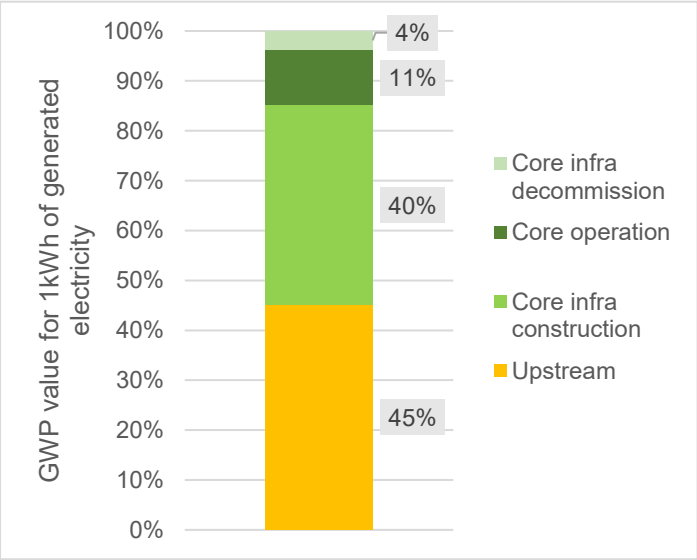

Figure 1: Overview breakdown of the GWP impact from generating 1kWh at SZC

In terms of the core stage, construction of the SZC development is expected to have the highest contribution to the GWP, largely arising from energy and materials required. Operation of the site during the 60-year operational lifetime is a lower contributor with decommissioning expected to contribute the smallest percentage.

Recommendations for reducing the GWP of the core stage are largely focused on energy reductions or reductions in the carbon intensity of energy sources. Accurate and consolidated record keeping during pre-construction, construction (and eventually the operational and decommissioning) stages, will be key to being able to update a future LCA and also enable performance to be tracked and improved.

When taking into account the full impacts of generating and distributing 1kWh of electricity, the results as per Figure 2 indicate that just under half of the impact arises from downstream attributes, largely grid infrastructure, emissions and losses over the network. These types of impact sources would similarly apply to any source of electricity generation exporting electricity to the grid.

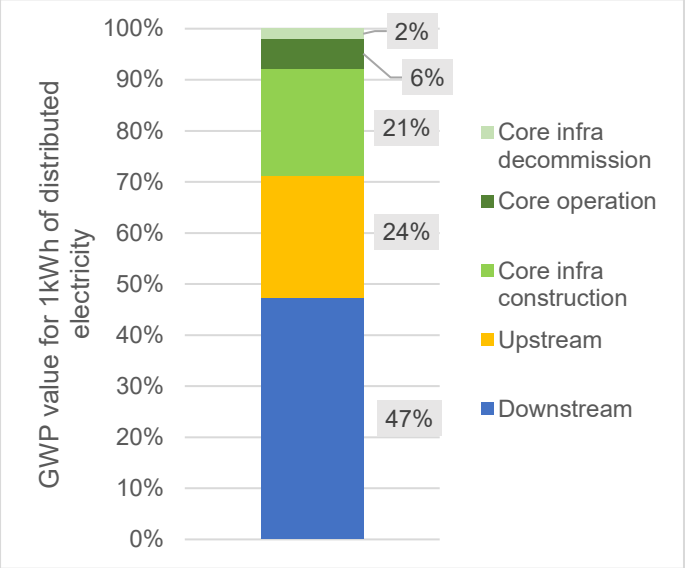

Figure 2: Overview breakdown of the GWP impact from generating and distributing 1kWh of electricity made at SZC

Upstream impacts contribute almost a quarter, with conversion and mining and milling processes being the dominant sources.

It is understood that both downstream and to some extent the upstream processes, are outside of SZC Co's control. It is recommended where possible that SZC Co takes steps to monitor and influence these upstream and downstream processes such as via third party data requests, so as to encourage GWP reductions.

As with all LCA modelling, it is important to be aware that the estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

This report and the underlying LCA have been verified by a third-party, WSP. The verification statement can be found appended to this document.

This issue of the report (v01.01) has had the original Appendices which contain inventory data, removed at the request of SZC Co for confidentiality purposes. Full inventory data can be found in the original full carbon report (v01.00).

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1 Introduction

NNB Generation Company SZC Limited (from here onwards, SZC Co), is proposing to develop a new nuclear power station, known as Sizewell C (SZC), in Sizewell, East Suffolk. The power station would comprise two European Pressurised Reactor (EPR) units, which are each capable of an estimated gross electrical output of circa 1.75GW. The site's total gross output is estimated to be circa 3.5GWe.

Once operational, the site would generate enough low carbon electricity to supply six million homes, helping to support the UK's net zero ambitions. In order to robustly quantify how low carbon (as well as other environmental impacts) the electricity will be, SZC Co wished to prepare an Environmental Product Declaration (EPD) for SZC.

EPDs are formal, independently verified, Life Cycle Assessments (LCA) that are conducted in accordance to Product Category Rules (PCR) specific to the product system under study. In the case of nuclear power, the relevant PCR is 'Electricity, Steam and Hot Water Generation and Distribution PCR2007:08, version 4' (Electricity PCR). EPDs prepared under the Electricity PCR must be based on real-world products, for which primary operational data is available. Since SZC is at the proposal stage, it is not possible to prepare a traditional EPD. However, SZC Co has engaged with the International EPD System (IES), who are responsible the General Programme Instructions for EPD development, regarding the preparation of a 'Design-EPD', based on SZC Co's available data. This document would conform to the electricity PCR but would be based on data from submitted proposals, rather than operational data. This Design-EPD will be the first of its kind and is a pilot for IES.

SZC Co commissioned Ricardo Energy & Environment (Ricardo) to undertake an LCA in accordance with the Electricity PCR, using the best data currently available from sources such as the Development Consent Order (DCO) submission. This work will assess SZC's impacts across its life cycle, considering the activities 'upstream' of generation, such as: the procurement of raw materials and fuel fabrication; the 'core' activities associated with constructing, operating and decommissioning SZC; and the 'downstream' activities associated with distributing electricity to customers. The assessment will consider eight environmental indicators, covering issues such as Global Warming Potential (GWP), Acidification Potential (AP) and Abiotic Resource Depletion (ARD), as well as 14 resource use and waste production indicators. The assessment is being independently verified by WSP to ensure the work is carried out in accordance with the Electricity PCR and the General Programme Instructions. Once complete, this work will be published as a Design-EPD, the first of its kind, reporting on the environmental impacts of a proposed new nuclear power station. It is SZC Co's aspiration that this work will be updated with a traditional EPD once the site is in operation.

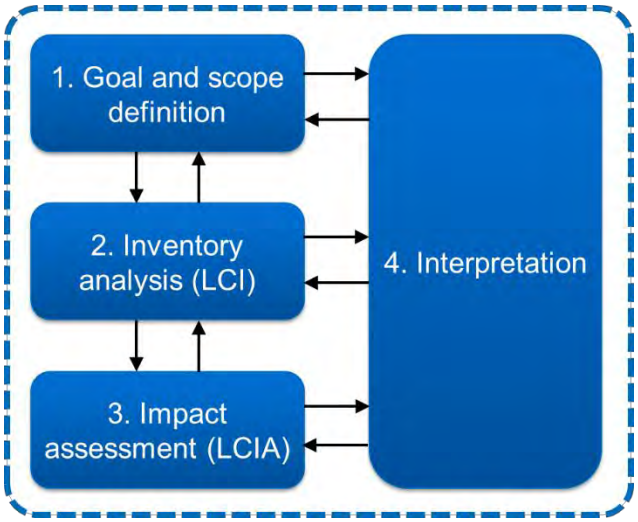
This document reports on the work undertaken to assess SZC's life cycle carbon impacts, as part of the overarching Design-EPD work. It is intended that this study (based on the Electricity PCR) will communicate the potential carbon impacts of SZC to the public and stakeholders pending completion of the more detailed LCA. Section 2 below details the study's goal and scope, section 3 details the data used to undertake the assessment, section 4 describes the methodology used to assess SZC's impacts and section 5 reports the results of the carbon assessment.

Whilst the methodology used to calculate the carbon results is inline with the requirements of the Electricity PCR, it should be noted that as only carbon is reported on (in the format of GWP), the report itself only partially fulfils the requirement of the PCR as it doesn't cover the other indicators and non-LCA impacts required in the PCR. The follow up full LCA and D-EPD will fulfil this aspect.

2 Goal and Scope

Life cycle assessment (LCA) is a method for analysing the impacts of a product or service over the course of its lifetime. By assessing all 'flows' within a study's system boundary, we can identify the real impact hotspots and better target decision making. ISO 14040 defines LCA to be the "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle". ISO14040 establishes a four-stage process for undertaking an LCA, as depicted in Figure 3.

Figure 3: The LCA Process (ISO14040)



As shown, defining the goal and scope should be the first step of any LCA study. The ISO standards detail that the goal should cover the intended application, the reasons for carrying out the LCA, the intended audience, clarify whether the results will be comparative and if they are to be disclosed to the public.

The scope should define the product system and its function, the system boundary and the allocation procedures followed.

2.1 Goal

The goal of this study is to assess the life cycle carbon emissions of the 3.5GWe new nuclear power station SZC Co plans to build and operate in Sizewell, Suffolk, UK. It forms part of a wider study assessing a range of environmental indicators as required within the Electricity PCR.

The study is being undertaken to understand SZC's GWP impact and communicate this with the public and other key stakeholders. Consequently, third party review is necessary.

2.2 Scope

2.2.1 Product system

As mentioned above, SZC will comprise two EPRs with a combined electrical output of 3.5GWe. EPRs are a type of Pressurised Water Reactor (PWR), which pump pressurised water into the reactor core. This water is heated by the radioactive decay of the uranium within the fuel assembly and the resultant pressurised steam flows into a generator, turning turbines to generate electricity. It will be capable of supplying over six million homes with electricity.

The plant will be almost identical to the Hinkley Point C (HPC) plant currently being constructed at Hinkley Point in Somerset. It will take 9-12 years to build and has been designed for an operational period of 60 years. In addition to the main reactors, buildings will be constructed during operation and decommissioning in order to manage and store waste in the short term.

The plant is expected to run all day, every day, except during planned maintenance periods, assumed to occur every 18 months.

The SZC project is currently in the development (pre-construction) stage and consequently very little actual SZC data is available (i.e. data from construction or operation already undertaken at SZC). Table 1 below summarises the project's key characteristics.

Table 1: Overview of SZC details

Characteristic	Assumption
Reactor type	European Pressurised Water Reactors (EPRs)
No. of reactors	2
Fuel	Enriched uranium oxide fuel (currently assumed to be enrichment level of 4.1%)
Start of construction	2022 TBC
Start of generation	2030s TBC
Start of decommissioning	2090s (estimated)
Designed service life	60 years
Fuel cycle	Designed to operate at full power for a "fuel cycle" of three years per reactor (including a few weeks for refuelling outage)
Location	Sizewell, Suffolk, UK
Total supply to grid	3.5GWe (gross)
Transmission	Electricity will be transmitted at 400kV and subsequently distributed to the majority of customers through lower voltage distribution networks (from 132kV to 33kV)

2.2.2 Functional Unit

Like all power stations, the function of SZC is to supply electrical energy to consumers. The Electricity PCR therefore specifies a functional unit of 1kWh net of electricity generated and thereafter distributed to the customer. It is assumed for this LCA that the customer receives medium voltage electricity.

It is important to note that 1kWh net refers to the gross electricity generated by the power station minus any of the generated electricity that is used internally within the NPP site. It is essentially the electricity available for export to the National Grid. Moreover, the electricity distributed will account for the generated electricity that is lost during transmission and distribution (all electricity that is transported over the transmission and distribution system has some losses). Table 2 below compares SZC's lifetime gross generation and net generation (assuming a 60-year operational life).

Table 2: Comparison of SZC energy outputs under different accounting boundaries

Gross generation	Net generation
1,694,098,080 MWh	1,569,751,800 MWh

Since the plant is not yet operational, predicted data for the 60-year operational period was used to apportion impacts to the functional unit, with all impacts associated with construction and decommission of the SZC development linked to the net generated value.

2.2.3 System boundary

In line with the electricity PCR, the scope of this LCA is cradle-to-grave. As such, the LCA model and the results are divided into three different life cycle stages:

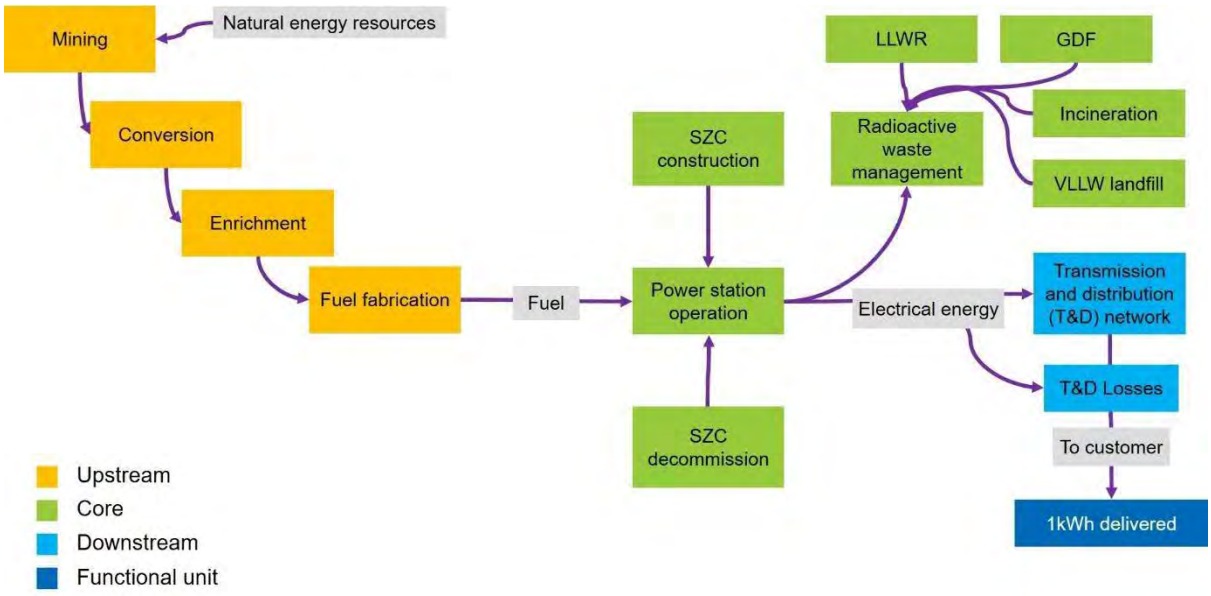
- **Upstream**: capturing processes associated with the mining, conversion, enrichment and fabrication of nuclear fuel which the plant will use.
- **Core**: capturing the infrastructure and operations associated with energy generation by the plant over its life cycle as well as those facilities associated with the treatment and disposal of

radioactive waste at the lower level waste repository (LLWR), the future geological disposal facility (GDF), via incineration and via very low level waste (VLLW) landfill.

- **Downstream**: capturing processes associated with the operation and infrastructure of the electricity network through which electricity generated at the power plant site is transmitted to customers. This includes accounting for transmission and distribution losses through the network.

This is shown in Figure 4 below. It is important to note that, while all impacts associated generating the electricity lost in transmission and distribution are included in this study, they are accounted for in the downstream life cycle stage "Losses", not the core life cycle stage.

Figure 4: System boundary overview schematic



The life cycle usually begins at the extraction point of raw materials and energy carriers from nature and the final stages include waste generation and delivering of electricity energy to the customer.

2.2.3.1 Representativeness – temporal

ISO14044 requires LCA studies to consider the impact of temporal differences within the data modelled. As noted in Table 1 above, it is anticipated that the site will be constructed in the 2020s, with operation starting in 2035 and continuing for 60 years. Decommissioning activities will begin immediately after the end of generation period, expected to be in the mid-2090s. Consequently, the temporal representativeness of data is an important consideration for this study. For example, SZC will consume some energy and require vehicle movements throughout its lifecycle. It is extremely unlikely that the grid electricity and vehicular movements will derive energy from the same sources today as they will in the future lifetime of SZC through to the 2090s.

It is envisaged significant decarbonisation will take place across SZC's construction and operational lifetime and beyond into decommissioning. Specifically, the UK has a legally binding obligation to achieve economy-wide 'net zero' carbon emissions with interim carbon budgets (which are also legally binding). For this reason, electricity requirements of the SZC development during operation have been modelled using a best approximation of what the UK grid mix will be in 2035. This grid mix has also been used for enrichment (which will take place during the SZC operational period).

Likewise, for decommissioning, which will begin in the 2090s, the electricity quantity provided by SZC Co has been modelled using an approximation of what UK grid mix will be in 2050. This is the furthest point in time to which BEIS and National Grid (on which these grid mixes were built) forecast, and it is expected that the bulk of decarbonisation will occur prior to 2050.

It is important to note that for the construction activity of SZC there have been no adjustments to the input data to reflect decarbonisation of the UK (for example the UK electricity mix), with input data

reflecting current levels of carbon intensity. In this respect, the analysis takes a conservative approach to calculating emissions caused by construction of the SZC development.

Details of the mixes forecasted can be found in section 2.2.6.1.

It is important to note that, whilst other aspects such as manufacture of materials, and transport, will also change over time, adjusting these datasets with forecasted grid mix is beyond the scope of this study. Therefore these aspects do not take into account any future decarbonisation either in the UK or internationally, and in this respect the carbon impacts can be considered conservative.

Beyond temporal considerations regarding the life cycle impacts of the LCIs' flows, temporal considerations are also applicable to the environmental criteria used. This study assesses GWP using a 100-year horizon. This is described in more detail in section 2.2.8.

2.2.3.1.1 Assessment periods

As noted in section 2.2.1 above, no primary data is available for SZC in terms of operation. Nevertheless, data has been estimated on the basis of certain assessment periods, such as a year's operation for the in-operation inventory. The data provided by SZC Co has been, in general, estimated for one year of operation and upscaled to reflect the 60 years of operational life. Wherever this is the case, it is stated in the relevant inventory described in section 3.

2.2.3.2 Representativeness – geographical

ISO14044 requires LCA studies to consider the geographical representativeness of the underlying data.

For this study, a number of geographies are considered. Operation and enrichment activities will occur in the UK, however fuel conversion and fabrication is assumed to occur in France and mining operations have been assumed, for the purposes of this study, to take place across the world in Canada, Kazakhstan and Namibia. To model flows throughout these life cycle stages, secondary data has been selected from the ecoinvent LCA database.

Wherever possible, data based on a UK geography has been selected for the core processes and the upstream fuel enrichment. Where this has not been possible, a European geography has been selected as the best available proxy and, if this was not available, a global geography has been selected.

Likewise, upstream processes occurring in France (fuel fabrication and conversion) have been modelled with a French geography if available and European or global processes if this was not available.

For in-situ leaching mined uranium sources, only a global ecoinvent generic dataset exists. Therefore, this was the option used to represent the example Kazakhstan in-situ leached mining process assumed for this LCA, with the embedded decarbonised water total put on the Russian decarbonised water dataset as the closest proxy.

For open cast mining, the generic dataset options were North America (RNA) or Rest of World (RoW). As for this LCA it is assumed that the open cast mine is in Namibia, the RoW dataset was used, with water inputs from nature and water emissions to nature adjusted to reflect 'NA' (Namibia).

For underground mining, the generic dataset options were RNA or RoW. As the assumed underground mine in this LCA is in Canada, the RNA dataset was used, and the water input from nature and water emissions to nature adjusted to reflect 'CA' (Canada).

None of the mining datasets contained embedded electricity datasets, so it was not possible to switch these out for representative geographical electricity datasets.

Further information on data quality and the ecoinvent database used are described in section 2.2.5. All processes used to model the core, upstream enrichment, and upstream fuel fabrication inventories are listed in the Appendices A1 to **Error! Reference source not found.**. As generic datasets with small tweaks (as described in this section) were used to model the other stages, they are not shown.

2.2.3.3 Representativeness – technological

ISO14044 requires LCA studies to consider differences in technological coverage, for instance whether processes are based on experimental data or widely adopted designs. This study considers data specific to SZC, based on various data sources and documents as described later in section 3. It does not attempt to model all nuclear power stations or all EPR, rather only electricity generated SZC.

As mentioned in section 2.2.3.2 above, secondary data has been sourced from ecoinvent to model individual inventory flows. Wherever possible, the most relevant geography has been selected when choosing data. It is understood that the ecoinvent datasets represent technological averages for the given geographies and reflect recent time frames.

2.2.4 Allocation procedures

ISO 14044 states that LCA studies should identify the processes shared with other product systems and deal with them according to three steps:

1. Allocation should be avoided by:
    a. Dividing processes into sub processes and collecting input and output data for these sub processes
    b. Expanding the product system to include the additional functions related to the co-products
2. If allocation cannot be avoided, it should be undertaken so as to reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system.
3. If a physical relationship cannot be established, allocation may be undertaken on the basis of other relationships such as the economic value of the products.

The product system for this study does not produce any coproducts or by-products within the core operation life cycle and consequently no allocation is considered outside of the secondary ecoinvent data used to model the life cycle impacts of material and energy flows. It is however important to note two allocations that occur within upstream processes for uranium mining and uranium enrichment. The Electricity PCR specifies the allocation procedure to use for these two processes.

2.2.4.1 Uranium mining

This study has considered three mining processes. These are based on generic ecoinvent datasets, selected as indicatively representative of SZC's potential supply if SZC secured its nuclear fuel supply from virgin sources requiring uranium mining. SZC Co is currently investigating if it could secure its nuclear fuel supply with reduced or no uranium mining (for example by using depleted uranium tails or reprocessed fuel). These alternatives are not considered in this study which assumes SZC secures all its nuclear fuel from virgin sources. Allocation between the differently mined sources of uranium has been done on a physical basis, based on the global sourcing of uranium by mass. See section 3.1 for further details on how this was done.

2.2.4.2 Uranium enrichment

The uranium enrichment process produces enriched uranium and a by-product of depleted tails. As the intended product is enriched uranium and there is a surplus of tails, 100% of the impacts of the enrichment process have been allocated to the enriched uranium product. See section 3.1.3 for details on enrichment.

2.2.4.3 Waste facilities

Whereas 100% of SZC's infrastructure has been included, only a portion of the offsite radioactive waste facility operation and infrastructure impacts have been allocated to SZC on a physical basis (i.e. by the mass or volume), according to the flow of the ecoinvent dataset used to represent these facilities and their respective treatment processes.

2.2.4.4 Recycling

The handling/treatment/transportation of operational waste and residues is included according to the polluter pays principle. In terms of the low-level radioactive waste metal sent for recycling, the

subsequent use of the metal is responsible for the impacts of the recycling process. For this reason, only any required packaging and transport of the waste metal to the assumed recycling location have been covered. The impacts of disposal of other wastes generated by SZC (which are not recycled) are included in the core module. No wastes are modelled as being sent to reuse or energy recovery.

2.2.5 Data sources and quality

LCA studies require two kinds of information: data regarding the environmental aspects of the product system such as its material and energy flows; and data regarding these flows' life cycle impacts. The former has been supplied by SZC Co for all of the core life cycle stages. The latter has been collected from the LCA database ecoinvent, v3.7 cut-off database as implemented in SimaPro v9.1.

Data and values were derived by SZC Co for the construction, operation and decommissioning of SZC project, and were based on an extensive evidence base including data from Hinkley Point C, SZC specific data and data from other UK nuclear power plants. This data will be considered as specific data in the context of this LCA. The dates of the documents vary, but all were submitted or date from within the past five years.

Nuclear decommissioning data sources are the one exception, where 2014 documents have been used, since these represent the most recent information and plans available at the time of writing (this reflects the current status of documentation for Hinkley Point C's Funded Decommissioning Programme). It is understood that SZC Co will update these at a later point in time and throughout the project's life (consistent with the Funded Decommissioning Programme arrangements).

SZC Co has a high degree of confidence in the sources on which values are based. A certain degree of uncertainty is introduced in the form of assumptions that have needed to be applied to derive primary data in the format required for the LCA, for example (but not limited to) assumptions of the specific material composition of components, the density of materials and assumed locations of disposal sites. However SZC Co has applied rationale and adopted a conservative approach when applying these assumptions.

Specific data was also obtained from the potential future fuel fabricator and uranium enricher. Whilst this data may change in the future prior to operation, it can be considered to be the most reliable data available to SZC Co at this point in time. This has additionally been supplemented with data from fuel fabrication and enrichment ecoinvent datasets to ensure that no 'key' input or output flows are unaccounted for.

Whilst generic datasets have been used to represent the life cycle stages substages for conversion, milling and mining, downstream infrastructure and offsite waste treatment, for these purposes and in the absence of available specific data, the selected ecoinvent datasets were chosen based on their technological and geographical relevance (see section 2.2.3), so are considered suitable and representative for purpose in this instance. Generic data (ecoinvent datasets) was also used to represent all upstream infrastructure.

Overall, it is considered that the characteristics of data within the model are sufficient to meet the goal of the study.

As stated previously, SZC is currently in the pre-construction stage and general assumptions were required to be made by SZC Co. An overview of these is provided within the description for each LCI, within section 3 with particular assumptions made in regards to future electricity mix, described in section 2.2.6.1.

2.2.6 Data assumptions

2.2.6.1 Energy and electricity assumptions

In section 4.10.1 of the Electricity PCR, a hierarchy for considering upstream electricity production impacts is specified. This sets out that in the first instance, a specific electricity mix as sold by the generator (and backed up with a Guarantee of Origin) should be used. Since SZC is not yet in operation, no such specific data is available. In its absence, national residual mix data should be used, and in the absence of this, national production mix data.

Electricity and energy consumption is modelled throughout the LCIs developed within this study. For the majority of life cycle stages, which are known to occur in the UK, a national production mix process has been selected from ecoinvent: "Electricity, medium voltage {GB}| market for | Cut-off, U". For upstream processes of mining and milling, conversion, and fuel fabrication, the most applicable region was selected in accordance with method described in section 2.2.3.2. The electricity markets contained within these original ecoinvent data processes have not been amended.

For other life cycle stages or sub-stages, it has been considered necessary to make assumptions regarding the energy and electricity type that SZC (or activities associated with SZC) will consume during its lifetime. As noted in section 2.2.3.10, energy and electricity sources will likely vary significantly throughout SZC's lifetime. Modelling this variation requires forecasting, introducing uncertainty into the model. However, in order to avoid unfairly disadvantaging SZC within this assessment and to provide a more realistic view of what carbon emissions of SZC will be in the future, electricity grid mixes have been created to represent potential future mixes for 2035 and for 2050 (with the 2050 mix to be used for decommissioning occurring from 2090s onwards).

These mixes were derived as per below:

1) BEIS 2019 Updated Energy & Emissions Projections, v1.0 11-12-2020, for Net Zero Lower Demand Projection of electricity generation by source [1], for 2035 and 2050 (the most distant year forecasted) were used, to derive splits of natural gas, nuclear and renewables. Note that certain values such as those for coal and natural gas with carbon capture and storage were not included in the split as there is no suitable dataset in ecoinvent to represent such a source.
2) The National Grid's Future Energy Scenarios (FES) 2020 Data Workbook data [2] for Total generation output by technology (TWh) for 2035 and 2050 was used to derive a further breakdown of 'renewables'. Scenario 4 (Steady Progression) was used. Renewables were considered to include biomass, offshore wind, onshore wind, hydro (using the percentage of 'other renewables' in the FES data) and solar.
3) The splits of renewables from FES data were combined with the BEIS derived splits of natural gas, nuclear and renewables, to create a more specific split by source for 2035 and for 2050, as shown in Table 3.

Table 3: Derived UK electricity grid mix breakdown by source for 2035 and 2050.

Electricity source split		
Source	**2035**	**2050**
Natural gas	3.5%	1.5%
Nuclear	16.3%	27.9%
Biomass	1.6%	1.3%
Offshore wind	43.2%	46.9%
Onshore wind	18.8%	11.4%
Other (hydro)	9.7%	6.0%
Solar	7.0%	5.2%
Total	100%	100%

4) The splits as shown in Table 3 were used to compile two separate datasets which fed into the relevant embedded datasets of copies of the "Electricity, medium voltage {GB}| market for | Cut-off, U" dataset in order to capture grid infrastructure, operation and losses as per the generic datasets. Where multiple datasets were available to represent each source type, a split was applied based on the split observed in the "Electricity, high voltage {GB}| market for | Cut-off, U" generic ecoinvent dataset.

Inventory data for the split can be found in the Appendix A1.

The derived 2035 UK grid mix was used to represent electricity values provided by SZC for:

- Operation and commissioning

- Enrichment

The derived 2050 UK grid mix was used to represent electricity values provided by SZC for:

- Decommissioning

The use of these datasets which are derived from recent and realistic publicly available data allows for a balance to be struck between allowing some of the effects of energy decarbonisation to be reflected in SZC's LCA model, keeping uncertainty of forecasts low in the model by not extending this to other embedded processes, and maintaining a level of conservatism (because the 2035 mix is applied to the whole 60-year operational period).

As a side note, BEIS forecast carbon emission factors for the UK electricity grid do not change between 2050 and 2090 so at this point in time, it seems reasonable to assume a 2050 grid mix to represent 2090 grid mix for the purposes of sensitivity.

Note that for modelling the construction stages, the existing ecoinvent grid mix dataset was used (i.e. not forecasting was applied and any future decarbonisation of the UK electricity mix is not taken into account). As the electricity mix is anticipated to decarbonise significantly over the construction period of SZC, this approach can be considered conservative.

2.2.6.2 Cut-off and exclusions

In line with the Electricity PCR, this study has excluded certain processes that occur within a power station's life cycle. These are listed within Table 4 below.

Table 4: Processes excluded from the study by life cycle stage

Stage	Process
Core	• Business travel of personnel • Travel to and from normal workplace by personnel • Research and development activities
Downstream	• The use stage of electricity (i.e. after delivery)

For upstream data, specific data was supplied by SZC Co for fuel fabrication and enrichment from suppliers and any gaps between the flows covered and the generic ecoinvent equivalent dataset for these two stages, was filled using the quantities for such from the generic dataset, to avoid the exclusion of such data. For all four upstream stages, infrastructure was included in the format of the ecoinvent infrastructure datasets embedded in each of the key ecoinvent processes (i.e. for fuel fabrication, enrichment, conversion, mining and milling). Therefore, infrastructure is included to the extent that the ecoinvent dataset covers it. This was also true for downstream.

For core processes, SZC Co has provided extensive data in order to cover the listed activities or flows that the Electricity PCR requires are covered for core infrastructure and core operation (see list in sections 3.2.2 and 3.2.1.)

In terms of core operation, no known inflows have been excluded. Therefore, the LCI data for core operation can be considered to meet the cut-off criteria of the Electricity PCR that requires a minimum of 99% of total inflows in terms of impact to the core operation to be included. Many assumptions were however made as actual operational data for SZC does not yet exist. These assumptions have been provided in section 2.2.5 and in section 3. In general, where assumptions were required, SZC Co has attempted to strike a balance between realistic and conservative, erring on the side of conservatism where greater uncertainty exists.

In terms of core infrastructure, SZC Co has attempted to include as much as possible. However, a very small amount (2014t) of construction materials, for which it was not possible to allocate to a specific material or origin, have been excluded. A number of conservative uplifts have been applied to different infrastructures material inventories, where higher uplifts have been applied to structures

which are more likely to change in terms of design between current design and execution, are considered to comfortably cover this quantity. The total mass of input materials with applied SZC Co uplifts comes to 6,493,591t. This means that the excluded 2014t of unknown construction materials would only account for 0.03% of total construction materials. Therefore, it is highly unlikely that, in comparison to the total impact of core infrastructure, which also includes energy, waste disposal, etc, that the missing 2014t would have a significant effect on results.

The Electricity PCR sets the maximum cut-off for core infrastructure to 1%, in terms of the environmental impact and it is therefore considered that the data for the core infrastructure stage of this LCA meets this requirement.

2.2.7 Limitations

It should be noted that as with any LCA and modelling, this study only considers potential impacts and does not reveal actual impacts on the state of the environment. The quality and uncertainties of the results are based on the quality and accuracy of the primary data provided, and also the secondary data and datasets selected, and any assumptions made. LCA also cannot directly consider future changes to technology or demand although some attempt at representing the influence of future UK electricity grid mix has been made.

For certain processes, largely those representing the upstream stage for mining and conversion, the core stage for offsite waste repositories and disposal facilities, and for infrastructure and operation of the downstream stage for transmission and distribution networks, no SZC specific data was available. Therefore, ecoinvent datasets have been used as proxies.

It is also important to note that whilst SZC Co have based values on the most recent available core data, until SZC has been built and is under operation, this should be considered to be a design LCA.

Additionally, as with all modelling, the estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

2.2.8 Impact categories and method

The Environmental Footprint (EF) method is an initiative of the European Commission, to establish a common methodological approach for quantifying the environmental performance of any good or service across its life cycle. This method has been used for calculating results for this report as it will be used to report a number of the impact categories specified by the PCR in the main non-LCA report.

As this is purely a carbon report, only the Global Warming Potential (GWP) indicator has been assessed using SimaPro v9.1.

This study assesses the global warming potential (GWP) of the product system, reporting impacts in CO_2 equivalents. The study uses the IPCC 100a model to characterise all GHG emissions' GWP in terms of the GWP of CO_2 over a period of 100 years.

Table 5: List of the LCA environmental criteria assessed in this study

Impact Category	Indicator	Units	Description	Method
Climate Change	Radiative forcing as **Global Warming Potential** (GWP100)	kg CO_2e	GWP is an assessment of the amount of gases emitted into the atmosphere that are liable to cause global warming.	Environmental Footprint (EF) method 3.0

It should be noted that for the purposes of this report, only the total Climate Change value will be reported. For the subsequent full LCA report, the value will be reported in its three subcategories of fossil fuel carbon, biogenic carbon, and land use and land use change carbon.

3 Life cycle inventory analysis

The LCA model uses a series of life cycle inventories (LCIs), which describe the cradle-to-grave generation of electricity at SZC. Each inventory is interconnected, with mining inventories feeding into conversion, which feeds into enrichment, and so on all the way through the life cycle up to the reference unit of lifetime net electricity generation over the planned 60 year operation of SZC and as shown in Figure 4.

The inventories describe a particular process and list the inputs and outputs, per amount of process. The quantitative inventories for each are reproduced in Appendices A2 to A6 of the full report.

This section describes SZC's different life cycle stages and the considerations made when developing each data inventories.

3.1 Upstream stage

Upstream processes relate to the production of the nuclear fuel to be used at SZC. It is assumed that SZC will purchase uranium fuel assemblies from Framatome (the fuel assembler) who will be provided with enriched uranium sources from a Urenco enrichment facility in the UK. It is assumed that SZC Co has no control over the upstream facilities further up this supply chain and uranium feed (natural uranium that has been mined and undergone a conversion process) is bought in commodity markets closer in time to the point of use so will vary from year to year. For this reason, generic data (ecoinvent datasets) have been used to represent the operational and infrastructure impacts of mining and extraction of uranium sources, and the conversion process. As stated above, SZC Co is also investigating the potential to secure its nuclear fuel requirements in a manner which reduces its requirement for uranium mining and conversion (these potential impacts are not considered in this study).

In order to fulfil certain non-LCA requirements of the PCR such as land use and biodiversity (not covered in this short carbon report), specific mining and conversion sites needed to be assumed. The below table shows the assumptions made in terms of where SZC's uranium fuel will be sourced from for each of the four main upstream fuel cycle stages.

For mining, all three main types of uranium mining were covered, with the split amongst the three aligned with the values of global uranium production method by type as per a 2020 report on uranium resources, production and demand [3]. Note that co-product/by-product and 'other' production methods from the reference source have been excluded. This is in order to capture the impacts of sourcing uranium by the three main virgin production types, to be conservative. The split between the three main methods can be seen in Table 6:

Table 6: Uranium production method by percentage of uranium mass 2019 derived from Table 1.22 of the reference source [3]

Uranium production method	Percentage by mass (%)
Underground mining	21.4%
In situ leaching (ISL)	61.4%
Open pit mining	17.2%

In terms of geography, the mining and milling sites, the specific examples chosen were assumed based on the ranking of uranium production by country [3].

Table 7: 2019 Global uranium production by country as per Figure 1.5 of the reference source [3].

Country	Uranium production in 2018
Kazakhstan	41%
Canada	13%
Australia	12%
Namibia	10%
Uzbekistan	6%
Russia	5%
Niger	5%
China	3%
Ukraine	2%
India†	1%
South Africa†	1%
USA	1%
Others‡	0.19%

† NEA/IAEA estimate
‡ Others include remaining producers

Based on Table 7, the example of an appropriate ISL uranium mine has been assumed to be Orano's ISL mines in Kazakhstan. This is because most of the mining done in Kazakhstan is via the ISL method so this felt reflective of the real world. Moreover, this accounts for the potential availability online of data for the non-LCA analysis.

As Canada is the next highest producer of uranium sources, it was deemed appropriate to assume that a suitable mine to use is Cigar Lake mine (with neighbouring mill at McClean Lake). Cigar Lake is an underground mine and it was the only source of Canadian uranium in 2019 [4].

At 12%, although Australia is the third largest producer of uranium based on Table 7, behind Kazakhstan and Canada, the largest operating mine, by production output, is Olympic Dam which is underground. Since the selected example of Cigar Lake mine is also an underground mine, it was decided to select another – Rossing mine in Namibia – as the third example mine. In 2019 (2020 values are not yet available on the World Nuclear Association site), Rossing was the fourth largest producer of uranium. The Rossing mine is an open pit mine. It is one of the largest in Namibia and is run by Rio Tinto, so there is a fair amount of publicly available data available from which to derive the non-LCA impacts data.

Table 8: Assumed percentage split and location for the four key upstream fuel stages†

Upstream production	Split by mass	Company	Location
Underground mining, milling	21.4%	Orano/Cameco	Cigar Lake and McClean Mill, Saskatchewan, Canada
In situ leaching (ISL)	61.4%	Orano	Muyunkum and Torkuduk, Kazakhstan
Open pit mining, milling	17.2%	Rio Tinto	Rossing, near Swakopmund, Namibia
Mining (total)	**100%**	**See above**	**See above**
Conversion	**100%**	**Orano**	**Pierrelatte & Malvési, France**
Enrichment	**100%**	**Urenco UK**	**Capenhurst, UK**
Fuel fabrication	**100%**	**Framatome**	**Romans-sur-Isère, France**

† Note that whilst SZC plans to use the services of Framatome and Urenco UK for fuel fabrication and enrichment at the listed sites, for conversion and mining, the listed companies and specific locations are given purely as the examples assumed for this project.

All upstream data has been linked to the reference unit of mass of enriched uranium needed for 60 years of operation, during which the plant is expected to generate 1.57TWh of electricity (net), i.e. 3,900 tonnes of enriched uranium. Table 9 shows the reference flow mass from each upstream stage in relation to the required operational enriched uranium.

Table 9: Corresponding masses of uranium material as related to the reference requirement of enriched uranium

Upstream fuel	Mass (t)
Underground sourced milled uranium*	67
ISL sourced uranium	19,157
Open pit sourced milled uranium*	5,366
Converted uranium	31,200
Enriched uranium	3,900
Fuel assemblies (total mass including enriched uranium)	5,889

*Includes a 5% uplift of impacts to account of milling losses as per the milling ecoinvent datasets

3.1.1 Mining

The energy source of nuclear power is the heavy metal, uranium. It is found as an ore in rock in the earth's crust. In order to access this ore, the first step of the traditional nuclear fuel cycle is therefore the extraction of uranium from nature by mining.

There are three main types of uranium mining processes [5]:

- Opencast mining: where uranium ores lie close to the earth's surface, they can usually be accessed by opencast (or open pit) mining. This surface mining technique involves the blasting and excavation of overburden from the earth in order to reach the desired mineral. Much waste rock is generated. The mineral uranium ore is then milled (crushed and ground), leached, precipitated and dried.
- Underground mining: where uranium ore lies deeper in the earth's surface, it is usually accessed via the digging and construction of tunnels and shafts, through which the desired mineral, which has been drilled and blasted to 'free' it, can be removed. Lower levels of waste rock are removed using this method. The uranium ore is then milled (crushed and ground), leached, precipitated and dried.
- In-situ leach mining: some uranium ores are found within the groundwater of materials such as sand and gravel. In these cases, it is often possible to dissolve the uranium in-situ by injecting chemicals to the ore location, and then pumping the solution to the surface where the uranium can be recovered via precipitation and drying.

The resulting uranium material from the mining and milling treatment stage is uranium oxide (U_3O_8) concentrate, also called "yellowcake".

As mentioned, if SZC Co requires uranium mining, it is not currently able to determine the specific mines from which the uranium to be used at SZC will be sourced. Likewise, SZC Co would not be expected to have direct management or control over this portion of the upstream supply chain. For this reason, specific data relating to the operation and infrastructure of the assumed mines was unavailable and proxy data, in this case, in the form of ecoinvent generic datasets for mining, have been used.

For the sake of this LCA, assumptions were made regarding the types and location of the upstream mines, in order to provide a representative view. These assumptions have been applied in the selection of the datasets.

The type of mine and the geography of the corresponding example site as assumed as per Table 8 for this LCA study was used to select the most relevant generic mining and milling datasets from the ecoinvent database. Where these datasets contained embedded electricity datasets, the electricity dataset was switched to the most suitable national grid mix. Embedded water input and outputs to nature were treated likewise, and transport geographies and distances between mine and mill sites were adjusted based on the assumption of mine and mill locations.

The ecoinvent dataset on which ISL sourced uranium was based on was: “Uranium, in yellowcake {GLO}| uranium production, in yellowcake, in-situ leaching | Cut-off, U”. The ecoinvent dataset used to reflect the milling of underground and opencast mined uranium sources was “Uranium, in yellowcake {RNA}| production | Cut-off, U”. The mining datasets to represent mined (unmilled) underground and opencast sourced uranium, and which feed into this mining dataset, are: “Uranium ore, as U {RNA}| uranium mine operation, underground | Cut-off, U” and “Uranium ore, as U {RoW}| uranium mine operation, open cast | Cut-off, U”, respectively Copies of these datasets were made an they were adjusted according to the paragraph above.

3.1.2 Conversion

As mentioned in section 3.1.1, uranium leaves the mining and milling sites as yellowcake, or U_3O_8, a stable oxide. However, it still contains some impurities and also needs to be converted to a form suitable for input to the enrichment process. The conversion process, which has dual purpose of removing impurities and converting U_3O_8 into uranium hexafluoride (UF_6), is the second main step in the nuclear fuel cycle.

There are two conversion processes that can be applied to ‘virgin’ U_3O_8: a ‘wet’ process and a ‘dry’ process.

For the purposes of this LCA, it has been assumed that the conversion process will take place at Orano owned Pierrelatte & Malvési conversion plants in France [6]. It is also the closest conversion facility to the UK enrichment facility at Capenhurst. Orano uses the wet process for conversion.

As per mining, specific data relating to the operation and infrastructure of the conversion site and process was unavailable. A proxy ecoinvent generic dataset for conversion (Uranium hexafluoride {RoW}| production | Cut-off, U), has been used. The embedded electricity datasets were switched to the French national grid mix dataset, embedded water input and outputs to nature were switched to ‘FR’ equivalents, and transport datasets were added to account for distances between the previous nuclear fuel stage and the Pierrelatte (in Tricastin) and Malvesi conversion site.

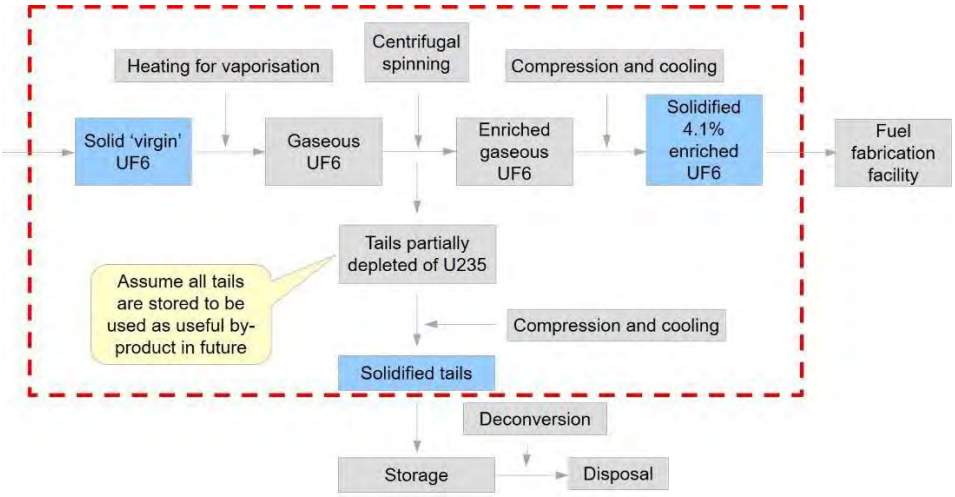
The upstream mining and milling datasets to total 1kg of U_3O_8 were fed into this dataset for conversion at the split defined in Table 8.

3.1.3 Enrichment

In nature, uranium is found largely as two isotopes: U-235 and U-238. The fission process produces energy by splitting U-235 atoms, which is the basis of nuclear power generation for many nuclear power plants, including that of the EPR reactors that SZC will use. As natural uranium contains only around 0.7% U-235, a process of concentrating this isotope is required. This step is known as enrichment. The overwhelming majority of global uranium enrichment is carried out using the centrifuge process [7].

Enrichment of uranium for SZC usage is assumed to be carried out by Urenco UK at Capenhurst, UK by the centrifuge method. While SZC and Urenco UK are currently exploring two different enrichment processes (one of which could reduce the need for uranium mining) only one will be included in this model. The modelled process represents a ‘standard’ enrichment process where virgin converted uranium undergoes enrichment. During the enrichment process, tails are created which consist of depleted uranium (i.e. uranium with an even lower U-235 concentration than the virgin input converted uranium).

Figure 5: An overview of the 'standard' enrichment process



The red dashed line indicates what is understood to be included in the primary data supplied by Urenco UK.

Specific data provided by Urenco via SZC Co was used to create the dataset for enrichment. The generic ecoinvent dataset for enrichment to 4.2% (there is not one for 4.1%) was used to supplement any inputs or outputs for which Urenco was not able to provide values.

Note that transport of the converted virgin UF_6 to site is included in the enrichment dataset, whilst transport of the enriched uranium to the fuel fabrication site is included in the fuel fabrication dataset.

The depleted tails are assumed to be burden free, with 100% of the impacts allocated to the enriched UF_6 product, as the desired output of enrichment is enriched UF_6. Currently, Urenco UK stores all solidified tails.

As the enrichment process will take place at the same time period as the operation of SZC, the electricity dataset used for the enrichment process was the 2035 electricity grid mix used for SZC operation.

The upstream conversion dataset for converted uranium was fed into this dataset for enrichment at the given quantity of 8kg of converted uranium needed to make 1kg of enriched uranium. The inventory for this enriched uranium dataset can be seen in Appendix A3 of the full carbon report.

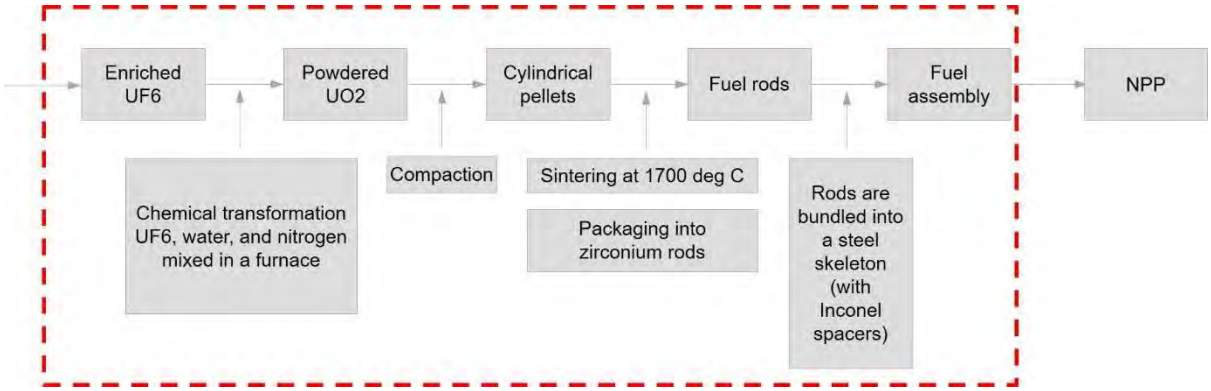
3.1.4 Fuel fabrication

The final step of the nuclear fuel production cycle is fuel fabrication. This involves first taking enriched UF_6 and transforming it into powdered uranium oxide via a chemical transformation process. The powder is then packed into cylindrical pellets and sintered in a furnace at 1700°C to reach a target strength and density.

Pellets are then stacked into zirconium tubes which are sealed at both ends. This constitutes a fuel rod. Multiple fuel rods are packaged into a metal skeleton to form a fuel assembly. At the NPP, it is fuel assemblies that make up the reactor core.

It is assumed that SZC fuel assemblies will be sourced from Framatome in Romans-sur-Isere, France, and Framatome has provided SZC Co with specific data which has been used to model the fuel fabrication stage of the SZC model.

Figure 6: An overview of the fuel fabrication process



The red dashed line indicates what is understood to be included in the primary data supplied by Framatome.

Note that a generic dataset for fuel fabrication has been used to supplement the specific data where Framatome was not able to supply certain bits of information.

The upstream enrichment dataset for enriched uranium was fed into this dataset for fuel fabrication at the given ratio of 1kg of enriched uranium needed to make a 1.5kg fuel assembly, consisting of 1kg of enriched uranium. The inventory for this fuel fabrication dataset can be seen in Appendix A2 of the full carbon report. Note that the custom dataset assumed a relationship as per generic dataset of 6.12p of enriched uranium process = 1kg enriched uranium.

In order to link the fuel fabrication dataset and the rest of the upstream nuclear fuel cycle, specific data provided by SZC Co on the estimate of fabricated fuel assemblies required during the 60 year operational period of SZC has been used. Based on the Spent Fuel and Waste Management Plan for SZC, it is assumed that 3,900 tonnes of enriched uranium in fuel assemblies will be required over the plant's lifetime [8].

3.2 Core stage

As specified in the PCR, the core stage should be subdivided into core operation and core infrastructure.

3.2.1 Core operation

In terms of the PCR requirements, core operation shall include:

- Energy conversion process of the plant
- Maintenance (but not reinvestment of components)
- Reserve power including test operation
- Transportation of waste
- Handling/treatment/deposition of spent nuclear fuel and other radioactive waste
- Handling/treatment/deposition of other operational waste

Once operational, SZC will generate electricity for 60 years. HPC and SZC data is largely the same. Both have the same designs for the reactor and main site and are hence expected to function in the same way and require the same quantities and types of materials, generate the same emissions and wastes, and electricity outputs. They vary slightly in terms of the associated developments but this difference is seen in the core infrastructure stage.

Data to represent operational processes at SZC has thus been based on values derived for HPC, which, although not yet operation, is further advanced than the SZC plant, with construction started in 2016 and operation scheduled to begin in 2026.

The commissioning stage of the plant is the period between construction and operation, and is where various components and systems are tested before full service beings. It includes activities such as

pipe flushing, and the majority of the commissioning activity is expected to last approximately 18 months. Both operation and commissioning are addressed below.

3.2.1.1 Materials

Quantities of materials required for operation are calculated based on expected annual consumption rates of the chemicals across the various processes they are used for, which has informed the inventory requirements of the site. For commissioning,18 months of operational material consumption was assumed.

Quantities of rechargeable batteries and monoethylene glycol, which support the running of diesel generators, were based on annual consumption values from the Combustion Activity Permit [9]. The Combustion Activity Permit captures the characteristics and the environmental impacts associated with the raw materials to be used in the regulated activities. For commissioning,18 months of operational material consumption was assumed.

For SF_6 Sulphur hexafluoride, values were calculated based on the volume needed to fill the electrical systems. This is only applicable to the commissioning stage and not the main operational stage.

For grease and oil, SZC was unable to provide the full values of grease and oil so the mass of oil per kWh within the generic ecoinvent {GB} dataset for electricity generated by a PWR has been used and scaled appropriately.

For most materials, there was a suitable generic dataset in ecoinvent. However, some copies were made to allow for unit conversions and also some proxy datasets were created based on material composition and ecoinvent datasets. The breakdown of the proxy datasets is show in Appendix A4 of the full carbon report.

The total quantity of enriched uranium fuel (as a fuel assembly) required for the operational life of SZC was based on the quantity of spent fuel generated as specified in the Spent Fuel and Radioactive Waste Management section of SZC's Environmental Statement [8].

For the inventory of materials required for general operation, see Table 16. For the inventory of materials required for commissioning, see Appendix A5 of the full carbon report.

Materials needed to package radioactive operational waste, quantities and types of materials were calculated by SZC Co based on the radioactive waste packaging specification mentioned in HPC's Radioactive Substances Regulation (RSR) permit [10] supplemented with calculations involving various assumptions such as the density of and specific types of packaging materials, in order to convert specification data into masses and volumes per material type. It was assumed that any packaging metal and solid polymer based materials would be in sheet or component format as opposed to raw format. Therefore, the datasets used to reflect these materials contained an input of the raw material (for example iron), plus an equivalent quantity of processing energy (for example sheet rolling). For operational radioactive waste packaging material inventory, see Table 17 in Appendix A4 of the full carbon report.

3.2.1.2 Transport

For transport of materials to site, an average distance of 43.4 km was extrapolated by SZC Co from the SZC DCO transport assessment modelling [11]. This was relevant to both operational materials and commissioning materials.

For transport of fuel assemblies to site, required for operation, Google maps was used to calculate the distance between the Framatome fuel fabrication plant in France, and SZC, assuming a 33.3km channel crossing.

It was assumed by SZC Co that, for radioactive wastes:

- Spent fuel (SF) and HLW once cooled and packaged, will go to the future UK GDF.
- ILW will also go to the future UK GDF
- LLW will be split depending on type and go to either the low level waste repository (LLWR) at Drigg, Cumbria, or to incineration at Frawley, Southampton. LLW consisting of only metal will

go for recycling at Cyclife, Workington. whilst VLLW will go to a licensed landfill site at Kings Cliffe, Peterborough.

Distances between SZC and these various sites was calculated using Google maps and applied to packaged masses to obtain freight tkm values.

Although the future location of the UK GDF has not yet been determined, SZC Co has provided a distance of 570km to reflect a potential theoretical location.

For transport of non-radioactive wastes from site, a specific facility has not yet been identified so it was assumed that the waste treatment destinations would be within 100km of SZC. Therefore, 100km was set as the distance.

For the selection of transport datasets, the closest equivalents modes in ecoinvent were chosen.

The transport inventory for the core main operation module can be found in Table 18 in Appendix A4 of the full carbon report.

The transport inventory for the core commissioning module can be found in Table 25 in Appendix A4 of the full carbon report.

3.2.1.3 Utilities

For operation, diesel consumption was calculated from SZC's Combustion Activity Permit application. This is based on a conservative assumption used for permitting purposes of testing and maintenance requirements anticipated for the diesel generators, which informs an annual running time and therefore diesel consumption. The actual requirements for diesel are expected to be lower and will depend on the manufacturer's recommendations and safety case requirements. This has been extrapolated for the 60-year life of the plant.

For commissioning, quantities of diesel required were based on the specification of the diesel generators, the number of diesel generators and an estimate of diesel consumption during the testing requirements of the generators for commissioning (including factory acceptance testing and endurance testing).

For operational electricity, a bespoke calculation for the electricity consumption was carried out based on known outages, and expected plant availability, gross plant output and site load requirement.

The electricity value for commissioning was estimated by SZC Co based on assumed energy requirements for the different testing steps to be carried out during this stage.

For both main operation and commissioning, the 2035 UK custom grid mix dataset was used as described in previous tables, Table 3 and Table 13.

For operational water, the value for demineralised water was not in the DCO, and is a high-level engineering estimate which is informed by site consumption requirements. For sea water, this is based on the water discharge activity permit maximum discharge rate (so is conservative) and has been extrapolated from an annual figure up to the 60-year life of the plant. Operational discharges of water were drawn from SZC's Water Discharge Activity Permit application [12].

For commissioning water, the quantity was provided by the HPC commissioning team, and is an estimate based on systems requirements. This data also informed HPC's Mid-Term Plan budgeting.

SZC plan to use two types of water, seawater and demineralised water, both of which will be released to the sea after use. For the purposes of modelling, only the demineralised water input and output was modelled as the water taken and released to the sea was considered to essentially cancel itself out.

The utility inventory for the core main operation module can be found in Table 19 in Appendix A4 of the full carbon report.

The utility inventory for the core commissioning module can be found in Table 26 in Appendix A4 of the full carbon report.

3.2.1.4 Waste & Emissions

Emissions to water during commissioning were calculated by SZC Co based on HPC's Water Discharge Activity Permit limits, as were emissions to water estimated for operation. Both were scaled according to the number of years each stage is expected to last (1.5 and 60 years, respectively). The values and datasets used for modelling of operational emissions to water can be seen in Appendix A4 of the full carbon report.

Operational emissions to air values were based on limits set in SZC's most recent Radioactive Substances Regulation (RSR) Permit [13].

The direct emissions to air and direct emissions to water inventory for the core main operation module can be found in Table 20 and Table 21 in Appendix A4 of the full carbon report, respectively.

The direct emissions to water inventory for the core commissioning module can be found in Table 27 in Appendix A4 of the full carbon report.

The estimate of non-radioactive operational waste arisings to be generated at SZC has been based on the annual arisings estimates given in EDF Energy and Areva's GDA UK EPR – Integrated Waste Strategy Document for a single EPR [14]. The total was thus multiplied by two to produce the final waste generation figures.

For these non-radioactive wastes, SZC Co determined wastes to be either non-hazardous or hazardous. The hazardous waste is estimated to be a mixture of batteries, aerosols, paints, and other wastes. As batteries and aerosol cans are likely to be recyclable, in the absence of a more detailed split, hazardous waste was split 50/50 recycling/hazardous incineration. The non-radioactive waste inventory for the core main operation module can be found in Table 22 in Appendix A4 of the full carbon report.

Quantities and types of radioactive wastes generated during operation were taken from SZC's Spent Fuel and Radioactive Waste Management document [8]. Masses were calculated based on density assumptions for each waste types SZC Co received from the LLWR "Request for Agreement in Principle to dispose of radioactive waste". The quantity of spent fuel generated was also based on the Spent Fuel and Radioactive Waste Management section of SZC's Environmental Statement [8].

Impacts of recycling were considered beyond the system boundary as belonging to the next user of the recycled material. A hazardous waste incineration dataset was selected as the treatment linking to packaged radioactive wastes for incineration as the specified incineration site does not refer to plasma incineration. This dataset was customised to include a volume process output to represent disposal of the resulting radioactive ash at a LLWR. It was assumed that 90% of the volume of the input is reduced during incineration based on information in the UK Radioactive Waste Inventory website [15].

The radioactive waste inventory for the core main operation module can be found in Table 23 in Appendix A4 of the full carbon report.

No radioactive or non-radioactive solid wastes are assumed to be generated specifically for the commissioning stage.

3.2.2 Core infrastructure

In terms of the PCR requirements, core infrastructure shall include:

- Reactor building and other infrastructure including digging, foundations, roads etc within the site, and respective construction processes
- Reactor, machinery, cables, tubes and other equipment for the conversion process and reserve power
- Power plant transformer
- Connection to the power network
- Transportation of inputs and outputs

- Facilities for handling of radioactive waste (on site and elsewhere) and facilities on site for handling of waste, residues and wastewater
- Reinvestments of material and components during the estimated technical service life

SZC Co has provided data to cover all of the above requirements other than facilities of handling of radioactive wastes that are not onsite ('elsewhere'), and which are not under the control of SZC Co. Such facilities are considered to refer to the lower level waste repository (LLWR) at Drigg and the future UK geological disposal facility (GDF) which has not yet been built or sited. Waste is also sent for incineration and recycling. Recycling has been excluded (other than transport from SZC to the recycling site) partly as data was not readily available but mainly because of the end-of-life cut-off principle, according to which impacts of recycling can be considered as belonging to the user of the future recycled material.

For the LLWR, the GDF, and the incineration facilities, it was not possible to obtain specific data to model these facilities at this point in time. However, the ecoinvent datasets used to represent the respective radioactive waste treatment activities, contain embedded datasets for infrastructure so these have been used to reflect these facilities.

3.2.3 Core infrastructure - construction

Construction of SZC is estimated to begin in 2022 and is anticipated to take around 9-12 years. As well as construction of more permanent infrastructure required for the operation of the plant over its designed 60-year generation life (which includes structures such as the reactor buildings, supporting buildings, connection to the grid, roads, parking, etc), the construction phase will also include the erection of a number other facilities, known as associated developments (ADs). An example of this is the accommodation campuses which will host construction workers during the construction phase. These temporary structures will be operational and are due to be dismantled during this phase. The impacts of their operation and demolition are therefore included in the SZC model in the construction phase. These temporary ADs are listed in the table below in purple text, alongside the non-temporary AD (road infrastructure) and the other infrastructures that make up the main site.

Table 10: Summary of sub-sites included in the associated development (AD) and main SZC sites

Associated Developments (AD)	Main site
Accommodation campus	Enabling Work
LEEIE P&R, HGV area, Bus management, Caravan park	Main Civil
Darsham P&R, Wickham Market P&R, Freight Management Facilities	Marine
Rail infrastructure	MEH/equipment (mechanical, electrical and HVAC systems)
Road infrastructure	Relocated Facilities
	SFEF (spent fuel encapsulation facility)
	SFIRF (spent fuel inspection and repackaging facility)

*LEEIE = Land East of Eastlands Industrial Estate, P&R = Park and ride

As per the Electricity PCR, reinvestment of construction materials, their transport to site, and their disposal during decommissioning have also been included.

3.2.3.1 Materials

The quantities of construction materials (including earthworks) have been calculated by SZC Co based on the most up to date understanding of the design of the plant and works required. This draws heavily on data from the Hinkley Point C project which is part way through construction, and for which large parts of the station design are the same as SZC. For earth movements this takes into account expected excavation requirements for plant foundations and other structures. For materials quantities this takes account of building dimensions, equipment requirements and materials assumptions such as the material composition breakdown of parts or components. Where tonnage was not available,

informed assumptions were applied to volumes or lengths based on external source material. These are taken from the estimating process used to inform the SZC cost estimate, with input from the engineering team.

Uplifts were applied by SZC Co to construction material quantities depending on which part of the development they contribute to in order to ensure the inputs provided were conservative. The uplift percentages varied according to infrastructure type that the materials were destined for based on the qualitative measure of confidence that SZC Co has in the values provided and to provide conservativeness for any unmeasured quants or unknown materials.

It was assumed that any metal and solid polymer based materials would be in sheet or form format as opposed to raw format (such as solid slabs). Therefore, the datasets used to reflect these materials contained an input of the raw material (for example iron), plus an equivalent quantity of processing energy (for example sheet rolling). An exception was for the copper material inputs which SZC Co has determined as being wiring. In this case, wire extrusion dataset was added to the copper.

Where several technologies existed for material manufacture, a copy of the relevant market dataset was used and top level transport zeroed, as has been accounted for separately by SZC Co.

SZC Co specified if materials were expected to be made in the UK, made in Europe, or unknown. If made in the UK, the most relevant ecoinvent dataset was copied and the tier 1 embedded energy dataset (if applicable), was switched for the UK (or rather {GB}) equivalent.

If unknown, it was assumed in general that they would be sourced from Europe apart from metals, for which global (or RoW) datasets were selected. The majority of materials are planned to be sourced from the UK.

For certain masses of some steel types, SZC Co was able to specify the recycled content of the steel. In this case, the relevant dataset was copied, and the embedded ratios of electric arc furnace (EAF) to converter production datasets altered to reflect this content. As per the ecoinvent dataset inventory and documentation, it can be considered that steel made by EAF is produced from scrap metal.

Inventory data of construction materials modelled can be found in Appendix A5 in Table 28 to Table 37 in the full carbon report.

Soil brought to site has also been included.

3.2.3.2 Transport

The transport of bulk construction materials was accounted for by the provision of tkm values per transport type, as calculated in a BYLOR Bulk Materials Transport Assessment based on contracts. For other non-bulk materials and wastes, estimated tkm from another transport modelling assessment was applied. This is calculated using the “remaining balance” tonnage of materials left over from the other transport data that has been provided separately (waste and some materials). It uses a weighted average distance for the delivery distance in km applied to this remaining tonnage of materials, including earth movements to and from site.

The most relevant ecoinvent freight datasets were selected based on the listed transport types provided by SZC Co.

3.2.3.3 Utilities

For the main site, electricity and water required for the construction stage was based on calculations by Atkins which drew on indicative assumptions of electricity and water requirements per activity. Estimated diesel quantities were calculated by SZC Co and BYLOR (the contractor for the construction work). This was based on consumption per employee per month per work package, and an assumed level of consumption specific to each work package (enabling works, civil works etc.). Assumptions were based on HPC site data, MEH consumption assumption, and indicative Bougues Marine works assumptions.

For the associated developments (ADs), quantities of electricity and water were assumed by SZC Co to be 2% of the main development site total, based on ratio of associated development man hours compared to total construction man hours. Diesel quantities were assumed to be 8% of enabling

works diesel volume, based on comparison between bill of materials for main site enabling works and associated developments.

As it is anticipated that construction activities will begin in 2022, which is only two years away, no forecasting was applied to the UK grid electricity dataset. This grid mix can therefore be considered as current. This was considered to be a conservative approach given UK forecasts for a reduction in grid carbon intensity over the SZC construction period.

The inventory data for utilities for construction can be found in Table 40 in Appendix A5 of the full carbon report.

3.2.3.4 Wastes & Emissions

Quantities and types of waste generated during construction were provided by SZC Co. These were taken by SZC Co from total construction waste quantity estimates calculated as part of SZC's Waste Management Strategy for Conventional Wastes [16], values which in turn were forecasted for HPC and adjusted according to differences in the number of workers accommodated during construction. These values contain contingency uplifts to allow for the fact that values have not been confirmed at this stage.

Soil waste leaving site for disposal has also been included and it has been assumed that it goes to landfill.

The inventory data values modelled for construction wastes can be found in Table 41 of Appendix A5 in the full carbon report.

3.2.3.5 Reinvestment

As required by the PCR, the reinvestment of construction materials and components over the lifetime of the plant and site has been included. This covers key components of the infrastructure which will require replacement during operational life and cover components of steam generator, cable, piping, valves, filtration system, pumps and transformers. Quantities for reinvestment were estimated by applying a percentage reinvestment per component type and then applying this to the material composition and mass of each part as established during construction phase.

Reinvestment material masses have also been taken into consideration in the calculation of decommissioning wastes. Transport of reinvestment materials has been covered in transport modelling data for operational deliveries to site. This is because although for the purposes of this study, the reinvestments relate to what is classed as core infrastructure, in terms of how SZC Co would manage them, they would form part of operational deliveries. The average operational material transport distance of 43.3 km has thus been applied to reinvested materials.

In terms of choice of ecoinvent dataset, the same considerations as per the construction materials were applied. The inventory for reinvestment materials can be found in Table 28 of Appendix A5 in the full carbon report.

There is no separate data for reinvestment materials in decommissioning as the SZC Co values are at a more granular level.

3.2.4 Core infrastructure - decommissioning

Both SZC and HPC have been designed with decommissioning in mind, to minimise both radiation doses to personnel and the quantity of radioactive waste generated at end of life. The planned decommissioning strategy means that decommissioning activities will start as soon as possible once the electricity generation period has ceased. HPC plans anticipate that, apart from the onsite interim storage facility (ISF), the site will be fully decommissioned within 20 years of end of generation.

It is planned that a portion of spent fuel (SF) is removed from the reactor every 18 months, with the exception of the last three refuelling batches. After a cooling period of about 10 years in the Spent Fuel Pool, the SF will then be transferred to the interim spent fuel store building on the SZC site. After sufficient cooling (up to 100 years), they will be packaged and made suitable for transport to the future UK GDF.

The location and details of the GDF are yet to be determined and inventory data for the facility was not available at the time of modelling. Therefore, the generic ecoinvent dataset for HLW final repository has been used as a proxy.

As an overview, data provide for decommissioning by SZC Co covers the below activities:

- Removal of the spent fuel (SF) and cooling of SF onsite including estimations of energy and water required
- Deconstruction of all constructions on site (with exception of the AD roads)
- Operation of the storage facilities onsite during the period of up to 100 years during which the SF is on site after generation, including estimations of energy and water required
- Packaging of the SF and radioactive deconstruction wastes, including materials needed for packaging
- Transport of packaged radioactive wastes and non-radioactive wastes generated during decommissioning
- Disposal of wastes at final repositories or facilities
- Return of site to the agreed post use condition

It should be noted that some of the above activities will be covered by overarching assumptions and values where necessary, as actual values are unknown, given how far away in time decommissioning is.

3.2.4.1 Materials

Packaging materials have been derived from detail given in an internal SZC Co document: HPC Detailed decommissioning and waste management plan (DDWMP) from 2014. This document gives packaging parameters and types which SZC Co have combined with general assumptions to calculate packaging masses, volumes and types.

Material ecoinvent dataset selection was based on the assumption that packaging materials would be in sheet or form format and processing applied. It was assumed that packaging materials would be made in the UK or Europe. Copies of relevant datasets created for construction were used.

The inventory data values modelled for decommissioning radioactive waste packaging can be found in Table 42 of Appendix A6 in the full carbon report.

3.2.4.2 Transport

For transport, the same assumptions of location of radioactive waste facilities as per core operation were made.

For packaging materials to site, SZC Co assumed a 300km distance as suppliers are not known and this represents a location from in the middle of the UK.

For non-radioactive waste, it was assumed by SZC Co that destinations would be up to 100km away from SZC.

The inventory data values modelled for decommissioning transport can be found in Table 43 in Appendix A6 in the full carbon report.

3.2.4.3 Utilities

It is expected that decommissioning of SZC will not occur until the 2090s. At this time, significant decarbonisation of the UK's energy systems is expected to have taken place. As mentioned in Table 3, a 2050 forecasted electricity grid mix was used to model the core decommissioning electricity quantity for SZC, to show carbon impacts may reduce in accordance with UK decarbonisation which will have occurred by the time of decommissioning.

The specific datasets used to represent these sources can be found in Table 13 in Appendix A1. For some sources, only one applicable GB dataset was available. Where multiple datasets were available to represent a source, an equal split was applied across all the applicable datasets.

It should be noted that only the dataset to represent the electricity quantity provided by SZC Co was adjusted, and so materials, transport and other inputs/outputs were not altered and therefore reflect today's carbon intensities. The outputs are therefore conservative because it is expected that many other changes will have occurred by the 2090s which will reduce the carbon impacts of infrastructure, materials and transport used (for example). However, there is uncertainty around these future changes and exploration into these factors would warrant a separate study in itself.

The inventory data values modelled for decommissioning utilities can be found in Table 44 in Appendix A6 of the full carbon report.

3.2.4.4 Waste & Emissions

Both non-radioactive and radioactive wastes will be generated during decommissioning.

Levels of non-radioactive wastes generated by dismantling of the infrastructures across site were calculated based on the raw material inputs (including any uplift applied to the raw materials). Depending on raw material type, the masses of said waste were categorised into one of four groups: metals for recycling, backfill for onsite use (inert demolition waste such as brick and concrete), inert waste to landfill, and hazardous waste for disposal.

Note that the total mass balance (input/output) of construction materials in over mass out (considered to be the mass of wastes from the deconstruction of temporary ADs during the construction phase plus decommissioning waste) is over 100%. This is due to a combination of certain infrastructure components remaining on site after decommissioning, such as the roads.

Quantities and types of radioactive wastes to be generated during the decommissioning process were established by SZC Co drawing on the Hinkley Point C Power Station Decommissioning and Waste Management Plan Revision 4.0 [17]

The radioactive ILW, LLW and VLLW wastes generated during decommissioning will include equipment but also contaminated building (construction) materials from the buildings. It was not possible to separate out the construction materials that would be radioactive at the end of life from those that would not, so we have included these as additional providing a little overlap between the two. This allows for conservatism as opposed to exclusion of impacts.

The other 'secondary' radioactive waste refers to waste generated during various decontamination and dismantling activities, e.g. decontamination of metallic components or flushing of systems to reduce the amount of primary waste. Secondary waste consists of liquid waste, spent ion exchange resins, spent filters and dry active waste.

A radioactive waste processing facility is planned to be built during decommissioning. However, materials required to construct this facility have been covered in construction stage data and waste generated during its dismantling have been covered in the decommissioning phase.

The inventory data values modelled for decommissioning wastes can be found in Table 45 in Appendix A6 of the full carbon report.

3.3 Downstream stage

The downstream life cycle stage refers to the distribution of electricity from the site of generation to the downstream electricity users.

Figure 7: Overview of where losses can occur during electricity delivery to the user

The transmission network is a high voltage network which transports electricity from its source of generation (such as from the nuclear power plant 'gate') to the distribution network (or to large electrical users directly connected to the transmission network). Transmission networks connect with distribution networks at grid supply points (GSP) [18]. In Great Britain, transmission networks operate at 275kV and 400kV. Distribution networks operate at 132kV and below.

Transmission losses occur when a portion of the energy of an electrical current travelling along a network is dissipated as heat as a result of the electrical resistance in the network. In addition to transmission losses, distribution losses also occur, where energy is lost between a GSP and a household or factory. Transmission losses are lower (as a percentage) than distribution losses. The National Grid suggests that transmission network losses are around 1.7% compared to a further 5-8% that is lost over distribution networks [19]. These losses affect all forms of power generation that are connected to the electricity network.

Transmission and distribution (T&D) losses effectively mean that more electricity needs to be generated in order to ensure that the customer receivers the required amount of electricity. This increased electricity transmitted also infers an uplifting of the impacts associated with the grid itself as it is being 'used' more.

The PCR requires that T&D losses be accounted for in the downstream life cycle stage. To model the downstream impacts associated with the nuclear power plant, generic ecoinvent datasets were used, as specific data representing the infrastructure and operation of the UK electricity network was not available to SZC Co.

The ecoinvent generic dataset for GB medium voltage market electricity was used, representing the generation and distribution of electricity from source to household and most industrial customers. This dataset is already set up to the reference unit of delivering 1kWh of medium voltage electricity to a customer. This dataset includes SF_6 switchgear inputs, SF_6 emissions, T&D infrastructure processes or flows related to land use, digging, construction, transformer stations, cables and poles, and waste treatment processes. Maintenance and dismantling of the T&D networks does not appear to be included in the ecoinvent datasets so should be considered to be excluded. The dataset did not state the assumed service life of the infrastructure, but other information on line estimates that UK electricity overhead lines have a design life of approximately 40 years [20] [21].

The generic dataset already contains uplifts for losses so a copy of the dataset (and relevant embedded electricity datasets) was made and these losses adjusted according to UK T&D losses.

Table 11: Parameter values modelled to represent T&D losses in the downstream module

Loss type	Loss modelled	Source
Transmission loss	1.7%	National Grid document 2019 [18]
Distribution loss	8%*	National Grid document 2019 [18]
Step up loss	3%	ecoinvent dataset

*The highest value in the range was used for conservatism

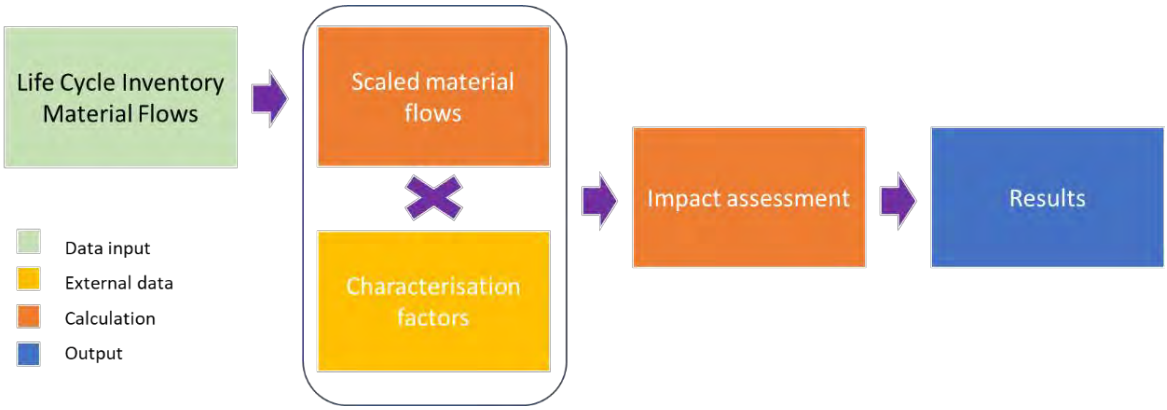
The model representing the generation of electricity at SZC was then fed into this copied dataset.

It is important to note that additional upstream and core impacts due to T&D losses will be assigned to the downstream stage, alongside impacts of the infrastructure and operation of the grid. In order to do this, the impacts of generating 1kWh at SZC must be subtracted from those of delivering 1kWh to the user. This difference will be the downstream impacts related to both the infrastructure and operation of the network plus impacts from the additional generation by SZC due to losses on the network.

4 Impact assessment

Within the SimaPro® software v9.1, the life cycle impact assessment uses the life cycle inventories to calculate results for each of the environmental indicators. First, each inventory is scaled to deliver the correct amount per functional unit (1 kWh). As described in section 3, the inventories are built in a cascading hierarchy by which each reads how much 'primary product' the next inventory needs, thereby scaling the inventory and related processes accordingly to meet that requirement. Once the inventories are scaled, characterisation factors (which are factors that link process flows with environmental indicator) are applied to the scaled material flows. The resulting impact is then summed per life cycle stage. The model flow is illustrated in Figure 8 below.

Figure 8: Model Flow Diagram



As specified by the PCR, results are reported at a minimum granularity of life cycle stage (i.e. upstream, core, downstream).

5 Life cycle assessment results and interpretation

The results of the SZC LCA are shown below in terms of GWP. As per the Electricity PCR requirements, results are reported per life cycle (LC) stage in terms of kg of CO_2 equivalents (eq.) per the functional unit of 1kWh distributed to a hypothetical customer. Note that only GWP was assessed for this report while the follow-up full LCA report will cover all required categories of the Electricity PCR.

An overview of the key LC stages is given in section 2.2.3 but can essentially be considered to be:

- **Upstream**: impacts associated with extracting and processing uranium and manufacturing the nuclear fuel assemblies required as an energy source for SZC, covering nuclear fuel fabrication, enrichment, conversion, mining and milling.
- **Core:** construction and decommissioning of SZC, plus infrastructure of offsite radioactive waste disposal to the extent covered by the ecoinvent datasets used to model these processes. Also, activities and processes associated with generation of electricity over the expected operation lifetime of SZC. Absolute results have been split between core infrastructure and core operation.
- **Downstream**: impacts beyond SZC which are due to the infrastructure and operation of the National Grid as well as impacts due to additional generated required to cover T&D losses that occur along the grid during delivery of energy to a customer. Downstream impacts are not SZC specific and will be applicable to some extent to any electricity source connected to the UK electricity grid.

The GWP impacts of generating 1kWh cover upstream and core LC stages, while GWP impacts of delivering (distributing) 1kWh cover upstream, core, and downstream.

Table 12 below shows that the GWP value for generating a net kWh of electricity at the modelled SZC development is 6.10g CO_2 eq. The GWP value of generating a net kWh of electricity at SZC and then

delivering (distributing) it to a customer, is somewhat higher, at 11.58gCO_2 eq. when taking into account grid impacts.

Table 12: GWP results per LC stage

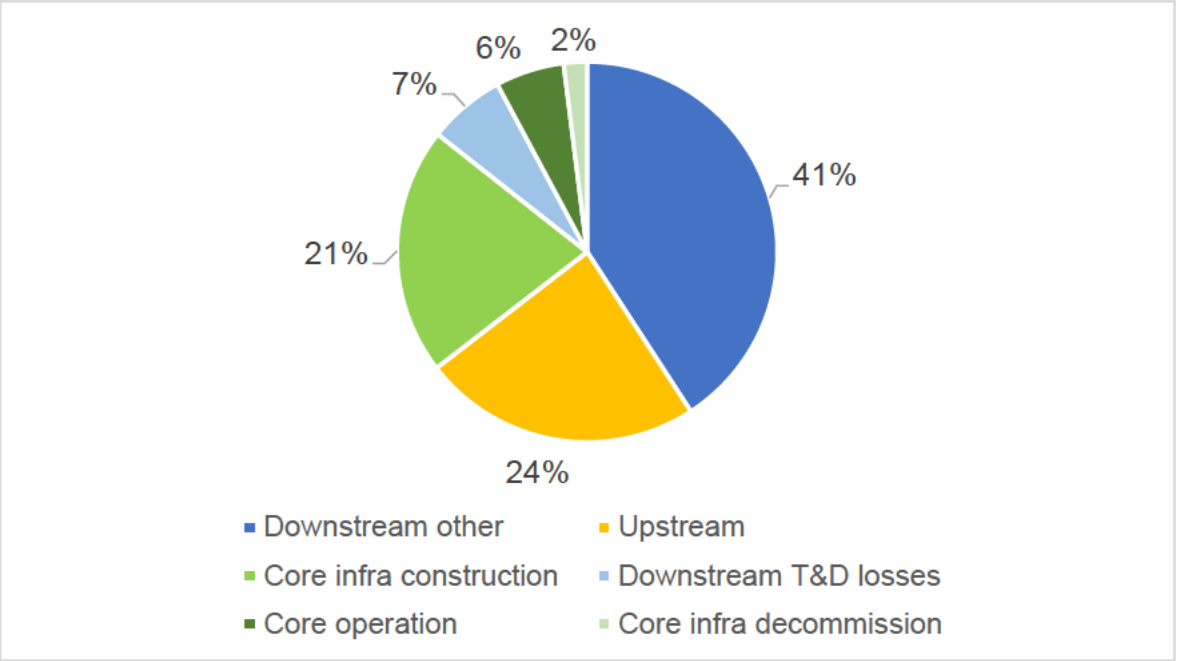
Life Cycle (LC) Stage	Upstream	Core op	Core infra - con	Core infra - decom	Total generated	Down* T&D losses	Down* other	Total distributed
kg CO_2 eq / kWh	2.75E-03	6.77E-04	2.44E-03	2.30E-04	**6.10E-03**	7.59E-04	4.73E-03	**1.16E-02**
g CO_2 eq / kWh**	2.75	0.68	2.44	0.23	**6.10**	0.76	4.73	**11.58**

*Downstream
**Results shown to two decimal places

5.1 GWP breakdown for 1kWh distributed electricity

A breakdown of this GWP value by each LC stage, is shown in Figure 10 below.

Figure 9: GWP breakdown of 1kWh distributed electricity by percentage per LC stage



As seen in Figure 9, the largest contributor to the total GWP value for a distributed kWh of electricity as modelled in this study, is 'Downstream other'. This encompasses the infrastructure and operational requirements of the grid itself and includes impacts of materials needed for aspects such as metals needed for pylons and emission leakages of SF6 insulation (a powerful greenhouse gas), as included in the ecoinvent dataset. These types of impacts are related to the grid itself and would therefore be relevant to any type of electricity transported over the grid.

Another downstream LC stage, 'Downstream T&D losses', is responsible for 7% of the total GWP value for a distributed kWh of electricity. This encompasses the additional impacts from generating electricity which are required to mitigate the key losses in the transmission and distribution network. These types of losses affect all forms of power generation that are connected to the electricity network. The total contribution from the downstream LC stage is therefore 48%.

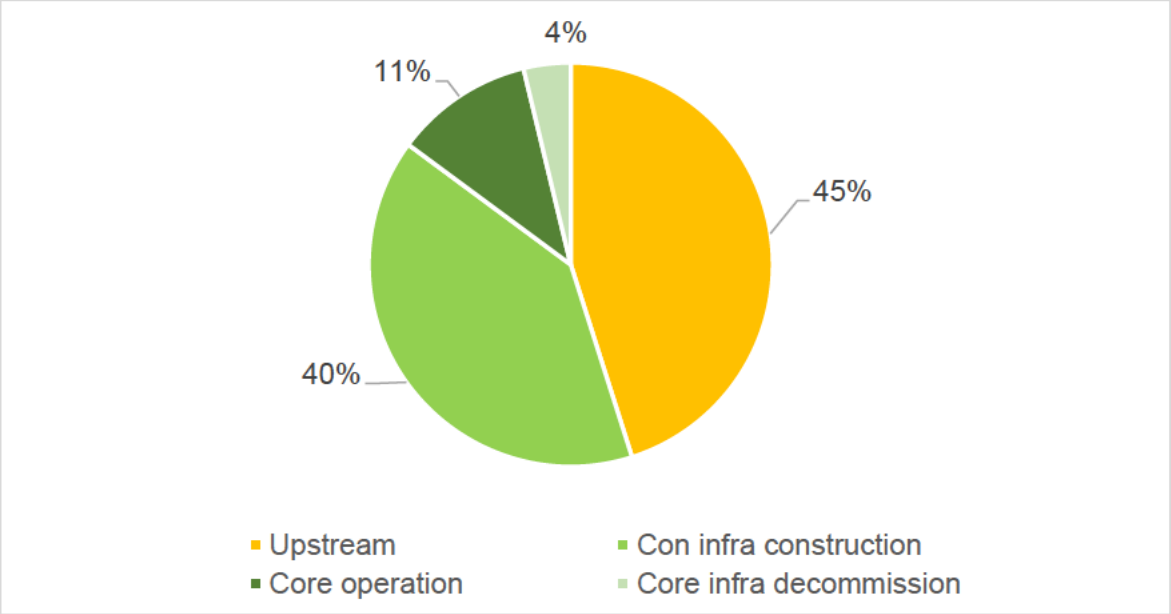
Upstream impacts are responsible for almost a quarter of the total GWP value of delivering 1kWh of electricity. This impact represents the nuclear fuel supply chain and will be broken down into its four key stages in section 5.2.1.

The next largest contributing stage, is the construction of core infrastructure, which is responsible for just over one fifth of the total distributed kWh GWP value. Core operation and Core decommissioning are responsible for 6% and 2% of the total, respectively. In total, core impacts account for 29% of the total GWP value.

5.2 GWP breakdown for 1kWh generated electricity

The previous section considers the impacts of delivering 1kWh, which is inclusive of losses within the network and the network itself. This section considers the GWP value of generating 1kWh of electricity at SZC, which excludes the downstream LC stages. This is shown in Figure 10 and indicates that SZC core activities are likely to be responsible for just over half of the total GWP value for 1kWh of SZC generated electricity.

Figure 10: GWP breakdown of 1kWh SZC generated electricity by percentage per LC stage



While the core LC stage makes up the largest contribution, Figure 10 indicates that at 45% the upstream stage's GWP is significant and is indeed higher than the individual core stages. It should be noted however, that just as the core LC stage has been split into constituent parts, so too can upstream. Core infrastructure and construction accounts for 40% of GWP, while Core operation contributes 11% and core decommission contributes the smallest percentage (4%).

The following subsections show where the key GWP contributions come from for upstream and core LC stages. Note that the percentages in the labels do not add up to 100% due to differences in rounding applied in order to display small percentages.

5.2.1 Upstream

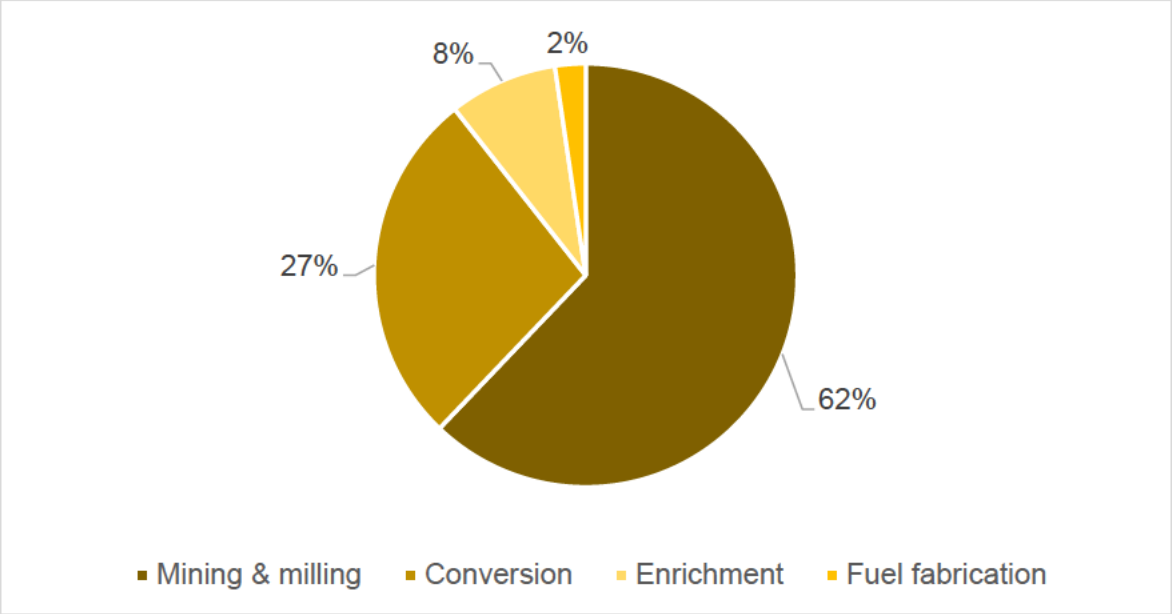
This section provides a breakdown of the four upstream LC stages' GWP contribution. Together, these stages contribute a GWP value of 2.75 g CO_2 eq. per kWh generated, over the 60-year operational life of SZC. It should be noted that this value is the same per kWh distributed since the extra impacts arising from the generation of electricity required to overcome losses are assigned to the downstream LC stage.

5.2.1.1 Milling and mining

Figure 11 shows that the majority (62%) of the upstream GWP impacts are associated with the milling and mining of uranium from nature. As noted in section 3.1.1, as no specific data was available, milling and mining was modelled using ecoinvent datasets. The largest GWP contribution comes from the ISL mining dataset (Uranium, in yellowcake {GLO} | uranium production, in yellowcake, in-situ leaching | Cut-off, U), within which combusted diesel is the key contributing process. ISL mining is responsible for the highest percentage of mined uranium (per the split defined earlier in Table 8) and

it is therefore understandable that it accounts for the highest GWP. However, it should be noted that ISL is an energy intensive process due to the pumping requirements of the mining technology. The highest contributor within the open cast mined uranium ore process is from milling energy, conversely mining and milling provide roughly equal contributions within the underground mine source. It should be noted that these are facets of the generic ecoinvent dataset so are not site specific and no energy forecasting has been applied.

Figure 11: GWP breakdown of LCA stage - upstream



The conversion process, whereby uranium ore is refined and converted to UF6, is responsible for 27% of the upstream GWP impacts. Its contributions arise mostly from gas usage in the ecoinvent dataset used. Energy for the wet conversion process (as modelled in this study) is needed for processes such as evaporation, calcining and drying. The disposal of the LLW generated is the next highest contributor to the conversion GWP value.

5.2.1.2 Enrichment

The enrichment of uranium, as based on the process described in section 3.1.3, generates 8% of the upstream GWP impacts. SimaPro network flows indicate that this is largely due to the embedded enrichment facility infrastructure dataset and from the forecasted 2035 UK electricity grid mix dataset, used for operating the centrifuge process.

5.2.1.3 Fuel fabrication

The final stage of the nuclear fuel supply chain, prior to its transportation to SZC, is fuel fabrication where enriched uranium is packaged into fuel assemblies. In this study, fuel fabrication generates only 2% of the total upstream impacts, with key contributions from the electricity and gas requirements plus fuel assembly material.

5.2.2 Core construction

In this section, the percentage breakdown of the GWP value assigned to core construction, part of the core infrastructure stage, is described. Together, these processes or sub-stages generate a GWP value of 2.44 g CO_2 eq. per kWh generated over the 60-year operational life of SZC. It should be noted that this value is the same per kWh distributed since the extra impacts arising from the generation of electricity required to overcome losses are assigned to the downstream LC stage.

Figure 12: GWP breakdown of LCA stage - construction of core infrastructure

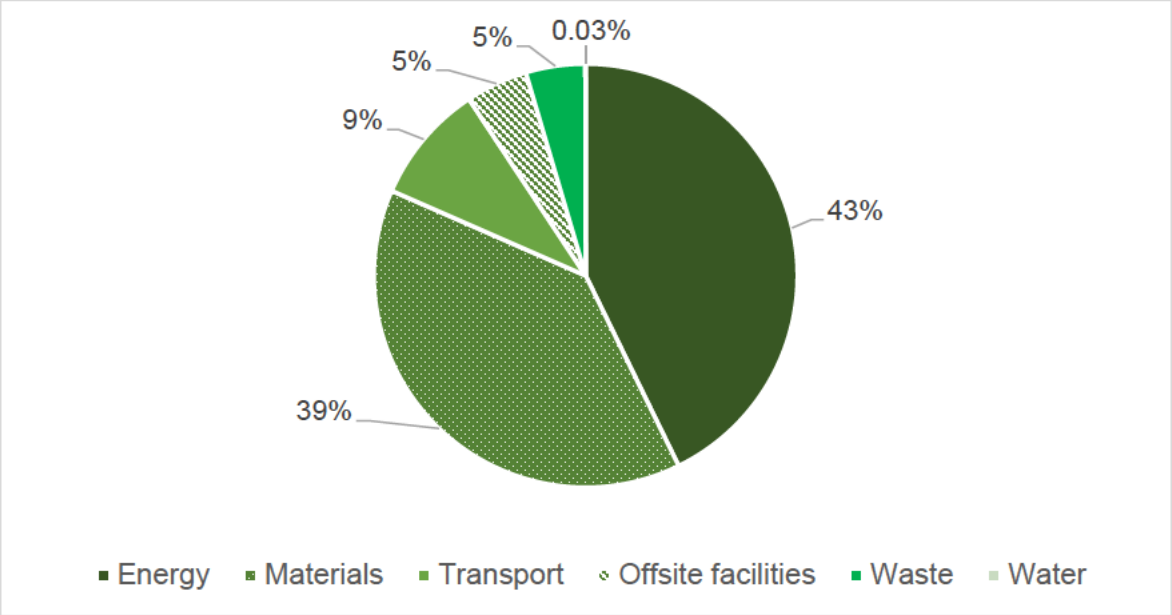


Figure 12 shows that over 80% of the GWP value associated with construction of core infrastructure, is from energy and material usage, with 43% associated with the energy needed for constructing the SZC development and 39% from the embodied carbon of the construction materials required, such as from the steel and concrete datasets. This energy relates to both UK grid electricity (based on current mix) and diesel.

The transportation of construction materials and earth works to the SZC site and transport of construction wastes offsite, including waste soils, are together responsible for 9% of core infrastructure construction's GWP. Transport impacts include, amongst others, emissions to air from fuel combustion and vehicle operation, as well as embodied carbon from the vehicle itself and the road infrastructure.

The treatment and disposal of waste generated during the construction period and the infrastructure of offsite facilities used for treating/disposing of operational radioactive wastes (as embedded with the ecoinvent datasets for radioactive waste disposal), are each responsible for 5% of the GWP value.

The impact of tap water usage during construction, can be considered to be relatively insignificant, at 0.03%.

5.2.3 Core operation

In this section, the percentage breakdown of the GWP value assigned to core operation of the SZC EPRs over their estimated 60-year life, is described. Together, these processes or sub-stages generate a GWP value of 0.68 kg CO_2 eq. per kWh generated over the 60-year operational life of SZC. This value includes commissioning of the SZC reactors and related buildings. As with the previous upstream and core processes, this value is the same per kWh distributed since the extra impacts arising from the generation of electricity required to overcome losses are assigned to the downstream LC stage.

Figure 13: GWP breakdown of LCA stage – core operation

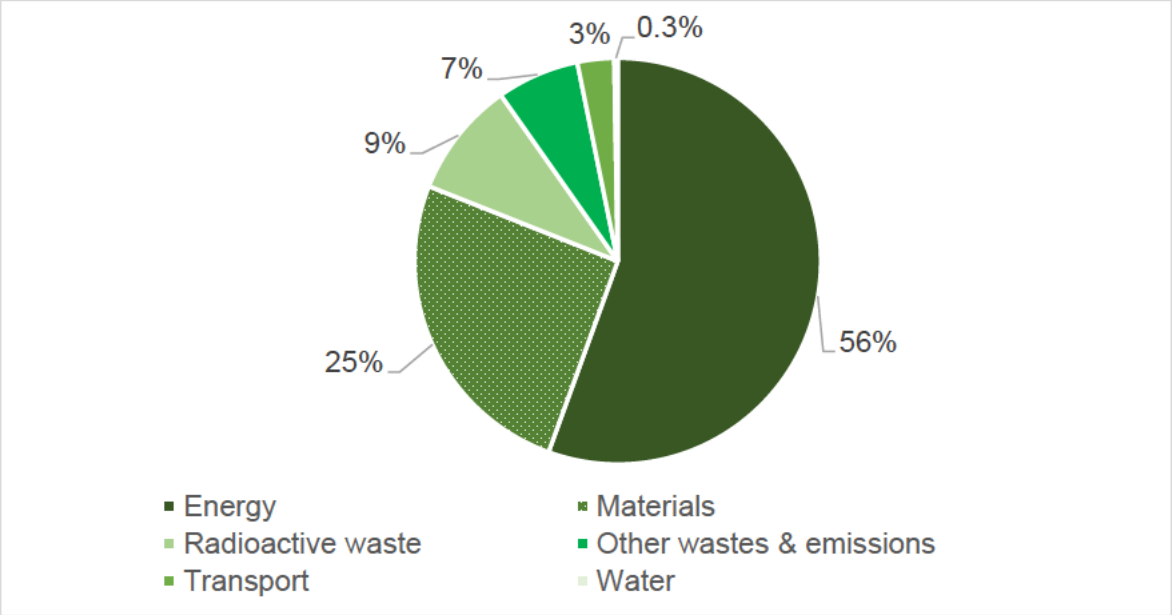


Figure 13 shows that in terms of core operation, 56% of the GWP value comes from energy requirements. This consists of electricity imports, modelled as per the forecasted 2035 UK electricity grid mix described in section 2.2.6.1, and diesel usage.

25% of the core operation GWP value can be allocated to the materials needed for commissioning and operation of the SZC plant. This includes materials such as stainless steel that are required to package radioactive wastes generated during operation.

A further 9% of core operation's GWP value comes from the offsite treatment and disposal of radioactive wastes. A large portion of this is due to the incineration dataset used to represent LLW incineration, mostly from emissions to air.

During operation, SZC Co expect to generate non-radioactive wastes, direct emissions to air and water. These cumulatively account for 7% of the core operation GWP value.

Transport of materials to site and of wastes from site to their respective offsite disposal or treatment locations contribute 3%. Decarbonised water contributes a relatively small amount of GWP (0.3%).

5.2.4 Core decommissioning

In this section, the percentage breakdown of the GWP value assigned to core decommissioning of the SZC development, is described. Together, these processes or sub-stages generate a GWP value of 0.23 g CO_2 eq. per kWh generated distributed over the 60-year operational life of SZC. Again, this value can be considered to be the same per kWh distributed since losses are assigned to the downstream life cycle stage.

Figure 14: GWP breakdown of LCA stage – decommission of core infrastructure

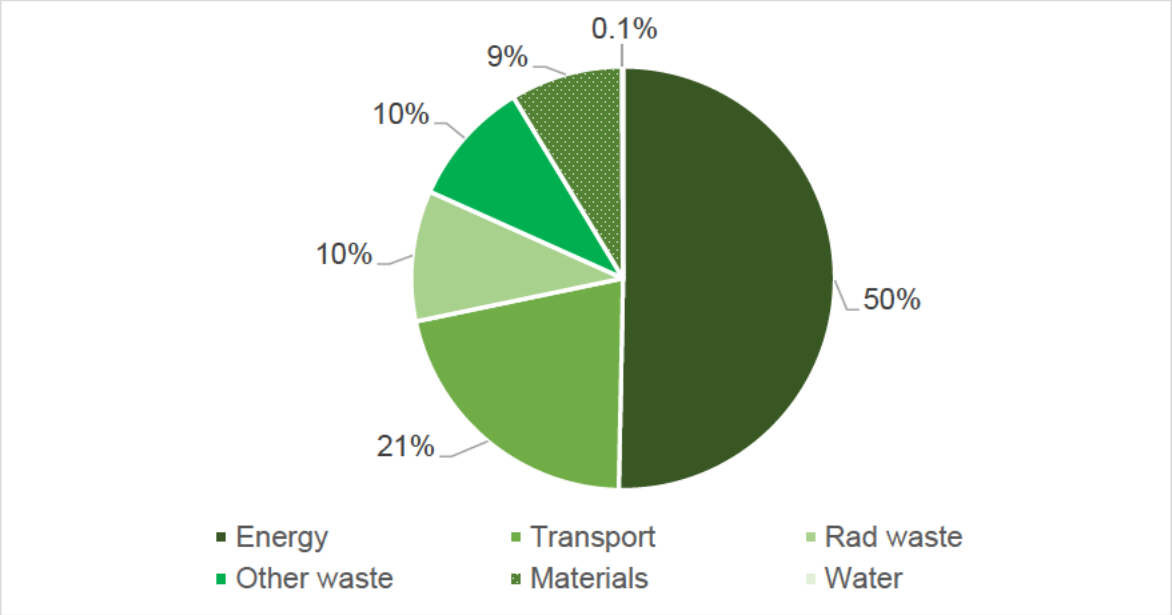


Figure 14 shows that half of decommissioning's GWP comes from the energy used. The GWP from energy usage is mainly contributed by the forecast 2050 UK electricity grid mix, and to a lesser extent, diesel.

Transport of packaging materials to site and of wastes offsite contributes 21% of the decommissioning GWP value. A large quantity of materials will be needed to be transported for suitable offsite disposal and recycling. The absolute GWP contribution of this transportation is likely an overestimate of the actual carbon impacts, as diesel vehicles are unlikely to be used in the 2090s, instead replaced with 'greener' lower carbon fuels.

The disposal of radioactive waste (rad waste) contributes 10% to the decommissioning model. The associated GWP value is derived mostly from the operational energy and materials from within the ecoinvent geological disposal facility dataset.

9% of the decommissioning GWP value is from the embodied carbon of the materials needed for packaging radioactive waste and 0.1% is from decarbonised water usage, such as that used in cooling pools at the SZC site.

5.3 Data commentary

As discussed in section 2.2.6.2, other than the 0.03% mass of construction material inputs which have been excluded, and whose impacts are assumed to be more than covered by the uplifts applied to the other construction materials, no known flows into or out of the system have been excluded. Results show that construction materials are responsible for 39% of the core construction value, which in turn is 21% of the total GWP value for 1kWh of distributed electricity, meaning construction materials contribute 8.2% of the total GWP value. The 0.03% excluded flow is therefore likely to be much lower than 1% of the total GWP value and can be considered to fall within the cut-off rules This indicates that the requirement for data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts have been included.

With all models, uncertainty exists. SZC Co has confidence that the data it has provided is reflective of the most up-to-date plans and data for the SZC development at the point of writing and has adopted a conservative approach to reflect any uncertainty or estimates required.

As discussed in section 2.2.3, secondary data from ecoinvent has been used for processes throughout the model. All ecoinvent data processes contain a level of uncertainty. Uncertainty analysis of the selected ecoinvent datasets in the model was carried out within SimaPro. Looking at

the uncertainty within the ecoinvent datasets themselves, it indicates with 95% confidence that results range from 10.66 to 12.78 g CO_2 eq. / kWh distributed and from 5.29 to 7.15 g CO_2 eq. / kWh generated.

Proxy datasets were used at various points within the model where an exact or same material type was not available within the ecoinvent database and the closest considered alternative ecoinvent dataset was used instead. This is relevant to fuel fabrication, which is responsible for 2% of the total GWP value for a distributed kWh of SZC electricity, and for operational material inputs, where these proxy datasets, such as those used to represent the Hydrex chemicals, accounted for around 2% of the total operational material GWP value. Therefore, for the GWP impacts associated with proxy data do not exceed 10% of the overall GWP impact from the product system.

As with any LCA modelling, it is important to note that estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

6 Conclusions

This study has considered the cradle-to-grave life cycle impacts of generating and delivering electricity from a SZC nuclear power station. Life cycle inventories have been developed based on SZC Co's most up to date plans and secondary data for the upstream fuel cycle and the downstream distribution network. Moreover, this study has been undertaken in accordance with the Electricity PCR and verified by an independent third party. It has been found that SZC's GWP is 6.1g CO_2 eq. per kWh generated and 11.58 g CO_2 eq. per kWh distributed.

Based on the results of this study, the distribution of electricity from generator to user, is responsible for a significant proportion (48%) of the potential carbon impacts of a distributed kWh. This is mainly due to the embodied carbon of the electricity network and its operation. The impacts from losses, are responsible for a smaller proportion of the total downstream impact.

A quarter of the carbon impact is found to arise from the upstream nuclear fuel supply chain. It should be noted however, that a theoretical split of uranium sources has been applied here and SZC Co are looking into the possibility of using reprocessed fuel once the plant is operational, which could lower its GWP.

The core LC stages cover the construction, operation and decommissioning of SZC itself and the offsite radioactive waste disposal infrastructure. It is found that all core stages combined account for 55% of the total distributed impact and 29% of the generated impact. Within the core stages, it is found that the SZC construction stage will have the highest carbon impacts. This is due to the quantities and types of raw materials needed for development, but more so to the energy requirements, which have been modelled using current processes for UK grid electricity and diesel. It should however be noted that as mentioned in section 3.2.3.3, the construction stage has been modelled using the UK's current electricity grid mix but in fact, the UK electricity grid is expected to undergo significant (further) decarbonisation over the construction period.

Core operation accounts for 6% of the distributed impact and 11% of the generated impact. However, this is considered to be an overestimated impact, despite the use of forecast 2035 UK electricity grid mix. This is because in the UK significant decarbonisation will occur between now and planned operation in 2035 that will affect all aspects of operation, including those beyond the operational energy required, such as the embodied carbon of the materials used and transport. Moreover, it will continue to decarbonise over the planned 60-year operational life.

Since the decommissioning phase will occur in the 2090s there is an increased level of uncertainty regarding its impacts. Decarbonisation forecasts are not available this far ahead and the stage has instead been modelled using UK Government forecasts for 2050 electricity grid mixes. It is anticipated that just as the operation LC stage will benefit from decarbonisation beyond that represented in this study, so will decommissioning, albeit much more so.

Bearing in mind the points above regarding decarbonisation, at this point in time, based on the most recent available data, the representativeness and quality of the data, as well as assumptions made,

(as described in sections 2.2.3, 2.2.5 and 2.2.6) are considered to be suitable in providing an estimate of the potential carbon impacts of the future SZC development in terms of the specified functional unit. This estimate is considered to meet the goal and scope of this study, providing SZC Co with an overview of the potential carbon related impacts of future SZC electricity generation, which it can communicate to its stakeholders and public alike.

6.1 Recommendations

Analysis of the results showed that almost half of the potential carbon related impacts of delivering 1kWh of electricity generated by SZC are likely to come from the grid itself, over which SZC Co has little influence and are impacts which affect all generators connected to the UK electricity grid in a similar manner. Likewise, 24% of the total GWP value relates to upstream impacts that are also out of SZC Co's direct control. It is recommended that SZC Co takes steps to monitor and influence these upstream and downstream processes so as to encourage GWP reductions.

Whilst it is unlikely that SZC cannot do much to influence the downstream impacts associated with distribution, as this represents grid level decision making, requesting further information from third parties will at least help to quantify SZC's allocation of these burdens.

For upstream processes, it is recommended that in the future SZC Co collects specific data from the conversion, milling and mining sites to improve the accuracy of this model but also to benchmark and improve suppliers' performance (noting that SZC's nuclear fuel chain is not yet confirmed). It is however acknowledged that this is no small task and there are sensitivity issues around the sharing of data in the nuclear industry. It is understood that SZC Co is already looking into the possibility of options for the upstream nuclear fuel supply chain which could reduce related burdens, such as those of mining and milling (including reprocessing spent fuel, enriching depleted tails or 'underfeeding' uranium enrichment).

Beyond this influence, it is recommended that SZC Co focuses on making reductions to the potential carbon impact of the SZC core development. Within all SZC core stages, energy is the highest contributor to GWP. Any possible reductions in the use of grid electricity imports, or increasing the renewable energy share of imports, or of reducing onsite diesel usage, perhaps by use of alternative fuels, if fit for purposes, would be key areas to focus on.

As described in section 3, certain core processes, largely offsite radioactive waste treatment processes and facilities, were modelled with generic ecoinvent datasets due to unavailability of specific data. While these have been considered representative of the potential impacts, if possible, data collection from the radioactive waste management facilities would allow further reduction of uncertainty in the model. It is understood that SZC Co is attempting to obtain specific data for a future UK GDF facility with a view to using this for future iterations of the SZC model.

It is strongly recommended that SZC Co keep a record of actual expended quantities required during the construction of SZC. This will be key to being able to update a future LCA with as accurate as possible data but also enable performance to be tracked and improved.

If, prior to construction, SZC Co's plans for the SZC development undergo significant changes in the contributing LC stages, such as if the design of a building changes drastically (core infrastructure construction), the amount of energy (electricity or diesel) required for construction, or the assumed quantity of enriched uranium for the 60-year operational life changes (affecting the upstream stage), then it is recommended that a reassessment of the carbon impacts is carried out to include these changes.

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[21] Western Power Distribution, “Lifetime Costs Report; Brechfa Forest Connection Project,” February 2014. [Online].

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Appendices

A1 2035 and 2050 electricity inventories

The ratio of these created dataset to each other was then adjusted according to the grid mixes given in Table 3 and embedded in the copy of 'Electricity, high voltage {GB}| market for | Cut-off, U' which was itself embedded in a copy of 'Electricity, medium voltage {GB}| electricity voltage transformation from high to medium voltage | Cut-off, U' which was itself embedded in a copy of 'Electricity, medium voltage {GB}| market for | Cut-off, U'. These copies were named as: [COPY – SZC……2035] Electricity, medium voltage {GB}| market for | Cut-off, U or [COPY – SZC……2050] Electricity, medium voltage {GB}| market for | Cut-off, U'], with the full name reflecting the LCA module in which this forecast dataset was applied.

Table 13: Breakdown of the customised processes used to tailor UK 2035 and 2050 UK electricity grid mix.

Created dataset	ecoinvent dataset
[SZC - electricity source] Natural gas	100%: Electricity, high voltage {GB}	electricity production, natural gas, conventional power plant	Cut-off, U
[SZC - electricity source] Nuclear	87%: Electricity, high voltage {GB}| electricity production, nuclear, boiling water reactor	Cut-off, U 13%; Electricity, high voltage {GB}| electricity production, nuclear, pressure water reactor	Cut-off, U
[SZC - electricity source] Biomass	100%: Electricity, high voltage {GB}	heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014	Cut-off, U
[SZC - electricity source] Wind, offshore	100%: Electricity, high voltage {GB}	electricity production, wind, 1-3MW turbine, offshore	Cut-off, U
[SZC - electricity source] Wind, onshore	84%: Electricity, high voltage {GB}| electricity production, wind, 1-3MW turbine, onshore	Cut-off, U 6%: Electricity, high voltage {GB}| electricity production, wind, >3MW turbine, onshore	Cut-off, U 10%: Electricity, high voltage {GB}| electricity production, wind, <1MW turbine, onshore	Cut-off, U
[SZC - electricity source] Hydro	57%: Electricity, high voltage {GB}| electricity production, hydro, run-of-river	Cut-off, U 43%: Electricity, high voltage {GB}| electricity production, hydro, pumped storage	Cut-off, U
[SZC - electricity source] Solar	33.3%: Electricity, low voltage {GB}| electricity production, photovoltaic, 570kWp open ground installation, multi-Si	Cut-off, U 33.3%: Electricity, low voltage {GB}| electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted	Cut-off, U 33.3%: Electricity, low voltage {GB}| electricity production, photovoltaic, 3kWp slanted-roof installation, multi-Si, panel, mounted	Cut-off, U

A2 SimaPro model screenshots of network

Figure 15: Network of the SimaPro model for 1kWh of distributed electricity at 5% cut-off

Note that networked impacts do not show direct emissions to air so contributions may appear different to those analysed in the results section.

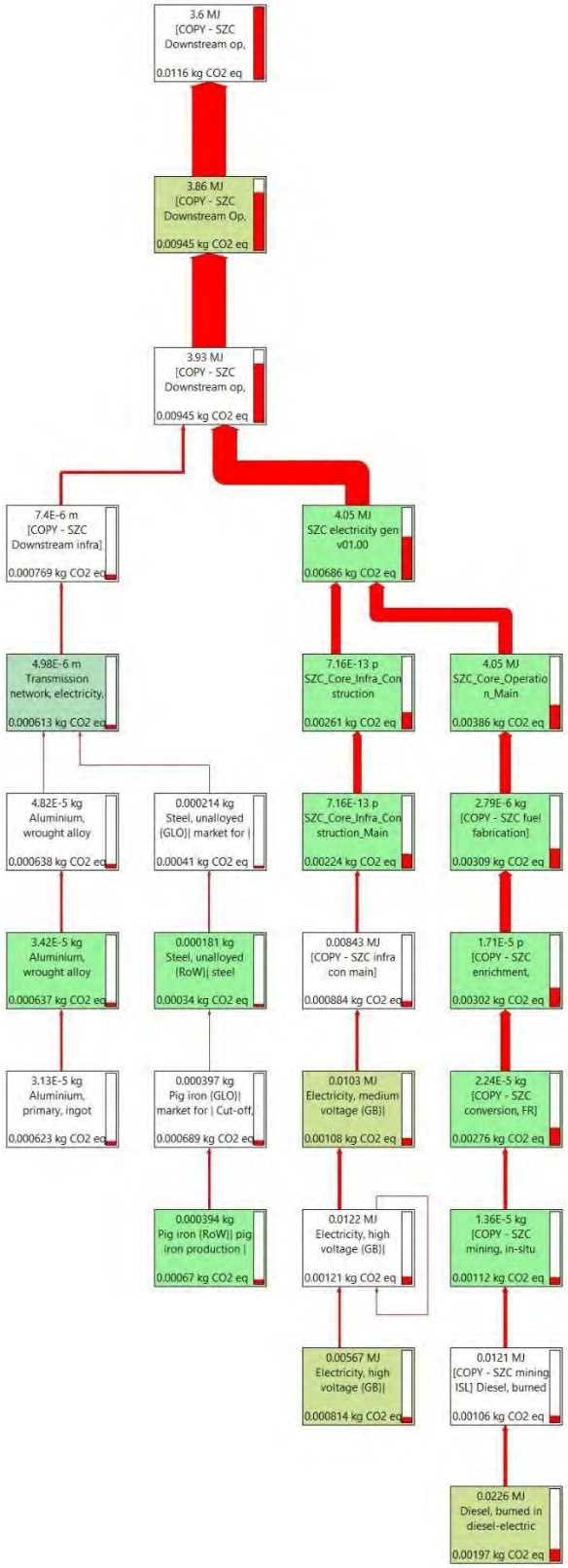
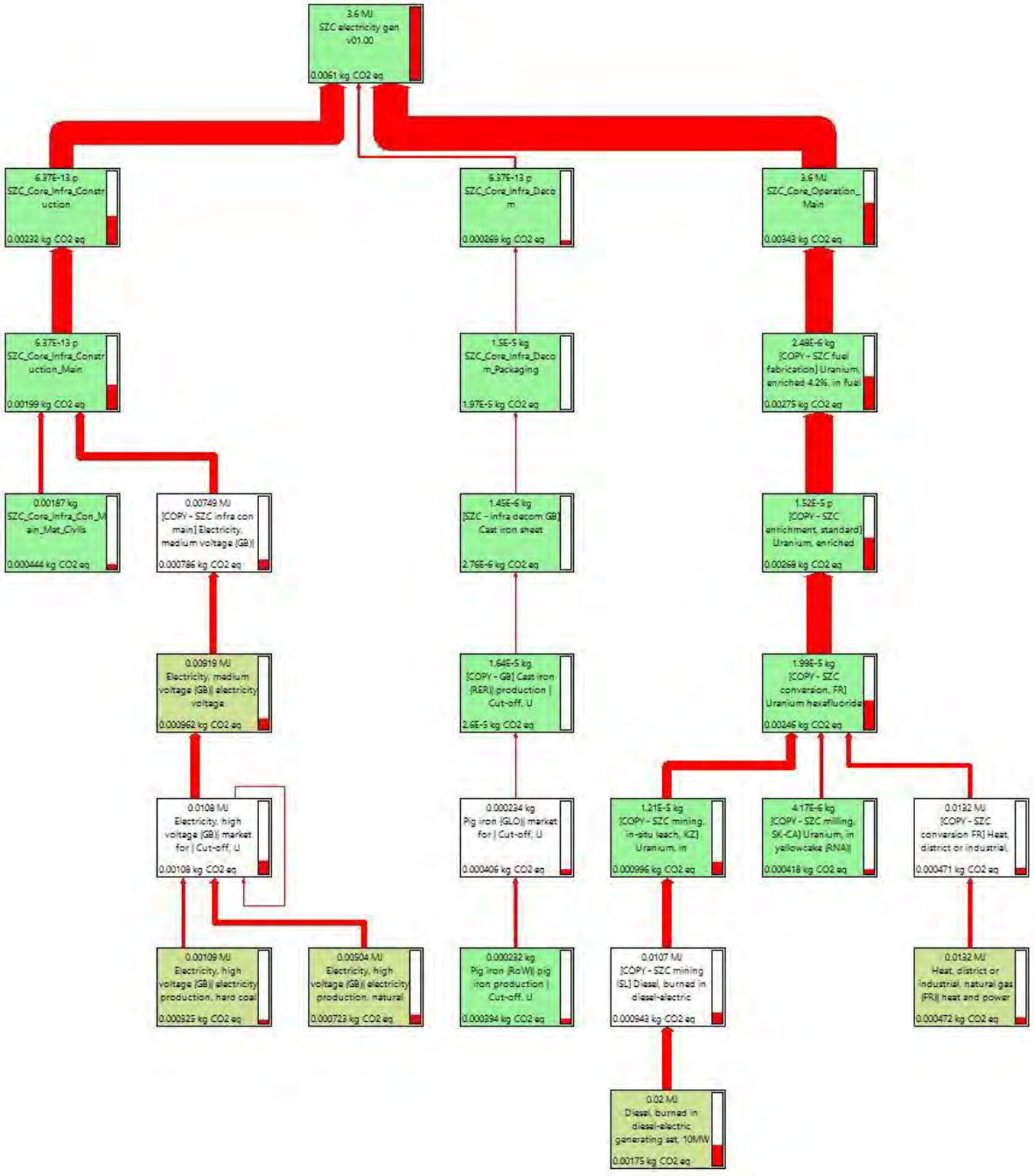


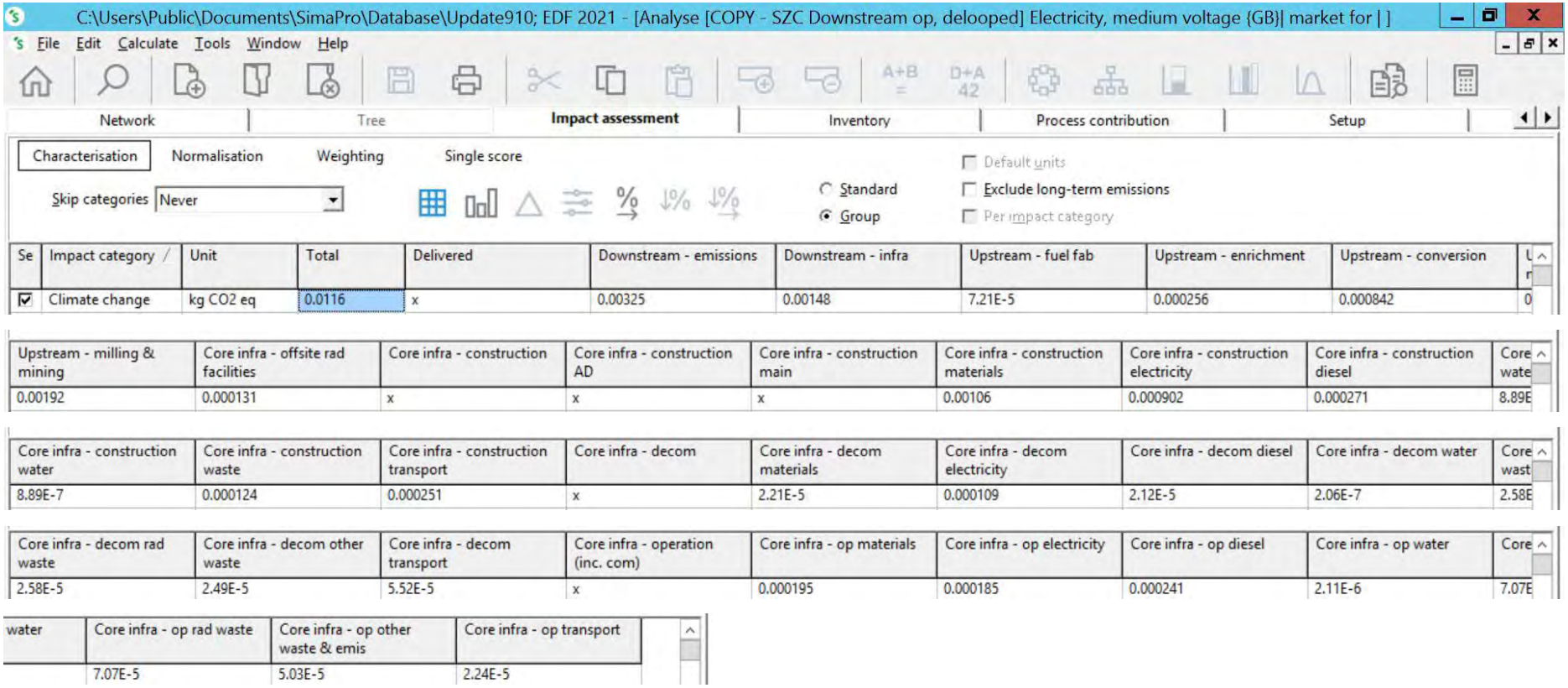
Figure 16: Network of the SimaPro model for 1kWh of generated electricity at 5% cut-off.

Note that networked impacts do not show direct emissions to air so contributions may appear different to those analysed in the results section.



A3 SimaPro screenshots of results

Figure 17: Screenshot of GWP results for 1kWh of distributed electricity from the model



Se	Impact category	Unit	Total	Delivered	Downstream - emissions	Downstream - infra	Upstream - fuel fab	Upstream - enrichment	Upstream - conversion
☑	Climate change	kg CO2 eq	0.0116	x	0.00325	0.00148	7.21E-5	0.000256	0.000842

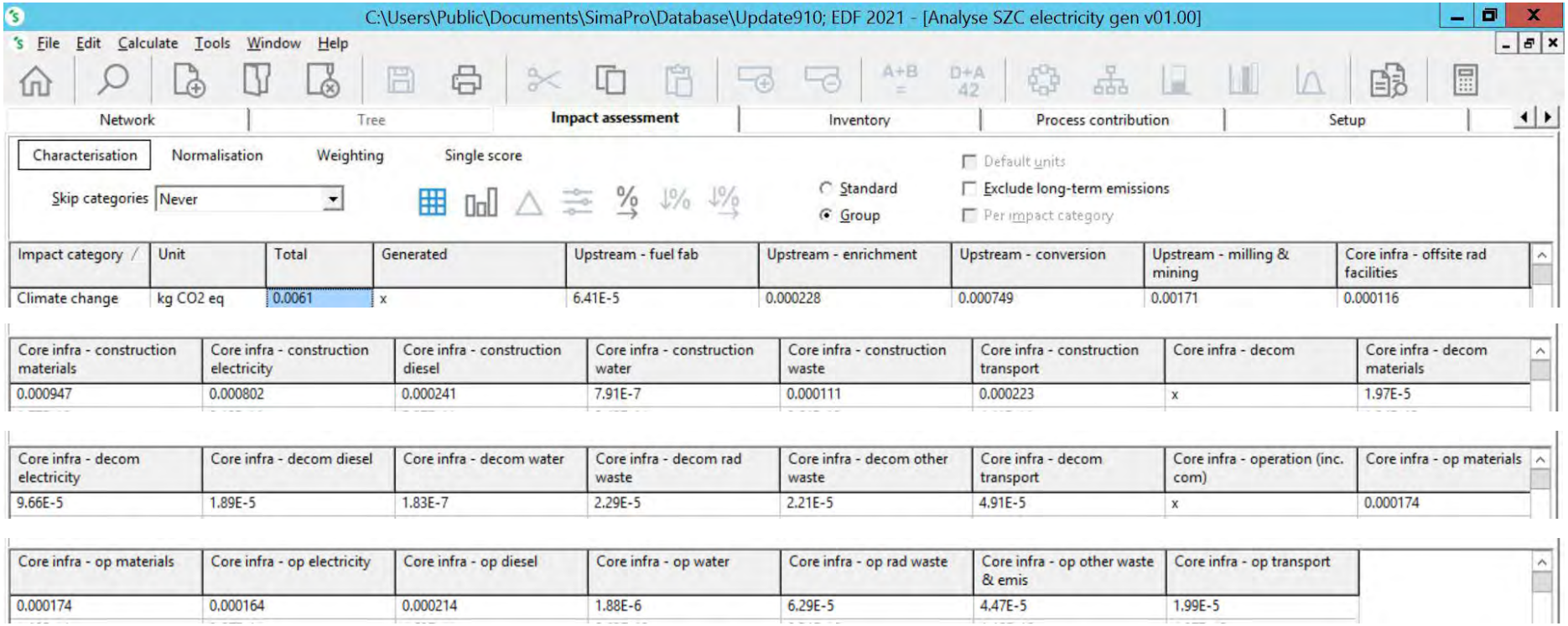
Upstream - milling & mining	Core infra - offsite rad facilities	Core infra - construction	Core infra - construction AD	Core infra - construction main	Core infra - construction materials	Core infra - construction electricity	Core infra - construction diesel
0.00192	0.000131	x	x	x	0.00106	0.000902	0.000271

Core infra - construction water	Core infra - construction waste	Core infra - construction transport	Core infra - decom	Core infra - decom materials	Core infra - decom electricity	Core infra - decom diesel	Core infra - decom water
8.89E-7	0.000124	0.000251	x	2.21E-5	0.000109	2.12E-5	2.06E-7

Core infra - decom rad waste	Core infra - decom other waste	Core infra - decom transport	Core infra - operation (inc. com)	Core infra - op materials	Core infra - op electricity	Core infra - op diesel	Core infra - op water
2.58E-5	2.49E-5	5.52E-5	x	0.000195	0.000185	0.000241	2.11E-6

water	Core infra - op rad waste	Core infra - op other waste & emis	Core infra - op transport
	7.07E-5	5.03E-5	2.24E-5

Figure 18: Screenshot of GWP results for 1kWh of generated electricity from the model



Impact category	Unit	Total	Generated	Upstream - fuel fab	Upstream - enrichment	Upstream - conversion	Upstream - milling & mining	Core infra - offsite rad facilities
Climate change	kg CO2 eq	0.0061	x	6.41E-5	0.000228	0.000749	0.00171	0.000116

Core infra - construction materials	Core infra - construction electricity	Core infra - construction diesel	Core infra - construction water	Core infra - construction waste	Core infra - construction transport	Core infra - decom	Core infra - decom materials
0.000947	0.000802	0.000241	7.91E-7	0.000111	0.000223	x	1.97E-5

Core infra - decom electricity	Core infra - decom diesel	Core infra - decom water	Core infra - decom rad waste	Core infra - decom other waste	Core infra - decom transport	Core infra - operation (inc. com)	Core infra - op materials
9.66E-5	1.89E-5	1.83E-7	2.29E-5	2.21E-5	4.91E-5	x	0.000174

Core infra - op materials	Core infra - op electricity	Core infra - op diesel	Core infra - op water	Core infra - op rad waste	Core infra - op other waste & emis	Core infra - op transport
0.000174	0.000164	0.000214	1.88E-6	6.29E-5	4.47E-5	1.99E-5

A4 SimaPro screenshots of uncertainty analysis

Figure 19: SimaPro screenshot of uncertainty analysis (1000 runs) of the ecoinvent dataset contained within the model for 1kWh of distributed electricity

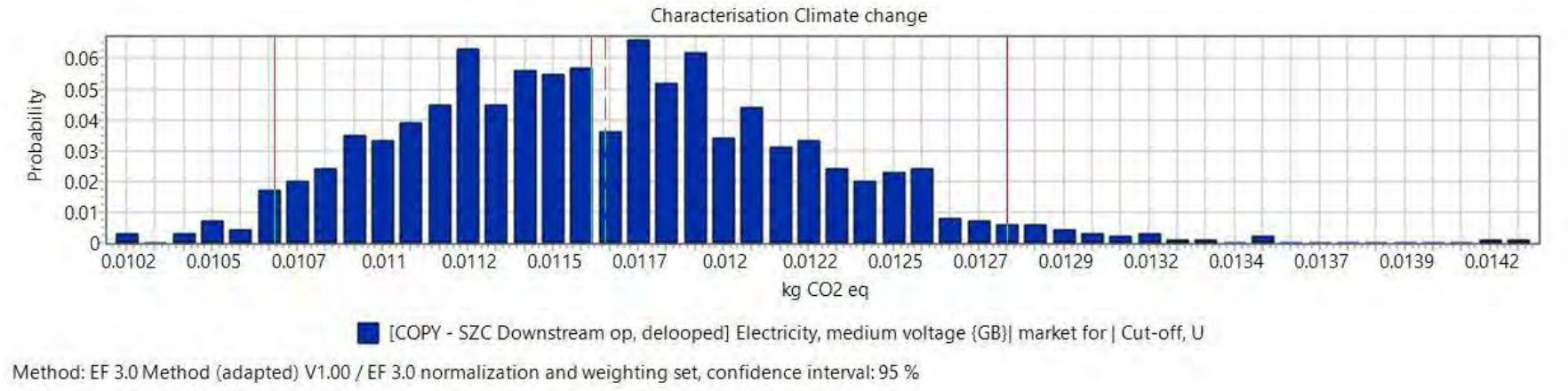
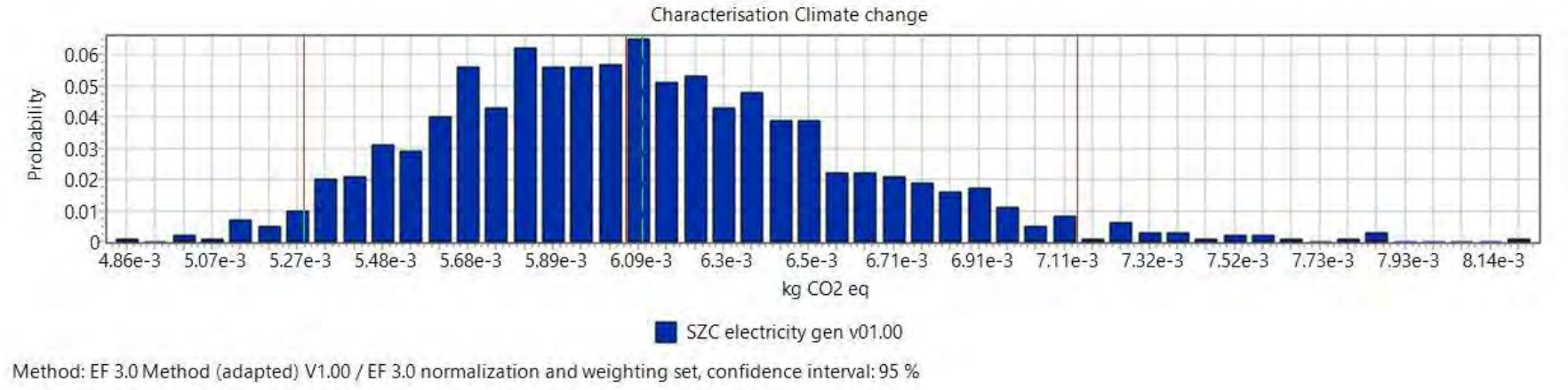


Figure 20: SimaPro screenshot of uncertainty analysis (1000 runs) of the ecoinvent dataset contained within the model for 1kWh of generated electricity



T: +44 (0) 1235 753000
E: enquiry@ricardo.com
W: ee.ricardo.com

LIFE CYCLE ASSESSMENT VERIFICATION STATEMENT

VERIFICATION INFORMATION	
Publication date	2021 -05-17
Project under review	Carbon focused Life Cycle Assessment of the proposed Sizewell C nuclear power plant development Ref: ED 13018102
LCA scope	Cradle-to-Grave
Functional unit	1kWh net electricity generated and distributed to the customer
Product group	UN CPC 171 – Electricity (Electrical energy)
Referenced standards and product category rule (PCR) used for the review	1. ISO 14040 :2006 2. ISO 14044 :2006 3. Electricity, Steam and Hot Water Generation and Distribution PCR 2007:08, version 4' (Electricity PCR)** ***partial conformance – only GWP indicator included in the report. Non-LCA aspects of this PCR are not included.*
Review criteria and procedure	- General checks: adherence to ISO 14040/44 and the PCR - Transperancy, consistency and accuracy checks for goal and scope - Transperancy, consistency and accuracy checks for product description and system boundaries - Consistency and accuracy checks for LCA model and data assumptions - Consistency and accuracy checks for the selected life cycle impact assessment method and characterisations - Transperancy, consistency and accuracy checks for results and interpretation The full details of the verification procedure, reviewer's comments and recommendations, dialogue trail, and list of documents used in the review process can be found in the workbook : Carbon LCA Verification Report_SZC_CR.xlsx
Final review statement	The carbon LCA report: Ref: ED 13018102 has been independently reviewed by WSP and deemed to be fully conformant with the requirement of ISO 14040:2006 and ISO 14044:2006 and partially conformant with the PCR - Electricity, Steam and Hot Water Generation and Distribution PCR2007:08, version 4. The LCA model, its underlying data, data assumptions, impact assessment method, results and interpretations were fully disclosed by Ricardo for verification and are adequately elucidated in the LCA report to enable transparent communication with the public.
Product owner	NNB Generation Company (SZC) Limited
LCA study prepared by	Ricardo Energy and Environment (Ricardo-AEA Ltd)
External verification by	WSP UK Ltd Verifier : Mobolaji Shemfe, Senior Sustainablity Consultant Individual verifier (International EPD® System) mobi.shemfe@wsp.com

2 London Square
Cross Lanes
Guildford, Surrey
GU1 1UN
Tel: +44 148 352 8400
wsp.com

APPENDIX 11A SZC RFI DRAFT COVER LETTER

Our Reference: XXXX

Address
XXX
XXX
XXX
XXX

Date: XXXX

Dear XXXX,

Sizewell C New Nuclear Power Station – Land Referencing

EDF Energy[1] is proposing to build and operate a new nuclear power station Sizewell C on the Suffolk Coast. The Sizewell C site is located on the Suffolk Coast, approximately half way between Felixstowe and Lowestoft, to the north-east of the town of Leiston. The proposed nuclear power station would be located immediately to the north of the existing Sizewell B power station and would comprise 2 UK EPR™ units with an expected net electrical output of approximately 1,630 mega watts (MW) per unit, giving a total site capacity of approximately 3,260 MW. The design of the UK EPR™ units is based on technology used successfully and safely around the world for many years, including innovations to enhance performance and safety. The UK EPR™ design has passed the Generic Design Assessment Process undertaken by UK regulators, and has been licensed and permitted at Hinkley Point C (HPC). Once operational, Sizewell C would be able to generate enough electricity to supply approximately 6 million homes (about 20% of Britain's homes).

In addition to the key operational elements of the power station, the project comprises other permanent and temporary development to support the construction and operation of the power station.

EDF Energy last consulted on its Sizewell C proposals between November 2016 and February 2017. The results of that consultation, continuing engagement with stakeholders and further environmental studies have enabled us to amend our proposals and take important steps towards settling our preferred scheme for our DCO application. Further work is necessary and, importantly, some choices still remain and this will all form part of the consultation that will take place early next year before finalising and preparing our DCO application ready for submission in 2020.

As part of this DCO process, Ardent have been instructed by EDF Energy to identify those parties who hold an interest in and/or rights over land and property, potentially affected by the project. This process is known as land referencing.

This letter, enclosed form and title plan are part of this identification process as it has become apparent from our searches of the Land Registry, that **you are in possession of a land interest or right which <u>may</u> be affected by part of the project.** As such, we need to identify the details of any freeholders, leaseholders, tenants, occupiers and other parties (such as rights of access, easements etc)

[1] NNB Generation Company (SZC Limited Company No. 9284825) (referred to in this document as "EDF Energy")

with an interest in your land, in order that they can be included in correspondence going forward and have the opportunity to comment on the proposals through the upcoming formal consultation process.

It is important to stress that all the development proposals at this stage are purely in draft form and we are investigating various different options at this current time. The Sizewell C Project is still evolving through consultation and we are continuing to investigate options to mitigate the impact of construction and enhance the benefits of the project in the local area. This land referencing process is simply to ensure the relevant people are consulted on these proposals - receipt of this letter should not be viewed as an indication that any development will be proposed on land in which you have an interest.

We would therefore be grateful if you could please complete the enclosed request for information form with as much detail as possible and return to **Ardent** (along with any marked-up plans if helpful) using the pre-paid envelope provided within 14 days. If you require any assistance with completing the form, please do not hesitate to contact **Ardent** using the details provided below.

SizewellC@ardent-management.com
Tel: 01908 802801

It would be helpful if you were able to return the completed attached form within 14 days of receipt of this letter to enable dialogue to be entered into, should it be requested or needed. You can also provide information via email if this is easier.

If you have any general comments or queries in relation to the project please direct these to **info@sizewellc.co.uk** or Telephone **0800 197 6102**

If you would like more information about the scheme, our webpage can be found at **http://sizewell.edfenergyconsultation.info/**

Our privacy notice provides information on what personal data we will collect as part of this process, how we will collect it and what we will use it for. You can access our privacy notice at **http://sizewell.edfenergyconsultation.info/privacy-policy/** or you can request a paper copy by emailing **dpo@edfenergy.com**

Yours sincerely/faithfully,

On behalf of
Head of Land & Property
Nuclear Development

APPENDIX 12A LETTER FROM BYLOR DATED 5 NOVEMBER 2020

05 November 2020

To whom it may concern

In support of the use of provided accommodation

BYLOR is a joint venture between Bouygues Travaux Publics and Laing O'Rourke delivering the main civil works on Hinkley Point C (HPC). BYLOR currently directly employ a workforce of 2300 employees, at peak this number will increase to 3500. In addition BYLOR employ 970 staff through either Joint Venture partner.

HPC have constructed two specifically designed accommodation facilities for employees working on the project. Sedgemoor Campus, is located a 10 minute walk from Bridgwater town centre and is the larger of the two campuses, with 986 bedrooms. Hinkley Campus, adjacent to the HPC construction site has 510 bedrooms. At present, 82% of our Workforce travel to HPC from outside the local area and BYLOR strongly supports the use of the two accommodation facilities by these employees.

Employees of BYLOR enjoy the convenience of the location of these facilities combined with the modern accommodation and access to the restaurant and leisure facilities.

Please do not hesitate to contact me should you require any further information.

Yours sincerely,

Janet Wessels
Human Resources Lead

BYLOR JV
Bristol Office: 10 Victoria Street, 2nd Floor, Bristol. BS1 6BN
Site: Hinkley Point C, Wick Moor Drove, Bridgwater, Somerset. TA5 1UF

APPENDIX 13A UPDATE TO CUMULATIVE EFFECTS ASSESSMENT

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1 APPENDIX 13A UPDATE TO CUMULATIVE EFFECTS ASSESSMENT

1.3 Introduction

1.3.11 This appendix has been prepared to consider any changes that have been made to the nearby energy Nationally Significant Infrastructure Projects (NSIPs) scoped in to the cumulative effects assessment in the Environmental Statement for Sizewell C since submission of the application for development consent for the Sizewell C Project in May 2020. The appendix identifies what changes have been made to each of the schemes and whether they have the potential to change the outcomes of the cumulative effects assessment, as presented in **Volume 10, Chapter 4** of the Sizewell C **Environmental Statement** (ES) [APP-578] and **Volume 1, Chapter 10** of the **ES Addendum** [AS-189].

1.3.12 The NSIPs in the vicinity of the Sizewell C Project that have been considered within this paper were identified on the short list of other plans, projects and programmes included as **Volume 10, Appendix 1B** of the **ES** [APP-573]. These NSIPs are:

- East Anglia ONE North (ID 13);
- East Anglia TWO (ID 14);
- East Anglia THREE (ID 366);
- Eurolink Interconnector (ID A112);
- Nautilus Interconnector (ID A111);
- Greater Gabbard Extension Offshore Wind Farm (OWF) (ID A113); and
- Galloper Extension OWF (ID A114).

1.3.13 This appendix has been written with regard to the following query, raised by Suffolk County Council during the relevant representations process [RR-1174]–

"148. The Council considers that the full cumulative impacts of the existing and potential future projects in the east Suffolk area have not been adequately assessed within the application. In addition, whilst a number of schemes have been included in some detail, further information on these and other schemes coming forward will become available during the course of the next few months and should be taken into account by the

Examination. These include offshore wind projects, inter-connector cables across the North Sea and an inter-connector project to Kent"

1.4 Changes to nearby energy NSIPs

1.4.11 The changes to the status of energy NSIPs in close proximity to the Sizewell C Project are listed in **Table 1.1** below.

Table 1.1: Status of energy NSIPs in close proximity to the Sizewell C Project

Application	Status reported within the ES	Status as of May 2021	New details available
East Anglia ONE North	DCO Submitted – pre examination	Examination period	Change in construction programme. New assessments made available.
East Anglia TWO	DCO Submitted – pre examination	Examination period	Change in construction programme. New assessments made available.
East Anglia THREE	DCO granted	Submission of non-material change made	Change in construction programme.
Eurolink Interconnector	Pre-application	Pre-application	No new information available.
Nautilus Interconnector	Pre-application	Pre-application	Change in construction programme.
Greater Gabbard Extension OWF	Pre-application	Pre-application	Project website launched in summer 2020 including name change to North Falls OWF.
Galloper Extension OWF	Pre-application	Pre-application	Project website launched in September 2020 including name change to Five Estuaries OWF.

a) Changes to the Scottish Power Renewables Schemes

i. Additional information

1.4.12 Whilst a range of new and additional information has been made available during the examination process of the East Anglia ONE North and East Anglia TWO projects, only the information relevant to the Sizewell C Project cumulative effects assessment is considered within this appendix. This relevant information includes:

- Changes to construction programmes; and
- Clarification notes.

Changes to construction programmes

1.4.13 The cumulative effects assessment within the Sizewell C Project ES [APP-578] considered the following years of construction for the Scottish Power Renewables schemes;

- East Anglia THREE – approximately 2021 – 2023;
- East Anglia TWO – approximately 2026 – 2028; and
- East Anglia ONE North - approximately 2025 – 2027.

1.4.14 The new construction programmes, as detailed on the new 'East Anglia Hub'[1] website (Ref. 1), state that offshore construction of all three schemes will commence in 2023, on shore works will commence in 2024 and all three schemes will be operational by 2026. Information provided by Scottish Power Renewables states that construction is likely to be sequential, with parallel construction being the worst case scenario.

1.4.15 There have also been a number of additional reports that have been made available during the examination process for East Anglia ONE North and East Anglia TWO, to which SZC Co. have responded, where relevant.

Clarification Notes

1.4.16 The following clarification notes have been published for the East Anglia ONE North and East Anglia TWO schemes in relation to the cumulative assessments:

[1] East Anglia Hub is the name for the collective East Anglia THREE, East Anglia TWO and East Anglia ONE North offshore windfarm schemes.

- Landscape and Visual: Sizewell C Cumulative Impact Assessment (Ref. 2);
- Sizewell Projects Cumulative Impact Assessment (Traffic and Transport) (Ref. 3); and
- Socio-economics and Tourism Clarification Note (SZC CIA) (Ref. 4).

1.4.17 SZC Co. has responded to each of the clarification notes during the Scottish Power Renewables examination, as appropriate.

b) Changes to the Greater Gabbard and Galloper off shore wind farm extensions

1.4.18 Although both schemes have had new websites launch in the period following the submission of the Application for the Sizewell C project, neither scheme has developed sufficiently that there is more information available for cumulative assessment. As such, the assessment of these schemes remains as presented within the ES and ES Addendum.

c) Changes to the Nautilus Interconnector

1.4.19 A new indicative project timeline is available, which states that construction of the interconnector could commence in 2025 and be operational by 2028. This is a change from the information considered within the cumulative assessments presented in the **ES** [APP-578] and **ES Addendum** [AS-189], which were based on the Nautilus interconnector being constructed from 2026 to 2028. This change in programme does not have any implications for the conclusions of the cumulative effects assessment presented in the **ES** [APP-578] and **ES Addendum** [AS-189] as the construction of the Nautilus interconnector overlaps with the Sizewell C peak year of construction in both scenarios.

1.5 Updated Assessment

1.5.11 The assessments with the potential for change following the receipt of additional information are the landscape and visual, transport, socio-economic, marine ecology and water quality, coastal geomorphology and marine navigation assessments. These updated assessments are presented within the sections below. Other topics have not been assessed further as it has been considered that the longer construction durations assessed in **Volume 10, Chapter 4** of the **ES** [APP-578] and **Volume 1, Chapter 10** of **the ES Addendum** [AS-189]., would provide a worst case assessment, and SZC Co. is aware of no other pertinent information that has become available.

d) Socio-economics

1.5.12 Further detail has been presented to supplement existing assessments that have been developed for the socio-economics workstream in response to the following;

- additional information that has been presented during the examination period of East Anglia ONE North and East Anglia TWO,
- information that has come to light since the submission of Sizewell C's Application, and
- in response to specific queries relating to wider skills demand planning raised by Suffolk County Council and East Suffolk Council in Relevant Representations (RR-1174, RR-0342).

1.5.13 This includes more detail to supplement the cumulative skills demand assessment considering the Sizewell C Project in addition to the Scottish Power Renewables projects, as well as other schemes in the wider area.

1.5.14 The additional detail is considered in Appendix 23.2 Response Paper – Cumulative Effects (Skills and Labour Market) which supports the conclusions for significance of effects identified in **Volume 10, Chapter 4, Section 4.3** (Socio-economics) of the **ES** [APP-578].

b) Transport

1.5.15 SZC Co. has had discussions with Scottish Power Renewables regarding the new proposed concurrent programmes of East Anglia ONE North, East Anglia TWO and East Anglia THREE. It has been confirmed that as the flow differences are small, there would be no material impact on the SZC Co. environmental assessment if the updated SPR flows were to be used. Due to the proposed timings and location of the on shore elements of East Anglia THREE, it is not considered that this would have cumulative impacts in combination with the Sizewell C Project. Therefore no further transport analysis is required to assess the alternative timelines for construction of the Scottish Power Renewables schemes.

c) Landscape and Visual and Amenity

1.5.16 The landscape and visual assessment of cumulative effects considered only the onshore elements of East Anglia ONE North and TWO, due to the distance of the offshore elements. Landfall for East Anglia THREE has also not been considered due to the distance between the proposed landfall and the Sizewell C Project. With the construction of East Anglia ONE North and TWO running concurrently, there would be a reduction in the overall

duration of onshore construction effects assessed in the ES and ES Addendum. However, the duration of effects is still likely to be categorised as medium-term and, therefore, the construction effects would be slightly reduced but not enough to alter any of the landscape and visual judgements presented within the ES and ES Addendum.

1.5.17 SZC Co. agrees with Scottish Power Renewables that there are unlikely to be significant cumulative landscape and visual effects from East Anglia ONE North and East Anglia TWO in combination with Sizewell C during operation (Ref. 3). It is also agreed that the only elements of the East Anglia ONE North and East Anglia TWO proposals that have the potential to result in significant cumulative landscape and visual effects in combination with Sizewell C during construction are the cable landfall and the onshore cable route. **Volume 10, Chapter 4** of the **ES** [APP-578] concluded that for the following receptors, there would be cumulative effects but that they would not result in an increase to the significance of the effects assessed for the Sizewell C Project alone:

- Ancient Estate Claylands LCT
- Coastal Dunes and Shingle Ridges LCT
- Estate Sandlands LCT
- Visual receptors along the coast from Minsmere to Sizewell Coast
- Visual receptors in the Sizewell Belts area
- Suffolk Coast Path
- Suffolk Coast and Heaths Area AONB
- Suffolk Heritage Coast

1.5.18 In addition, **Volume 10, Chapter 4** of the **ES** [APP-578] concludes that for visual receptors around Knodishall and Aldringham; Aldringham Common and The Walks; and along the coast between Sizewell and Thorpeness, there would be medium-term significant visual effects as a result of the construction of the East Anglia ONE North and East Anglia TWO cable landfall and the onshore cable route in combination with the construction of Sizewell C. For these receptors, the level of significance is increased from the assessment of effects from the construction of Sizewell C Project alone, primarily as a result of the combined construction effects of the East Anglia ONE North and East Anglia TWO cable route and/or landfall.

1.5.19 **Volume 1, Chapter 10** of the **ES Addendum** [AS-189] considered the additional effects of the changes accepted in April 2021. Of the accepted changes, the proposed temporary beach landing facility has the greatest potential to increase the level of effects recorded in the ES. However, the ES Addendum concludes that there would be no additional significant cumulative effects on landscape and visual receptors from those identified in **Volume 10, Chapter 4** of the **ES** [APP-578]. This remains unchanged when considering the additional information to nearby NSIP schemes.

d) Marine Navigation

East Anglia Three

1.5.20 East Anglia Three cable landfall is planned at Bawdsey, Suffolk (approximately 15-16nm south of Sizewell C). As the cable corridor lies between Sizewell C and Harwich, there may be an increase in collision risk from passing vessels with Abnormal Indivisible Load (AIL) delivery vessels, if any construction, maintenance and/or repair works are required on the East Anglia Three export cable during the Sizewell C delivery period (during the construction or operational phases), if Harwich is chosen as the transhipment facility for Sizewell C AIL deliveries. However, due to the relatively low number of vessels involved in deliveries compared to the number of vessels transiting within the area, the effect remains tolerable (**not significant**).

East Anglia One North and East Anglia Two

1.5.21 There may be an increase in collision risk from passing vessels with Sizewell C AIL delivery vessels, if the construction period for the East Anglia One North and East Anglia Two wind farms overlaps with the AIL delivery periods during construction or operation of Sizewell C. Due to the relatively low number of vessels involved in deliveries and the distance between the developments, the effect remains tolerable (**not significant**).

1.5.22 There is also the potential for the export cables for these wind farms to make landfall close to the Sizewell C development site, with the current lease agreement adjacent to the main development site. As such, there may be cumulative impacts if construction or maintenance of the export cables overlaps with the construction period or any maintenance of the proposed Sizewell C development. There is potential for an increased collision risk with installation vessels and disruption to small craft activities in the area. Both operators are expected to follow best practice guidelines in order to minimise the risk of collision and thus the effect remains tolerable (**not significant**).

e) Marine Ecology and Water Quality

1.5.23 This section of the report is to revise the marine ecology and fisheries and marine water quality cumulative effects assessments following changes to the construction programmes of East Anglia One North, East Anglia Two and East Anglia Three schemes. A full assessment is provided in **Annex 1A** of this report with reference to **Volume 3, Appendix 10.4D-F** of the **ES Addendum** [AS-201].

i. Revised assessment

1.5.24 The potential for cumulative effects has been considered in relation to the effects of underwater noise arising from installation of the Sizewell C's beach landing facilities (BLFs) in combination with relevant cumulative schemes on the three key marine mammal species of importance at Sizewell; harbour porpoise (*Phocoena phocoena*), grey seal (*Halichoerus grypus*) and, harbour seal (*Phoca vitulina*). The effects of piling activities are contextualised against the relevant Management Units (MUs) for each species to provide a population level assessment of the proposed development acting cumulatively with other third-party projects.

Construction Phase

1.5.25 There are a total of six projects where the timeline for piling has the potential to overlap with the indicative installation period for the BLF structures (refer to **Annex 1A**). The additional information discussed in **Table 1.1** of this report has led to the inclusion of East Anglia TWO within this assessment, as there is now the potential for the piling of this scheme to overlap with installation of the BLF structures. Therefore, the assessment has been undertaken using the following projects piling concurrently to represent the worst-case scenario in terms of effects (**Figure 1.1**):

- Dogger Bank Creyke Beck A OWF;
- Dogger Bank Teesside A OWF;
- Thanet Extension OWF;
- Hornsea Project Three OWF;
- East Anglia THREE OWF; and
- East Anglia TWO OWF.

Piling: Marine mammals

1.5.26 The impact magnitude associated with cumulative assessments of underwater noise considers the total area of exposure to piling noise and the proportion of the reference population of marine mammals (porpoise or seals) that are potentially disturbed. Impact magnitude scales are provided in **Annex 1A**, **Table 1.2**.

1.5.27 The cumulative assessment in the **ES** [APP-578] and **ES Addendum** [AS-189] considered separate construction windows for the Scottish Power Renewables OWF schemes (East Anglia THREE; East Anglia TWO; and East Anglia ONE North). The new construction programmes as detailed on the 'East Anglia Hub' website (Ref. 1) states that offshore construction of all three schemes will commence in 2023. Onshore works will commence in 2024 and all three schemes will be operational by 2026. However, the Report on the Implications for European Sites for East Anglia One North OWF (Ref. 9) states that there would be no concurrent piling events between East Anglia ONE North OWF and East Anglia TWO OWF. Therefore, only East Anglia TWO OWF has been considered, as this represents the worst-case in terms of seal densities and therefore disturbance.

1.5.28 Hornsea Project 2 OWF is expected to be operational before Sizewell C commences piling. However, a hypothetical assessment is included in **Annex 1A**.

1.5.29 Natural England recommend applying a 15km effective deterrent range (EDR) for determining the impact for small piling operations, such as those for the proposed development. The 15km radius has been applied from the terminus of the temporary BLF as a worst-case scenario to calculate the maximum sea area for underwater noise impacts from the proposed development. The total sea area within the EDR is 359km^2.

1.5.30 The larger piles and greater hammer energies associated with offshore wind farms means a standard 26km EDR has been applied from the centre of the offshore wind farm area. The effect ranges are based on temporary avoidance which would cause disturbance but minimise acoustic injury.

1.5.31 In the worst-case scenario, each of the six OWF projects are assumed to pile concurrently and at the same time as piling for the BLFs at the proposed development. In such a case, the estimated maximum area of disturbance would be approximately 13,103km^2 (i.e. 6 x 2,124 km^2 OWFs + 359km^2 from the proposed development). The area estimate is precautionary in that it does not account for overlap of project EDRs and assumes concurrent piling (**Figure 1.1**).

Harbour Porpoise

1.5.32 The maximum number of harbour porpoise that could potentially be disturbed is 9,744 (2.82% of the reference population) (**Annex 1A**, **Table 1.3**). The proposed development has the potential to expose 218 animals 0.06% of the reference population and 2.2% of the total number of animals disturbed in the cumulative effects assessment scenario. The impact magnitude is assessed as *low* (**Annex 1A**, **Table 1.2**).

1.5.33 Maximum temporary auditory damage ranges from the proposed development and displacement behaviours from OWFs mean harbour porpoises have the potential to recover (Ref. 8) and sensitivity is judged as *medium*.

1.5.34 Minor adverse effects are predicted for harbour porpoise in the North Sea MU. Effects are **not significant** at the level of the reference population.

Phocid seals

1.5.35 The harbour seal reference population is based on the most recent count for the south-east England MU = 4,944 harbour seal (Ref. 5) (**Annex 1A**).

1.5.36 The grey seal reference population is based on the most recent counts and telemetry data (Ref. 5). Due to the transient nature of grey seals (Ref. 6) the south-east England MU (8,199), north-east England MU (6,442) and east coast of Scotland MU (3,762) are included in the reference population (Ref. 5) (**Annex 1A**), with a total of 18,403 grey seals used for the assessment.

1.5.37 Seal densities within the EDR for each OWF project and the proposed development (2,124km^2 for OWFs and 359km^2 for Sizewell C) have been calculated. Seal densities are provided at 25km^2 resolution and the relative weighted mean density and the upper (95% confidence interval) seal usage in these areas has been calculated spatially in GIS using the 2017 updated seal usage maps (Ref. 7). The number of seals within each EDR provides a measure of the total number of seals potentially disturbed based on the latest available data of the relative density of seals at sea.

1.5.38 The number of grey seals that could potentially be disturbed as a result of consecutive piling is 327 based on the relative mean weighted densities in each EDR. This equates to 1.78% of the reference population (**Annex 1A**, **Table 1.4**). The impact magnitude is assessed as low (**Annex 1A, Table 1.2**).

1.5.39 The number of harbour seals that could potentially be disturbed as a result of consecutive piling is 179 based on the relative mean weighted densities

in each EDR, equating to 3.62% of the reference population (**Annex 1A, Table 1.5**). The impact magnitude is assessed as low (**Annex 1A, Table 1.2**).

1.5.40 Following the same rationale as for the harbour porpoises, seals are assigned *medium* sensitivity to impacts from piling.

1.5.41 In the case where all six OWF projects were to undertake impact piling concurrently with the proposed development, the cumulative effects are predicted to expose 1.78% and 3.62% of the grey and harbour seals reference populations, respectively. For both grey and harbour seals, this represents a *low* impact magnitude, combined with a *medium* sensitivity, therefore, minor adverse effects are predicted and are **not significant** at the reference population level.

1.5.42 The relative contribution of Sizewell C piling to underwater noise is low. (0.11% and 0.15% of the grey and harbour seal reference population respectively; 6.4% and 4.1% of the total number of grey and harbour seals respectively disturbed in a cumulative effects assessment context). Therefore, the proposed development contributes little to the overall effect.

e) Coastal geomorphology

1.5.43 Cumulative impacts identified within **Volume 10, Chapter 4** of the **ES** [APP-578] and **Volume 1, Chapter 10** of the **ES Addendum** [AS-189] for coastal geomorphology were as follows;

- Sedimentation from the Soft Coastal Defence Feature (SCDF) (and impacts on this due to barge presence during operation) and the new temporary BLF onto the cable landfall envelope for National Grid's Nautilus and Eurolink cables, and
- Overlap of sediment plumes (from dredging for intakes and outfalls, Beach Landing Facility use and access).

1.5.44 The change in construction programmes for the East Anglia Hub, does not affect the sedimentation from the SCDF as the envelope of impact on sediment mobility from the temporary BLF is confined to the Sizewell C frontage. Although the licensed envelope for landfall does intersect the Sizewell A and Sizewell B frontages, it was considered highly unlikely that landfall would actually be permitted here and would be located further south, where no overlap would actually arise. With regard to the overlap in sediment plumes, the timing changes for the East Anglia Hub might mean that there is (notional) increase in potential overlap between multiple dredge activities, but it remains the case that the plumes from the Sizewell C Project are short lived and unlikely to overlap with each other or specific

events at the Offshore Wind Farms. The new worst-case outcome would be a small increase in the 'peak plume' sediment concentration for a brief period (order of days). For coastal geomorphology assessments, this is a negligible effect and there is no change in the significance of the cumulative assessment.

1.6 Summary

1.6.11 Overall the changes to the nearby energy NSIPs would result in no new or different significant effects than those reported in **Volume 10, Chapter 4** of the **ES**) [APP-578] or in **Volume 1, Chapter 10** of the **ES Addendum** [AS-189].

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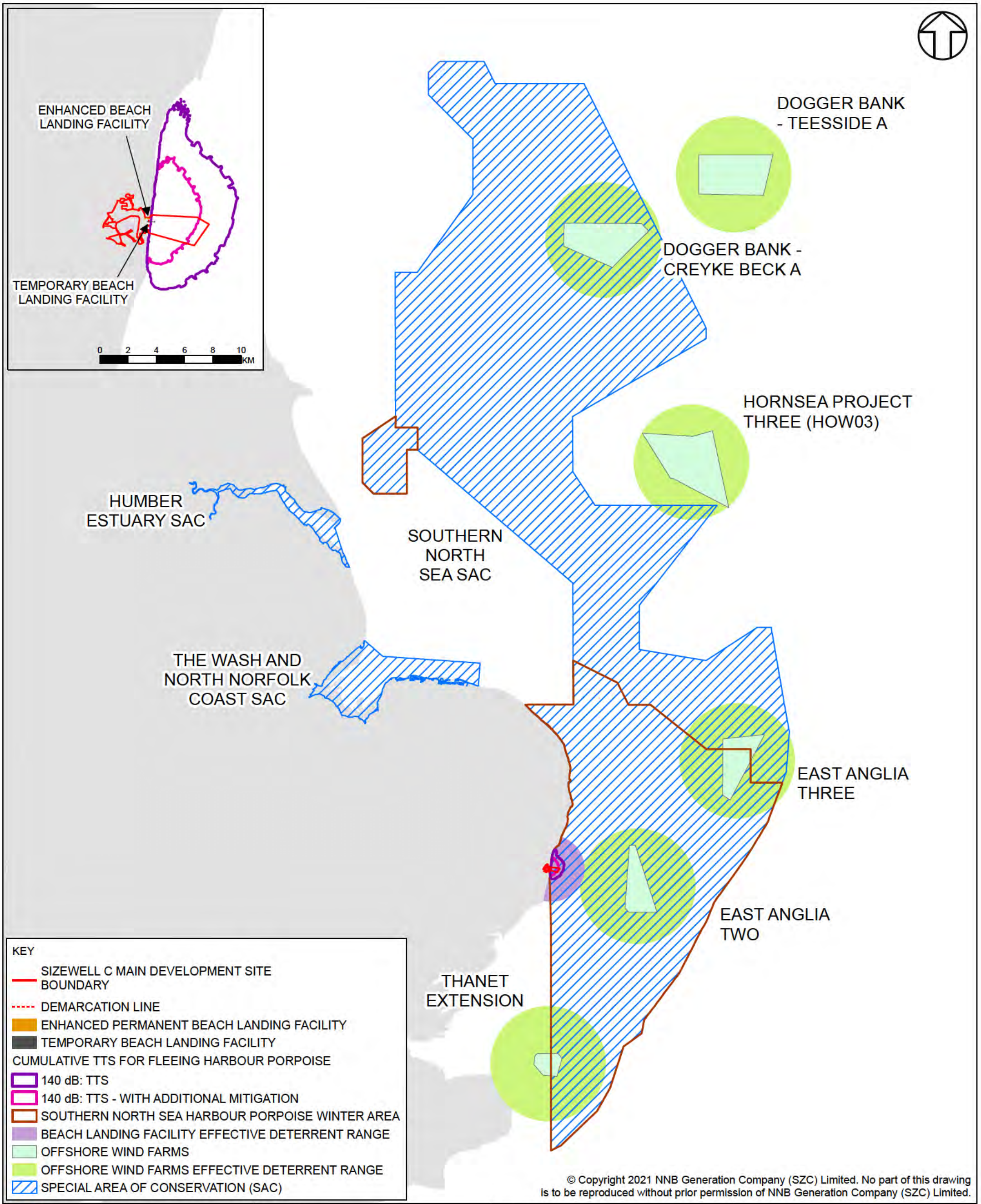
FIGURES



DRAWING TITLE:
MARINE MAMMAL CUMULATIVE NOISE ASSESSMENT FOR THE REVISED MARINE FREIGHT OPTIONS

NOT PROTECTIVELY MARKED

DRAWING NO:
FIGURE 1.1

DATE:	DRAWN:	SCALE :	REV:
JUNE 2021	R.D.H	1:1,550,000@A3	01

DOCUMENT:
SIZEWELL C PROJECT
RESPONSES TO EXAMINING AUTHORITY'S WRITTEN QUESTIONS ISSUED ON 21ST APRIL 2021
CHAPTER 13: CUMULATIVE AND TRANSBOUNDARY

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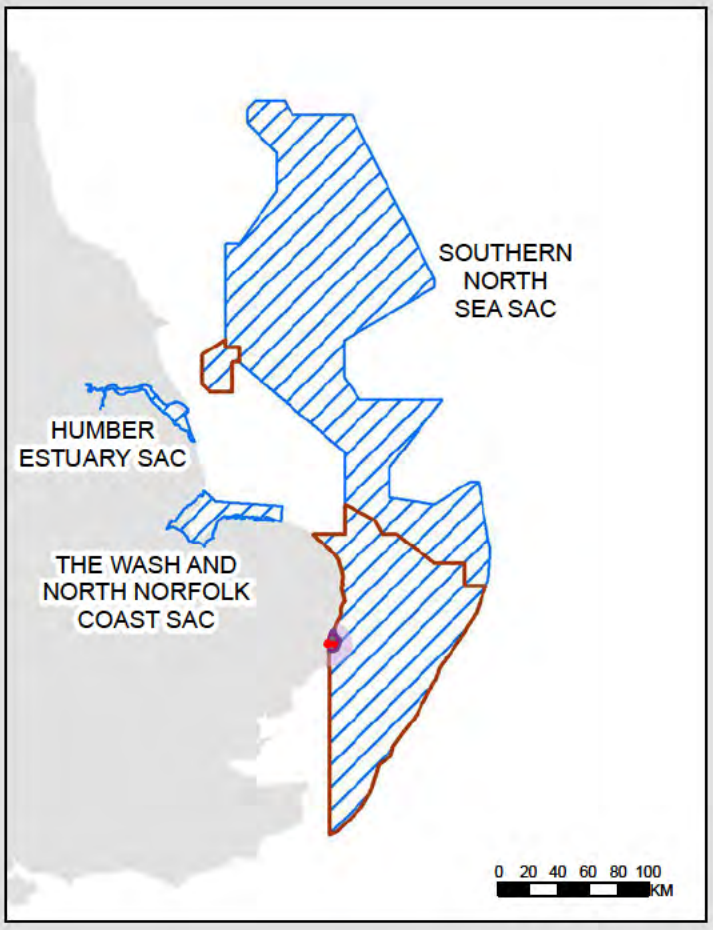
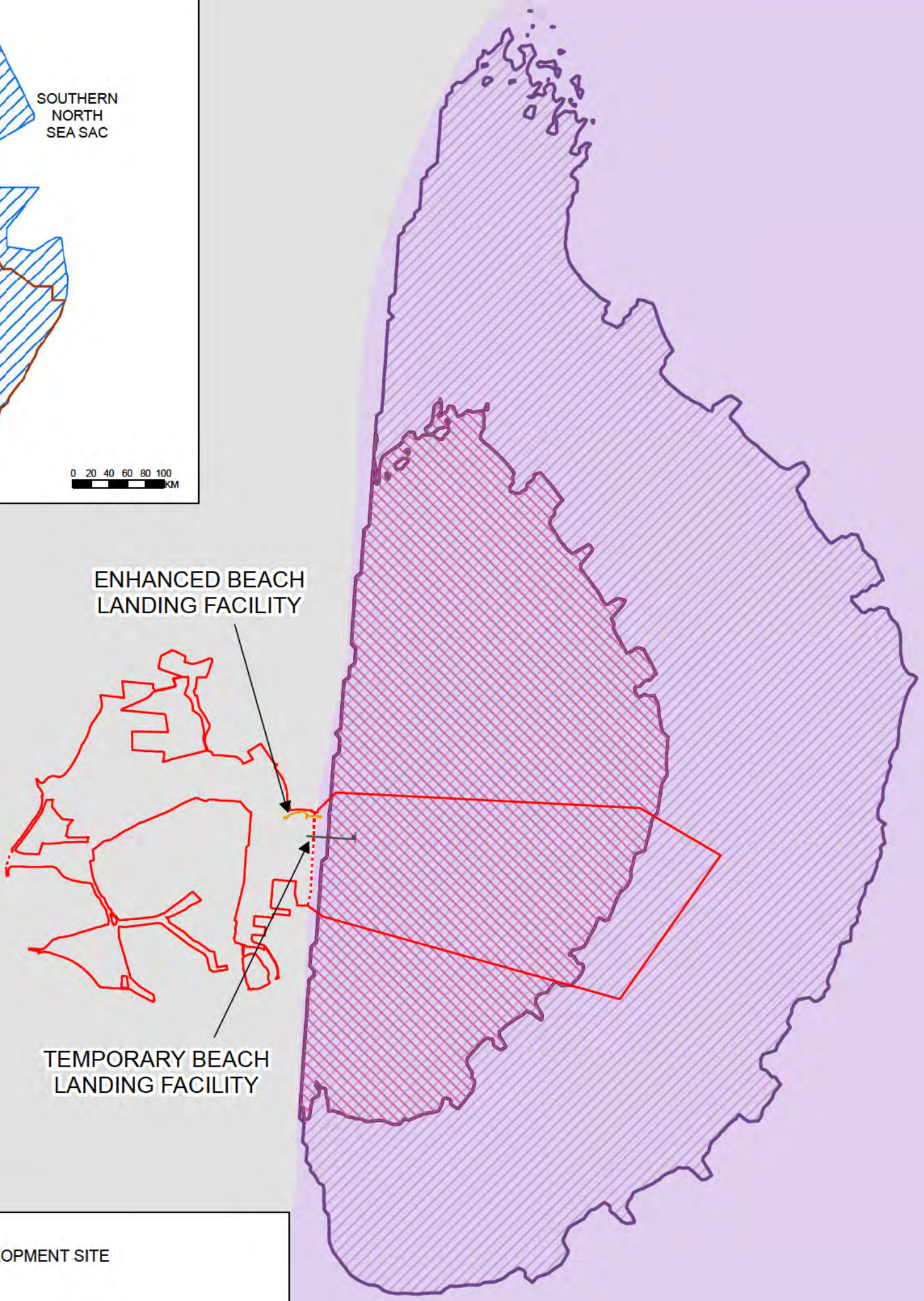
SizewellC
Doing the power of good for Britain
EDF CGN





KEY

- SIZEWELL C MAIN DEVELOPMENT SITE BOUNDARY
- DEMARCATION LINE
- ENHANCED PERMANENT BEACH LANDING FACILITY
- TEMPORARY BEACH LANDING FACILITY

CUMULATIVE TTS ON FLEEING HARBOUR PORPOISE

- 140 dB FLEEING TTS RANGE UNMITIGATED
- 140 dB FLEEING TTS RANGE WITH ADDITIONAL MITIGATION
- 15km EFFECTIVE DETERRANCE RANGE (EDR)
- SOUTHERN NORTH SEA HARBOUR PORPOISE WINTER AREA
- SPECIAL AREA OF CONSERVATION (SAC)

DRAWING TITLE:
CUMULATIVE (24-HOUR) AUDITORY TTS RANGES DURING INSTALLATION OF MOORING DOLPHINS AT THE ENHANCED PERMANENT BLF ON FLEEING HARBOUR PORPOISE (WITH AND WITHOUT ADDITIONAL MITIGATION).

NOT PROTECTIVELY MARKED

DRAWING NO:
FIGURE 1.2

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DOCUMENT:
SIZEWELL C PROJECT
RESPONSES TO EXAMINING AUTHORITY'S WRITTEN QUESTIONS ISSUED ON 21ST APRIL 2021
CHAPTER 13: CUMULATIVE AND TRANSBOUNDARY

SCALE BAR
0 0.4 0.8 1.2 1.6 2 KM

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ANNEXES

ANNEX 1A: Marine Ecology and Fisheries and Marine Water Quality Cumulative Effects Assessment

1 MARINE ECOLOGY AND FISHERIES AND MARINE WATER QUALITY CUMULATIVE EFFECTS ASSESSMENT

1.1 Introduction

1.1.1 Since the submission of the DCO Application, SZC Co. have investigated plans to enhance the capacity for sustainable freight transport to increase the import of materials to the site by sea.

1.1.2 The changes submitted, as described within **Volume 1, Chapter 2** of the **ES Addendum** [AS-181], relevant to this assessment consist of:

- An enhancement to the design of the permanent beach landing facility (enhanced permanent BLF) and addition of seabed structures to facilitate more regular deliveries of abnormal indivisible loads (AILs) by sea without the requirement for additional maintenance works and reduced dredging requirements.
- Installation of a temporary BLF to reduce the amount of construction material, such as aggregate and backfill soils, that would otherwise be delivered by land.

1.1.3 **Volume 3**, **Appendices 10.4.D** to **F** [AS-201], of the **ES Addendum** presented the updated marine ecology and fisheries and marine water quality cumulative effects assessment and considered the potential cumulative effects on the following receptors:

- marine water quality;
- benthic ecology;
- fish;
- marine mammals; and
- commercial and recreational fisheries.

1.1.4 The purpose of this report is to revise the marine ecology and fisheries and marine water quality cumulative effects assessment following changes to the construction programme of third-party projects (see **Section 1.1.13**).

1.1.5 The methodology and results for underwater noise modelling that provide the evidence base for the changes in marine freight options are included in BEEMS Technical Report TR538 (Ref. 1.1).

1.1.6 CEA are considered in relation to the effects of underwater noise arising from installation of the BLFs on the three key marine mammal species of importance at Sizewell; harbour porpoise (*Phocoena phocoena*), grey seal (*Halichoerus grypus*) and, harbour seal (*Phoca vitulina*). The effects of piling activities are contextualised against the relevant Management Units (MUs) for each species to provide a population level assessment of the proposed development acting cumulatively with other third-party projects.

1.1.7 An assessment of the effects in relation to SAC conservation objectives is provided in the **shadow Habitats Regulations Assessment (sHRA) Addendum** [AS-173].

Construction Phase

Piling: Marine mammals

1.1.8 All three marine mammal key taxa are highly mobile species. As such, impacts from the proposed development can act cumulatively across broad spatial scales. For CEA purposes impacts from piling activities within the species relevant MUs are considered.

1.1.9 The CEA for marine mammals for underwater noise associated with piling activities for the installation of the enhanced permanent BLF and the temporary BLF is considered in relation to the potential for spatial or temporal overlap with projects identified in **Volume 10**, **Appendix 4C** of the **ES** [APP-579] and updated in **Volume 3**, **Appendix 10.4.D-F** of the **ES Addendum** [AS-201].

1.1.10 Installation of the BLFs is anticipated in the first year of the construction phase, assumed to be 2022. Installation of piles is anticipated to last nine months from August of year 1 to April of year 2. Piling would not occur during the sensitive periods for designated breeding birds of May, June and July.

1.1.11 A total of 106 piles and four mooring dolphins seawards of MHWS would be installed for the temporary BLF and 12 piles and four mooring dolphins/fenders for the enhanced permanent BLF. This results in a total of 126 marine piles. The installation sequence indicates piling would occur for 52-60 days during the nine-month installation period. For further details see Marine Ecology and Fisheries Addendum **Volume 1, Chapter 2** of the **ES Addendum** [AS-181].

1.1.12 The cumulative assessment of underwater noise considers the potential disturbance of harbour porpoise and seals during piling operations from the proposed development and other projects screened into the CEA that could be piled at the same time (**Table 1.1**).

1.1.13 The cumulative assessment in the **ES** and **ES Addendum** considered separate construction windows for the Scottish Power Renewables OWF schemes (East Anglia THREE; East Anglia TWO; and East Anglia ONE North). The new construction programmes as detailed on the 'East Anglia Hub'[1] website (Ref. 1.9) states that offshore construction of all three schemes will commence in 2023. Onshore works will commence in 2024 and all three schemes will be operational by 2026. However, the Report on the Implications for European Sites for East Anglia One North OWF (Ref. 1.10) states that there would be no concurrent piling events between East Anglia ONE North OWF and East Anglia TWO OWF. Therefore, only East Anglia TWO OWF has been considered, as this represents the worst-case in terms of seal densities and therefore disturbance.

[1] East Anglia Hub is the name for the collective East Anglia THREE, East Anglia TWO and East Anglia ONE North offshore windfarm schemes.

Table 1.1: Marine developments considered in CEA due to the potential for disturbance to harbour porpoise or seals. Timelines are taken from project specific Environmental Statements or Scoping Reports but should be considered indicative.

Project Name.	Distance from Sizewell C.	Number of turbines/piles.	Expected construction window.	Dates of piling.	Piling potentially occurring at same time as Sizewell C.
Sizewell C.	0km	126	2022 – 2028 (early construction years).	2022 - 2023 (9 months).	N/A
Tier 3: Consented					
Hornsea Project Two.	179km	165	2020 – 2025	2021 – 2024 (16 months, (expected to be operational in 2022).	No[3]
East Anglia Three.	84km	100 – 172	2023 – 2026	2023 – 2024 (15 months).	Yes
Dogger Bank Creyke Beck A.	272km	200	2020 – 2023	Unknown[2]	Yes[1]
Dogger Bank Creyke Beck B.	294km	200	2020 – 2023	Unknown[2]	No[1]
Dogger Bank Teesside A.	311km	200	2023 – 2029	Unknown	Yes[1]
Sofia (formerly Teesside B).	294km	200	2023 – 2029	Unknown	No[1]
Norfolk Vanguard.	85km	120 – 257	2024 – 2028	2024 – 2026 (8 months).	No
Tier 4: Application submitted and not yet determined or project on hold.					
Thanet Extension.	83km	35	2021 – 2024	Unknown (6 months).	Yes

Project Name.	Distance from Sizewell C.	Number of turbines/piles.	Expected construction window.	Dates of piling.	Piling potentially occurring at same time as Sizewell C.
Hornsea Project Three.	181km	342	2020 – 2026	Earliest possible Q1 2023.	Yes
Norfolk Boreas.	105km	90 – 180	2024 – 2028	2027 – 2028	No
East Anglia One North.	50km	Up to 67	2023 – 2026	2023 - 2026	No[4]
East Anglia Two.	35km	Up to 75	2023 – 2026	2023 - 2026	Yes
Tier 5: Application in process.					
Horsea Project Four.	180km	Up to 180	Unknown	Unknown	No

[1] It is highly unlikely that all four Dogger Bank projects would be piling at the same time (as per EIAs for these projects); therefore only two projects that could be constructed at the same time (i.e. with different developers) have been included in this assessment.
[2] Offshore works to begin in 2021.
[3] It is highly unlikely that Hornsea Project 2 would be piling at the same time as SZC as it is expected to be operational in 2022, however, an assessment has been presented in Appendix A and Appendix B to account for hypothetical overlap.
[4] There will not be concurrent piling for East Anglia ONE North and East Anglia TWO; therefore only one project (worst-case) has been included in this assessment.

1.1.14 The methods used for the CEA for underwater noise from impact pilling on harbour porpoise follows the approach applied in previous assessments for offshore wind farms (e.g. Norfolk Vanguard, Ref. 1.7). A population level approach is used to determine the total number of animals affected by simultaneous piling activities within the MU.

1.1.15 The impact magnitude associated with cumulative assessments of underwater noise considers the total area of exposure to piling noise and the proportion of the reference population of marine mammals (i.e. harbour porpoise or seals) that are potentially disturbed. Impact magnitude scales are provided in **Table 1.2**.

Table 1.2: Assigning impact magnitude for cumulative noise assessments relative to the reference population.

Impact Magnitude.	Percentage of reference population disturbed.
Negligible (here Very Low).	<1% of the reference population.
Low	1-5% of the reference population.
Medium	5-10% of the reference population.
High	>10% of the reference population.

1.1.16 The updated scoping exercise has identified a total of six offshore wind farm projects where the timeline for impact piling has the potential to overlap with the indicative installation period for the BLF structures (**Table 1.1**). The assessment has been undertaken assuming the following projects pile concurrently to represent the worst-case scenario in terms of cumulative effects (**Figure 1.1**):

- Dogger Bank Creyke Beck A OWF;
- Dogger Bank Teesside A OWF;
- Thanet Extension OWF;
- Hornsea Project Three OWF;
- East Anglia Three OWF; and
- East Anglia Two OWF.

1.1.17 Natural England recommend applying a 15km effective deterrent range (EDR) for determining the impact for small piling operations, such as those for the proposed development. The 15km radius has been applied from the terminus of the temporary BLF as a worst-case scenario to calculate the maximum sea area for underwater noise impacts from the proposed development. The total sea area within the EDR is 359km^2.

1.1.18 The larger piles and greater hammer energies associated with offshore wind farms means a standard 26km EDR has been applied, from the centre of the offshore wind farm area. The EDR is based on temporary avoidance which would cause disturbance but minimise acoustic injury.

1.1.19 In the worst-case scenario, each of the six OWF projects are assumed to pile concurrently and at the same time as piling for the BLFs at the

proposed development. In such a case, the estimated maximum area of disturbance would be approximately 13,103km^2 (i.e. 6 x 2,124 km^2 OWFs + 359km^2 from the proposed development). The area estimate is precautionary in that it does not account for overlap of project EDRs and assumes concurrent piling (**Figure 1.1**).

Harbour Porpoise

1.1.20 The North Sea MU population of harbour porpoise is 345,373 individuals. SCANS-III density estimates (Ref 1.2) for the relevant survey block that each of the projects are located within have been used to estimate the number of harbour porpoise within the EDRs for each project.

1.1.21 The maximum number of harbour porpoise that could potentially be disturbed is 9,744 (2.82% of the reference population) (**Table 1.3**). The proposed development has the potential to expose 218 animals which is 0.06% of the reference population, and 2.2% of the total number of animals disturbed in the CEA scenario.

1.1.22 The magnitude for the cumulative effects of piling is predicted to disturb between 1% and 5% of the reference population (2.82%) and therefore, based on the methodology outlined in **Table 1.2**, is assessed as *low*.

1.1.23 Underwater noise assessments specific to the proposed development detailed the auditory effect ranges for piling activities (Ref. 1.1). The EDR represents an area within which behavioural effects may cause disturbance or displacement of harbour porpoises. In addition to behavioural effects injurious effects were assessed (Ref. 1.1). The worst-case cumulative auditory effects from underwater noise modelling resulted from the installation of two mooring dolphins at the enhanced permanent BLF (installed within a 24-h period and piling using 280kJ hammer energy). Underwater noise modelling predicted no PTS effect ranges for harbour porpoise and TTS effect ranges of up to 5,258ha (modelling assumes fleeing behaviours occur[1]). The implementation of additional mitigation (a hydrohammer system) reduces TTS auditory effect ranges to 1,894ha (**Figure 1.2**). For further details see Marine Ecology and Fisheries Addendum **Volume 1, Chapter 2** of the **ES Addendum** [AS-181].

1.1.24 The spatial range for auditory damage from the proposed project is limited and the effects of TTS are anticipated to be short-term. Hearing recovery for harbour porpoises following TTS as a result of piling activity may occur after 4 to 96 minutes depending on the exposure level, duration, and the

[1] Model parameters, including for fleeing behaviour are described in TR538 (Ref. 1.1).

TTS induced (Ref. 1.3; Ref. 1.8). Thus, the sensitivity is primarily behavioural and is judged as *medium*.

1.1.25 Minor adverse effects are predicted for harbour porpoise in the North Sea MU. Effects are **not significant** at the level of the reference population. The relative contribution of Sizewell C piling to underwater noise is very low affecting only 0.06% of the reference population and 2.2% of the total number of animals disturbed in a CEA context.

Table 1.3: CEA for the potential disturbance of harbour porpoise during consecutive piling of marine developments with possible temporal overlap with the enhanced permanent BLF and temporary BLF at Sizewell C.

Project	Tier	Distance to Sizewell C.	SCANS-III Survey Block.	SCANS-III density estimate (No./km^2).	Potential number of harbour porpoise disturbed during consecutive piling.
Sizewell C.	4	N/A	L	0.607	217.9
Dogger Bank Creyke Beck A.	3	272km	O	0.888	1,886.1
Dogger Bank Teesside A.	3	311km	O	0.888	1,886.1
East Anglia Three.	3	84km	L	0.607	1,289.3
East Anglia Two.	4	35km	L	0.607	1,289.3
Thanet Extension.	4	83km	L	0.607	1,289.3
Hornsea Project Three.	4	181km	O	0.888	1,886.1
Total					**9,744.1**
% of North Sea Management Unit reference population (345,373 individuals).					**2.82%**

Phocid seals

1.1.26 The assessment of underwater noise effects on seals applies the same rationale as for harbour porpoise. A 15km radius EDR from the terminus of the temporary BLF has been applied for underwater noise impacts from the proposed development, which results in a sea area of 359km^2.

1.1.27 The harbour seal reference population is based on the most recent count for the south-east England MU of 4,944 harbour seals in 2019 (Ref. 1.4).

1.1.28 The grey seal reference population is based on the most recent counts and telemetry data (Ref. 1.4). Due to the transient nature of grey seals (Ref. 1.5) the south-east England MU (8,199), north-east England MU (6,442) and east coast of Scotland MU (3,762) are included as the reference population (Ref. 1.4), with a total of 18,403 grey seals used for the assessment.

1.1.29 Seal densities within the EDR for each OWF project and the proposed development (2,124km^2 for OWFs and 359km^2 for SZC) have been calculated. Seal densities are provided at 25km^2 resolution and the relative weighted mean density and the upper (95% confidence interval) seal usage in these areas has been calculated spatially in GIS using the 2017 updated seal usage maps (Ref. 1.6). The number of seals within each EDR provides a measure of the total number of seals potentially disturbed based on the latest available data of the relative density of seals at sea.

1.1.30 There are a total of six projects where the timeline for piling has the potential to overlap with piling at the proposed development (**Table 1.1**).

1.1.31 In the worst-case scenario, each of the six OWF projects are assumed to pile concurrently, and at the same time as the proposed development. In such a case, the estimated maximum area of disturbance would be approximately 13,103km^2 (i.e. 6 x 2,124 km^2 OWFs + 359km^2 from the proposed development) (**Figure 1.1)**.

1.1.32 The number of grey seals potentially disturbed as a result of concurrent piling is 327 based on the relative mean weighted densities in each EDR. This equates to 1.78% of the reference population (**Table 1.4**).

1.1.33 The number of harbour seals that could potentially be disturbed as a result of concurrent piling is 179 based on the relative mean weighted densities in each EDR, equating to 3.62% of the reference population (**Table 1.5**).

1.1.34 The magnitude of effects of piling for projects acting cumulatively with the proposed development is between 1% and 5% of the reference population for grey and harbour seals (1.78% and 3.62%, respectively). Therefore, based on the methodology in **Table 1.2**, the magnitude is assessed as *low* for both grey and harbour seals.

1.1.35 Underwater noise assessments specific to the proposed development detailed the auditory effect ranges for piling activities (Ref. 1.1). The worst-case impact zone from underwater noise modelling is the installation of two mooring dolphins at the enhanced permanent BLF (installed within a 24-h period and piling using 280kJ hammer energy). The fleeing model predicts no PTS effect ranges for phocid seals and TTS effect ranges within 25m with and without additional mitigation measures. The spatial area for auditory damage is negligible in fleeing animals, and the primary effects on seals from the proposed development are behavioural effects.

1.1.36 Following the same rationale as for the harbour porpoises, seals are assigned *medium* sensitivity to impacts from piling due to the potential for behavioural effects.

1.1.37 In the case where all six OWF projects were to undertake impact piling concurrently with the proposed development, the cumulative effects are predicted to expose 1.78% and 3.62% of the grey and harbour seals reference populations, respectively. For both grey and harbour seals, this represents a *low* impact magnitude, combined with a *medium* sensitivity, therefore, minor adverse effects are predicted. Effects are **not significant** at the reference population level.

1.1.38 The relative contribution of Sizewell C piling to underwater noise is low (affecting 0.11% and 0.15% of the grey and harbour seal reference population, respectively and 6.4% and 4.1% of the total number of grey and harbour seals, respectively disturbed in a CEA context). Therefore, the proposed development contributes little to the overall effect.

Table 1.4: CEA for the potential disturbance of grey seals during piling of marine developments with possible temporal overlap with the enhanced permanent BLF and temporary BLF at Sizewell C (worst-case) density estimates are taken from the 2017 updated seal usage maps (Ref. 1.6)

Project	Tier	Distance to the proposed development.	Grey seal upper (95% confidence interval) density estimate (No/km²).	Upper estimate for disturbance for each project[2].	Grey seal mean density estimate (No/km²).	Estimated (mean) number of grey seals disturbed.
Sizewell C.	4	0km	0.10	44.5	0.06	21.1
Dogger Bank Creyke Beck A.	3	272km	0.09	183.5	0.05	115.9
Dogger Bank Teesside A.	3	311km	0.02	42.7	0.01	27.7
East Anglia Three.	3	84km	0.0002	0.5	0.0001	0.30
Thanet Extension.	4	83km	0.04	86.0	0.03	59.9
Hornsea Project 3.	4	181km	0.08	167.1	0.04	87.7
East Anglia Two.	4	35km	0.01	29.7	0.007	14.7
Total						**327.3**
% of Management Unit (18,403 grey seals).						**1.78**

[2] The upper (95th percentile confidence interval) estimate shows the maximum number of seals within the EDR that could potentially be disturbed by piling at a given site. The sum of the upper values for all projects is not compared to the mean population density.

Table 1.5: CEA for the potential disturbance of harbour seals during piling of marine developments with possible temporal overlap with the enhanced permanent BLF and temporary BLF at Sizewell C (worst-case) mean density estimates are taken from the 2017 updated seal usage maps (Ref. 1.6).

Project	Tier	Distance to the proposed development.	Harbour seal upper (95% confidence interval) density estimate (No/km^2).	Upper estimate for disturbance for each project[3].	Harbour seal mean density estimate (No/km^2).	Estimated (mean) number of harbour seals disturbed.
Sizewell C.	4	0km	0.040	12.6	0.020	7.3
Dogger Bank Creyke Beck A.	3	272km	0.003	6.2	0.001	3.0
Dogger Bank Teesside A.	3	311km	0.00005	0.1	0.00003	0.1
East Anglia Three.	3	84km	0.0001	0.2	0.00007	0.2
Thanet Extension.	4	83km	0.100	284.2	0.080	165.4
Hornsea Project 3.	4	181km	0.002	4.0	0.001	2.3
East Anglia Two.	4	35km	0.0006	1.3	0.0004	0.8

[3] The upper (95th percentile confidence interval) estimate shows the maximum number of seals within the EDR that could potentially be disturbed by piling at a given site. The sum of the upper values for all projects is not compared to the mean population density.

Project	Tier	Distance to the proposed development.	Harbour seal upper (95% confidence interval) density estimate (No/km^2).	Upper estimate for disturbance for each project[3].	Harbour seal mean density estimate (No/km^2).	Estimated (mean) number of harbour seals disturbed.
Total						**179.1**
% of Management Unit (4,944 harbour seals).						**3.62**

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APPENDIX A: HARBOUR PORPOISE CUMULATIVE EFFECTS ASSESSMENT INCLUDING HORNSEA PROJECT 2 OWF

Table 1.6: CEA including Hornsea Project 2 OWF for the potential disturbance of harbour porpoise during consecutive piling of marine developments with possible temporal overlap with the enhanced permanent BLF and temporary BLF at Sizewell C

Project	Tier	Distance to Sizewell C.	SCANS-III Survey Block.	SCANS-III density estimate (No./km^2).	Potential number of harbour porpoise disturbed during consecutive piling.
Sizewell C.	4	N/A	L	0.607	217.9
Dogger Bank Creyke Beck A.	3	272km	O	0.888	1,886.1
Hornsea Project 2.	3	179km	O	0.888	1,886.1
Dogger Bank Teesside A.	3	311km	O	0.888	1,886.1
East Anglia Three.	3	84km	L	0.607	1,289.3
Thanet Extension.	4	83km	L	0.607	1,289.3
Hornsea Project Three.	4	181km	O	0.888	1,886.1
East Anglia Two.	4	35km	L	0.607	1,289.3

Project	Tier	Distance to Sizewell C.	SCANS-III Survey Block.	SCANS-III density estimate (No./km^2).	Potential number of harbour porpoise disturbed during consecutive piling.
Total					**11,630.2**
% of North Sea Management Unit reference population (345,373 individuals).					**3.37%**

1.1.39 Hornsea Project 2 is expected to be operational before Sizewell C commences piling, however, a hypothetical assessment is included in **Table 1.6**. The maximum number of harbour porpoise that could potentially be disturbed is 11,630 (3.37% of the reference population). Minor adverse effects are predicted for harbour porpoise in the North Sea MU. Effects are **not significant** at the level of the reference population.

APPENDIX B: PHOCID SEAL CUMULATIVE EFFECTS ASSESSMENT INCLUDING HORNSEA PROJECT 2 OWF

Table 1.7: CEA including Hornsea Project 2 OWF for the potential disturbance of grey seals during piling of marine developments with possible temporal overlap with the enhanced permanent BLF and temporary BLF at Sizewell C (worst-case) density estimates are taken from the 2017 updated seal usage maps (Ref. 1.6)

Project	Tier	Distance to the proposed development.	Grey seal upper (95% confidence interval) density estimate (No/km^2).	Upper estimate for disturbance for each project[4].	Grey seal mean density estimate (No/km^2).	Estimated (mean) number of grey seals disturbed.
Sizewell C.	4	0	0.10	44.5	0.06	21.1
Hornsea Project 2.	3	179km	0.40	839.3	0.20	452.3
Dogger Bank Creyke Beck A.	3	272km	0.09	183.5	0.05	115.7
Dogger Bank Teesside A.	3	311km	0.02	42.7	0.01	27.7
East Anglia Three.	3	84km	0.0002	0.5	0.0001	0.3
Thanet Extension.	4	83km	0.04	86.0	0.03	59.8
Hornsea Project 3.	4	181km	0.08	167.1	0.04	87.7

[4] The upper (95th percentile confidence interval) estimate shows the maximum number of seals within the EDR that could potentially be disturbed by piling at a given site. The upper values are not compared to the mean population density.

Project	Tier	Distance to the proposed development.	Grey seal upper (95% confidence interval) density estimate (No/km^2).	Upper estimate for disturbance for each project[4].	Grey seal mean density estimate (No/km^2).	Estimated (mean) number of grey seals disturbed.
East Anglia Two.	4	35km	0.01	29.7	0.007	14.7
Total						**779.3**
% of Management Unit (18,403 grey seals).						**4.23**

1.1.40 Hornsea Project 2 is expected to be operational before Sizewell C commences piling, however, a hypothetical assessment is included in **Table 1.7**. The maximum number of grey seals that could potentially be disturbed is 779 (4.23% of the reference population). Minor adverse effects are predicted for grey seals. Effects are **not significant** at the reference population level.

Table 1.8: CEA including Hornsea Project 2 OWF for the potential disturbance of harbour seals during piling of marine developments with possible temporal overlap with the enhanced permanent BLF and temporary BLF at Sizewell C (worst-case) density estimates are taken from the 2017 updated seal usage maps (Ref. 1.6)

Project	Tier	Distance to the proposed development.	Harbour seal upper (95% confidence interval) density estimate (No/km^2).	Upper estimate for disturbance for each project[5].	Harbour seal mean density estimate (No/km^2).	Estimated (mean) number of harbour seals disturbed.
Sizewell C.	4	0	0.040	12.6	0.020	7.3
Hornsea Project 2.	3	179km	0.100	263.8	0.070	146.4
Dogger Bank Creyke Beck A.	3	272km	0.003	6.2	0.001	3.0
Dogger Bank Teesside A.	3	311km	0.00005	0.1	0.00003	0.1
East Anglia Three.	3	84km	0.0001	0.2	0.00007	0.2
Thanet Extension.	4	83km	0.100	284.1	0.080	165.4
Hornsea Project 3.	4	181km	0.002	4.0	0.001	2.3
East Anglia Two.	4	35km	0.0006	1.3	0.0004	0.8
Total						**325.5**

[5] The upper (95th percentile confidence interval) estimate shows the maximum number of seals within the EDR that could potentially be disturbed by piling at a given site. The upper values are not compared to the mean population density.

Project	Tier	Distance to the proposed development.	Harbour seal upper (95% confidence interval) density estimate (No/km²).	Upper estimate for disturbance for each project[5].	Harbour seal mean density estimate (No/km²).	Estimated (mean) number of harbour seals disturbed.
% of Management Unit (4,944 harbour seals).						**6.58**

1.1.41 Hornsea Project 2 is expected to be operational before Sizewell C commences piling, however, a hypothetical assessment is included in **Table 1.8**. The maximum number of harbour seals that could potentially be disturbed is 326 (6.58% of the reference population). In this scenario, moderate adverse effects are predicted for harbour seal. Effects would be **significant** at the reference population level.

1.1.42 Based on the proposed construction sequence in **Table 1.1**, it is highly unlikely that Hornsea Project 2 OWF will be piling at the same time as Sizewell C. The relative contribution of Sizewell C piling to underwater noise is low (0.15% of the harbour seal reference population and 4.1% of the total number of animals disturbed in a CEA context). Therefore, the proposed development contributes little to the overall effect.

APPENDIX 13B MITIGATION ROUTE MAP SUMMARY FOR INTER-RELATIONSHIP EFFECTS

CONTENTS

TABLES

PLATES

None Provided

FIGURES

None Provided.

APPENDICES

None Provided.

1 RESPONSE TO CU.1.22

1.1 Introduction

1.1.1 This appendix has been prepared to support the response to question **Cu.1.22** raised by the Examining Authority. An extract of the **Mitigation Route Map** (Doc Ref. 8.12(B)) for each development site is included in the sections that follow.

1.2 Main Development Site

1.2.1 Table 1.1 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the main development site.

Table 1-1: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the main development site

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-NV1.	Noise and vibration	Primary	To minimise construction noise impacts on noise sensitive receptors.	**Boundary treatments: noise** The site layout will incorporate noise barriers in the form of landscape bunds and/or acoustic screens to reduce, as far as practicable, the spread of construction noise from the main development site towards identified noise-sensitive receptors (NSRs). These are detailed on the **Main Development Site Construction Parameter Plan** (Doc Ref. 2.5), and are as follows: • Barrier #4 (B4) – 5m high acoustic fence. • Barrier #6 (B6) – 3m high earth bund. • Barrier #7 (B7) – 3m high earth bund with a 2m high acoustic fence on top of the ridge (5m total height).	Construction	Requirement 8 (MDS: Temporary construction-related development)	ES Volume 2, Chapter 11, Section 11.5	MDS-LV3. MDS-LV4. MDS-LV6. MDS-LV9.
MDS-NV2.	Noise and vibration	Primary	To minimise plant noise impacts on noise sensitive receptors.	**Design measures - operational plant selection** The final plant selection and design is to be determined, and therefore sound levels from the final proposal would be controlled during the construction phase for the air source heat pump network and for both the construction and operational phases for the combined heat and power (CHP) energy centre only, by ensuring the sound rating level does not exceed a free-field level of 35dB LAr,15minute outside the nearest residential receptor. This may therefore require a system-specific mitigation scheme to meet this target sound rating level.	Operation	Requirement 8 (MDS: Temporary construction-related development) Requirement 11 (MDS: Approved buildings, structures and plant)	ES Volume 2, Chapter 11, Section 11.6	
MDS-NV3.	Noise and vibration	Primary	To minimise construction noise impacts on noise sensitive receptors.	**Design measures to minimise construction traffic noise and vibration across Sizewell C Project** The following design measures will result in an overall reduction in noise exposure: • Use of two off-site park and ride facilities to reduce construction worker traffic to site, and a park and ride facility at LEEIE, as well as the use of an accommodation campus and caravan park to further reduce travel to site which help reduce transport-related emissions. • Use of an off-site freight management facility, which will help manage freight arrivals and reduce on-site queuing and engine idling. • Minimising freight movements on roads through	Construction	DCO Article 3 (Scheme design)	ES Volume 2, Chapter 11, Section 11.5	MDS-T2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				the provision of the beach landing facility, Saxmundham to Leiston branch line upgrades, rail siding at LEEIE, and the green rail route.				
MDS-NV4.	Noise and vibration	Tertiary	To minimise construction noise and vibration impacts on noise sensitive receptors.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 would be followed, as set out in the **CoCP** (Doc Ref 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction	Requirement 2 (PW: CoCP)	ES Volume 2, Chapter 11, Section 11.5	
MDS-NV5.	Noise and vibration	Tertiary	To minimise construction noise and vibration impacts on noise sensitive receptors.	**Management measures to reduce construction traffic noise** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) would help to reduce and manage the effects of traffic generated by the Sizewell C Project (see **Volume 2, Chapter 10** of the ES).	Construction	~~Section 106 agreement~~ Deed of Obligation (CTMP, CWTP)	ES Volume 2, Chapter 11, Section 11.5	MDS-T3.
MDS-NV6.	Noise and vibration	Tertiary	To minimise construction noise and vibration impacts on noise	**Management of any noise or vibration complaints** SZC Co. will have a system of monitoring construction noise and for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for	Construction	Requirement 2 (PW: CoCP)	ES Volume 2, Chapter 11, Section 11.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
			sensitive receptors.	investigating and acting appropriately as necessary upon those complaints.				
MDS-NV7.	Noise and vibration	Secondary	~~To minimise construction noise and vibration impacts on noise sensitive receptors.~~To reduce noise from construction, road and rail, and operational noise sources at niose-sensitive receptors	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.	Construction and operation	~~Section 106 agreement~~Deed of Obligation (Noise Mitigation Scheme)	ES Volume 2, Chapter 11, Section 11.5	
MDS-NV8.	Noise and vibration	Secondary	To minimise construction noise and vibration impacts on noise sensitive receptors.	**Construction management measures: noise and vibration - acoustic screening** The **CoCP** (Doc Ref. 8.11) also includes a commitment that contractors will install solid noise barriers of adequate surface density and/or landscaping, where required and practicable, to provide additional acoustic screening and reduce construction noise levels at relevant noise sensitive receptors. Such barriers would be secondary mitigation for the purposes of assessment and would be installed for the duration of the noisy works requiring mitigation. The construction noise modelling outputs, presented in **Appendix 11B** of **Volume 2** of the ES, were used to identify where barriers and/or screens could be installed by comparing the predictions for each receptor with the assessment criteria for the main development site construction noise. Where predicted construction noise levels during any phase had the potential to exceed the LOAEL, barrier and screening options were explored, and where effective incorporated into the model to reduce construction noise levels as far as reasonably achievable.	Construction	Requirement 2 (PW: CoCP)	ES Volume 2, Chapter 11, Section 11.7 TBC	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				The additional barriers identified on this basis are as follows: • Barrier #1 (B1) – 5m above ground; • Barrier #2 (B2) – 3m above ground; • Barrier #3 (B3) – 3m above ground; • Barrier #5 (B5) – 3m above ground; and • Barrier #8 (B8) – 5m above ground. If it is identified that the barriers (or others) are necessary to mitigate noise effects, then contractors would need to provide appropriate screening for as long as required to mitigate those effects. This would be secured through the **CoCP** as described above.				
MDS-NV9.	Noise and vibration	Secondary	To minimise construction noise and vibration impacts on noise sensitive receptors.	**Sports pitches and access road** With respect to off-site developments, additional mitigation is required for the proposed sports facilities at Alde Valley Academy in Leiston. A 2 metre high acoustic barrier will mitigate noise levels to receptors to the east of the site when the pitches are in use, details of which are set out in **Appendix 11E** of **Volume 2** of the ES.	Construction and operation	~~Section 106 Agreement~~ Deed of Obligation Requirement 12A (Sports facilities: reserved matters)	ES Volume 2, Chapter 11, Section 11.7	MDS-S3.
MDS-NV10.	Noise and vibration	Secondary	To minimise construction noise and vibration impacts on Pro Corda Music School.	**Pro Corda Music School** SZC Co. will undertake a further, bespoke assessment of impacts of the Sizewell C Project on the Pro Corda Music School at Leiston Abbey. The results of this assessment would inform any additional mitigation requirements which will be secured through further planning obligations. SZC Co. is committed to further liaison with Pro Corda to take account of their specific needs relating to noise impacts and any required mitigation.	Construction and operation	~~Section 106 agreement~~Deed of Obligation (Noise Mitigation Scheme)	ES Volume 2, Chapter 11, Section 11.7	MDS-NV7.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-AQ1.	Air quality	Primary	To minimise effects of the construction workforce traffic.	**Design measures to minimise traffic across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction of the Sizewell C Project. These measures are set out in **Volume 2, Chapter 10** of the ES. These include: • two off-site park and ride facilities at Darsham and Wickham Market, a park and ride facility at the LEEIE, together with the use of the accommodation campus and caravan park close to site, which will reduce construction worker traffic to main development site, and therefore help reduce transport related emissions. • Use of an off-site freight management facility , which would help manage freight arrivals and reduce on-site queuing and engine idling. • minimising freight movements on roads through the provision of the beach landing facility, Saxmundham to Leiston branch line upgrades, rail siding at LEEIE, and the green rail route.	Construction	DCO Article 3 (Scheme design) ~~Section 106 agreement~~Deed of Obligation (Implementation Plan)	ES Volume 2, Chapter 12, Section 12.5	MDS-T2.
MDS-AQ2.	Air quality	Primary	To minimise the impact from combustion derived pollutant emissions from the diesel generators.	**Stack heights for diesel generators** Diesel generator stack heights set as high as practicable for the power station and emissions of nitrogen oxides controlled through primary means. These are described in **Volume 2, Chapter 2** of the **ES**, and shown on the **Main Development Site Operational Parameter Plan Operational Platform** (Doc Ref. 2.5)	Operation	DCO Article 3 (Scheme design) Requirements 11 (MDS: Approved buildings, structures and plant) Requiremet 12 (MDS: Reserved Matters) Requirement 13 (MDS: Ancillary structures, other buildings and plant)	ES Volume 2, Chapter 12, Section 12.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-AQ3.	Air quality	Primary	To minimise the impact from combustion derived pollutant emissions from the diesel generators.	**Combined Heat and Power (CHP) Plant** In the scenario that the accommodation campus energy centre comprises a CHP plant, it will be designed, maintained, and operated in accordance with Medium Combustion Plant Directive requirements. The combustion plant emission stack height has been optimised to minimise ground-level air quality impacts balanced against the visual impacts of taller stacks. The stack location is fixed within the parameters plan. Further detail is shown on **Main Development Site Construction Parameter Plan** (Doc Ref 2.5).	Construction and operation	Requirement 17 (Accommodation campus: Buildings and structures) Combustion Activities Environmental Permit (if required).	ES Volume 2, Chapter 12, Section 12.5	
MDS-AQ4.	Air quality	Primary	To minimise traffic emissions and construction dust.	**Site access** The site access for the main development site is located as far as practicable from sensitive receptors, to minimise impacts from transport-related emissions, including vehicle exhaust emissions and fugitive dust emissions from trackout of mud onto the road.	Construction and operation	DCO Article 3 (Scheme design)	ES Volume 2, Chapter 12, Section 12.5	
MDS-AQ5.	Air quality	Tertiary	To minimise impacts of construction dust.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(A)) sets out control measures to manage construction impacts on air quality, including but not limited to: • Hard-surfaced roadways used as far as practicable, on a risk-based basis to minimise trackout and dust raising from vehicle movements within the construction site. • Use of earth bunds with grassing/seeding, including a bund along the length of the southern temporary construction area boundary (5m height), and early planting to supplement existing vegetation and hedging, to screen sensitive boundaries from fugitive dust from construction activities. • Deposited dust and materials to be monitored and controlled through additional mitigation as necessary to avoid trackout of material into adjacent construction zones. • Wheel wash-facilities would be installed at strategic points within the main development site, and maintained for the duration of earthworks and excavations, to minimise tracked out materials from high risk to lower risk areas. • Concrete batching plant located as far as practicable from sensitive receptors, to minimise	Construction	Requirement 2 (PW: CoCP) Requirement 8 (MDS: Temporary construction-related development)	ES Volume 2, Chapter 12, Section 12.5 ES Addendum Volume 1, Chapter 2, Section 2.7	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				emission impacts. • Mobile crushing and screening plant located as far as practicable from sensitive receptors, to minimise emission impacts. • Use of modular (pre-fabricated) buildings, as far as practicable, for temporary accommodation and site facilities during construction phase to minimise dust raising during the construction and final removal and reinstatement phase. • Use of contractor vehicles as far as practicable that meet the Euro ~~V~~ VI emissions standards and Euro V standards (98/69/EC) ~~as a minimum, unless otherwise agreed with the local authority~~ unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the non-road mobile machinery (NRMM) Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites. Furthermore, an outline Dust Management Plan included within **Volume 2, Appendix 12A** of the ES sets the approach to dust mitigation that the contractors would be required to implement. The contractors would prepare Construction Environmental Management Plans including Dust Management Plans, in accordance with the **CoCP** and the associated outline Dust Management Plan.				

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-AQ6.	Air quality	Tertiary	To minimise impacts of non-mobile plant emissions.	**Batching plant** Where batching cement plant or mobile crushing plant is employed at sufficient scale to require an environmental permit to be in place for the facility, dust and particulate emissions to air will be regulated by the local authority under the Environmental Permitting Regulations (Part B Activities) and controlled in accordance with an environmental permit to be issued for such operation.	Construction	Environmental Permitting Regulations (Part B Activities)	ES Volume 2, Chapter 12, Section 12.5	
MDS-AQ7.	Air quality	Tertiary	To minimise impacts of combustion emissions on air quality.	**Stationary generators during construction and operation** Where stationary generators from the Sizewell C Project plant, such as the emergency diesel generators, are required, combustion emissions to air will be regulated by the Environment Agency and controlled in accordance with an environmental permit to be issued for such operation. The accommodation campus energy centre would be designed, maintained and operated in accordance with Medium Combustion Plant Directive (MCPD) requirements.	Construction	Combustion Activities Permit	ES Volume 2, Chapter 12, Section 12.5	
MDS-AQ8.	Air quality	Tertiary	To minimise dust impacts on air quality.	**Measures to manage construction traffic** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7) and a **Construction Worker Travel Plan** (Doc Ref. 8.8) would be implemented to manage the effects of traffic generated by the Sizewell C Project (see **Volume 2 Chapter 10** of the ES).	Construction	~~Section 106 Agreement~~ Deed of Obligation (CTMP, CWTP)	ES Volume 2, Chapter 12, Section 12.5	MDS-T3.
MDS-AQ9.	Air quality	Secondary (monitoring)	To minimise dust impacts through monitoring of weather conditions and dust emissions.	**Construction monitoring** Monitoring is proposed for meteorological conditions, and dust and particulate emissions from certain activities, as detailed in **Volume 2, Chapter 12** of the ES and the **CoCP** (Doc Ref. 8.11(A)), including: • Regular site inspections would be carried out to ensure compliance with the dust management measures and monitoring results and corrective actions would be recorded in a log book. Site inspections would be increased in frequency during periods of prolonged dry or windy conditions. • All dust and air quality complaints, and corrective actions, would be recorded in a log book to be made available to local authority on request.	Construction	Requirement 2 (PW: CoCP)	ES Volume 2, Chapter 12, Section 12.7 ES Addendum Volume 1, Chapter 2, Section 2.7	MDS-TE43.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				• Weather conditions would be reviewed prior to works to be undertaken within 50m of sensitive boundaries in Zones A and E and within 100m of sensitive boundaries in Zone C to determine the need for additional mitigation. • Baseline and activity-specific dust and particulates monitoring would be carried out according to the requirements identified within the risk assessment. • The need for diffusion tube monitoring of NO2 concentrations on key road links will be agreed with the local authority.				
MDS-LV1.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Design principles and site layout** The layout, form and design of the site and proposed structures have been guided by a series of high-level landscape and visual design principles, which are outlined in the **Design and Access Statement** (Doc Ref. 8.1) and summarised below: • Plan the construction and operational phases of the development to minimise land take and mitigate landscape and visual effects where practical. • Retain existing screening landscape features, where reasonably practicable, and promote appropriate new landscape design (planting and landform) to mitigate the landscape and visual effects of the development. • Establish new planting and landform at the earliest practicable opportunity. • Plan the development and design structures and buildings to respect the rural and, in part, wilderness character of the landscape. For example the permanent buildings and structures inland from the coast, such as the emergency equipment store, would be architecturally designed to respond to their local landscape and built context, providing the required technical performance of the building or structure in question is met. • Select finishes (materials, colour and texture) to be sympathetic to local landscape and seascape and built context, where reasonably practicable. • Design associated infrastructure, including lighting, access and fencing, to minimise, where reasonably practicable, landscape, seascape and visual effects	Construction and operation	Requirement 6 (MDS: Site clearance) Requirement 8 (MDS: Temporary construction-related development) Requirement 11 (MDS: Approved buildings, structures and plant) Requirement 12 (MDS: Reserved Matters) Requirement 13 (MDS: Ancillary structures) Requirement 14 (MDS: Landscape works)	ES Volume 2, Chapter 13, Section 13.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				• Minimise, where reasonably practicable, visual effects at night from lighting and light spill without compromising either safety or security.				
MDS-LV2.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Site boundary amendments** The following design principles have been followed to reduce the extent of physical disturbance to the landscape and the visual prominence of construction works including buildings, structures, compounds, storage areas and stockpiles: • Optimising the land required for construction to minimise disturbance to as small an area of the landscape as practicable. • Avoiding construction activity and major works in visually sensitive locations such as Great Mount Walk and land west of Eastbridge Road, to the east of Theberton House/south of Potter's Farm. • Configuring the physical extents of the main development site boundary to exclude and protect existing woodland and forested areas (e.g. Ash Wood, Great Mount Wood and northern extents of Dunwich Forest and Goose Hill), which would screen lower level views of construction from the north (e.g. from National Trust Dunwich Coastguard Cottages, RSPB Minsmere and beach. • Configuring the physical extents of the main development site boundary to exclude and protect existing woodland and belts of vegetation (e.g. Kenton Hills and Grimseys, trees along bridleway 19, vicinity of Upper Abbey Farm and Old Abbey	Construction	DCO Article 3 (Scheme design)	ES Volume 2, Chapter 13, Section 13.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				Farm) that would screen views of lower level construction from vantage points to the west.				
MDS-LV3.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Layout of the land east of Eastlands Industrial Estate (LEEIE) area:** Arranging the layout of the temporary construction area to exclude materials storage areas south of residential properties along Valley Road adjacent to the railway bridge. Further details are shown on the **Main Development Site Construction Parameter Plan** (Doc Ref. 2.5).	Construction	Requirement 8 (MDS: Temporary construction-related development)	ES Volume 2, Chapter 13, Section 13.5	MDS-NV1.
MDS-LV4.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Stockpile heights** The maximum height parameters of stockpiles have been limited to reduce their visual prominence. Further details are shown on the **Main Development Site Construction Parameter Plan** (Doc Ref. 2.5).	Construction	Requirement 8 (MDS: Temporary construction-related development)	ES Volume 2, Chapter 13, Section 13.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-LV5.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Retention and early planting of vegetation** • Retention of established vegetation where these have an important function in containing views towards the site. These include vegetation along bridleway 19, Eastbridge Road, field boundaries around Upper Abbey Farm and woodland along the northern edge of Goose Hill. • Early planting within the construction phase to strengthen/enhance existing boundary vegetation and allow areas of new planting associated with the landscape masterplan to become established. This includes planting around the entrance plaza, along Eastbridge Road and Bridleway 19, and around the perimeter of the LEEIE. • Some advance planting has already been completed around the perimeter of the main development site, including tree/shrub planting at Red Rails and White Gates Fields and along the northern edge of Goose Hill. Planting to reinforce existing hedgerows has been completed south of Lower Abbey Farm and at Black Walks. Further details are shown on the **Main Development Site Landscape Retention Plan** and **Main Development Site Clearance Plan** (Doc Ref. 2.5). An indicative masterplan is shown for the site is shown on the **Main Development Site Landscape Masterplan (Operational)** (Doc Ref. 2.5)	Construction and operation	Requirement 8 (MDS: Temporary construction-related development) Requirement 6 (MDS: Site clearance) Requirement 14 (MDS: Landscape works)	ES Volume 2, Chapter 13, Section 13.5	
MDS-LV6.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Bunds and screening for construction** • Creation of earth bunds and acoustic fencing/construction hoarding will provide visual containment of lower level construction activity and vehicle movements. This includes areas along the northern haul road, along the eastern edge of the sea defences, adjacent to Sizewell Beach and adjacent to Lover's Lane at LEEIE. • Creation of an earth bund and vegetated retaining structure at northern edge of Kenton Hills will contribute to the screening of views of vehicle movements along the proposed access road and construction activity from permissive paths in Kenton Hills, and contribute to the characteristic	Construction	Requirement 8 (MDS: Temporary construction-related development)	ES Volume 2, Chapter 13, Section 13.5	MDS-NV1.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				wooded backdrop to the lower lying Sizewell Marshes SSSI. Further details are shown on the **Main Development Site Construction Parameter Plan** (Doc Ref. 2.5).				
MDS-LV7.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Construction lighting** The **Lighting Management Plan** (**Volume 2, Appendix 2B** of the ES) includes requirements to minimise visual impact of artificial lighting during construction: • target lighting where it is required to ensure safe and secure working environment in the absence of natural light; • avoid unnecessary illumination (such as illumination of construction company logos); and • minimise upward lighting and light spill to neighbouring areas. Where possible fixed lighting has been minimised within areas of the main development site which are adjacent to sensitive visual receptors including Leiston Old Abbey Nursing Home, residential properties along Lover's Lanes, Sandy Lane and Abbey Road (B1122) and east of Leiston Abbey. Similarly, fixed lighting has been minimised in the area of the sea defences, northern mound and beach.	Construction	Requirement 9 (MDS: Construction lighting)	ES Volume 2, Chapter 13, Section 13.5	MDS-TE18. MDS-AR13. MDS-HE2.
MDS-LV8.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Accommodation campus** Structures at the accommodation campus will be up to 3 or 4 storeys, excluding roof mounted plant. Structures that are lower in height than the accommodation blocks are located to the north (car deck) and south (amenity hub and ancillary/servicing buildings) to reduce visual effects from in the vicinity of Leiston Abbey and from elevated locations to the north.	Construction	Requirement 17 (Accommodation campus: Buildings and structures)	ES Volume 2, Chapter 13, Section 13.5	MDS-AR11.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-LV9.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Sequencing of construction works** Undertaking and completing works to the sea defences, northern mound and beach landing facility and access road as early as possible in the programme in part to minimise impacts on amenity to users of Sizewell Beach and Suffolk Coast Path/Sandlings Walk.	Construction	Requirement 8 (MDS: Temporary construction-related development)	ES Volume 2, Chapter 13, Section 13.5	MDS-NV1. MDS-AR12.
MDS-LV10.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Sea defences design** • The new sea defences and the northern mound would be designed to tie in the existing sea defences at Bent Hills adjacent to Sizewell B. • The heights would be such that these features screen views to activity and lower lying buildings and structures adjacent to the main power station structures from locations along Sizewell Beach and offshore. • Planting on the sea defences and northern mound would comprise species that are characteristic of the local coastline, including trees that, once established, would add further screening.	Operation	Requirement 12 (MDS: Approved buildings, structures and plant) Requirement 12B (MDS: Marine Infrastructure~~coastal defences~~) Deemed Marine Licence 41	ES Volume 2, Chapter 13, Section 13.5	
MDS-LV11.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Sizewell C - Building and structures design** • The layout of the main platform will be along a similar axial alignment as the existing power station structures, parallel to the coastline and replicating the 'behaviour' of them in views. This would reduce the sense of encroachment into the coastal strip. • The turbine halls and operational service centre have been architecturally designed to respond to their sensitive landscape and visual context, and reflect the behaviour of the main reactor buildings at Sizewell A and Sizewell B, which present generally simple geometric forms. The seaward façades of the turbine halls and operational service centre would be windowless to minimise light spill in this direction. • A maximum height parameter (to include all roof plant) has been established for smaller buildings and structures adjacent to the main reactors, turbine halls and operational service centre to reduce their visibility. • Permanent buildings and structures inland from the coast, such as the emergency equipment store, would be architecturally designed to respond to	Operation	Requirement 11 (MDS: Approved buildings, structures and plant) Requirement 12 (MDS: Reserved Matters) Requirement 13 (MDS: Ancillary structures, other buildings and plant)	ES Volume 2, Chapter 13, Section 13.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				their local landscape and built context, providing the required technical performance of the building or structure in question is met.				
MDS-LV12.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Sizewell B relocated facilities - buildings design** • The design of the proposed training centre, outage store and other buildings and structures associated with Sizewell B relocated facilities land would be designed to respond to the context of existing buildings and structures at Sizewell B. Roof top plant on the training centre would be enclosed to avoid visual clutter and maintain views to simple geometric forms. • The building is orientated to present the shortest elevations to the west. This façade is also windowless to minimise light spill in this direction.	Operation	Requirement 11 (MDS: Approved buildings, structures and plant) Requirement 6 (MDS: Site clearance)	ES Volume 2, Chapter 13, Section 13.5	
MDS-LV13.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Sizewell B relocated facilities - Pillbox Field design** • The outage car park at Pillbox Field has been designed to reduce the visibility of infrastructure and vehicles through its location to the north of rising land the sensitive reprofiling of landform and use of reinforced grass surfacing. • New hedgerow is proposed across the southern portion of Pillbox Field (to replace the existing hedgerow along Sizewell Gap removed to accommodate visibility splay) and woodland and woodland edge planting is proposed along the crest of the rising land on which the Pillbox sits to screen views of the outage car park.	Operation	Requirement 11 (MDS: Approved buildings, structures and plant) Requirement 14 (MDS: Landscape works)	ES Volume 2, Chapter 13, Section 13.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-LV14.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Outline Landscape and Ecology Management Plan** Land will be restored and developed in accordance with the **Outline Landscape and Ecology Management Plan** (Doc Ref. 8.2), measures include: • using excavated materials and stored soils; • areas of land will be returned to agriculture, and other areas used to create acid grassland and woodland; and • tree lost during construction, would be mitigated by new native tree planting. The establishment and management of the restored landscape areas and new habitats/vegetation, including areas of proposed and existing planting that provide screening of the proposed development and existing structures.	Operation	Requirement 14 (MDS: Landscape works)	ES Volume 2, Chapter 13, Section 13.5	MDS-TE19. MDS-HE7. MDS-SA7.
MDS-LV15.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Access road** • The access road would be screened using naturalistic landforms at the end of the construction phase. • ~~The width of the access road including the section of road across the SSSI crossing would be reduced during the operational phase from their maximum widths during construction and the margins planted with native trees and shrubs to further integrate these features into the local landscape and screen/filter views to moving vehicles.~~ The seaward slopes would accommodate new planting to integrate the crossing with its surrounding landscape, and over time as planting becomes established filter views to vehicles using the crossing from locations to the east.	Operation	Requirement 14 (MDS: Landscape works)	ES Volume 2, Chapter 13, Section 13.5 ES Addendum Volume 1, Chapter 2, Section 2.8	MDS-AQ4.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
MDS-LV16.	Landscape and visual	Primary	To minimise impacts of light spill on adjacent habitat and effects on nocturnal species.	**Operation lighting** Lighting during the operational phase will provide illumination for the safe operation of the power station facility and provide a safe working environment in the absence of natural light allowing workers and site traffic to safely navigate the site and to provide security lighting. Further details are provided in the **Lighting Management Plan** (**Volume 2, Appendix 2B** of the ES) and includes the following mitigation measures for both fixed and temporary lighting. • Adopt the lowest safe lighting levels possible for task being undertaken. • Limit the hours of lighting where practicable. • Use a high quality luminaire with good optical control. • Use the lowest possible mounting for the luminaire based on the required level of illumination needed for the task being undertaken. • Direct luminaires into the area to be lit (light from the boundary inwards). • Ensure the luminaire is mounted at zero degrees to the horizontal and avoid any tilt. • If required make use of manufacture supplied custom shields. • Provide local control for the lighting so it may be switched off when not required. In addition to the physical equipment, lighting should be placed such that it makes use of the existing and proposed topography: • Keep mounting heights lower than fences and bunding, where possible. • Position equipment so it is not visible to sensitive receptors by using natural screening.	Operation	Requirement 15 (MDS: Permanent operational lighting)	ES Volume 2, Chapter 13, Section 13.5	MDS-TE18. MDS-AR13. MDS-HE3.
MDS-LV17.	Landscape and visual	Primary	To minimise ecological effects on woodlands.	**Wider Estate Management (Woodland)** The **Outline Landscape and Ecology Management Plan** (Doc Ref. 8.2) is supported by an existing Woodland Management Plan, part of the Sizewell Integrated Land Management Plan (ILMP). The plan states that the long-term aim of the woodlands on the wider EDF Energy estate is "to maintain the contribution they make to the local landscape character and/or screening, and to improve and enhance their value for biodiversity".	Operation	Requirement 14 (MDS: Landscape works)	ES Volume 2, Chapter 13, Section 13.5	MDS-LV14. MDS-TE17.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				The Woodland Management Plan has been prepared in accordance with UK Forestry Standard (UKFS) guidelines and sets out management measures which include selective thinning (but no clear felling) and restocking/replanting to increase species and structural diversity and ensure the long-term resilience of the woodland. The areas covered also include the retained section of Goose Hill and Kenton Hills and the woodlands to the north of the site (which are important for visual containment) such as Ash Wood, Great Mount Wood and the Grove.				
MDS-LV18.	Landscape and visual	Tertiary	To minimise landscape and visual impacts.	**Construction management measures: landscape and visual** Tertiary measures set out in the **CoCP** (Doc Ref. 8.11) include: • contractors will seek to avoid unnecessary tree and vegetation removal; • where required, tree felling will be carried out taking appropriate consideration of the UK Forestry Standard Guidelines; • trees within or adjacent to the site boundary which are to be retained, will be protected in line with the recommendations in BS 5837, and works would be managed through measures such as provision of appropriate fencing around root protection zones, prevent compaction of soils, selective removal of lower branches to reduce risk of damage by construction plant and vehicles. Works relating to the protection of retained trees and trees subject to works will be overseen by an qualified arboricultural consultant; • the supply, storage, handling, planting and maintenance of new planting will be undertaken in accordance with appropriate British Standards; and • the design of hoardings around construction activities shall include consideration of the character of the surrounding landscape (e.g. use of open mesh fencing where possible and appropriate in rural areas). Fencing and hoarding shall be kept well maintained throughout construction.	Construction	Requirement 2 (PW: CoCP)	ES Volume 2, Chapter 13, Section 13.7	MDS-AR19.

1.3 Northern Park and Ride

1.3.1 Table 1.2 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the northern park and ride.

Table 1-2: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the northern park and ride

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
NPR-NV1.	Noise and vibration	Primary	To minimise noise impacts.	**Landscape bunds** The site layout would incorporate landscape bunds as shown on the **Northern Park and Ride Proposed Landscape Masterplan and Finished Levels** (Doc Ref. 2.6). The landscape bunds would provide acoustic screening with an approximate 5dB reduction in sound level for residential receptors in the area south of Willow Marsh Lane, to the east of the bund and to the west of the A12 once constructed.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 20 (AD: Buildings and structures)	ES Volume 3, Chapter 4, Section 4.5	NPR-LV1. NPR-AR1.
NPR - NV2.	Noise and vibration	Primary	To minimise noise impacts.	**Operational plant selection** The mechanical services plant (such as air conditioning condenser units and air handling units) would be selected to ensure that limit values would be met.	Operation	Requirement 20 (AD: Buildings and structures)	ES Volume 3, Chapter 4, Section 4.5	
NPR - NV3.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 would be followed, as set out in the **Code of Construction Practice** (**CoCP**) (Doc Ref 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction, operation and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 3, Chapter 4, Section 4.5	
NPR - NV4.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Management measures to reduce construction traffic noise** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) would help to reduce and manage the effects of traffic generated by the Sizewell C Project including the northern park and ride (see **Volume 2, Chapter 10** of the **ES**).	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 3, Chapter 4, Section 4.5	NPR-AQ4. NPR-AR9.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
NPR - NV5.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Monitoring and management of any noise or vibration complaints** Routine monitoring would be carried out in accordance with the **CoCP** (Doc Ref. 8.11) and SZC Co. would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.	Construction, operation and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 3, Chapter 4, Section 4.5	
NPR - NV6.	Noise and vibration	Secondary	To minimise noise and vibration impacts.	**Additional mitigation** Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the **CoCP** (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant. Contractors will be required to identify mitigation to avoid significant construction noise and vibration effects, as far as reasonably practicable. Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons. The following mitigation measures provide an example of the measures that would be used, where practicable, during the construction phase: • Localised acoustic barriers could be used as an effective noise mitigation measure when construction activities take place within 50m of Receptors B, D and E during the construction and reinstatement. The reduction provided by these screens would be likely result in a reduction in noise level of at least 5dB. • Reducing noisy activities during construction between 13:00 and 19:00 hours on Saturdays.	Construction, operation and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 3, Chapter 4, Section 4.7	
NPR - NV7.	Noise and vibration	Secondary	~~To minimise the impacts of noise and vibration.~~To reduce noise from construction and road	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 3, Chapter 4, section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
			operational noise sources at noise-sensitive receptors	insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.				
NPR-AQ1.	Air quality	Primary	To minimise dust impacts.	**Site layout** Primary mitigation for construction of the proposed development include: • Site location and layout to minimise distance of park and ride facility from A12. • Site access would be located at least 10m, from residential receptors. • Re-use of soils on-site to form bunds instead of transporting them for off-site storage.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 2 (PW: CoCP) Requirement 22 (Highway works)	ES Volume 3, Chapter 5, Section 5.5	
NPR-AQ2.	Air quality	Primary	To minimise traffic emissions.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction of the Sizewell C Project which will also minimise impacts from the construction, operation and removal and reinstatement of the northern park and ride. These measures are set out in **Volume 2, Chapter 10** of the **ES**. The proposed development is one of these primary measures.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design)	ES Volume 3, Chapter 5, Section 5.5	NPR-AR4.
NPR-AQ3.	Air quality	Tertiary	To minimise dust impacts.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(~~A~~B)) sets out control measures to manage construction impacts on air quality, including: • Use of surface covering (such as seeding of earthworks, hardstanding or permeable paving for the car park) to minimise extent of exposed soils and minimise potential resuspension of dust. • Avoid site runoff of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures in the **CoCP**. ~~• Contractors will seek to ensure that all road vehicles will~~	Construction, operation and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 3, Chapter 5, Section 5.5 ES Addendum Volume 1, Chapter 3, Section 3.3	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				~~comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
NPR-AQ4.	Air quality	Tertiary	To minimise traffic emissions.	**Management measures to reduce construction traffic emissions** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project including the northern park and ride (see **Volume 2, Chapter 10** of the **ES**).	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 3, Chapter 5, Section 5.5	NPR -NV4. NPR-AR9.
NPR-LV1.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Landscape bunds** The creation of 3m high landscape and acoustic screening bunds to parts of the eastern and northern edged of the site using on-site material removed due to earthworks associated with the levelling of the site and top soil storage. The locations of landscape bunds are shown on the **Northern Park and Ride Proposed Landscape Masterplan and Finished Levels plan** (Doc Ref. 2.6).	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 2 (PW: CoCP) Requirement 20 (AD: Buildings and structures)	ES Volume 3 Chapter 6 Section 6.5	NPR-NV1. NPR-AR1.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
NPR-LV2.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Retention of woodland and hedgerow** The retention of existing woodland and hedgerows where appropriate, as shown on the **Northern Park and Ride Site Clearance Plan** (Doc Ref. 2.6).	Construction, operation and removal and reinstatement	Requirement 19 (AD: Site clearance)	ES Volume 3 Chapter 6 Section 6.5	NPR-TE4. NPR-HE2.
NPR-LV3.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Proposed planting** • Hedgerows along the eastern and northern site boundaries supplemented with further planting to permanently infill existing gaps which currently do not serve a purpose (such as for access). • Hedgerows planted will also be planted around the proposed roundabout on the A12. • Additional hedgerow planting along the southern side of Willow Marsh Lane where there is no hedgerow at present. • Additional temporary soft landscaping and suitably sited tree and shrub planting within the car parking areas. Proposed planting is shown on the **Northern Park and Ride Proposed Landscape Masterplan and Finished Levels plan** (Doc Ref. 2.6).	Construction and operation	DCO Article 3 (Scheme design) Requirement 20 (AD: Buildings and structures) Requirement 23 (AD: Landscape planting)	ES Volume 3 Chapter 6 Section 6.5	NPR-TE4. NPR-HE2.
NPR-LV4.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Changes to planting during removal and reinstatement phase** Hedgerows planted around the proposed roundabout on the A12 would be removed when the roundabout is removed, and would be reinstated along the existing hedgerow alignments during the removal and reinstatement phase, as shown on the **Northern Park and Ride Removal and Reinstatement plan** (Doc Ref. 2.6).	Removal and reinstatement	Requirement 24 (AD: Removal and reinstatement)	ES Volume 3 Chapter 6 Section 6.5	NPR-HE3.
NPR-LV5.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Building design** A general design approach aiming to create an unimposing appearance, with the buildings screened as far as possible. Where visible the buildings will adopt natural colours to allow their appearance to harmonise with the surroundings, in line with the **Associated Development Design Principles** (Doc Ref 8.3).	Operation	Requirement 20 (AD: Buildings and structures)	ES Volume 3 Chapter 6 Section 6.5	NPR-AR3
NPR-LV6.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Operational Lighting** • Lighting columns within the car parking areas and along the access road will be restricted to 6m in height to minimise visibility during day and night time. • Lighting columns around the proposed roundabout and along the proposed access road between the roundabout and Willow Marsh Lane would be 8m in height to reduce the number of columns necessary to produce a lighting scheme	Operation	Requirement 20 (AD: Buildings and structures) Requirement 22 (AD: Highway works)	ES Volume 3 Chapter 6 Section 6.5	NPR-TE2. NPR-AR2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				that meets highway authority requirements. • Lighting columns would utilise LED base lights with zero-degree tilt to minimise light spill and along the perimeter would be fitted with demountable shield to reduce backward spill of light. Use of a Central Management System for the lighting which would be capable of dimming of parts of the site independently from other parts.				
NPR-LV7.	Landscape and visual	Tertiary	To minimise landscape and visual impacts.	**Construction lighting** To minimise the adverse effects of lighting during construction: • Minimum light levels for safe working and the minimum number of lighting elements to illuminate the work area safely will be used. • Lighting will be directed away from site boundaries to minimise nuisance to adjacent properties. If lights cannot be positioned in such way because of physical constraints or for safety reasons, then local screening of the lights, including shielding of luminaires, where appropriate, will be used to reduce disturbance. • Task-specific lighting will be turned off on completion of the task, or at the end of the working day by the contractor. • Spotlights and task lighting towers will be positioned away from sensitive receptors, where identified. • Contractors will consider the use of sensors or timing devices to automatically switch off lighting, where appropriate.	Construction, operation and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 3 Chapter 6 Section 6.5	NPR-TE7.
NPR-LV8.	Landscape and visual	Secondary	To minimise landscape and visual impacts.	**Maintenance of planting** The proposed planting would require maintenance and management during the operation of the proposed development, with replacement of plant failures during the first few years of establishment (usually 5 years) as required.	Operation	Requirement 23 (AD: Landscape planting)	ES Volume 3 Chapter 6 Section 6.7	

1.4 Southern Park and Ride

1.4.1 Table 1.3 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the southern park and ride.

Table 1-3: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the southern park and ride

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SPR-NV1.	Noise and vibration	Primary	To minimise noise impacts.	**Landscape bunds** The landscape bunds as shown on the **Southern Park and Ride Proposed Landscape Masterplan and Finished Levels** (Doc Ref. 2.7). This would provide some sound level reduction for the receptors once constructed.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 20 (AD: Buildings and structures)	ES Volume 4, Chapter 4, Section 4.5	SPR- LV1. SPR-TE2. SPR-AR1. SPR-HE5.
SPR-NV2.	Noise and vibration	Primary	To minimise noise impacts.	**Operational plant selection** The mechanical services plant (such as air conditioning condenser units and air handling units) would be selected to ensure that limit values would be met.	Operation	Requirement 20 (AD: Buildings and structures)	ES Volume 4, Chapter 4, Section 4.5	
SPR-NV3.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 would be followed, as set out in the **Code of Construction Practice** (**CoCP**) (Doc Ref 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 4, Chapter 4, Section 4.5	
SPR-NV4.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Management measures to reduce construction traffic noise** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) would help to reduce and manage the effects of traffic generated by the Sizewell C Project	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 4, Chapter 4, Section 4.5	SPR -AQ4. SPR-AR9.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				including the southern park and ride (see **Volume 2, Chapter 10** of the **ES**).				
SPR-NV5.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Monitoring and management of any noise or vibration complaints** Routine monitoring would be carried out in accordance with the **CoCP** (Doc Ref. 8.11) and SZC Co. would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 4, Chapter 4, Section 4.5	
SPR -NV6.	Noise and vibration	Secondary	To minimise noise and vibration impacts.	**Additional mitigation** Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the CoCP (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant. Contractors will be required to identify mitigation to avoid significant construction noise and vibration effects, as far as reasonably practicable. Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons.	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 4, Chapter 4, Section 4.7	
SPR -NV7.	Noise and vibration	Secondary	~~To minimise the impacts of noise and vibration.~~To reduce noise from construction and road operational noise	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded,	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 4 Chapter 4, section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
			sources at noise-sensitive receptors	noise insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.				
SPR -AQ1.	Air quality	Primary	To minimise dust impacts.	**Site layout** Primary mitigation for the proposed development includes: • Site selection to minimise distance of park and ride facility from A12. • Site access would be located at least 10m, from residential receptors. • Re-use of soils on-site to form bunds instead of transporting them for off-site storage.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 2 (PW: CoCP) Requirement 22 (AD: Highway works)	ES Volume 4, Chapter 5, Section 5.5	
SPR -AQ2.	Air quality	Primary	To minimise traffic emissions.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction of the Sizewell C Project which will also minimise impacts from the construction, operation and removal and reinstatement of the southern park and ride. These measures are set out in **Volume 2, Chapter 10** of the **ES**. The proposed development is one of these primary measures.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design)	ES Volume 4, Chapter 5, Section 5.5	SPR-AR5.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SPR -AQ3.	Air quality	Tertiary	To minimise dust impacts.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(AB)) sets out control measures to manage construction impacts on air quality, including: • Use of surface covering (such as seeding of earthworks, hardstanding or permeable paving for the car park) to minimise extent of exposed soils and minimise potential resuspension of dust. • Avoid site runoff of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures in the **CoCP** (Doc Ref. 8.11(AB)). ~~• Contractors will seek to ensure that all road vehicles will comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 4, Chapter 5, Section 5.5 ES Addendum Volume 1, Chapter 4, Section 4.4	SPR-TE11. SPR-AR7. SPR-SA5. SPR-LQ4. SPR-GSW4.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
SPR -AQ4.	Air quality	Tertiary	To minimise impacts of traffic on air quality.	**Management measures to reduce construction traffic emissions** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project (see **Volume 2, Chapter 10** of the **ES**).	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 4, Chapter 5, Section 5.5	SPR-NV4. SPR-AR9.
SPR- LV1.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Landscape bunds** The creation of landscape bunds up to 3m high as shown on the **Southern Park and Ride Proposed Landscape Masterplan and Finished Levels** (Doc Ref. 2.7). The landscape bunds would be constructed using on-site material removed due to earthworks associated with the levelling of the site and top soil storage.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 2 (PW: CoCP) Requirement 20 (AD: Buildings and structures)	ES Volume 4, Chapter 6, Section 6.5	SPR-NV1. SPR-TE2. SPR-AR1. SPR-HE5.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SPR- LV2.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Retention of woodland and hedgerow** The retention of existing woodland and hedgerows where appropriate, as shown on the **Southern Park and Ride Site Clearance Plan** (Doc Ref. 2.7).	Construction, operation and removal and reinstatement	Requirement 19 (AD: Site clearance)	ES Volume 4, Chapter 6, Section 6.5	SPR-TE6. SPR-HE3.
SPR- LV3.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Proposed Planting** • Permanent hedgerow planting proposed along the southern and eastern boundaries of the site to screen views from Footpaths E-387/008/0 and E-288/007/0. • Temporary hedgerow planting would also be planted along the access road, whilst the park and ride is operational, to replace hedgerows lost during construction • Additional temporary soft landscaping and suitably sited tree and shrub planting within the car parking areas. • Proposed planting is shown on the **Southern Park and Ride Proposed Landscape Masterplan and Finished Levels plan** (Doc Ref. 2.7).	Construction and operation	DCO Article 3 (Scheme design) Requirement 20 (AD: Buildings and structures) Requirement 23 (AD: Landscape planting)	ES Volume 4, Chapter 6, Section 6.5	SPR-TE6. SPR-HE3.
SPR- LV4.	Landscape and visual	Primary	To minimise landscape and visual effects following reinstatement.	**Changes to planting during removal and reinstatement phase** Temporary hedgerow planted along the access road would be re-planted as close as possible to the original hedgerow line during the removal and reinstatement phase, as shown on the **Southern Park and Ride Removal and Reinstatement plan** (Doc Ref. 2.7).	Removal and reinstatement	Requirement 24 (AD: Removal and reinstatement)	ES Volume 4, Chapter 6, Section 6.5	SPR-TE7. SPR-HE4.
SPR- LV5.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Operational Lighting** • Lighting columns within the car parking areas and along the access road would be restricted to 6m in height to minimise visibility during day and night-time. • Lighting columns, to a maximum height of 10m including lanterns, would be provided from the roundabout with the B1078 and along the slip road leading to the site and the northbound A12. • Lighting columns would utilise LED base lights with zero-degree tilt to minimise light spill and along the perimeter would be fitted with demountable shield to reduce backward spill of light. Use of a central management system for the	Operation	Requirement 20 (AD: Buildings and structures)	ES Volume 4, Chapter 6, Section 6.5	SPR-TE4. SPR-AR2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				lighting which would be capable of dimming of parts of the site independently from other parts.				
SPR- LV6.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Building design and site layout** A general design approach aiming to create an unimposing appearance, with the buildings screened as far as possible. Where visible the buildings will adopt natural colours to allow their appearance to harmonise with the surroundings, in line with the **Associated Development Design Principles** (Doc Ref. 8.3). The layout aims to maximise the benefit of existing screening provided by Whin Belt and the other blocks of woodland located to the north, west and east.	Operation	Requirement 20 (AD: Buildings and structures) Requirement 22 (AD: Highway works)	ES Volume 4, Chapter 6, Section 6.5	
SPR- LV7.	Landscape and visual	Tertiary	To minimise landscape and visual effects.	**Construction lighting** To minimise the adverse effects of lighting during construction: • Minimum light levels for safe working and the minimum number of lighting elements to illuminate the work area safely will be used. • Lighting will be directed away from site boundaries to minimise nuisance to adjacent properties. If lights cannot be positioned in such way because of physical constraints or for safety reasons, then local screening of the lights, including shielding of luminaires, where appropriate, will be used to reduce disturbance. • Task-specific lighting will be turned off on completion of the task, or at the end of the working day by the contractor. • Spotlights and task lighting towers will be positioned away from sensitive receptors, where identified. • Contractors will consider the use of sensors or	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 4, Chapter 6, Section 6.5	SPR-TE9. SPR-AR8. SPR-HE6.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				timing devices to automatically switch off lighting, where appropriate.				
SPR- LV8.	Landscape and visual	Secondary	To minimise landscape and visual effects.	**Maintenance of planting** The proposed planting would require maintenance and management during the operation of the proposed development, with replacement of plant failures during the first few years of establishment (usually 5 years) as required.	Operation	Requirement 23 (AD: Landscape planting)	ES Volume 4, Chapter 6, Section 6.7	

1.5 Two Village Bypass

1.5.1 Table 1.4 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the two village bypass.

Table 1-4: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the two village bypass

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-NV1.	Noise and vibration	Primary	To minimise noise and vibration impacts.	**Design measures to minimise construction traffic noise and vibration across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction and operation of the Sizewell C Project. These measures are set out in **Volume 2, Chapter 10** of the **ES.** The proposed development is one of these primary measures.	Construction and operation	DCO Article 3 (Scheme design) ~~Section 106 agreement~~ Deed of Obligation (Implementation plan)	ES Volume 5, Chapter 4, section 4.5	2VBP-AQ1. 2VBP-AR1.
2VBP-NV2.	Noise and vibration	Primary	To minimise noise impacts on sensitive receptors.	**Site location and site boundary design** • The proposed alignment of the two village bypass would offer road users a more direct route than travelling through the Stratford St Andrew and Farnham. This would reduce traffic flows, during both the peak construction of the Sizewell C Project and upon completion of the power station through the villages, and reducing associated traffic noise. • The site boundary has been designed to minimise maximise the separation distance of construction works and the proposed development from noise sensitive receptors where reasonably practicable.	Construction and operation	DCO Article 3 (Scheme design)	ES Volume 5, Chapter 4, section 4.5	2VBP-AQ2.
2VBP-NV3.	Noise and vibration	Primary	To minimise noise impacts on Farnham Hall, Pond Barn cottages, Foxburrow Wood.	**Proposed development design** Where the proposed route of the two village bypasses Farnham Hall and Foxburrow Wood, it will be in a cutting which will help to reduce noise impacts on sensitive receptors.	Operation	DCO Article 3 (Scheme design)	ES Volume 5, Chapter 4, section 4.5	2VBP-LV1.
2VBP-NV4.	Noise and vibration	Tertiary	To minimise noise and vibration impacts during piling.	**Construction Management Measures: Piling** Where percussive piling is necessary, and where feasible to do so, a resilient dolly will be used between the hammer and driving helmet, or an acoustic shroud will be used to enclose the percussive elements.	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 4, section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-NV5.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 will be followed, as set out in the **Code of Construction Practice** (**CoCP**) (Doc. Ref. 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 4, section 4.5	
2VBP-NV6.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Management measures to reduce construction traffic noise** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7) and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project including the two village bypass (see **Volume 2, Chapter 10** of the **ES**).	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (CTMP, CWTP)	ES Volume 5, Chapter 4, section 4.5	2VBP-AQ4. 2VBP-AR10.
2VBP-NV7.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Management of any noise or vibration complaints** SZC Co. will have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 4, section 4.5	2VBP-NV10.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-NV8.	Noise and vibration	Secondary	To minimise noise and vibration impacts.	**Additional mitigation** • Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the **CoCP** (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant. • Contractors will be required to identify mitigation to avoid significant construction noise and vibration effects, as far as reasonably practicable. • Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons. The following mitigation measures provide an example of the measures that would be used, where practicable, during the construction phase, as follows: • Reducing noisy activities during construction between 13:00 and 19:00 hours on Saturdays. • During vegetation clearance work, including use of a chipper (for substantial stems and branches, not lightweight hedges), plant could be screened from the nearest affected receptors or positioned more remotely, so that the benefit of distance attenuation is maximised. Screening could take the form of acoustic panel/pads attached to temporary fencing. There would be a potential for a 5dB (LAeq,T) benefit from a 2m tall screen arrangement. • Creation of a minimum 20m buffer zone at the edge of the temporary contractors compound adjacent to Benhallstock Cottage and provision of screening in this area. The compound could be laid out and operated in a manner which minimises materials handling and vehicle movements in the north-east corner close to the property.	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 4, section 4.7	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-NV9.	Noise and vibration	Secondary	~~To minimise the impacts of noise and vibration.~~To reduce noise from construction and road operational noise sources at noise-sensitive receptors	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 5, Chapter 4, section 4.5	
2VBP-NV10.	Noise and vibration	Secondary (monitoring)	To minimise noise and vibration impacts.	**Noise monitoring**Routine monitoring of noise and vibration during construction will be carried out as proposed in the **CoCP** (Doc Ref. 8.11). Provision will be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors.	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 4, section 4.7	2VBP-NV7.
2VBP-AQ1.	Air quality	Primary	To minimise impacts of transport emissions on air quality.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction and operation of the Sizewell C Project. These measures are set out in **Volume 2, Chapter 10** of the **ES**.	Construction and operation	DCO Article 3 (Scheme design) ~~Section 106 agreement~~ Deed of Obligation (Implementation plan)	ES Volume 5, Chapter 5, Section 5.5	2VBP-NV1. 2VBP-AR1.
2VBP-AQ2.	Air quality	Primary	To minimise air quality impacts on sensitive receptors.	**Site boundary design and location** The proposed alignment of the two village bypass would offer road users an alternative route for the A12, reducing traffic flows within Stratford St. Andrew and Farnham during both the peak construction of the Sizewell C Project and upon completion of the power station. The site boundary has been designed to avoid sensitive receptors and increase distance of construction works and the proposed development where reasonably practicable.	Construction and operation	DCO Article 3 (Scheme design)	ES Volume 5, Chapter 5, Section 5.5	2VBP-NV2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-AQ3.	Air quality	Tertiary	To minimise dust impacts.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(~~AB~~)) sets out control measures to manage construction impacts on air quality, including: • Positioning site entrances as far practicable from sensitive receptors. • Any potential use of concrete batching plant located as far as practicable from receptors; • Locating any mobile crushing and screening plant as far as practicable from sensitive receptors; • Covering potentially dusty loads (loose earth, spoil, aggregates etc.) in transit; • Managing site run-off of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures, as set out in the **CoCP** (Doc Ref. 8.11(~~AB~~)). ~~• Contractors will seek to ensure that all road vehicles will comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 5, Section 5.5 ES Addendum Volume 1, Chapter 5, Section 5.4	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
2VBP-AQ4.	Air quality	Tertiary	To minimise impacts on air quality.	**Measures to manage construction traffic** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to help govern worker behaviour and reduce and manage the effects of traffic generated by the Sizewell C Project including the two village bypass (see **Volume 2 Chapter 10** of the **ES**).	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (CTMP, CWTP)	ES Volume 5, Chapter 5, Section 5.5	2VBP-NV6. 2VBP-AR10.
2VBP-LV1.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Proposed development design** The route of the proposed two village bypass will be within a cutting as it passes between Farnham Hall and Farnham Hall Farmhouse to reduce visual impacts on residents of these properties.	Operation	DCO Article 3 (Scheme design)	ES Volume 5, Chapter 6, Section 6.5	2VBP-NV3.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-LV2.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11) sets out control measures to manage construction impacts on air quality, including: • Positioning site entrances as far practicable from sensitive receptors. • Any potential use of concrete batching plant located as far as practicable from receptors; • Locating any mobile crushing and screening plant as far as practicable from sensitive receptors; • Covering potentially dusty loads (loose earth, spoil, aggregates etc.) in transit; • Managing site run-off of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures, as set out in the **CoCP** (Doc Ref. 8.11).	Construction and operation	DCO Article 3 (Scheme design) Requirement 22 (Highway works) Requirement 19 (AD: Site clearance plans) Requirement 23 (AD: Landscape planting)	ES Volume 5, Chapter 6, Section 6.5	2VBP-TE4. 2VBP-AR5. 2VBP-HE1.
2VBP-LV3.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Hedgerow Planting** Hedgerow will be planted along the route of the proposed development to integrate the road with the surrounding landscape and to compensate for the loss of hedgerow severed by the route. The hedgerow planting will connect into the existing hedgerow network, where possible. Proposed hedgerow planting is shown on the **Two Village Bypass Proposed Landscape Masterplan and Finished Levels plan** (Doc Ref. 2.8)	Operation	DCO Article 3 (Scheme design) Requirement 22 (Highway works) Requirement 23 (AD: Landscape planting) Requirement 22A (AD Landscape works)	ES Volume 5, Chapter 6, Section 6.5	2VBP-TE5. 2VBP-AR5. 2VBP-HE2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-LV4.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Woodland Planting**Woodland will be planted at strategic locations along the route of the proposed two village bypass to provide visual screening and help integrate the proposed road and earthworks into the landscape. These locations are:• Along the western side of the cutting in the vicinity of Farnham Hall as well as along the western side of the proposed embankment up to the proposed overbridge.• On the east side of the proposed Foxburrow Wood footbridge, adjacent to Foxburrow Wood and Farnham Hall Farmhouse.Proposed planting is shown on the **Two Village Bypass Proposed Landscape Masterplan and Finished Levels plan** (Doc Ref. 2.8)	Operation	DCO Article 3 (Scheme design)Requirement 22 (Highway works)Requirement 23 (AD: Landscape planting)Requirement 22A (AD Landscape works)	ES Volume 5, Chapter 6, Section 6.5	2VBP-TE6. 2VBP-AR5.2VBP-HE3.
2VBP-LV5.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Operational Lighting** • Lighting will be provided at the A12 western roundabout and the A12/A1094 eastern roundabout extending north for road safety reasons. The rest of the route of the road will be unlit. • The lighting columns will be up to 10m in height. • Operational phase lighting will be designed to achieve a balance between providing lighting appropriate for all road users whilst applying suitable mitigation measures in keeping with the local environment.	Operation	Requirement 22 (Highway works)	ES Volume 5, Chapter 6, Section 6.5	2VBP-TE15.
2VBP-LV6.	Landscape and visual	Tertiary	To minimise landscape and visual impacts.	**Construction management measures: landscape and visual** Compliance with measures set out within **CoCP** (Doc Ref. 8.11) to minimise landscape and visual effects during the construction phase: • Avoidance of unnecessary tree removal and appropriate protection of trees and vegetation to be retained. • Design of hoardings around construction activities to include consideration of the character of the surrounding landscape. • Construction site lighting, where required to ensure safety and security, will be positioned and directed to minimise intrusion into occupied residential properties and sensitive areas, and will not create a road hazard.	Construction	Requirement 2 (PW: CoCP)	ES Volume 5, Chapter 6, Section 6.5	2VBP-TE17. 2VBP-TE20. 2VBP-TE21.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
2VBP-LV7.	Landscape and visual	Secondary	To minimise landscape and visual impacts.	**Maintenance of planting** New planting would require maintenance and management during its lifetime, with replacement of plant failures during the first few years of establishment.	Construction and operation	Requirement 4 (PW: Terrestrial Ecology Monitoring and Mitigation Plan)	ES Volume 5, Chapter 6, Section 6.7	
2VBP-LV8	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Outline Landscape and Ecology Management Plan (oLEMP)** The oLEMP provides the framework for the Landscape and Ecological Management Plan (LEMP) which will provide further details of the management measures and implementation of the habitat created, along with ongoing monitoring arrangements.	Operation	Requirement 22 (Highway works) ~~Requirement 2 (PW: CoCP)~~ Requirement 22A (AD Landscape works)	ES Addendum Volume 1, Chapter 5, Section 5.5	2VBP-TE33

1.6 Sizewell Link Road

1.6.1 Table 1.5 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the Sizewell link road.

Table 1-5: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the Sizewell link road

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SLR-NV1.	Noise and vibration	Primary	To minimise noise and vibration impacts.	**Design measures to minimise traffic across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction and operation of the Sizewell C Project which will minimise the traffic impacts of the construction and operation of the Sizewell link road. These measures are set out in **Volume 2, Chapter 10** of the **ES**.	Construction and operation	DCO Article 3 (Scheme design) ~~Section 106 agreement~~ Deed of Obligation (Implementation plan, CTMP and CWTP)	ES Volume 6, Chapter 4, Section 4.5	SLR-AQ1. SLR-AR1.
SLR-NV2.	Noise and vibration	Primary	To minimise noise and vibration impacts.	**Proposed development and site boundary design** Measures embedded into the design which minimise the noise impact of the proposed development, include: • The proposed alignment of the Sizewell link road would offer road users an alternative route for the B1122, reducing traffic flows within Middleton Moor and Theberton during both the peak construction of the Sizewell C Project and upon completion of the power station. This would reduce associated traffic noise within the villages. • The site boundary has been designed to maximise the separation distance of construction works and the proposed development from noise sensitive receptors where reasonably practicable. • The location of the Middleton Moor link, from the route of the proposed Sizewell link road to the proposed roundabout on the B1122 (Yoxford Road), has been sited to increase the distance to Middleton Moor.	Construction and operation	DCO Article 3 (Scheme design)	ES Volume 6, Chapter 4, Section 4.5	SLR-AQ2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SLR-NV3.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 will be followed, as set out in the **Code of Construction Practice** (**CoCP**) (Doc. Ref. 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required; • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 4, Section 4.5	
SLR-NV4.	Noise and vibration	Tertiary	To minimise noise and vibration.	**Management measures to reduce construction traffic noise** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) would help to reduce and manage the effects of traffic generated by the Sizewell C Project including the Sizewell link road (see **Volume 2, Chapter 10** of the **ES**).	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP) Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 4, Section 4.5	SLR-AQ4. SLR-AR9.
SLR-NV5.	Noise and vibration	Tertiary	To minimise noise and vibration.	**Management of any noise or vibration complaints** SZC Co. will have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 4, Section 4.5	SLR-NV9.
SLR-NV6.	Noise and vibration	Tertiary	To minimise noise and vibration during	**Construction Management Measures: Piling** Where percussive piling is necessary, and where feasible to do so, a resilient dolly will be used between the hammer and driving helmet, or an acoustic shroud will be used to enclose the percussive elements.	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 4, Section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
			piling activities.					
SLR-NV7.	Noise and vibration	Secondary (mitigation)	To minimise noise and vibration.	**Additional mitigation** Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the **CoCP** (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant. Contractors will be required to identify mitigation to avoid significant construction noise and vibration effects, as far as reasonably practicable. Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons. The following mitigation measures provide an example of the measures that would be used, where practicable, during the construction phase: • Reducing noisy activities during construction between 13:00 and 19:00 hours on Saturdays. • During vegetation clearance work including the use of a 'chipper', plant could be screened from the nearest affected receptors or positioned more remotely, so that the benefit of distance attenuation is maximised. Screening could take the form of acoustic cover barriers attached to temporary fencing. There would be a potential for a 5dB (LAeq,T) benefit from a 2m tall screen arrangement. • The temporary compound for contractors at the A12/west-end of the Sizewell link road could feature a minimum 20m buffer zone to Rosetta. In addition, a solid acoustic-grade fence could be located along the compound boundary to Rosetta, Kelsale Lodge Cottages and Fir Tree Farm. The north and south outer zones of this compound	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 4, Section 4.7	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				could also be designated for the storage of lightweight materials, to minimise materials handling and vehicle sound at receptors.				
SLR-NV8.	Noise and vibration	Secondary	~~To minimise the impacts of noise.~~To reduce noise from construction and road operational noise sources at noise-sensitive receptors	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.	Construction and operation	~~Section 106 Agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 6, Chapter 4, Section 4.5	
SLR-NV9.	Noise and vibration	Secondary (monitoring	To minimise noise and vibration impacts.	**Noise monitoring** Routine monitoring of noise and vibration during construction will be carried out as proposed in the **CoCP** (Doc Ref. 8.11). Provision will be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors.	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 4, section 4.7	SLR-NV5.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SLR-AQ1.	Air quality	Primary	To minimise effects on air quality.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction and operation of the Sizewell C Project. These measures are set out in **Volume 2, Chapter 10** of the **ES**.	Construction and operation	DCO Article 3 (Scheme design) ~~Section 106 agreement~~ Deed of Obligation (Implementation plan, CTMP and CWTP)	ES Volume 6, Chapter 5, Section 5.5	SLR-NV1. SLR-AR1.
SLR-AQ2.	Air quality	Primary	To minimise effects on air quality.	**Proposed development and site boundary design** • The proposed alignment of the Sizewell link road would offer road users an alternative route for the B1122, reducing traffic flows within Middleton Moor and Theberton during both the peak construction of the Sizewell C Project and upon completion of the power station. This would reduce therefore existing traffic noise within the villages. • The site boundary has been designed to avoid sensitive receptors as far as practicable. • The location of the Middleton Moor link, from the route of the proposed Sizewell link road to the proposed roundabout on the B1122 (Yoxford Road), has been sited to increase the distance to Middleton Moor.	Construction and operation	DCO Article 3 (Scheme design)	ES Volume 6, Chapter 5, Section 5.5	SLR-NV2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SLR-AQ3.	Air quality	Tertiary	To minimise dust impacts.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(~~AB~~)) sets out control measures to manage construction impacts on air quality, including: • Positioning site entrances as far practicable from sensitive receptors. • Any potential use of concrete batching plant located as far as practicable from receptors; • Locating any mobile crushing and screening plant as far as practicable from sensitive receptors; • Covering potentially dusty loads (loose earth, spoil, aggregates etc.) in transit; • Managing site run-off of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures, as set out in the **CoCP** (Doc Ref. 8.11(~~AB~~)). ~~• Contractors will seek to ensure that all road vehicles will comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 5, Section 5.5 ES Addendum Volume 1, Chapter 6, Section 6.4	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
SLR-AQ4.	Air quality	Tertiary	To minimise effects on air quality.	**Measures to manage construction traffic** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project (see **Volume 2 Chapter 10** of the **ES**).	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 6, Chapter 5, Section 5.5	SLR-NV4. SLR-AR9.
SLR-LV1.	Landscape and Visual	Primary	To minimise landscape and visual effects.	**Retention of woodland and hedgerow** • The retention of existing woodland and hedgerows where possible, except where the proposed development crosses existing field boundaries or tree belts, as shown on the **Sizewell Link Road Site Clearance Plan** (Doc Ref. 2.10). • Where vegetation is temporarily lost within the land required for construction, it would be replanted at the end of construction as shown on the **Sizewell Link Road Proposed Landscape Masterplan and Finished Levels Plan** (Doc Ref. 2.10)..	Construction and operation	Requirement 22 (Highway works) Requirement 19 (AD Site clearance) Requirement 23 (AD: Landscape planting) Requirement 22A (AD: Landscape works)	ES Volume 6, Chapter 6, Section 6.5	SLR-TE2. SLR-AR6. SLR-HE3.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
SLR-LV2.	Landscape and Visual	Primary	To minimise landscape and visual effects.	**Hedgerow Planting** Hedgerow would be planted along the route of the proposed Sizewell link road to integrate into the surrounding landscape, and to compensate for the loss of hedgerows severed by the route of the proposed Sizewell link road. These would connect into the existing hedgerow network. Proposed hedgerow planting is shown on the **Sizewell Link Road Proposed Landscape Masterplan and Finished Levels Plan** (Doc Ref. 2.10)	Construction and operation	Requirement 22 (Highway works) Requirement 23 (AD: Landscape planting) Requirement 22A (AD: Landscape works)	ES Volume 6, Chapter 6, Section 6.5	SLR-TE3. SLR-AR6. SLR-HE4.
SLR-LV3.	Landscape and Visual	Primary	To minimise landscape and visual effects.	**Tree, shrub and woodland planting** Tree and shrub planting around infiltration basins south of the route of the proposed Sizewell link road, to help integrate these features into the surrounding landscape. Woodland planting would be provided at the following locations, to compensate for the loss of woodland during construction of the proposed development and provide visual screening and help to integrate the proposed development into the landscape: • Adjacent to the proposed Middleton Moor link road to replicate the pattern of small woodland blocks in the surrounding landscape. • In areas adjacent to the East Suffolk Line. • In areas to the north and south of the route in the vicinity of Fordley Road, to minimise visibility of the route from nearby residential properties; • To the south of the route of the proposed Sizewell link road in the vicinity of Trust Farm to Hawthorn Road to minimise visibility from nearby residential properties. • West of the route of the proposed Sizewell link road in the vicinity of Dovehouse Farm, to compensate for the loss of woodland in the belt west of Theberton Hall and to infill field corners severed by the proposed route. Further woodland would be planted east of the route of the proposed Sizewell link road in this area to minimise visibility from the Theberton Hall estate, and to help integrate the proposed Pretty Road overbridge into	Construction and operation	Requirement 22 (Highway works) Requirement 23 (AD: Landscape planting) Requirement 22A (AD: Landscape works)	ES Volume 6, Chapter 6, Section 6.5	SLR-TE4. SLR-AR6. SLR-HE5.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				the surrounding landscape. • North and south of the route of the proposed Sizewell link road between Theberton and Theberton Grange, to minimise visibility of the route from residential properties and to infill field corners severed by the proposed route. Proposed planting is shown on the **Sizewell Link Road Proposed Landscape Masterplan and Finished Levels Plan** (Doc Ref. 2.10).				
SLR-LV4.	Landscape and Visual	Primary	To minimise impacts on the night-sky and visual effects.	**Operational Lighting** • The route of the proposed Sizewell link road would be mostly unlit to minimise light spill, except at the A12 western roundabout, and the B1122 northern roundabout where lighting would be required as it is a dark area, and the proposed road introduces a new deviation of the existing route. • The lighting would be up to 10m in height and in compliance with adoptable standards. • Operational phase lighting would be designed to achieve a balance between providing lighting appropriate for all road users whilst applying suitable mitigation measures in keeping with the local environment.	Operation	Requirement 22 (Highway works)	ES Volume 6, Chapter 6, Section 6.5	SLR-TE11. SLR-AR8. SLR-HE2.
SLR-LV5.	Landscape and Visual	Tertiary	To minimise landscape and visual effects during construction.	**Construction management measures: landscape and visual** Compliance with measures set out within **CoCP** to minimise landscape and visual effects during the construction phase: • Avoidance of unnecessary tree removal and appropriate protection of trees and vegetation to be retained. • Design of hoardings around construction activities to include consideration of the character of the surrounding landscape. • Site lighting, where required to ensure safety and security, will be positioned and directed to minimise intrusion into occupied residential properties and sensitive areas, and will not create a road hazard.	Construction	Requirement 2 (PW: CoCP)	ES Volume 6, Chapter 6, Section 6.5	SLR-TE12. SLR-TE13. SLR-TE15.
SLR-LV6.	Landscape and Visual	Secondary	To minimise long-term landscape	**Maintenance of planting** New planting would require maintenance and management, with replacement of plant failures during the first few years of establishment.	Construction and operation.	Requirement 23 (AD: Landscape planting) Requirement 22A (AD:	ES Volume 6, Chapter 6, Section 6.7	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
			and visual effects.			Landscape works)		
SLR-LV7	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Outline Landscape and Ecology Management Plan (oLEMP)** The oLEMP provides the framework for the Landscape and Ecological Management Plan (LEMP) which will provide further details of the management measures and implementation of the habitat created, along with ongoing monitoring arrangements.	Operation	Requirement 22 (Highway works) ~~Requirement 2 (PW: CoCP)~~ Requirement 22A (AD: Landscape works)	ES Addendum Volume 1, Chapter 6, Section 6.5	SLR-TE27

1.7 Yoxford Roundabout and Other Highway Improvement

1.7.1 Table 1.6 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the Yoxford roundabout and other highway improvements.

Table 1-6: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the Yoxford roundabout and other highway improvements

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
YOX-NV1.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 will be followed, as set out in the **Code of Construction Practice (CoCP)** (Doc. Ref. 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction	Requirement 2 (PW: CoCP)	ES Volume 7, Chapter 4, Section 4.5	
YOX-NV2.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Measures to manage construction traffic** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project (see **Volume 2, Chapter 10** of the **ES**).	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 7, Chapter 4, Section 4.5	YOX-AQ4. YOX- AR5.
YOX-NV3.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Management of any noise or vibration complaints** SZC Co. will have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.	Construction	Requirement 2 (PW: CoCP)	ES Volume 7, Chapter 4, Section 4.5	
YOX-NV4.	Noise and vibration	Secondary	~~To minimise the impacts of noise.~~To reduce noise from construction and road operational noise sources at noise-sensitive receptors	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 3, Chapter 4, section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
YOX-NV5.	Noise and vibration	Secondary	To minimise noise and vibration impacts.	**Additional mitigation** • Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the **CoCP** (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant. • Contractors will be required to identify mitigation to avoid significant construction noise and vibration effects, as far as reasonably practicable. • Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons. The following mitigation measures provide an example of the measures that would be used, where practicable, during the construction phase of the proposed Yoxford roundabout, as follows: • During site set-up and clearance, acoustic screening around the temporary contractor compound, installed prior to the works. This could include a solid 2.4m high acoustic-grade barrier/hoarding, which would reduce noise levels by 5 dB, and reduce the impact at nearby receptors. • During the use of wood chippers, the chipper could be located at least 10m from the tree-line (and away from the receptors), and a tow vehicle or similar would need to be parked immediately alongside to act as a partial screen/sound barrier orientated to the benefit of the closest receptor. • The potential benefit of the extra 10m, and the partial barrier would be approximately 7 dB LAeq,12hr. • During the main construction phase works noise levels could be reduced at nearby receptors using acoustic covers applied to mesh fencing erected around the percussion works area. This would result in a 5dB LAeq,T reduction in level, to these receptors. • For work occurring between 13:00 and 19:00 hours on a Saturday, measures may include screening and changing working methods and times, including limiting noisy activities on Saturday afternoons. The following mitigation measures provide an example of the measures that would be used, where practicable, during the	Construction	Requirement 2 (PW: CoCP)	ES Volume 7, Chapter 4, Section 4.7	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				construction phase of the proposed A12/A144 junction improvements site, as follows: • Localised screening during road breaking works.				
YOX-NV6.	Noise and vibration	Secondary (monitoring	To minimise noise and vibration impacts through monitoring.	**Noise monitoring** Routine monitoring of noise and vibration during construction will be carried out as proposed in the **CoCP** (Doc Ref. 8.11). Provision will be made as necessary for monitoring of noise and vibration levels in the event of complaints being received from occupiers of noise sensitive receptors.	Construction	Requirement 2 (PW CoCP)	ES Volume 6, Chapter 4, section 4.7	
YOX-AQ1.	Air quality	Primary	To minimise impacts from transport emissions.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction of the Sizewell C Project. These measures are set out in **Volume 2, Chapter 10** of the **ES**. The proposed development is one of these primary measures.	Construction and operation	DCO Article 3 (Scheme design) ~~Section 106 agreement~~ Deed of Obligation (Implementation plan)	ES Volume 7, Chapter 5, Section 5.4 b)	YOX- AR1.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
YOX-AQ2.	Air quality	Primary	To minimise impacts on air quality.	**Site boundary** The site boundary has been designed to avoid sensitive receptors as far as practicable, including avoidance of Roadside Nature Reserve 197.	Construction and operation	DCO Article 3 (Scheme design)	ES Volume 7, Chapter 5, Section 5.4 b)	YOX-TE1.
YOX-AQ3.	Air quality	Tertiary	To minimise dust impacts.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(~~A~~B)) sets out control measures to manage construction impacts on air quality, including: • Positioning site entrances as far practicable from sensitive receptors. • Any potential use of concrete batching plant located as far as practicable from receptors; • Locating any mobile crushing and screening plant as far as practicable from sensitive receptors; • Covering potentially dusty loads (loose earth, spoil, aggregates etc.) in transit; • Managing site run-off of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures, as set out in the **CoCP** (Doc Ref. 8.11(~~A~~B)). ~~• Contractors will seek to ensure that all road vehicles will comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to	Construction	Requirement 2 (PW: CoCP)	ES Volume 7, Chapter 5, Section 5.4 b) ES Addendum Volume 1, Chapter 7, Section 7.4	YOX-TE19. YOX- AR8. YOX-SA5.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
YOX-AQ4.	Air quality	Tertiary	To minimise impacts on air quality.	**Measures to manage construction traffic** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project (see **Volume 2 Chapter 10** of the **ES**).	Construction and operation	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 7, Chapter 5, Section 5.4 b)	YOX-NV2. YOX- AR5.
YOX-LV1.	Landscape and visual	Primary	To minimise landscape and visual impacts.	**Retention of existing trees and hedgerow** Trees and hedgerow would be retained at the following locations, as shown on the **Yoxford roundabout site clearance plan** (Doc Ref. 2.9): • To the north-west of the site, along the boundary of Satis House Hotel. • Hedgerow along the southern side of the B1122 (Middleton Road). • Retaining hedgerow would help to screen construction works and proposed roundabout.	Construction and operation	DCO Article 3 (Scheme design) Requirement 22 (Highway works) Requirement 19 (AD Site clearance plans)	ES Volume 7, Chapter 6, Section 6.4 b)	YOX-TE2. YOX- AR2. YOX- HE1.
YOX-LV2.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Proposed planting** The following planting would be provided at the following locations, as shown on the **Yoxford roundabout proposed landscape masterplan and finished levels plan** (Doc Ref. 2.9): • Trees and hedgerow would be planted along the eastern edge of the realigned roads. • Trees and hedgerow would be planted around the proposed infiltration basin south of the A12. This planting will help to integrate the proposed Yoxford roundabout into the landscape and provide visual screening.	Construction and operation	DCO Article 3 (Scheme design) Requirement 22 (Highway works) Requirement 23 (AD: Landscape planting)	ES Volume 7, Chapter 6, Section 6.4 b)	YOX-TE3. YOX- AR2. YOX- HE2.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
YOX-LV3.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Operational lighting** • Street lighting will line the proposed Yoxford Roundabout and will be up to 10m in height and in compliance with adoptable standards. • Operational phase lighting would be designed to achieve a balance between providing lighting appropriate for all road users whilst applying suitable mitigation measures in keeping with the local environment.	Operation	Requirement 22 (Highway works)	ES Volume 7, Chapter 6, Section 6.4 b)	YOX-TE5.
YOX-LV4.	Landscape and visual	Tertiary	To minimise landscape and visual effects.	**Construction lighting** The **CoCP** (Doc Ref. 8.11) will include the following measures to minimise landscape and visual effects during construction: • Minimum light levels for safe working and the minimum number of lighting elements to illuminate the work area safely will be used. • Lighting will be directed away from site boundaries to minimise nuisance from light spill. If lights cannot be positioned in such way because of physical constraints or for safety reasons, then local screening of the lights, including shielding of luminaires, where appropriate, will be used to reduce disturbance. • Task-specific lighting will be turned off on completion of the task, or at the end of the working day by the contractor. • Contractors will consider the use of sensors or timing devices to automatically switch off lighting, where appropriate.	Construction	Requirement 2 (PW: CoCP)	ES Volume 7, Chapter 6, Section 6.4 b)	YOX-TE7.
YOX-LV5.	Landscape and visual	Secondary	To minimise landscape and visual effects.	**Maintenance of planting** New planting would require maintenance and management during its lifetime, with replacement of plant failures during the first few years of establishment.	Operation	Requirement 23 (AD: Landscape planting)	ES Volume 7, Chapter 6, Section 6.4 d)	

1.8 Freight Management Facility

1.8.1 Table 1.7 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the freight management facility.

Table 1-7: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the freight management facility

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
FMF-NV1.	Noise and vibration	Primary	To minimise noise and vibration impacts.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 would be followed, as set out in the **Code of Construction Practice** (**CoCP**) (Doc Ref 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 8, Chapter 4, Section 4.5	
FMF-NV2.	Noise and vibration	Tertiary	To minimise noise and vibration impacts.	**Management measures to reduce construction traffic noise** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7), and a **Construction Worker Travel Plan** (Doc Ref. 8.8) would help to reduce and manage the effects of traffic generated by the Sizewell C Project including the freight management facility (see **Volume 2, Chapter 10** of the **ES**).	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 8, Chapter 4, Section 4.5	FMF-AQ4. FMF-AR6.
FMF-NV3.	Noise and vibration	Tertiary	~~To minimise the impacts of noise.~~To reduce noise from construction and road operational noise sources at noise-sensitive receptors	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise insulation or temporary rehousing may be	Construction and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 8, Chapter 4, Section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.				
FMF-AQ1.	Air quality	Primary	To minimise dust impacts.	**Site layout** Primary mitigation comprises: • Site access would be located at least 10m, from receptors. • Re-use of soils on-site to form landscape bunds instead of transporting them for off-site storage.	Construction and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 2 (PW: CoCP)	ES Volume 8, Chapter 5, Section 5.5	FMF-LV4.
FMF-AQ2.	Air quality	Primary	To minimise traffic emissions.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction of the Sizewell C Project which will also minimise impacts from the construction, operation and removal and reinstatement of the freight management facility. These measures are set out in **Volume 2, Chapter 10** of the **ES**. The proposed development is one of these primary measures.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design)	ES Volume 8, Chapter 5, Section 5.5	
FMF-AQ3.	Air quality	Tertiary	To minimise dust impacts.	**Construction management measures:** The **CoCP** (Doc Ref. 8.11(~~A~~B)) sets out control measures to manage construction impacts on air quality, including: • Re-use of soils on-site to form landscape bunds instead of transporting them for off-site storage. • Use of surface covering (such as seeding of earthworks and hardstanding surface/permeable paving for parking areas) to minimise extent of exposed soils and minimise potential resuspension of dust. • Avoid site run-off of water or mud. • Cover, seed or fence stockpiles to prevent wind whipping. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s)	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 8, Chapter 5, Section 5.5 ES Addendum Volume 1, Chapter 8, Section 8.2	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				accountable for air quality and dust issues on the site boundary. • Develop and implement a Dust Management Plan, which may include measures to control other emissions as part of the **CoCP** (Doc Ref. 8.11~~A~~B). ~~• Contractors will seek to ensure that all road vehicles will comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
FMF-AQ4.	Air quality	Tertiary	To minimise traffic emissions.	**Management measures to reduce construction traffic emissions** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7) and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to help govern worker behaviour and reduce and manage the effects of	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 8, Chapter 5, Section 5.5	FMF-NV2. FMF-AR6.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				traffic generated by the Sizewell C Project (see **Volume 2, Chapter 10** of the **ES**).				
FMF-LV1.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Retention of existing vegetation** Retention of existing vegetation on site where possible to provide visual screening of the site for PRoW and road users. The retention of vegetation is shown on the **Freight Management Facility Site Clearance Plan** (Doc Ref. 2.11).	Construction, operation and removal and reinstatement	Requirement 19 (AD: Site clearance plans)	ES Volume 8, Chapter 5, Section 5.5	FMF-TE1. FMF-HE1.
FMF-LV2.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Proposed planting**Propose planting would provide additional screening around all boundaries of the site, to supplement the existing boundary vegetation. A 10m landscaped buffer zone is proposed to the northern, eastern and western boundaries, which would enhance existing vegetation in these areas. This planting would be retained during the removal and reinstatement phase, subject to landowner approval.The proposed planting is shown on the **Freight Management Facility Proposed Landscape Masterplan and Finished Levels** (Doc Ref. 2.11).	Operation and removal and reinstatement	DCO Article 3 (Scheme design)Requirement 20 (AD Buildings and structures)Requirement 23 (AD: Landscape planting)	ES Volume 8, Chapter 6, Section 6.5	FMF-TE5.FMF-HE5.
FMF-LV3.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Reinstatement planting** Temporary hedgerow planting within the site would be removed and reinstated along the original hedgerow lines. This is shown on the **Freight Management Facility Removal and Reinstatement Plan** (Doc Ref. 2.11)	Removal and reinstatement	DCO Article 3 (Scheme design) Requirement 20 (AD Buildings and structures) Requirement 24 (AD: Removal and reinstatement)	ES Volume 8, Chapter 6, Section 6.5	FMF-TE9.
FMF-LV4.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Landscape bunds** The creation of three grassed landscaped bunds up to 3m high to parts of the eastern and western edges of the site using on-site material removed due to earthworks associated with the levelling of the site and topsoil storage. The landscape bunds is shown on the **Freight Management Facility Proposed Landscape Masterplan and Finished Levels** (Doc Ref. 2.11).	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 23 (AD: Landscape planting) Requirement 2 (PW: CoCP)	ES Volume 8, Chapter 6, Section 6.5	FMF-TE2. FMF-AR1. FMF-HE4.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
FMF-LV5.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Building/ Structure design and site layout** • A general design approach aiming to create an unimposing appearance, with the buildings screened as far as possible and a maximum height of 4m. • The canopy over the screen and search bays would have a maximum height of 6m and would be open sided, with the width of columns and the roof structure minimised to reduce the visual impact.	Operation	DCO Article 3 (Scheme design) Requirement 20 (AD Buildings and structures)	ES Volume 8, Chapter 6, Section 6.5	
FMF-LV6.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Operational lighting** • Lighting columns within the car parking areas and along the access road would be restricted to 8m in height to minimise visibility during day and night time. Lanterns would utilise LED based light fittings with zero-degree tilt, and lighting along the perimeter would be fitted with a demountable light shield to reduce backward spill of light. • To further assist on mitigating obtrusive light, a Central Management System has been proposed which would be capable of dimming parts of the site independently as usage changes throughout the day.	Operation	Requirement 20 (AD: Buildings and structures)	ES Volume 8, Chapter 6, Section 6.5	FMF-NV1.
FMF-LV7.	Landscape and visual	Primary	To minimise landscape and visual effects.	**Removal and reinstatement** • Following cessation of use of the proposed development, the buildings, lighting, surfacing and associated infrastructure, including drainage, would be removed. The widened Felixstowe Road would remain in place but the road marking and signage for access to the site would be removed during the removal and reinstatement. • The topsoil stored in the landscape bunds would be used for reinstatement and the area would be returned to agricultural use.	Removal and reinstatement	Requirement 24 (AD: Removal and reinstatement)	ES Volume 8, Chapter 6, Section 6.5	FMF-TE8. FMF-HE2.
FMF-LV8.	Landscape and visual	Tertiary	To minimise landscape and visual effects.	**Construction lighting** To minimise the adverse effects of lighting during construction: • Where construction lighting is required, minimum light levels for safe working and the minimum number of lighting elements to illuminate the work area safely will be used. • Lighting will be directed away from site boundaries to minimise nuisance from light spill. If lights cannot be positioned in such way because of physical constraints or for safety reasons, then	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 8, Chapter 6, Section 6.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				local screening of the lights, including shielding of luminaires, where appropriate, will be used to reduce disturbance. • Task-specific lighting will be turned off on completion of the task, or at the end of the working day by the contractor. • Contractors will consider the use of sensors or timing devices to automatically switch off lighting, where appropriate.				
FMF-LV9.	Landscape and visual	Secondary (monitoring)	To monitor planting activities.	**Maintenance of planting** The proposed planting would require maintenance and management during the operation of the proposed development, with replacement of plant failures during the first few years of establishment (usually 5 years) as required.	Operation	Requirement 23 (AD: Landscape planting)	ES Volume 8, Chapter 6, Section 6.7	

1.9 Rail

1.9.1 Table 1.8 provides a summary of the mitigation measures of relevance to inter-relationship effects assessment for the rail proposals.

Table 1-8: Summary of the mitigation measures of relevance to inter-relationship effects assessment for the rail proposals

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
GRR-NV1.	Noise and vibration	Primary	To minimise the impacts of noise on the surrounding area.	**Use of rail** There will be no train movements through Leiston at night east of Saxmundham Road Level Crossing the early years prior to operation of the full green rail route.	Operation	Requirement 25 (Rail Noise ~~Mitigation Strategy~~)	ES Volume 9, Chapter 4, Section 4.5	
GRR-NV2.	Noise and vibration	Primary	To minimise the impacts of noise on the surrounding area.	**Rail design** • The upgraded Saxmundham to Leiston branch line track would be continuously welded rail which would reduce noise and vibration generation. • Speed limit restrictions are proposed for freight trains using this line as a result of the construction of Sizewell C nuclear power station at night on parts of the East Suffolk line and Sizewell to Leiston branch line. In general, the maximum speed along the line would be limited to 20mph, however, in three locations on the East Suffolk line, Woodbridge and Melton, Campsea Ashe and Saxmundham, trains would be required to travel no faster than 10mph at night. A 10mph speed limit will also apply during the daytime and night-time along the Sizewell to Leiston branch line in the early years. Speed limits on the Saxmundham to Leiston branch line and rail extension route in the later years are subject to further assessment of the effectiveness of the installed mitigation. Locations of the East Suffolk line speed limits are shown in **Figures 4.2**, **4.3** and **4.4** in **Volume 9** of the **ES**.	Operation	Requirement 25 (Rail Noise ~~Mitigation Strategy~~)	ES Volume 9, Chapter 4, Section 4.5 ES Addendum Volume 1, Chapter 9, Section 9.3	
GRR-NV3.	Noise and vibration	Tertiary	To minimise the impacts of noise and vibration.	**Construction management measures: noise and vibration** The standard of good practice outlined in BS 5228-1 and BS 5228-2 would be followed, as set out in the **Code of Construction Practice** (**CoCP**) (Doc Ref 8.11), including: • Selection of quiet plant and techniques in accordance with good practice in BS5228 for all construction, demolition and earthmoving activities. • Switching off equipment when not required. • Use of reversing alarms that ensure proper warning, whilst minimising noise impacts off site. • Provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts. BS 5228-2 gives detailed advice on standard good	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 9, Chapter 4, Section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				practice for minimising impacts from construction vibration. The key requirements of BS5228-2 are set out in the **CoCP** (Doc Ref. 8.11), and contractors will be required to adhere to this.				
GRR-NV4.	Noise and vibration	Tertiary	To minimise the impacts of noise and vibration.	**Monitoring and management of any noise or vibration complaints** Routine monitoring would be carried out in accordance with the **CoCP** (Doc Ref. 8.11) and SZC Co. would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 9, Chapter 4, Section 4.5	
GRR-NV5.	Noise and vibration	Secondary	~~To minimise the impacts of noise.~~To reduce noise from construction, road and rail, and operational noise sources at noise-sensitive receptors	**Noise Mitigation Scheme** SZC Co. has established a voluntary Noise Mitigation Scheme which seeks to mitigate residual ~~significant~~ effects above SOAEL on properties from construction or operation of the proposed development, subject to eligibility criteria, as set out in **Volume 2, Appendix 11H** of the **ES**, and updated following discussions with ESC (Doc Ref 6.3 11H(A)) Where specified noise criteria ~~is~~are exceeded, noise insulation or temporary rehousing may be provided. SZC Co. will undertake further assessment and engage with stakeholders to further understand the affected receptors and their use.	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (Noise Mitigation Scheme)	ES Volume 9, Chapter 4, Section 4.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
GRR-NV6.	Noise and vibration	Secondary	To minimise the impacts of noise.	**Additional mitigation - Construction** • Exact working methods and plant to be used will not be determined until a contractor is appointed and therefore precise details of noise mitigation measures cannot yet be established. As set out in the **CoCP** (Doc Ref. 8.11), mitigation measures that could be implemented during construction to minimise construction noise include selection of alternative plant or working methods, barrier screening and/or stand-off margins and/or alternative plant. • Contractors will be required to identify mitigation to avoid significant construction noise and vibration effects, as far as reasonably practicable. Construction mitigation measures may include additional screening or changing working methods and times, including limiting noisy activities on Saturday afternoons.	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 9, Chapter 4, Section 4.7	
GRR-NV7.	Noise and vibration	Secondary	To minimise the impacts of noise.	**Rail noise mitigation strategy -airborne noise** • SZC Co. would develop a Rail Noise Mitigation Strategy in consultation with Network Rail and the rail freight operator, informed by the further detailed assessments, to establish the package of measures to be implemented to mitigate noise impacts on the Saxmundham to Leiston branch line and the East Suffolk line. • It may be possible to use quieter locomotives to pull trains and further work is planned to evaluate the potential effectiveness of this. • Some mitigation of noise levels may also be possible at Saxmundham, where, under present arrangements, trains using the Saxmundham to Leiston branch line for the Sizewell C Project would need to stop at Saxmundham and then pull away under load twice each time they pass. This is because the system in place for changing points and ensuring branch line safety requires this. Further details of this system are provided in Annex G of **Appendix 4B** (**Volume 9** of the **ES**).	Operation	Requirement 25 (Rail Noise ~~Mitigation Strategy~~)	ES Volume 9, Chapter 4, Section 4.7	

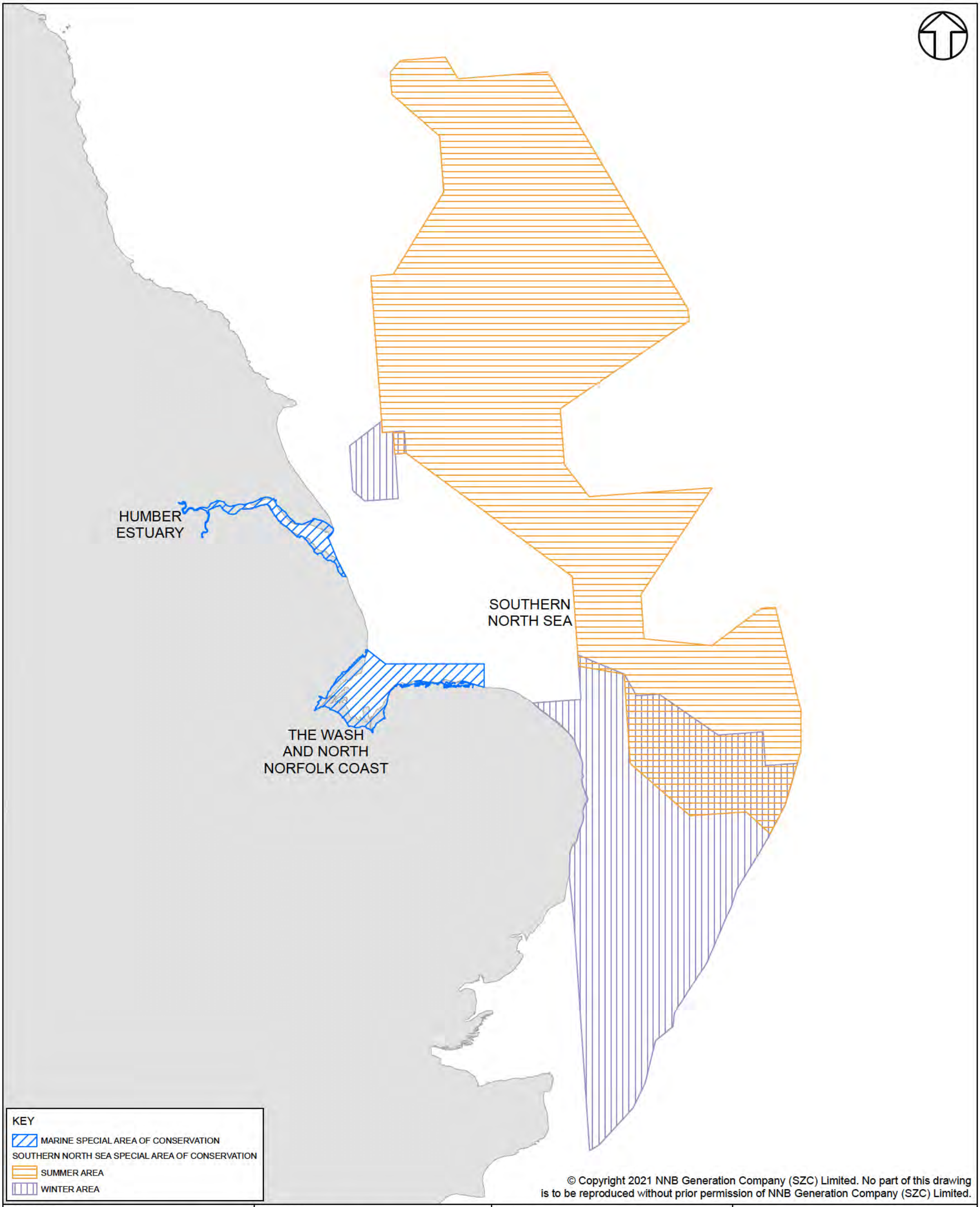
Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
GRR-NV8.	Noise and vibration	Secondary	To minimise the impacts of noise.	**Rail noise mitigation strategy - groundbourne noise** • When track is being upgraded on the Saxmundham to Leiston branch line or laid for the rail extension, under-ballast mats (or equivalent) will be used where the track is within 15m of a residential property. ~~vibration isolating track support systems will be used to achieve an LASmax level of below 45dB within any adjacent property.~~ • For the East Suffolk line, further assessment has been undertaken and a more stringent approach to the assessment of groundborne noise adopted, whereby groundborne noise is combined with low frequency airborne noise and assessed against the same criteria as set out in **Volume 9, Chapter 4** of the **ES** (Doc Ref 6.10) [APP-545]. The combined assessment of groundborne and low frequency airborne noise has shown that there are only two locations where major adverse effects are likely without mitigation, and in both instances improvements to their glazing/sound insulation under the 'Noise Mitigation Scheme' (**Volume 2, Appendix 11H** of the **ES** (Doc Ref 6.3) [APP-210]) are expected to reduce the airborne component of the internal sound level, such that no significant adverse effects on health and quality of life occur. ~~should there be any properties within 5m or 10m of the line where Sizewell C freight trains travel at 10mph or 20mph respectively, further, more detailed assessment would be undertaken to determine the site specific exposure to groundborne noise to fully quantify the likelihood of residual adverse effects.~~	Operation	Requirement 25 (Rail Noise ~~Mitigation Strategy~~)	ES Volume 9, Chapter 4, Section 4.7 ES Addendum Volume 1, Chapter 9, Section 9.3	
GRR-AQ1.	Air quality	Primary	To minimise the impacts of transport emission on air quality.	**Design measures to minimise transport emissions across Sizewell C Project** There are primary measures to minimise and manage additional traffic on the roads associated with the construction and operation of the Sizewell C Project. These measures are set out in **Volume 2, Chapter 10** of the **ES.** The proposed green rail route is one of these measures.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) ~~Section 106 agreement~~ Deed of Obligation (Implementation plan)	ES Volume 9, Chapter 5, Section 5.5	
GRR-AQ2.	Air quality	Primary	To minimise the impacts of dust.	**Site layout** Primary mitigation for construction of the proposed development includes: • Site access would be located at least 10m, from receptors. • Re-use of soils on-site to form landscape bunds instead of transporting them for off-site storage.	Construction	DCO Article 3 (Scheme design) Requirement 2 (PW: CoCP)	ES Volume 9, Chapter 5, Section 5.5	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				• Ballast stockpiling located as far as practicable from receptors.				
GRR-AQ3.	Air quality	Tertiary	To minimise the impacts of noise and vibration.	**Measures to manage construction traffic** During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7) and a **Construction Worker Travel Plan** (Doc Ref. 8.8) will be implemented to reduce and manage the effects of traffic generated by the Sizewell C Project (see **Volume 2 Chapter 10** of the **ES**).	Construction, operation and removal and reinstatement	~~Section 106 agreement~~ Deed of Obligation (CTMP and CWTP)	ES Volume 9, Chapter 5, Section 5.5	GRR-AR10.
GRR-AQ4.	Air quality	Tertiary	To minimise the impacts of dust on air quality.	**Construction management measures: air quality** The **CoCP** (Doc Ref. 8.11(AB)) sets out control measures to manage construction impacts on air quality, including: • Re-use of soils on-site to form bunds instead of transporting them for off-site storage. • Use of surface covering (seeding of earthworks, hardstanding surface for car park) to minimise extent of exposed soils and minimise potential resuspension of dust. • Avoid site run-off of water or mud. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. • Develop and implement the dust management measures, as set out in the **CoCP** (Doc Ref. 8.11(~~AB~~)). ~~• Contractors will seek to ensure that all road vehicles will comply with the requirements of Euro VI emission standards where possible and Euro V standards (98/69/EC) as a minimum, unless otherwise agreed with the local authority.~~ ~~• Non-Road Mobile Machinery (NRMM) engines should achieve Stage IV emissions standards where practicable and available.~~ • Use of contractor vehicles as far as practicable that meet the Euro VI emissions standards and Euro V standards (98/69/EC) unless it is an exempt vehicle. A formal exemption process will be used for certain HDVs which may be exempt due to being a specialist vehicle; unforeseen circumstances; triviality (i.e. a small number of	Construction and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 9, Chapter 5, Section 5.5 ES Addendum Volume 1, Chapter 9, Section 9.4	

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
				visits); or being used by a community / local supplier. Any exempt vehicle must meet Euro V standards where possible. The totality of the exemptions will account for no more than 8% of individual vehicles on an annual basis. • Use of non-road mobile machines as far as practicable and available that meet the Stage IV engine standards of the NRMM Emission Standards Directive to minimise NOx and particulate emissions on site. A formal exemptions process will be used to enable use of NRMM that are unable to achieve the target emissions standards for a range of operational reasons, with a target cap on the total percentage of exemptions. A registration scheme will be established requiring NRMM to be registered prior to being allowed access to the project sites.				
GRR-LV1.	Landscape and visual	Primary	To minimise visual and noise impacts on landscape and visual amenity.	**Landscape bund** • The creation of an approximately 2m high grassed visual and noise screening bund along the northern edge of the proposed rail extension route, which widens towards the eastern end of the proposed rail extension route and a second bund (also approximately 2m high) to the south of the rail extension at the eastern end of the proposed rail extension route, west of the B1122 (Abbey Road). • The landscape bunds are shown on the **Green Rail Route Proposed Landscape Masterplan and Finished Levels** (Doc Ref. 2.12). • Both bunds would utilise on-site material removed due to earthworks associated with the alignment of the proposed rail extension route through the landscape and top soil storage.	Construction, operation and removal and reinstatement	DCO Article 3 (Scheme design) Requirement 18 (Rail ~~works~~ infrastructure) Requirement 23 (AD: Landscape planting)	ES Volume 9, Chapter 6, Section 6.5	GRR-TE4. GRR-AR2. GRR-HE2.
GRR-LV2.	Landscape and visual	Primary	To minimise impacts on landscape and visual amenity.	**Retention of woodland and hedgerows** The retention of existing woodland and hedgerows wherever possible, including hedgerows along Abbey Lane and the current alignment of Footpath E-363/003/0. Buckle's Wood falls outside of the site and would not be impacted. Further detail is shown on the **Green Rail Route Site clearance plan** (Doc Ref. 2.12).	Construction, operation and removal and reinstatement	Requirement 18 (Rail ~~works~~ infrastructure) Requirement 19 (AD: Site clearance plans) Requirement 23 (AD: Landscape planting)	ES Volume 9, Chapter 6, Section 6.5	GRR-TE1 GRR-TE2
GRR-LV3.	Landscape and visual	Primary	To minimise impacts on users of the PRoW network.	**Diversions of footpaths** Diversion of existing Footpaths E-363/003/0, E-363/006/0 and E-363/010/0, which currently cross the site to safe crossing points over the rail route at level crossings.	Operation	~~DCO Article 14 to 16 (Rights of Way)~~ Requirement 6A	ES Volume 9, Chapter 6,	GRR-AR6.

Ref	Topic	Mitigation type (IEMA)	Effect	Mitigation / commitment	Phase (Construction, Operation and/or removal and reinstatement)	Securing Mechanism	Source	Related Mitigation
						(Public Rights of Way)	Section 6.5	
GRR-LV4.	Landscape and visual	Primary	To minimise lighting impacts.	**Operational lighting** The level crossing lighting would be designed so as to not cause substantial levels of glare to road users, train drivers or signallers and others operating the crossing.	Operation	Requirement 18 (Rail ~~works~~ infrastructure)	ES Volume 9, Chapter 6, Section 6.5	GRR-TE7.
GRR-LV5.	Landscape and visual	Primary	To minimise impacts on landscape and visual amenity.	**Reinstatement of land** Following the completion of SZC track bed and level crossings would be removed to revert area back to original topography (boundary hedgerows would be reinstated and the area would then be returned to agricultural use). Further detail is shown on the **Green Rail Route Removal and Reinstatement Plans** (Doc Ref. 2.12).	Removal and reinstatement	DCO Article 3 (Scheme design) Requirement 24 (AD: Removal and Reinstatement)	ES Volume 9, Chapter 6, Section 6.5	GRR-TE3. GRR-TE8.
GRR-LV6.	Landscape and visual	Tertiary	To minimise impacts on landscape and visual amenity.	**Construction lighting** To minimise the adverse effects of lighting during construction: • Minimum light levels for safe working and the minimum number of lighting elements to illuminate the work area safely will be used. • Lighting will be directed to minimise nuisance to adjacent properties. If lights cannot be positioned in such way because of physical constraints or for safety reasons, then local screening of the lights, including shielding of luminaires, where appropriate, will be used to reduce light spill. • Task-specific lighting will be turned off on completion of the Task, or at the end of the working day by the contractor. • Spotlights and Task lighting towers will be positioned away from sensitive receptors, where identified. • Contractors will consider the use of sensors or timing devices to automatically switch off lighting, where appropriate.	Construction, operation and removal and reinstatement	Requirement 2 (PW: CoCP)	ES Volume 9, Chapter 6, Section 6.5	GRR-TE11.
GRR-LV7.	Landscape and visual	Secondary	To minimise landscape and visual impacts.	**Maintenance of planting** The proposed planting would require maintenance and management during the operation of the proposed development, with replacement of plant failures during the first few years of establishment (usually 5 years) as required.	Operation	Requirement 23 (AD: Landscape planting)	ES Volume 9, Chapter 6, Section 6.7	

APPENDIX 13C UPDATED FIGURE 22.15 OF VOLUME 2, CHAPTER 22 OF THE ES



DRAWING TITLE:
LOCATION OF DESIGNATED SITES OF RELEVANCE FOR MARINE MAMMALS IN RELATION TO THE PROPOSED DEVELOPMENT

NOT PROTECTIVELY MARKED

DRAWING NO:
FIGURE 22.15

DATE: APRIL 2021 | DRAWN: R.D.H. | SCALE : 1:1,535,000 @A3

DOCUMENT:
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ENVIRONMENTAL STATEMENT
VOLUME 2
CHAPTER 22
MARINE ECOLOGY AND FISHERIES

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