East Anglia
Offshore Wind

VATTENFALL

SCOTTISHPOWER
RENEWABLES

East Anglia THREE

Health Impact Review

Document Reference – 8.14

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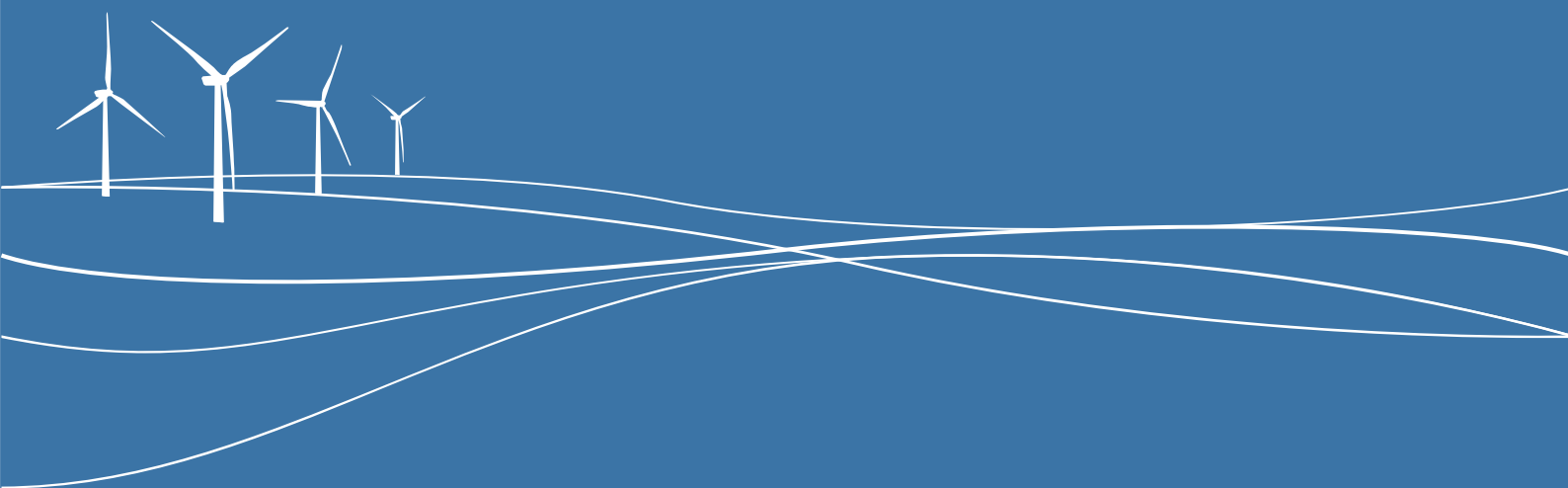
East Anglia THREE Limited
Date – November 2015
Revision History – Revision A



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1 HEALTH IMPACT REVIEW

1.1 Introduction

1. This Health Impact Review (HIR) assesses potential impacts on the health of the local population in relation to the proposed East Anglia THREE project. This review only considers the onshore components of the project, including landfall as there are no sensitive receptors that would be affected by offshore components of the proposed East Anglia THREE project. Human health aspects of the offshore and nearshore environment are not part of this assessment.

1.2 Background

2. In line with good practice, the assessment process has included the identification and review of the potential public health impacts of the full life-cycle (i.e. construction, operation and decommissioning) of the proposed East Anglia THREE project's features, including their emissions (DCLG 2006). The findings are documented in individual chapters from the Environmental Statement (ES) and collated in this HIR.

3. The ES provides information on a range of parameters relating to the environmental impacts of the project relevant to health, chapters of relevance are;

- Chapter 5 Description of the Development;
- Chapter 20 Air Quality;
- Chapter 21 Water resource and flood risk;
- Chapter 22 Land Use;
- Chapter 26 Noise and Vibration
- Chapter 27 Traffic and Transport; and
- Chapter 28 Socio-economics, Tourism and Recreation.

4. The consideration of human health is implicitly included as part of these ES chapters; however, the ES is not intended to be a detailed assessment of potential 'human' and 'public health' implications. This report is not a Health Impact Assessment (HIA) in the formal sense but rather a HIR, i.e., a review of the health interactions and findings of the project and those in the receiving environment of impacts. This approach has been used for previous offshore wind projects and the approach was

accepted by the Planning Inspectorate for the Dogger Bank Teesside A & B application.

1.3 Consultation

5. To inform this HIR, East Anglia THREE Limited (EATL) has undertaken a thorough pre-application consultation programme. Consultation undertaken to date in relation to human health is provided in *Table 1*. The table only includes key items which have been addressed in this review. A full explanation of how the consultation process has shaped the ES, as well as tables of all responses received during the statutory consultation periods is provided in the Consultation Report which has been submitted as part of the development consent order (DCO) application.

6. The key consultation includes specific health impact consultation comments regarding the proposed East Anglia THREE project from the Scoping Report and responses to the Preliminary Environmental Information Report (PEIR). Responses from consultees in relation to the East Anglia ONE Offshore Windfarm Scoping Report (RSK 2012a), the East Anglia ONE PEIR (RSK 2012b) and Phase 2 Consultation (RSK 2012c) which are also considered relevant to the proposed East Anglia THREE project are provided in the Consultation Report.

Table 1 Consultation Responses

Consultee	Date / Document	Comment	Response / where addressed in the application
Public Health England	PEIR Response June 2014	Public Health England (PHE) welcomes the opportunity to comment on your proposals and preliminary environmental information report at this stage of the project. Our records indicate that a scoping opinion was provided by the Health Protection Agency HPA (now succeeded by PHE) to the Planning Inspectorate on 23rd November 2012. Please note that this response only considers radiation, poisons or chemical hazards and the preliminary environmental information accompanying the current consultation has been assessed in this context. PHE has reviewed the Preliminary Environmental Information Report (PEIR) for the development (May 2014). We note this report does not contain any consideration of human health impacts, as requested in the scoping response dated 23rd November 2012. However, the EIA	The consideration of human health is implicitly part of onshore chapters of the ES. However, the ES is not intended to be a detailed assessment of potential 'human' and 'public health' implications. This report has been prepared to provide a review of the health interactions and findings of the project and those in the receiving environment of impacts

Consultee	Date / Document	Comment	Response / where addressed in the application
		concludes that the construction works in the onshore will have a negligible or a minor adverse effect on the environment in relation with soils and air quality, and a similar impact could be expected on human health. Moreover, PHE has also noted that the PEIR has not evaluated any potential risks to human health of the electric and magnetic fields produced by the equipment that involves onshore electricity cables and related equipment. These possible risks to human health should be addressed in the final environmental statement (ES). In order to assist the promoter in the production of the subsequent ES we have included an appendix which outlines the generic considerations that PHE advises should be addressed by all promoters when they are preparing ESs for NSIPs. PHE will provide further comments when the ES becomes available. Should the promoter or their agents wish to discuss our recommendations or seek specific advice prior to the submission of the ES, PHE would of course be pleased to assist.	
Health and Safety Executive	PEIR Response July 2014	As well as satisfying general health and safety legislation (i.e. Health and Safety at work etc. Act 1974 and supporting regulations), the proposed design and future operations must comply with the Electricity at work regulations 1989 and the Electricity, Safety, Continuity and Quality Regulations 2002 as amended. Generators, distributors, their contractors and others have defined duties in order to protect members of the public from the dangers posed by the electrical equipment used. HSE enforces the safety aspects of these regulations.	Noted. For construction, operation and decommissioning of the proposed East Anglia THREE project, EATL will comply with all legislative requirements relevant at that time and ensure that this applies to all contractors employed.

1.4 Report Structure

7. This HIR has been carried out as a result of feedback from consultees, in particular, responses from Public Health England (PHE) and the Health and Safety Executive (HSE) and the following sections of this HIR are as follows:

- The approach taken to the Health Impact Review;
- Discussion of elements of the proposed East Anglia THREE project with the potential to impact on health;
- Potential health effects (and impacts) that might arise primarily from the construction, operation and decommissioning phases; and
- Summary and conclusions.

2 THE PROPOSED EAST ANGLIA THREE PROJECT AND HEALTH IMPACTS

2.1 Introduction

8. This section outlines some of the principal concepts which underpin the approach to the review of health impacts. This section also provides context on which health impacts and influences are important for offshore wind energy projects. The concept of health determinant is introduced and this document outlines what pathways can link sources of health impact to receptors. This section has been informed through a review of existing literature, primarily the approach undertaken for the Dogger Bank Teesside A & B Health Impact Review (HIR) (Forewind, 2014).

2.2 The proposed East Anglia THREE project

9. The construction, operation and decommissioning of an onshore cable route have the potential to influence the health of local residents and communities, both physically through degradation of environmental conditions and mental / emotional wellbeing through stresses caused by, for example, exposure to noise or restricted access to community infrastructure. Effects on health can be both positive and negative. Key influences include; exposure to elevated noise levels, reductions in air quality, loss of access to green space, employment and income.

10. The proposed East Anglia THREE project is fully described in Chapter 5 Description of Development of the ES. Key components of the project that are relevant to this HIR are as follows:

- The landfall location with associated transition bays to connect the offshore and onshore cables;
- Onshore cables. East Anglia THREE are proposing to use either high voltage direct current (HVDC) or low frequency alternating current (LFAC) electrical infrastructure. The HVDC option would include up to four, single core onshore electrical cables and the LFAC solution would require up to 12 cables. Cables will be pulled through four pre-installed ducts with a single HVDC cable in each duct or three LFAC cables in each duct.
- One onshore substation compound with up to two electrical substations.

11. The onshore cable installation and associated construction activities with a benign (passive) situation during operation, are considered to be typical of this type of project. The proposed East Anglia THREE project can also be considered typical for this type of renewable energy project, for instance, in terms of size, cable length, placed depth and construction methodology. The project design does not feature

any extraordinary or unusual features that require unique engineering or construction techniques. All proposed approaches to design and construction have been used before by construction contractors and operational personnel.

12. The construction of the project is likely to result in some temporary disturbance to the local community, most likely in the form of minor inconveniences, for example, from minor loss of access to roads during construction. The onshore cable route mostly passes through rural agricultural areas and avoids residential areas, therefore the number of people who are could potentially be adversely affected by work sites is predicted to be small. The scale and nature of the onshore cable route, substations and features are not considered to be of a magnitude that will influence major health determinants such as housing, access to services or social capital.

2.3 Health Determinants

13. Human health can be influenced by a wide variety of direct and indirect factors, from controllable factors such as lifestyle to uncontrollable factors such as genetics. The influences and effects can be wide-ranging and are likely to vary between individuals. In determining 'well-being', contributory factors, known as 'determinants', are considered. Determinants are a reflection of a mix of influences from an individual's society and environment.

14. Influences that result in a change in determinants have the potential to cause beneficial or negative effects on health, either directly or indirectly. For any individual or community, the degree to which these determinants influence health varies, given the degree of personal choice, location, mobility and exposure. For communities, influences may be more uniform, such as access to services.

15. The construction, operation and decommissioning of onshore electrical infrastructure have the potential to influence health determinants. Employment and impacts to the local economy and community are likely to be the principal influences on health determinants. These are likely to include; ability to access amenities, impacts on different modes of transport and loss / gain of recreational facilities.

16. The proposed East Anglia THREE project is fully described in Chapter 5 of the East Anglia THREE ES, which has been submitted as part of the East Anglia THREE DCO application.

17. The key elements of the proposed East Anglia THREE project which will be considered within this HIR are;

- Up to four individual cables coming onshore near Bawdsey using pre-installed ducts.
- Up to two fibre optic cables coming onshore near Bawdsey using pre-installed ducts.
- Onshore cable route, depending on the approach taken would consist of up to 12 single core cables (or four single HVDC cables) and up to two fibre optic cables, installed using pre-installed ducts. The cable route would be 37km long between the export cable termination at Bawdsey and substation at Bramford.
- EATL are considering the use of either HVDC or LFAC electrical infrastructure options for the substation(s). A substation compound, which would consist of up to two substations and cover a maximum area of 160m by 190m, under the LFAC solution, has been considered. The connection to the National Grid would be at the substation at Bamford.

18. Active works during the construction period in combination with passive impacts during the operational impacts are considered to be a typical of a renewable energy project. There will be no infrastructure that is unusual or unique compared with other renewable energy projects. Installation methods will be reduced from those undertaken at other renewable projects due to the use of the pre-installed ducts.

19. There would be no new or unusual construction techniques being used or trialled during the construction or operation, which have not previously been used on other, similar projects. It is not currently possible to discuss methods used for decommissioning with certainty as it is impossible to know what construction methods or standard best practice guidelines will be available at the time of decommissioning.

20. The project will result in temporary disturbances during the construction period that are likely to result in minor inconveniences to the local community. Disturbances are likely to be mainly temporary impacts to traffic, increased noise and access to amenities. Health pathways associated with these types of impacts are discussed in section 2.4 below.

21. Given the locations of the infrastructure, type of infrastructure and the method of installation, the number of people anticipated to be impacted is low, with impacts to traffic being low after the implementation of embedded traffic management. Due to the low magnitude of impacts, it is not expected that there would be significant negative impact on determinants such as housing, local economy, education or access to local services.

2.4 Health Pathways

22. Health pathways describe how a specific activity could potentially result in a health impact. The identification of health pathways, in particular determining the links between 'sources, pathways and receptors' is an essential part of undertaking a risk assessment. Source, pathway and receptors, as relates to this HIR, are defined as follows;

- A 'source' represents an activity or factor that has the potential to impact on the health of the receptor.
- A 'pathway' describes the method or route by which the 'source' will affect the 'receptor'.
- A 'receptor' is the recipient of an impact from the 'source', via the 'pathway'.

23. The selection of sites and the onshore cable route has been chosen to actively avoid interaction with sensitive receptors; this is described in Chapter 4 Site Selection and Alternatives. The onshore cable route has also been sited to avoid residential areas, and will be primarily within sparsely populated agricultural land. Ducts for the onshore cables for the proposed East Anglia THREE project will be installed during the construction of East Anglia ONE. The use of the pre-installed ducts has the benefit of minimising construction activities required along the East Anglia THREE onshore cable route.

24. Sensitive receptors have been identified within the relevant ES chapters. Sensitive receptors are typically associated with fixed infrastructure such as residential properties, schools, hospitals etc. but can also be communities or neighbourhoods.

25. For this health impact review, the following activities and their pathways require consideration;

- Temporary loss of access to green space or agriculture could result in impacts to levels of physical activity. This could also include diversions to access routes (e.g. footpaths), which might impact upon local users and visitors (see Chapter 22 Land Use of the ES).
- Noise impacts from excavation machinery and associated movements may result in temporary disturbance, especially from any sensitive groups (e.g. schools, hospitals). These aspects are described in Chapter 26 Noise and Vibration of the ES.
- Air Emissions

- Dust generated during construction could cause a potential nuisance for neighbouring receptors to the new facilities, especially residential areas and sensitive groups (e.g. children/schools). Mitigation measures at source are described in Chapter 20 Air Quality of the ES; and
- Exhaust emissions and particulates from machinery could have an impact on air quality that may affect health. Equipment used by the contractors will include mobile machinery, haul roads and vehicles to deliver equipment and materials. There might be some perceived risk of significantly increased exhaust emissions, but the assessment of air quality in Chapter 20 of the ES describes the limited significance of these potential impacts.

- Traffic and transport effects are considered in Chapter 27 Traffic and Transport of the ES. Potential effects and pathways are
  - Disruption of access to services and amenities caused by reduced access may invoke instances of nuisance to residents, passers-by and visitors to the area
  - Road transportation of materials and equipment to install the onshore cables along the approximately 37km route may increase the risk of accidents and new exposure to emissions. Sensitive groups include road users in and around the site area, the elderly and children.
- Increases in employment and commercial opportunity associated with the project can lead to improved quality of life and standard of living (see Chapter 28 Socio-economics of the ES).
- Impacts of electrical and magnetic fields (EMF) have been highlighted for consideration in a response to the East Anglia THREE Preliminary Environmental Information Report (PEIR) regarding the consideration of EMF (Royal HaskoningDHV 2014). The potential risks to human health from EMF will be considered within this HIR.
- The production and disposal of waste as part of the development has the potential to result in public health impacts. This is particularly the case where hazardous or contaminated waste is found. There are strict guidelines for the disposal of waste, designed to ensure that impacts to public health are avoided.
- Emissions to ground or surface water and the increased flood risk that could result from the development has the potential to impact human health and

communities. Impacts on water resource and flood risk are considered in Chapter 21 Water Resource and Flood Risk of the ES.

- Emergency situations which may result in offsite impacts for example; fire, accidental spillage or contamination of water resources (onsite or offsite), offsite load spillage etc. The impacts of accidental spillage to environmental receptors are considered within the relevant ES chapters. Mitigation and contingency for reducing the risk and addressing impacts in the case of an emergency, such as accidental spillage, are provided in relevant ES chapters with emergency procedures summarised in construction documents such as; the Outline Code of Construction Practice (OCoCP) and Environmental Management Plan (CEMP) which will be developed pre-construction and agreed with the relevant local authorities.

26. The majority of the sources of impacts described above are temporary and will be associated with the construction phase of the project. Embedded mitigation measures have been included within the ES (and further detailed in the OCoCP) in order to minimise risks to human health. Where significant impacts were identified, additional mitigation has been proposed to reduce the risk.

2.5 Evidence for health effects

27. Health impact studies are informed using an existing evidence base of publicly available information to identify potential sources and pathways for human health impacts on sensitive receptors. In general, two sources of information are used; peer-reviewed (published) scientific papers and secondary information which tends to be published by representative groups such as local authorities, Health Trusts, health charities, and local authorities. This existing information is used to identify the extent to which impacts are likely to affect human health.

28. For this HIR information has been collated from existing literature available on the internet. Secondary information used includes health industry published material and existing examples of HIR undertaken for other, similar projects, and which have been made available through the Planning Inspectorate website.

29. PHE, in their response from the 25th of June 2014 provided useful feedback regarding the types of sources and pathways that should be considered within the ES and HIR. In general, this HIR reviews and collates the conclusions drawn from the ES and considers them in terms of health impacts where not already done so within the ES.

2.6 Evaluating health effects

30. Health based guidelines are available for the assessment of air quality and noise parameters. The Committee on the Medical Effects of Air Pollution (COMEAP) provide expert advice on all matters concerning the effects of air pollutants on health as part of its Public Health Outcomes Framework (HPE 2010-2013). The Clean Air Act (1993) aims to reduce pollution from smoke, grit and dust and gives local authorities powers to designate smoke control areas. Local authorities also have a number of regulatory powers to address noise nuisance issues, including under the Environmental Protection Act, 1990.

31. Although there are guidance and thresholds published to protect the population, different receptors are likely to have differing levels of sensitivity. For example, individuals within a population may exhibit different levels of sensitivity to air borne particles (PM_{10}) concentrations depending on whether they suffer pre-existing respiratory conditions.

32. Demolition, earth works and excavation works can generate emissions of PM_{10}, as can the stockpiling of uncovered earth, construction materials and/ or rubble. There will be no large scale demolition undertaken as part of the East Anglia THREE project and the amount of excavation and earth works required is minimised through the use of pre-installed ducts. Earth preparation works and some excavation will be required at the landfall site and there will be ground preparation required at the substation compound.

2.7 Standards and Guidance

33. Guidance published by the HPA (now PHE) in 2008 states that there is no conclusive evidence linking wind farms and their associated infrastructure with adverse health effects from chemical emissions. During their operation period, wind farms should not produce significant emissions, pollutants or waste products. The HPA therefore concluded that installations are highly unlikely to result in negative impacts on public health from emissions or chemical releases.

34. The PHE released guidance in 2013 regarding the health effects of exposure to electric and magnetic fields; this guidance has been used to consider the effects of EMF in section 6.4.

35. There is the risk of impacts to occur during the construction and decommissioning. Potential risks include spillage, leaks or accidents during the transport of material, plant and equipment. During earth works there is the potential of uncovering contaminated land and other materials which could impact health onsite, and offsite

if the material needs to be removed for disposal. Standard guidelines and mitigation measures have been incorporated into the assessment and recommendations within Chapter 19 Soils, Geology and Ground Conditions, Chapter 20 Air Quality, Chapter 21 Water Resource and Flood Risk and Chapter 22 Land Use of the ES.

36. The project will be constructed and operated in compliance with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines on EMF. These 1998 guidelines, updated step-by-step in 2009 concern limiting exposure to time-varying EMFs (up to 300 GHz). The advice of the ICNIRP is requested by many national and international organisations including the European Union and Governments, including Ministries in the UK. The ICNIRP's health protection guidance is also sought from a wide variety of bodies so they are considered to be a very credible authority on EMF.

3 EXISTING ENVIRONMENT

37. This section outlines the existing environment in relation to public health and potential receptors. It is based on a desk study of existing information sources and provides context for the assessment.

3.1 Regional Populations

38. The East Anglia THREE onshore cable route makes landfall at Bawdsey, which is within the Suffolk Coastal District; the onshore cable route travels inland to the south of Woodbridge into the Mid Suffolk District to the north of Ipswich. The substation compound location is in the Mid Suffolk District.

39. Principal conurbations along the cable route are Ipswich and Woodbridge, with Bramford also being within a 45 minute commutable distance. Great Yarmouth, Lowestoft and Harwich have all been identified as potential development ports for the offshore construction and operation elements of the project.

40. ES Chapter 28 Socio-economics, Tourism and Recreation identified 5 key regions for the socio-economic assessment, based on the reasonable commutable distances of 45 minutes and 90 minutes. These areas, with details of the population are provided in *Table 2*.

Table 2 Key regional socio-economic data[1]

	Potential Deployment Ports			Onshore Construction		
	Great Yarmouth (90 minute drive time)	Lowestoft (90 minute drive time)	Harwich (90 minute drive time)	Woodbridge (45 minute drive time)	Bramford, PML (45 minute drive time)	UK
Population						
Population 2015	1,156,930	1,226,819	2,805,499	440,049	767,030	65.2m
Population Growth 2001-2015	11.8%	12.1%	11.7%	14.5%	12.9%	10.3%
Population Growth 2015-2021	4.1%	3.8%	4.9%	3.7%	6.8%	4.0%
Working Age – 2015						
0 to 15	17.1%	17.4%	19.0%	18.4%	18.4%	19.1%
16 to 64	59.3%	59.9%	61.2%	60.3%	61.5%	61.7%
65 +	23.6%	22.7%	19.8%	21.2%	20.1%	19.2%
Economic Activity						
Active	69.1%	69.7%	71.9%	71.9%	70.9%	69.8%
Inactive	30.9%	30.3%	28.1%	28.1%	29.1%	30.2%
Unemployment	4.2%	4.4%	4.4%	4.0%	5.2%	5.4%

[1] Source: 2015 MicromarketerG3 software, Experian Population Projections & Census 2011. Data for Woodbridge and Bramford, PML is based on a 45 drive time catchment. Data for Great Yarmouth, Lowestoft and Harwich is based upon a 90 minute drive time catchment.

	Potential Deployment Ports			Onshore Construction		
	Great Yarmouth (90 minute drive time)	Lowestoft (90 minute drive time)	Harwich (90 minute drive time)	Woodbridge (45 minute drive time)	Bramford, PML (45 minute drive time)	UK
Key Employees						
% Manufacturing employees	9.3%	8.6%	7.5%	7.1%	8.2%	8.7%
% Construction employees	8.5%	8.3%	9.7%	8.2%	7.8%	8.1%
% Electricity, gas, steam and air conditioning supply	0.6%	0.8%	0.5%	1.2%	0.8%	0.6%
% Accommodation and food services	7.0%	6.7%	5.0%	5.9%	4.7%	5.5%
Qualifications						
Level 4+	23.9%	24.3%	24.1%	26.8%	25.5%	28.2%
Level 3	12.6%	12.7%	12.2%	12.5%	12.5%	12.9%
Level 2	15.6%	15.8%	16.5%	16.1%	16.4%	14.6%
Level 1	13.5%	13.8%	15.4%	13.9%	14.3%	13.6%
Apprenticeship	4.2%	4.2%	3.7%	3.9%	3.8%	3.3%
No qualifications	24.7%	24.2%	23.2%	22.0%	22.6%	22.3%
Other	5.5%	5.0%	4.9%	4.8%	4.9%	5.1%
Skills						
AB - Highly Skilled	19.2%	19.8%	21.4%	22.6%	22.0%	22.2%
C1 - Skilled	30.0%	29.9%	33.0%	30.6%	31.3%	30.9%
C2 - Skilled manual	24.7%	24.2%	22.9%	22.8%	22.7%	20.9%
DE - Semi-skilled/ unskilled manual	26.0%	26.1%	22.7%	24.1%	23.9%	26.0%

41. The population within these areas has demonstrated relatively high levels of historic population growth with population in each area increasing faster than the national average between 2001 and 2015.

42. All areas within the study area have a higher proportion of retired-aged people in relation to their working age populations, when compared with the national UK averages.

3.2 Regional sensitivities

43. Levels of economic activity within the study area are generally positive with levels of activity within Great Yarmouth and Lowestoft being comparable with the national average. The Woodbridge, Bramford and Harwich study areas (Chapter 28 Socio-economics, Tourism and Recreation of the ES) are characterised by high levels of economic activity. Whilst economic activity is not a direct measure of health, it is useful for indicating the potential number of certain sensitive demographics of the population (retired and under 18's).

44. Based on data gathered between 2009-2011 (ONS, 2015) for Suffolk, healthy life expectancy (at birth) for males is 65.6 years and 68.3 years for females, both of which are within the top 25% of UK counties. The UK average is 63.5 years for males and 65.7 years for females.

45. In the Suffolk Coastal District, health indicators are generally higher than the average across England with life expectancy being higher than the national average for both males and females. Generally, deprivation is lower, however about 10.5% of children live in poverty. Child obesity is at 15% (in Year 6 children) which is better than the national average. Adult obesity is also better than the average for England, with 19.2% of adults being classified as obese in 2012 (HPE, 2015a).

46. The 2015 health profile for Suffolk Coastal District (HPE, 2015a) shows that the electoral wards around Bawdsey are among the most deprived in the Suffolk Coastal District. Deprivation levels generally reduce with increased proximity to Woodbridge and Ipswich. Life expectancy between the most and least deprived areas differs by approximately 6.1 years for males and 2.6 years for women.

47. Trends in early deaths (all causes), early deaths from heart disease and stroke and early deaths from cancer have all shown a downwards trend between 2003 and 2012. For most health indicators Mid Suffolk District is above the England range with the exception of excess weight in adults, incidents of malignant melanoma, infant mortality and fatalities and serious injuries on the road. Of these, only the number of road incidents is considered significantly below the average for England.

48. In general, the Suffolk Coastal Area is above average for most health indictors provided, however, it is below average for level of GCSEs gained (5 A*-Cs), incidences of malignant melanoma, excess winter deaths (three year), infant mortality and fatalities/serious injuries on roads; however, for all of these indicators the difference is not considered significant.

49. For the Mid Suffolk District (HPE, 2015b) life expectancy is higher than the average for England with no significant difference between people in more or less deprived areas of the Mid Suffolk District. Child poverty, at 9.8% is below national average and below that of the Suffolk Coastal District. In terms of deprivation, deprivation across 90% of the Mid Suffolk District is equal to or less deprived than the top 40% of England (HPE, 2015b).

50. Adult obesity within the Mid Suffolk District is 19.6%, which is lower than the national average but 0.4% higher than the Suffolk Coastal District.

51. Local health priorities within the Suffolk Coastal District and Mid Suffolk District focus on child obesity, reducing the number of preventable deaths through the promotion of activity, and actively promoting the use of open spaces (HPE, 2015).

52. Levels of activity are a strong contributing factor to mortality; annually an average of 2747 deaths registered in Suffolk are from conditions which are preventable by increased levels of activity. There were also 1,496 registered cases of coronary heart disease and 30,789 cases of diabetes. The percentage of adults recorded as physically active in Suffolk have been estimated at 23% (ONS 2015).

3.3 Key receptors

53. Much of the onshore cable route, substation(s) and associated infrastructure are largely routed through agricultural land. In addition, pre-installed ducting will have been placed near some sensitive receptors during the East Anglia ONE onshore cable route installation.

54. The onshore cable route does pass near to built-up areas at Woodridge, as well as passing individual properties.

55. Individual receptors that are sensitive to potential health impacts from the construction phase have been discussed in the individual ES chapters and are summarised in section 5 below.

4 PROJECT INFRASTRUCTURE

4.1 Potential sources of 'interaction' during East Anglia THREE construction phase

56. A full description of the activities proposed during construction are provided in Chapter 5 Description of the Development of the ES. A summary of relevant project components and construction methods is outlined below.

57. Generally speaking, impacts associated with the onshore cable route are likely to be localised and therefore areas directly adjacent to the onshore works are likely to contain the most sensitive receptors. The most sensitive areas are therefore most likely to be those in close proximity to the:

- Landfall between the intertidal zone and two transition bays, including the area for the transition bays;
- The onshore cable route containing up to four HVDC or up to 12 LFAC cables and up to two fibre optic cables;
- Access roads, the seven construction consolidation sites (CCS) and jointing bays; and
- The substation compound at Bramford.

58. Construction activities that will be required that have the potential to result in 'interaction' with the local communities include; delivery of construction materials, excavation and earth works, construction of infrastructure and fencing off areas of land to form construction compounds. The type of 'interactions' experienced are likely to be restricted to small-scale, localised and temporary disturbances from noise, loss of access, minor changes in localised air quality, landscape and visual disturbance and impacts to road users. The following construction activities have the potential to result in 'interactions'.

4.1.1 Landfall and transition bay

59. Works for the construction of the transition bay at the land fall would require;

- Securing the area around the transition bay with fencing to prevent access by members of the public during construction activity.
- Removal of topsoil;

- Mechanical excavation of the transition bay (excavation would be slightly larger than the jointing bay dimensions). Excavated material may either be used as backfill or removed from the site and suitably disposed of.
- Construction of a concrete transition bay. This would involve the installation of shuttered walls, reinforcement and poured concrete (which would be transported to the site). Shuttering would be removed once the concrete is suitably cured.
- Addition of pre-cast slab to form the roof structure
- Temporary backfill (sand or similar) of the transition bay chamber until the cables are installed.

4.1.2 Construction Consolidation Sites

60. Works for the creation of seven CCS; this would require;

- Set out and install drainage features as required;
- Erect security fencing around the perimeter of CCS;
- Remove and locally store topsoil material over CCS area;
- Excavate to formation level and store any excess material;
- Place imported stone in accordance with the design CCS base structure; and
- Following completion of the CCS, the following facilities would be installed; offices and welfare buildings, car parking, vehicle marshalling facilities, storage and hardstanding.
- Following completion of construction works the CCS would be removed and topsoil reinstated.

4.1.3 Works to the Road Network

61. Creation of access points will be required along the onshore cable route to allow construction works to progress along the route; this would require;

- The modification of existing road network at access points;
- Upgrading of existing farm tracks; and
- Installation of haul road.

62. The existing road network would need to be modified in areas to aid with traffic management; this would require;

- Localised widening / creation of overrun areas;
- Temporary moving or socketing of street signs; and
- Temporary moving of street furniture etc.

63. The impacts of installing a new road need to be considered as part of the East Anglia THREE project; this would require;

- Mark out road and set out and install drainage features the length of track to be constructed (approximately 100m);
- Remove and locally store topsoil material over the working width;
- Excavate to formation level and store any excess material;
- Under-track drainage would be installed where necessary and in accordance with the drainage requirements;
- Place imported stone in accordance with the design to form the track structure;
- Where site tracks cross existing watercourses it would be necessary to install temporary watercourse crossings to maintain flows within the existing watercourse; and
- In the vicinity of private water supplies it may be necessary to monitor the water quality and consider further protection measures (e.g. bunding).

4.1.4 Jointing Bays

64. Jointing bays would need to be constructed along the onshore cable route; these would be required approximately every 1000m. A maximum of 124 jointing bays will be required and would require the following works;

- Mark out and install perimeter security fence erected;
- Remove and store the topsoil layer within of the joint bay construction area;
- Installation of hardstanding areas;

- Excavate subsoil materials up to 2.5m depth with adequate slope batter or shoring on all sides of the excavation to prevent the soil from collapse. Remove and store the subsoil separately to the topsoil;
- Uncover the duct and cut a suitable length to allow construction of the slab;
- Installation of a concrete blinding layer beneath the slab location;
- Installation of reinforced concrete slab for the foundation of each concrete box;
- Excavate additional sump pit at a lower level to facilitate drainage and dewatering;
- Install and joint cables;
- Install concrete blocks which would be constructed to a height of 1.3m and dowelled into the excavated ground level;
- Install pre-cast slabs to form the roof;
- Surround concrete boxes with sand and then selected backfill with subsoil;
- Lay tiles and/or warning tape on top of the surround layer;
- Restoration any land drains affected by the operation;
- Off-site disposal of any excess subsoil; and
- Reinstatement of surface with stored topsoil and re-planting.

4.1.5 Construction of the Substation(s)

65. Works for the construction of the substation compound and associated buildings would require:

- The installation of temporary fencing around the substation location:
- Enabling works;
- Removal and disposal of surface vegetation, where possible material will be stored for use as infill;
- Construction of Sustainable Drainage System (SuDS);
- Construction of foul drainage system;

- Construction of substation foundations;
- Construction of buildings.

66. In addition to the types of interactions previously mentioned, there is the potential for impacts to the water environment caused by contaminated or silt-laden run-off. Accidental spillage and leaks, as well as rare, but potential emergency situations such as fire, flooding or serious road accident resulting in spillage of a load also have the potential to result in 'interactions' with the local communities which could result in changes to health determinants.

4.2 Potential Sources of 'Interaction' During Operation

67. Many of the potential 'interactions' will be only associated with the construction phase and will be temporary. Mitigation measures have been incorporated into the project to ensure that during operation, baseline conditions are not significantly altered. As such, there should be no significant change to health determinants.

68. The key consideration required during the operational period is the presence of new electrical infrastructure which has the potential to change exposure levels to magnetic and electrical fields, particularly for residents in close proximity to the onshore cable route and substation. As previously discussed, the onshore cable route is primarily through agricultural land which will limit the number of people being regularly or permanently exposed to EMF emissions.

69. There are two considerations to be made when assessing EMF, the electrical element and the magnetic element, both of which form fields with different characteristics. Therefore, it is not strictly correct to use the term electromagnetic fields, although EMF are largely discussed together.

70. EMF are invisible energy forces which are persistently present in the world. They occur naturally within our bodies and in the surrounding environment. The earth generates its own magnetic fields and the atmosphere contains natural electrical fields, as can be demonstrated most obviously by lightning.

71. Modern electrical infrastructure, in the vast majority of cases uses alternating current (AC). Within the UK, the frequency of mains electricity is 50 hertz (Hz). AC fields are described as Extremely Low Frequency (ELF). Direct current (DC) is constant and therefore has a frequency of 0 and has constant electric and magnetic fields, otherwise known as static fields. Electric and magnetic fields are produced by power systems operating at 50 Hz frequencies. Sources of static fields are from the earth's natural fields, and fields from lines and cables.

72. Electric fields are produced by charge separation and are measured in volts per metre (V/m) or kilovolts per metre (kV/m) where 1 kV/m = 1,000 V/m. The size of an electric field depends on the operating voltage of the electrical equipment and can exist when there is no current flowing. Electrical equipment can be designed to avoid producing an external field through the use of screening or coverings. Underground electricity cables, which are enclosed in a metal sheath to screen and protect the integrity of the cable, do not generate any external electric fields (Forewind, 2014).

4.3 Source and Exposure Limits

73. There are natural sources of EMFs as well as those relating to equipment. Naturally occurring electric fields are produced by the build-up of electric charges in the atmosphere

74. The earth's magnetic field, which everyone is constantly exposed to, is around 50µT in the UK. The earth's electric field is usually around 100V/m, but thunderstorms can stimulate an increase to many thousands of V/m. Both these natural fields are static. They are naturally occurring background levels and it is safe for humans to be exposed to them. All other values given in this section are for variable (50Hz) fields, typical of the UK's electricity supply. Reference levels (which are significantly above naturally occurring background levels) that provide some context to these figures are provided in the following text and tables.

Table 3 Electric Fields from typical sources

Electrical Field Source	Electrical Field (V/m)
Natural fields (DC)	100
Main Power (home) AC	100
Electric trains and trams (AC)	300
TV and computer screens	10

Table 4 Magnetic fields from typical DC sources

	Magnetic Field (µT)	
Magnetic Field Source	Adjacent to Appliance	One Meter Away
Vacuum Cleaner	800	2
TV, washing machine	50	0.2
Bedside clock	50	0.02
Refrigerator	2	0.01

75. Within the UK, the Government has set guidelines for exposure to EMF based on advice from PHE. The guidelines adopted are based on those released from the ICNIRP (2010). These guidelines include permitted levels of exposure. The guidelines also provide reference levels for exposure, where reference levels of EMF

are exceeded, further information is required to ensure that emitted fields are within the maximum permitted level.

76. The size of fields for various cable types, along with reference and permitted levels of exposure are shown in *Table 5*.

Table 5 Size of fields for 400kV HVAC cables

Type of field	High voltage AC (reference only)	Low Frequency AC	High Voltage DC	Reference level of exposure	Permitted level of exposure
Electric field	Generally considered 0 when buried provided cables are covered with metallic screens.	Unburied cables-100-400V/m. Buried cables approximately 0	Generally considered 0 when buried provided cables are covered with metallic screens.	5000 V/m	9000 V/m
Magnetic Field	Approximately 25µT	0.3-5µT Unburied. Buried approximately 0.	5-10µT	100µT	360µT

4.4 Potential interactions during decommissioning

77. For the purposes of this HIR (and the assessments within the ES) it is assumed that the decommissioning phase would be largely the same as the construction phase, only reversed. As such the same impacts are anticipated and a separate assessment has not been undertaken.

5 REVIEW OF IMPACTS

5.1 Approach to the Health Impact Review

78. The purpose of this section is to identify positive and negative health concerns, and where appropriate, make recommendations to mitigate effects. Impacts are prioritised and allocated a significance based on the results of the risk management approach in HIA. There are no specific guidelines which inform the management or assessment of health impacts. This review has been informed through a review of previously accepted HIA approaches such as the one used for the Dogger Bank Teesside A&B HIR (Forewind, 2014).

79. The approach to determining impact severity has derived from the four step approach outlined in (Birley, 2011). Categories used for determining severity are shown in *Table 6*.

Table 6 Definitions of impact

Impact	Risk and consequence components			
	Extent	Intensity	Duration	Health effects
No impact or negligible	Rare	Minor	<1 month	Not perceptible
Minor	Local, small and limited e.g. a small number of households affected.	Easy adaptation to the health impacts.	1-12 months. Low frequency.	Annoyance, minor injuries or illness (not requiring hospital visit).
Moderate	Project area, medium but localised.	Adaptation with some difficulty. Maintenance of pre-impact level of health with support required.	1-6 years. Medium or intermittent frequency.	Moderate injury or illness that may require hospitalisation
Major	Extends beyond project area. Regional level.	Unable to adapt to health impact or to maintain pre-impact level of health.	>6 years. Long-term or irreversible. Constant frequency.	Loss of life, severe injuries or chronic illness that may require hospitalisation.

80. Potential health related issues are identified through knowledge of the proposed East Anglia THREE project, information from previous health impact assessments, experience in renewables and similar infrastructure projects and the use of technical specialists during the EIA process. This experience and knowledge, in conjunction with existing guidance, has also been used to assign impact significance based on the criteria outlined in *Table 6* above. Impacts have been determined through the identification of source-pathway-receptor linkages.

81. Where significant impacts are identified, it is standard practice within the EIA to make recommendations of mitigation that can be incorporated to reduce the severity of impacts. The impact is then re-assessed taking into consideration the mitigation to provide a residual impact with the aim of the residual impact being non-significant.

5.2 Construction

5.2.1 Introduction

82. Construction phases of projects have the potential to result in disturbance to local residents and visitors to the area and to those passing through the area. Potential impacts are generally related to road use, noise and vibration, restricted land access and air quality. Increased road use by construction traffic and temporary works on the roads for site access and haulage roads have the potential to impact on other road users and local communities through increased driver delay which leads to driver frustration and loss of access to amenities. Impacts identified during the EIA are outlined below with reference to potential health impacts.

83. Impacts associated with the offshore elements of the project have not been assessed as there would be no sensitive receptors close enough to the offshore construction area to experience health impacts.

5.2.2 Potential impacts to health from changes in air quality

84. Works associated with the construction of the onshore elements have the potential to generate dust and emissions that could potentially impact on health. The construction works associated with the proposed development have the potential to impact on local air quality conditions as described below:

- Dust emissions generated by excavation, construction and earthwork activities associated with the construction of the proposed development, have the potential to cause nuisance to, and soiling of, sensitive receptors.
- Emissions of exhaust pollutants, especially NO_2 and PM_{10} from construction traffic on the local road network, have the potential to impact upon local air quality at sensitive receptors situated adjacent to the routes utilised by construction vehicles.
- Emissions of NO_2 and PM_{10} from non-road mobile machinery (NRMM) operating within the proposed development site, have the potential to impact local air quality at sensitive receptors in close proximity to the works.

85. Particulate matter emissions during the construction phase of the proposed East Anglia THREE project would arise from the 62 jointing bay locations, the seven CSS, the substation(s) site and unpaved haul roads along the onshore cable route. Chapter 20 Air Quality of the ES outlines embedded mitigation that has been incorporated into the project design and construction methods; these mitigation measures were taken into account during the assessment.

86. In terms of health impacts, PM_{10} concentration is the most important factor in considering potential health risks. The assessment in Chapter 20 Air Quality of the ES determines that construction and earthwork activities would result in the highest annual mean background PM_{10} concentration across the study area is less than 24µg.m^{-3} and there are 10 - 100 receptors within 50m from the PCCS and jointing bay. The sensitivity is therefore low.

87. There is also a potential for increased PM_{10} levels at the track-out. The EIA determines that there are 10 - 100 receptors within 50m from the CCS, jointing bay locations and haul roads. The sensitivity is therefore low.

88. The assessment within Chapter 20 Air Quality of the ES concludes that the risk to human health from increases in PM_{10} concentrations from earth works and track-out would be low and that the risk from general construction activities would result in negligible risk. The impact on air quality is expected to be low or negligible and the number of sensitive receptors near to construction areas is low. However, there is the potential for members of the community with respiratory conditions to experience minor adverse impacts. The overall impact on health from impacts on air quality from dust is expected to be **minor adverse**.

89. Assessment of exhaust emissions generated from construction plant and off-site vehicles were predicted to have a negligible impact on air quality. That being the case, the intensity of the health impact is assessed as being minor and **negligible** and no perceptible effect on health is predicted.

90. Overall, there are not anticipated to be any impacts that will significantly impact on health as a result of changes to air quality. Chapter 20 Air Quality of the ES provides full details of the assessment and underlying conclusions supporting this assessment.

5.2.3 Potential impacts to health due to changes in the water environment

91. Negative impacts on water resource and flood risk can occur as a result of construction activities due to accidental spillages, changes to drainage and changes to surface run-and ground water conditions.

92. Full details of the activities proposed during the construction phase are provided in Chapter 5 Description of the Development of the ES. In summary, the activities considered likely to impact on water resource and flood risk are:

- Installation of onshore cables including landfall transition bay and jointing bay locations;
- Construction of an onshore substation(s), associated infrastructure and landscaping;
- Creation of temporary CCS / laydown areas;
- Temporary upgrade of existing access tracks, construction of new access tracks and haul roads;
- Stockpiling of topsoil and subsoil;
- Re-use of excavated soil in jointing bays;
- Disposal of excess spoil offsite to a suitably licensed facility; and
- Removal and reinstatement of existing drainage systems.

93. Impacts to groundwater condition from construction activities at the landfall have been assessed as negligible; as such, impact on public health from changes to ground water is also expected to be **negligible**.

94. The construction phase has the potential to affect surface water and watercourses in the following ways:

- Increase sediment loading;
- Disturbance and transmission of contaminated sediments; and
- Change in water quality through spills and leaks; and
- Changes to the flow patterns, sediment transport and direct disturbance of bed and banks due to construction of new watercourse crossings.

95. The geology beneath the onshore electrical transmission works from landfall to Great Bealings predominantly comprises granular sand and gravel type material within the Kesgrave Catchment Subgroup, Alluvium or Red Crag. All these deposits are classed as Secondary A Aquifers. This area does not lie within a groundwater source protection zone although three private abstraction licences lie within the Great Bealings area, licensed for agricultural purposes. The sensitivity of the

groundwater in this area is considered to be medium. As this water is used for agricultural purposes there is a potential pathway to public health impacts, however, the risk of direct impact is low.

96. Chapter 21 Water Resource and Flood Risk of the ES concludes that the level and type of activities to be undertaken during the onshore cable route and substation construction are likely to have a negligible impact on ground water conditions on the site. There is a low risk of change to ground water conditions due to construction works; therefore there is a low risk pathway to public health. Any changes to water quality as a result of construction activities are likely to be minor and not directly impact on human health, although there could be indirect impacts through the use of water for agricultural purposes. Impacts to water are likely to be mainly due to increased sediment load as the release of contaminants will be minimised through the use of best practice guidelines.

97. There is a low risk of changes to water directly impacting on community health as the water is not a source of drinking water and direct contact is unlikely. Risk of contamination is low and it is highly unlikely that serious conditions would develop from contact with water. Due to the low risk of effect and the unlikely nature of serious impact, the health effect is predicted to be **negligible.**

98. Impacts on surface water have the potential to result in increased risk to public health through members of the public coming into contact, either directly or indirectly (through the environment) with surface water.

99. The assessment in Chapter 21 Water Resource and Flood Risk of the ES predicts that construction activities for all areas of the onshore works would result in either no impact or negligible impacts on surface water quality. With little or no risk of impacts on water quality there is no source of risk to public health. Adverse impacts may occur in the case of an accident where contaminants come into contact with surface waters, however, the risk of this is very low due to the mitigation measures and best practice methods incorporated into construction methods. Any impacts to water are likely to result in minor reduction of water quality through increased sediment load and are therefore unlikely to result in more than a temporary annoyance and would not represent a significant risk to health.

100. Surface water in the area is not a source of drinking water and the public are unlikely to come into direct contact with surface waters along the onshore cable route. Therefore, if there was a reduction in water quality it is unlikely that health impacts would be caused. Therefore the impact on health is considered **negligible to minor adverse**.

101. In summary, there are not anticipated to be any impacts that would result in significant changes to the current health of receptors near the landfall, onshore cable route or substation.

5.2.4 Potential impacts to health through changes to land-use

102. Changes to land use have the potential to result in either short-term or long-term loss of access to important public spaces such as public rights or way (PRoW) or community green space. This can lead to reduced levels of activity which can impact on a community's fitness and well-being. The use of outdoor space is important from both a physical and mental health perspective.

103. Temporary loss of access to land during the construction period will occur where land needs to be fenced off for safety and security purposes. These areas would be re-opened once construction works have been completed. The impact on the local community is largely dependent on the existing use of the land and whether it is an important source of public outdoor space.

104. Most of the land that will be required for the onshore cable route and substation is within agricultural land, which, unless there is a PRoW across the land, is private land of limited use to the general public as outdoor space. Fencing of land will result in loss of access and potentially severance for land owners and occupiers, however, the loss would be of limited consequence to the wider community.

105. At this stage it is not possible to calculate the area of land that would become isolated or inaccessible, as access to individual fields would be determined as part of detailed design and construction planning. It is however likely that relatively small areas or strips of land would be affected. The impacts of this loss of land are likely to be low as land agreements have been implemented. Land owners will be aware of the consequences of the land agreement and will have taken them into consideration during the negotiation stage, thereby limiting the negative impacts of loss and separation.

106. The loss of agricultural land as an important source of food and employment also needs to be considered. In total, all land taken for either temporary or permanent works would equate to between 0.014% and 0.027% of available agricultural land within Suffolk. This would represent a negligible loss of land for food production and is not expected to result in a reduction in agricultural employment.

107. The loss of land was assessed within Chapter 22 Land Use of the ES as a **minor adverse** impact. In terms of health implications it is highly unlikely that the temporary loss of access to private agricultural land will have impacts on the local

community. Individual landowners / occupiers may experience some inconvenience and / or annoyance, however, as land owners and occupiers are likely to be fully aware of the implications of allowing works on their land, it is unlikely that these activities would result in significant impacts on emotional / mental health (from increased stress). Therefore impacts on health are considered to be **negligible**.

108. There are PRoW within the landfall area. One is a bridleway and the second is The Suffolk Coastal Path (see ES Volume 2 *Figures 22.6a-g)*. This path has significantly eroded away to a state whereby it is currently impassable. However, in the assessment within Chapter 22 Land Use of the ES, a worst case assumption has been made whereby the path has been considered as reinstated by the relevant authorities prior to EATL commencing construction. The footpath is therefore considered to be of medium sensitivity. Access to the beach may also be required with some temporary restriction of access to the general public.

109. It is currently proposed that the bridleway would remain open for duration of the construction period, which would be 10 weeks for the Single Phase approach and would be two separate periods of 10 weeks for the Two Phased approach.

110. The Suffolk Coastal Path would potentially experience some disturbance as a result of requiring vehicular access to the beach, however, it is anticipated that this would be a period of several hours only during the excavation and re-burial of the cable exit pit. During this period, some access to parts of the beach will be restricted.

111. The onshore cable route and substation crosses a number of PRoW and cycle paths. Where works are only expected to impede PRoWs for a short duration of time (days) it is not anticipated that diversions will be required. PRoW access will be maintained using safety personnel to guide PRoW users across the construction site. Where access is impeded for longer the use of diversions will be set up to maintain access. It is not anticipated that any of the cycle paths will require closure or diversion and therefore no impact to users is anticipated.

112. Chapter 22 Land Use of the ES concluded that effect of loss of access to PRoW would be negligible. In terms of impacts to health, there would be some increased noise at these sections of PRoW which may cause temporary annoyance and avoidance of these areas by regular users. However, as access will be maintained in most locations there is unlikely to be a significant reduction in people using the paths, therefore there should not be any impact on levels of physical activity in the local area. Impacts to health are likely to be limited to mild annoyance for limited period of time. People are likely to adapt easily to the disruption and be infrequently subject to the increased noise which would only affect limited sections of the path.

Therefore impacts to health as a result of temporary loss of access to PRoW at the landfall are predicted to be **negligible to minor adverse.**

113. Overall, there are no significant impacts to health predicted from the change in land use and temporary loss of access to facilities. No communal land will be lost from use and although PRoW and cycle paths may experience some disruption, this is likely to be temporary, minor and access would in most cases be fully maintained. Chapter 22 provides full details on the impacts on land-use.

5.2.5 Potential impacts to health from construction noise and vibration

114. Noise and vibration caused by construction activities, in particular excavation, earth moving and piling, have the potential to cause noise disturbance to sensitive receptors. Different receptors are likely to have different sensitivities to noise and vibration impacts, for example if the receptor was a school, children's education may be disturbed, however, if the receptor was a retirement home noise may result in increased stress to residents. Due to the location of the onshore cable route and substation, the only receptors that have been identified are residential and there are no sensitive community receptors identified.

115. Reference should be made to Chapter 5 Description of the Development of the ES, for full details of the activities proposed during the construction phase. In summary, the activities considered to have the potential to generate a noise and vibration impact are:

- Construction of onshore cable systems including landfall transition bay and cable jointing bays and pull-through of cables;
- Construction of onshore substation(s), associated infrastructure and landscaping; and
- Operational onshore substation(s).

116. For the landfall, works that will generate noise will be required to uncover the pre-installed duct, construct the transition bay and for cable pulling activities. Residents at Ferry Road were identified as a sensitive receptor for noise impacts relating to the landfall works. Standard mitigation measure for reducing construction noise have been incorporated into the assessment. In Chapter 26 Noise and Vibration of the ES it was assessed that noise impacts received by the Ferry Road residents from works would be negligible. As the change in noise levels has been assessed as negligible it is considered that that the source of any health impact would also be negligible, and therefore health impacts for the residents of Ferry Road would be of **negligible** significance and not result in a perceptible change in health.

117. During cable installation activities several residential receptors were identified. Works required for cable installation were all predicted to result in negligible changes to noise levels and therefore it was predicted there would be a negligible effect on residents. This being the case, the source for consideration of health impacts would also be negligible and therefore it is predicted that there would be a **negligible** impact on health determinants and residents along the onshore cable route.

118. The construction of the substation will require excavation and potentially impact piling activities which have the potential to generate high amplitude noise, however, the assessment in Chapter 26 Noise and vibration of the ES did not identify any receptors that would receive effects from construction noise. Therefore there is no pathway for an impact on health and as such **no impact** on health is expected.

119. Noise and vibration generated by increased road traffic (offsite), particularly heavy goods vehicles has the potential to disturb residents living adjacent to the road network. Chapter 26 Noise and Vibration of the ES identifies sensitive receptors and discusses noise likely to be generated by an increase in traffic. The assessment concludes that off-site traffic would result in a negligible to minor effect on receptors identified. Off-site road traffic is likely to be fairly constant during the day, last for the duration of the onshore cable installation phase and would potentially result in mild annoyance to local residents, therefore the impact on health is predicted to be **minor adverse**.

120. No significant impacts on health associated with noise and vibration have been identified.

5.2.6 Potential health impacts from changes in traffic and transport conditions

121. Increased traffic flow during construction has the potential to cause local communities to experience severance or a restriction of access to local amenities such as local shops or public transport. A lack of access to community facilities has the potential to effect physical and emotional health.

122. The assessment of traffic and transport conditions in Chapter 27 Traffic and Transport of the ES assesses the impact of severance as a result of increased construction traffic as negligible. If severance effects are likely to be negligible there would be no perceivable effect on health, as a result, the impact of severance on health is also predicted to be **negligible**.

123. Links 6 (Paper Mill Lane and 15 (Top Street) were identified as experiencing large increases in HGV numbers but were assigned a low sensitivity for pedestrian amenity

in the assessment. Both these links serve the Primary CCSs which have been located specifically to avoid impacting on human receptors (i.e. located outside settlement envelopes). This in turn ensures that HGV traffic can access the Primary CCSs from the HGV distributor network with minimum effect on pedestrian activity.

124. Pedestrian amenity along Link 30 (School Lane and Waldringfield Road) was identified as potentially experiencing significant impacts on pedestrians (and cyclists) using the road due to being narrow and un-footpathed. The ES proposes that appropriate mitigation would be to avoid using Link 30 as a haul road for HVGs thus avoiding the impact.

125. As a result of the mitigation, the overall effect of impacts on pedestrian amenity is predicted to be minor. It is not anticipated that pedestrians will experience significant impacts on amenities, however, minor impacts are likely to be experienced throughout the construction period and pedestrians are likely to experience mild annoyance, in particular at Links 6, 15 and 30 therefore, health impacts associated with amenity are predicted to be **minor adverse**.

126. Road safety is an important consideration when a project is likely to increase the number of vehicles using local road networks. ES Chapter 27 Traffic and Transport identifies two Links, 12 and 27 (Trimley Road and B1083 south from the A1152 to south of Shottisham), where road collision is calculated to be above the national average as a result of the addition vehicles, and as such is predicted to receive a major adverse impact. In addition to Links 12 and 27, the assessment also identifies Links 7, 19 and 21 (B1113, B1079 from the A12 to Grundisburgh and B1077 between the B1078 and A1156) also have been assigned a major adverse effect on road safety as a result of increased traffic. Mitigation embedded into the project to manage traffic is outlined in Chapter 27 Traffic and Transport of the ES. With this mitigation taken into consideration road safety at all of the links is predicted to be minor adverse or less.

127. In terms of health, road safety is an important factor, as although collisions are likely to be rare, the consequences can be severe. Traffic management techniques embedded into the mitigation are likely to prevent serious collisions (such as those at speed) but injuries from collision still have the potential to require hospital treatment. However, collisions are expected to be rare and impact on a local scale, therefore it is predicted that there will be a **minor adverse** impact on health overall.

128. With the use of traffic management planning and mitigation, there is predicted to be a minor adverse effect on driver delay. Driver delay has the potential to result in frustration and stress within drivers, particularly local residents that will pass the

project area on a regular basis i.e. commuting. As the effects will be minor, local and will be likely to change over the construction period, drivers are likely to experience annoyance but not injuries; the effect on health is predicted to be **minor adverse**.

129. Overall, there are no significant impacts that have been identified as a result of changes to conditions in traffic.

5.2.7 Potential health impacts due to socio-economic factors

130. Socio economic factors such as direct and indirect employment and economic boosts for the local economy are likely to have a positive impact on health within an area through the provision of jobs and additional income which have positive emotional benefits on those who are impacted. The assessment within Chapter 28 Socio-economics, Tourism and Recreation of the ES predicts that the offshore construction phase will result in a high beneficial magnitude of effect to be gained by the economic and job prospects the project will bring. The onshore construction phase will result in a moderate beneficial impact.

131. Economic activity in Suffolk is above average for the UK, however, the creation of local jobs, either through direct employment (employed to work on the project) or indirect employment from the undertaking (through the supply chain, local shops, accommodation etc.) is likely to bring some additional security to local communities along the onshore cable route and surrounding catchment area.

132. In terms of health, the emotional wellbeing that accompanies socio-economic stability is difficult to predict as it is difficult to predict which communities will benefit the most. As beneficial impacts will last for the duration of the project construction phase (and operational phase) and have the potential to result in local to regional benefits it is predicted that the project will have **minor to moderate beneficial** effect on health.

5.2.8 EMF

133. As electrical infrastructure will not be active during the construction period there is no impact to consider during the construction phase.

5.2.9 Waste

134. During construction any waste generated by the project will be disposed of in accordance with government guidelines on the disposal of commercial and business waste.

135. It is expected that there will be little waste generated during the construction phase of the onshore cable route works, waste generated is likely to be largely excavated material from green field agricultural land and will therefore largely be suitable for

reuse. Where possible EATL will seek to reuse and recycle waste prior to disposal at landfill. Material removed during excavation will be used in reburial and landscaping where possible.

136. Welfare facilities for workers during the construction period will be designed so that no untreated brown or grey water is released into the environment and refuse from the sites is treated in a responsible manner. Recycling of waste will be done where possible. All waste generated by onsite workers will be disposed of in a responsible way in accordance with government guidelines on the disposal of commercial waste. Recycling will be undertaken where possible.

137. As the onshore cable route and substation will be installed in agricultural land, it is not anticipated that there will be hazardous material present that would require disposal. During construction, excavated material will be monitored for signs of contamination. In the unlikely event of contaminated land being found during construction guidelines on the handling, removal and disposal of hazardous waste would be followed. This would include measures to avoid contamination of ground and surface water and measures to avoid particulates becoming airborne and dispersed. It is not anticipated that any hazardous waste will be produced during the operational period.

138. All waste generated from the construction of the proposed East Anglia THREE project will be disposed of in accordance with best practice guidance. There is not anticipated to be a risk to public health, therefore it is anticipated there would be **no impact** on public health**.**

5.3 Operation

5.3.1 Potential impacts on health from changes in air quality during operation

139. It was the opinion of the Planning Inspectorate that there would be no impacts on air quality during the operational phase; it was therefore scoped out of the EIA. As there will be no impacts on air quality, it is predicted that there will be **no impact** on health as a result of the project's operation.

5.3.2 Potential impact on health from changes in water resource quality during operation

140. The construction of jointing bays, kiosks and transition bays are designed to ensure that there is no impact on ground water and would be positioned at least 10m from surface water receptors. Mitigation measures to avoid any spills or leakages have been embedded within the project design. Sustainable drainage systems will be installed at the substation to manage surface water flows on the site. The

assessment predicts that there would be no pathway for impacts to surface and ground water during the operation period.

141. This being the case, there is also no pathway for impacts on health; as such it is predicted that there will be **no impact** on health**.** See Chapter 21 Water Resources and Flood Risk of the ES for full details of the assessment.

5.3.3 Potential impacts to health due to changes to land use during operation

142. At the landfall and along the onshore cable route areas of land that would be affected by permanent easement restrictions have been minimised through the route selection process as described in ES Chapter 4 Site Selection and Alternatives.

143. The easement restrictions may restrict the types of activities that can be undertaken directly over the installed cables, however, it is anticipated that normal agricultural activities would be able to resume.

144. It is anticipated that 3.04ha of agricultural land will be permanently altered for the construction of the substation and, due to the quality of the land, would constitute a minor adverse loss of land.

145. In terms of health impacts, as all the land that will be altered is privately owned agricultural land of limited use to the public, and there will be no restrictions on access to PRoW or cycle networks, there would be no change from current baseline conditions and therefore it is predicted that there will be **no impact** on health during operation from changes of land use. See Chapter 22 Land Use of the ES for full details of the assessment.

5.3.4 Potential health impacts from noise and vibration during operation

146. There will be no noise emitted at the landfall during operation, therefore residents will not experience changes in noise background levels from the current baseline.

147. There would be small amounts of traffic associated with occasional maintenance of the cable (undertaken at the jointing bays), therefore receptors along the onshore cable route may experience noise from this activity. The noise increase as a result of this traffic and as a result of maintenance works on the onshore cable route would be of negligible magnitude on receptors of medium sensitivity and is therefore predicted to be of negligible significance.

148. The proposed East Anglia THREE project will commit to a requirement limiting operational noise from the substation(s) to no greater than 5dB above the background noise level ($L_{A90,1hr}$) during the daytime and 35dB $L_{Aeq,\ 15\ min}$ during the night at Bullenhall Farm, Hill Farm and Woodlands Farm. The effect of this

requirement will be such that noise emissions from the proposed East Anglia THREE project will not exceed the prescribed limit at any of the identified receptors.

149. Detailed mitigation for the proposed East Anglia THREE project will be set out in an operational Noise and Vibration Management Scheme to be agreed with the local authorities. Measures likely to be considered as part of these schemes will involve:

- Selection of quieter equipment;
- Installation of acoustic enclosures;
- Installation of acoustic barriers (fire walls may be required around the substation transformers, which may provide some acoustic benefit);
- Screening substations further by the construction of a landform / embankment around the site (see Chapter 29 Seascape, Landscape and Visual Amenity of the ES for more details), which will protect against flooding and may also provide up to 10dB attenuation;
- Silencing of exhausts/outlets for air handling/cooling units; and
- Locating equipment to take advantage of screening inherent in the design, i.e. from the substation hall(s) or control room buildings.

150. Residual impacts following mitigation are predicted to be **negligible** at all locations.

151. Operational noise after mitigation is predicted to be negligible at all receptors along the land fall, cable route and substation, as such receptors are unlikely to receive levels of noise that would induce annoyance, therefore, it is predicted that there would be **negligible** impact on health of residents at sensitive receptors.

5.3.5 Potential impact to health from changes in traffic and transport during operation

152. The peak change in operational traffic flow is 20 (two-way) vehicle movements for the substation and six (two-way) vehicle movements per day to any of the jointing bays and is therefore assessed as negligible. If unplanned maintenance encompassing excavation of trenches is required during operation then there may be a requirement for the cables to be excavated to gain access. Notwithstanding, the impacts are considered to be indiscernible from background fluctuations in traffic and therefore the impacts are considered to be negligible.

153. As there is predicted to be a negligible change in traffic levels as a result of the operational phase, there is unlikely to be impact to health due to severance,

pedestrian amenity, road safety or driver delay. Therefore health impacts as a result of changes in traffic and transport during operation are predicted to be **negligible.**

5.3.6 Potential impacts to health due to socio-economic factors during operation

154. EATL estimates the annual operation and maintenance requirement will be approximately 100 full time employees (FTE). This will support 160 net additional jobs and provide £13.7million GVA per annum. The operation and maintenance phase will provide £341.5million cumulative GVA to the East Region over the lifetime of the project. As a result of the job creation, a moderate beneficial effect is predicted.

155. Although beneficial impacts to the community are likely to be highest during construction, the permanent creation of jobs is expected to have some limited benefit on emotional and financial stability to local communities. Therefore the benefit on health is assessed as being **negligible** to **minor beneficial**.

5.3.7 Impacts from electric and magnetic fields during operation

156. The East Anglia Three project has two potential options for electrical infrastructure that are being proposed, the use of HVDC electrical components and the use of LFAC electrical components. The project will include the following components, either as HVDC or LFAC.

- Up to four individual cables coming onshore at near Bawdsey using pre-installed ducts;
- Up to two fibre optic cables coming onshore near Bawdsey using pre-installed ducts;
- Onshore cable route, for the LFAC option there would be up to 12 single core cables within 4 pre-installed ducts (i.e. 3 cables per duct) and up to two fibre optic cables. For the HVDC option there would be four cables, one per duct. The cable route would be 37km long between the landfall and the substation at Bramford.
- Onshore substation compound, which would consist of up to two LFAC or HVDC substations.

157. If the LFAC solution is used the cable system would consist of up to 12 single core cables contained within four ducts. Each duct could contain up to 3 cables which could potentially cancel out the effects of each other's magnetic fields. Buried cables are usually shielded LFAC cables and are not considered to emit significant electrical fields, particularly once buried. For a comparison, unburied (overhead)

LFAC powerlines have been recorded to emit magnetic fields of between 0.3-5µT which is between 0.08% & 1.3% of the permitted exposure limit, whilst buried cables have reported fields of 2-3 µT within 5m of buried cable (Forewind, 2014).

158. If the HVDC solution is used the cable system would consist of up to four single core cables contained within up to four ducts. Magnetic fields from HVDC overhead lines have been measured at between 5 & 10 µT (EU, 2009), which represents between 1.3% & 2.7% of the maximum exposure levels. It would be anticipated that once buried, exposure levels would be less than 5-10 µT. It is generally accepted that DC magnetic fields are static and are similar in behaviour and strength as naturally occurring magnetic fields.

159. For both the LFAC and HVDC systems there is predicted to be no exposure to electrical fields and exposure to magnetic fields is expected to be much lower than the maximum permitted exposure level. In addition, electrical infrastructure will be installed in agricultural land and away from any areas of permeant residence; therefore the potential for exposure is limited. Therefore it is anticipated that there would be **no impact** to **negligible** impact on health from exposure to electric or magnetic fields generated by the project's electrical infrastructure.

160. The substation(s) would produce both DC and AC electromagnetic fields, but these are very short range and would be shielded by the building and perimeter fence. EATL would require the Contractor to evaluate the electromagnetic fields at the onshore substation(s) with respect to human exposure. This study would be followed up with a Site Acceptance Test to demonstrate that the substation(s) and AC connection comply with UK Government guidelines on occupational and public exposure limits.

161. Following the implementation of the embedded mitigation above, **no impacts** are predicted at the substation(s).

5.3.8 Waste

162. During the operational period any waste generated by the project will be disposed of in accordance with government guidelines on the disposal of commercial and business waste.

163. During the operation, welfare facilities at the substation will be suitably plumbed to avoid release of untreated sewage or water to the environment. All waste generated by onsite workers will be disposed of in a responsible way in accordance with government guidelines on the disposal of commercial waste. Recycling will be

undertaken where possible. It is not anticipated to be a risk to public health, therefore it is anticipated there would be **no impact** on public health**.**

5.4 Decommissioning

164. The impacts during decommissioning will be similar to those during construction and will be subject to a Decommissioning Plan and associated assessment at the relevant time.

6 SUMMARY

6.1 Noise disturbance and nuisance

165. Construction activities have the potential to cause disturbance through the generation of noise from plant, machinery and construction activities such as excavation and piling. The only sensitive receptors identified along the onshore cable route and substation(s) were residential properties. All other receptors were deemed too far to experience noise disturbance. The noise assessment determined that there were no sensitive receptors that would receive significant noise impacts during construction.

166. During operation, significant noise levels were predicted at residential receptors near the substation. Embedded mitigation measures have been incorporated into the design of the substation and the residual effects were determined to be non-significant.

167. As there will be limited exposure of sensitive receptors to elevated sound levels there is limited capacity for impacts to health determinants; as such, all effects on health during construction, operation and decommissioning phases are predicted to be **minor impacts or** less and not significant.

6.2 Air quality

168. Construction activities have the potential to result in localised reductions in air quality due to the release of exhaust emissions (from plant and vehicles) as well as elevating PM_{10} concentrations through generating dust. Mitigation measures to minimise the amount of exhaust fumes and dust generated by construction have been incorporated into the design of the project and construction methodology. By following standard best practice it is not predicted that construction will result in a significant impact on air quality. During operation there will be no activities undertaken that would have the potential to reduce air quality.

169. Due to the limited and non-significant nature of any impacts to air quality during construction, operation and decommissioning, health effects associated with reduction in air quality are likely to be minor (annoyance), highly localised and short term, therefore health effects are predicted to be **minor** or less and not significant.

6.3 Traffic and transport

170. During construction, increased presence of traffic, especially HGVs, has the potential to result in adverse effects on local communities' ability to access facilities through increased severance. In addition, road safety would be significantly impaired on

several minor roads. A traffic management scheme has been produced that would alleviate impacts on local communities and road safety by distributing construction traffic along more suitable roads and reduce peak flows and driver delay. During operation, the addition of 20 vehicles to the road network for permanent workers was determined to have no impact on the road network.

171. After the implementation of mitigation measures there is unlikely to be any significant impediment to local communities that would result in detrimental effects on health determinants during construction, operation or decommissioning. Any impacts during the construction period would be minor (annoyance) and temporary. It is therefore predicted that effects on health determinants would be **minor adverse** or less and not significant.

6.4 EMF

172. No EMF effects are anticipated during the construction period.

173. Once electrical infrastructure is live there will be little of no electrical field generated by either HVDC or LFAC infrastructure. Very small magnetic fields will be generated by both HVDC and LFAC systems; however, these are anticipated to be less than 5% of the maximum permitted exposure level and are therefore predicted to have **no impact** on health determinants during the operational phase.

6.5 Lifestyle and physical activity

174. There will be some temporary impedance of PRoW and cycle paths during the construction period, as well as some highly temporary (less than 1 day) loss of access to the beach during cable laying works on the beach. Where there is a need PRoW and cycle paths will be diverted or safety personnel used to ensure users can cross safely, therefore there will be no overall loss of access. Noise and visual disturbance during construction may result in lower usage by residents for short periods but as disruption will only affect small areas of the path and ample alternatives are available for use there is unlikely to be a significant impact on health determinants. During operation there will be no loss of access to common green space and all PRoW and paths will be fully accessible.

175. Impacts experienced are not likely to be any more severe than mild annoyance and will be temporary in nature, therefore it is predicted that there would be a **minor adverse** or less and non-significant effect on health determinants during the construction, operation and decommissioning phases.

6.6 Employment and income

176. The project is predicted to result in major (offshore) or moderate (onshore) beneficial effects in terms of employment and additional income to the area during construction. This can be expected to bring some level of positive impacts to local communities. During the operational period there is predicted to between 100-160 FTE. The employment and income that construction, operation and decommissioning phases would result in would be likely to result in **a minor beneficial** or less effect on health determinants.

6.7 Conclusions

177. After consideration of potential health impacts during the construction, operation and decommissioning phases there are not predicted to be any significant impacts on physical or mental health as a result of the project.

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