

Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three Offshore Wind Farm

Preliminary Environmental Information Report:
Chapter 11 - Inter-related Effects (Onshore)

Date: July 2017

Hornsea 3
Offshore Wind Farm

DONG
energy

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 3

Chapter 11 – Inter-related Effects (Onshore)

Report Number: P6.3.11

Version: Final

Date: July 2017

This report is also downloadable from the Hornsea Project Three offshore wind farm website at: www.dongenergy.co.uk/hornseaproject3

DONG Energy Power (UK) Ltd.

5 Howick Place,

London, SW1P 1WG

© DONG Energy Power (UK) Ltd, 2017. All rights reserved

Front cover picture: Kite surfer near one of DONG Energy's UK offshore wind farms © DONG Energy Hornsea Project Three (UK) Ltd., 2016.

Liability

This report has been prepared by RPS, with all reasonable skill, care and diligence within the terms of their contracts with DONG Energy Power (UK) Ltd.

Table of Contents

11.	Inter-related Effects	1
11.1	Introduction	1
11.2	Purpose of this chapter	1
11.3	Study Area	2
11.4	Planning Policy Context	2
11.5	Consultation	3
11.6	Data Sources	14
11.7	Impact Assessment	14
11.8	Summary	22
11.9	Conclusion	22
11.10	References	23

List of Tables

Table 11.1:	Summary of key consultation issues raised during consultation activities undertaken for Hornsea Three relevant to inter-related effects (onshore)	13
Table 11.2:	Summary of staged approach to the inter-related effects assessment for Hornsea Three	14
Table 11.3:	PEIR topics excluded from further inter-related effects assessment*	15
Table 11.4:	Potential effects for each receptor group	16
Table 11.5:	Definitions of project lifetime and receptor led inter-related effects	17
Table 11.6:	Summary of the potential inter-related effects on people living at dwellings within 350 m of onshore construction activities and 1 km of the operational onshore HVAC booster station and HVDC converter/HVAC substation occurring across all phases of the project (project lifetime effects) and from multiple effects interacting (receptor-led effects)	18
Table 11.7:	Summary of potential inter-related effects on people using public rights of way and other linear routes	20

List of Figures

Figure 11.1:	Hornsea Three inter-related effects study area	4
--------------	--	---

Glossary

Term	Definition
Decibel	Units of sound measurement and noise exposure measurement.
High Voltage Alternating Current	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
Inter-related effects	<p>Those that arise from the combined action of a number of different environmental topic-specific impacts from a single scheme upon a single receptor/resource.</p> <p>Multiple effects on the same receptor arising from Hornsea Three. These occur either where a single effect acts on a receptor over time to produce a potential additive effect or where a number of separate effects, such as noise and visual effects, affect a single receptor (for example, people living nearby).</p>

Units

Unit	Description
km	kilometre
m	metre

Acronyms

Acronym	Description
CoCP	Code of Construction Practice
DCO	Development Consent Order
EIA	Environmental Impact Assessment
HVAC	High Voltage Alternating Current
IPC	Infrastructure Planning Commission
NPS	National Policy Statement
NPS EN-1	Overarching National Policy Statement for Energy
NPS EN-3	National Policy Statement for Renewable Energy Infrastructure
NPS EN-5	National Policy Statement for Electricity Networks Infrastructure
PINS	Planning Inspectorate
PRoW	Public Right of Way
SoS	Secretary of State

11. Inter-related Effects (Onshore)

11.1 Introduction

11.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the findings to date of the Environmental Impact Assessment (EIA) of the onshore elements of the Hornsea Project Three offshore wind farm (hereafter referred to as Hornsea Three) relevant to inter-related effects (onshore) (namely the Hornsea Three landfall, the onshore cable corridor search area, the onshore HVAC booster station, the onshore HVDC converter/HVAC substation and the interconnection with the Norwich Main National Grid substation) during its construction, operation and maintenance, and decommissioning. The onshore cable corridor search area comprises a 200 m wide corridor within which the refined onshore cable corridor (80 m) will be located. The refined onshore cable corridor will be included in the application for Development Consent. The onshore HVAC booster station is an option which would only be considered for the HVAC transmission option (see volume 1, chapter 3: Project Description).

11.1.1.2 The assessment of inter-related effects on offshore receptors is presented in Volume 2, Chapter 12 Inter-related Effects (Offshore). Offshore elements have been taken into account where relevant in the onshore chapters.

11.2 Purpose of this chapter

11.2.1.1 The primary purpose of the Environmental Statement is to support the Development Consent Order (DCO) application for Hornsea Three under the Planning Act 2008 (the 2008 Act). This PEIR constitutes the Preliminary Environmental Information for Hornsea Three and sets out the findings of the EIA to date to support pre-application consultation activities required under the 2008 Act. The EIA will be finalised following completion of pre-application consultation and the Environmental Statement will accompany the application to the Secretary of State for Development Consent.

11.2.1.2 The PEIR will form the basis for Phase 2 Consultation which will commence on 27 July and conclude on 20 September 2017. At this point, comments received on the PEIR will be reviewed and incorporated (where appropriate) into the Environmental Statement, which will be submitted in support of the application for Development Consent scheduled for the second quarter of 2018.

11.2.1.3 In particular, this PEIR chapter:

- Presents the receptor groups considered within the inter-related assessment;
- Presents the potential for effects on receptor groups across the three key project phases (construction, operation and maintenance and decommissioning); and
- Presents the potential for multiple effects on a receptor group, as presented within the topic specific chapter, to interact to create inter-related effects.

11.2.1.4 The impact assessment presented within this chapter draws upon the information, assessment and conclusions presented in these chapters:

- Volume 3, chapter 1: Geology and ground Conditions;
- Volume 3, chapter 2: Hydrology and flood risk;
- Volume 3, chapter 3: Ecology and nature conservation;
- Volume 3, chapter 4: Landscape and visual resources;
- Volume 3, chapter 5: Historic environment;
- Volume 3, chapter 6: Land use, agriculture and recreation;
- Volume 3, chapter 7: Traffic and transport;
- Volume 3, chapter 8: Noise and vibration;
- Volume 3, chapter 9: Air quality; and
- Volume 3, chapter 10: Socio-economics.

11.2.1.5 Inter-related effects between topic chapters on onshore receptors are assessed within this chapter. Cumulative effects (i.e. effects arising from other developments acting together with Hornsea Three) are addressed in the individual topic chapters of the PEIR.

11.2.1.6 The EIA Directive states that Environmental Statements should include a description of “*interrelationships*” between environmental aspects likely to be significantly affected by a proposed development. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Paragraph 5) states that “*the EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant impacts of the proposed development on the following factors: a) population and human health; b) biodiversity.....; c) land, soil, water, air and climate; d) material assets, cultural heritage and the landscape; e) the interaction between the factors referred to in sub-paragraphs a) to d).*”

11.2.1.7 Chapters 1 to 10 of volume 3 assess the impacts that may be experienced by topic-specific receptors. The assessments are impact-led i.e. the impacts are identified from the construction, operation and maintenance, and decommissioning phases and are then related to the topic-specific receptors. The topic-specific receptors may experience multiple impacts (for example, ecological receptors may experience a combination of effects such as loss of habitat due to land take, disturbance from noise or light intrusion, or a reduction in water quality). These inter-related effects on the same topic-specific receptors are a key part of the assessments and are reported within the topic-specific chapters. They are not repeated in this chapter.

11.2.1.8 The inter-related effects chapter adopts a different approach by focusing on the receptor and then identifying the impacts which may arise from more than one environmental topic.

11.2.1.9 The approach to identifying and assessing inter-related effects (including the scoping of receptor/resource types affected by in-combination effects) is set out 11.7.1.

11.3 Study Area

- 11.3.1.1 The inter-related effects study area is based on the study areas used in the topic-specific assessments, identified as having potential for inter-related effects (i.e. which are not explicitly addressed elsewhere in the PEIR). The justification behind the selection of the topics that have been included in the inter-related assessment is explained in 11.7.1.7.
- 11.3.1.2 The inter-related effects study area comprises the onshore elements of Hornsea Three (as defined in 11.1.1.1) and the potential locations for the main compound plus a 350 m buffer around the Hornsea Three landfall, onshore cable corridor search area and 1 km buffer around the onshore HVAC booster station and onshore HVDC converter/HVAC converter station. The potential locations of the main compound are identified in volume 1, chapter 3: Project Description.
- 11.3.1.3 The inter-related effects study area is shown on Figure 11.1. The reasoning behind the study areas is summarised below.
- 11.3.1.4 Following the methodology set out in 11.7.1 the onshore receptors/resources most likely to experience inter-related effects are people living in or using the area near Hornsea Three, for example users of Public Rights of Way (PRoW). The impacts most likely to lead to potentially significant effects on these receptors are dust, noise, visual and traffic. As stated in paragraph 11.3.1.1 the inter-related study area is based on the study areas used in the assessments. These are set out below:
- The air quality (construction dust assessment) study area (chapter 9: Air Quality) is based on the area over which dust effects may occur and includes an area extending up to 350 m from the onshore elements of Hornsea Three
 - The noise and vibration assessment (chapter 8: Noise and Vibration) has considered noise sensitive receptors within up to 1 km of the onshore elements of Hornsea Three.
 - The study area for the visual assessment (chapter 4: Landscape and Visual Resources) comprises a 1 km wide corridor study area along the onshore cable corridor search area (including Hornsea Three landfall and intertidal area); and a 5 km radius study area from the outermost edges of the onshore HVAC booster station and HVDC converter/HVAC substation site.
 - In terms of transport impacts (chapter 7: Traffic and Transport), receptors comprise people living in an area, using facilities in an area and using transport networks in an area i.e. a much wider area.
- 11.3.1.5 Based on the above topic specific study areas, it has been deemed appropriate to define the core study area for the assessment of inter-related effects as 350 m from construction activities of the onshore elements of Hornsea Three and 1 km from the onshore HVAC booster station and HVDC converter/HVAC substation operational area as shown Figure 11.1.

- 11.3.1.6 Traffic and visual assessments both consider a wider study area than the core 350 m inter-related effects study area. Visual effects on occupiers of vehicles are assessed in chapter 5: Landscape and Visual Resources. These receptors could also be affected by impacts related to traffic such as driver delay and severance. As such, dynamic receptors are considered in this assessment within the residential receptor group but it is accepted that these receptors could be located outside the 350 m core study area.
- 11.3.1.7 There are 1,682 dwellings within the inter-related study area, however there are no dwellings within the onshore elements of Hornsea Three (i.e. the Hornsea Three landfall, onshore cable corridor search area, onshore HVDC booster station and HVDC converter/HVAC substation).
- 11.3.1.8 The location of the final refined onshore cable corridor, construction compounds, and works locations is not yet confirmed. When it is, it will be possible to group residential receptors by their proximity to defined cable installation operations.

11.4 Planning Policy Context

- 11.4.1.1 Guidance on the issues to be assessed for offshore renewable energy developments is contained in Overarching National Policy Statement (NPS) for Energy (NPS EN-1; DECC, 2011a), the NPS for Renewable Energy Infrastructure (NPS EN-3, DECC, 2011b), the NPS for Electricity Networks Infrastructure (NPS EN-5, DECC, 2011c), and the Marine Policy Statement (MPS; HM Government, 2011).
- 11.4.1.2 This chapter of the PEIR has been compiled following advice from PINS on the need to ensure that inter-related effects are fully addressed in any Environmental Statement accompanying a DCO application. This advice was outlined in Advice Note 9 issued by PINS in April 2012 (PINS, 2012a), which states the following in paragraph 3 of page 7:
- “The Environmental Statement should not be a series of separate unrelated topic reports. The interrelationship between aspects of the proposed development should be assessed and careful consideration should be given by the developer to explain how interrelationships have been assessed in order to address the environmental impacts of the proposal as a whole. It need not necessarily follow that the maximum adverse impact in terms of any one topic impact would automatically result in the maximum potential impact when a number of topic impacts are considered collectively. In addition, individual impacts may not be significant but could become significant when their inter-relationship is assessed. It will be for the developer to demonstrate that the likely significant impacts of the project have been properly assessed.”*
- 11.4.1.3 Section 4.2.6 of NPS EN-1 also states that:
- “The Infrastructure Planning Commission (IPC) should consider how the accumulation of, and interrelationship between, effects might affect the environment, economy and community as a whole, even though they may be acceptable when considered on an individual basis with mitigation measures in place.”*
- 11.4.1.4 There is no policy relevant to inter-related effects in EN-3 or EN-5.

11.5 Consultation

- 11.5.1.1 A summary of the key issues raised during consultation specific to inter-related effects (onshore) is outlined in Table 11.1 below, together with how these issues have been considered in the production of this PEIR. Consultation relating to topic-specific issues is reported in the relevant onshore chapters (chapter 1 to 10).

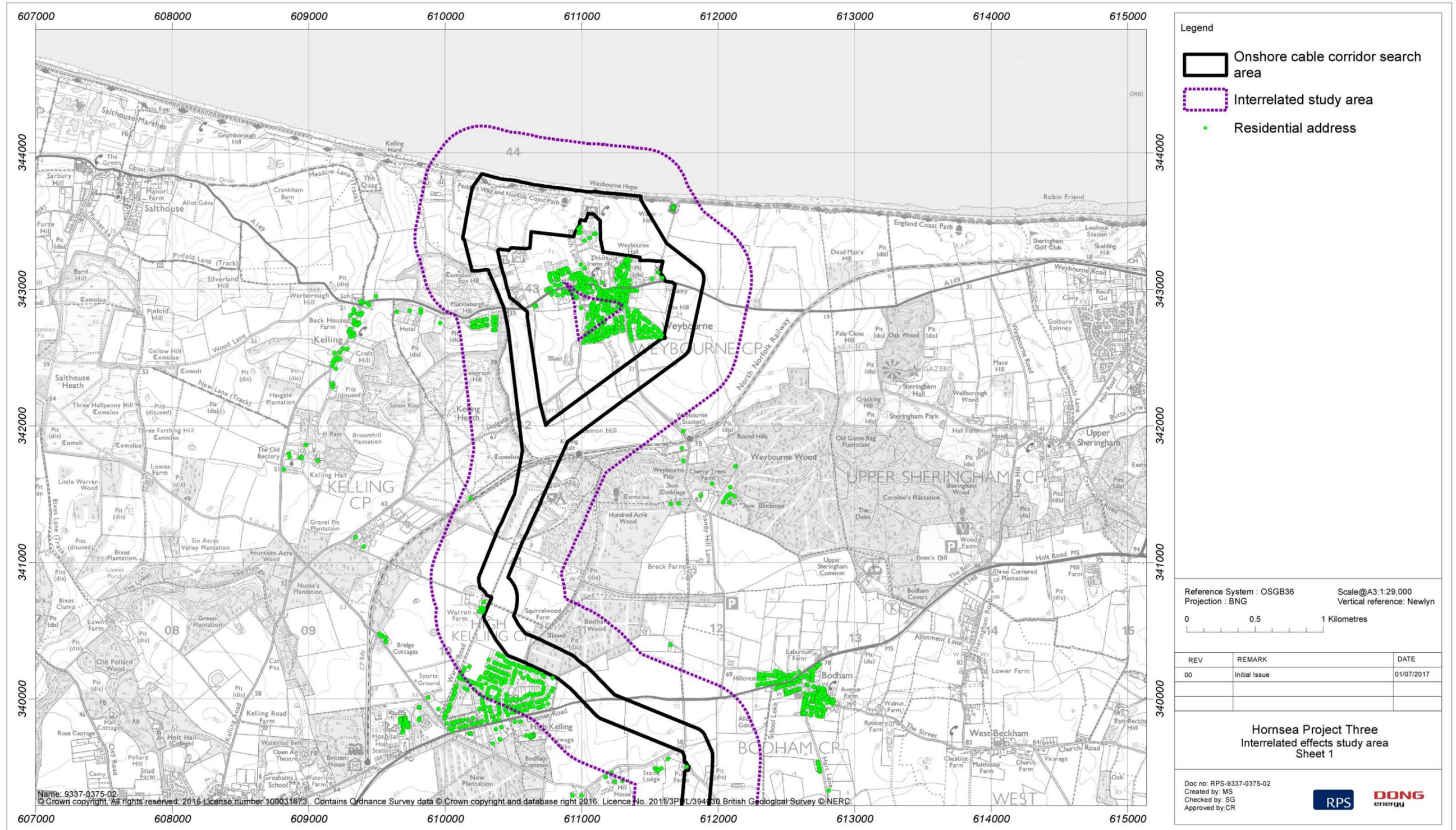


Figure 11.1: Hornsea Three inter-related effects study area

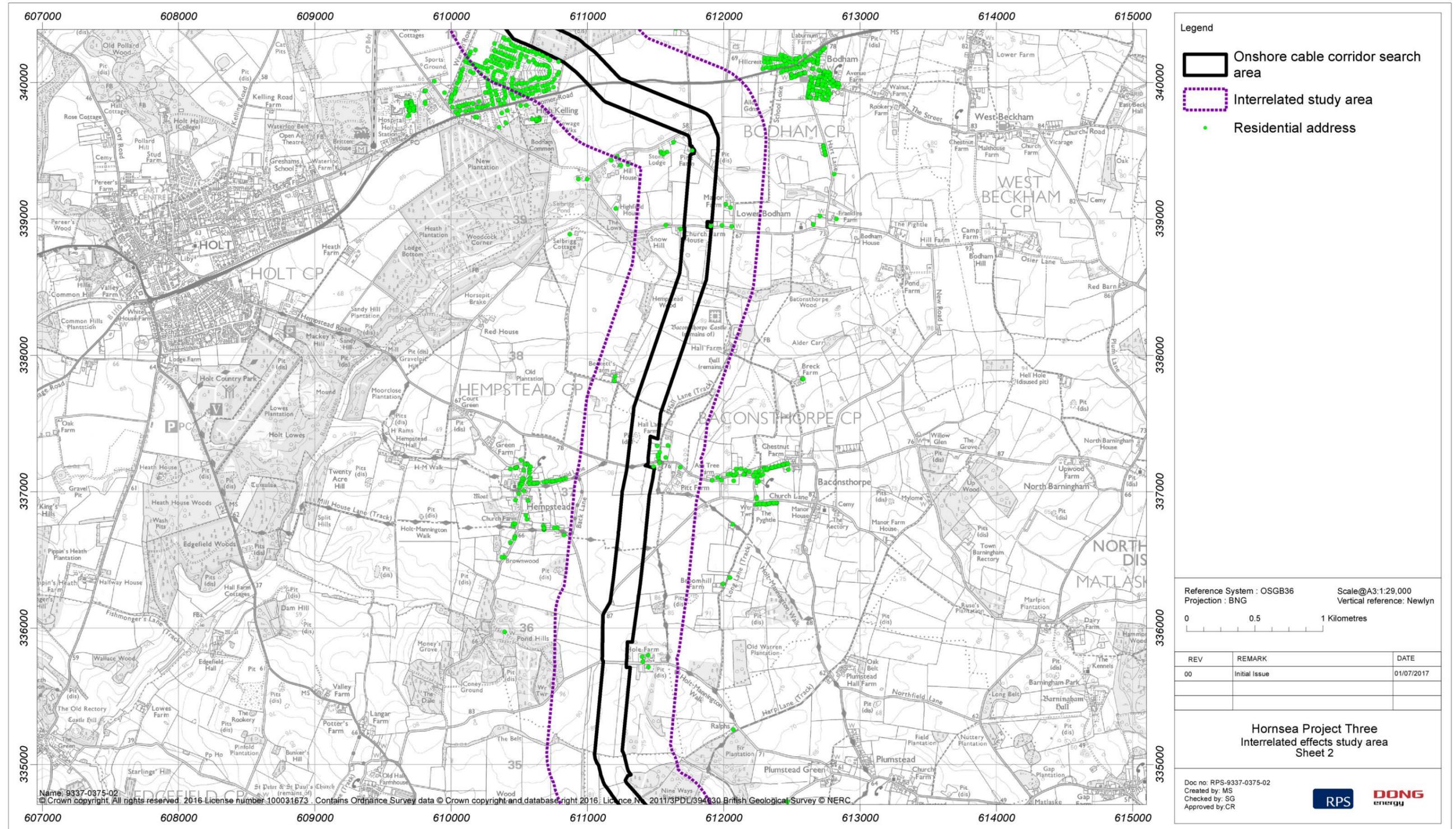


Figure 11.1: Hornsea Three inter-related effects study area

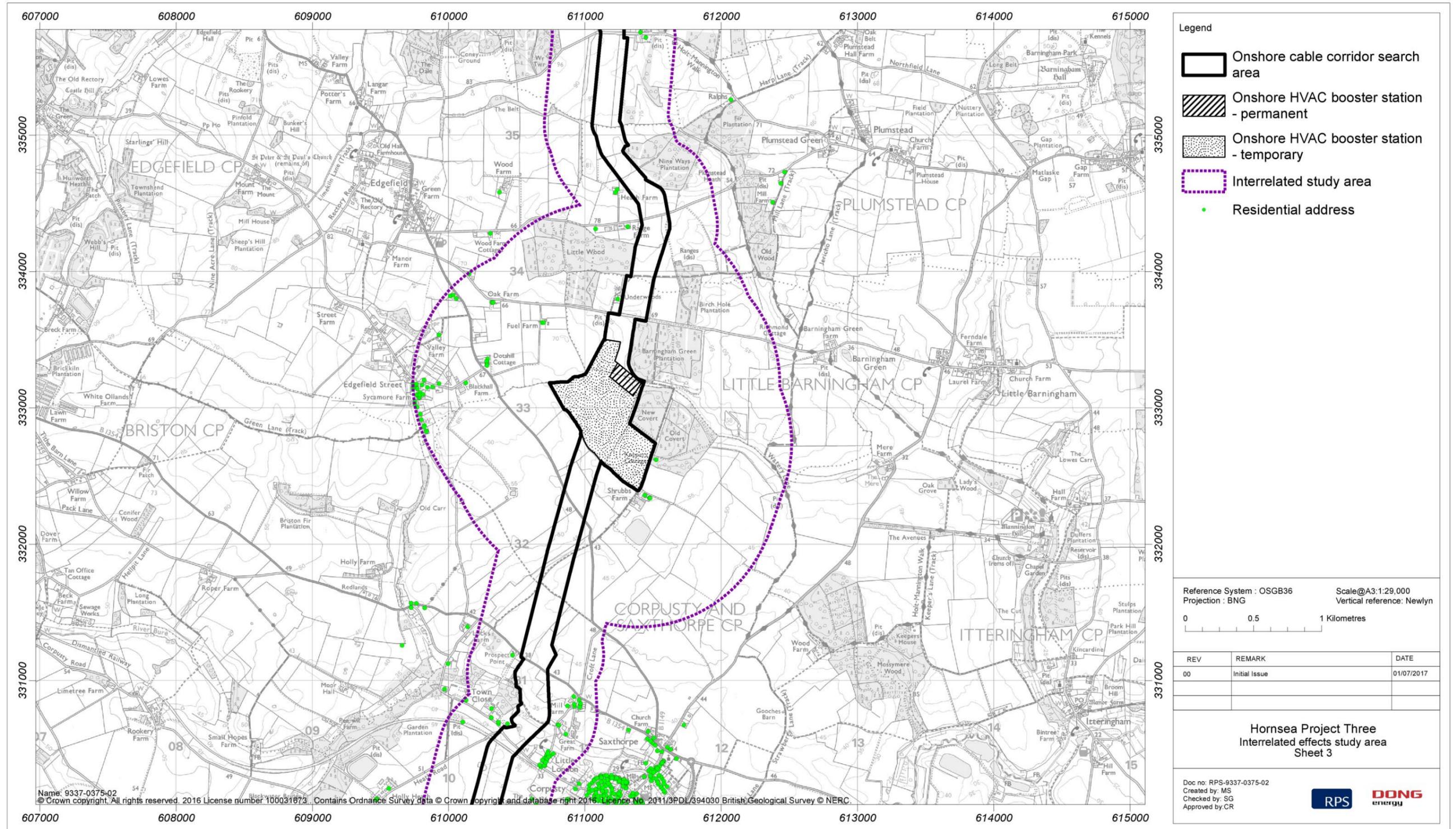


Figure 11.1: Hornsea Three inter-related effects study area

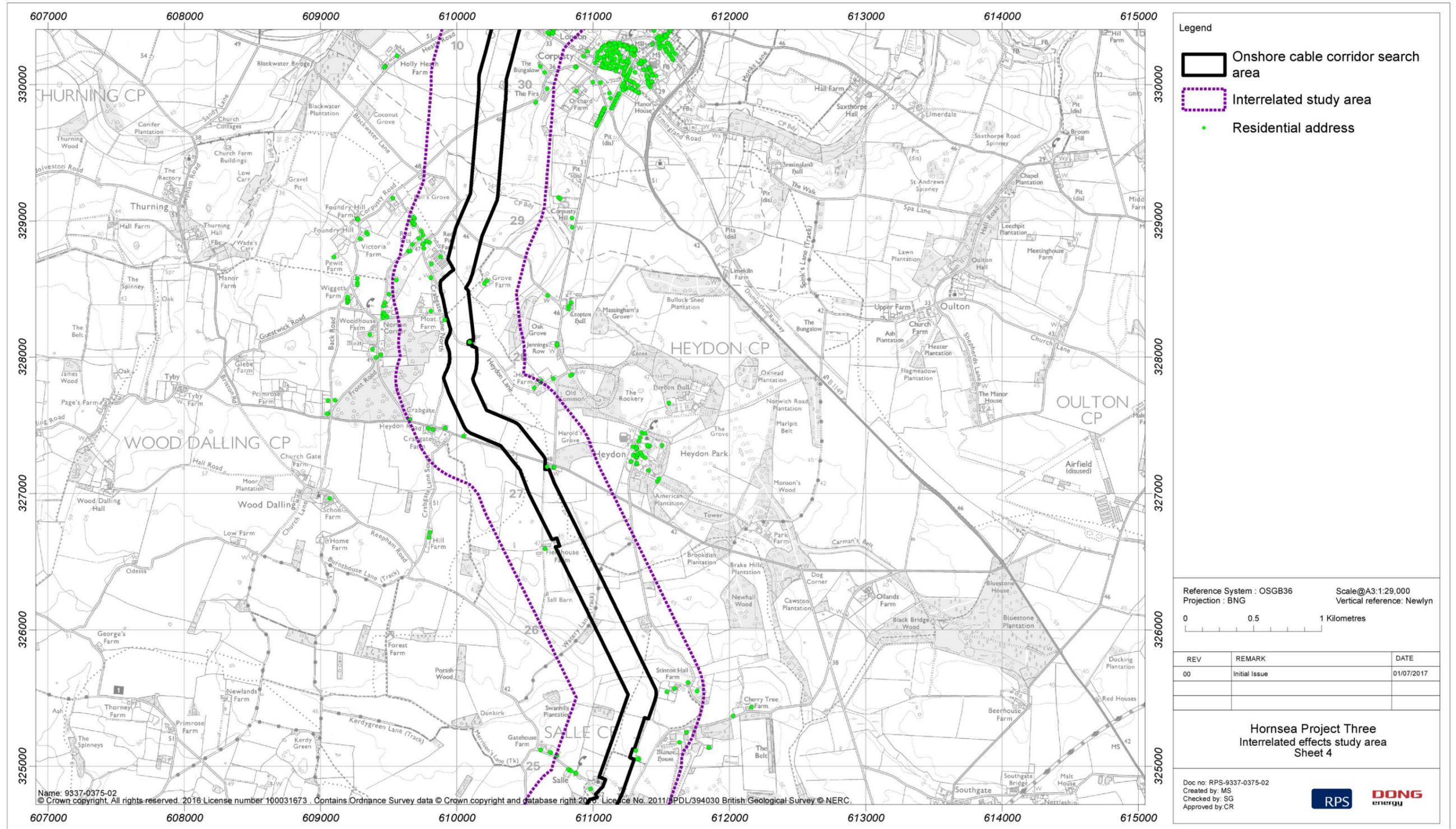


Figure 11.1: Hornsea Three inter-related effects study area

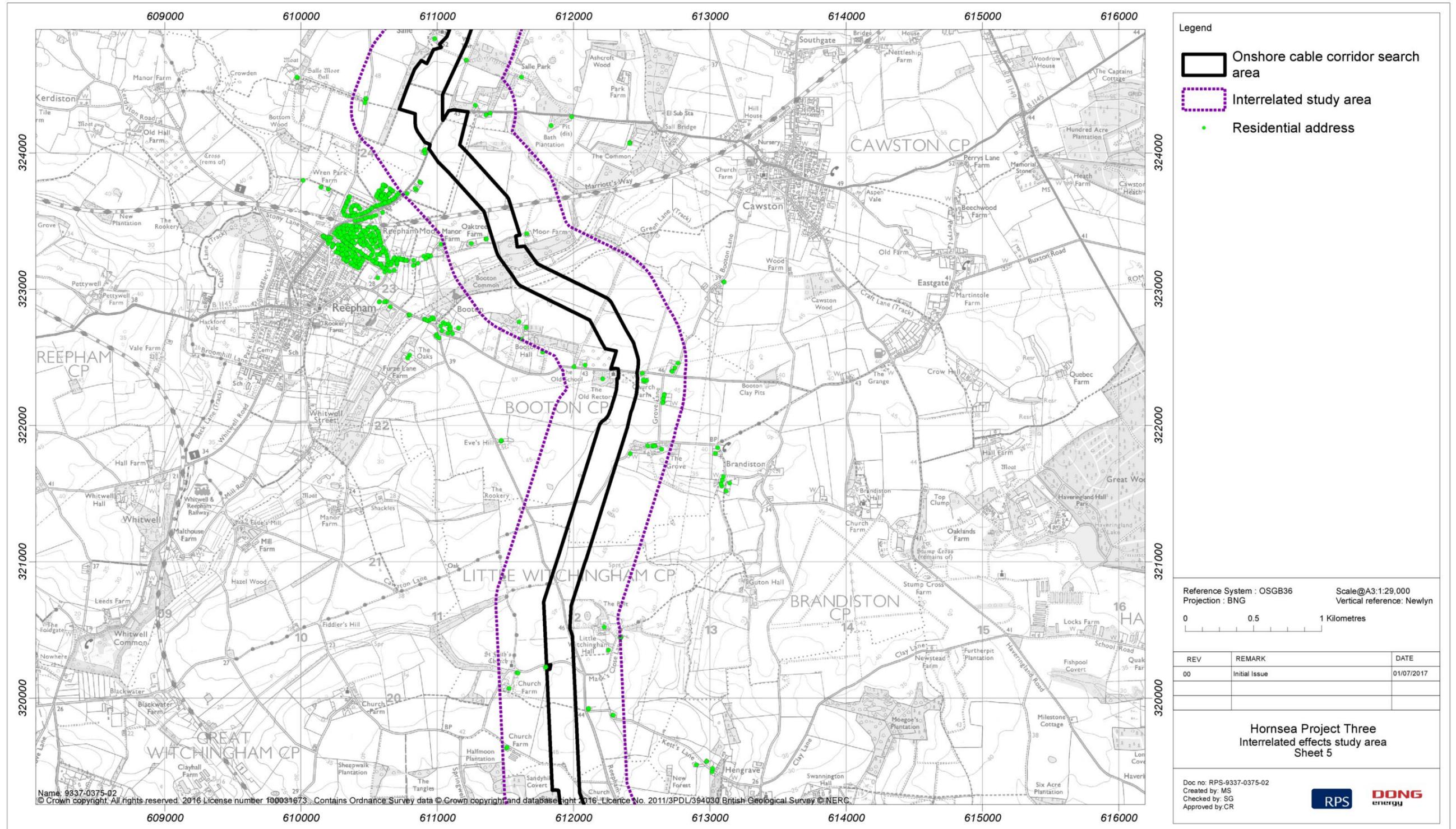


Figure 11.1: Hornsea Three inter-related effects study area

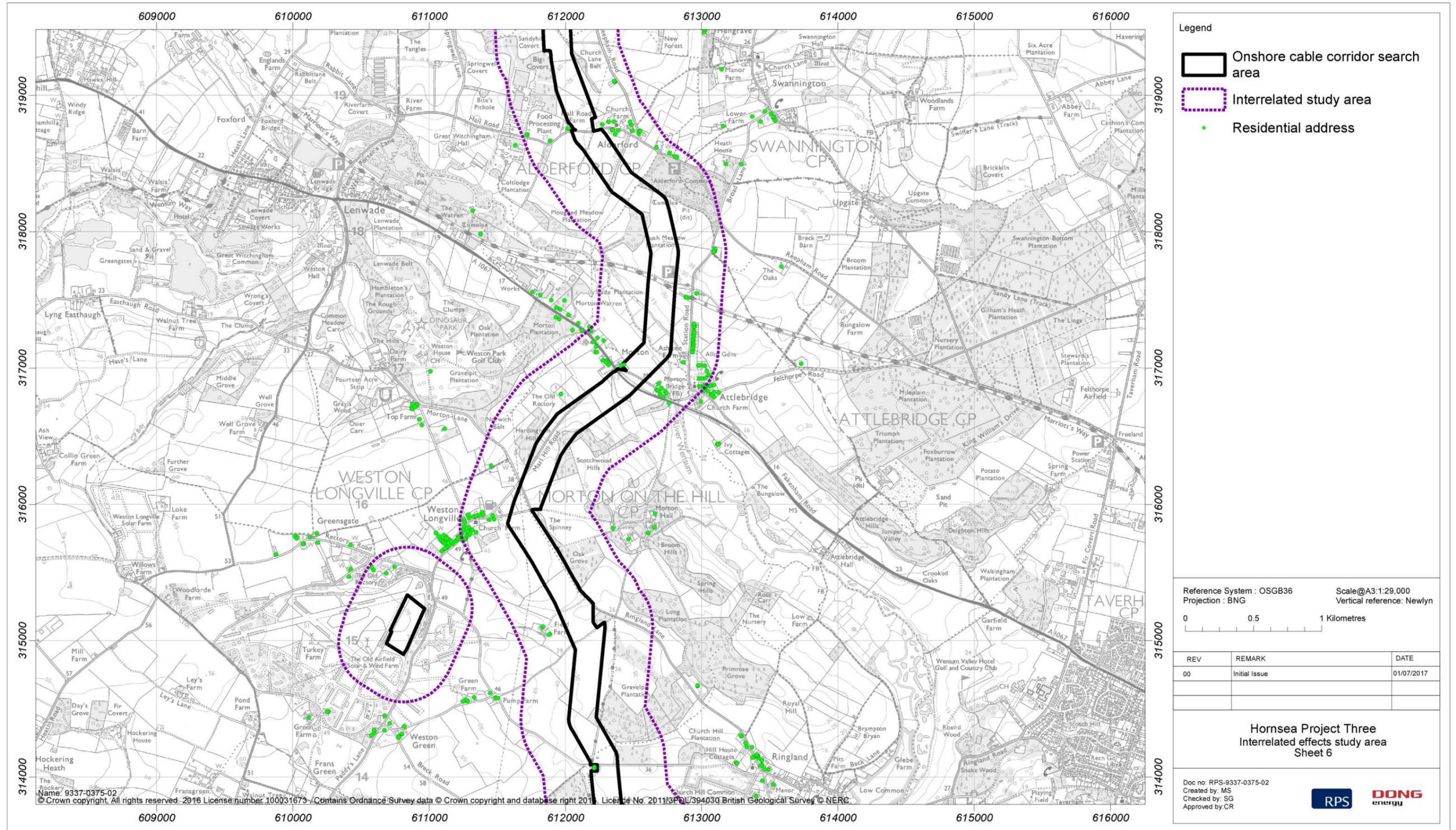


Figure 11.1: Hornsea Three inter-related effects study area

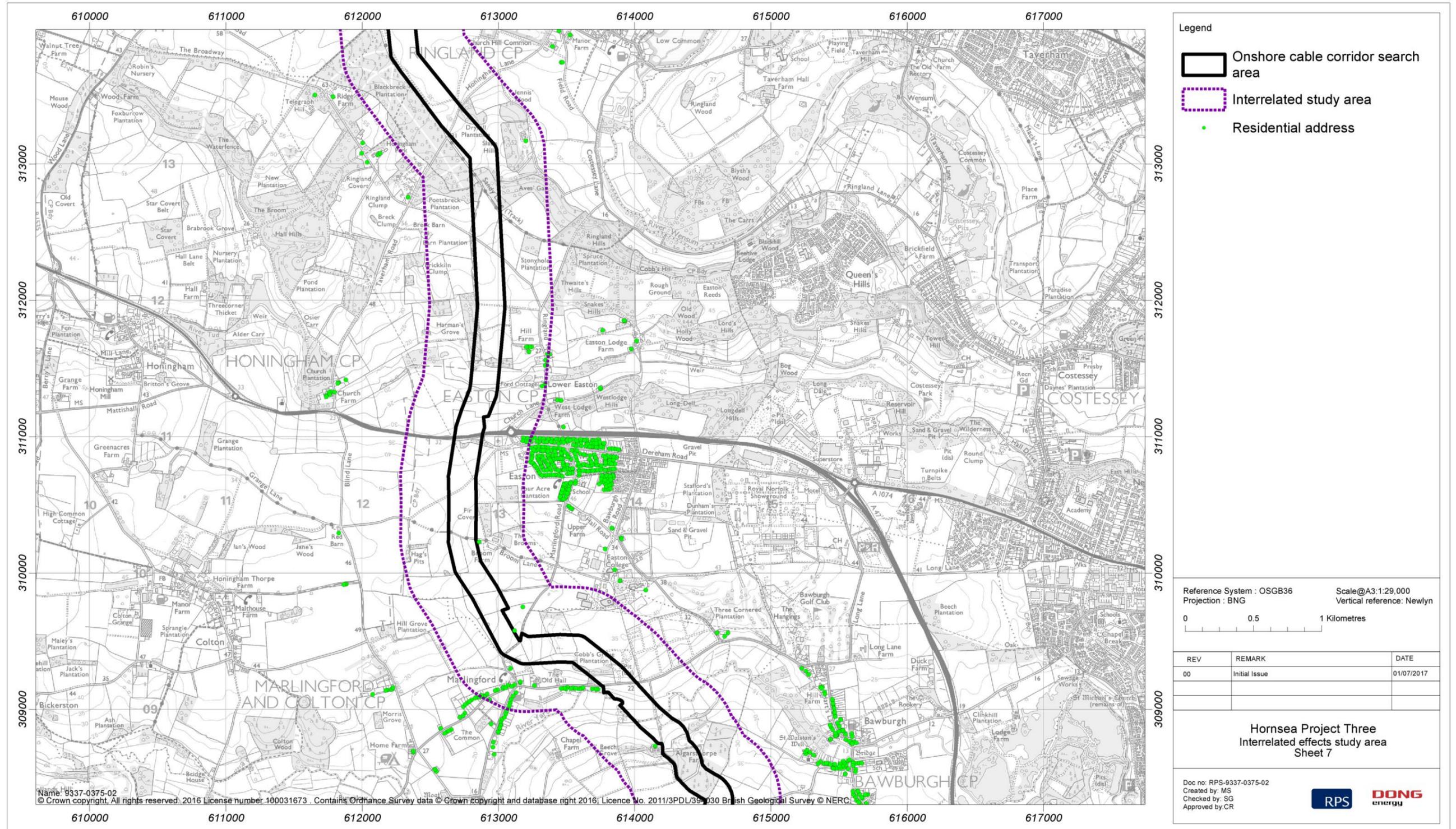


Figure 11.1: Hornsea Three inter-related effects study area

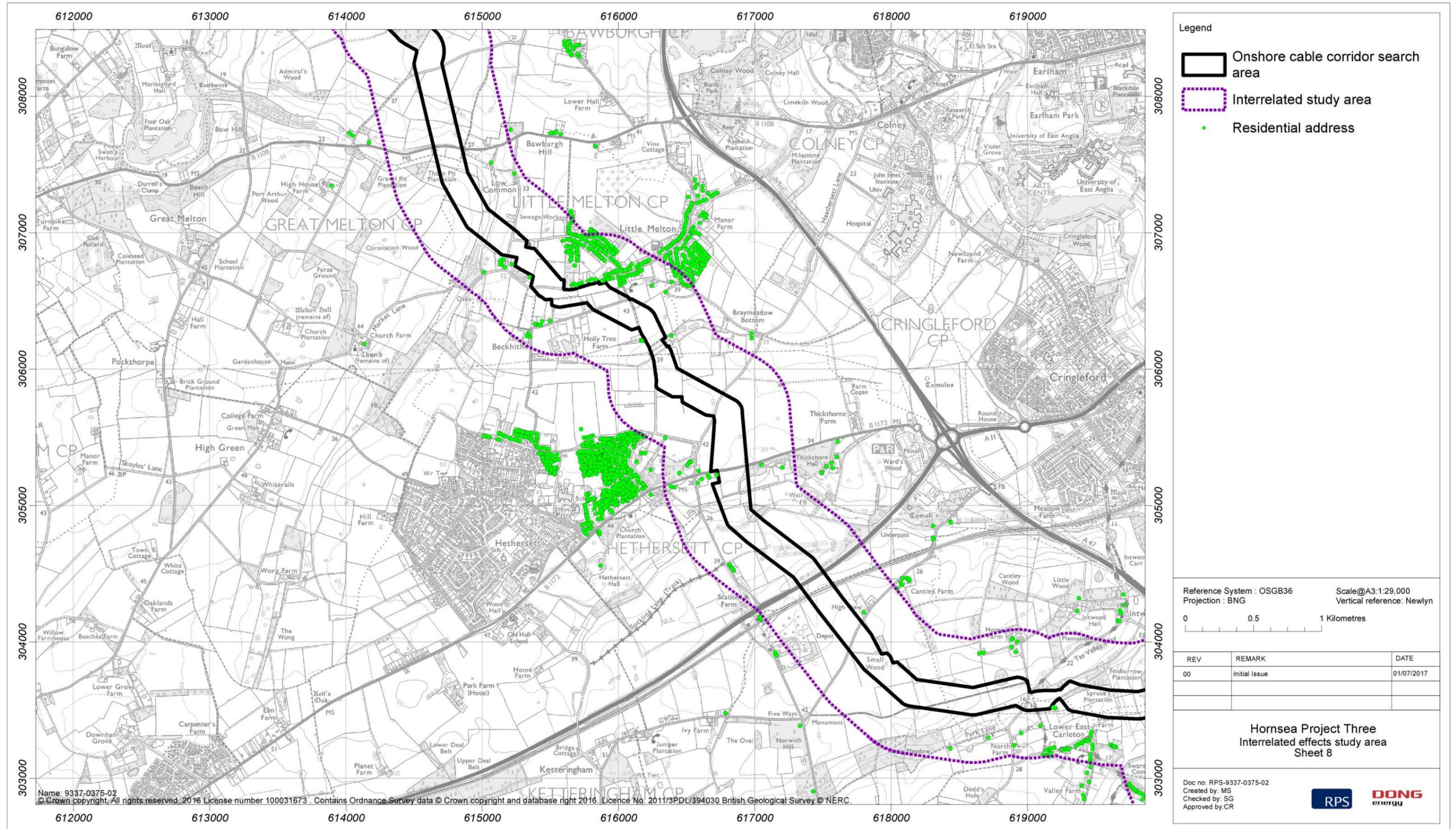


Figure 11.1: Hornsea Three inter-related effects study area

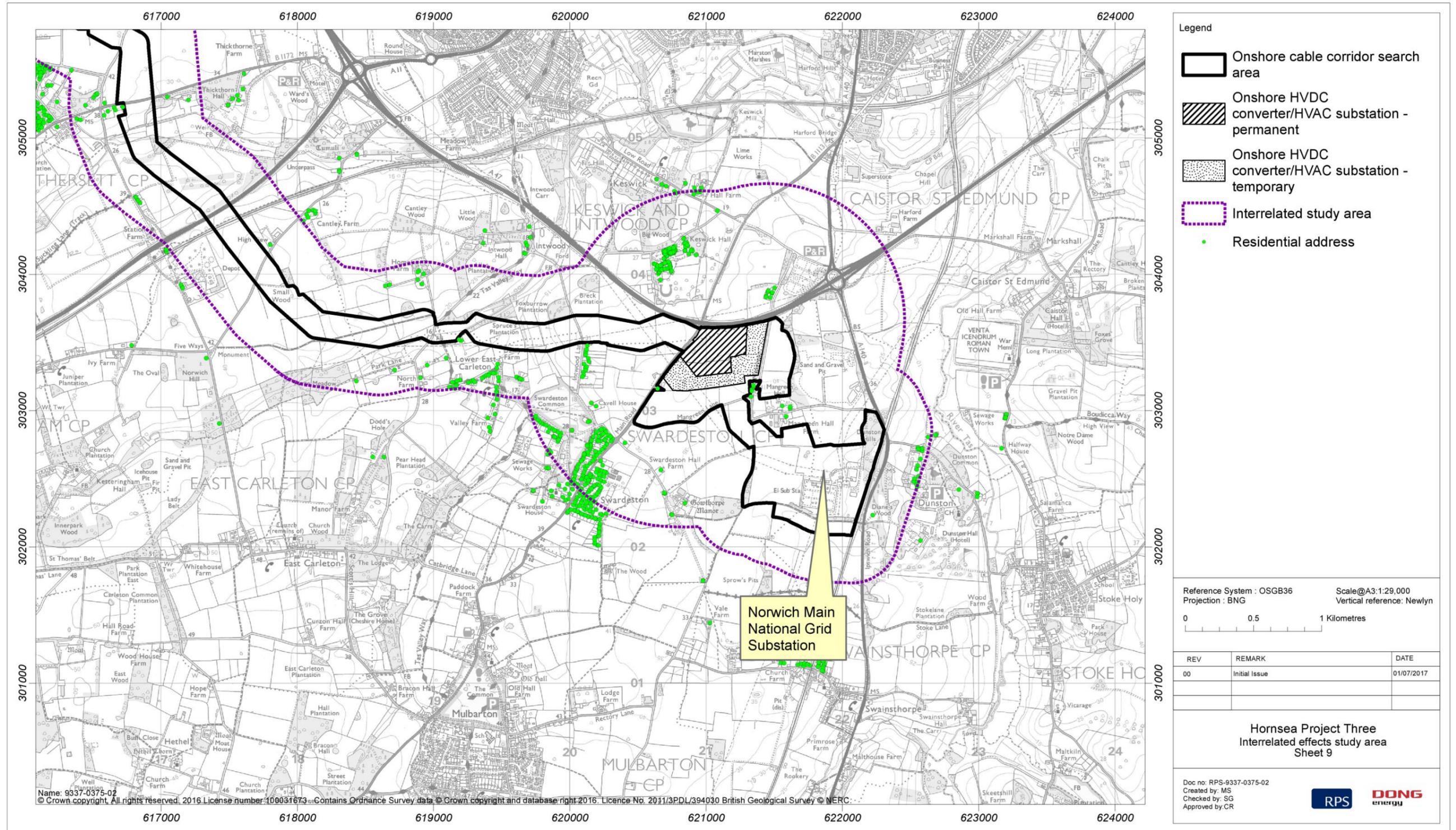


Figure 11.1: Hornsea Three inter-related effects study area

Table 11.1: Summary of key consultation issues raised during consultation activities undertaken for Hornsea Three relevant to inter-related effects (onshore)

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
December 2016	PINS – Scoping Opinion	The Secretary of State recommends that in order to assist the decision making process, the Applicant may wish to consider the use of tables to identify and collate the residual impacts after mitigation on the basis of specialist topics, inter-relationships and cumulative impacts and to demonstrate how the assessment has taken account of this Opinion and other responses to consultation.	The significance of effects for the individual assessments (taking into account mitigation) have been summarised in a table at the end of each chapter. The inter-related assessments for the defined receptor groups are presented in Table 11.6 and Table 11.7
		The EIA Regulations state that information submitted within the ES includes a description of the development, including a description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors.	An assessment of these environmental aspects has been provided in chapters 1 to 10 of the PEIR. The assessments include inter-related effects which may occur on topic-specific receptors (e.g. land take and noise disturbance impacts on a protected species). This chapter only considers inter-related effects which are not covered within the topic chapters and has been prepared to meet the requirement of the EIA Regulations. It does not include all of the environmental aspects listed in the PINS scoping opinion for reasons outlined above. The inter-related assessments for the defined receptor groups are presented in Table 11.6 and Table 11.7.
		The Secretary of State considers it is imperative for the ES to define the meaning of 'significant' in the context of each of the specialist topics and for significant impacts to be clearly identified. The Secretary of State recommends that the criteria should be set out fully and that the ES should set out clearly the interpretation of 'significant' in terms of each of the EIA topics. Quantitative criteria should be used where available. The Secretary of State considers that this should also apply to the consideration of cumulative impacts and impact inter-relationships.	The EIA methodology is set out volume 1, chapter 5: Environmental Impact Methodology which describes the assessment process and criteria used to define significant effects. Individual topics identify what effects are considered significant. Several topic-specific chapters use quantitative criteria to identify significant impacts according to their appropriate guidance.
		The inter-relationship between aspects of the environments likely to be significantly affected is a requirement of the EIA Regulations (see Schedule 4 Part 1 of the EIA Regulations). These occur where a number of separate impacts, e.g. noise and air quality, affect a single receptor such as fauna.	Impacts which affect topic-specific receptors are assessed within the relevant topic chapter as described in 11.2.1.8. Impacts on fauna from noise (i.e. disturbance) are addressed in chapter 3: Ecology and Nature Conservation, and impacts from air quality are addressed in chapter 9: Air Quality. The inter-related chapter only considers inter-related effects which are not covered within the topic chapters. The assessments for the defined receptor groups are presented in Tables Table 11.6 and Table 11.7.
		The Secretary of State considers that the inter-relationships between factors must be assessed in order to address the environmental impacts of the proposal as a whole. This will help to ensure that the ES is not a series of separate reports collated into one document, but rather a comprehensive assessment drawing together the environmental impacts of the proposed development. This is particularly important when considering impacts in terms of any permutations or parameters to the proposed development.	Potential inter-related effects on topic specific receptors are inherent in the assessment and are described in the relevant topic chapter. Other inter-related effects (where the receptor is common to several topic chapters) are presented in this chapter. The inter-related assessments for the defined receptor groups are presented in Table 11.4 and 11.5.
		The Secretary of State considers that the ES should not be a series of disparate reports and stresses the importance of considering inter- relationships between factors and cumulative impacts.	Onshore inter-related effects are presented in volume 3, chapter 11: Inter-related Effects (Onshore). Cumulative impacts from multiple schemes are considered within the topic chapters.
November 2016	Natural England – Scoping Opinion	We note that EIA should consider the environment as a whole, and not as a discrete set of individually sensitive receptors. Within the scoping report there is a section (5.6) on inter-related effects where the Applicant has outlined suggestions regarding the assessment of linkages between receptors, and how impacts on one receptor may influence others e.g. such as impacts to fish which may be important as prey species for birds and marine mammals. We consider that such inter-relationships are likely to be key in interpreting the environmental impacts of the development and welcome the applicant's intention to integrate these aspects as part of the EIA process.	Linkages between topic-specific receptors are acknowledged and where such linked relationships arise these have been assessed within the individual topic chapters and are not repeated here. The inter-related chapter only considers inter-related effects which are not covered within the topic chapters.

11.6 Data Sources

11.6.1.1 The baseline environments for the receptor groups considered in this chapter are specific to each receptor group and are, therefore, set out in the relevant topic specific chapters. This chapter draws on the conclusions made within the individual chapters for the assessment of impacts acting in isolation on the receptor groups. The relevant sections drawn upon in this inter-related effects (onshore) assessment are presented in the following sections of the ES chapters:

- Volume 3, chapter 1: Geology and ground conditions;
- Volume 3, chapter 2: Hydrology and flood risk;
- Volume 3, chapter 3: Ecology and nature conservation;
- Volume 3, chapter 4: Landscape and visual resources;
- Volume 3, chapter 5: Historic environment;
- Volume 3, chapter 6: Land use, agriculture and recreation;
- Volume 3, chapter 7: Traffic and transport;
- Volume 3, chapter 8: Noise and vibration;
- Volume 3, chapter 9: Air quality; and,
- Volume 3, chapter 10: Socio-economics.

11.7 Impact Assessment

11.7.1 Impact Assessment Methodology

11.7.1.1 The following sections present the approach for the inter-related effects (onshore) assessment for Hornsea Three, which is also described in volume 1, chapter 5: Environmental Impact Assessment Methodology. DMRB guidance (Highways Agency *et al.*, 2008) has been applied throughout this chapter which states that inter-related effects are those that arise from the combined action of a number of different environmental topic-specific impacts from a single scheme upon a single receptor/resource.

11.7.1.2 The approach to the inter-related effects assessment has been developed with specific regard to the following text (footnote 11, page 7) from PINS Advice Note 9 (PINS, 2012):

“Inter-relationships consider impacts of the proposals on the same receptor. These occur where a number of separate impacts, e.g., noise and air quality, affect a single receptor such as fauna.”

11.7.1.3 The approach also serves to accommodate PINS Advice Note 9 (and Scoping Opinion; PINS, 2016) regarding the need to consider the assessment as a whole and not as a series of unconnected specialist reports.

11.7.1.4 The chapter also takes into account guidance from HA205/08 Principles of Environmental Assessment – Assessment and Management of Environmental Effects (Highways Agency *et al.*, 2008).

Approach to Assessment

11.7.1.5 The approach to assessing inter-related effects within this chapter has followed a four stage process, as summarised in Table 11.2 and outlined below. More details of the approach summarised above and used to develop this chapter are presented in volume 1, chapter 5: Environmental Impact Assessment Methodology.

11.7.1.6 The assessment considers receptors or receptor groups, such as local residents, users of local rights of way or services that may be affected by different environmental effects generated by the onshore elements of Hornsea Three. This may include, for example, particular locations where noise, air quality and visual change may all occur at the same time.

Table 11.2: Summary of staged approach to the inter-related effects assessment for Hornsea Three

Stage	Description
1	Scoping exercise of receptor/resource types not affected by in combination effects of where these receptor/resource types are assessed wholly in a single PEIR topic area.
2	Review of the likely receptor(s)/resource(s) affected by more than one impact through analysis of the 'assessment of effects' sections undertaken for individual PEIR topic areas.
3	Identification of potential inter-related (onshore) effects on these receptor groups through review of the topic specific assessments in the PEIR chapters.
4	Assessment undertaken on how individual effects may combine to create inter-related effects on each receptor group for: <ul style="list-style-type: none"> • 'project lifetime effects', i.e. during construction, operational and decommissioning phases; and • 'receptor-led effects', i.e. multiple effects on a single receptor.

Stage 1: Scoping of receptors/resources

11.7.1.7 The majority of the PEIR topic assessments consider the effects of Hornsea Three on receptor or receptor groups, and as such, many of the inter-related impacts on those receptors are considered in the topic chapters. Therefore, the potential for inter-relationships is an integral part of the topic assessments and these effects are not repeated in this chapter. The topics where this applies are shown in Table 11.3.

Table 11.3: PEIR topics excluded from further inter-related effects assessment*

Topic	Definition
Geology and Ground Conditions	<p>Receptors considered within chapter:</p> <ul style="list-style-type: none"> geologically designated sites; principle and secondary aquifers; and Source Protection Zones. <p>Potential inter-related effects considered in chapter:</p> <ul style="list-style-type: none"> Groundwater-fed surface watercourses. <p>All the potential impacts (including inter-related effects) on geological receptors have been assessed within Volume 3, Chapter 1: Geology and Ground Conditions.</p>
Hydrology and Flood Risk	<p>Receptors considered within chapter:</p> <ul style="list-style-type: none"> surface water quality; and flood risk (natural sea defences, surface watercourses, drainage pipeline infrastructure and field drainage). <p>All the potential impacts (including inter-related effects) on hydrological features and the level of flood risk are assessed in Volume 3, Chapter 2: Hydrology and Flood Risk.</p>
Ecology and Nature Conservation	<p>Receptors considered within chapter:</p> <ul style="list-style-type: none"> ecologically designated sites (SPA/SAC, SSSI, CWS); important habitat features (e.g. hedgerows, ponds, watercourses); designated features of the North Norfolk Coast SPA; and protected species. <p>Potential inter-related effects considered in chapter:</p> <ul style="list-style-type: none"> land take; noise disturbance; and surface water quality (particularly at designated sites). <p>The assessment of inter-related effects is central to the assessment of potential impacts on ecological receptors and the integrity of designated sites and, as such, has already been assessed within Volume 3, Chapter 3: Ecology and Nature Conservation. No additional effects are therefore considered likely to occur beyond those identified in the assessment in Volume 3, Chapter 3: Ecology and Nature Conservation.</p> <p>There is one exception to this. There are impacts on non-seabird migrants across the onshore and offshore study areas of the project. This relates to the potential for non-seabird migrants to be affected by barrier effects and collision risk offshore and disturbance and displacement impacts within the intertidal and onshore area. These inter-related effects are considered in volume 1, chapter 5: Offshore Ornithology.</p>
Landscape and visual Resources	<p>Receptors considered within chapter:</p> <ul style="list-style-type: none"> Landscape character and landscape quality; and Designated sites (AONB); <p>The assessment presented in Volume 3, Chapter 4: Landscape and Visual Resources, includes the consideration of all potential impacts on landscape character and landscape quality. Therefore no additional interrelated effects are considered likely to occur beyond those identified in the specific assessment in Volume 3, Chapter 4: Landscape and Visual Resources.</p>

Topic	Definition
Historic Environment	<p>Receptors considered within chapter:</p> <ul style="list-style-type: none"> buried archaeology; heritage assets (scheduled monuments, listed buildings, conservation areas, registered parks and gardens); and settings of heritage assets. <p>Potential inter-related effects:</p> <ul style="list-style-type: none"> historic landscape. <p>The assessment of effects on historic assets is provided in Volume 3, Chapter 5: Historic Environment. This assessment considers all potential impacts on the relevant receptors, namely buried archaeology and potential effects on the setting of historic assets.</p>
Soils and Farm Holdings	<p>Receptors considered within chapter:</p> <ul style="list-style-type: none"> agricultural land classification (including best and most versatile land); and farm businesses. <p>The assessment of effects on soils and farm holdings is provided in Volume 3, Chapter 6: Land Use and Recreation. This assessment considers all potential impacts on these receptors.</p>
Vibration	<p>The assessment (Volume 3, Chapter 8: Noise and Vibration) explains that vibration emissions from the activities related to the project would not be perceptible beyond the immediate construction site. As such no inter-related effect is assessed in this chapter.</p>
Construction dust and air borne pollutants	<p>Potential inter-related effects considered within chapter:</p> <ul style="list-style-type: none"> ecological receptors. <p>The assessment of dust effects on ecological receptors is provided in Volume 3, Chapter 9: Air Quality.</p>
Socioeconomics	<p>Because of the nature of socio-economic effects, all receptors considered in the socio-economic assessment cover a combination of onshore and offshore project elements of Hornsea Three. Some effects are interrelated with landscape and visual and noise and vibration effects. Where this is the case, the assessment (Volume 3, Chapter 10: Socio-economics) draws on and cross references relevant information from other chapters of the Environmental Statement.</p>

* Items listed in the topic column do not necessarily correspond to a specific PEIR chapter. The topic name presented refers to individual topics or receptors within a chapter.

Stage 2: Identification of receptor/receptor group

11.7.1.8 Stage 2 involved a review of the assessments undertaken in the topic specific chapters to identify 'receptor groups' requiring assessment within the inter-related effects assessment.

11.7.1.9 The potential for inter-related effects is limited to the study areas (i.e. zones of influence) presented in this chapter (shown on Figure 11.1). The receptors identified as likely to experience inter-related effects are people living in or using the area near Hornsea Three, for example, users of Public Rights of Way. There is potential for air quality, noise and visual impacts to combine and affect these people. Based on the zones of influence, a core study area for the assessment of these effects of 350 m from construction activities has been proposed.

- 11.7.1.10 Operational noise, traffic noise and visual effects may all have wider zones of influence and therefore, for the operation of Hornsea Three the study area for inter-related effects is 1 km around the onshore HVAC booster station and HVDC converter/HVAC substation.
- 11.7.1.11 Receptors to visual change (including users of PRow, users of local facilities, visitors and local residents) would experience effects beyond the boundaries of the zones of influence for other topics. Beyond 350 m, air quality effects on people would not be felt (the zone of influence for construction dust is 350 m and 200 m for emissions for traffic emissions during operation). Therefore, the visual change effect would not be experienced in combination with an air quality change beyond 350 m. Construction noise would be experienced within 300 m for machinery, and 20 m for vibration.
- 11.7.1.12 Traffic and visual assessments consider a wider study area than the core study area for inter-related effects. Visual effects on occupiers in vehicles are assessed in the landscape and visual assessment. Road user receptors are considered in the assessment within the residential receptor group but it is accepted that these receptors could be located outside the core zone of influence.
- 11.7.1.13 It is assumed that the users of properties within the zones of influence for air quality, noise and visual effects would use the local transport network and are therefore also receptors in terms of effects on 'all travellers'. Dwellings are shown on Figure 11.1.
- 11.7.1.14 To conclude, there are broadly two receptor groups. These are as follows:
- Closest long-term receptors - people living at dwellings within 350 m of construction activities (and within 1 km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site); and,
 - Closest intermittent receptors - people using PRowS (and other linear routes such as the English Coast Path) within 350 m of construction activities and within 1 km of the onshore HVDC converter/HVAC substation operational site.

Stage 3: Identification of potential inter-related effects on receptor groups

- 11.7.1.15 For each receptor group Table 11.4 lists the potential effects on these receptors:

Table 11.4: Potential effects for each receptor group

Receptor Group	Impacts Considered
Closest long-term receptors – people potentially living at dwellings within 350 m of construction activities and within 1 km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site. Exact locations and relationships will be considered further once the onshore cable corridor and construction activities have been more fully defined.	<ul style="list-style-type: none"> • Traffic related impacts, namely driver delay, severance of routes, pedestrian delay, pedestrian amenity, accidents and road safety and hazardous, dangerous and abnormal loads; • Potential impacts from dust soiling surfaces, particularly window sills, cars and laundry; • Noise and vibration associated with the onshore HVAC booster substation (if required); • Noise and vibration associated with the onshore HVDC converter/HVAC substation; • Noise and vibration associated with the cable route; • Noise and vibration associated with the increase in traffic movements as a result of the scheme; • Changes to views towards the onshore HVDC converter/HVAC substation experienced by people living at dwellings within 350 m; • Changes to views towards the cable route; and • Changes in views towards onshore HVAC booster station, HVDC converter/HVAC substation and cable route experienced by occupiers of vehicles.
Closest intermittent receptors - people using PRowS (and other linear routes such as the Norfolk Coastal Path near the landfall area) within 350 m of construction and within 1 km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site.	<ul style="list-style-type: none"> • Disruption due to temporary closures on the PRow network and other linear routes; • Noise and vibration associated with the onshore HVAC booster substation (if required); • Noise and vibration associated with the onshore HVDC converter/HVAC substation; • Noise and vibration associated with the cable route; • Changes to views towards onshore HVAC booster substation (if required); • Changes to views towards onshore HVDC converter/HVAC substation; • Changes in views towards the landfall and intertidal works; and • Changes to views towards the cable route.

Stage 4: Assessment of inter-related effects on each receptor group

- 11.7.1.16 Individual effects on each of the key receptors were identified across the three project phases (i.e. project lifetime effects) as well as the interaction of multiple effects on a receptor (i.e. receptor-led effects), as defined in Table 11.5. It is important to note that the inter-related effects assessment considers only effects produced by Hornsea Three and not from other projects which are considered within the cumulative impact assessment sections of each topic chapter.

Table 11.5: Definitions of project lifetime and receptor led inter-related effects

Effect Type	Definition
Project lifetime effects	Assessment of the scope for effects that occur throughout more than one phase of the project, (construction, operation and maintenance and decommissioning) to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages (e.g., construction phase noise, operational noise and noise during decommissioning and dismantling at the onshore HVAC booster station and HVDC converter/HVAC substation).
Receptor-led effects	Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor or receptor group. As an example, all effects on a given receptor such as local residents – construction dust and noise, increased traffic and visual change etc. may interact to produce a greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

11.7.1.17 The significance of the individual effects, as defined in the topic specific chapters, is presented in the assessment tables for each receptor group (all conclusions for significance of effect for impacts defined in the topic chapters assume successful implementation of mitigation measures where appropriate, i.e. the residual effect has been used). A descriptive assessment of the scope for these individual effects to interact to create a different or greater effect is then undertaken. This assessment incorporates qualitative and, where reasonably quantitative assessments. The assignment of significance of effect to any such inter-related effect is not undertaken, but instead any inter-related effects that may be of greater significance than the individual effects acting in isolation on a given receptor are identified and discussed within this chapter.

11.7.1.18 The inter-related effects assessment presents and utilises the maximum significant adverse effects for the project (i.e. the maximum design scenarios, including implementation of mitigation where appropriate), noting that individual effects may not be significant at the topic-specific level but could become significant when their inter-related effect is assessed. Effects of negligible significance or greater (minor, moderate, major) may occur in only one phase of the project (e.g. during construction but not operation and maintenance, or decommissioning). Where this is the case, it has been made clear that, as a result, there will be no inter-related effects across the project phases. Effects of negligible significance identified the individual topic assessments have been included since there is the potential for inter-related effects to increase the level (significance) of effect when considered with other sources.

11.7.2 Assessment of Inter-related Effects

11.7.2.1 For each of the receptor groups listed above, the scope for impacts to these receptors to create project lifetime effects over all the project phases and/or receptor-led effects through interacting together on the receptor group in question has been explored and discussed in the following sections.

11.7.2.2 Table 11.6 and Table 11.7 **Error! Reference source not found.** list the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operation and maintenance and decommissioning of Hornsea Three. The tables present project lifetime inter-related effects and the text beneath each table describes the receptor led inter-related effects.

11.7.2.3 For some impacts, a range of significant effects has been reported. This is due to the proximity of the receptors to the onshore elements of Hornsea Three. Further detail on the significant effects is provided within the relevant topic chapter.

11.7.2.4 Where significant individual effects have been identified in the topic specific chapters, further work is proposed following PEIR to mitigate these effects through refinement of the design and consultation with stakeholders. This work is reported in the relevant chapters

Table 11.6: Summary of the potential inter-related effects on people living at dwellings within 350 m of onshore construction activities and 1 km of the operational onshore HVAC booster station and HVDC converter/HVAC substation occurring across all phases of the project (project lifetime effects) and from multiple effects interacting (receptor-led effects)

People living at dwellings within 350 m of onshore construction activities and within 1km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site					
Impact type	Where assessed in PEIR	Significance of effect			Inter-related assessment
		Construction	Operation and maintenance	Decommissioning	Project lifetime effects
Driver delay can result from an increase in traffic flows, particularly during peak hours resulting in increased queues on links and at junctions; the passage of slow moving vehicles such as abnormal loads; and a reduction in link capacity resulting from changes in carriageway width or other highway characteristics.	Chapter 7: Traffic and transport	There is potential for significant effects to occur during the construction phase. These effects will be identified using site specific traffic data and will be reported within the Environmental Statement.	Based on information in volume 1, chapter 3: Project Description, traffic movements associated with maintenance visits will be minimal and under the thresholds on which assessment is required. Negligible effects are predicted.	Vehicle movements generated during the decommissioning phase will be lower than those during the construction phase and, therefore the effects are likely to be minimal.	Potential impacts on all travellers (i.e. local drivers and pedestrians) as a result of slow moving traffic, severance of route, pedestrian delay, pedestrian amenity and road safety associated with the Hornsea Three may occur across the local road network during the construction phase as the cable route is constructed. Such impacts after construction are likely to be more discrete and localised. The potential impacts during operation and decommissioning are expected occur as discrete events over a long time period. Therefore, no inter-related effects across the project phases are anticipated.
Increases in total traffic and in HGV movements making it more difficult to cross roads and access facilities or other sections of the local community.					
An increase in total flows on links where pedestrians are required to cross without signal controlled crossings.					
An increase in HGV movements, particularly in areas where there are significant pedestrian movements and where footway provision is poor.					
An increase in HGV movements.					
An increase in dangerous and/or abnormal loads.					
Dust soiling surfaces as a result of movement of plant and vehicles, excavation and associated earthworks both on and around the landfall, the other trenchless installation crossing points, the cable route and the onshore HVAC booster station and HVDC converter/HVAC substation.	Chapter 9: Air quality	Not significant	This impact has been scoped out of the assessment.	Not significant	Whilst there is potential for impacts during construction, on the basis of the assessment undertaken to date there is no potential for project lifetime dust effects as there are no potential impacts during operation and decommissioning would occur as discrete events with any potential impacts concentrated at the onshore HVAC booster station and HVDC converter / HVAC substation.
Noise and vibration associated with the construction activities at the HVDC converter/HVAC substation.	Chapter 8: Noise and vibration	Negligible to major	Moderate to major	Negligible to minor	The potential exists for project lifetime inter- related impacts in that there would be noise sources at the onshore HVDC converter/HVAC and HVAC booster substation during all phases. However, the levels of effects, with the benefit of designed in mitigation through noise attenuation are expected to be low and controlled within acceptable limits for this type of project. Consultation with the relevant local planning authorities' regards noise mitigation will take place as the project design progresses.
Noise and vibration associated with construction activities at the HVAC booster station		Negligible to major	Moderate	Negligible to minor	
Noise and vibration associated with cable installation by open cut and trenchless technologies, construction of haul roads and construction site accesses.		Negligible to major	None due to the operation of the cable. Effects are negligible where any maintenance and repair of the onshore cable may affect receptors.	Negligible.	

People living at dwellings within 350 m of onshore construction activities and within 1km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site					
Increased traffic on the local road network causing increased noise levels.		This effect will be assessed using the site-specific traffic data and will be reported in the Environmental Statement.	Scoped out of the noise assessment due to the very low level of maintenance traffic.	This effect will be assessed using the site-specific traffic data and will be reported in the Environmental Statement	Potential noise impacts on those living in dwellings close to the local road network, where increases in noise as a result of traffic movements are predicted, would be limited to discrete time periods within the construction phase. These impacts would not reoccur in the operation or decommissioning phases therefore, no inter-related effects across the project phases are anticipated.
Construction of the onshore HVAC booster station and removal of vegetation resulting in views of construction activities, plant and machinery.	Chapter 4: Landscape and visual receptors	Night time effects - none. Day time effects - major.	Night time effects - none. Day time effects -major.	Night time effects - none. Day time effects - major.	Scope exists for inter-related project lifetime effects on visual receptors living close to the onshore HVAC booster station as there are visual effects throughout the phases. However, the proposed planting would, in time, lessen these effects, but would still remain significant.
Construction of the onshore HVDC converter/HVAC substation and removal of vegetation resulting in views of construction activities, plant and machinery.		Night time effects - none. Day time effects - major.	Night time effects - none. Day time effects - major.	Night time effects - none. Day time effects - major.	Scope exists for inter-related project lifetime effects on visual receptors living close to the onshore HVDC converter/HVAC substation as there are visual effects throughout the phases. However, the proposed planting would, in time, lessen these effects, but would still remain significant.
Removal of vegetation, construction of side accesses, compounds and haul roads, cable laying operations and trenchless installation operations. Views of construction activities, construction traffic, plant and machinery e.g. trenchless technology machinery.		Night time effects – none. Daytime effects - none to major depending on the visibility of the construction activities and openness of views towards the construction activities.	Night time effects - none. Daytime effects – none	None.	The replanting along the cable route would reduce effects significantly during the operational phase, therefore no inter-related effects across the project phases are anticipated.
Construction of the onshore HVDC converter/HVAC substation and removal of vegetation resulting in views of construction activities, plant and machinery.		None to major.	None to major.	None to minor.	The replanting of the hedgerows and trees along the cable route would reduce effects during the decommissioning phase and therefore, no inter-related effects across the project phases are anticipated.
Removal of vegetation, construction of construction side accesses, compounds and haul roads, cable laying operations and trenchless installation operations. Views of construction activities, construction traffic, construction plant and machinery e.g. trenchless technology machinery.					

People living at dwellings within 350 m of onshore construction activities and within 1km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site
Receptor-led effects
<p>Potential exists for spatial and temporal interactions of impacts to affect people living within 350 m of the onshore construction activities and 1 km of the operational onshore HVAC booster station and HVDC converter/HVAC substation.</p> <p>Based on current understanding and expert knowledge the greatest scope for potential inter-related impacts is predicted to arise through the interaction of changes in noise levels, visual changes (as a result of removal of vegetation and views of construction plant and machinery) and increased dust and traffic related effects during the construction phase. These individual impacts were assigned a significance of none to major as standalone impacts. Whilst in-combination effects may arise, they are unlikely to be of greater significance than the individual impacts in isolation (i.e. none to major). The potential for combined effects at individual receptors will be assessed in the Environmental Statement following the refinement of the cable route, and the locations of the compounds, construction access, haul roads and trenchless crossings have been identified.</p> <p>Potential impacts on properties within 350 m of cable route construction activities would be reduced through the use of quieter alternative methods, plant and/or equipment, where reasonably practicable; the use of site hoardings, enclosures, portable screens and/or screening noisier items of plant, where reasonably practicable; and maintaining and operating all vehicles, plant and equipment in an appropriate manner, to ensure that extraneous noise from mechanical vibration, creaking and squeaking is kept to a minimum. These principles will be secured through the Code of Construction Practice (CoCP) which will be developed in consultation with the relevant stakeholders, and submitted as part of the final DCO application.</p>

Table 11.7: Summary of potential inter-related effects on people using public rights of way and other linear routes

People using public rights of way (PRoW) and other linear routes within 350 m of onshore construction activities and within 1km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site					
Impact type	Where assessed in PEIR	Significance of effect			Inter-related assessment
		Construction	Operation and maintenance	Decommissioning	Project lifetime effects
Disruption due to temporary closures on the PRoW network and other linear routes	Chapter 6: Land use, agriculture and recreation	Major (Peddlars Way and Norfolk Coast Path). Moderate (other linear routes). Minor (footpaths).	Negligible (footpaths and other linear routes) None (other PRoW).	None	The temporary closures or diversions of PRoWs (where required) would only occur during the construction phase, therefore no inter-related effects across the project phases are anticipated.
Noise associated with the onshore HVAC booster station and HVDC converter/HVAC substation.	Chapter 8: Noise and vibration	Negligible to major	Moderate to major	Negligible to minor	There is potential for project lifetime inter-related impacts to occur as there would be noise sources at the onshore HVAC booster station and HVDC converter/HVAC substation during all phases. However, the levels of effects, with the benefit of designed in mitigation through noise attenuation are expected to be low and controlled within acceptable limits for this type of project. Consultation with the relevant local planning authorities' regards noise mitigation will take place as the project design progresses.
Noise associated with the onshore cable route		Negligible to moderate	None	Negligible	Potential noise impacts on users of PRoW close to trenchless installation crossings would be limited to discrete time periods within the construction phase. These impacts would not reoccur in the operation phase and would be negligible during decommissioning. Therefore, no inter-related effects across the project phases are anticipated

People using public rights of way (PRoW) and other linear routes within 350 m of onshore construction activities and within 1km of the onshore HVAC booster station and HVDC converter/HVAC substation operational site					
Construction of the onshore HVAC booster station and removal of vegetation resulting in views of construction activities, plant and machinery.	Chapter 4: Landscape and visual receptors	Day time effects (footpaths) - none to major (depending on the viewer's location along the path).	Day time effects - (footpaths) none to major (depending on the viewer's location along the path).	Day time effects (footpaths) - none to major (depending on the viewer's location along the path).	There is potential for inter-related project lifetime effects on regular PRoW users close to the onshore HVAC booster station and HVDC converter/HVAC substation as there are none and major effects throughout the project lifetime, although operational effects would diminish as the planting matures.
Removal of vegetation, construction of temporary accesses, compounds and haul roads, cable laying operations and trenchless installation operations. Views of construction activities, construction traffic, plant and machinery e.g. trenchless technology machinery.		Daytime effects - negligible to major depending on the visibility from PRoWs of the construction activities and openness of views towards the construction activities.	Daytime effects – none	Daytime effects - none.	The main effects would occur during the construction phase. The replanting along the cable route would reduce effects significantly during the operational phase, therefore no inter-related effects across the project phases are anticipated.
Receptor-led effects					
<p>Potential exists for spatial and temporal interactions of impacts to affect people living within 350 m of the onshore construction activities and 1 km of the operational onshore HVAC booster station and HVDC converter/HVAC substation.</p> <p>Based on current understanding, the greatest scope for potential inter-related impacts is predicted to arise during the construction phase through the interaction of changes in noise levels, visual changes (as a result of removal of vegetation and views of construction plant and machinery) and temporary diversion of some PRoWs and/or management measures to maintain passage of PRoW users. The PRoW users most likely to experience inter-related effects are those following paths which have been temporarily diverted during construction (particularly bridleway users) and also passing the noisier construction activities (e.g., crossings using trenchless technologies) and seeing open uninterrupted views of the project.</p> <p>These individual impacts were assigned a significance of none to major as standalone impacts. Whilst in-combination effects may arise, they are unlikely to be of greater significance than the individual impacts in isolation (i.e. none to major). The potential for combined effects at individual receptors will be assessed in the Environmental Statement following the refinement of the cable route, and the locations of the compounds, construction access, haul roads and trenchless crossings have been identified.</p> <p>Only the PRoW users closest to the onshore HVAC booster station and HVDC converter/HVAC substation would potentially experience major visual effects throughout all phases of development. However, such effects would be intermittent as the user of the PRoW is transitory. This would be further mitigated through the development and implementation of the LSMP which will be submitted as part of the final DCO application.</p> <p>Principles for the management of temporary diversions will be developed in consultation with the relevant stakeholders and included as part of the final DCO application.</p>					

11.8 Summary

11.8.1.1 The tables presented within this chapter assess potential inter-related effects arising from the onshore elements of Hornsea Three on a range of onshore receptor groups. Much of the content of these tables has been based upon the assessments of individual impacts presented in the topic-specific PEIR chapters. The identification of potential inter-related effects has been based on a largely qualitative assessment using expert judgement, and noting that inter-related effects have already been accounted for, in many instances, within the assessments in the topic chapters. The following conclusions arise in the context of physical and human environments.

11.9 Conclusion

11.9.1.1 This chapter has defined the potential inter-related effects considered to arise from Hornsea Three. Project lifetime and receptor-led effects have been defined in order to differentiate the two types of inter-related effects that may arise as a result of Hornsea Three.

11.9.1.2 The potential for inter-related effects is greatest during the temporary construction phase of the onshore elements of Hornsea Three. The potential for long term inter-related effects is expected to be greatest for people living in dwellings closest to the onshore HVDC converter/HVAC substation where visual effects could combine with other low level effects.

11.9.1.3 Due to concurrent multiple activities, the construction phase presents the most likely opportunity for effects combining on occupiers of the nearest dwellings. During the construction phase there could potentially be properties within 300 m of trenchless installation locations which could experience moderate noise effects and major visual effects, both being significant. These temporary significant effects could combine with concurrent negligible and minor traffic effects and other noise and visual effects.

11.9.1.4 It is anticipated that PRoWs and other linear routes such as the Norfolk Coastal Path could be closed temporarily during the construction phase causing minor and moderate effects on these users. During construction, these short term effects could combine with major visual effects (which are significant) and negligible to minor noise effects. For all PRoW users and users of other linear routes, inter-related effects would be intermittent as users move through the area.

11.10 References

Department for Energy and Climate Change (DECC) (2011a). Overarching National Policy Statement for Energy (EN-1).. July 2011. London: The Stationery Office.

Department for Energy and Climate Change (DECC) (2011b). National Policy Statement for Renewable Energy Infrastructure (EN-3).. July 2011. London: The Stationery Office.

Department of Energy and Climate Change (DECC) (2011c). National Policy Statement for Electricity Networks Infrastructure (EN-5).. July 2011. London: The Stationery Office.

DONG Energy (2016) Hornsea Project Three Offshore Wind Farm Environmental Impact Assessment Scoping Report. London, DONG Energy [online] Available at: < <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000065-Scoping%20Report.pdf> > [Accessed 19 May 2017].

Highways Agency *et al* (2008) Design Manual for Roads and Bridges HA205/08.

HM Government (2011) UK Marine Policy Statement. [Internet, available <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf>, accessed 18 April 2017]

PINS (2012). Advice Note nine: Using the “Rochdale Envelope”. Bristol, PINS

PINS (2016). Scoping Opinion Proposed Hornsea Three Offshore Wind Farm. PINS Reference EN010080 [online] Available at: < <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000069-Scoping%20Opinion.pdf>>