Chapter 9: Air Quality

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Connecting Europe Facility

NorthConnect KS

Servicebok 603, Lundsiden

N-4606 Kristiansand

Norway

Phone +47 38 60 70 00

Mail: post@northconnect.no

Web: www.northconnect.no

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9.1 Introduction

In this chapter, the potential effects on air quality are discussed and assessed. Mitigation measures required to minimise impacts are identified and residual effects assessed. The focus is on dust associated with construction onshore, and the overall Carbon Dioxide (CO_2) savings of the project during operations. Decommissioning has been scoped out of the assessment.

9.2 Sources of Information

9.2.1 Regulatory Framework

9.2.1.1 International

The Directive 2008/50/EC on ambient air quality and cleaner air (European Parliament, 2008), aims to reduce harmful effects on health and the environment by defining and establishing ambient air quality objectives. It lays down measures for assessment, information collation and sharing, maintaining and improving air quality, and promotes member state cooperation to assist with its aim.

Directive 2008/50/EC sets out specific monitoring requirements and targets for Sulphur Dioxide, Nitrogen Dioxide (NO_2) and oxides of Nitrogen (NO_x), particulate matter (PM10 and PM2.5), Lead, Benzene and Carbon Monoxide (CO) as well as Ozone (O_3).

Similarly, Directive 2004/107/EC relating to Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in ambient air (European Parliament, 2004), aims to minimise effects on human health associated with these substances in air. It lays out target values for each of the substances.

9.2.1.2 National

Air Quality Standards (Scotland) Regulations 2010 enacts the two European directives into Scottish Law. It identifies the circumstances under which Air Quality Plans must be drawn up for zones, in order to achieve the appropriate limits and target values.

As discussed in Chapter 2: Project Description, Section 2.3: Needs Case, there are both International and National policy drivers to reduce Carbon emissions, this is reflected down through the planning policy framework as discussed in Chapter 5: Planning Policy.

The Climate Change (Scotland) Act 2009 (Scottish Parliament, 2009) sets a target of reducing greenhouse gas emissions by at least 80% by 2050, with an interim target of reducing emissions by at least 42% by 2020.

The Scottish Government has also developed policies relating to air quality in the document, 'Cleaner Air for Scotland – The Road to a Healthier Future' (Scottish Government, 2015). This document provides a national strategy in order to *"achieve the best possible air quality for Scotland"*.

9.2.1.3 Local

Since the Local Air Quality Management (LAQM) review and assessment process was introduced by the Environment Act 1995 (UK Government, 1995) and associated regulations, local authorities across Scotland have been required to review and assess the air quality within their geographical areas. The process is designed to identify any exceedances of the Scotland Air Quality Strategy Objectives, and to enable any local authority that identifies such an exceedance to develop and implement a plan to improve air quality within the area.

Under section 83(1) of the Environment Act 1995, Local Authorities have a duty to designate any relevant areas where the air quality objectives are not being (or are unlikely to be) met as Air Quality Management Areas (AQMAs) and follow the declaration with an Air Quality Action Plan to improve air quality in that area.

Aberdeenshire Council carry out a yearly review of monitoring data and emission sources within the Council area, in which the information is compared with National Air Quality Objectives (NAQS), and their last published report was in 2017 (Aberdeenshire Council, 2017). Additionally, a triennial Air Quality Updating and Screening Assessment is undertaken, the last having been published in 2015 (Aberdeenshire Council, 2015).

In the last yearly report published in 2017, NO_2 concentrations were monitored at 15 sites, 6 of which were located in Peterhead. It must be noted that Aberdeenshire Council does not carry out any monitoring in respect of any of the other pollutants included in the Air Quality Standards (Scotland) Regulations 2010, since the concentration of those pollutants has traditionally been negligible and there is no reason to believe otherwise at present.

9.2.2 Air Quality Guidance

The following documents published by the Institute of Air Quality Management (IAQM) have been utilised in the production of this chapter:

- Assessment of Dust from Demolition and Construction (IAQM, 2014); and
- Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites(IAQM, 2012).

9.2.3 Energy Forecasts

The following sources of information were used to help inform the analysis of CO_2 savings of the NorthConnect project:

- ENTSO-E 10 Year Network Development Plan; and
- National Grid Future Energy Scenarios.

9.3 Assessment Methodology

9.3.1 Baseline

A desk study was undertaken to inform the characterisation of the existing baseline conditions. The Air Quality in Scotland website provides a centralised source of air quality information for Scotland. Data and maps on Local Air Quality Management parameters, and Air Quality Management Areas, are provided (Ricardo-AEA, 2015).

9.3.2 Impact Assessment Methodology

The air quality impact associated with the project, which could have a negative effect, is particulate and dust emissions during construction works. PM_{10} is particulate matter of particles with a diameter of 10 micrometres (µm) or less. Dust is the particulate matter whose diameter is larger than 10 µm. Suspended particulate matter is known to affect breathing and respiratory systems, damage lung tissue, as well as being linked to cancer. The elderly, children, and people with chronic lung disease, asthma, or influenza, are especially sensitive to the effects of particulate matter.

In practical terms, the sources of dust and PM_{10}s as well as the mitigation measures utilised to control them are the same. As such, the term dust will be utilised within this chapter to cover both dust and PM_{10} effects.

The impact assessment methodology utilised is based on the IAQM Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014). It should be noted that the methodology, unlike that described in Chapter 3: Methodology, does not take into account tertiary mitigation such as standard construction practices outlined in Pollution Prevention Guidance notes, in the initial assessment.

The NorthConnect project has the potential to contribute towards a reduction in CO_2 emissions. CO_2 is the primary greenhouse gas emitted through human activities. Global climate change is the most obvious consequence of the increasing levels of CO_2, and some of the effects associated with this phenomenon are rising sea levels and structural changes to ecosystems, amongst others. The use of the standard methodology detailed in Chapter 3 for assessing the significance of effects is not appropriate in this case. As an alternative, CO_2 calculations and estimates have been carried out to estimate the carbon cost of construction. This is offset against the potential CO_2 savings predicted by energy modelling, to provide an understanding of the overall effect of the project.

9.3.2.1 Evaluation of Receptors

The sensitivity of various receptors to air pollution is determined by a number of factors including:

- Duration spent within the area, i.e. transient or constant presence;
- Sensitivity of receptor i.e. the very old or young or certain plant species; and
- Distance from the source.

For any human receptor within 350m or ecological receptor within 50m of the site boundary, or any human or ecological receptor 50m of the route used by construction up to 500m from the site entrance, an assessment is required (IAQM, 2014).

Table 9.1 considers a range of factors based on the IAQM Guidance (2014) to define sensitivity of air quality receptors.

Table 9.1 Air Quality Sensitivity

Sensitivity	Criteria
High	Hospitals, Care homes, Schools within 50m of the source. >10 residences within 20m of the source. >100 residences within 50m of source. Areas where people expect a high level of enjoyment of an amenity or where people are continually present or will spend long periods of time e.g. museum. Amenities of high cultural or sensitive nature within 50m. Long-term carparks within 50m. Internationally or Nationally designated sites and the designated feature may be affected by dust soiling is within 20m. Community of dust sensitive species included in the Red Data list species within 20m.
Medium	1-10 residences within 20m of source. >10 residences between 20 to 50m of source. >100 residences between 50 and 100m of source Non-residential properties where people are present for long periods of time e.g. offices within 50m. Areas of amenity users would expect to enjoy at a reasonable level continuously or regularly for extended periods e.g. parks within 100m. Medium-term carparks within 100m. Internationally or Nationally designated sites where the qualifying feature dust sensitivity is uncertain or unknown or may be sensitive within 50m (SSSI).
Low	1-10 residence between 20m and 350m of source. >10 residences between 50m and 350m of source. >100 residence between 100 and 350m of source Transient exposure groups, people moving through an area i.e. footpaths. Short term carparks. Where users would not reasonably expect the enjoyment of the amenity and reasonably be expected to be present only for limited time. Non-residential properties where people are present for long periods of time e.g. offices within 100m. Locally designated sites where the qualifying feature may be sensitive to dust. Internationally or Nationally designated sites and the designated feature may be affected by dust soiling is within 100m.

9.3.2.2 Magnitude of Impact

The definitions of impact magnitude for various dust emitting operations that may occur on a construction site provided in the IAQM Guidance (IAQM, 2014). The ones relevant to the HVDC cable laying are outlined in Table 9.2.

Table 9.2 Magnitude of Potential Impact

Dust Emissions Classes for Earthworks Activities	
Large	Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonne.
Medium	Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000tonne – 100,000tonne.
Small	Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000tonne, earthworks during wetter months.
Dust Emissions Classes for Trackout	
Large	>50 HGV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m.
Medium	10-50 HGV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m.
Small	<10 HGV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m.

9.3.2.3 Significance Evaluation

The significance of effects will be determined as per Table 9.3, taking account of receptor sensitivity accounting for distance from the source, and impact magnitude.

Table 9.3 Categorising significance of effects.

	Receptor Sensitivity		
Magnitude of Impact	**High**	**Medium**	**Low**
Large	Major	Moderate	Minor
Medium	Moderate	Moderate	Minor
Small	Minor	Minor	Negligible

Key

(orange)	**Significant Effect**
(blue)	**Non-Significant Effect**

9.3.3 Mitigation Identification

Appropriate mitigation is identified for the management of dust, taking into account IAQM Guidance (IAQM, 2014) and Pollution Prevention Guidance (PPG) 6: Working at Construction and Demolition Sites (SEPA, 2014). Monitoring is also proposed in line with IAQM's Air Quality Monitoring in the Vicinity of Demolition and Construction Sites (IAQM, 2012).

9.3.4 Residual Effects

Residual effects are assessed by reassessing the impact magnitude taking account of the mitigation and then re-categorising the significance of the effect.

9.4 Baseline Information

This section describes the baseline local air quality conditions within the area of influence of the HVDC cabling. The majority of the HV cable corridor is currently farmland and, as such, is assumed to have a relatively high air quality. The cable corridor crosses the A90, a busy road, which will produce some vehicle fuel emissions.

According to the Air Quality in Scotland database and website, there are no Air Quality Management Areas in Aberdeenshire Council Area (AQIS, 2017). The closest AQMAs are located in Aberdeen, 30 miles to the south of the proposed development.

The locations of the six NO_2 concentration monitoring locations in the Peterhead area are provided in Table 9.4 (Aberdeenshire Council, 2017). The closest monitoring location to the NorthConnect site is Peterhead SR which is approximately 2.8km north north east of Fourfields.

Table 9.4 Details of NO_2 Monitoring Sites in Peterhead in 2017.

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	Distance to kerb of nearest road
Peterhead 2	Kerbside	E 413209 N 846356	NO_2	< 5m
Peterhead 4	Kerbside	E 415758 N 846144	NO_2	< 5m
Peterhead BH	Roadside	E 413379 N 845906	NO_2	< 5m
Peterhead MS1	Kerbside	E 413420 N 845918	NO_2	< 5m
Peterhead MC	Kerbside	E 412553 N 844839	NO_2	<3m
Peterhead SR	Kerbside	E 412495 N 844286	NO_2	<3m

The last results published by Aberdeenshire Council in 2017, includes data to 2016 (Aberdeenshire Council, 2017). The emissions data covering the period from 2012 to 2016 is included in Table 9.5.

Table 9.5 Results of NO_2 Diffusion Tubes (2012-2016) at Peterhead

Site Name	Valid data capture in 2016 (%)	NO_2 annual mean concentrations (µg/m^3)				
		2012	**2013**	**2014**	**2015**	**2016**
Peterhead 2	75	29.3	27.5	30.0	28.3	23.0
Peterhead 4	75	22.4	28.5	25.3	22.5	21.4
Peterhead BH	75	N/A	N/A	32.2	31.4	26.6
Peterhead MS1	75	N/A	N/A	28.1	28.1	25.4
Peterhead MC	75	N/A	N/A	N/A	N/A	9.8
Peterhead SR	75	N/A	N/A	N/A	N/A	9.7

None of the annual mean concentrations at any of the stations exceeded the National Air Quality Objective for NO_2, set at 40 µg/m^3. The highest annual mean concentration was recorded at the Peterhead BH station, being 32.2µg/m^3 in 2014. It is noted that the lowest concentrations of NO_2 are those closest to the site, and on the outskirts of the Peterhead. Around the HVDC onshore cable route levels would be expected to be lower still, with highest concentration of NO_2 being in the vicinity of the A90.

Other air pollutants are below concentration levels that would give local concern, hence the lack of routine monitoring data available. This is expected to be true of the HVDC onshore corridor also due to the lack of significant air pollution sources. Traffic on the A90 will contribute to PM_{10} and NO_x concentrations, but not at significant levels.

The presence of the Breedon Aggregates quarry to the east of the Fourfields site at the northern end of the HVDC cable corridor may give rise to dust emissions, particularly during peak times of activity or under unfavourable weather conditions. This is appropriately managed and controlled by Breedon Aggregates under their permits and licenses to operate the site.

It should be noted that the east coast of Scotland has a drier climate than the west or north of Scotland, with the annual precipitation rates at the nearest SEPA weather station amounting to less than 800mm per year (Scotland Info, 2018; SEPA, 2018). Under drier conditions, there is more of a chance for dust to be blown from the site. However, the ground along the HVDC cable corridor is known to be highly permeable with wet soil present (see Chapter 8: Geology and Hydrogeology), which means it is less likely to be lose and blown.

There are limited sources of information on air quality in the North Sea and there is no air quality management in place in the UK related to shipping specifically. A report produced in 2017 for the Department for Environment, Food and Rural Affairs (DEFRA), Scottish Government, Welsh Government and the Department of the Environment in Northern Ireland, assessed the impact of shipping on UK air quality (AQEG, 2017). Shipping does contribute to onshore emissions of NO_x and $PM_{2.5}$ concentrations near busy ports such as Aberdeen where the annual mean NO_x contribution from local shipping has been modelled in be in excess of 25µm/m^3 Aberdeen. In the immediate vicinity of Peterhead Harbour levels local shipping is modelled to contribute between 1 and 5µg/m^3, reducing to less than 1µg/m^3 before it reaches the cable corridor. Regional contributions to NO_x from shipping is between 0.5 and 1µg/m^3 from shipping for the whole of Aberdeenshire. Contribution to the UK's PM2.5 levels contributed to shipping are very low with mean annual level predictions below 1µg/m^3.

9.5 Identification and Evaluation of Receptors

Figure 9.1 demonstrates where the human receptors are in relation to the HVDC cable works. Station House, to the south of the A90 is approximately 50m from where the Access Road will be constructed. The closest occupied property to the HVDC cable corridor is Longhaven Mains farm whose farm house and outbuilding are between 50 and 100m from the cable construction corridor. Highfields is between 50 and 100m from the northernmost end of the HVDC consenting corridor. All other residencies are beyond 100m of HVDC cable construction works. In total there are less than 10 residential properties within 100m and less than 100 residencies within 350m as such residential receptors are classed as low sensitivity in accordance with Table 9.1.

The quarry boundary is within 20m of the Fourfield site and hence the redline boundary, however the cables will be installed such that they enter the west side of the converter station site, as such it is over 100m away. The quarry does include office accommodation, however it is not utilised for long periods of time, as such the quarry is not deemed to be a sensitive receptor.

The paths around the Fourfields site and along the cliff top, facilitate access to transient leisure receptors which are defined as having low sensitivity.

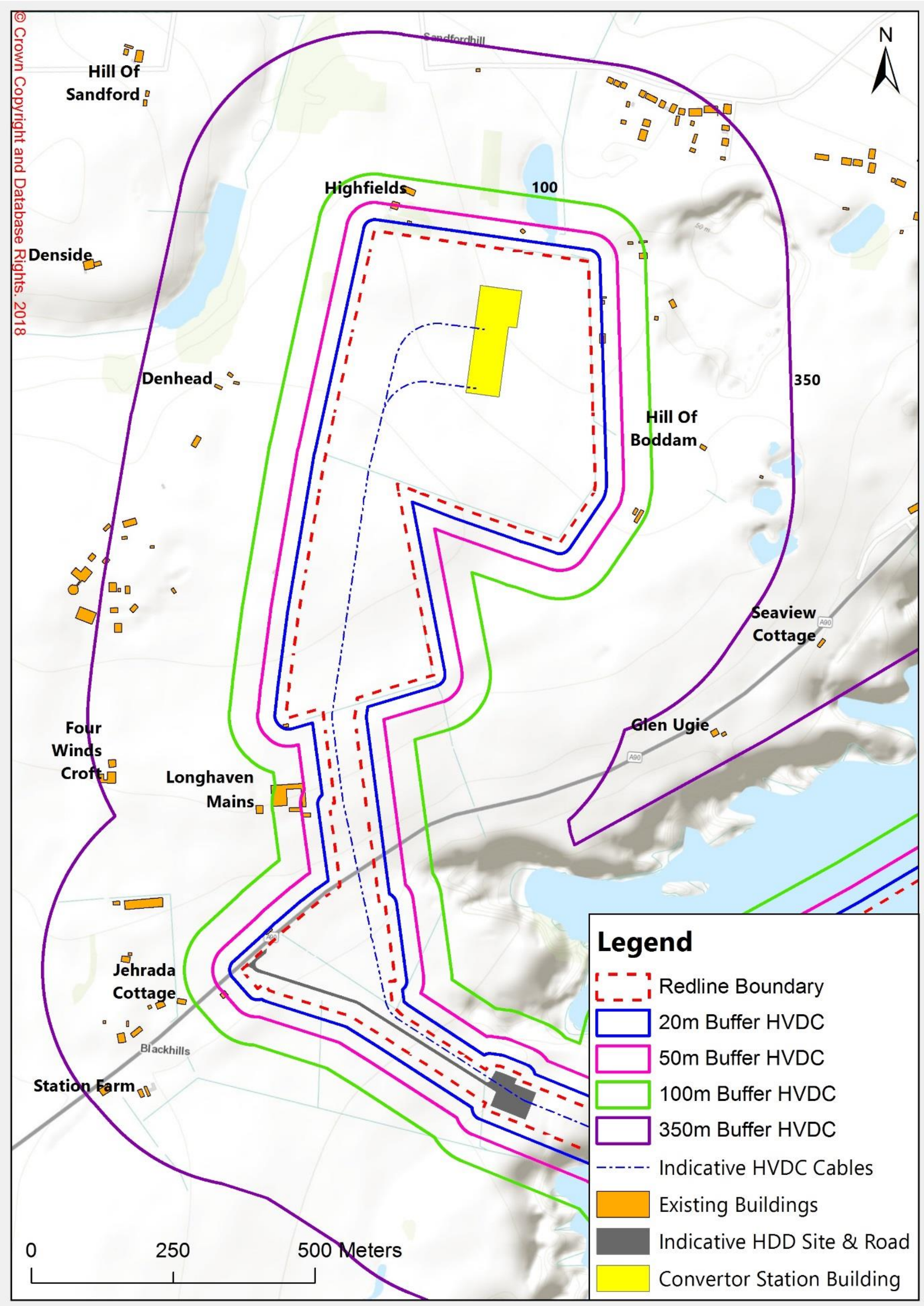

Figure 9.1 Human receptors within 350m of the HVDC cable corridor.

Further receptors which require evaluation are the Buchan Ness to Collieston Coast SAC, the Bullers of Buchan Coast SSSI designated sites; and Longhaven cliffs SWT nature reserve. These receptors are located close to the Landfall Horizontal Directional Drill (HDD) site. The Landfall HDD site and the HVDC cable corridor are all beyond 20m of the nature conservation sites apart from a very small section of land near the Landfall HDD site. This same section of the cliff falls within 50m of the HVDC cable corridor. From the vegetation survey carried out as part of the assessment on terrestrial ecology (see Chapter 13: Terrestrial Ecology), it is noted that this relates to a small section of MC9 (subdominant habitat), which is a designated maritime grassland; coastal heathland; and tall herbs and ferns. Due to lack of data, it is unknown whether these species are particularly sensitive to dust pollution but in accordance with Table 9.1, these habitats are assessed as being of medium sensitivity as a precautionary approach.

Figure 9.2 demonstrates where the nature conservation receptors are in relation to the HVDC cable works.

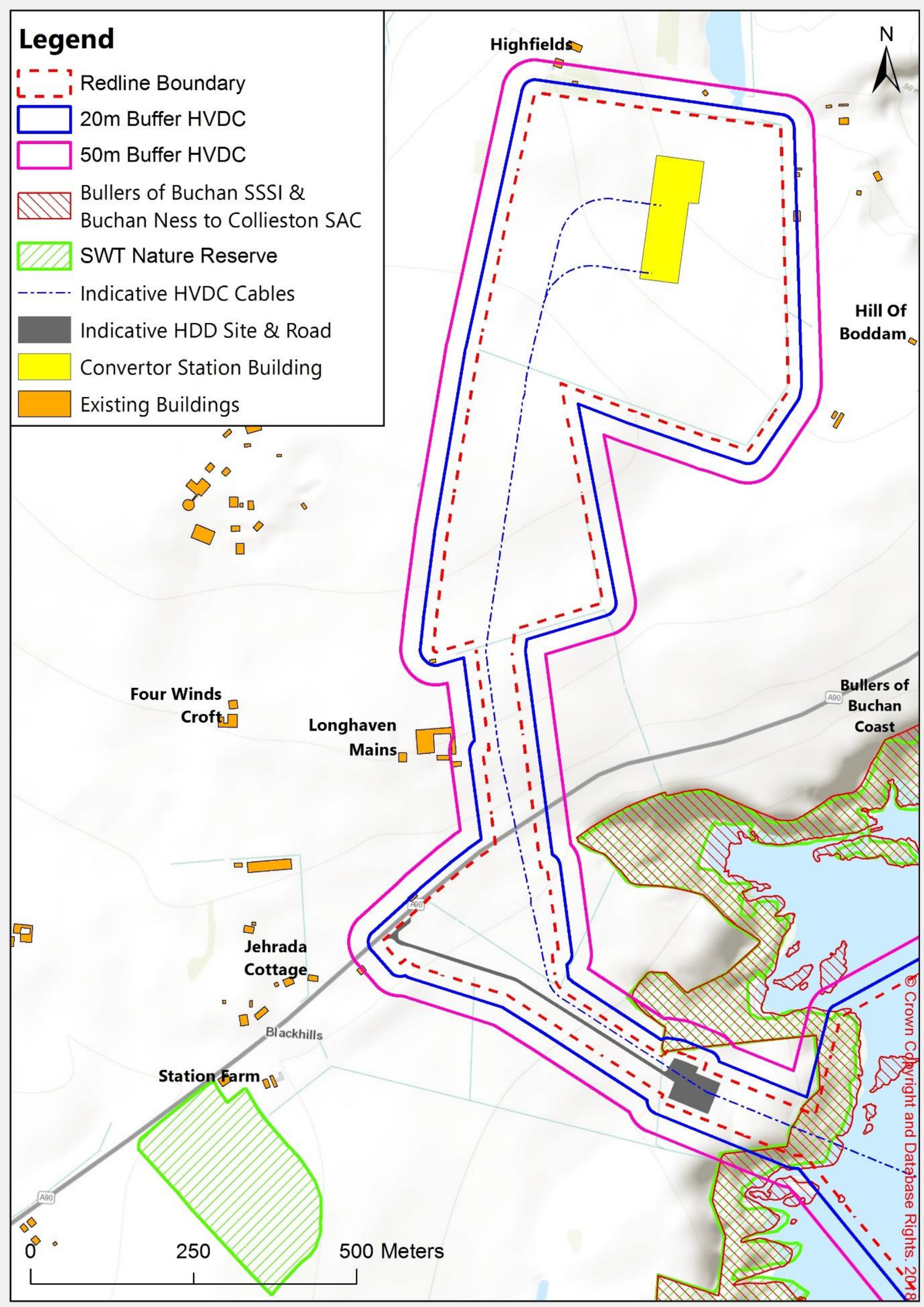

Figure 9.2 Nature Conservation Interests in relation to the HVDC cable corridor.

9.6 Impact Assessment

9.6.1 Construction

9.6.1.1 Dust

There are several sources which could give rise to local dust issues during the onshore construction works including: ground works, track out and material storage. As discussed in Chapter 24: Resource Usage and Waste, bentonite will be delivered dry in one tonne bags for use in the drilling fluid. Volumes stored on site at any one time will be minimised and as such will not give rise to a dust source of a scale requiring consideration here. Similarly aggregates utilised in the cable trench and the road construction will be delivered just in time and not stored hence do not provide a source of dust requiring consideration.

9.6.1.1.1 Earthworks

Earthworks required for the onshore installation of the cables, their approximate areas and associated potential dust sources are listed in Table 9.6.

Table 9.6: Dust Sources associated with Earthworks.

Earthworks Requirement	Approximate Area	Dust Sources
Access Road to Landfall HDD Site Installation	3,500m^2	Soil stripping. Aggregates utilised in road construction. Reinstatement removal of aggregate and replacement of soils.
Landfall HDD Compound Preparation	6,000m^2	Soil stripping. Bund creation. Aggregates utilised in compound construction. Reinstatement removal of aggregate and replacement of soils.
Road Crossing HDD Compound Preparation	2,000m^2	Soil stripping. Aggregates utilised in compound construction. Reinstatement removal of aggregate and replacement of soils.
Joint Pits Cable Trenching • Landfall HDD to Joint Pit 1 • Road HDD to Joint Pit 2 • Joint Pit 2 to Converter Station	300m^2 3,400m^2 7,000m^2 4,000m^2	Soil stripping. Soil removal and storage. Reinstatement of soil.
Cable Route Access Road	7000m^2	Soil stripping. Aggregates utilised in road construction. Reinstatement removal of aggregate and replacement of soils.

Not all activities will be carried out at one time, and there may be weeks or months between activities, however the total earthworks will cover an area well in excess of 10,000m^2 and as such are deemed to have a **large** magnitude of impact without mitigation in accordance with Table 9.2.

All human receptors (residential and leisure) are deemed to be of low sensitivity giving rise to a **minor**, **non-significant** effect on this residential and leisure receptor.

The Buchan Ness to Collieston Coast SAC, the Bullers of Buchan Coast SSSI designated sites; and Longhaven cliffs SWT nature reserve was deemed to be of **medium** sensitivity, the enabling works associated with the HDD site set up and sections of the access road and cable trenching could impact this receptor, giving rise to a **moderate, significant** effect without mitigation.

9.6.1.1.2 Trackout

The HDD access road will provide the track out for construction traffic getting to the HDD site and the HVDC cable corridor south of the A90.

The estimated average numbers of vehicle movements to the construction area to the south-east of the A90 are as follows:

- Personnel movements - 24 light vehicle movements per day for the duration of construction;
- Road construction - 20 heavy vehicle movements per day for a period of approximately 6 weeks (delivery of construction materials and equipment);
- HDD site establishment - 10 heavy vehicle and 4 light vehicle movements per day for a period of approximately 4 weeks (delivery of site accommodation and drilling equipment);
- HDD operations - 6 heavy vehicle and 6 light vehicle movements per day for a period of approximately 26 weeks (removal of material/waste and equipment deliveries).

Therefore, the worst case is during road construction with a total of 44 vehicle movements per day, including 20 heavy vehicle movements, for an estimated duration of six weeks.

Vehicle numbers accessing the area to the north of the A90 will be much lower, and most access will be from the Fourfields site. Track out associated with the access to the Fourfield site has been assessed as part of the Converter Station and HVAC Cable Route Environmental Statement (NorthConnect, 2015) and as such will not be re assessed here.

In accordance with the Table 9.2, track-out associated with the enabling works and reinstatement is deemed to be of **medium** magnitude. The nearest receptor to the track-out will be station house, which has been identified as a low sensitive receptor and as such will give rise to a **minor, non-significant** effect without any mitigation.

The Buchan Ness to Collieston Coast SAC, the Bullers of Buchan Coast SSSI designated sites are well over 100m from the potential trackout location onto the A90 and as such will not be affected.

Once the enabling works are complete the road will be in place, hence the surface material will be much less of a dust source and the heavy vehicle numbers will be reduced. The magnitude of impact will reduce to **small** giving rise to a **negligible, non-significant** effect on residential receptors.

9.6.1.2 Carbon Dioxide

There is a carbon cost associated with the installation of the HVDC cables. The carbon cost is associated with the use of fossil fuels to power vessels, vehicles plant and equipment associated with the cables installation and associated enabling works. This is estimated to be in the order of 200 to 300 tonnes CO_{2e}

In addition, the materials utilised will have an inherent carbon cost or CO_2 equivalence (CO_{2e}). The main material for the project is the HVDC Cables, as described in Chapter 2: Project Description, the cables are made up of a variety of components, however the metal conductors are likely to have the highest CO_{2e} values. The conductor can be either copper or aluminium, the CO_{2e} conversion factors for these are 2.77 $kgCO_{2e}/kg$ and 2.01 $kgCO_{2e}/kg$ respectively. As a worst-case assumption, it could be assumed that the full 11,752 tonnes of UK cable has a CO_{2e} of 2.77 $kgCO_{2e}/kg$ then the cable carbon cost would be 32,553 tonnes.

Other construction materials required such as cement, aggregates and bentonite for the HDD have much lower volume and/or carbon conversion factors and as such a conservative estimate of 1,000 tonnes is utilised. There is a high quantity of rock utilised for cable protection, however it has a low associated CO_{2e} from 'production' the associated carbon is associated with transport, which will be determined by the distance from source an estimate of 150 tonnes of CO_{2e} has been utilised.

Overall around 35,000 tonnes of CO_{2e} is expected for this element of the project primarily due to the cable.

The estimated carbon cost of the HVAC cables and converter station site was previous calculated as 11,925 tonnes of CO_{2e} (NorthConnect, 2015). Assuming similar values for the Norwegian elements of the project a total CO_{2e} for construction of the full NorthConnect project is in the region of 100,000 tonnes.

9.6.2 Operation

9.6.2.1 Dust

During operation the HVDC cables will be buried and therefore there should be no dust sources on the site. No effects are predicted and therefore no further assessment is required.

9.6.2.2 Carbon Dioxide

Although NorthConnect does not produce electricity, it does facilitate the increase of renewables into the energy mix, by coupling the variable renewable energy sources such as wind, wave and tidal in the UK, to the hydropower resource of Norway. A larger proportion of renewable energy sources in the energy supply mix will reduce demand on conventional power such as oil, gas, nuclear and coal and hence contribute to reducing CO_2 emissions.

Modelling can be utilised to predict energy trading, the potential for additional Renewable Energy Systems (RES), associated CO_2 savings, and the associated financial performance of changes to the grid such as introducing new interconnectors.

The European Network of Transmission System Operators for Electricity (ENTSO-E) have developed models for Interconnectors which has been utilised for projects across Europe. The ENTSO-E model is utilised for multiple projects it is appropriately generic. It should be noted that it as does not accurately take account of the hydro-electric dominated Norwegian energy market, nor the constraints within the UK grid system.

The ENTSO-E's 10 Year Network Development Plan (ENTSO-E, 2014) considers four scenario visions for future energy generation mixes:

- Vision 1: Slowest Progress;
- Vision 2: Constrained Progress;
- Vision 3: National Green Transition; and
- Vision 4: European Green Revolution

Table 9.8 shows the ENTSO-E model outcomes in terms of additional RES that could be brought on line due to NorthConnect and the associated CO_2 savings/emissions per year (measured in 1000's of Tonnes - kT). The CO_2 lifetime savings has assumed a project lifespan of 40 years.

Table 9.1 ENTSO-E's NorthConnect Predictions from 2014 and 2016 (ENTSO-E, 2014, 2016).

Vision	Renewable Energy Systems (RES) TWh/Year		CO_2 Annual Savings (Green)/Emissions (Yellow) kT/Year		CO_2 Lifetime Savings (Green)/Emissions (Yellow) MT	
	2014	2016	2014	2016	2014	2016
1	1-1.2	0.15 ± 0.15	360-440	1500 ± 400	14.4-17.6	60 ± 16
2	0.9-1.1	0.85 ± 0.06	190-240	700 ± 300	7.6-9.6	28 ± 12
3	2.7-3.3	0.84 ± 0.17	1700-2000	900 ± 300	68-80	36 ± 12
4	2.1-2.6	0.87 ± 0.39	1500-1800	900 ± 600	60-72	36 ± 24

ENTSO-E visions in 2014 showed a CO_2 lifetime savings for all visions, I the 2016 model only visions 3 and 4 predict substantial CO_2 savings throughout the project.

The UK National Grid has also completed modelling which takes account of the specific challenges associated with UK's grid constraints. The National Gird have utilised BID3 Pöyry's power market model which incorporates sophisticated hydro modelling, which allows it to appropriately account for the Norwegian energy market. Analysis was carried out for four scenario's to identify carbon savings as detailed in Figure 9.1, the scenarios take account of different financial availability and environmental ambition (National Grid Systems Operator, 2018).

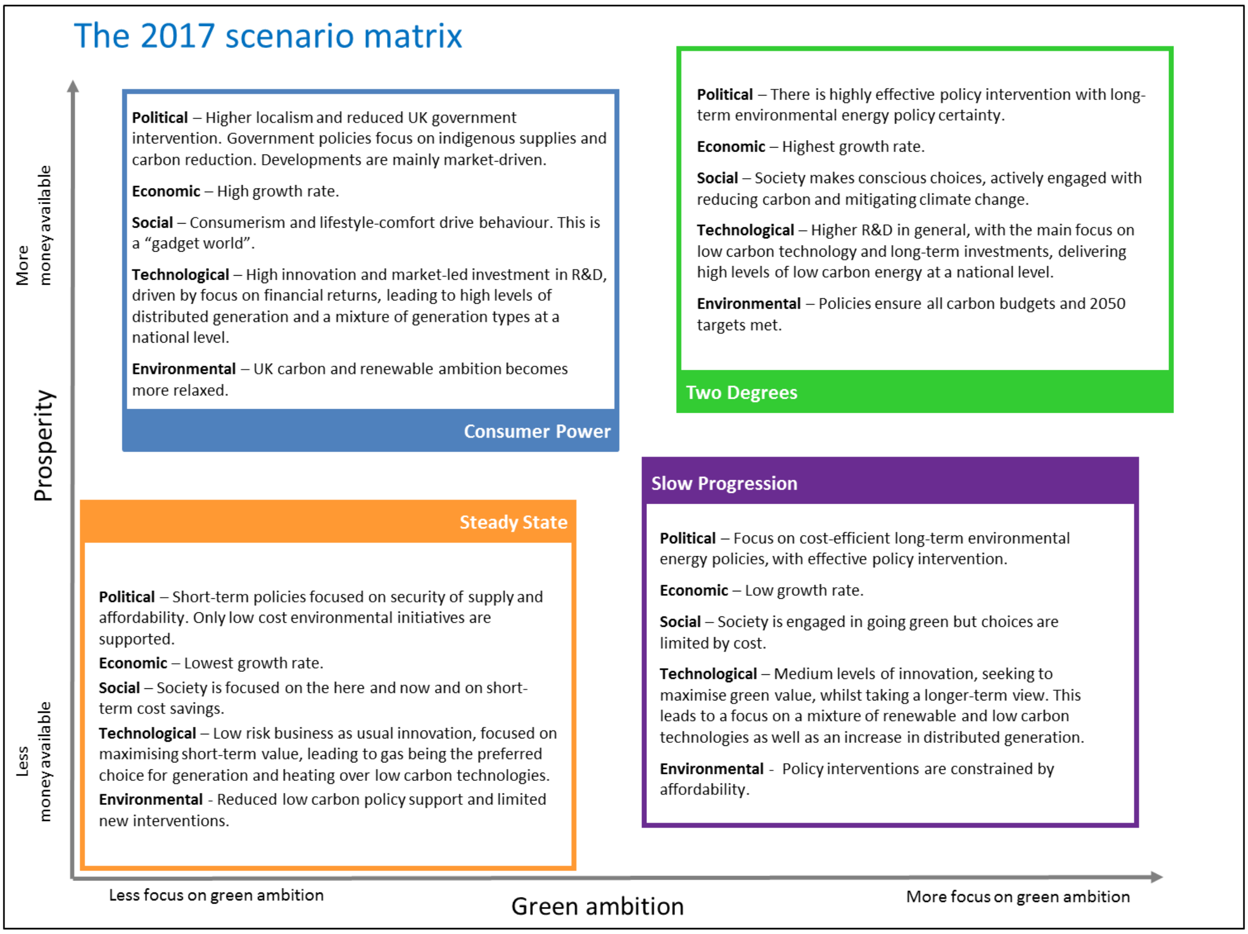

Figure 9.1: Future Energy Scenario's for National Grid Modelling (National Grid Systems Operator, 2018).

The four scenarios: Two Degrees (TD); Slow Progression (SP); Steady State (SS); and Consumer Power (CP) were then further divided for modelling, relating to predictions of a central assumption case, a wet weather case, or a dry weather case. The results of the modelling are shown in Figure 9.2 (National Grid, 2018).

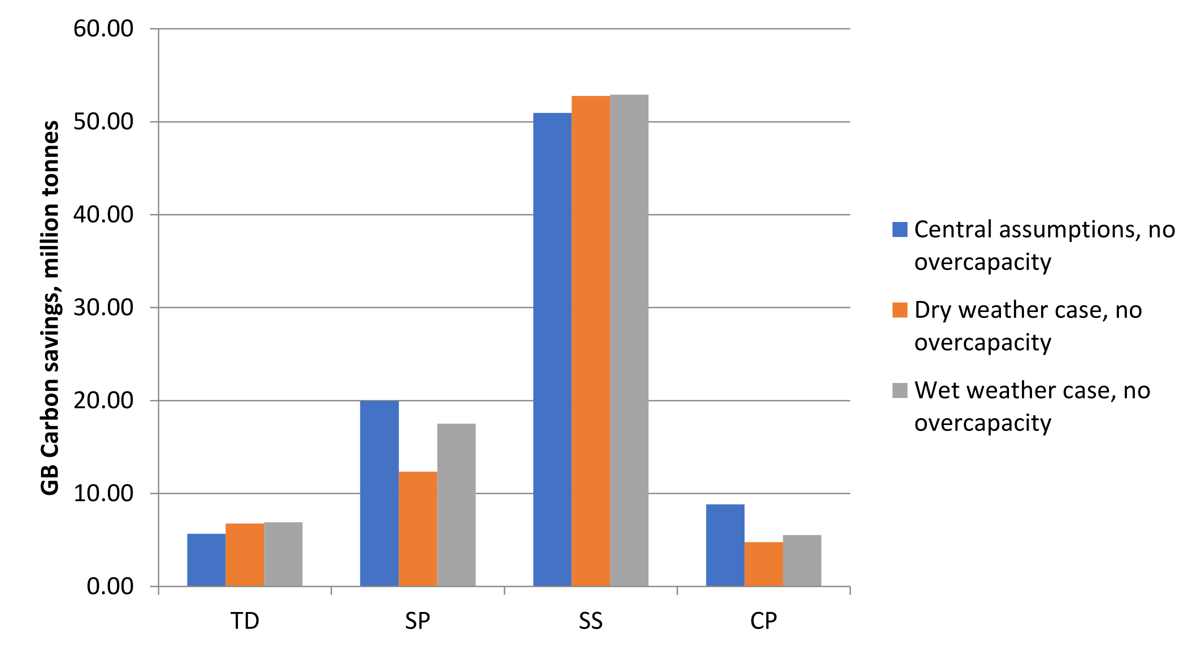

Figure 9.2: Lifetime Carbon Savings by NorthConnect Project as Predicted by National Grid Models (National Grid Systems Operator, 2018).

In all four scenarios under the National Grid modelling, the NorthConnect project has overall carbon savings, ranging from approximately 4.76 million tonnes of carbon saving, up to over 52.92 million tonnes of carbon saving.

As previously mentioned, the combined project carbon cost of construction is around 100,000 tonnes of CO_{2e}. The worst-case scenario from the National Grid modelling (4.76 million tonnes), this would result in an overall saving of 4.66 million tonnes, best case would be 52.82 million tonnes of CO_{2e} saved.

Hence overall the NorthConnect project has a **moderate to major benefit**, significant effect.

9.6.3 Decommissioning

9.6.3.1 Dust

If the onshore cable is removed at the point of decommissioning, dust effects will be similar to construction, but likely to be on a smaller scale, mitigation measures required will be equivalent to those required for construction but will be specified as required at the time.

9.6.3.2 Carbon Dioxide

The marine cable is likely to be removed from the seabed for the majority of the route, this is partly due to the value or the cable conductor. The cable would be stripped to allow the conductor (copper or aluminium) and potentially other components to be recycled. The recycling of metals utilises much less energy than virgin material as such this helps to reduce overall carbon emissions. Hence the recycling of the redundant cable at decommissioning could be seen as a carbon saving. This has conservatively not been taken account of in the overall carbon calculations for the project.

9.7 Mitigation Measures

9.7.1 Dust

A Dust Management Plan (DMP) will be developed and included within the Construction Environmental Management Document. This will detail both the monitoring and mitigation strategies. The detail of the DMP will take account of best practise included within IAQM Guidance (2014) and PPG 6: Working at Construction and Demolition Sites (SEPA, 2014).

Mitigation measures proposed for earthworks include:

- Appropriate planning to minimise the number of times material is moved and the time material is stored and ground left bare; and
- Due to the volume of materials being removed from the cable trench, it is not possible to cover stored material. The topsoil and subsoils will be separated to ensure they are reused again appropriately. The stored materials will be compacting to help reduce the amount of loose material, reducing the potential for dust.
- The material removed for the Landfall HDD work area will be utilised to create bunds around the site, vegetation will be allowed to establish on these as they will be in place for potentially over a year.
- If required, mobile water bowsers or equivalent will be utilised in dry weather conditions to damp down potential dust sources and, where possible, they will utilise runoff water (grey water) gathered on the site.

Mitigation measures to avoid trackout will include:

- Vehicles entering and leaving sites will be covered to prevent escape of materials during transport;
- The access road will be appropriately surfaced such that vehicles returning to the A90 will travel over clean stone and bituminous surfaces for at least 50m;
- Rumble strips shall be installed on the access roads at least 45m before exit onto the A90 to assist in the removal of mud from wheels; and
- Signs of track out will be monitored and if an issue arises, water-assisted dust sweeper(s) will be utilised on the A90 and bitumous section of the access roads to remove track out as necessary.

Mitigation measures for general construction activities will include but not be limited to:

- Appropriate material management as detailed in Chapter 24: Resource Usage and Waste; and
- Good housekeeping across the site.

A full monitoring plan will be developed taking account of the IAQM Guidance (IAQM, 2014) as part of the DMP, and it will include:

- Directional dust deposit gauges will be installed at least 2 weeks prior to construction works starting to gain an understanding of background dust levels;
- Directional dust deposit gauges will be utilised throughout the construction period, the frequency of change will be proportionate to the risk associated with onsite activities;
- Monitoring results will be reviewed to ensure that mitigation employed is effective and, if not, improvements made; and
- Dust Audits will be undertaken. A checklist will be utilised to ensure all issues are covered and recorded. The audit will include: material storage status; use of dust covers by delivery vehicles; inspection of the access roads and the A90; and looking for signs of surface soiling

on surfaces around site. Dust audits will be carried out more frequently in periods of dry weather and when cable trenches are open.

9.7.2 Carbon Dioxide

The lifecycle CO_{2e} for the full project is predicted to be a carbon saving, efforts will be made to maximise the benefits. The mitigation techniques identified in Chapter 24: Resource Usage and Waste to minimise material usage and maximise recycling will aid in the minimisation of the Carbon costs of construction.

The recycling of the cable at the point of decommissioning will also help to reduce the lifecycle CO_{2e} of the project.

Once NorthConnect is operational, the renewables sector will have access to additional market opportunities. This should encourage additional RES entry to the market in Scotland, potentially the wider UK and Norway. NorthConnect will continue to keep the energy sector informed of progress, such that the grid operators renewable energy developers know when the project will be coming on line so that they can maximise the benefits of the interconnector at the earliest point.

9.8 Residual Effects

9.8.1 Construction Dust

With appropriate mitigations, dust impact magnitude will be reduced to small from all sources, giving rise to **negligible, non-significant** effects on human receptors (residential properties and leisure), and **minor, non-significant** effects on the Buchan Ness to Collieston Coast SAC, the Bullers of Buchan Coast SSSI designated sites.

9.8.2 Lifecycle CO_2

The CO_{2e} cost of construction will be in the region of 100,00 tonnes. However, this is off-set by the role the project plays in allowing more renewable energy to come online replacing CO_2 emitting electricity sources, estimated to be between 4.76 and 52.92 Million tonnes. This is a **significant beneficial** effect.

9.9 Cumulative effects

The NorthConnect Convertor Station and HVDC works will have a cumulative effect on dust with the HVDC cabling element of the project. With mitigation the Convertor Station and HVDC works were identified to have negligible to minor effects due to dust. There is one residential property that could be affected by both elements of the NorthConnect project namely Highfields and leisure users of the paths around the Fourfields site could be affected by both elements, however in both instances the effects are negligible or minor with mitigation hence cumulatively it is highly unlikely they will be significant.

In addition, the whole NorthConnect project will operate under the Overarching Construction Environmental Management Plan which will outline the dust management strategy for the whole project. The specific construction element DMP's will be based on these and incorporate the requirements detailed within this chapter and the schedule of mitigation.

For NorthConnect to operate and for the potential CO_2 savings to be realised, it will require all parts of the project to be consented, constructed and operated.

9.10 Summary

The construction earthworks and track out have the potential to lead to dust effects if not mitigated. However, standard construction best practice can be utilised to mitigate dust impacts so no significant effects result.

NorthConnect has the potential to greatly reduce CO_2 emissions which is an overall positive effect of the full NorthConnect project.

Table 9.2 summarises the results of the assessment.

Table 9.2 Summary of Air Quality Effects

Receptor	Nature of Impact	Receptor Sensitivity	Impact Magnitude	Significance (Absence of Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Construction							
Residential and Leisure Users	Dust: Earthworks	Low	Large	Minor, Non-Significant	DMP Implemented	Small	Negligible, Non-Significant
Buchan Ness to Collieston Coast SAC, the Bullers of Buchan Coast SSSI designated sites; and Longhaven cliffs SWT nature reserve	Dust: Earthworks	Medium	Large	Moderate: significant	DMP Implemented	Small	Minor: non-significant
Residential - Station Farm	Dust: Trackout during enabling works and reinstatement	Low	Medium	Minor: non-significant	DMP Implemented	Small	Negligible: non-significant
Residential - Station Farm	Dust: Trackout	Low	Small	Minor: non-significant	DMP Implemented	Small	Negligible: non-significant
Lifecycle							
Climate Change	CO2 Savings		Large Positive	Moderate to Major: significant benefit	Material Optimisation Recycling of Wastes Engagement with Energy Sector	Large Positive	Moderate to Major: significant benefit

Key

	Significant Effect

9.11 References

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