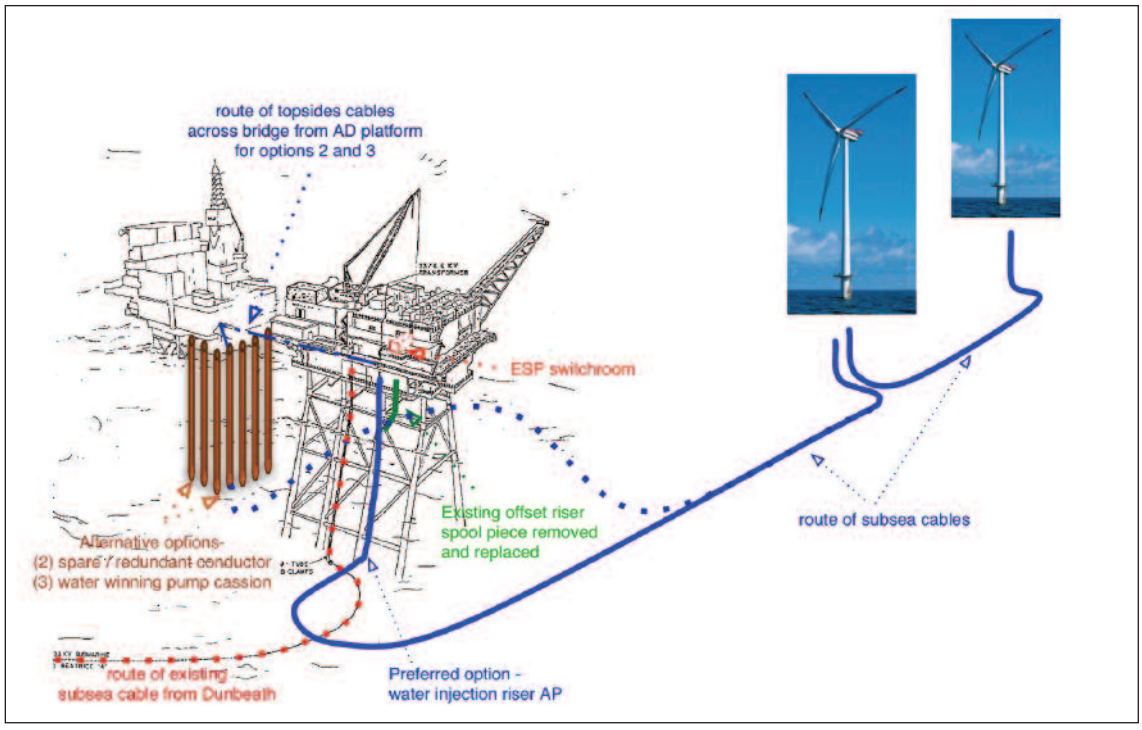
1 NON-TECHNICAL SUMMARY

1.1 INTRODUCTION

Talisman Energy (UK) Limited seeks to provide cost-effective electricity to its Beatrice platforms in the Moray Firth by installing two stand-alone wind turbine generating units (WTGs). These will be located about 1.6km and 2.3km from the Beatrice AP platform, and linked to it by a buried umbilical containing the electrical cable (Figure 1.1). The WTGs will operate as a Demonstrator Project for five years, supplying power to Beatrice and also providing valuable information about the technical, environmental and economic issues associated with creating a commercial deepwater wind farm at this site.

Figure 1.1 Illustration showing the general layout of the proposed Demonstrator site in relation to the existing Beatrice Alpha platforms.



This project is being undertaken by Talisman and its co-venturer Scottish and Southern Energy, and many of the research aspects are part-funded under a European Project called DOWNVInD which is examining the potential for developing wind farms offshore in deepwater where they will result in less visual intrusion than onshore wind farms.

Talisman Energy (UK) is therefore seeking consent for the Demonstrator Project as a variation of its existing consent for the Beatrice field operations. This Environmental Statement presents the results of a comprehensive Environmental Impact Assessment carried out under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999.

If the Demonstrator Project proves successful and the decision is made to proceed with the creation of a commercial wind farm, a second comprehensive EIA, including consultation, would be undertaken for that development.

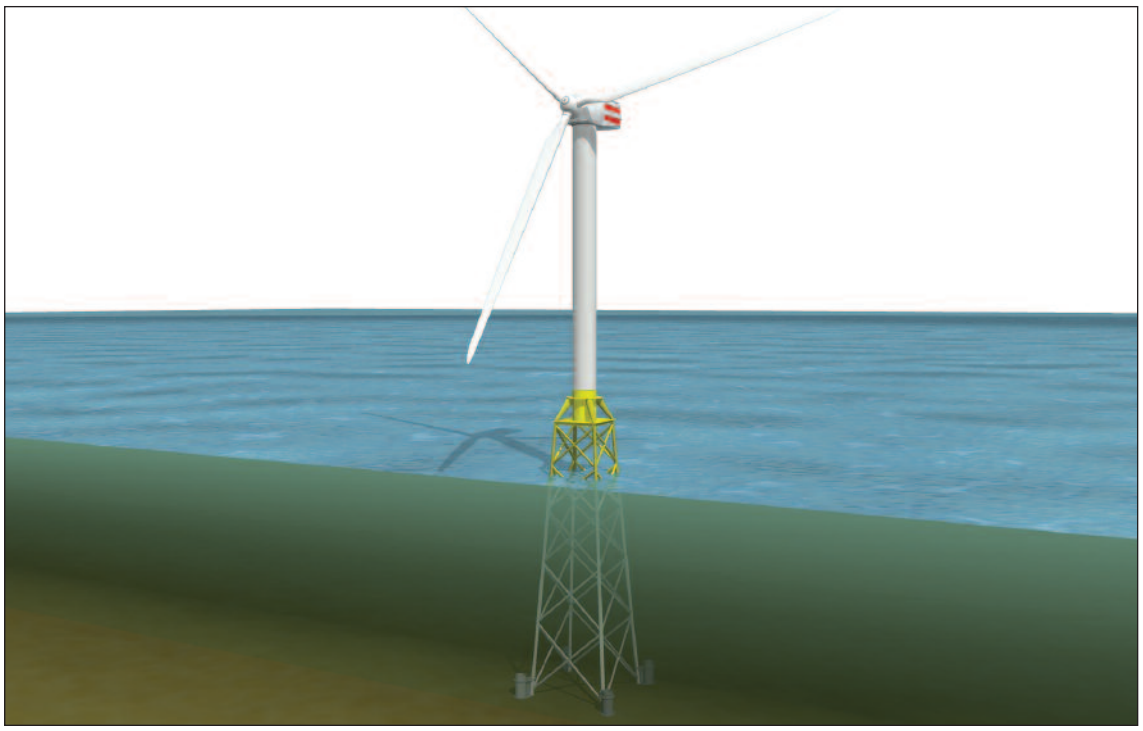
1.2 DESCRIPTION OF PROPOSED PROJECT

1.2.1 WIND TURBINE GENERATORS (WTGs)

The WTGs will each carry a REpower 5MW turbine, and together they will deliver an estimated 10MW of electricity to the platform. Figure 1.2 shows the design of each WTG, which comprises:

- *a substructure, a small, four-legged steel jacket which will be fixed to the seabed using four piles driven into the seabed*
- *a cylindrical steel tower fixed to the top of the substructure and rising to a height of 88m above sea level*
- *the REpower turbine nacelle, which weighs about 400 tonnes and is fitted with three blades 63m long.*

Figure 1.2 The structure of the wind turbine generating units (WTGs) for the proposed Beatrice Demonstrator Project.



The two WTGs and the Beatrice AP platform will be linked by a subsea umbilical containing the main electrical cable, and other lines for the control and monitoring of the WTGs. The umbilical will be buried to a depth of about 0.9m in the seabed, using a remotely-operated vehicle equipped with directed high pressure jets of water that fluidise the seabed, allowing the umbilical to sink into a trench. The umbilical will cross the existing 16" oil export line from Beatrice, and for about 200m, between this crossing and the platform, it will lie on the surface of the seabed protected by concrete "mattresses".

Some very minor modifications for one of the external pipes running down the leg of the Beatrice AP platform will be required, so that the end of the umbilical can be pulled up through it and on to the platform.

1.2.2 INSTALLATION PROGRAMME

The programme to install facilities at the Demonstrator site will be carried out in two phases in the late spring and summer of 2006.

Firstly, the umbilicals will be laid and then trenched by a pipelaying vessel, in an operation lasting a total of 14 days. Secondly, the WTGs will be installed, in a programme lasting a total of 15 days. This will require the use of several different types of vessel, including a heavy lift crane, a dive support vessel, a cargo barge and anchor-handling tugs.

The main components of the WTGs (substructure, piles, tower, nacelle and blades) will be sourced or manufactured at several locations, and then transported by sea to a port or harbour for final assembly. The onshore site for final assembly has not yet been selected but it is likely to be a port or harbour at which industrial and commercial activities have already taken place. At the assembly site onshore, the nacelle and blades will be fitted to the tower. It is planned that the WTGs can be transported to the Demonstrator site as two units, the substructure plus piles, and the tower plus complete nacelle.

A heavy lift crane will be used to place the substructure accurately on the seabed at the Demonstrator site. The tower and nacelle unit will then be lifted onto the substructure, and mated with it using a unique "soft landing" system to minimise any relative motion between the substructure fixed to the seabed and the tower and nacelle suspended from the floating crane. Finally, the end of the umbilical lying on the seabed will be pulled up through a pipe on the substructure and connected to the electrical circuit inside the tower.

1.3 ENVIRONMENTAL SETTING FOR THE PROPOSED WIND TURBINE GENERATORS

1.3.1 LOCATION

The site of the Demonstrator Project in which the two WTGs and umbilical will be located, lies wholly within the existing licence area for the Beatrice field in Block 11/30a of the UK Continental Shelf. This is approximately 25km off the north-east coast of the Moray Firth, in a water depth of 45m.

1.3.2 SEABED ENVIRONMENT

A project-specific survey of the seabed at the Demonstrator site was carried out in October 2005 to confirm the nature of the benthic environment. The seabed at the site comprises sandy sediments formed into low gently undulating sand waves. The existing levels of contaminants are very low; the sediments have concentrations of metals and hydrocarbons that are within the range of concentrations found at unperturbed locations in other parts of the North Sea, and which may be considered to represent background concentrations. The seabed communities of worms, bivalve snails and crustaceans are diverse, again reflecting the uncontaminated nature of the seabed. The seabed survey in October did not reveal any indications of the presence of beds of the horse mussel *Modiolus modiolus*, and only a single juvenile specimen of this species was recovered in grab samples.

1.3.3 MARINE MAMMALS

Several species of marine mammal have been observed in the area of the Beatrice field or Moray Firth including common seal, grey seal, harbour porpoise, Risso's dolphin, Atlantic white-sided dolphin, stripped dolphin, common dolphin and minke whale.

The Moray Firth population of bottlenose dolphin is thought to number between 100 and 174 individuals. Bottlenose dolphins have not been observed in the area, but it is possible that some of the unidentified dolphin recorded acoustically in the area were bottlenose dolphins. An acoustic monitoring programme carried out in the Moray Firth in 2005 by the University of Aberdeen under the DOWNVInD programme provided more specific information about the way in which different species of cetaceans use the Firth. This showed that in summer harbour porpoises are found widely throughout the Moray Firth SAC and around the Beatrice field, but that dolphin species (they could not be identified to species level using the acoustic monitoring equipment that was used)

were found predominantly in the Inner Moray Firth and close to the coast. Visits by dolphin species to the area of the Beatrice field were less frequent, and on average of shorter duration, than those made by harbour porpoise.

1.3.4 BIRDS

The coastline of the Moray Firth and its hinterland offer a wide range of feeding and breeding sites for both resident and migrant birds, and several sites in the Moray Firth are of national or international importance for different species. Nearshore, there are important populations of sea duck and waders, and at cliff nesting sites there are important populations of auks, terns, kittiwake and fulmar.

A year-long survey of the Demonstrator site was completed by experienced ornithologists, based on the nearby Beatrice AP platform. This survey obtained site-specific information about the variety, numbers, densities and flying patterns of all birds seen in and around the Demonstrator site. These data were used to make an assessment of the importance of the Demonstrator site for birds and to quantify the potential collision risk to birds posed by the WTGs. Seven species of birds were observed frequently, and with total numbers in excess of 100 for the year; these were auk sp., herring gull, great black-backed gull, fulmar, gannet, kittiwake and tern sp.

1.3.5 COMMERCIAL FISHERIES

The Demonstrator site is located on the Smith Bank, an important feature for fish, shellfish and commercial fisheries in the area. The most important commercial fishery is for scallops, and overall the area is assessed as having a "high" commercial value for fisheries. Fishing effort in ICES Rectangle 45E6 in 2004 amounted to some 850 fishing days, predominantly by scallop dredge and otter trawl.

1.3.6 OTHER USERS OF THE SEA, CABLES AND SITES OF ARCHAEOLOGICAL INTEREST

The general area of the Beatrice field is used by fishing boats, small and medium-sized cargo vessels and ferries. An area-specific review of vessel traffic has been undertaken and shows that the general level of vessel traffic is low. The Beatrice field lies beyond specific areas in which the MOD conduct exercises, and it does not contain any cables or pipelines (other than those used by Talisman at Beatrice) or any sites (wrecks) that have been notified because of their historic or archaeological interest.

1.3.7 PROTECTED OR DESIGNATED SITES

The Moray Firth contains many sites of national and international importance for wildlife; the Inner Moray Firth itself is a Special Area of Conservation (SAC) established under the Habitats Directive, primarily for its resident population of bottlenose dolphin, one of only two such populations in the UK. Along the coasts of the Firth there are other SACs, and also Special Protection Areas (SPAs) established under the Birds' Directive. The outer limit of the Moray Firth SAC is 25km from the nearest WTG in the Demonstrator site, and the nearest coastal SAC or SPA is the Berriedale Cliffs, approximately 25km from the closest WTG.

1.4 CONSULTATION PROGRAMME

Starting in 2003, Talisman has conducted an open and wide-ranging programme of consultation with members of the public; organisations representing communities, businesses and environmental groups; NGOs; and statutory consultees. It has published newsletters and articles in newspapers and journals; established and maintained a website (www.beatricewind.co.uk); held open public meetings and presentations; and conducted workshops. Talisman has endeavoured to ensure that all interested parties have been able to find out about the project and to keep track of developments and plans as they have unfolded. To this end, presentations and question and answer sessions were arranged for stakeholders in communities along the whole coast of the Moray Firth.

To inform and support the extensive programme of consultation, Talisman published a detailed Scoping Report in January 2005. This was used to inform the discussions with interested parties about the project, and to identify the potential key environmental effects that the project might have.

1.5 SCOPING THE POTENTIAL IMPACTS OF THE BEATRICE WIND FARM DEMONSTRATOR PROJECT

As a result of the extensive feed-back from the consultation programme, and in the light of the preliminary assessment of key effects from the scoping report, Talisman completed a detailed review of all the potential environmental effects that could arise as a result of the planned, unplanned and accidental events associated with the proposed project.

The outcome of this review is presented in the environmental statement, along with a justification for excluding those effects or risks that were judged to be very small.

Talisman has identified the following issues (Table 1.1) of greatest concern to stakeholders. All of these issues are examined in appropriate detail by the environmental assessment, and reported in the environmental statement.

Table 1.1 Key potential environmental effects associated with the Demonstrator Project.

CAUSE OF EFFECT	POTENTIAL ENVIRONMENTAL EFFECT(S)
Underwater noise from piling operations	Noise disturbance to marine mammals
Physical presence of operating WTGs	Collision risk to birds
	Visual impact on landscape and seascape
	Damage to seabed communities
	Interference with aviation and telecommunications
	Collision risk to commercial and fishing vessels
Presence of subsea electrical cables	Effects of electromagnetic fields on fish

1.6 EFFECTS ON MARINE MAMMALS OF UNDERWATER NOISE FROM PILING

1.6.1 SOURCE AND DURATION OF PILING NOISE

Piles will be driven into the seabed using a piling hammer typical of the systems routinely employed both offshore and at coastal locations. It is estimated that underwater noise from piling may be created for about two hours at each pile, and it is planned that two piles will be driven each day, over a four day period. The piling operations for the Demonstrator Project will be similar to those undertaken to fix oil or gas platforms to the seabed, rather than the larger monopiles associated with free-standing wind turbines typically developed in shallower, near shore locations.

1.6.2 EXTENT OF NOISE EFFECTS FROM PILING

Recent publications were sourced in order to obtain a realistic value for the source noise associated with piling 1.8m diameter piles, and a source level of 225dB was selected (Nedwell and Newall, 2005). Standard equations for the propagation of sound underwater were then used to estimate the physical extent of two zones of effect for marine mammals. The first was the zone in which temporary changes in hearing ability may occur in marine

mammals and fish; this change is temporary and data in the literature suggest that it occurs when marine mammals are exposed to noise levels of greater than 240dB which are also 80-90dB above the threshold of their hearing. The threshold of temporary change in hearing ability was selected because it is the least damaging physical effect, and would be found over the largest area. It is therefore the most precautionary physical threshold and there are data in the literature for this threshold level for different species.

The second zone was one in which marine animals may exhibit a "strong avoidance reaction" (i.e. they will tend to swim away from the source). Again, the literature suggests that this behaviour would be elicited when marine mammals are exposed to a noise level at a particular frequency that is >90dB above their hearing threshold (this is expressed as >90dB ht (species). The threshold for strong avoidance reaction was selected because it is the lowest level at which overt behavioural changes occur in the animals which might be exposed to underwater noise and, again, there are data in the literature for this threshold level for different species.

The noise propagation model was run for bottlenose dolphin, harbour porpoise, common seal, harbour seal, and the mysticetes (the group to which minke whale belongs). Different frequencies were examined, to determine the maximum extents of the zones within which temporary changes in hearing, and avoidance, might occur.

For bottlenose dolphin and harbour porpoise, the zone within which temporary changes in hearing might occur was found to extend to about 1km radius around the piling site. For common seal this zone was about 1km, and for mysticetes it was about 0.4km. For bottlenose dolphin, the zone in which a strong avoidance reaction might be elicited extended to about 2km radius from the piling site. The equivalent zone for harbour porpoise was 9km, harbour seal 7km, and mysticetes 33km. It is stressed that all these estimated distances assume that no mitigation measures are in place from the project to try to reduce the absolute source level of piling noise.

On the basis of this assessment, it was concluded that cetaceans and seals within 1km of the piling site might be exposed to noise levels that cause temporary changes in hearing ability, and that mitigation measures should be focused on ensuring that piling did not start if marine mammals were present in this zone.

It was also concluded that marine mammals (excluding mysticetes) out to perhaps 10km from the site might be exposed to noise levels that caused an avoidance reaction. This means that the individuals would be expected to change their behaviour and move away from the site while the noise lasted, but then return to it when the noise ceased. Studies at the Horns Rev wind farm have shown that marine mammals returned to the area within a few hours of the cessation of piling noise (Tougaard *et al.,* 2003).

It does not appear that noise of a level sufficient to cause strong avoidance reaction will reach the boundaries of the Moray Firth SAC, some 25km away.

1.6.3 MITIGATION OF PILING NOISE

Underwater noise from piling will be generated for perhaps four hours each day, over a four day period. Talisman will develop a project-specific environmental protection plan outlining the mitigation measures to be used during piling. This will include a series of mitigation measures based on the principles in the JNCC 'Guidelines for Minimising Accoustic Disturbance from Seismic Surveys', specifically:

- *reduce the source level of piling noise, if possible, using physical barriers*
- *use marine mammal observers and passive acoustic monitoring to ensure as far as possible that no marine mammal is within 1km of the site before piling starts*
- *use a "soft start" technique to alert marine mammals in the immediate vicinity (for example within 10km) to the commencement of the piling operations.*

It may be possible to use various physical devices to reduce the level of noise from piling. Such systems can reduce the source noise level in the water column, and reductions of 3dB to 10dB are claimed (Nedwell *et al.,* 2003). Talisman is currently exploring opportunities for physical noise mitigation, and how to overcome the technical and logistical problems of deploying such arrangements in 45m of water offshore. Clearly, even a reduction of a few dB at source reduces the radius of the zones of effect estimated in the modelling.

The focus of the project's mitigation measures will be firstly, to ensure that no marine mammal is present within 1km of piling operations, and secondly, that individuals present in the zone where perceived noise levels might be expected to cause strong avoidance reactions are encouraged to move further away.

Talisman will follow the principles of the JNCC guidelines for minimising the acoustic effects of seismic operations on marine mammals. Independent marine mammal observers will be present offshore throughout the piling programme. Before operations begin, the area within 1km of the site will be carefully surveyed to ensure that there are no marine mammals present. Piling will not be started during darkness. The environmental protection plan will be based on similar plans produced and operated by Talisman (Talisman, 2000) and will identify clear actions to be taken if marine mammals are detected before and during all operations.

Before full piling operations begin, a "soft start" will be implemented, whereby the force of piling is gradually increased, steadily raising the underwater noise level over a period of time. This will alert animals located more than 1km from the site to the piling activities, without exposing them to more intense levels of noise, and provide an opportunity for them to move away from the noise source.

1.7 EFFECTS OF THE PRESENCE OF WIND TURBINE GENERATORS ON BIRDS

1.7.1 SOURCES OF EFFECTS ON BIRDS

Commercial-scale wind farms present a collision risk to birds, may represent a barrier to bird movement, exclude birds from feeding grounds, displace them from important areas, or adversely affect their food supply. On the basis of the extensive literature on bird distribution in and around the Moray Firth, and using the year-long site-specific monitoring data from the Beatrice field, the environmental assessment has concluded that the greatest risk to birds from the two WTGs is the risk of collision.

1.7.2 MAGNITUDE OF COLLISION RISK FOR BIRDS

Attention was focused on those species that were seen at the site most frequently, and in high numbers. Results from observations made at the Demonstrator site showed that auk species, great black-backed gulls, herring gulls, gannets, fulmars and kittiwakes were the species most likely to interact with the turbine blades.

A standard collision risk model (Band, 2000) was used to estimate the likelihood of a collision with the Demonstrator WTGs for each of these species. Data on bird density were then used to calculate the potential numbers of interactions between birds and the turbine blades, in order to estimate the likely number of additional mortalities as a result of the presence and operation of the two WTGs.

With the exception of great black-backed gull, the additional potential increase in natural mortality of the Moray Firth population for that species as a result of the WTGs was estimated to be $<1\%$. For great black-backed gulls, the potential mortality was estimated to be about 2.5% of the natural mortality of the population. This was based on an estimated average number of 8,000 birds in the Moray Firth area, and must be treated with caution, since numbers of great black-backed gull in the Moray Firth vary significantly with the season.

1.7.3 MITIGATION FOR EFFECTS ON BIRDS

The two WTGs will be sited more than 25km from land, and from all SPAs UKBAP sites, Ramsar Sites, IBA sites, and estuaries. They do not appear to be located in a particularly important feeding ground for any species of sea bird, or in an area that is frequented by large numbers of either flying or moulting birds.

No mitigation can be proposed for short-term disturbance effects on birds during construction, except to complete the activities in a timely manner. During their operational life, the WTGs will bear navigation lights, and the lower parts of the towers will be painted to make them more visible to shipping (Section 3.3.11). The rest of the tower, and the blades, will be painted grey to reduce their overall visual impact.

Inspection and maintenance will be carried out periodically, using the fast rescue craft (ERIC) deployed from the nearby Beatrice platform. Given the present existence of vessel activity around the Beatrice field, and the fact that few birds have been observed at the Demonstrator site on the water surface or feeding, the localised disturbance caused by maintenance visits is likely to be localised and not significant.

1.7.4 FURTHER RESEARCH PROPOSED

The University of Aberdeen will conduct field surveys of the feeding and resting behaviour of marine birds in and around the site of the Demonstrator Project. This work will probably use boat transect and may also use radar observations of seabird movements before and after the installation of the WTGs. Work is continuing to optimise the bird data that can be obtained using offshore radar.

1.8 VISUAL IMPACT OF DEMONSTRATOR PROJECT ON LANDSCAPE AND SEASCAPE

1.8.1 SOURCES OF EFFECTS ON LANDSCAPE AND SEASCAPE

Under good viewing conditions the WTGs will be visible from certain parts of the north-east coast of the Moray Firth, as are the Beatrice platforms themselves. The presence of the WTGs could, therefore, affect people's appreciation of the landscape and seascape by introducing another man-made structure into the field of view, and thus detracting from the "wildness", "openness" or "naturalness" of the wide seascape presented by the Firth. The movement of the turbine blades would be unlikely to be discernible from the coast.

A detailed Landscape and Visual Impact Assessment (LVIA) was therefore completed to determine the possible nature and extent of the visual impact that the WTGs might have. The methodology employed was based on the 'Guidelines for Landscape and Visual Assessment' (Landscape Institute and Institute of Environmental Management and Assessment, (2002)), modified to incorporate elements of Seascape Assessment as recommended within the Guide to Best Practice in Seascape Assessment (Countryside Council for Wales, Brady Shipman Martin and University College Dublin, 2001).

A study entitled "Guidance on the assessment of the impact of offshore wind farms: seascape and visual impact report", by the DTI in association with the Countryside Agency, the Countryside Council for Wales and Scottish Natural Heritage, was published in November 2005, after the LVIA for the Beatrice Demonstrator was completed. Although this study was not available to be utilised in Talisman's assessment, given the wealth of existing material that has been drawn upon to complete this LVIA, and the experience of the landscape architects who undertook the work, Talisman believes that the methods, approach and assessment techniques used for the Demonstrator LVIA will be in broad agreement with any future developments in best practice that may be available later in 2006.

The initial stages of assessment defined the study area and identified landscape character, landscape designations and relevant government policy, to determine the general extent of visibility and to identify a representative range of potential viewpoints from which to carry out the LVIA. These viewpoints were largely concentrated within publicly accessible areas along roads and public footpaths, in residential locations and in areas popular for outdoor recreation.

Maps showing the Zone of Theoretical Visibility (ZTV) were generated to identify the potential extent of visibility of the proposed wind farm over a 60km radius from the centre of the site. The 60km radius was chosen, with support from a number of consultees, because this was the theoretical limit at which the tips of the blades might be seen.

The ZTVs identified a number of viewpoints that would represent the potential range of views to the wind farm that could have significant visual impacts. The final viewpoints selected for the LVIA are listed in Table 1.2.

Some of these viewpoints also represent potential cumulative visual impacts of other wind farms proposed for the North of Scotland. The potential cumulative and sequential impacts of the proposed Demonstrator WTGs with other, onshore wind turbines, were also examined.

Table 1.2 Viewpoints selected for the LVIA.

Viewpoint nr	Location	Main users (receptors)	Grid ref	Approx altitude(m)	Approx distance from edge of wind farm (km)	Direction to centre of wind farm	Other wind farms theoretically visible*
1	Lybster	Local residents and visitors (also similar to views from A9)	324884, 935060	51	26	SSE	B D K > 35km G > 35 km
2	Latheron	Motorists and local residents	319809 933137	72	28	NE	K > 35km G > 35 km
3	Dunbeath Heritage Centre	Local residents, visitors and motorists	315943, 929538	55	26	SE	B D K > 35km
4	Scaraben	Hill walkers and stalkers	308074, 927326	626	32	SE	C, B, G, D
5	A9/Berriedale Borgue area	Motorists and local residents	313171, 924717	135	26	SE	D K > 35km
6	A9 Navidale	Motorists and local residents	303767, 916153	79	33	ESE	B > 35km C > 35 km
7	Creag Riasgain	Local walkers	295746, 912661	415	41	E	B > 35km C > 35 km K, G
8	Brora golf course/car park	Golfers, local residents, visitors	291004, 903966	10	46	ENE	B > 35km C > 35 km D > 35 km K
9	Tarbat Ness	Local residents and tourists	294821, 887641	10	49	SSE	B > 35km C > 35 km D > 35 km K
10	Lossiemouth	Local residents	323321, 871291 or 323317, 871285	3	44	NNE	C > 35 km B> 35 km G> 35 km K> 35 km D> 35 km
11	Durn Hill	Local residents and visitors	357100, 863842	195	53	NNW	C > 35 km B> 35 km G> 35 km K> 35 km D> 35 km

** C=Causeymire, B=Buolfruich, D=Dunbeath, K=Kilbraur, G=Gordonbush*
>35km=outside the study area of the wind farm and thus visibility data not provided

1.8.2 CHARACTER AND MAGNITUDE OF VISUAL EFFECTS

Landscape impacts of the WTGs

Generally the WTGs would relate strongly to many of the key characteristics of the landscapes along the coast, specifically their large scale, sense of exposure, existing patchy composition of features and existing presence of human-made elements. Most importantly, the Demonstrator WTGs would seem closely associated with the existing oil platforms – appearing to complement the energy generation function and focal qualities of these features.

For all local landscape areas, landscape impacts were judged to be of low magnitude. No substantial adverse impacts were identified.

Visual impacts of the WTGs

From most viewpoints the proposed development would be seen as a single cohesive feature within the landscape, of similar prominence to existing foci within the onshore landscape such as telecom masts and distinctive low hills, as well as the existing oil platforms seen offshore. Given its distance from the coast, it would appear clearly separated from the onshore landscape and, alternatively, part of the open sea, and the movement of wind turbine blades would rarely be discernible from the mainland. In addition, although the vertical line of the turbines would contrast to the existing platforms and the surrounding horizontal emphasis of the sea, this disparity would appear as a "clean" contrast of line and form on account of the simple composition of elements.

The proposed WTGs would appear most prominent from the coastal areas that have a simple foreground pattern, with fewer distracting features, especially when views are directed towards the proposed development. Visibility would mainly occur from southern directions and at high elevations.

For the 11 viewpoints, the proposed development would mainly result in only negligible or slight significance of visual impacts, with only two viewpoints resulting in moderate significance of visual impact, reflecting their higher sensitivity. No substantial visual impacts were found.

Sequential impacts of the Beatrice wind turbines

Sequential impacts occur when the observer moves along a linear route, as a series or continuing of points. View from these routes may include other developments. The possible sequential impacts of the Demonstrator WTGs were assessed in both directions along two coastal roads. Most of the views from locations along these routes would result in impacts of 'no' or 'negligible' magnitude (because of the distance of the proposed development), although low magnitude of impacts would occur along some sections. This would result in impacts of 'none', 'negligible' or 'slight' significance of impacts along all sections of the roads apart from one section travelling south between Wick and Latheron and one section travelling north between Navidale and Dunbeath. From these sections, which equate to 51km of a total sequential assessment of 313km, there would be moderate sequential visual impacts. No substantial sequential impacts were found.

Impacts of the Beatrice wind turbines on areas of landscape and scenic value

The proposed Demonstrator Project would have low or negligible magnitude of impact on areas of recognised landscape and scenic value. It would have no significant impact on any National Scenic Area. However, it would result in moderate adverse impacts on one proposed Area of Great Landscape Value and two Garden and Designed Landscapes, which reflects their medium sensitivity. No substantial significant impacts have been identified on areas of landscape and scenic value.

Cumulative landscape and visual impacts of the Beatrice wind turbines with other wind farms

Cumulative impacts of the proposed WTGs with the existing Causeymire and Buolfruich wind farms were considered, as well as the combined landscape and visual impacts of the Demonstrator WTGs with the proposed Dunbeath, Kilbraur and Gordonbush wind farms.

Generally the Beatrice wind turbines would appear as a separate isolated feature from these wind farms, seen within a different setting and when looking in a different direction from key viewpoints. Thus the Demonstrator WTGs would seem more closely associated with the existing offshore oil platforms than other wind farms within the vicinity of viewpoints. It was judged that direct cumulative impacts during construction and operational phases would have a negligible adverse effect on the landscape and visual resource. This was considered to be a non-significant effect.

Overall effect of the proposed WTGs

The LVIA has established that the proposed WTGs at the Demonstrator site would change the landscape and visual baseline conditions during its construction and operational phases. The WTGs would introduce two new elements into the land and seascape. The construction phase would be relatively short, however, and would have only temporary adverse effects on the landscape and visual resource of the study area.

The design of the WTGs has been determined by technical and practical factors. The resulting design would appear concentrated from all viewpoints, forming a simple feature that would seem to relate to the character of the surrounding land and seascape and the existing oil platforms. In this way, the proposed WTGs would satisfy good practice guidance.

The Demonstrator site is not subject to any statutory or local designations for landscape or scenic interest. In addition, the proposed Demonstrator site would not be visible from any major settlement.

Overall, during construction and operational phases, it was judged that direct impacts would have a slight adverse effect on the landscape resource, and on the visual resource. Both these effects were considered to be non-significant effects.

1.9 EFFECTS ON THE SEABED

1.9.1 SOURCES OF EFFECTS ON THE SEABED

The operations to install the WTGs and the umbilicals, and the presence of the WTG substructures on the seabed, may cause temporary or permanent effects to the seabed and seabed (benthic) communities. Benthic communities may be disrupted when sediments are disturbed, smothered by resettling suspended sediments, or permanently covering by parts of the facilities on the seabed.

1.9.2 MAGNITUDE AND SIGNIFICANCE OF EFFECTS ON THE SEABED

It is estimated that operations to install the umbilicals and substructure will physically disturb only a small proportion of the seabed within the Beatrice field determination boundary. The bases of the WTGs and the mattresses that would be placed at the points where the umbilicals emerged from the seabed, would in total cover about 2,800m^2. The corridor of seabed that would be temporarily disturbed during the burial of the umbilcals would cover an estimated area of about 10,500m^2.

Together, these areas of potential disturbance represent about 0.02% of the seabed within the Beatrice field determination boundary. The sediment is clean and uncontaminated, and although a very small proportion of

the benthic community within the bounds of the Beatrice site licence may be impacted, the sediment will be quickly recolonised by animals from adjacent undisturbed sediment. The site-specific benthic survey at the Demonstrator site did not find any evidence of the presence of beds of *Modiolus modiolus*.

1.9.3 MITIGATION PROPOSED

The installation operations for the support structure, mattresses and subsea umbilicals will be carefully planned and executed so as to minimise the area of seabed disturbed. The routes of subsea umbilicals will be designed so as to minimise the length of each umbilical, and hence the extent of seabed disturbance.

1.9.4 SURVEY AND MONITORING OF OPERATIONAL WIND TURBINE GENERATORS

There are no plans to monitor the condition of the seabed around the WTGs. The bases of the support structures may be surveyed from time to time, using an ROV, to determine if any seabed scour is occurring. The umbilical routes may be surveyed periodically, to ensure that the umbilicals remain buried to the required depth.

1.10 EFFECTS ON AVIATION AND TELECOMMUNICATIONS

1.10.1 SOURCES OF EFFECTS ON AVIATION AND TELECOMMUNICATIONS

The presence of the WTG units may affect fixed radio links, maritime radio systems, civil and military radars, and aeronautical radio navigation aids. Wind turbines can, for example, interfere with signals or create blind areas on radar coverage. The magnitude of potential effects depends on the size, extent and location of the wind turbines in relation to the affected instruments. Telecommunications and aviation may be affected by large-scale wind farm developments. Although it is unlikely that the effects of the two WTGs at the Demonstrator site would be significant, the issue was raised during consultation.

A review was made of the nature, location and use of all radar and telecommunication facilities within a 30km radius of the WTGs. Discussions were held with the operators/owners of these facilities to determine the detailed operating parameters of each system, to evaluate whether they would be likely to be affected by the presence of the WTGs. These discussions included the examination of possible mitigation measures. This information was then drawn together by an independent expert to provide a comprehensive assessment of the potential for the WTGs at the Demonstrator site to affect telecommunications or aviation (Spaven, 2005).

1.10.2 CONCLUSIONS OF ASSESSMENT OF EFFECTS ON AVIATION AND TELECOMMUNICATIONS

There are no known telecommunications facilities with the potential to be affected by the development, and television reception will not be affected.

No potential impacts on aviation have been identified other than possible restrictions on existing instrument approach procedures for helicopters to the Beatrice platforms. The WTGs may be marginally visible from the NATS Allanshill radar, but this is not expected to be of any operational significance. A new radar planned for Inverness Airport may be able to detect the Beatrice WTGs but this is not expected to be of operational significance.

1.10.3 MITIGATION PROPOSED

In view of the results of the assessment for potential effects on telecommunications and aviation, Talisman do not propose to undertake any additional mitigation measures.

1.11 COLLISION RISK TO COMMERCIAL VESSELS AND FISHING BOATS

1.11.1 POTENTIAL EFFECTS

The presence of the operating WTGs may present a collision risk for vessels, including fishing boats, in the area, even though the WTGs will be required to have a 500m radius safety zone around them.

Talisman commissioned Anatec UK to undertake an assessment of the collision risk. The Anatec UK database "ShipRoutes" was used to provide data on the numbers, types and sizes of vessels passing in close proximity to the Demonstrator site. These data were then used in the Anatec COLLRISK model, to estimate the likelihood of two types of collision – a vessel under power accidentally hitting one of the structures, and a vessel having lost power drifting into one of the WTGs. This model is based on the premise that the collision frequency is proportional to the volume of traffic interacting with the structures. It is stressed that neither assessment considers or takes account of the potential mitigating effects of potential collision risk management measures, such as use of a guard vessel or a radar warning system.

1.11.2 RESULTS OF COLLISION RISK ASSESSMENT

Six shipping routes pass within 10nm of the WTG locations, with an estimated 232 vessels using them each year (Anatec, 2005). The majority of vessel traffic is associated with the ports of Cromarty, Invergordon, and Inverness, and the Nigg Terminal. A summary of the collision results for each WTG is presented in Figure 1.3.

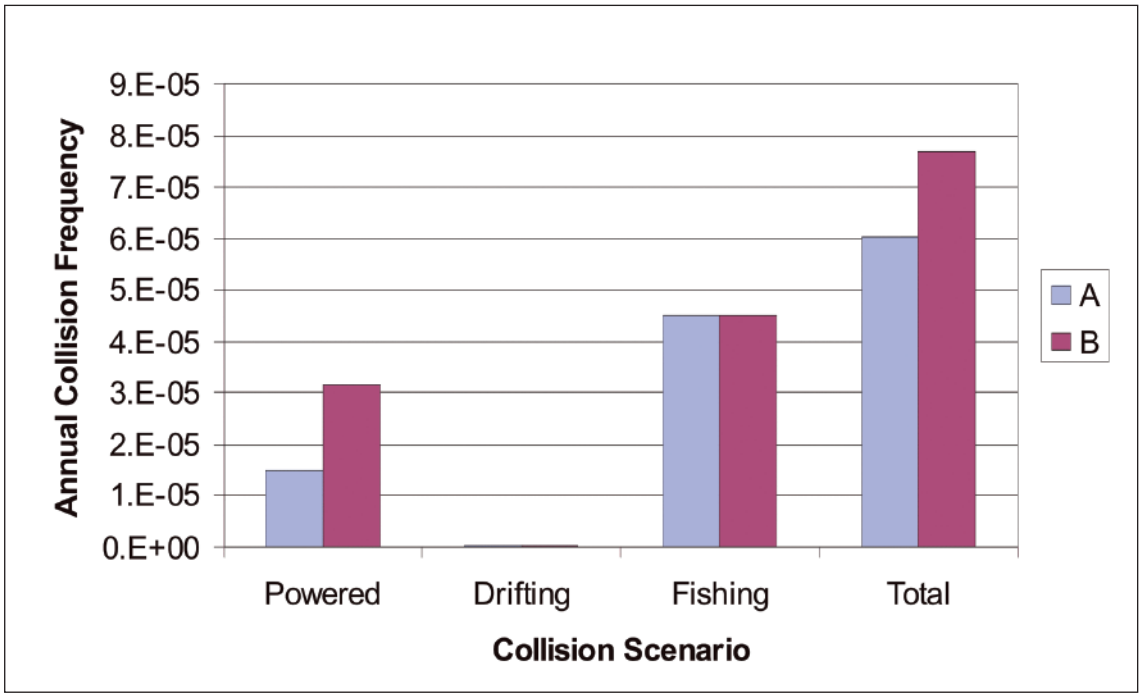


Figure 1.3 Summary of collision risks for powered collisions, drifting collisions and fishing boat collisions for each WTG at the Demonstrator site.

The overall collision risk for WTG 2 is slightly higher than for WTG 1 (a return period of 13,010 years versus 16,585 years). This is mainly due to the higher frequency of passing powered ship collisions. Overall, the collision risks for both turbines were assessed to be low based on the relatively low shipping and fishing vessel activity identified in the Beatrice area.

The relatively low level of fishing activity in the immediate area of the Demonstrator site was confirmed by the results of another study commissioned by Talisman (SML, 2005). This examined the level of vessel activity within 10nm of the Beatrice field, using data from radar surveillance from the Beatrice platform. A very large amount of raw data was made available, and an example of the results of this study is shown in Figure 1.4.

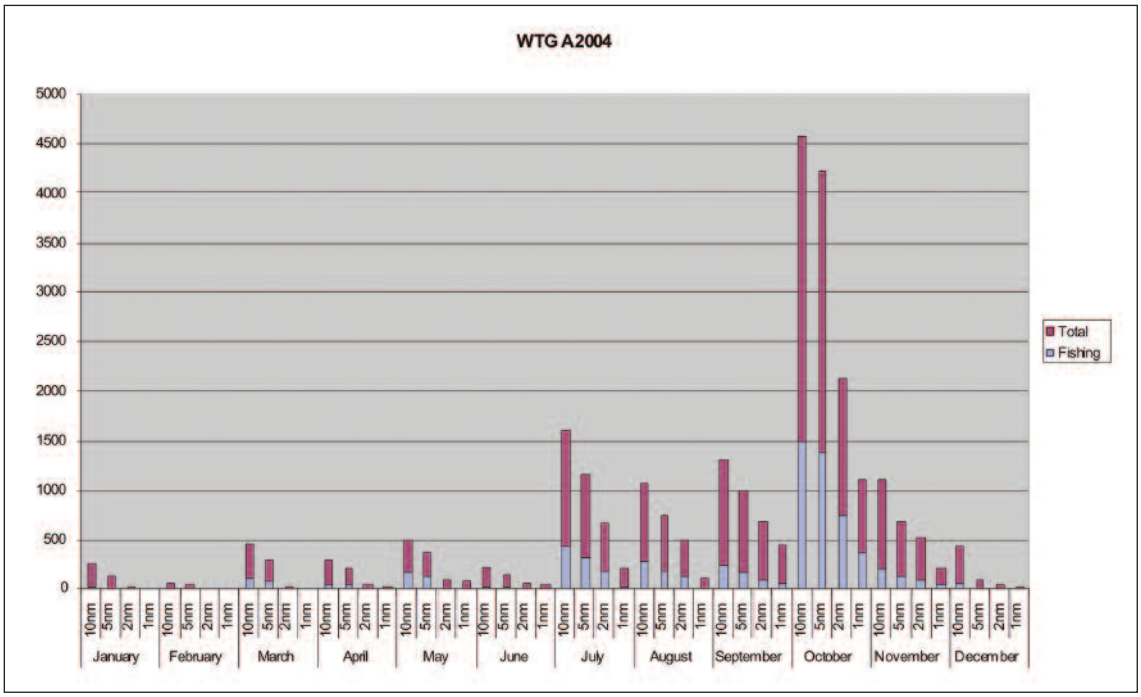


Figure 1.4 shows for each month of 2004, the total numbers of approaches by all vessels, and the numbers of approaches by fishing vessels, to within 10nm, 5nm, 2nm and 1nm of WTG 1 (labelled WTG A on the graph). These data confirm that the WTG sites are not used or crossed at present by a large number of vessels. This underscores the overall assessment that collisions risk is low, and also that the presence of the WTGs and the 500m safety zone around them, will not result in a significant inconvenience to commercial fishing operations.

1.11.3 MITIGATION FOR COLLISION RISKS

The offshore activities associated with the installation of the facilities, and the locations of the WTG units will be notified in Admiralty "Notices to Mariners". The WTG units will be painted and lit in accordance with International Association of Marine Aids to navigation and lighthouse authorities guidelines, and will be visible on ships' radar.

The HSE has determined that the two WTGs will become "supplementary units" as defined in the Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995. They will thus effectively become part of the Beatrice Installation, and will therefore attract an automatic 500m safety zone around them, in accordance with Section 21 of the Petroleum Act 1987.

1.12 EFFECTS OF ELECTROMAGNETIC FIELDS

1.12.1 POTENTIAL EFFECTS

Several marine species use magnetic and electrical fields for navigation and for locating prey. The electrical cables linking the WTGs to the Beatrice AP platform may create electrical and magnetic fields that may affect these marine organisms, in particular affecting their ability to navigate or locate food.

1.12.2 MAGNITUDE OF POTENTIAL EFFECTS AT THE DEMONSTRATOR SITE

Electrical fields are produced around electrical cables that are not perfectly shielded. Industry-standard cables are constructed with shielding designed to retain electrical fields within the cabling. Magnetic fields, however, exist beyond even industry-standard cables, and can induce electrical fields in the surrounding environment.

In a typical industry-standard cable conducting 132kV and an AC current of 350A, the size of the magnetic field would be 1.6μT (micro Tesla) (CMACS, 2003). This field would be present only directly adjacent to the cable, and although it would be additive with the earth's natural geomagnetic field (approximately 50μT), the magnitude of magnetic field associated with the cable would fall to background levels within 20m of the cable.

In the same study CMACS showed that for a cable buried 1m below the seabed the magnitude of the induced electrical field at the seabed would be approximately 91μV/m. Although the magnitude of the magnetic field was not affected by the fact that the cable was buried, the induced electrical field dissipated more quickly in sediment than in seawater.

The cable that will be used for the proposed Demonstrator Project is an industry-standard, three-phase 33kV, 175A, 50Hz alternating current (AC) XLPE (cross linked polyethylene) cable carrying 10MW. Extrapolating from studies carried out by CMACS (2003), it is predicted that this cable will generate a magnetic field of approximately 0.8μT. The Beatrice cable will be buried 0.9m below the seabed, so the induced electrical field at the seabed should be approximately 45μV/m adjacent to the cable. As the current flowing in the cable at the Beatrice Demonstrator Project will be half that modelled by CMACS (2003), it is expected that the magnitude of the magnetic field and induced electrical field will be approaching zero at 10m and 20m, respectively.

A species of particular importance in the Moray Firth, both commercially and ecologically, is the Atlantic salmon (*Salmo salar*). Several studies, including those by Quinn and Brannon (1982), Taylor (1986), and Chew and Brown (1989) on several different members of the Salmonid family of fishes suggest that Salmonid fishes are able to detect and orient to artificial magnetic fields of a similar magnitude to the earth's geomagnetic field. However a study by Yano *et al*. (1997) suggests that horizontal and vertical movement of migrating chum salmon (*Oncorhynchus keta*) in an artificial magnetic field (of two orders of magnitude greater than the earth's geomagnetic field) was no different to their normal range of movements in the absence of the artificial field.

Caution should be exercised when extrapolating the results of such studies to the proposed wind farm Demonstrator Project. These studies are usually carried out under controlled, laboratory conditions (with the exception of Yano *et al*.'s 1997 study), that are not representative of those that pertain in the natural world. In addition, knowing that an organism has the ability to detect magnetic fields does not enable accurate prediction as to the effects of those fields on that organism's behaviour or physiology.

Patterns of migration indicated by tagging studies around the Scottish coast (Dunkley, 1985) suggest that Atlantic salmon make landfalls at many different parts of the coast and then redistribute themselves. Other studies such as those by Smith *et al*. (1995) and Dittman and Quinn (1996) highlight the importance of environmental factors such as salinity and temperature, as well as the olfactory sense of salmon, in the return

of migrating salmon to their native rivers. The degree to which salmon rely on electrical and magnetic fields compared to degree to which they rely on such olfactory and physical stimuli is not yet known.

Several other major wind farm developments have been planned, or indeed are under construction, in the UK. From a review of the environmental statements produced for these developments, it would appear that there is a general consensus that the electromagnetic fields likely to be present around a wind farm development will not have a significant environmental impact.

1.12.3 POTENTIAL MITIGATION MEASURES

There are no specific additional mitigation measures that will be taken by the project. The electrical cables are one component of the umbilical, and they are sheathed and armoured. This will shield organisms from the electrical field, but not from the induced electrical field arising from the magnetic field.

The umbilicals will be buried, so that they do not interact with bottom-towed fishing gear, and this will also reduce the magnitude of the induced electrical fields to which marine organisms on the surface of the seabed will be exposed. Burial will also mean that demersal species of fish will not come into such intimate contact with the umbilicals, and thus will be exposed to induced electrical fields of a lower magnitude.

1.13 OVERALL EFFECTS OF THE PROPOSED DEMONSTRATOR PROJECT ON NATURA 2000 SITES

1.13.1 POTENTIAL FOR THE DEMONSTRATOR PROJECT TO AFFECT NATURA 2000 SITES

The Demonstrator site does not lie within any site of conservation interest; the nearest such site is the Berriedale Cliffs, about 25km away from WTG 1. However, Talisman is fully aware of the high conservation importance of parts of the Moray Firth, and many coastal sites around its shores. Talisman also appreciates that marine mammals and birds which may be qualifying interests of such sites are not confined to those sites, but, to a greater or lesser extent, use other parts of the Moray Firth. It is therefore possible that the proposed Demonstrator Project could have an effect on those species.

1.13.2 IMPORTANCE OF NATURA 2000 SITES

To comply with the Habitats Directive, Member States must ensure that within Natura sites (Special Protection Areas (SPA) and Special Areas of Conservation (SAC)) appropriate steps are taken to avoid deterioration of habitats, and habitats of species, as well as significant disturbance of species. As part of this process, new plans and projects require to be assessed with respect to a Natura site's conservation objectives, to determine if it might adversely affect the integrity of the site.

The consideration as to whether a proposed project or development may affect a Natura 2000 site has two important stages. The first is an appraisal as to whether the proposal is "likely to have a significant effect on the site", and the second is a consideration as to whether the proposal will adversely affect the integrity of the site. Guidance notes (SNH, 2000) define a likely significant effect as "any effect that may reasonably be predicted as a consequence of a proposal that may affect the qualifying interests, but excluding trivial or inconsequential effects". This test of significance is a coarse filter intended to identify which proposed plans and projects require further assessment, and it is distinct from the subsequent appropriate assessment of adverse effects on the integrity of a site. Guidance notes stress that the importance of the international conservation interest of the site should be at the forefront of decision-making.

1.13.3 TALISMAN'S ASSESSMENT OF POTENTIAL EFFECTS ON NATURA 2000 SITES

In Talisman's view, the environmental assessment indicated that some of the activities associated with the installation and operation of the WTGs at the Demonstrator site might affect some of the qualifying features of SACs and SPAs in the Moray Firth, and thus their integrity. In terms of Natura 2000 sites, therefore, the proposed Demonstrator Project is "likely to have a significant effect" on one or more of these sites.

Talisman has therefore considered whether the proposed project might affect the conservation objectives of any of these sites, using the information and assessments presented in other parts of the ES. The conservation objectives of a site are defined as "the reasons for which the site was classified", and the integrity of a site is "the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified" (SE Circular 6/95, as amended). The integrity of the site only applies to the qualifying features, and is directly linked to the conservation objectives for the site. If the conservation objectives are met, then the integrity of the site will be maintained, and deterioration of habitat or habitat of species or significant disturbance of species avoided (SNH Guidance document, 2000).

From the above guidance it is clear that if the conservation objectives for which a Natura site was classified can be met, then the integrity of the site will not be adversely affected. Talisman has therefore undertaken a review of the conservation objectives of each of the Natura sites in the Moray Firth that could reasonably be expected to be potentially exposed to adverse effects from the Demonstrator Project, in order to determine if the integrity of any site might be affected.

SNH Guidance (2000) offers checklists with which to consider potential impacts on the integrity of a site, and these are summarised in Table 1.3.

Table 1.3 Checklist of elements for construction of conservation objectives and consideration of impact upon integrity (SNH, 200).

Annex I Habitats Conservation Objectives: To avoid deterioration of the qualifying habitat(s) thus ensuring the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features.

To ensure for the qualifying habitat(s) that the following are maintained in the long term:

- *extent of the habitat on site*
- *distribution of the habitat within the site*
- *structure and function of the habitat*
- *processes supporting the habitat*
- *distribution of typical species of the habitat*
- *viability of typical species as components of the habitat*
- *no significant disturbance of typical species of the habitat*

Annex II Species Conservation Objectives: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving FCS for each of the qualifying features.

To ensure for the qualifying species that the following are maintained in the long term:

- *population of the species (including range of genetic types where relevant) as a viable component of the site*
- *distribution of species within site*
- *distribution and extent of habitats supporting the species*
- *structure, function and supporting process of habitats supporting the species*
- *no significant disturbance of species distribution and viability of species' host species (where relevant)*
- *structure, function and supporting processes of habitats supporting the species host species (where relevant)*

Bird Species Conservation Objectives: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained.

To ensure for the qualifying species that the following are maintained in the long term:

- *population of the species as a viable component of the site*
- *distribution of the species within the site*
- *distribution and extent of habitats supporting the species*
- *structure, function and supporting process of habitats supporting the species*
- *no significant disturbance of the species*

1.13.4 OVERVIEW OF RESULTS OF THE ASSESSMENT OF EFFECTS ON NATURA 2000 SITES

The potential effects of the Demonstrator Project on the qualifying features of SACs and SPAs in the Moray Firth were assessed in light of this guidance. For each SPA and SAC, a separate table was prepared giving details of:

- *the site's conservation objectives*
- *each of the primary qualifying interests (species or habitats)*
- *other qualifying interests*
- *a summary of the potential effects of the Demonstrator Project on those interests*
- *a review of the main mitigation measures that would be enacted by Talisman*
- *a conclusion as to whether the qualifying interest(s) of the site would be affected by the proposed development.*

The conclusion regarding potential effects was derived by completing an assessment of the relevant checklist (Table 1.3), using the qualitative and quantitative information on predicted specific effects contained in the body of the ES. In total 16 tables were completed.

On the basis of the quantitative assessments of potential impact made in the environmental statement, and bearing in mind the range of mitigation measures that will be enacted by Talisman, Talisman has concluded that the installation and operation of the propose WTGs at the Demonstrator site in the Beatrice field will not affect the viability or integrity of any SAC or SPA in the Moray Firth.