



# Whitehill Gas Storage Project Offshore Works

Non Technical Summary

January 2011

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E.ON Ltd

## Whitehill Gas Storage Project: *Non Technical Summary*

24 January 2011

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For and on behalf of  
Environmental Resources Management

Approved by: Dr Kevin Murphy

Signed:



Position: Partner

Date: 24 January 2011

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## NON-TECHNICAL SUMMARY

### INTRODUCTION

*This document is a summary in non-technical language of an Environmental Statement (ES), prepared by Environmental Resources Management (ERM), for E.ON in accordance with The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) and Directive 85/337 (as amended). The ES addresses the offshore components of the Whitehill Gas Storage Development in the context of approvals being sought under the Food and Environment Protection Act 1985 (FEPA) (as amended), the Coast Protection Act 1949 (as amended) and the Petroleum Act 1998.*

*In the remainder of this Non-technical Summary and throughout the ES, the following terminology is used in reference to the Whitehill Gas Storage Development:*

- *The **Scheme** refers to all aspects of construction and operation of the development, onshore and offshore;*
- *The **Project** refers to those elements of the Scheme that are seaward of mean high water springs; and*
- *The **Regulated Activity** refers to those elements of the Project that require (or would, but for the provisions of section 7A(1)(a) FEPA, require) (a) a licence under Part 2 of the Food and Environment Protection Act 1985 (as amended), and/or (b) a consent under Section 34 of the Coast Protection Act 1949 (as amended).*

### THE PROPOSED DEVELOPMENT

#### **Background**

*E.ON is proposing to develop the Whitehill Gas Storage Development (the Scheme) to store gas underground in caverns to be specially created in the salt strata underlying the Holderness coast north of Aldbrough (see Figure 1). This area offers one of the few locations, in geological terms, in the UK where such a project can be undertaken.*

*It is anticipated that approximately 10 caverns will be created some 1.8 km below ground, by pumping seawater down wells drilled into the formation and returning it to the sea as brine. Part of the Scheme will be a surface facility which will take gas from the National Transmission System (NTS) and store it at high pressure in the caverns. When required to meet high demand, or at times of reduced supply, the facility will process the gas from the caverns to the appropriate standards and return it to the NTS.*



*The Scheme will also include marine facilities required for the leaching of salt to form the gas caverns. It is the marine facilities which are the subject of this ES <sup>(1)</sup>.*

### ***The Need for the Scheme***

*There is a clearly demonstrated need for gas storage. The import facilities which are currently being developed will be constrained by capacity and as the domestic supply declines further the supply 'gap' will become more prominent. The flexibility of new import pipelines and liquefied natural gas (LNG) infrastructure remains unclear and as worldwide demand increases, the level of competition for gas from Europe and LNG shipments at times of UK need will also increase. In the future, as the UK becomes more reliant on specific assets and countries for gas, storage facilities will have a greater role to play.*

*Gas storage can bring additional liquidity to the traded gas market. Storage facilities are highly responsive assets which can take gas from and supply gas to the NTS, reacting to demand and supply-side swings. In recent years, the UK market has become more volatile; storage may contribute to reducing market volatility and help to stabilise prices for customers.*

*The Secretary of State for Trade and Industry made an announcement to the House of Commons on 16<sup>th</sup> May 2006 on the impact of existing Government policy and planning procedures on the need for additional gas supply infrastructure.*

*The Ministerial Written Statement summarised the position as follows:*

*"...we need timely and appropriately sited gas supply infrastructure to be delivered by the market because:*

- Great Britain is becoming increasingly dependent on gas imports and requires new gas supply infrastructure to help ensure security of supply;*
- new projects enable extra supply and storage options if they proceed without avoidable delays;*
- there are limited locations currently suitable for much needed gas storage projects;*
- onshore storage is needed to enable slow-moving gas to be available close to market when consumers require it;*
- new energy infrastructure projects provide national benefits, shared by all localities".*

*A further note (including annexes) accompanied the Statement which included an overview of national energy policy and its implications for new gas supply infrastructure.*

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(1) An EIA of the onshore facilities has been reported in the *Whitehill Gas Storage Project Further Information Document, May 2010 (the 'Onshore ES')*.

*The 2007 White Paper, “Meeting the Energy Challenge” identifies two long term energy challenges of tackling climate change by reducing carbon dioxide emissions and ensuring secure, clean and affordable energy. In considering the relative significance of Government policies and the balance of priorities, it is suggested that “the costs of energy developments tend to be local, tangible and short-term, whereas the benefits are diffuse” for which it names gas storage projects as an example of providing benefits for users of gas across the entire country (paragraph 8.15).*

*The revised Draft Overarching National Policy Statement for Energy (EN-1) 2010 states that the UK is highly dependent on natural gas and while “reliance on fossil fuels will fall, the transition will take some time and gas will continue to play an important part in the UK’s fuel mix for some years to come”(paragraph 3.8.1).*

*Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) 2010 confirms that certain underground natural gas storage facilities are to be considered Nationally Significant Infrastructure Projects (NSIPs). and it notes that storage, along with import and transmission infrastructure is crucial to meeting our energy needs (paragraph 1.1.1). EN-4 requires that this NPS should be read in conjunction with EN-1; it states that “EN-1 sets out the Government’s conclusion that there is a significant need for new major energy infrastructure generally”; hence, the Infrastructure Planning Commission (IPC) should act on the basis that the need for the infrastructure covered by EN-4 has been demonstrated (paragraphs 1.3.1, 2.12).*

*The Appeal decision in 2008 made by the Secretary of State for Communities and Local Government and the Secretary of State for Business Enterprise and Regulatory Reform (BERR), to grant planning permission for gas storage at the Caythorpe Gas Field was based on amongst other things the need for gas storage facilities. An Appeal Decision to grant planning permission for gas storage in 2009 at King Street, Northwich referred to the urgent need for additional gas storage in the UK. A scheme for gas storage at Saltfleetby was approved by the Secretary of State for Energy and Climate Change in 2010, in which it was noted that “additional storage would be a very valuable asset in helping to maintain security of supply and price stability”.*

### **Description of the Project and Regulated Activity**

#### *Overview*

*The main onshore and process elements of the Scheme are described in the Onshore ES.*

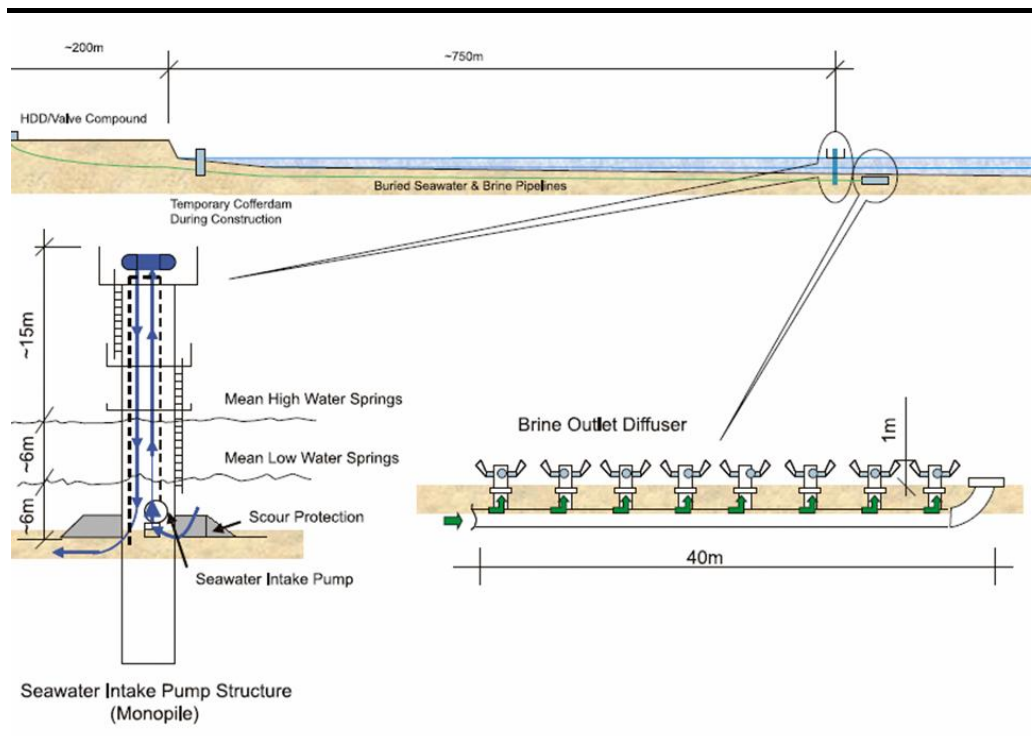
*The principal components of the Project and Regulated Activity comprise:*

- *seawater abstraction system including intake structure, screens, pumps, valves and surge tank located on an offshore monopile platform fitted with navigation aids and other electrical and control equipment;*
- *conveyance of seawater from the offshore platform through a buried sub-sea pipeline to the Mean Low Water Spring mark (and thence to the onshore facilities where it will be used in the cavern leaching process);*

- brine discharge (originating from the onshore caverns) via a buried sub-sea brine discharge pipeline to the brine diffuser;
- brine dispersal through a diffuser system;
- power and control cables installed within plastic conduit alongside or attached to the pipelines; and
- a temporary cofferdam on the beach (accessed either from land or by marine barge) associated with directional drilling (from land) and trenching for the installation of seawater intake and brine outfall pipelines and cables.

Figure 2 illustrates the layout of the seawater intake pump (monopile) and diffuser, together with a cross-section from the onshore valve station to the monopile and diffuser.

**Figure 2**      **Layout of Offshore Components**



### Schedule

It is anticipated that construction of the complete Scheme will take approximately six years. The key activities of relevance to this ES broadly comprise 6 months construction of marine structures and approximately 5 years for cavern leaching and brine discharge.

The gas storage facility will be decommissioned at the end of its operational life. On decommissioning, the surface facilities (gas handling facility, well heads, pumping facility, site roads, etc) will be removed and the land returned to agriculture, the

*caverns will be filled with seawater (which will form a brine solution at equilibrium with the rock and remain in situ) and the well shafts will be sealed with concrete.*

### *Alternatives*

*Various alternatives were evaluated (on cost, technical, environmental and other grounds) for the Project and Regulated Activity as follows.*

- ***Water supply for leaching:*** *there are no rivers or suitable aquifers in the area that could provide water in the quantities required. Seawater can be sourced from nearby and provides a suitable and proven source.*
- ***Brine disposal:*** *although there are some areas in the UK where the chemical industry uses brine as a raw material no such industry exists in the area of the Project and Regulated Activity. Disposal to sea was therefore selected as a suitable and proven option.*
- ***Use of SSE/Statoil intake and outfall:*** *sharing of facilities was considered but rejected on several grounds including commercial and legal, the likelihood that the leaching programmes for both facilities would overlap and the need for longer pipelines either across land or the seabed.*
- ***Installation of the subsea pipelines (intake and outfall):*** *a number of options were evaluated covering tunnelling, open trenching and horizontal directional drilling (HDD). In order to accommodate the coastal erosion issues and the technical feasibility of drilling over long distances a combination of HDD from a compound set back 200 m from the cliff top to a cofferdam structure on the beach and then conventional trenching out to the monopile location was judged to be the optimal solution.*
- ***Beach access:*** *options involving a cliff access ramp, a crane lift from the cliff-top, beach access from Mappleton and a marine barge access were assessed. The crane and access from Mappleton along the beach were discounted on the grounds of reliability and safety. Both the cliff access ramp and marine barge are technically and environmentally feasible and will be subject to further evaluation with construction contractors. Both options are assessed in the onshore ES.*
- ***Outfall Structures:*** *a diffuser was selected over an open pipe option on the basis of better environmental performance as regards initial dilution even though it will have a slightly larger footprint.*
- ***Pump platform:*** *there are essentially four possible alternative concepts for the offshore pump platform, namely a steel monopile, concrete gravity base, steel tripod or suction caissons. Due to its small footprint, minimal disturbance of the seabed habitats and fauna and cost, the monopile option was considered the most appropriate for the water depth at the proposed location and the size of platform required.*

- **Location of facilities:** a location has been selected that will provide the following:
  - adequate dispersion of brine discharges without a significant overlap with the SSE/Statoil scheme, and therefore minimise impact to water quality and marine fauna (and commercial fisheries);
  - has the shortest practicable length of pipeline buried in the seabed and therefore minimises impact to water quality and marine fauna (and commercial fisheries); and
  - can be monitored without needing to collect samples in the now non-operational MoD danger area.

## **APPROACH TO THE EIA**

### **Scope of the EIA**

*This assessment is primarily concerned with activities prior to the commissioning of the gas caverns and commencement of full operations onshore. The construction phase for the Project and Regulated Activity comprises the installation of the marine components (pipelines, intake and outfall structure) and associated activities. For the 'operational' phase the EIA scope relates to the abstraction of seawater and discharge of brine (also referred to as leaching of the caverns) which will last for approximately 5 years. Decommissioning of facilities at the end of leaching is also addressed.*

*Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (the 'Regulations') and the Offshore Petroleum and Pipe-lines (Assessment of Environmental Effects) Regulations 1999 (Schedule 2) specifies a range of environmental issues, the significant effects of which should be addressed as part of an EIA. These issues comprise effects on human beings, fauna, flora, soil, water, air, climate, landscape (seascape), material assets, cultural heritage and the interactions between any two or more of the foregoing.*

*A scoping exercise was undertaken to determine the main issues for the EIA to focus on and whether any environmental issues might be wholly or partially omitted from the EIA on the grounds that they were unlikely to give rise to significant environmental effects. Scoping and associated consultation involved the release of a Scoping Report in 2006, ongoing contact and meetings with certain consultees and release of further scoping information in 2010 in the form of an interim version of this ES. As a result of the scoping exercise the list of potential environmental issues (both positive and negative) was refined. The main issues of relevance to the Project and Regulated Activity considered in this ES are:*

- *coastal processes (and climate change);*
- *water quality;*
- *marine ecology and nature conservation;*
- *commercial fisheries;*
- *air quality and noise;*

- *shipping and navigation;*
- *amenity (public access on foreshore);*
- *archaeology and cultural heritage;*
- *seascape and visual impact; and*
- *construction environmental management.*

## **Assessment Methodology**

### *General*

*The EIA has been supported by a combination of desk based studies and field work, including the following:*

- *collection of bathymetric and hydrodynamic data (ADCP <sup>(1)</sup>);*
- *video and acoustic ground discrimination survey (AGDS);*
- *marine benthic sampling programme (2006);*
- *crustacean shellfish survey (2006);*
- *epifaunal and finfish survey (2006);*
- *commercial and natural fish assessment (desk study);*
- *marine drop down video survey (2010);*
- *archaeological desk study; and*
- *seascape and visual assessment.*

### *Significance of Impacts*

*The assessment takes information on the magnitude of impacts, and explains what this means in terms of its importance to society and the environment, so that decision makers and consultees can take an informed view of how much weight may be given to the issue in evaluating the Project and Regulated Activity. This is referred to as 'evaluation of significance'.*

*The evaluation of significance requires an exercise of judgement. The evaluations of impacts that are presented in the ES are based on the judgement of the EIA team and are informed by reference to legal standards, government policy, current good practice and the views of stakeholders.*

*Criteria for assessing the significance of impacts are clearly defined in the ES for each relevant topic area and types of impact taking into account whether the Project and Regulated Activity will:*

- *cause legal or accepted environmental standards to be exceeded, e.g. water quality, noise levels, or make a substantial contribution to the likelihood of exceedence;*
- *adversely affect protected areas or features, or valuable resources, such as nature conservation areas, rare or protected species, historic features, commercial fisheries; or*
- *conflict with established government policy e.g. to manage coastal protection.*

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(1) Acoustic Doppler Current Profiling

*A set of criteria for each topic has been used in order to evaluate the significance of effects arising from the scheme. In many cases, such as for water quality, there are accepted methods for quantifying effects and determining the threshold of significance that can be applied. In others the effects may not be directly quantifiable, or there is no established practice that offers a consensus on the significance of effects. In these cases it is necessary to define more subjective criteria and thresholds based upon a case-by-case use of professional judgement and local knowledge. For example, where standards are not available or provide insufficient information on their own to allow grading of significance, significance is evaluated taking into account the magnitude of the impact and the value or sensitivity of the affected resource or receptor.*

### *Mitigation*

*Paragraph 5 of Schedule 3 to the EIA Regulations requires that where significant effects are identified, "a description of the measures envisaged to prevent, reduce and where possible remedy any significant adverse effects on the environment" should be included in the ES. The mitigation measures described in the ES are ones which E.ON is committed to delivering. Some are built into the design of the Project and Regulated Activity and others will be delivered through measures and procedures set out in an Environmental Management Plan.*

### *Residual Impacts*

*The residual impacts are those which are predicted to remain following the implementation of mitigation measures described in the ES. The degree of significance attributed to residual impacts is related to the weight the EIA team considers should be given to them in reaching a decision on the Project and Regulated Activity.*

- Any residual major impacts, whether positive or negative, are considered to warrant substantial weight, when compared with other environmental, social or economic costs and benefits, in the decision on whether the Project and Regulated Activity should be permitted to proceed; conditions would be expected to be imposed to ensure adverse impacts are strictly controlled and monitored and beneficial impacts are fully delivered.*
- Residual moderate impacts are considered to be of reducing importance to the decision, but still warranting careful attention to conditions regarding mitigation and monitoring, to ensure best available techniques are used to keep adverse impacts as low as reasonably practicable, and to ensure beneficial impacts are delivered.*
- Minor impacts are brought to the attention of the decision-maker but will be identified as warranting little if any weight in the decision; mitigation will be achieved using normal good practice and monitoring measures will be carried out to confirm that impacts do not exceed predicted levels.*

### *Cumulative Impacts*

*Cumulative impacts are those which arise from the combination of different effects (which could arise from the Project and Regulated Activity together with other*

*proposed projects in the area of development) at a specific location, the recurrence of effects of the same type at different locations or the interaction of different effects over time.*

## **KEY EXISTING ENVIRONMENT**

### ***The Physical Environment***

#### *Hydrography and Water Quality*

*The tidal ranges along the East Coast of England are higher than those found elsewhere in the North Sea. The mean spring tidal range is 5.0 m at Flamborough Head. The main component of flow in the North Sea is the tidal stream, which reaches speeds of 1.5 m s<sup>-1</sup> at Flamborough Head.*

*The water is relatively turbid, with suspended solids concentrations fluctuating between approximately 50-200 mg l<sup>-1</sup>, occasionally reaching 700mg l<sup>-1</sup>, in response to factors such as tide, sea state and heavy rainfall.*

*The mean salinity of surface waters is 34.25 to 34.5 parts per thousand (ppt). The mean bottom salinity is generally very slightly lower.*

*Dissolved oxygen levels along the open coast in this region are average for the North Sea as a whole, and there are no records of algal blooms causing oxygen deficiency.*

#### *Sediment Quality*

*Sediment samples were collected and analysed for several environmental parameters, including heavy metals, butyltins, hydrocarbons and PCBs. Although some samples had slightly high levels of nickel this was not at levels to cause concern. Overall there was no evidence of significant contamination and the sediments were generally of good quality.*

#### *Coastal Geology*

*The section of the Holderness coastline within which the Project and Regulated Activity will be located comprises glacial boulder clay till cliffs. The adjacent seabed consists of similar material, generally covered with sand. Sediments sampled during the benthic survey ranged from fine sands at inshore sites, to mixed sand, gravel, cobbles and boulders, in highly variable proportions further offshore. The levels of silt and clay were fairly low across the proposed development area (less than 10% at all sites and less than 1% at the majority of sites), as was the organic carbon content (less than 4%).*

#### *Seabed and Coastal Processes*

*The boulder clay cliffs and beaches to the south of Flamborough Head are subject to strong erosion by waves and currents, making this one of the fastest eroding stretches of coastline in North West Europe. Long-term average erosion rates at the coast in the vicinity of the Project and Regulated Activity are around 2.2 m per year. The Coast*

actually recedes as a series of small landslides, which can sometimes take 10-20 metre 'bite' out of the cliff at one time followed by several years with no detectable erosion at that point. It is also worth noting that sea level rise (due to a combination of global warming and land subsidence ongoing since the end of the last ice age) together with a projected increase in storm frequencies and severity (due to global warming) may possibly increase the average rate of erosion. The potential rate of coastal erosion has been taken into consideration in the location of cliff top facilities (namely the HDD/valve compound and the pipelines). These will be set sufficiently far back and will be removed at a point in time such that it is not expected they will be threatened by erosion (or require hard protection) even if the rate of erosion was to double.

Much of the eroded cliff material is transported along the coast in suspension or by longshore drift. The net movement of material is southwards towards the Humber Estuary where some of it settles to contribute to the extensive mudflats of the estuary, which are of international importance for wildlife as well as forming a fronting barrier enhancing flood protection. The coastal processes of Holderness are therefore of great importance for the region.

## **Marine Ecology**

### *Benthos*

The composition of the intertidal and subtidal nearshore communities are to a large extent determined by the environmental conditions of the area. 160 different species were identified from site surveys carried out in November 2006. Bristleworms (polychaetes) were the dominant taxonomic group across the whole survey area, but some mollusc and crustacean species were also moderately abundant. The abundant species recorded during this survey were all typical in areas of mixed coarse sediments, although their distributions were patchy due to the heterogeneity of the sediments. The most common large mobile species recorded were swimming crab, velvet crab, brown crab, long-clawed porcelain crab, green shore crab and lobster.

There were significant differences between the nearshore communities and those further offshore. The nearshore area was characterised by opportunistic species. Communities of this type are typical in areas where frequent disturbance (in this case sediment re-working by natural processes) prevents the development of more mature communities associated with stable substrates. Abundance and overall diversity were generally higher at the sites further offshore than the nearshore sites due to the greater stability of the sediments.

The Ross-worm, which is protected and is often a feature of marine Special Areas of Conservation on occasions where it forms biogenic reefs, was present at several of the offshore sampling stations. The abundance of this species was relatively low and not high enough to indicate the presence of significant aggregations. The results of the drop down video surveys in 2006 and 2010 confirm that no extensive reef formations are present in the survey area.

### *Fish*

Sixteen finfish species were recorded during surveys conducted in and around the proposed development area in November 2006. Most of these species were recorded

*infrequently. Cod and snake pipefish were by far the most abundant, with whiting and pouting being less abundant.*

*Salmonids use the Holderness coast as a migratory corridor en route to spawning rivers such as the Esk, Tyne and Humber. The principal migrations of salmon occur during February to May and again in July to September, while sea trout migrations occur from May to late October. Sea bass take up residence throughout the Holderness coast for a significant portion of the year, migrating into the area along the shallow waters adjacent to the shoreline. A percentage of these fish will migrate north along the coast to Flamborough Head and on to grounds further north. Anecdotal evidence indicates that sea bass are generally present all year round, but that numbers historically declined from mid-January to early March.*

*In addition to commercially important species, there are also species of nature conservation interest in the area. The twaite shad is protected under the EU Habitats Directive and Berne Convention. Until recently, twaite shad had only been recorded from the North Norfolk coast, but has more recently been recorded along the North East Lincolnshire coast. There is also anecdotal evidence to indicate that the species is frequently encountered along the Holderness coast during the summer and early autumn months as bycatch in the intertidal salmon and bass fishery.*

#### *Seabirds and Shorebirds*

*The cliffs of the area of the Project and Regulated Activity do not provide good seabird nesting habitat and the beach and nearshore areas are not noted for large aggregations of either waterfowl or seabirds.*

#### *Marine Mammals*

*Three cetacean species are commonly recorded in the proposed development area: the harbour porpoise, the minke whale and the white-beaked dolphin. The harbour porpoise is the most common marine mammal on the Holderness coast, and is regularly recorded at Spurn Head and Flamborough Head, particularly during the summer months. A shift in the distribution of porpoises towards the southern regions of the UK, possibly associated with changes in prey abundance, has locally increased the abundance of harbour porpoise in the area of the Project and Regulated Activity.*

*Minke whales are also occasionally observed off Flamborough Head, particularly between July and October. The species is widely distributed in the northern, western and central areas of the North Sea, but the Holderness coast forms the southern limits of its usual range.*

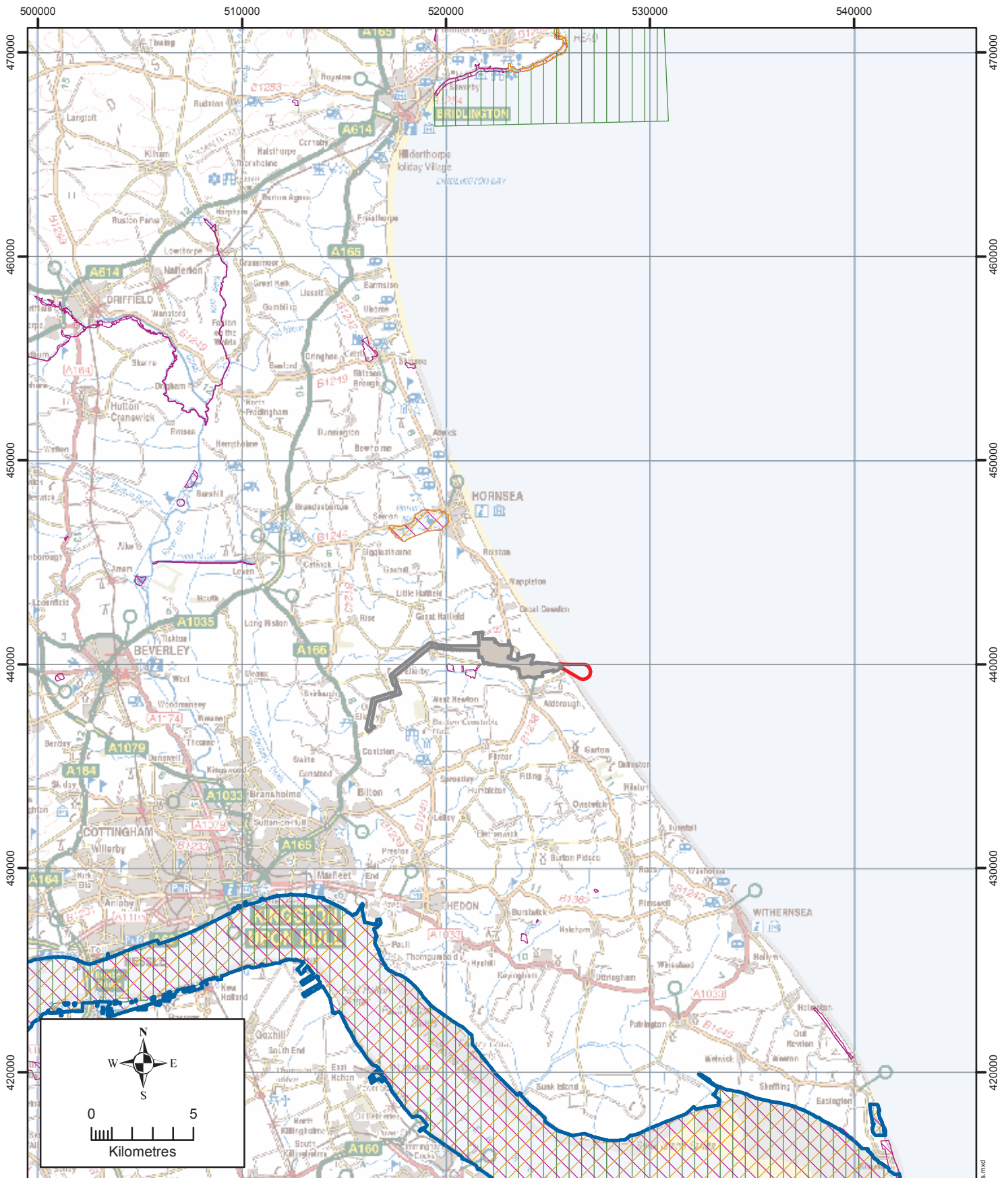
*The white-beaked dolphin is common throughout the western sector of the central and northern North Sea; however, sightings of this species become far less frequent in waters to the south of Flamborough Head. White-beaked dolphins are rarely observed along the coast as they prefer deeper waters (generally 100 m deep or more).*

*In addition to the cetaceans, common seal and grey seal forage for food along the Holderness coast. Grey seals are frequently observed within the Flamborough Head SAC. There is a large grey seal breeding colony on the Lincolnshire coast at Donna*

*Nook, located to the south of the Humber estuary. Donna Nook is also an important haul-out site for common seals.*

#### *Protected Areas*

*The Project and Regulated Activity will not directly affect and areas designated for nature conservation or geological interest. Figure 2 shows the locations of nationally and internationally protected sites along the Holderness coast and Humber Estuary relative to the area of the Project and Regulated Activity. It can be seen that the nearest sensitive sites are some distance from the Project and Regulated Activity.*



KEY:

	Main Site Area
	Project Boundary
	RAMSAR
	SPA
	SSSI
	SAC

CLIENT: **e-on**

SIZE: A4

ERM  
2nd Floor  
Exchequer Court  
33 St Mary Axe  
London  
EC3A 8AA  
Tel: 020 3206 5200  
Fax: 020 3206 5440

SOURCE: Reproduced from Ordnance Survey digital map data. © Crown copyright. All rights reserved. 2010 License number 0100031673.  
PROJECTION: British National Grid

TITLE: <b>Figure 3 Nature Conservation Areas</b>		
DATE: 09/09/2010	CHECKED: NK	PROJECT: 0049473
DRAWN: MTC	APPROVED:	SCALE: As Scale Bar
DRAWING: <b>Offshore_Designations.mxd</b>		REV: <b>0</b>

## **Sea Use and Socioeconomic Features**

### *Commercial Fisheries*

*The Humber region is of great historic and continued importance for commercial fishing fleets. The commercial shell fisheries along the inshore coastal region between Spurn Head and Bridlington are of local, regional and national importance. The fisheries are largely fished by operators of under 10 m boats, although some over 10 m boats may occasionally fish inshore. There is no trawling activity within the site or immediate area due to the Prohibited Trawl Area (PTA) sited from shore baselines out to three miles under North Eastern Sea Fisheries Committee (NESFC) byelaws.*

*Waters in the area of the Project and Regulated Activity and adjacent waters are fished by shellfish boats, which are the main local commercial fishery. The principal launch sites for vessels working within the wider area are Tunstall and Hornsea and to a lesser extent Bridlington; one or two vessels from Withernsea may occasionally fish the site on a seasonal basis. The long-term decline of the fin fishery within the Holderness district for traditional target finfish species has resulted in an increase in crustacean fishing effort. The inshore catch is mainly lobster and brown crab, which are of significant economic importance, whilst catches of velvet crab have increased substantially in recent years, providing additional economic opportunities.*

*Fishing effort in the area is fairly constant all year round, although there is a temporal and spatial shift in effort. Anecdotal evidence and information derived from the NESFC indicate that potting effort is relatively constant along the Holderness coast, with a tendency to migrate effort inshore during the early summer months to target the lobster. As lobsters migrate into deeper water, a significant proportion of the fishing effort follows. These shellfishermen also follow the offshore movement of brown crab especially the females, which migrate offshore to winter spawning grounds.*

*Both sea bass and sea trout are important to the local fin fishery. The bass tend to have a more extensive temporal distribution than the sea trout and are significantly more available to the commercial sector, due to seasonal closure regulations that limit sea trout availability. Recently, indication of a potential recovery in cod, and increased fishing opportunities for Dover sole has brought some confidence into the fin fish fishery, with a number of vessels employing drift nets to target cod, sea bass and sole. There is also an intertidal fishery for sea bass, sea trout and salmon. The salmonid season extends from April to September, and outside this period it is illegal to retain any salmonid species. However, the yield of salmonids is low and intertidal fishermen therefore capture a range of other species, predominantly comprising sea bass, but also Dover sole, thornback ray, cod, mullet, dab and flounder.*

### *Recreational Fisheries*

*There is also a substantial shore-based recreational angling component within and adjacent to the development site boundaries; boat based recreational angling activity tends to be further offshore. Sea angling activity within the development site occurs predominantly during the winter months targeting cod, bass and whiting, although there is some summer based recreational fishing which tends to concentrate on bass, rays and smoothhound.*

## *Other Coastal Development*

*There are several existing and proposed coastal developments in the general vicinity and wider area of the Project and Regulated Activity. The main ones of relevance are as follows.*

- The Aldbrough Gas Storage Facility owned by SSE and Statoil has consent to discharge brine from solution mining into the North Sea. An expansion of this facility has been approved which will extend the period of solution mining and brine discharge. The proposed Phase II extension will utilise the existing offshore and coastal infrastructure that was installed for the Phase I work, including the offshore pumping station, brine outfall diffuser and subsurface brine and seawater pipelines. No significant additional marine or coastal construction work is planned so potential operational impacts are those associated with extending the duration of brine release from the diffuser.*
- The proposed Humber Gateway offshore wind farm development is located approximately 25 km south-southeast of the area of the Project and Regulated Activity. The proposed wind farm site is located approximately 8 km offshore, directly to the east of Easington and Spurn Head on the Holderness coast. The proposed development covers an area of 35 km<sup>2</sup> offshore and includes 25 km of onshore grid connection and buried cable route, with a landfall at Easington, roughly 25 km to the south of the proposed Whitehill site.*
- An application for a further offshore wind farm development (Westernmost Rough) has been submitted however it is understood that this development is at a very early stage.*

## *Shipping and Navigation*

*During the winter months vessel traffic is mainly restricted to vessels fishing (usually potting) or in transit to fishing grounds. In the summer the number of vessels passing through the area increases substantially, especially yachts during weekends. There is some very limited passage of recreational sea angling boats through the development site en route to fishing marks and or launch facilities, although this is principally during the summer. The majority of vessels stay at least one mile from the coast; there is no inshore merchant vessel traffic (i.e. within 6 nautical miles of the shore) in the area. Static fishing gears are deployed more or less throughout the area.*

*Navigational restrictions in the immediate area include a number of wrecks located on the seabed and a Ministry of Defence (MoD) firing range located directly to the north of the proposed outfall location. The presence of the range was a key factor in deciding on the location of the marine elements of the Scheme.*

*The main navigational feature in the vicinity of the Project and Regulated Activity is the Humber Traffic Separation Scheme (TSS), an internationally recognised routing measure established by the International Maritime Organisation (IMO) in 2001, with the aim of separating opposing streams of shipping traffic and reducing the likelihood of ship-to-ship encounters and hence collisions. The TSS is approximately 17 nautical miles (32 km) away from the Project and Regulated Activity.*

## *Tourism and Amenity Use*

*Tourism is important to the Holderness and wider East Riding economy. The area of the Project and Regulated Activity is not extensively used, in part due to safe access to the beach. However recreational sea angling does take place in the general area from the beach and from vessels. Offshore there is also some leisure boating, mainly in the summer months and the wider area contains Royal Yachting Association racing and sailing areas. However compared with elsewhere along the Holderness coast there is no significant concentration of amenity activity.*

#### *Noise and Residential Receptors*

*Onshore there are several residential receptors at Mount Pleasant/Seaside Road that are theoretically within the zone of influence of noise impacts from the Project. Baseline noise levels at these receptors are generally low and the main influences comprise natural sound from wind and the sea.*

#### *Marine Archaeology and Cultural Heritage*

*The area of the Project and Regulated Activity has a long history of human use, with potential terrestrial and marine finds. The importance of any former coastal terrestrial features is difficult to quantify, as there are no specific artefacts or locations known. With the exception of World War II coastal defences, the potential for terrestrial remains to survive in the study area is very low. Given that they would have regional interest, such sites, if present, are likely to be of low to moderate importance.*

*Similarly, the importance of recorded shipping losses along the coast is also difficult to quantify while their locations remain unknown. Remains of low to moderate importance may be present in the area, but the potential for wrecks to survive in situ in good condition is very low. The wreck of the steamer Amcott is centred some 200 m from the proposed diffuser location and 150 m to the north of the outfall line. Because it dates to the last quarter of the 19th century when such vessels were common, it is considered to be of low importance.*

*Sidescan sonar, bathymetric, seismic and magnetometer data were all reviewed. Some magnetic anomalies were identified and deemed likely to be of low and medium archaeological potential. The medium potential anomalies are sufficiently far from the locations of construction works that they will be avoidable or can be adequately protected by temporary exclusion zones to construction activity.*

#### *Seascape and Visual*

*The existing view from coastal locations mainly consists of just two elements; sea and sky, which combine to form an open expanse of seascape with a strong focus on the horizon. A number of permanent structures are visible in the seascape, interrupting the uniformity of the view. Nearest to the coast is the monopile intake structure associated with the SSE/Statoil gas storage development. Further out to sea, oil platforms sit on the horizon and large cargo ships are sporadically seen en-route to port at the Humber Estuary. The coast and hinterland elements of the seascape are typical of the Holderness coastline.*

A relatively moderate number of people will experience views of the Project and Regulated Activity. None of the landscape in the vicinity is designated for its scenic value.

### Seasonal Sensitivities

The sensitive receptors identified in the study area are not equally sensitive all year round. Key seasonal features are presented below.

**Table 1** Key Seasonal Sensitivities

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Seal pupping												
Sea trout migration												
Bass migration												
Bass spawning												
Shad												
Inshore potting (1-6 miles from shore)												
Nearshore potting (within 1 mile of shore)												
Salmonid season												

### CONSTRUCTION IMPACTS

#### Coastal Change

In considering the Project and Regulated Activity and whether it creates a risk in terms of accelerating the coastal erosion process, only the beach works will result in a slightly altered beach profile and may slightly alter sediment transportation rates. This will be associated with the construction of the sheet piled cofferdam, installation of the stone built access platform, beach access and, if necessary, installation of temporary netting on the cliff face to protect the workforce from falling debris. However, the sheet piled cofferdam, access platform, beach access and netting will only be in place for a period of 6 months after which they will be decommissioned and removed and the beach/cliff re-instated to its former condition. In addition, it is anticipated that the beach works will only be in position during the summer months when the risk of severe storms and rough seas and the subsequent chance of enhanced coastal erosion is minimal.

Further from shore localised alterations will occur to near-shore sediment transport from the pipeline trenching works and the installation works for the outfall structure. Trenching, pipe laying and backfilling will be completed within an approximate 6 month period and the impacts will be reversible and not significant.

Overall the works with the reinstatement measures will not lead to any significant changes to the natural rate of coastal erosion in regard to the cliff, the foreshore and the supply of terrestrial sediments into the marine environment.

## **Benthic Fauna**

*Some impacts to benthic fauna will occur during dredging for the pipes due to direct habitat loss, smothering of adjacent areas, backfilling and release of fine sediment. Approximately 3 ha of seabed will be affected (by pipeline installation and a much smaller area by installation of the monopile and diffuser), some of which is of reasonable quality in terms of abundance and diversity of species present. Impacts will be short-term, small scale and reversible and of minor significance further from shore in better quality habitat. Nearer to shore no significant impacts will occur.*

## **Commercial Fishing**

*During construction there will be a temporary safety exclusion zone around the works and along an access corridor to the works. The temporary loss of access to fishing grounds within the construction exclusion zone and construction access corridor will be a primary impact to fisheries. The majority of local fishermen will not be significantly affected but for a very small number of fishermen E.ON will explore further mitigation in consultation with NESFC. The measures that will be applied would typically include but not necessarily be limited to the following:*

- *notification of all works and the location for works at a suitable time in advance;*
- *liaising with fishermen over fixed gear deployment so that fishing effort can be maximised without risk to fishermen or risk of damage to gear;*
- *where there is flexibility in the timing of works, to programme such work to minimise interruption of fishing effort; and*
- *setting up and ongoing maintenance of good communication channels to facilitate the delivery of the mitigation measures.*

*These impacts will, however, all be temporary and reversible. The combined impact of turbidity, noise and loss of fishing grounds will only last for the duration of the construction phase (approximately 6 months), after which fish and crustaceans will re-colonise the areas directly affected by physical works and access for fishing will resume to all but a very small area.*

*E.ON is addressing the residual impact through consultation with relevant fishing bodies to mitigate the economic impact of the temporary reduction in fishing area. In the medium term any impacts to profitability will be mitigated by E.ON's support of the NESFC lobster research programme, designed to lead to Marine Stewardship Council accreditation, which has the potential to increase the first sale value of lobsters significantly. E.ON has also appointed an independent fisheries liaison officer dedicated to consultation with the fishing industry to develop purpose designed measures to mitigate the effects of physical displacement of individual fishermen and temporary displacement of their target species, as listed above.*

## **Marine Mammals**

*Underwater noise from various construction activities, especially piling, may displace marine mammals, through avoidance responses on their part should they be present in the area at the time.*

*'Soft-starts' (ie start at a low level and then increase the intensity) will be employed in order to allow marine mammals the opportunity to move away from the area, without causing stress or physical harm. Once noisy elements of construction are complete, animals will resume their normal behaviour and distribution.*

*Works will be planned where practicable during periods that minimise impacts; impacts will be short-term, localised and reversible. During piling (the main source of noise) the use of soft start procedures will minimise the potential for physiological impacts so the response will be limited to avoidance behaviour. This residual impact will be of minor significance.*

## **Noise Impacts to People**

*Noise levels from plant dredging close to shore are predicted to exceed the night-time impact assessment criterion by between 1 and 3 dB, an impact of potential minor significance on residential amenity. This would only happen if a number of ambient conditions (wind, sea state and tide) all occur simultaneously with construction activity being in certain places. E.ON will undertake spot checks on noise levels in the event that the above circumstances do combine. If necessary (i.e. the monitoring shows noise limits are exceeded the nighttime noise criterion) the option to move to work on a section of trench further from the shore at night to further reduce this noise impact will be considered. Baseline LAeq noise levels (from natural sources comprising wind and breaking waves on the shore) are sometimes higher than the highest predicted noise from pipeline trenching and this may help to lessen or mask this residual noise impact at times.*

*Implementation of the above measures, together with applying contingencies in the event monitoring of noise levels shows that the assessment criterion could be exceeded will ensure that potentially minor noise impacts will be reduced to not significant.*

## **Other Impacts**

*In addition to the topics addressed above, impacts to people due to dust, impacts to marine archaeology, seascape/landscape, recreational fishing, tourism and navigation have all been assessed. With the mitigation measures proposed as part of the Project and Regulated Activity there will be no significant impacts to these resources and receptors.*

*The EIA has also assessed potential accidental events, particularly some form of oil spill. The only mechanism whereby a significant quantity of oil could be spilled would be as a result of vessel collision or grounding which also then resulted in rupture of fuel tanks. In the first instance there is a very low likelihood of this occurring. There will be exclusion zones around the construction works and the construction vessels will be operated to high standards of care in terms of maritime safety. In the event of a*

*spill there will be contingencies and response equipment and given the distance of sensitive receptors from the works, successful intervention would be possible. The Marine Works Environmental Management Plan will set out the measures to be adopted in terms of spill prevention and response in the event of a spill occurring.*

*Overall the Project and Regulated Activity will not significantly add to the existing levels of risk of an environmental incident along this section of the Holderness coast.*

## **LEACHING IMPACTS**

### ***Coastal Change***

*The valve compound will be sufficiently far back from the cliff edge that it will not be exposed in the lifetime of leaching. In addition the pipelines will be installed by HDD in such a way that they also will not be exposed by erosion for some years after the end of leaching even if the current average rate of cliff erosion was to double.*

*However there is a residual risk of exposure and consultees have expressed concerns that in the event this did happen it might be necessary to take protective measures that interfered with natural processes of coastal change (ES 7.2.2(4)). In terms of managing these residual risks there will be remediation plans in place to deal with the onset of any exposure of infrastructure. In the event that sections of pipeline become exposed, options for reburied and/or local protection would be examined. In the unlikely event that remedial works were to be required they would be designed to be of a nature that would not significantly alter sediment transport rates or have any significant impacts on coastal change. In advance of leaching (also referred to as solution mining), E.ON will prepare a scheme for the removal of any infrastructure that at a future date becomes threatened or exposed. The scheme will be developed in consultation with Natural England and submitted to East Riding of Yorkshire Council for approval. This means that if a threat to infrastructure is detected there will be in place an approved remediation scheme that can be implemented before infrastructure becomes totally exposed. Consequently no significant impacts to coastal erosion are anticipated.*

### ***Water Quality***

*The outfall diffuser has been designed to achieve maximum initial dilution and dispersion, thereby minimising impacts to water quality. The process of design refinement is ongoing, and E.ON will demonstrate optimisation of the design during detailed engineering. Dispersion modelling has shown that salinity impacts of the plume will be localised (approximately 0.1 km<sup>2</sup> during a neap tide worst case scenario), using MOHID, which is a three dimensional water modelling system. Given that this is also a temporary (albeit medium term) and reversible impact, it is considered of minor to moderate significance. The affected area will be small in relation to the wider coastal waters and although there will be minor to moderate localised impacts, there will be no significant impact to water quality on the Holderness coast as a result of the brine discharge.*

*The mixing zone for copper around the diffuser will be small and the Environmental Quality Standard for the metal will be met within a few metres of the discharge. In addition the likelihood of bioaccumulation in marine organisms occurring to any significant degree is very small. Impacts to water quality (and secondary impacts to marine ecology) will be of minor significance and localised.*

*Other components of the brine discharge (temperature, suspended solids and trace constituents from the salt) will have no significant impacts.*

### **Mobile Marine Fauna**

*Mobile fauna avoid areas of unfavourable water quality conditions such as elevated salinity and avoidance behaviour by these groups may result in local ecological changes. However as noted above the design will be optimised for minimising effects on water quality.*

*Species will rapidly return to the area of the Project and Regulated Activity once the discharge has ceased. The impact will be medium-term, localised and of minor significance.*

*Similar effects to some fauna may result from exposure to pump noise. Again the impact will be medium-term, localised and of minor significance.*

### **Sessile Benthic Fauna**

*Mortality of benthic species that are unable to tolerate elevated salinities caused by the brine discharge may result in changes to the local benthic community, in terms of species distribution in areas affected by the plume. As noted above the Project and Regulated Activity includes design measures to maximise dispersion of the brine discharge. Modelling has shown that the majority of the plume area will be within the range of salinities that marine species can tolerate so the area within which mortality and significant redistribution of benthic species may occur will be small. The disturbance will be temporary and re-colonisation is anticipated to occur within a year after completion of leaching operations.*

*The residual impact will be medium term, but localised and reversible. It is an impact of medium magnitude to a medium sensitivity receptor and is therefore of moderate significance but highly localised.*

### **Commercial Fishing**

*Potentially there will be a 500 m safety exclusion zone around the monopile and diffuser to vessels, including fishing boats. Given the very small proportion of the overall fishery affected, impacts to the regional fishery from the safety exclusion zone are anticipated to be not significant. However, there may be some small-scale impacts to the profitability of a small number of individual fishermen who traditionally deployed gear at or around the monopile location. These impacts will be mitigated by the following:*

- *E.ON's support of the NESFC lobster research programme, designed to lead to Marine Stewardship Council accreditation, which has the potential to increase the first sale value of lobsters significantly;*
- *the appointment of a Fisheries Liaison Officer for the Project and Regulated Activity; and*
- *ongoing consultation with the relevant bodies (NESFC, NFFO and local fishermen's associations) to develop purpose designed measures to mitigate the effects of physical displacement of individual fishermen.*

*The above mitigation measures will ensure that even if the 500 m safety exclusion zone remains in place around the monopile throughout the leaching period, there will be no significant negative impacts to the profitability of individual fishermen and the fishery as a whole.*

*If E.ON's application for a reduced safety exclusion zone during the leaching phase is successful, it is likely that a much smaller 50 m permanent safety exclusion zone would be applied around the monopile and diffuser, with a temporary 500 m safety zone being enforced on the infrequent occasions when it is necessary to carry out maintenance.*

*The impact will be fully reversed at the time of decommissioning.*

### ***Archaeology***

*It is possible that archaeological artefacts could be exposed to elevated brine concentrations and this would lead to impacts that are of minor significance at most if not negligible. Measures will be implemented to protect and archaeological artefacts during routine maintenance.*

### ***Other Impacts***

*In addition to the topics addressed above, impacts to marine archaeology, seascape/landscape, recreational fishing, tourism and navigation have all been assessed. With the mitigation measures proposed as part of the Project and Regulated Activity there will be no significant impacts to these resources and receptors.*

## **DECOMMISSIONING IMPACTS**

### ***Marine Fauna***

*Decommissioning activity at the monopile may create a temporary zone of avoidance by fish and marine mammals, but mortality of sensitive species is not anticipated, and impacts will be of minor significance at most.*

## **Commercial Fishing**

*Decommissioning will require vessel access which it is assumed will entail an exclusion zone around the works and access corridor extending out to sea. Consequently some fishermen may be temporarily excluded from fishing grounds they would normally use and E.ON will explore further mitigation in consultation with NESFC nearer the time of activity. The mitigation to be applied at this time is likely to be broadly similar to that applied during construction. It should be noted that the benefits of the NESFC lobster research programme leading to Marine Stewardship Council accreditation will endure beyond the decommissioning of the Project and Regulated Activity.*

## **CUMULATIVE IMPACTS**

### **Water Quality**

*Modelling of the discharge of the SSE/Statoil Project found that the maximum plume length was 2,000 m during peak current speeds at spring tides. Under these conditions the salinity (salt content) in most of the plume was only just above ambient salinity and less than 35.5 parts per thousand (ppt).*

*The maximum length of the 35.5 ppt plume from the Project and Regulated Activity was modelled to be between 1,037 m and 1,465 m, depending on the degree of horizontal and vertical diffusion.*

*The discharge outfalls for the Aldbrough and Whitehill Gas Storage schemes are approximately 3 km apart. Given that under spring tide maximum flow conditions the plumes from each discharge will travel in the same direction along the coast, the saline discharges from Aldbrough and Whitehill will not interact, and there will therefore be no cumulative impact of the two projects on water quality.*

### **Fisheries**

*The Environmental Statements for both the Aldbrough and Whitehill schemes have concluded that any impacts to marine ecology resulting from the Project and Regulated Activity will be minor and reversible.*

*The outfalls and associated brine mixing zones for both schemes are within the same fishing area, but do not overlap. The cumulative impact of the two developments on the regional fishing industry will therefore be the sum of the separate impacts of each development. A reduction in abundance of shellfish and finfish in the vicinity of each outfall may lead to reduced catches and displacement of fishing effort into other areas.*

*However, given that the crustacean fishery, in particular, is currently thought to be exploited to capacity, even relatively small changes to stock availability around the proposed outfalls may have a moderate, medium-term impact on the fishing industry. Furthermore, the intensity of potting means that fishermen displaced from their grounds may not be able to find suitable alternatives. Ongoing liaison with fishermen's associations and the NESFC will seek to design mitigation strategies that will minimise these impacts to as low as reasonably practicable. These mitigation*

*measures will be implemented prior to the commencement of any offshore construction work and will be facilitated by the Fisheries Liaison Officer.*

### ***Decommissioning***

*As it is expected that SSE/Statoil will leave in place their infrastructure to assist in Phase II of its scheme, decommissioning is not expected to take place in the near future and is not predicted to happen concurrently with construction of the Project and Regulated Activity. There is no scope for cumulative impacts.*

*On completion of its own leaching activities E.ON will take measures to ensure that decommissioning of any part of the Project and Regulated Activity will not coincide with any potential decommissioning activities carried out by SSE/Statoil. Again there will be no scope for cumulative impacts.*

### **ENVIRONMENTAL MANAGEMENT**

*E.ON will deliver on the commitments it has made in the ES with the help of a Marine Works Environmental Management Plan (EMP) (a draft of which is presented in the ES Annex F). The EMP will be a living document and will continue to be developed as the whole Scheme proceeds through the detailed design and construction phases, to reflect the results of any discussions with relevant bodies such as the Marine Management Organisation (MMO) and Environment Agency and to include details of the conditions imposed by the consents obtained, and to consider the concerns of all stakeholders. E.ON's contractors for all works will be required to comply with the provisions of the EMP.*

*A monitoring programme has been developed in discussion with the Environment Agency. The biannual monitoring programme will incorporate epifaunal surveys, subtidal benthic grab surveys where these are possible, summer and winter fish surveys, crustacean stock assessments and drop down video. Water quality will be monitored during the initial period of operation, the duration to be agreed with the Environmental Agency, and additional sidescan sonar and/or drop down video surveys and borehole/CPT works will be undertaken prior to construction. The methods proposed for the monitoring programme have been revised and updated in light of the lessons learned from the EIA process.*

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