

East Neuk Cross-Community Renewable Energy Feasibility Report

Version: Final

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EXECUTIVE SUMMARY

This report presents the findings of a study into the feasibility of a community wind energy development within the East Neuk in which several community trusts could invest in and benefit from. The key findings are as follows:

- The FIT banding favours wind turbine projects of 500kW, 1.5MW and 5MW generation capacity. The site search therefore focused on areas which could potentially accommodate a 500kW turbine, a 1.5MW development of 1 to 3 turbines and opportunities for community investment in other planned wind turbine developments in the East Neuk.
- The current MOD height constraints restricted the area of search largely to the Anstruther, Carnbee & Arncroach and Crail community councils
- A potential site suitable for a 500kW development was identified at Cornceres farm to the east of Kilrenny. An alternative site on the same farm which could potentially support a 1.5MW development was identified but the wind resource is likely to be lower due to the more sheltered location. A detailed site survey was carried out on the priority 500kW site.
- The estimated cost of installing a 500kW turbine is in the region of £1,115,000. Assuming a capacity factor of 25% the turbine would provide a net annual income of £211,000 and pay back in 5.3 years, providing a return of 21.2%.
- There may be potential for community investment in the 2 x 225kW development at North Baldutho, however, the scale of this development means that this may be limited to one community trust.
- There may also be scope for an additional community turbine at the planned development at Bonerbo, Balmonth and Drumrack farms. The viability of this will depend on establishing grid connection costs and the sensitivity of this to an increase in capacity to accommodate a fourth turbine. Clarity is also needed on the applicable FIT tariff code for this development.
- The financial viability of any project will require an accurate determination of the wind resource through on-site anemometry (ideally at 50m above ground level and for a period of 12 months) and an assessment of the grid capacity and connection costs. Bird survey work is also likely to be a requirement.
- It is recommended that an application is made for the CARES loan scheme to fund the pre-planning consent work required to develop the project further.

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1 INTRODUCTION

A number of Community Councils within the East Neuk of Fife have commissioned studies to investigate the feasibility of a renewable energy development within their community council to provide an income stream to help support various community-based projects and services. These have shown that a medium-sized wind turbine of around 225 to 250kW and under 50m height could offer a viable option for each. Total project costs are estimated at around £600,000 with up to 20% of this attributable to grid connection.

Concerns surrounding the ability of each community to independently raise the required capital and project manage the development have prompted a subsequent study into the feasibility of a larger, *cross-community* wind development whereby the capital costs, administrative burden and income are shared across several communities within the East Neuk. In addition to spreading the risk and returns there may be economies of scale advantages to this approach. This report presents the results of this work.

This study was funded by Community Energy Scotland and has been produced for Martin Dibbley of the Royal Burgh of Killrenny, Anstruther and Cellardyke Community Council who is managing the contract on behalf of the other East Neuk communities.

2 METHODOLOGY

The area of search for this study is as defined by the boundary of *Ward 20 - East Neuk and Landward* which can be found on the Fife Council website.¹ The study involved an initial desk-based investigation to assess the key constraints and to identify potential sites and installation capacities. For each identified site the relevant landowner and community council were contacted to discuss the potential for a community wind turbine development. A detailed site assessment was carried out where both parties expressed a willingness to investigate this further.

3 FEED-IN TARIFF

On 1st April 2010 the Government implemented legislation for a Feed-in Tariff (FIT) scheme to incentivise small-scale renewable generation developments of up to a maximum limit of 5MW generation capacity.² This complements the Renewables Obligation which is the primary mechanism to incentivise large-scale renewable electricity generation. The FIT scheme is regulated by the Office of the Gas and Electricity Markets (Ofgem).³

3.1 Tariff levels

The FIT sets a *generation tariff* which varies depending on the type of renewable technology and the rated capacity of the installation. An additional *export tariff* is paid for each unit of electricity exported to the national grid. Participants can opt for a guaranteed 3.1p/kWh export tariff or negotiate a price through a Power Purchase Agreement with a supplier. The FIT for wind generation installations of various sizes as at 1st April 2011 is shown in the table below. The FIT is adjusted annually for inflation based on the Retail Price Index (RPI) measure. As such the current FIT levels for Year 2 of the scheme are a result of a 4.8% increase on the Year 1 level.

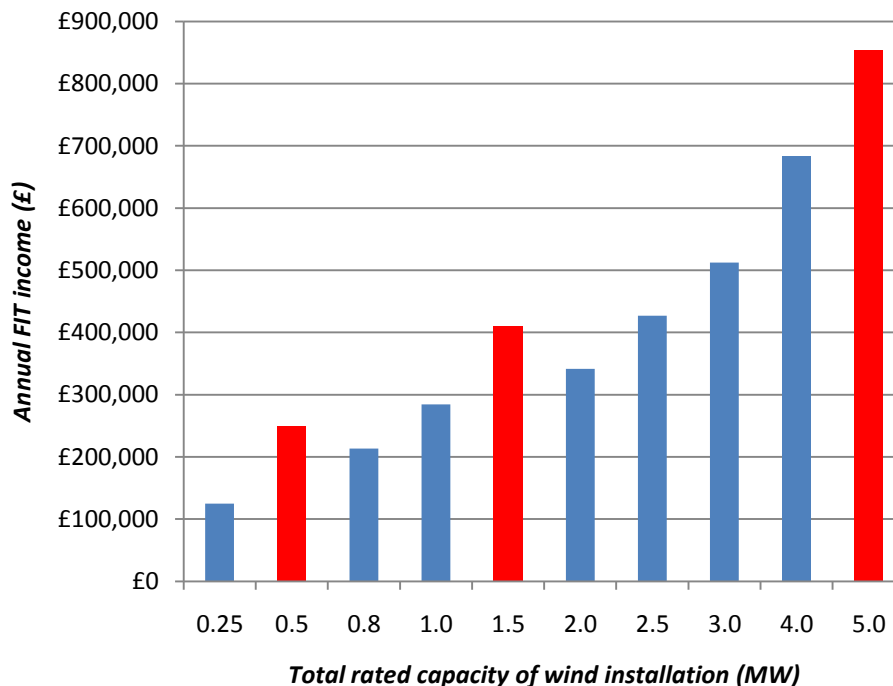
Wind capacity	Generation (p/kWh)	Export (p/kWh)	Total (p/kWh)
>100kW-500kW	19.7	3.1	22.8
>500kW-1.5MW	9.9	3.1	13.0
>1.5MW-5MW	4.7	3.1	7.8

*FIT levels for selected wind generation capacities
(FIT Year 2, 1st April 2011-31st March 2012)*

3.2 Effect of tariff banding on project economics

The approximate 50% reduction of the FIT generation tariff across each band has a significant impact on the optimal installation size for a project. The chart below shows the theoretical annual FIT income for various sizes of wind developments from 250kW to 5MW based on the Year 2 FIT levels assuming a 3.1p/kWh export tariff and a capacity factor of 25%.

The capacity factor is the ratio of the actual annual energy generated over a period of a year (or other fixed time period) to the theoretical maximum energy which could be generated; i.e. if the plant continuously operated at its maximum rated capacity throughout the year. The most successful onshore wind installations typically have capacity factors of 30 to 35%.



The chart shows that doubling the generation capacity from 0.5MW to 1MW results in only a 14% increase in annual FIT income. The project capital and grid connection costs will have a significant impact on the overall project economics (the cost per installed kW of generating capacity tends to fall with increasing turbine size and larger turbines tend to have improved capacity factors due to the increased height and rotor swept area); however, the effect of the FIT banding clearly favours developments of 0.5MW, 1.5MW and around 4-5MW.

3.3 FIT accreditation

Owners of eligible renewable generation technologies between 50kW and 5MW total generating capacity wishing to receive FITs must apply to have the installation accredited as per the Renewables Obligation Order “ROO-FIT” process. This process is managed via Ofgem’s online Renewable & CHP Register which is Ofgem’s central repository for administering the FIT.⁴ Ofgem applies the same criteria and rules for determining accreditation under ROO-FIT as it does for accreditation under the Renewables Obligation Order.⁵

Installations which gain ROO-FIT accreditation receive a ROO-FIT number by Ofgem and in order to complete the process and receive FIT payment, the installation owner or nominated agent must contact and nominate a licensed FIT supplier. The major electricity suppliers with >50,000 domestic customers are mandatory FIT licensees obliged to supply FITs.⁶

3.4 Multi-turbine installations and the treatment of ‘sites’

Ofgem determines how multi-turbine installations are treated in terms of the applicable tariff level (referred to as the tariff code) through the ROO-FIT accreditation process. This is significant for considering joint venture developments e.g. where a community trust invests in a single turbine which is part of a larger, multi-turbine development.

The FIT legislation makes a distinction between *Sites* and *Accredited FIT Installations*. According to the FIT Order “the Authority [Ofgem] must determine the site of an accredited FIT installation in accordance with the definition of “site” in Schedule A to Standard Licence Condition 33.” The latter defines a site as “the premises to which are attached one or more Accredited FIT Installations or Eligible Installations in close geographical proximity to each other, to be determined as required by the Authority by reference to: (a) the relevant Meter Point Administration Number for electricity supply; (b) street address; (c) OS grid reference; and any other factors which the Authority at its discretion views as relevant.”⁷

Ofgem’s ROO-FIT guidance document states that “a domestic or non domestic postal address will normally be viewed as a single site for the purpose of the FIT scheme. In areas where no postal address exist, the OS grid reference will be taken from the position of the import and/or export meters, and the area served by the meters will normally be viewed as a single site... Multiple installations of the same technology type on a site will be viewed as one combined installation regardless of whether any particular part of the installation is an eligible installation under FITs or not, or if they have different owners... The combined installation capacity is considered when determining tariff codes.”

For multi-turbine installations in locations which are not attached to premises or import meters, the criteria for determining whether the turbines are treated as part of the same or separate sites appears to be the export metering, the OS grid reference and any other factors which Ofgem deems relevant, but not the ownership of the individual turbines.

At present there is no specific ROO-FIT guidance on multi-turbine wind installations e.g. providing details or case studies on how the metering and OS grid references would be used to determine the extent of a site. Based on the available information, if a community trust was to invest in a turbine which was part of a larger development utilising a common grid connection infrastructure in the same geographical area then it is likely

this would be treated as a single site with a FIT code based on the total installed capacity, regardless of the fact that the turbines have different owners.

3.5 Increasing capacity at existing sites

The FIT Order makes specific provision for *extensions* to accredited FIT installations. An extension is defined as an increase in the generation capacity at a site. This is best explained through an example whereby a generator extends a single wind turbine site of 500kW by adding a second 500kW turbine:

- If the second turbine is commissioned *before* the first anniversary of the commissioning of the original turbine then the two turbines are treated as one accredited installation and the tariff code for the whole site is re-allocated based on the total installed capacity which is 1MW, therefore receives 9.9p/kWh
- If the second turbine is commissioned *after* the first anniversary of the commissioning of the original turbine then the second turbine is treated as a separate FIT-accredited installation. The generation tariff received by the first turbine remains at the level for a 500kW installation (19.7p/kWh) but the second turbine receives a tariff based on the 1MW total capacity at the site (9.9p/kWh).

3.6 Government review of the FIT

As it currently stands the FIT scheme will continue for new installations until 2020 and will be paid for the lifetime of the FIT period i.e. up to 20 years for wind installations. However, in November 2010 the Government announced it would review the FIT scheme to deliver £40 million of savings by 2014-15.⁸ To this end a fast track review of solar PV and anaerobic digestion (AD) generation tariffs was announced in February 2011 with the aim of substantially reducing tariff levels for PV installations >50kW and increasing support for AD. These tariff changes are likely to be effective from July 2011.

A broader *comprehensive review* of the FIT scheme will be completed by the end of 2011. This will consider all aspects of the scheme including tariff levels, eligible technologies, accreditation, etc. The accompanying announcement states that “tariffs will remain unchanged until April 2012 (unless the review reveals a need for greater urgency)... any changes to generation tariffs implemented as a result of the review will only affect new entrants into the FITs scheme. Installations which are already accredited for FITs at the time will not be affected.”⁹

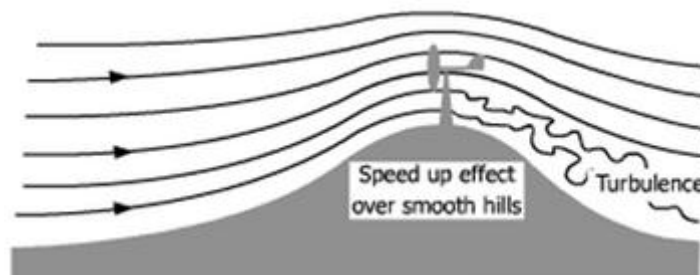
4 WIND SPEEDS

The key to a successful wind energy development is the availability of sufficient wind resource over terrain free of topographic features and obstacles such as buildings and trees which shelter the site from the prevailing wind and could generate turbulence. The minimum annual mean wind speed required for an economically viable development is typically taken at around 6 to 7m/s at the turbine hub height. Appendix 1 shows the estimated annual mean wind speed for each 1km square within the East Neuk at 45m above ground level (AGL) using the dataset from The Department of Energy and Climate Change (DECC) Wind Speed Database.¹⁰

The DECC database uses a computational air flow model and Met Office weather station historical data to calculate a mean value for each grid square. The model makes no allowance for local wind effects of the sea, mountains and valleys; or small scale topographic and local surface roughness features such as buildings or

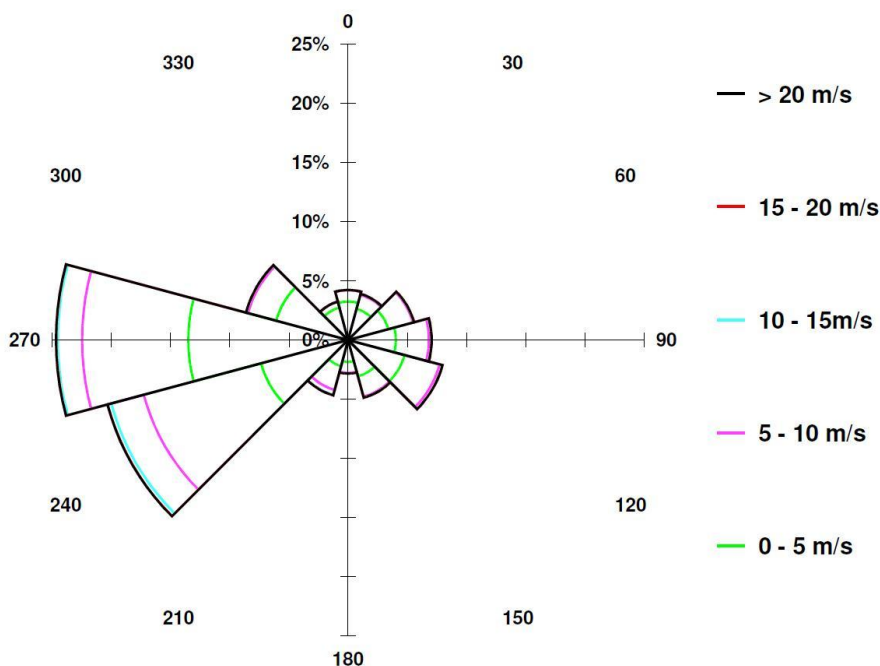
trees; all of which can have a significant impact on the actual wind speed experienced at a particular site. As such the DECC data provides a useful starting point for site selection but is no substitute for on-site anemometry.

Appendix 1 shows that the estimated annual mean wind speeds range from 6.5m/s to 9.4m/s with the greatest resource found across the “spine” of the East Neuk from New Glisten and Largoward in the west approximately following the route along the B940 to Crail in the east. Wind speeds tend to increase with increasing height above sea level. The topographic map in appendix 2 confirms this, showing that the areas of highest mean wind speed approximately correlate to the areas of highest elevation. Wind speeds are typically higher on the windward side of hills due to the “speed-up” effect and lower on the leeward side as this tends to be more sheltered as shown in the schematic diagram below.



Speed-up effect on windward side of hills
(source: adapted from RenewableUK¹¹)

10-year average wind speed frequency data at 10m AGL was purchased from the Meteorological Office for Leuchars weather station to provide an indication of the prevailing wind directions. This data is summarised in the wind rose diagram below which shows that the prevailing winds are from the W and WSW directions. It is likely that the wind directions experienced over much of the East Neuk will be similar to this.



10 year average wind rose for Leuchars weather station (source: Met Office)

5 PLANNING POLICY AND GUIDANCE

5.1 Fife Structure Plan and wind turbine policy

Fife Council has implemented the national Scottish Planning Policy (SPP)¹² through *The Fife Structure Plan* and a number of *Local Plans*. The *Structure Plan* sets out a strategy on how Fife should develop until 2026 and includes a specific policy on wind turbine development (Policy R1: Wind Turbines) which “provides a range of criteria against which all future wind farm applications will be considered.”¹³ It sets out the requirement for Local Plans to include Areas of Search “where proposals for large and small scale wind farm development will be supported subject to specific proposals satisfactorily addressing all other material considerations.”

The focus of the policy is wind farms of over 20MW; however, it also states that “individual turbine proposals will be considered in relation to the issues in policy R1 and the Fife Landscape Character Assessment. The extent to which the considerations in the spatial framework will be relevant to proposals below 20 megawatts will be dependent on the scale of the proposal, its design, location and the landscape.”

5.2 St Andrews and East Fife Local Plan

At present there are ten Local Plans for Fife but Fife Council is in the process of reducing these to three. The consultation period on the St Andrews and East Fife Local Plan which includes the East Neuk area has been completed and the council aims to have this approved by the Scottish Government by late 2011.

In accordance to policy R1, the local plan contains an Area of Search map which indicates areas which could accommodate single turbines of various heights (*low*, *medium* and *high*) and *small extent* developments of 1 to 5 medium turbines.¹⁴ These have been selected “based on an assessment of the capacity of the Fife landscape to accommodate [wind turbines]” and are based on a landscape assessment study commissioned by the council. A composite of the Areas of Search map is reproduced in appendix 3. The table below shows the corresponding turbine heights for the three categories of turbine. Indicative generation capacities for each are provided based on currently available turbines.

Category	Tip height (m)	Indicative wind capacity (MW)
Low	0-50	≤0.25
Medium	50-100	0.25 to 1.5
High	100-150	1.2 to 3.0

Fife Council Area of Search categories and indicative electrical capacities

The Area of Search map may be summarised as follows:

- No areas within the East Neuk have been identified as having capacity to accommodate wind farms of 20MW or more
- Developments of 1 to 5, 100m high turbines could be accommodated in the west of the East Neuk including parts of Carnbee & Arncroach, Colinsburgh and Largoward community councils

- Single turbine developments of up to 100m could be accommodated in parts of Carnbee & Arncroach and inland areas of Anstruther, Crail, Kingsbarns and Pittenweem
- Parts of Cameron and Boarhills & Dunino community councils could accommodate single 150m high turbines
- Two “corridors” which follow the Kinaldy Burn/Kenly Water and Kilduncan Burn could only accommodate single turbines of up to 50m

Areas which are not shaded predominantly along the coast are deemed outside the Area of Search. However, according to policy R1 this does not necessarily preclude wind turbine developments in these areas: “outside the areas of search, wind farm proposals will be assessed against the following constraints, any positive or adverse effects on them and how the latter can be overcome or minimised:

1. Historic environment
2. Areas designated for their regional and local natural heritage value
3. Tourism and recreational interests
4. Communities
5. Buffer zones
6. Aviation and defence interests
7. Broadcasting installations”

5.3 Supplementary guidance

Fife Council has produced a Supplementary Planning Guidance (SPG) document which sets out detailed information on the council’s approach to wind generation developments to supplement the local plans.¹⁵ The guide makes specific reference to community wind projects, defined as “a community led development for the erection of a single turbine or small turbine cluster which will provide a source of energy and potential income source serving that community. This also covers where a community has a significant interest in a larger wind development with commercial or public interest. This will allow communities to choose to support wind developments where they could benefit and allow Fife Council to work with communities where there is a shared benefit. Projects promoted and led by private sector or other commercial interests will not be considered as community projects.”

5.4 Landscape character assessment

The SPG advises that “across Fife there are several areas which have been designated at the Regional level as having particular landscape importance. These have been identified primarily for a combination of their recreational opportunities and their scenic quality. The Areas of Great Landscape Value are being replaced by a series of Special Landscape Areas (SLAs).” This follows a review of the Areas of Great Landscape Value (AGLV) designations in 2008.¹⁶ The map in appendix 4 shows both the AGLVs and candidate SLAs. Note that the SLAs generally correspond to the areas outwith the Area of Search for wind turbines in appendix 3.

The Local Plan states that “development proposed within a SLA or outwith the boundary but which may impact on the designated area, will only be permitted where it has no significant adverse effect on the identified landscape qualities of the area and/or its overall landscape integrity and setting. Proposals must demonstrate, through form, scale, layout, detailing, siting, design, materials and landscaping, how the development will contribute to the preservation, restoration, or enhancement of the SLA and its associated landscape qualities.”

5.5 Buffer zones

The SPG states that for wind farms “a separation distance of up to 2km between areas of search and the edge of cities, towns and villages is recommended to guide developments to the most appropriate sites and to reduce visual impact, but decisions on individual developments should take into account specific local circumstances and geography. Development plans should recognise that the existence of these constraints on wind farm development does not impose a blanket restriction on development, and should be clear on the extent of constraints and the factors that should be satisfactorily addressed to enable development to take place. Planning authorities should not impose additional zones of protection around areas designated for their landscape or natural heritage value.”

As there are no areas within the East Neuk which can incorporate wind farms (i.e. of 20MW plus) the issue of buffer zones as defined in the SPG is not applicable here. There appears to be no specific guidance on the recommended buffer zones for wind turbines to the nearest domestic dwellings. Following discussions with the community council it was decided that the initial site search for a cross-community wind development would incorporate 2km and 500m buffer zones around settlements and detached dwellings respectively.

5.6 Cumulative impacts

The SPG states that “developers will be expected to demonstrate to the satisfaction of Fife Council that any proposals will not result in unacceptable impacts on landscape and visual amenity resulting from cumulative impact. New proposals will be tested against existing and proposed developments to assess cumulative impacts. Cumulative impact is complex and variable, however the use of OS data for geographic analysis, ZVIs and photomontage linked to analysis can assist in the overall analysis and for drawing conclusions.” The SPG refers to guidelines produced by Scottish Natural Heritage (SNH) as a means to assist in assessing the cumulative impact of individual applications.¹⁷

5.7 Other East Neuk wind developments

Based on the information available from the Fife Planning Application online system it appears there are 6 wind turbine developments at various stages of the planning process located in the East Neuk area (this excludes micro-wind turbines of 15kW and below). Note that the 750kW, 81m high turbine in the Fife Energy Park, Methil is outside of the East Neuk boundary.

Appendix 5 shows the location of proposed wind developments currently being considered in the planning system along with the 2km and 500m buffer zones around settlements and dwellings respectively. Details of the planned sites are given in the accompanying table.

6 KEY CONSTRAINTS

6.1 Aviation

According to the RenewableUK, the trade and professional body for the UK wind and marine renewable energy industries, “half of all wind farm developments in the UK will face objections from aviation stakeholders on the grounds of radar interference, obstruction or impact to low flying.”¹⁸ The DECC website provides a consolidated list of Aviation Safeguarding Maps produced by the major aviation stakeholders including the Ministry of Defence (MOD), Civil Aviation Authority (CAA) and National Air Traffic Services (NATS).¹⁹

Ministry of Defence

The MOD will object to any planning application which could potentially disrupt their operations and they advise “it is best practice for developers and local planning authorities to consult the MOD if a proposed turbine is 11 metres to blade tip or taller, or has a rotor diameter of two metres or more.”²⁰ The proximity of RAF Leuchars means that MOD constraints are a significant issue for wind developments in the East Neuk. The main constraints are from MOD air bases, air traffic control, air defence radar systems, weather radar and low fly zones.

Appendix 6 shows the MOD air traffic control and air defence radar coverage map, indicating the areas where turbines of various heights would impinge on the line-of-sight of the MOD radar, thus potentially present operational issues to the MOD. Due to the topography of the East Neuk, this theoretically rules out much of the north half of the East Neuk for turbines over 60m in height. Turbines of 100m height could potentially be erected in the area south of an imaginary line drawn from Crail due west to New Gilston.

The MOD Met Office weather radar site map shows that the East Neuk is outwith any areas of concern;²¹ and the low fly zone map shows the East Neuk is in *a low priority military low flying area less likely to raise concerns*.²²

An objection from the MOD to a wind turbine development does not necessarily mean a project will be automatically rejected by the planning authority; however, it is likely to complicate the process significantly, causing delays. For this reason it is recommended that only sites and turbine heights which comply with the MOD radar restrictions are considered.

Note that the Area of Search map defined in the St Andrews and East Fife Local Plan and supplementary guidance appears at odds with the MOD constraints e.g. it states that single turbines of up to 150m could be accommodated in parts Cameron and Boarhills & Dunino which would not be acceptable to the MOD. This is because the former considers only the capacity of the landscape to accommodate turbines and does not factor in other constraints such as aviation and radar.

Civil Aviation Authority

Airports require specific zones to be free of obstacles above certain heights and radar or navigational aids to be unimpeded. None of the CAA consultation zones for nearest airports to East Neuk impinge on the East Neuk boundary: Edinburgh (zone radius of 30km), Dundee (17km radius) and Glenrothes (5km radius). The Dundee consultation zone passes within one kilometre of the East Neuk boundary just outside St Andrews.²³

National Air Traffic Service

Radar signals reflected from wind turbine blades can potentially affect radar systems operated by NATS. NATS have a separate business arm NATS En-Route Plc (NERL) which provides pre-planning services for developments which may impact on NATS infrastructure and operations and a range of self assessment maps indicating zones where wind developments would require a detailed technical assessment.

The consultation zones are 10km for the air-ground-air communication stations and navigation aids and 15 nautical miles (nm) for the secondary surveillance radar. Line-of-sight zone maps for primary surveillance radars corresponding to turbines with tip heights from 20m to 200m are also provided.²⁴ A review of these maps has shown that the East Neuk is outwith all applicable consultation zones.

6.2 Grid connection

Connection to the electricity grid is a major constraint for wind energy developments and the cost of connection can be significant e.g. around 20% of the total project costs. The costs are related to the cabling required from the turbine to the local network connection point which is proportional to the distance involved (and dependent on the price of copper). Switchgear and a transformer are also required, the latter to step up the voltage from turbine alternator voltage (typically 415V or 690V) to the local grid voltage (11kV or 33kV).

The East Neuk is supplied with electricity via 33kV overhead distribution lines from the transmission network to primary substations at Anstruther and St Andrews. An extensive network of 11kV overhead lines distributes electricity to consumers across the East Neuk from these substations. The main issue in terms of wind developments is less likely to be the proximity of a given site to the nearest 11kV overhead line, rather the *embedded generation* capacity of the grid.

The electricity grid is based on a hierarchical structure with transmission from centralised power stations to distribution networks, primary substations and local supply networks before finally stepping down to mains single (230V) and three-phase (415V) voltage. Introducing variable generation plant embedded in the supply network reverses this approach and can cause disruption to the network voltages and stability which the DNO must maintain within strict parameters.

Initial informal discussions with the DNO indicated that much of the 11kV network across the East Neuk is “weak” with insufficient capacity to accommodate direct connection of a turbine of more than 500kW without grid reinforcement; the cost of which is born by the developer. The capacity to accommodate embedded generation in the 11kV network increases with increasing proximity to the substations. The budget cost of a connection to the 11kV network is £100k to £125k depending on the connection distance.

A 1.5MW embedded generation connection would potentially require new cabling to a part of the 11kV network within 2km of either Anstruther or St Andrews primary substations. A 4-5MW installation would probably require new 11kV cabling direct to one of these primary substations. Approximate costs are £75k for 11kV switchgear at the generator site, and £100k for 11kV switchgear at the primary substation end. The budget cost for 11kV cabling is £150k per km.

6.3 Natural heritage

Scottish Natural Heritage (SNH) is the body responsible for protecting Scotland's natural heritage and is a statutory consultee, acting as adviser to the local authority on the natural heritage implications of planning consents. SNH are responsible for designating environmentally valuable sites with various levels of protection²⁵ and has published detailed guidance and information on onshore wind turbine developments.²⁶ SNH "encourage a Local Planning Authority or the developer of a small scale wind energy project to consult us before submitting a planning application whenever natural heritage issues could be of significant concern." The guidance states that SNH "would normally only wish to be consulted on turbines of greater than 50m."

Fife Council's supplementary planning guidance states that "wind turbine/wind farm developments will not be supported in designated natural heritage protection areas including Ramsar sites, Special Areas of Conservation, Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI) or in locations, advised to Fife Council by Scottish Natural Heritage, which play a supporting role to these designated areas. Large lengths of the Fife Coastline and one inland site are designated Natura 2000 sites and proposals which could affect the qualifying habitats and qualifying species may require to be the subject of an appropriate assessment. An assessment of the effect on qualifying species of Natura 2000 sites in adjacent authority areas will also be required."²⁷

Appendix 7 shows the location of all designated sites within the East Neuk and other non-designated nature areas. A description of each site is given in the accompanying table.

6.4 Historic sites

The Scottish Government National Planning Policy Guideline *NPPG5 Archaeology and Planning*²⁸ sets out the role of the planning system in protecting ancient monuments and archaeological sites. *NPPG 18 Planning and the Historic Environment*²⁹ provides guidance to local authorities on planning decisions where a development may impact listed buildings, conservation areas, world heritage sites, historic gardens, designed landscapes and their settings. Development is regarded as affecting the setting of a site when it can be seen in any principal view either of or from the site.

Historic Scotland is an executive agency of the Scottish Government responsible for "safeguarding the nation's historic environment and promoting its understanding and enjoyment on behalf of Scottish Ministers." Appendix 8 shows the locations of scheduled monuments, listed buildings, conservation areas and gardens and designed landscapes based on a dataset available from Historic Scotland.

Scheduled monuments

A scheduled monument is a "monument of national importance that Scottish Ministers have given legal protection under the Ancient Monuments and Archaeological Areas Act 1979." Historic Scotland must be consulted before any developments are undertaken which could impact scheduled monuments in the area.

Listed buildings

The statutory list of listed buildings is maintained by Historic Scotland. When considering sites for a wind turbine development these "should not restrict or obstruct views of, or from, the listed building or rise above and behind the building so that its silhouette can no longer be seen against the sky from the more familiar viewpoints. Distant views of features and landmarks which may have been exploited in the design of

the building should not be obstructed by new development. Planting which forms part of the original landscape should be retained in order to maintain the integrity of the landscape and to protect the amenity of the main subject of listing.”

Gardens and designed landscapes

There are six designated Gardens and Designed Landscapes in Historic Scotland’s inventory list for the East Neuk area. Inventory status is not a statutory designation, however, the planning policy requires local authorities to consult “Scottish Ministers on development which may affect a historic garden or designed landscape.” All six designated Gardens and Designed Landscapes within the East Neuk are included in the candidate Special Landscape Areas shown in appendix 4.

7 SITE SEARCH PARAMETERS

For the purposes of this study the following constraints were applied to identify potential sites:

- The scale and extent of the development should adhere to the criteria set out in the St Andrews and East Neuk local plan wind turbine Area of Search
- The turbine height should be within the MOD height constraint applicable to the site location
- Where possible the development should be a minimum of 500m from the nearest dwelling, however, sites nearer homes would be considered if the visual impact, noise and shadow flicker effects could be shown to be acceptable
- The site should not be within any environmentally designated areas, scheduled monuments, designated gardens and designed landscapes and gardens

Clearly the extent to which these constraints impact on a project depend on the scale of the development, which in turn depends on the level of investment which the community is willing to take and the desired returns. Given the inherent complexity, three sizing options were selected to provide a focus for the site search. The capacity of these was selected based primarily on the FIT generation tariff bands but also taking into account the grid connect and MOD height constraints.

7.1 Option 1: 500kW

It was assumed that the minimum scale for a cross-community development would be around 500kW. This would take maximum advantage of the 100kW to 500kW generation tariff of 19.7p/kWh, with a potential annual income of £220,000 to £280,000 at 25% and 30% capacity factors respectively. The estimated total project cost for a 500kW development is around £1,100,000. This scale of project could be appropriate for a cross-community development involving two or three community trusts.

There is greatest geographic scope for a 500kW site due to the reduced height constraints and grid capacity requirements. This means that the turbine could be located in areas with the best wind resource i.e. on the higher ground north of Anstruther, potentially without the need for costly grid reinforcement. The priority was therefore to identify potential sites in these areas to maximise the returns. Planning could be further simplified by installing 2 x 250m turbines thereby keeping the turbines under 50m height.

7.2 Option 2: 1.5MW

A 1.5MW development would take maximum advantage of the 9.9p/kWh, 500kW to 1.5MW generation tariff band. This could be achieved with a single turbine of around 100m height to tip or 2 to 3 turbines of 70m to 80m height. Connection costs could be minimised at sites within 2km of the Anstruther sub-station. Sites at a greater distance from the substation may require new cabling to a part of the 11kV network within 2km Anstruther at an estimated cost of £150,000/km. The priority was therefore to identify a site within 2km of Anstruther. A ballpark cost for a 1.5MW development is estimated to be around £2,500,000 depending on grid connection costs. This could potentially generate an annual income of £400,000 to £480,000 at 25% and 30% capacity factors respectively.

7.3 Option 3: joint venture

Due to the lower FIT generation tariff from 1.5MW to 5MW capacity and the requirement for costly grid reinforcement, the economies of scale benefits of an installation above 1.5MW are only likely to be realised for significantly larger installations e.g. of 5MW or more. A project of this scale was judged to be beyond the scope of an independent community development; however, it was decided that the study should also include an investigation of the potential for a community trust to invest in a wind turbine development as part of a joint venture. This could allow the costs of the development to be reduced through economies of scale and sharing of infrastructure cost.

8 SITE SEARCH RESULTS

Appendix 9 shows a composite map of the key constraints impacting on the site search including:

- Area of Search zones for wind turbines as set out by Fife Council
- MOD radar restrictions for turbines of 80m height (approximate height of 500kW turbine)
- 500m buffer zones around domestic dwellings

As the site search was primarily concerned with single turbine developments, the 2km buffer zones around settlements (which apply to wind farm as per the planning guidance) are not included and the 500m domestic dwelling buffer zone is applied. Also shown is the 2km radius from the Anstruther substation which is the approximate limit for a 1.5MW turbine to be installed without the need for grid reinforcement.

The Area of Search and MOD radar constraints limit the search area for potential sites largely to Anstruther, Carnbee & Arncroach and Crail community councils. Separate renewable feasibility studies have already been carried out for each of these communities, identifying potential sites for single 225kW turbines of 45m height for Anstruther and Crail. The potential for a cross-community development in each of these community council areas is discussed below.

8.1 Carnbee & Arncroach

The Carnbee & Arncroach renewables feasibility study concluded that there was insufficient support for an independent community wind turbine development within the community council. This is mainly due to concerns about the number of wind turbine projects already planned within the community council. The

community did however express an interest in either a cross-community development or joint venture e.g. with one of the planned developments within Carnbee & Arncroach or in other community councils.

8.2 Crail

A site for a community wind turbine for Crail was identified near the airfield; however, the viability of this is in doubt due to an objection from Historic Scotland based on the impact on the setting of the airfield which is a scheduled monument. A possible alternative site was identified in the former “communications area” of the airfield. Due to time restrictions this site has not been investigated further as part of this study. The weak grid and MOD restrictions mean that a turbine here is likely to be restricted to 225kW to 250kW.

8.3 Anstruther

The site identified as part of the Anstruther feasibility study is within 2km of the substation. The area is unaffected by the MOD height restrictions and could therefore potentially be up-rated to 500kW or close to 1.5MW. However, subsequent to the completion of the Anstruther report, the landowner at Pitkeirie farm decided he did not wish to have a turbine at this site.

The landowner at Crawhill farm which includes land within 2km of the substation and outside the 500m buffer zones stated he would not support a community wind turbine development in this area unless the community was very keen.

An alternative site was identified at Cornceres Farm to the east of Kilrenny. The landowner, Andrew Peddie, was very keen to have community turbine on his land. The site is discussed in more detail below.

8.4 Joint ventures

The potential for community investment in the various wind turbine developments currently in the planning or pre-planning stage (see appendix 5) was also investigated, firstly through a review of the publicly available planning application records and where appropriate through consultation with the relevant community council and developer.

South Cassingray

According to the supporting documents included in the planning application for this site, the community response to a questionnaire on the development returned 78.5% against therefore the potential for community involvement was not investigated.

North Baldutho

It is understood that the Carnbee & Arncroach Community Trust have discussed the possibility for a community share in the proposed 2 x 225kW North Baldutho Farm development with the landowner, Balcaskie Estate. Due to the elevated and exposed location the wind resource is likely to be very good at this site with capacity factors of 30% or higher achievable. The scope for wider cross-community investment may be limited due to the relatively small scale of the development.

Pittarhie

It is understood that the developer made an initial contact with Cameron community council. At this stage there appears to be some uncertainty over whether a planning application will be made and so the potential for community involvement was not investigated further.

Upper Kenly

Boarhills & Dunino community council object to the proposed development by St Andrews University at Upper Kenly and so the potential for community investment was not investigated further. It is understood that a possible route for investment should the communities wish to take this further would be via an additional community turbine as part of this development which would take advantage of the grid connection infrastructure.

Troywood

The developer stated he would not seek community involvement should the development go ahead.

Bonerbo, Balmonth and Drumrack

The current proposal is for 3 x 330kW turbines in an area where the three farms meet with each farm investing in a turbine and sharing the grid connection infrastructure. The site is likely to have a very good wind resource with 30%-plus capacity factors being achievable. The site also benefits from being relatively secluded due to a line of trees around the perimeter of the fields. There is ample space at the site and the developers indicated that they would be open to discussing the potential for a fourth community turbine with the proviso that this would not delay the installation. It should be noted that the proposed turbine supplier typically requires at least 1 year of wind monitoring to determine the wind regime and site class.

The site is close to 11kV and 33kV overhead lines, however, given the scale of the development and the distance from Anstruther, grid reinforcement may be required. The costs of this and the sensitivity to an increase in embedded generation capacity are a key factor in determining the economic feasibility of the development and community involvement e.g. if the addition of a fourth community turbine does not significantly affect the overall grid connection cost then clearly there would be a mutual benefit in sharing the costs.

How Ofgem assess the development under the ROO-FIT process will also be a key factor in assessing the project economics. It is at the discretion of Ofgem whether they assesses a multi-turbine development as a single accredited FIT installation with generation tariff allocated based on the combined capacity of the turbines or separate installations with tariff codes assigned based on the individual turbine capacity. If the former case prevailed and the four turbines were all 330kW then this would keep the total capacity below the 1.5MW tariff banding limit.

Greater clarity on the financial implications of a community turbine at this site will be required in order to fully assess the viability and the shared benefits. This would require a formal grid connection assessment by the DNO. Confirmation of the treatment of the site in terms of the applicable FIT level could be achieved through seeking provisional ROO-FIT accreditation from Ofgem, however, note that obtaining planning consent for the development is a prerequisite.

9 CORNCERES FARM SITE ASSESSMENT

Two potential sites were identified at Cornceres Farm are indicated in the map in appendix 10 by the green and red dots respectively.

9.1 Primary site: 500kW

The site around 380m to the north east of the farmhouse was assessed as having the better wind resource due to its position on the top of a ridge with good exposure to the prevailing wind. The site is around 340m from the nearest 11kV line which is at the pole-mounted transformer close to the farm house. Connection would be a 'soft dig' across farm fields (i.e. it would not need to cross any roads or hard-standing areas). There is ready access via the farm road and an existing track which runs along the edge of the field to the proposed site area (although this has been unused for some time).

A concern is the proximity to a number of houses along the A917 and the farmhouse itself. The two semi-detached houses and the detached bungalow are owned by Mr Peddie, however, the four red-roofed bungalows are privately owned and these are likely to be closest to the turbine if it is positioned on apex of the ridge. Positioning the turbine to the eastern end of the field on the ridge will put the turbine just over 300m from the houses but will increase the grid connection and access track distance. This would however minimise the turbulent effects of the farm buildings and trees to the west (the direction of the prevailing wind) whilst still benefiting from the maximum wind resource at the top of the ridge.

Because of the proximity to the houses it is suggested that this site would be suitable for a single wind turbine up to 500kW. Positioning the turbine further north would increase the separation from the nearest dwellings but is likely to result in reduced wind resource as this places the turbine on the leeward side of the ridge.

9.2 Alternative site: up to 1.5kW

An alternative site was identified 1km to the north of the farm at a lower elevation and in a more sheltered location with trees to the west and south. It is likely that 400m of new access track would be required and the existing 1km track from the farm would require some upgrading to permit access for the construction plant. The site is in a shallow basin and the drainage is poor which results in parts of the field becoming regularly waterlogged which may be an issue.

The advantage of the site is that it is more remote: Backfields Cottage at the end of the farm track is owned by Mr Peddie. There is scope to position a turbine around 400m from the cottage which would put the next nearest property at Blacklaws 750m away. Although the nearest 11kV connection point is over 700m away, should grid reinforcement be required there is a more direct route across fields to the Anstruther substation.

Because of the relative remoteness and possible ease of grid reinforcement, this site could potentially be suitable for a larger development of up to 1.5MW. However, given that the primary site is likely to have the better wind resource it is recommended the feasibility of developing the primary site is investigated first. The following sections discuss the technical and planning constraints and economics of the primary site.

9.3 Turbine specification

The evaluation of the various constraints detailed below is based on the installation of a single 500kW turbine: the DW54-500 turbine manufactured by EWT has been used as an example but should not be seen as an endorsement of this manufacturer or model. The turbine uses direct drive technology which relies on electronic convertors rather than a gear box to convert the low frequency blade rotation to the high frequency AC power of the grid. Typically direct drive turbines have lower cut-in speeds and reduced noise but the technology and reliability is less well established than the traditional gearbox-based systems. The turbine specification is shown in the table below.

Manufacturer	EWT
Model	DW54-500
Power regulation	Pitch
No. of blades	3
Swept area (m ²)	2,290
Hub height (m)	50
Blade diameter (m)	54
Max height to tip (m)	77
Speed (m/s)	Variable
Cut in wind speed (m/s)	4
Cut out wind speed (m/s)	25
Rated power (kW)	500
Rated speed (m/s)	10

Example 500kW turbine specification

9.4 Access and site considerations

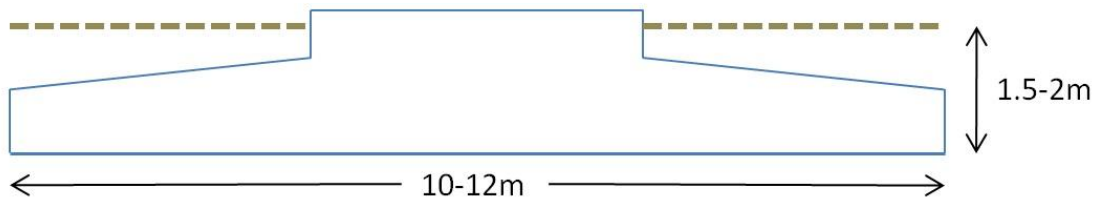
It is likely that the turbine components will be transported by sea from Europe to a UK container port in standard 40 foot shipping containers. Access on the public highway (e.g. via the M90, A92, A915 and A917) is unlikely to present a significant issue but the transportation logistics and access routes should be carefully reviewed and planned once the load sizes and weights are confirmed.

The construction site will be self-contained within the field offset from the road, therefore it is envisaged that there will be no disruption of the access road during the majority of the construction phase. An access road of around 4m width and hard standing construction site surface of around 25 x 25m will be required, suitable for a 120 tonne mobile crane, unloading and turning. These should be maintained throughout the life of the turbine to permit maintenance access.

Some work may be required to bring the farm access road and 300m of track across the field up to the required standard. The depth of sub base material required for the track and hard standing construction area will depend on an assessment of the track and soil conditions. Assuming a base depth of 0.3m for the hard-standing area and minimal upgrading work required on the track it is estimated that around 400m³ of sub base material could be required.

The diagram below shows a schematic of a typical foundation arrangement for a turbine of this size. The required dimensions of the turbine foundation depend on the ground conditions and soil properties which are established through probing. It is likely that excavation of approximately 12m diameter and up to 2m

depth would be required comprising around 120 cubic metres of concrete and 5 to 6 tonnes of reinforced steel bar.



Typical wind turbine foundation dimensions

9.5 Grid connection

The DNO has provided a budget connection cost of £125,000 which includes all civil work, cabling, connections, metering and a transformer substation. The latter accounts for around £75,000 of the total and is required to step up the 415 Volt power produced by the turbine to the 11,000 Volt (11kV) of the grid. The 11kV cable will be laid underground below ploughing depth at 1.5m. It is likely that costs could be reduced through contracting out the “non-contestable” elements of the work to a third party e.g. excavation and back filling of the cable trench.

Connection of the turbine to the grid requires a formal G59 connection agreement with the DNO. To initiate this process a completed G59 application form should be submitted to the DNO who then perform an in-depth network modelling study to determine the size of generation plant which could be accommodated and assess the voltage rise, fault levels and thermal limits. The cost of a connection application is around £7,500 which should be refundable against the cost of the connection installation if it were to go ahead. The DNO operates a first come first serve policy and as there is limited capacity on the network it is recommended the Trust initiate the G59 application process as soon as possible. Once the G59 application has been received a place is reserved in the connection queue.

9.6 Photomontages and zone of theoretical visibility

Appendix 10 provides photomontages taken from four viewpoints as indicated in the accompanying map. The turbine is a generic shape based on the specified tower height and rotor blade lengths. Appendix 11 shows the zone of theoretical visibility (ZVI) for the turbine. Note that this takes no account of surface features such as buildings and trees which may obscure the view of the turbine and hence the area indicated is greater than the actual area. Appendix 12 shows an annotated aerial photograph of the site area.

9.7 Noise

The WindFarm software package was used to model the turbine related noise experienced at the closest dwellings based on a wind speed of 8m/s at 10m agl. The noise contour map in appendix 13 shows the expected noise level is 39db outside the closest dwelling (the furthest east of the Corceres farm cottages). When the wind is from the prevailing direction the nearest cottages will be up-wind of the turbine therefore noise levels will be considerably lower for the majority of the periods when the turbine is operating. The table below provides indicative noise levels for comparison.

Source / Activity	Indicative noise level dB(A)
Threshold of pain	140
Jet aircraft at 250m	105
Pneumatic drill at 7m	95
Truck at 30mph at 100m	65
Busy general office	60
Car at 40mph at 100m	55
Wind farm at 350m	35-45
Quiet bedroom	35
Rural night-time background	20-40
Threshold of hearing	0

Indicative noise levels (Source: The Scottish Government, PAN 45 (revised 2002): Renewable Energy Technologies)

9.8 Shadow flicker

The coatings used on modern turbines are selected to minimise reflection from the blades, however, direct sunlight passing through moving blades can cause a flickering effect. Appendix 14 shows the WindFarm flicker effect model calculation results. The hours of flicker shown are those experienced inside houses where, based on a review of aerial photography available, it appears that the building has a window facing or partially facing the turbine site. The analysis assumes a 1 x 2m window on each wall which faces the turbine.

The results show that the most significant shadow flicker effect will be experienced at the Thirdpart Holdings cottages H5 and H6. These are estimated to experience a maximum of 11.8 hours of shadow flicker a year with a daily average of 13.8 minutes of shadow flicker over a period of 52 days.

9.9 Aviation

The site was selected in part because it was identified as being outside all applicable MOD, CAA and NATS restriction zones. Should the project be taken further it is recommended that the *Aviation Consultation Proforma*, produced in agreement between RenewableUK and the key aviation consultees, is submitted to the relevant parties.³⁰ The response should be included in the planning application to Fife Council.

9.10 Electromagnetic interference

Terrestrial television

Interference with terrestrial television broadcasts can occur if an obstacle is placed in between the transmitter and receiving aerial giving rise 'ghosting' where a pale shadow or shadows appear to the right of the main picture on viewers' television screens. However, digital television signals are much better at coping with signal reflections, and digital television pictures do not suffer from ghosting.

The BBC online wind farm assessment tool provides an estimate of the number of households that might be affected by wind turbines at potential turbine sites.³¹ This does not take into account of turbine size or type or the number of homes which use satellite reception and so is likely to overestimate the numbers affected. The results of the query were as follows:

“You would be likely to affect 77 homes for whom there is no alternative off-air service. In addition, you may affect up to 826 homes for whom there may be an alternative off-air service. The transmitters likely to be affected are: BLACK HILL CH5, ANGUS, DURRIS, BLACK HILL and CRAIGKELLY”

Of these transmitters only Black Hill and Craigkelly have yet to switch to digital and these are due to switch over in June 2011 (according to Digital UK, the independent organisation leading the process of digital TV switchover).³² Given the timescales of the project, all TV transmitters serving the area will have switched to digital prior to the construction of the turbine and therefore interference with reception is unlikely to be an issue.

Reception problems caused by wind turbines must be rectified at the expense of the developer. In the unlikely event that loss of reception quality is experienced, normally these can be rectified by minor alterations to the aerial orientation. If this fails the simplest solution is normally to upgrade to satellite reception for the affected homes.

Mobile telephone network

Mobile phone network operators typically request a minimum separation of 100m plus the turbine blade radius, therefore clearance of 125m will be sufficient. According to the OFCOM Sitefinder database,³³ the nearest mobile communication receivers are over 1.5km away from the site which was verified by a visual inspection. Details of these are provided in the table below.

Operator	T-Mobile	O2	Orange	Airwave	Orange
Site Ref	97369	3548	FIF0036	FFE023F	FIF0035
Station Type	Macrocell	Macrocell	Macrocell	Macrocell	Macrocell
Height of Antenna (m)	15m	13.5m	15m	16.27m	15m
Frequency Range	1800MHz	900MHz	1800MHz	400MHz	1800MHz
Transmitter Power	30 dBW	19.8 dBW	25.9 dBW	21 dBW	25.9 dBW
Type of Transmission	GSM	GSM	GSM	TETRA	GSM
Distance	1.7km	3.2km	3.3km	3.6km	2.8km

Details of the nearest mobile phone transmitter masts to the site (Source: Ofcom)

HM Coastguard

HM Coastguard Fife Ness is located 7km to the east of the site on the tip of the Fife Ness peninsula. The Maritime and Coastguard Agency have been consulted with regards to the potential for interference with their communication systems for turbines at Crail, Anstruther and St Monans and have assessed that these will have no foreseen impact upon MCA radio communications.

Microwave and scanning telemetry links

Microwave links are used for point-to-point communications and require an unobstructed line of sight between receiver and transmitter. Scanning telemetry is used primarily by utility companies to remotely operate and monitor their infrastructure. A survey of the surrounding area identified no microwave or scanning telemetry links in areas which could be impacted by the development.

9.11 Natural heritage

Since the proposed development is for a turbine with a tip height in excess of 50m, SNH would expect to be consulted by Fife Council as part of the planning consent process and they recommend developers consult with SNH prior to applying for planning consent to identify areas of concern and scope out any survey work which they would require in order to make a decision. An initial consultation with SNH identified a requirement to conduct a basic Landscape Visual Impact Assessment and scoping work for a geese survey (see appendix 15).

It should be noted that SNH have objected to two of the planned developments in the East Neuk (see appendix 5) due to insufficient information provided with the planning application regarding the impact on birds and bats.

Landscape Visual Impact Assessment

SNH advised that the “basic LVIA should be undertaken as per our small-scale renewables guidance” would be sufficient for a single turbine of this scale.³⁴ The proposed site is assessed as being in a “Zone 2” or medium sensitivity area according to the SNH impact classification system. The Zone 2 impact assessment should include the following:

- A map showing the zone of theoretical visibility (ZTV) of the turbine out to a 30km radius from site
- Photomontage images taken from key viewpoints
- Representations of other wind turbines in development or operational within a 30km radius of the site to show the potential cumulative visual impact wind farms could have on the area
- A list of all planned and operational wind developments to a radius of 60km from the proposed site
- An assessment of the local landscape to determine whether the size of the proposed turbine would appear out proportion with the scale of other landscape features in the area.

Photomontages and the 30km radius ZTV are included in appendices 10 and 11 respectively. There are currently no operational turbines over 15m height within the East Neuk. Appendix 16 provides a list of all wind turbines which are planned, under construction or operational within a 60km radius. Should the development be taken further then it is recommended that a separate study of the local landscape study is commissioned to determine whether the development is out of proportion with landscape. Guidance on the scope of this study should be sought from SNH prior to proceeding with this.

Geese scoping survey

In addition to the risk of mortality from strikes with the blades, the potential impacts of wind turbines include displacing bird populations, forming a barrier between designated sites for migratory birds and other short term impacts associated with the construction phase of the development. SNH have suggested geese from the Eden Estuary, which is around 17km to the north east of the site, are likely to feed in the fields surrounding the site. They state they will require more information regarding the populations, species and usage in order to scope out a more detailed survey.

According to the BirdTrack bird survey website³⁵ Pink-footed goose, Snow goose, Barnacle goose, Brent goose and Brent goose (light bellied) have been recorded in the 1km grid square containing the site and eight 1km grid squares which surround this since 2008. Confirmation of the typical numbers and feeding areas are likely to be required. Knowledge of this may exist amongst the local community and it is recommended that should the development be taken further, advice is sought from local bird enthusiasts and a dialogue opened up with SNH to assist in the scoping of any required geese surveys. SNH will then advise as to whether they require further survey work to be carried out in order to reach a position on the development.

9.12 Bats

All bat species found in Scotland are classed as European protected species. They are protected under law and it is an offence to disturb or interfere with bat roosts. There are likely to be bats roosting in nearby buildings and there is some potentially insect-rich areas around the perimeter of the fields. It is unlikely that the development will have a significant impact on bats; however, it is recommended that a bat survey is commissioned in the spring or summer months to confirm this.

9.13 Environmental Impact Assessment

An EIA is a detailed assessment of the potential impact of a development on the environment, taking into account all the factors that the development would influence. EIA legislation has been set via EU Directive and is implemented into Scottish law via *The Environmental Impact Assessment (Scotland) Regulations*. A project is required to produce an EIA “where it is likely to have significant environmental effects because of factors such as its nature, size or location.” The EIA legislation classifies various different types of project as either Schedule 1 where an EIA is mandatory or Schedule 2 where an EIA is required only if the project is “likely to generate significant environmental effects.” Wind farm projects are classified as Schedule 2 development and therefore “must be screened to establish if it is likely to have significant environmental effects.”

The Scottish Government planning advice note PAN 45 states that “if the proposed development is located within a 'sensitive area'... or involves the installation of more than 2 turbines; or the hub height of any turbine, or the height of any other structure exceeds 15 metres then the need for EIA must be considered. The likelihood of significant effects will generally depend upon the scale of the development, and its visual impact and other potential impacts. EIA is more likely to be required for commercial developments of 5 or more turbines, or more than 5 MW of new generating capacity.”³⁶

The requirement for an EIA was discussed with Fife Council planning department. It was recommended that should the development be taken further, the appropriate sections from this feasibility report should be used as the basis for a formal EIA screening request.

9.14 Historic environment

Appendix 17 provides a list of the scheduled monuments and designed landscapes which are within the ZVI of the turbine and the nearest A-listed buildings. The setting of the Skeith Stone (the nearest scheduled monument 1.3km away) is unlikely to be affected as the turbine is largely obscured by buildings and trees in Kilrenny village, which lies directly in between the turbine and the monument. The turbine is visible from West Pitcorthie standing stone (the next nearest monument at 1.8km) and the view will be similar to that in

the first photomontage taken from the B9171 at Muiredge. The turbine would not be visible from the Caiplie Caves.

Perhaps the greatest impact on setting will be at the B-listed dovecot remains 600m from the site. The view from this is shown in the second photomontage.

The only grade-A listed building within 1km of the site is Innergellie House which is 840m away. All other listed buildings in Kilrenny are either Grade B or C. This information has been passed to Historic Scotland for assessment and the response will be forwarded once this is available.

10 FINANCIAL AND CO₂ ANALYSIS

This section provides an analysis of the financial feasibility of the 500kW project based on the projected capital and running costs and the expected income.

10.1 VAT assumptions

Capital expenditure for wind turbine installation works currently qualify for the reduced VAT rate of 5% for the FIT income has been assumed to be non-taxable as it is believed that this could be achieved if the trading company 'gift-aids' the income to the community charitable trust. For more information on tax relief for charities see VAT Notice 708/6 Energy-saving materials on the HMRC website.³⁷

10.2 Project costs

The budget installation cost for a EWT 500kW turbine direct from the supplier is €880,000. Based on a EUR:GBP exchange rate of 0.88 is equivalent to £774,400. This price excludes the balance of plant, grid connection and foundation costs. The estimated total project cost including 12 month anemometry hire, planning costs, turbine installation and grid connection is around £1,115,000. A breakdown of the costs is provided in appendix 18. These are indicative and can vary widely depending on the on circumstances. Formal quotations would necessitate a preliminary survey of the site by the supplier.

10.3 Annual running costs

Annual running costs include the rental for the land lease, insurance, maintenance and grid connection/metering costs and are summarised in the table below. Note that quotes were obtained for the insurance however; the remaining elements are based on typical estimates with a nominal £2,000 annual rent for the land lease.

Element	Cost (£)
Insurance	£4,000
Land lease	£2,000
Grid costs	£1,500
Service contract	£20,000
Business rates	£500
Annual running costs	£28,000

Estimated annual operating costs

Turbine manufacturers will typically offer a range of service contract options from a standard fixed price service to a full maintenance and availability warranty contract. The latter is typically priced based on the annual generation of the turbine e.g. 1 to 2p/kWh with a minimum price floor and covers all replacement parts (including main components) and compensation for loss of earnings if the turbine is unavailable for e.g. more than 5% of the year.

10.4 Income and CO₂ abatement

The annual electricity generation has been calculated based on capacity factors of 25% and 30%. Until actual wind speed data has been collated it is recommended that the project proceeds on assumption of a relatively conservative 25% capacity factor. The financial and carbon emissions abatement benefits of the development shown in the table below have been based on the following assumptions:

- An annual inflation rate of 2.5% and a discount rate of 7.5% has been applied to determine the Internal Rate of Return (IRR) and Net Present Value (NPV) of the project
- The carbon emissions abatement calculation is based on the amount of CO₂ emissions which would have otherwise been emitted through consumption of the equivalent amount of electricity on the national grid. The *2010 greenhouse gas conversion factors* published by the Department for Environment, Food and Rural Affairs (DEFRA) has been used. This states a grid average emissions factor of 0.000545tCO₂/kWh grid electricity consumed.³⁸
- The *household equivalent* measure is based on a medium usage household consuming 3,300kWh electricity per year.

Capacity factor	25%	30%
Energy yield (kWh)	1,095,000	1,314,000
Household equivalent	332	398
FIT generation	£205,860	£247,032
FIT export	£32,850	£39,420
Gross annual income	£238,710	£286,452
Net annual income	£210,710	£258,452
Annual emissions abatement (tonnesCO ₂)	597	716
Lifetime emissions abatement (tonnesCO ₂)	11,936	14,323
Abatement cost (£/tonnesCO ₂)	93	78
Simple payback period (years)	5.3	4.3
IRR	21.2%	25.9%
NPV	£1,466,736	£2,039,946

Annual energy yield, income and emissions abatement at 25% and 30% capacity factors

10.5 Financing options

The introduction of the FIT scheme has been accompanied by a move away from providing government grants for renewables projects and therefore it is likely in the current climate that the trust will be required to raise a significant proportion of the funds. With commercial bank lending rates at around 6 to 10%, an IRR

of 21.2% for a 25% capacity factor energy yield would generally be considered attractive. In order to secure a bank loan, a minimum level of capital of around 40% may be required which equates to £445,000. The bank will also need evidence to demonstrate the viability of the project including planning permission, site lease, site wind data, grid connection, insurance, and procurement and maintenance arrangements.

A list of possible sources of grant funding is provided on the Scottish Government Community Renewable Energy Toolkit website.³⁹ The Development Trusts Association Scotland also has information on possible funding sources for community development trusts.⁴⁰

The Scottish Government's Community and Renewable Energy Scheme (CARES) which funded this report currently will provide an unsecured loan of up to £150,000 for "Any renewable energy project, up to 5 MW, requiring financial outlay prior to planning consent". This could therefore be used to cover the cost of wind anemometry, geese surveys and other work necessary to complete the planning consent process.⁴¹ The loan is written off if the project fails to gain planning consent otherwise it is paid off at 10% interest.

11 CONCLUSIONS

The current FIT scheme banding favours wind turbine projects of 500kW, 1.5MW and 5MW generation capacity. A standalone 5MW development was judged to be beyond the scope of a community wind development and so the site search focused on potential sites to accommodate a single 500kW turbine and a 1.5MW development of 1 to 3 turbines. Opportunities for community investment in planned wind turbine developments in the East Neuk were also investigated.

The site search took into account the Area of Search zones for wind turbines set out by Fife Council in the St Andrews and East Fife local plan; MOD radar restrictions and 500m buffer zones around domestic dwellings. The current MOD height constraints restricted the area of search largely to the Anstruther, Carnbee & Arncroach and Crail community councils. Previous renewable feasibility studies for each of these communities showed that Carnbee & Arncroach has the best wind resource but because of the number of planned wind turbines in this area the community currently would not support a separate community wind development. The electricity grid in Crail is weak, particularly in the more remote sites which could be suitable for a wind turbine and so the opportunities for larger scale developments are limited.

Two potential sites were identified at Cornceres Farm which lies to the east of Kilrenny in Anstruther community council. The best site in terms of wind resource is assessed as being on an exposed ridge approximately 300m to the east of the farm to the north of the A917. The potential drawback of the site is the proximity to a number of cottages, the closest of which is around 300m to the preferred site. For this reason it is assessed that this site could support a turbine of up to 500kW only. The shadow flicker and noise impact of the turbine at the closest houses is mitigated by the fact that they are to the south west of the site and so are unaffected by shadow flicker and the noise levels (calculated at 39db at the nearest house) are likely to be minimised as they are upwind of the turbine in prevailing wind.

The alternative site to the north of the farm is more remote and could potentially accommodate 1.5MW of generation capacity, however, the site is more sheltered and judged to have a poorer wind resource. Therefore the first site was assessed as offering the best opportunity for a community wind development.

The potential for community investment in the six planned wind developments identified within the East Neuk area was investigated. Balcaskie Estate have indicated that they would be interested in community involvement in their 2 x 225kW development at North Baldutho farm in Carnbee & Arncroach community council. Given the scale of the development there may only be scope for involvement of one or two community trusts.

There may be scope for an additional community turbine to be incorporated into the planned development at Bonerbo, Balmonth and Drumrack farms, also in Carnbee and Arncroach. The developers indicated that they would be open to discussing community involvement (e.g. a fourth turbine) as long as this did not impact on the project timescales. There is currently significant uncertainty with regards the grid connection costs and how sensitive these are to increasing the generation capacity. There is also some uncertainty regarding the applicable FIT tariff code which Ofgem will apply to the site.

The estimated cost of installing a 500kW turbine is in the region of £1,115,000. This includes pre-installation costs for wind monitoring, bird surveys and planning application processing. Annual operating costs are likely to be around £28,000 including full maintenance and warranty covering loss of earnings in the event of turbine failure. Assuming a capacity factor of 25% the turbine should pay back in 5.3 years, providing a return of 21.2% based on an inflation rate of 2.5%.

The limited availability of grants means that it is likely that a bank loan would be required to cover a significant portion of the development costs. Confirmation of the financial viability will require an accurate determination of the wind resource through on-site anemometry ideally at 50m above ground level and for a period of 12 months.

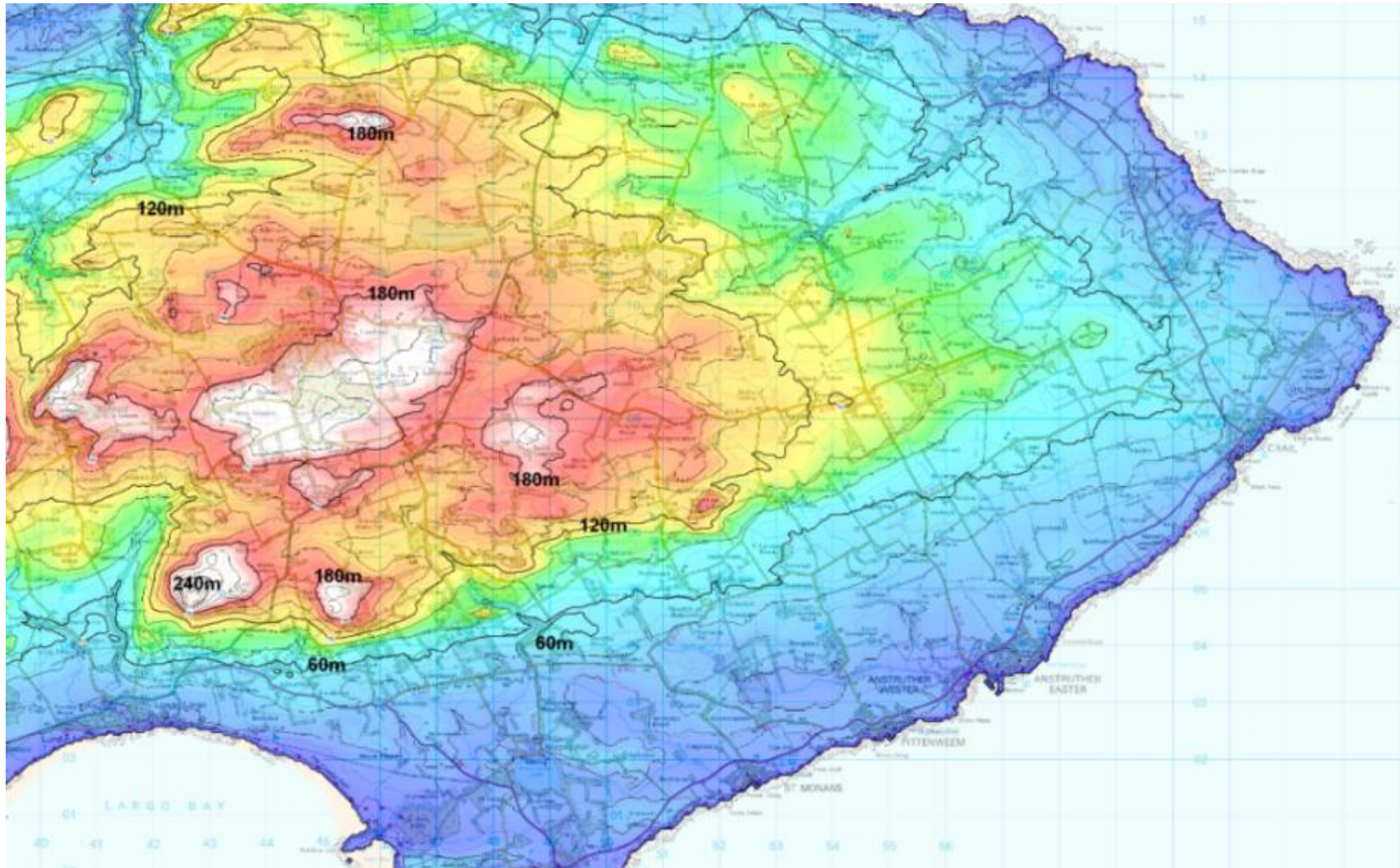
It is recommended that an application is made for the CARES loan scheme to fund the pre-planning consent stage of the project. In addition to funding wind monitoring, this could be used to fund the grid connection assessments at the Cornceres and Balmonth sites and any survey work as required (e.g. geese surveys for SNH).

APPENDIX 1 - WIND SPEEDS



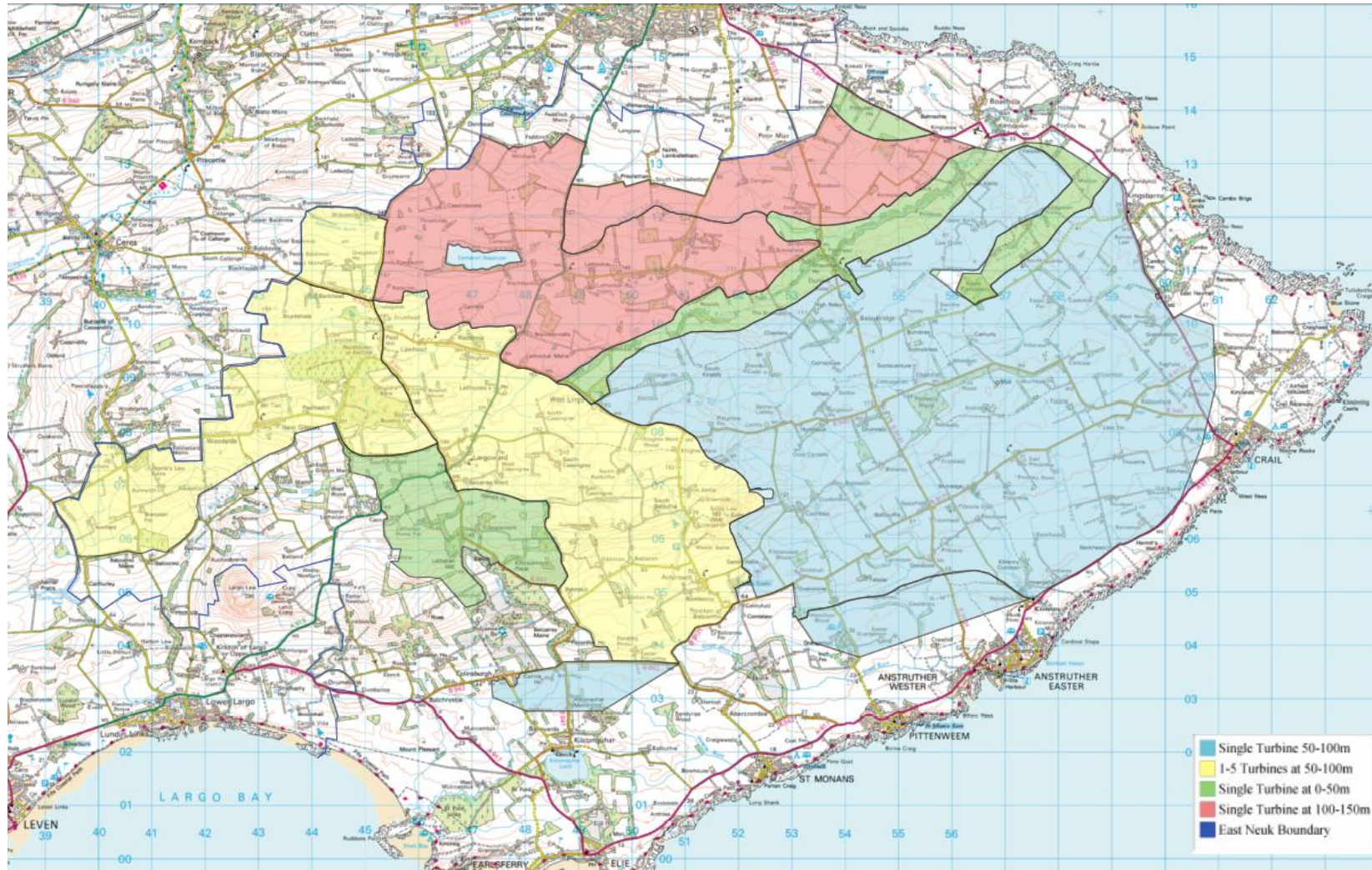
Annual mean wind speeds at 45m AGL (source: DECC wind speed database). Underlying map © Crown Copyright, all rights reserved. 2010 Licence number 0100031673

APPENDIX 2 - TOPOGRAPHY



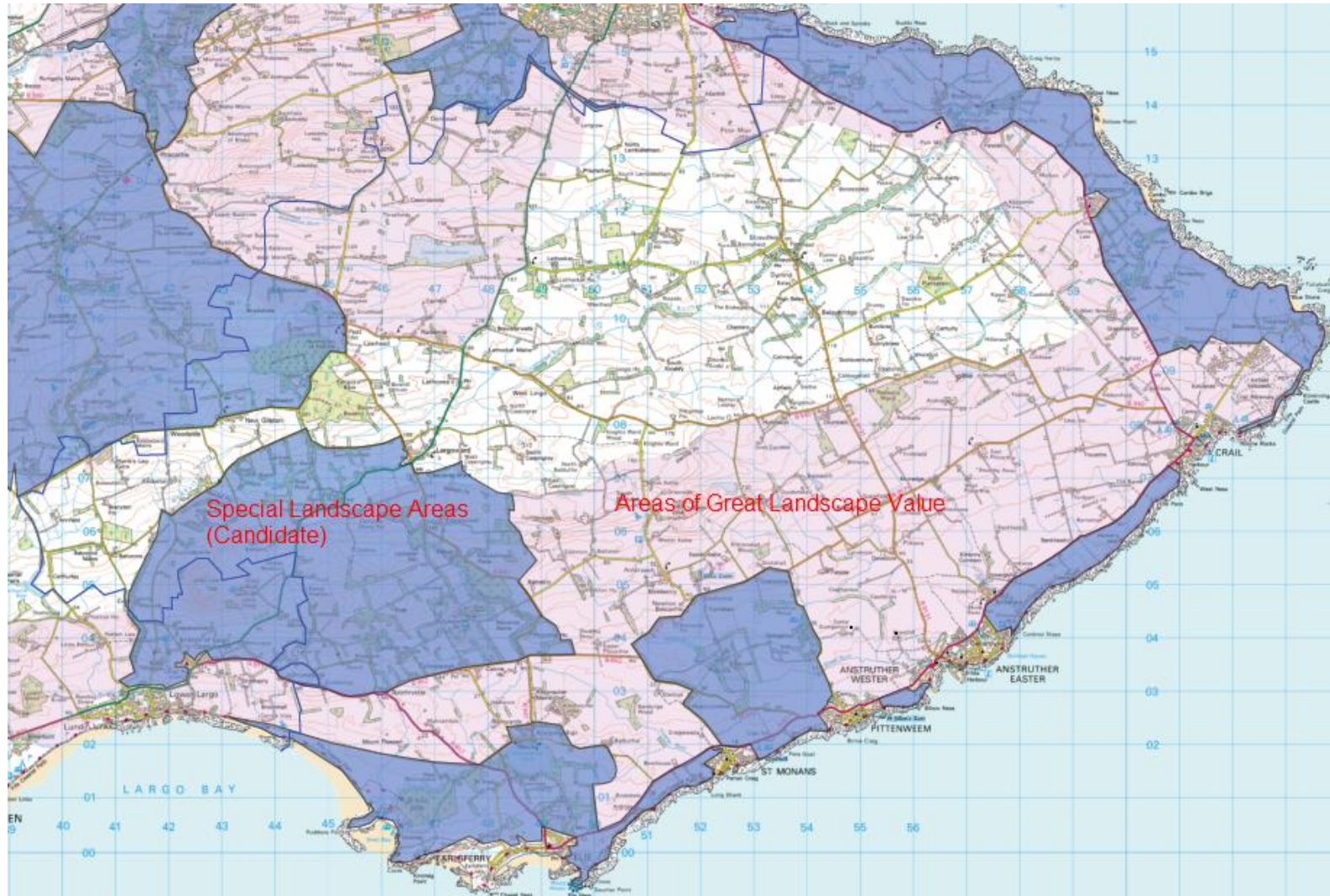
East Neuk topography. Underlying map © Crown Copyright, all rights reserved. 2010 Licence number 0100031673

APPENDIX 3 – FIFE COUNCIL AREA OF SEARCH FOR WIND TURBINES



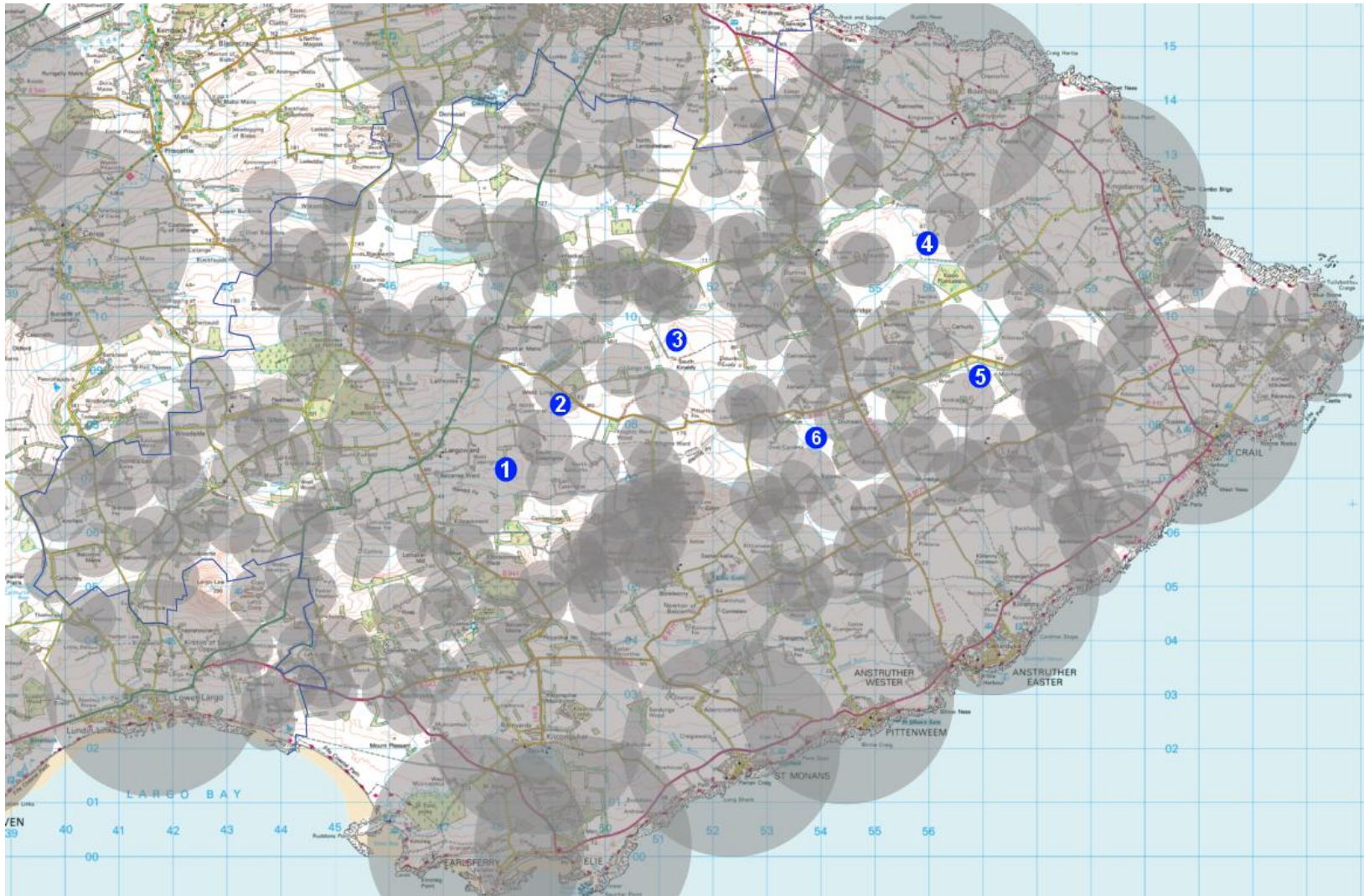
*Composite Area of Search map for wind turbine developments adapted from Fife Council Supplementary Planning Guidance: Wind Energy (draft)
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APPENDIX 4 – AREAS OF GREAT LANDSCAPE VALUE AND SPECIAL LANDSCAPE AREAS



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APPENDIX 5 - BUFFER ZONES AND PROPOSED WIND DEVELOPMENTS

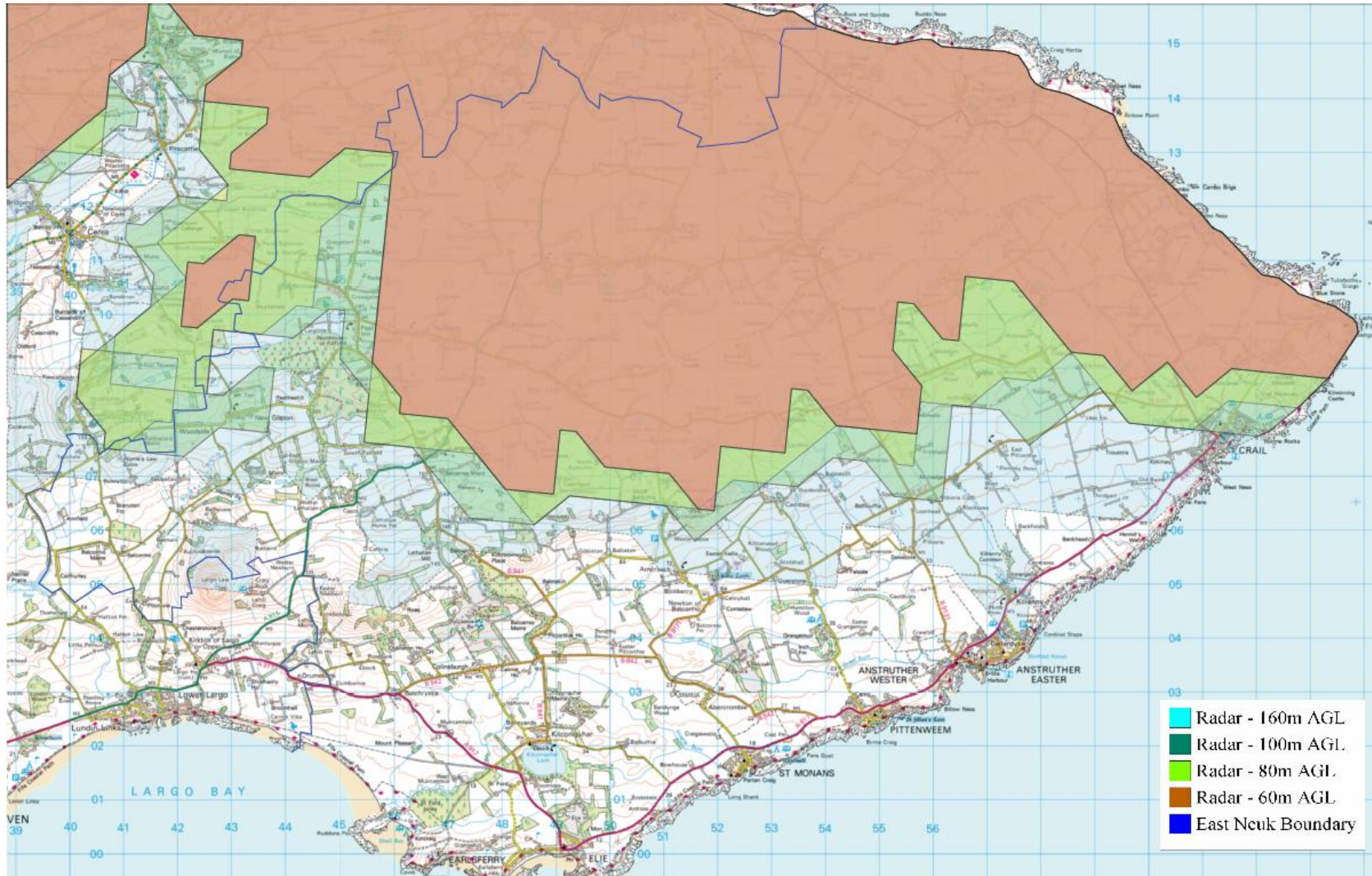


Buffer zones and location of proposed wind turbine developments. Underlying map © Crown Copyright, all rights reserved. 2010 Licence number 0100031673

#	Site, owner/agent	Reference	Community Council	Description	Status
1	South Cassingray	10/02616/FULL	Largoward & District	Application for 2 x Enercon E70 2.3MW turbines, 64m hub height, 99.5m blade tip	Pending consideration MOD and SNH object
2	North Balducho, Balcaskie Estate	11/01314/FULL	Carnbee & Arncroach	Application for 2 x ACSA A27 225kW turbines, 31.5m hub height, 46m blade tip	Pending consideration
3	Pittarhie, West Coast Energy	09/00956/EFULL 11/00737/SCO	Cameron, Boarhills & Dunino	Application for 80m anemometer Scoping opinion request for 5 turbines up to 12.5MW total capacity	Anemometer erected Scoping request pending consideration
4	Upper Kenly, University of St Andrews	09/00725/EFULL	Boarhills & Dunino	Application for a 50m anemometer Proposal is for 12MW, 6 x 2MW, 100m or 4 x 3MW, 125m high turbines	Anemometer erected Ongoing EIA and public consultation
5	Troywood, Scotland's Secret Bunker	09/02880/FULL	Crail	Application for 1 x Enercon E70 2.3MW turbine, 58m to 113m hub height (specific height not given) , 71m rotor diameter	Pending consideration SNH object
6	Bonerbo, Balmonth and Drumrack	11/01180/SCO 10/04272/SCR	Carnbee & Arncroach	Scoping and EIA screening request for 3 x Enercon E33, 330kW turbines, 50m hub height and 66m blade tip	Pending consideration

Proposed East Neuk wind turbine developments currently under consideration within the Fife Council planning system

APPENDIX 6 - MOD RADAR CONSTRAINTS



RAF Leuchars radar restriction zones. Underlying map © Crown Copyright, all rights reserved. 2010 Licence number 0100031673

APPENDIX 7 - NATURAL HERITAGE SITES

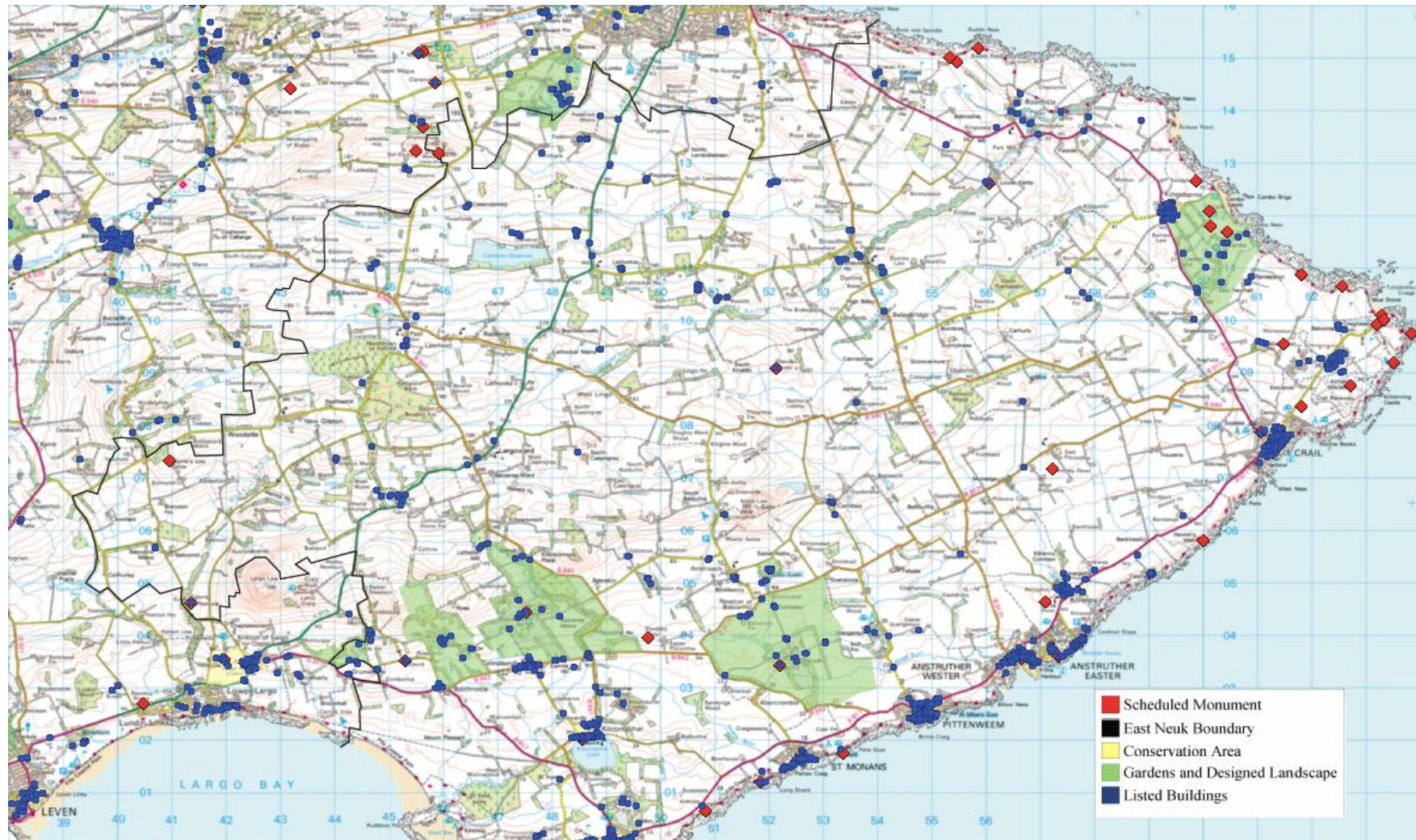


Location of designated nature reserve sites within the East Neuk. Underlying map © Crown Copyright, all rights reserved. 2010 Licence number 010003167

#	Sites	Designation(s)	Key features
1	Cameron Reservoir	Natura 2000	Regularly supports more than 5% of the world's population of pink-footed geese.
2	Cassindonald Moss	SSSI	Most extensive site of lowland peatland remaining in North East Fife. Site is important for its unmodified nature and the occurrence of several locally rare plant species e.g. lesser butterfly orchid.
3	Bankhead Moss	SSSI	One of only two examples of raised bog habitat in East Fife which is in good condition. Contains important peat archive possibly spanning a considerable part of the Holocene (last 10,000 years).
4	Craigtoun Country Park	Country Park	Park land of 16.5 hectares containing family attractions.
5	Swinkie Muir	SSSI	Site represents the only lowland heath and mixed broadleaved woodland in the East Neuk of Fife. Provides a habitat for 112 recorded species of vascular plants some of which are now very rare in East Neuk.
6	Gillingshill Reservoir	Local Nature Reserve	Reservoir holds a variety of over-wintering waterfowl. A wide range of breeding birds can be found in the woodland, scrub and grassland areas, and bluebells are prolific in the wooded areas.
7	Craig Hartle	SSSI	Variety of habitats and over 300 species of vascular plants, including 18 species which are rare or scarce in Fife, and over 140 lichens, including 10 species which are also rare or scarce in Fife.
8	Fife Ness	SSSI	Extensive neutral cliff slope grassland and blackthorn-whin scrub with small areas of freshwater fen, beach-head saltmarsh, shingle and maritime grassland and coastal heath.
9	Firth of Forth	Natura 2000	The site includes extensive invertebrate-rich intertidal mudflats, rocky shores and sand-dunes as well as areas of saltmarsh and coastal grasslands. The rocky shorelines include areas of geological interest whilst the large intertidal mudflats and associated habitats support nationally important numbers of wintering bird species. Firth of Forth regularly supports over 20,000 waterfowl in the winter with recorded peaks of 95,000 and support internationally important wintering populations of bird species. Sites contain nationally scarce species including narrow-leaved and dwarf eelgrass.
10	Firth of Forth	SSSI	Same as site 9 above without the Ramsar and SPA designation.
11	Kilconquhar Loch	SSSI	The natural features of the Loch include; Eutrophic Loch, open water transition fen, wet woodland, breeding bird assemblage, non-breeding Pochard, non-breeding Tufted Duck.

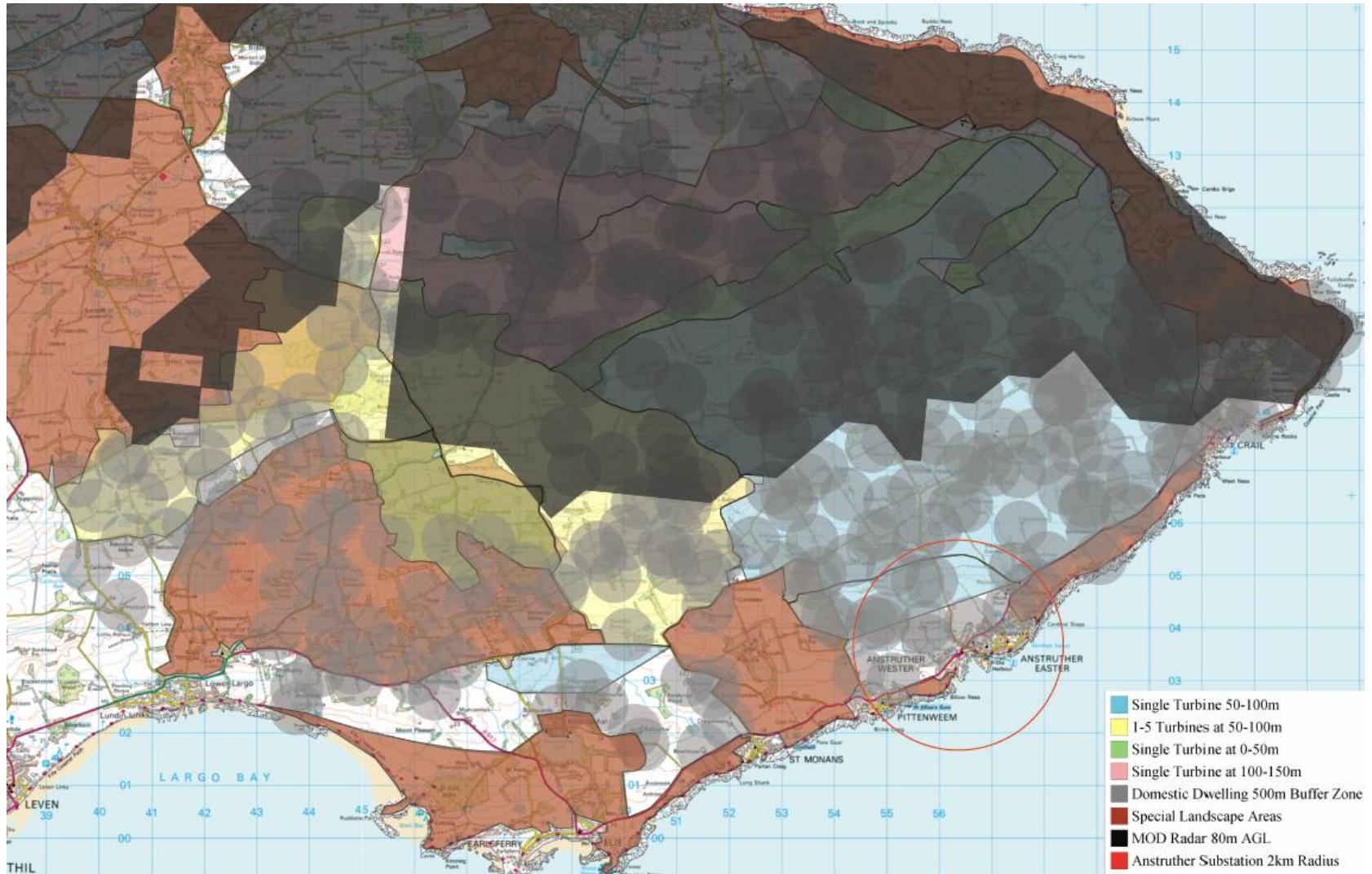
Details of natural heritage sites within the East Neuk (Source: Scottish Natural Heritage interactive map⁴²)

APPENDIX 8 - HISTORIC AND ARCHAEOLOGICAL SITES



Historic and archaeological sites (source: Historic Scotland). Underlying map © Crown Copyright, all rights reserved. 2010 Licence number 010003167

APPENDIX 9 – SITE SEARCH MAP



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APPENDIX 10 - CORNCERES FARM SITES AND PHOTOMONTAGE LOCATIONS



- Potential 500kW site
- Potential 1.5MW site
- 500kW photomontage viewpoints:
 1. B9171 at Muiredge
 2. A917 at Dovecot remains
 3. Fife Coastal Path at Kilrenny burn
 4. Windmill Road, Cellardyke

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1. B9171 at Muiredge



2. A917 at Dovecot remains

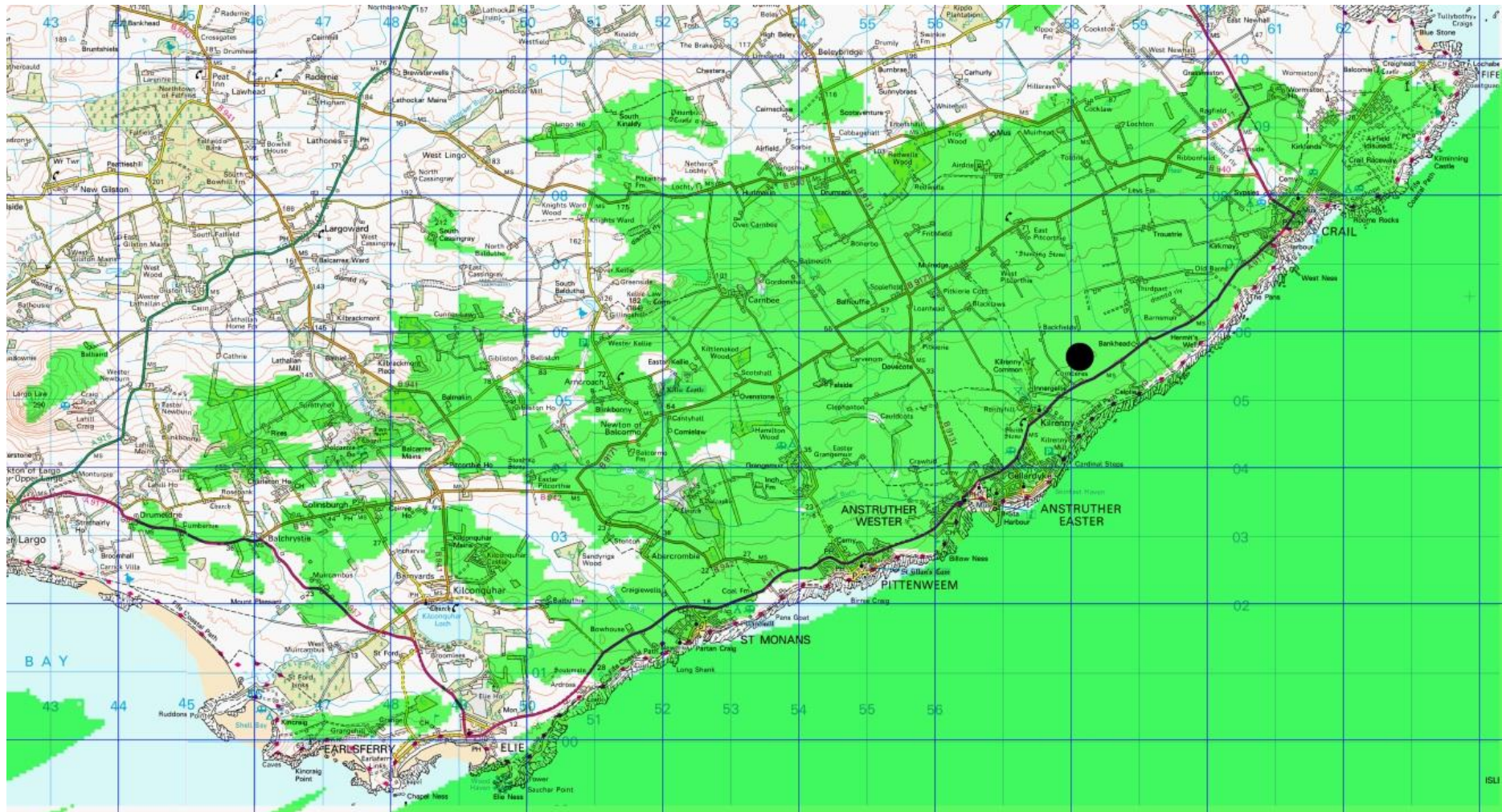


3. Fife Coastal Path at Kilrenny burn



4. Windmill Road, Cellardyke

APPENDIX 11 - ZONE OF THEORETICAL VISIBILITY



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APPENDIX 12 - SITE AERIAL VIEW

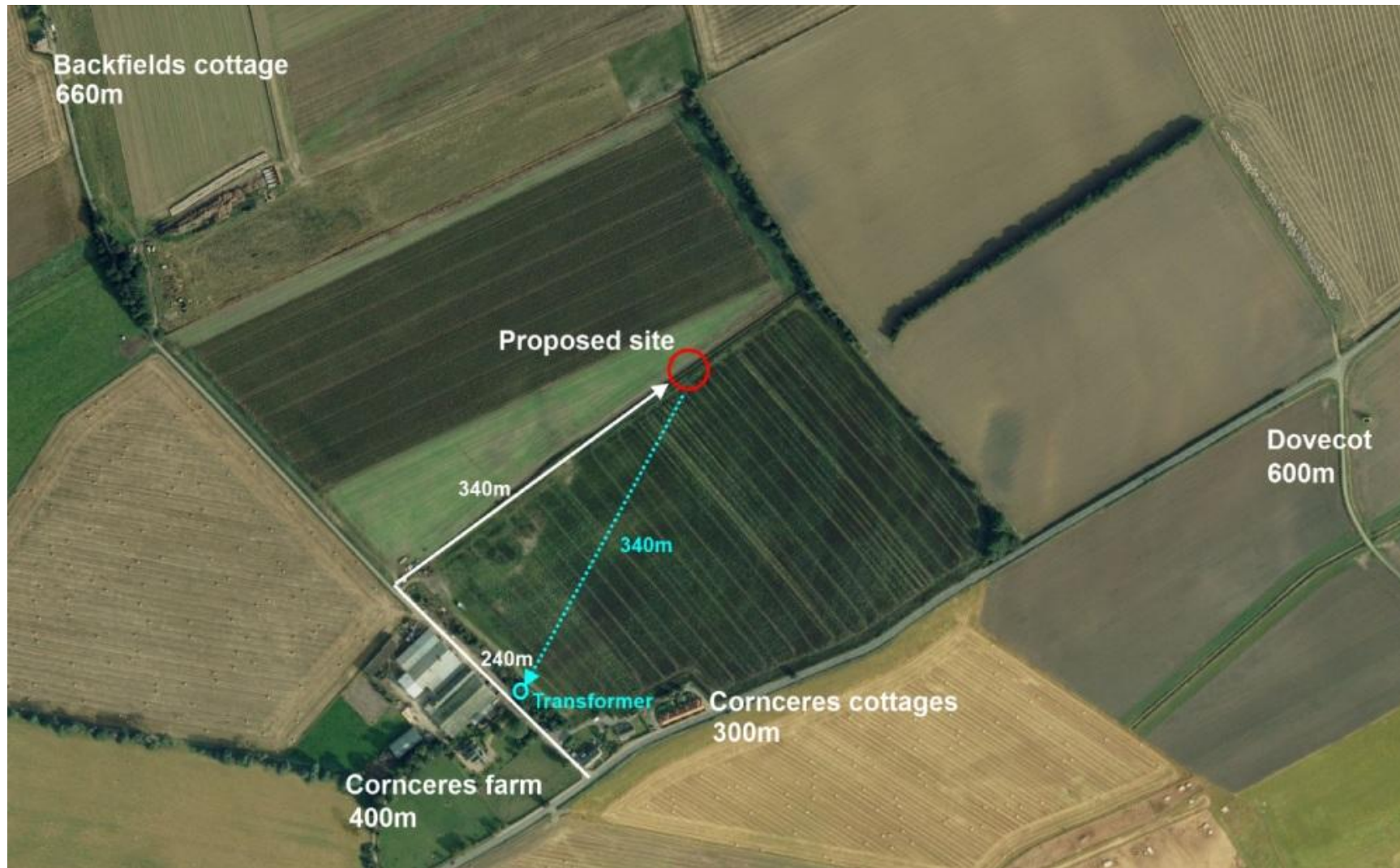
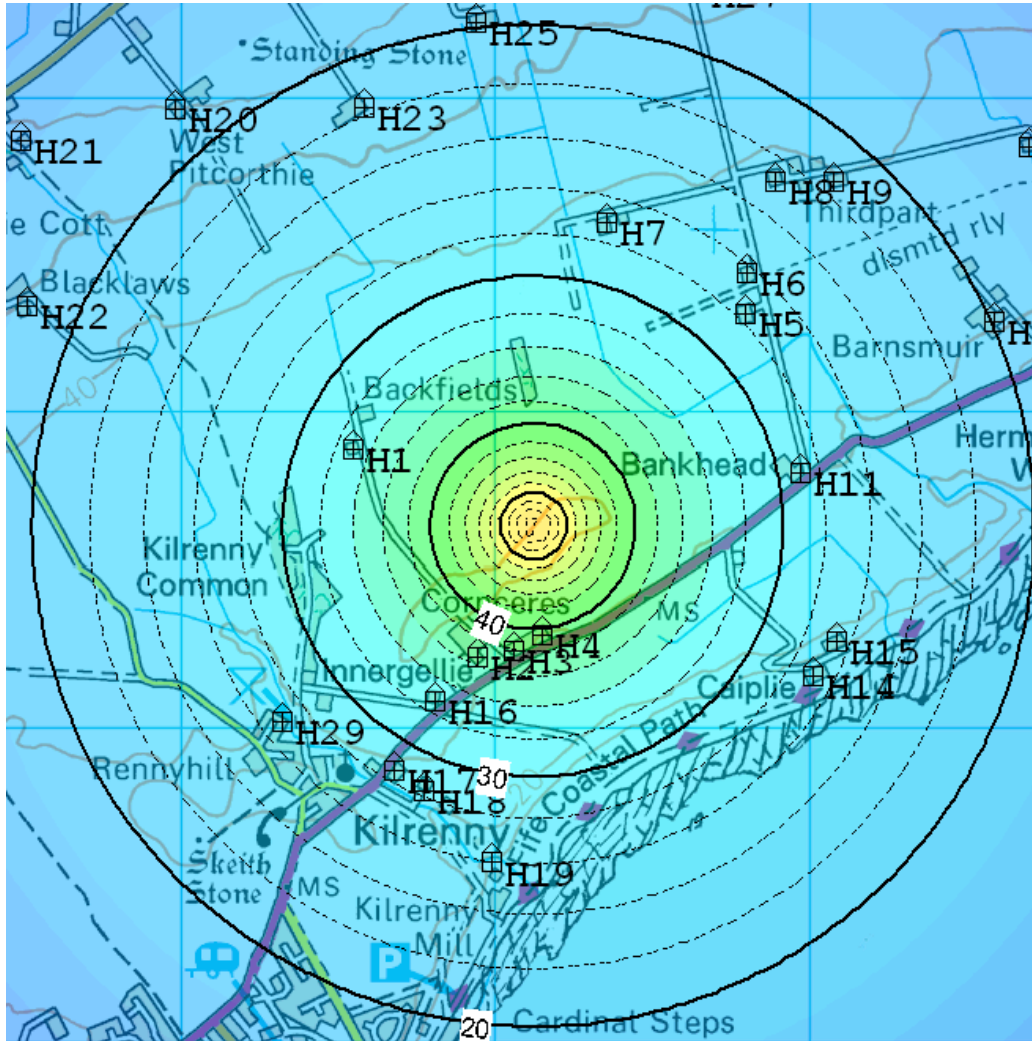


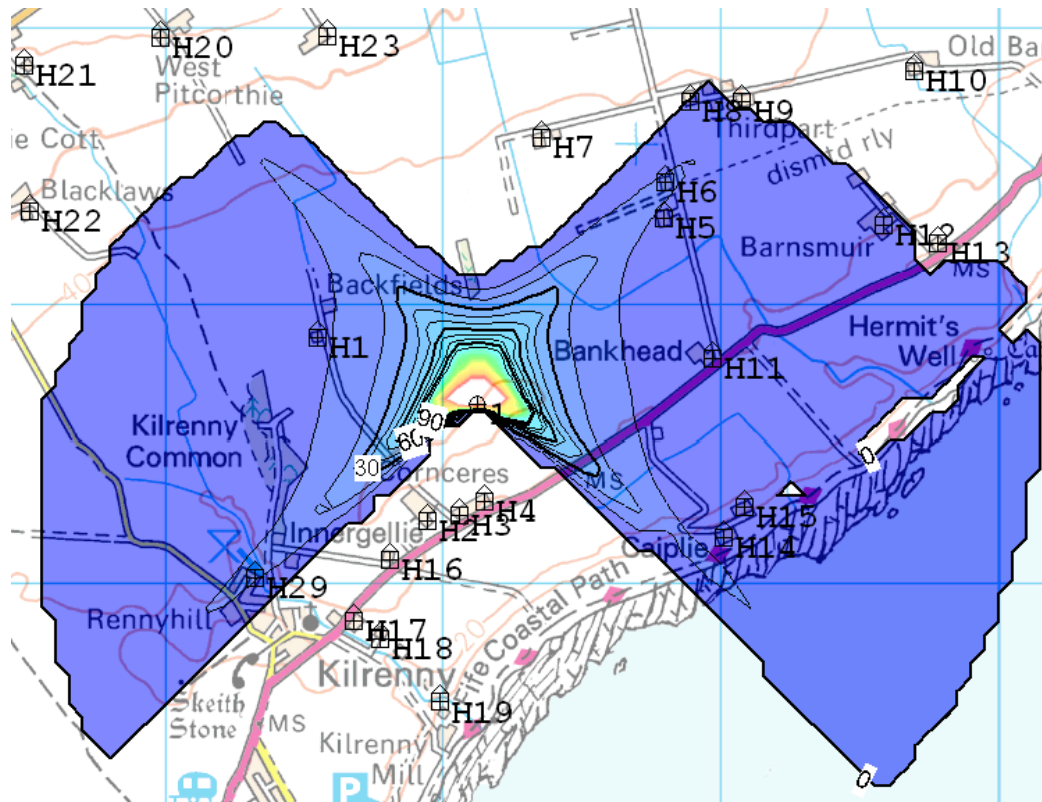
Image (c) Getmapping plc.

APPENDIX 13 - NOISE CONTOURS



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House ID	Name	Noise (db)
H4	Cornceres farm cottages	39
H3	Cornceres farm cottages	38
H2	Cornceres farm house	37
H1	Backfield cottage	33
H16	Inner Gellie lodge	33
H11	Bankhead	29

APPENDIX 14 - SHADOW FLICKER


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House ID	Name/ Location*	Days/year	Max hours/day	Mean hours/day	Total hours/year
H6	Thirdpart holdings	52	0.25	0.23	11.8
H29	Kilrenny village	49	0.27	0.23	11.3
H1	Backfield cottage	30	0.38	0.29	8.8
H5	Thirdpart holdings	38	0.27	0.21	8.1
H14	Caiplie court	28	0.26	0.2	5.6
H11	Bankhead	20	0.28	0.23	4.6
H15	Caiplie court	16	0.24	0.17	2.8

*House names are approximate based on map location

APPENDIX 15 – SNH CONSULTATION RESPONSE

From: Gavin Johnson [mailto:Gavin.Johnson@snh.gov.uk]

Sent: 18 February 2011 16:29

To: Alexander Batten

Subject: Re: East Neuk community wind projects

Dear Alexander,

Thank you for contacting us in relation to the further two community windfarm proposals you are working on at present in Anstruther and St Monans. Our comments at this initial stage are as follows.

Anstruther

In regards to this site and the sensitivity of the landscape and residual impacts what will be particularly important is the consideration of how the turbines relate to the scale of the landscape. For both cases a basic LVIA should be undertaken as per our small-scale renewables guidance:

<http://www.snh.gov.uk/docs/C206956.pdf>

Further to this there is the issue of geese feeding within the vicinity of the site. In respect of SPA interests we believe the goose interest is unlikely to be Firth of Forth SPA population as the roosts for this SPA are located at Alloa Inches and Aberlady Bay approximately 65 km and 25 km away from the proposed site, respectively.

The geese that would visit this area are likely to be Eden Estuary birds, we'd need to know a bit more regarding these birds and the use of the area surrounding the site before scoping them in or out required survey work. If survey work is required then the full 36 hours per vantage point will be required to ascertain if there is no likely significant effect on site integrity of the relevant SPA.

APPENDIX 16 - PLANNED AND OPERATIONAL TURBINES WITHIN 60KM RADIUS OF SITE

Wind Farm	Description	Distance from Cornceres	Status
Methil	1 X 0.75MW	21km	Operational
Devon Wood	7 X 120metre	22.5km	Application
Clatto Hill	3 X 100metre	23km	Application
Earlseat	9 X 2.3MW	26km	Application
Dundee Port	2 X 127metre (2-2.5MW each)	29km	Scoping
Dundee Michelin Plant	2 X 2MW	30km	Operational
Dunbar Wind Farm	3 X 3MW	32.5km	Application
East Skichen	3 X 1.3MW	35km	Application
Dusty Drum	3 X 110metre	35.5km	Application
Crystal Rigg Phases	86 turbines – 180MW	36.5km	Operational
Wester Dod Community	22 X 3.6MW	39.3km	Application
Little Raith Wind Farm	9 X 3MW	40.5km	Construction (May)
Scotston Hill	0.8MW	42km	Approved
Blackburn	6 X 2.3MW	42.5km	Scoping
Ark Hill	8 X 1.3MW	43km	Approved
Drone Hill	22 X 1.3MW	43.5km	Approved
Lochelbank	12 X 0.8MW	46.5km	Construction
Dun Law	26 X 0.9MW	47km	Operational
Monashee	17 X 0.9MW	49km	Scoping
Black Hill	22 X 1MW	50km	Operational
FMC Dunfermline	1 X 1.5MW	52km	Construction (May)
Toddleburn	12 X 2.3MW	52.8km	Operational
Brunta Hill	10 X 2.3MW	53km	Scoping
Carcant	3 X 2MW	53.5km	Construction
Rowantree	23 X 3MW	56km	Application
Muir of Pert	4 Turbines	58.5km	Scoping
Greenknowes	18 X 1.5MW	59.5km	Operational

APPENDIX 17 – SCHEDULED MONUMENTS AND DESIGNED GARDENS WITHIN ZVI

Name	Description	Distance from site (km)	Bearing
Scheduled monuments			
Skeith Stone	Carved stone	1.4	225°
West Pitcorthie	Prehistoric standing stone	1.8	331°
Caiplie Caves	Caves containing early Christian and Medieval Carvings	2.0	82°
Victoria Gardens	Cross slab	3.8	52°
Crail	Market cross	4.0	55°
Crail Airfield Pillbox	Second world war pillbox	4.7	52°
Crail Airfield	Remains of a military airfield	5.7	55°
Abercrombie Church	Church site containing crosses, cross slabs and sculptured stones	6.3	249°
Pittenweem	Market cross	4.4	226°
Easter Pitcorthie	Standing stone	8.4	258°
Pittarthis Castle	Defensible house	6.9	300°
Isle of May Priory	Excavated remains of the Benedictine Priory of the Isle of May	9.7	129°
Isle of May Lighthouse	Lighthouse	10.2	129°
Macduff's Castle & Dovecote	Castle & dovevote	25.0	249°
Wemyss Caves	Caves	25.1	249°
Designed gardens and landscapes			
Balcaskie House		4.7	244°
Balcarres		8.7	257°
Charleton		11.5	258°
Lahill		12.9	308°
Craigtoun		4.9	24°

APPENDIX 18 - ESTIMATED 500KW TURBINE PROJECT COSTS

50m mast anemometry hire for 12 months	£20,000
Geese and landscape impact surveys	£10,000
Preliminaries	£45,000
Legal fees	£3,000
Insurance	£7,000
Site set up, facilities, security	£16,000
Soil survey, local authority requirements	£3,000
Site management	£4,000
Health and safety	£2,000
Planning costs	£10,000
Turbine	£774,400
Civil works	£48,000
Foundation works. All plant, steel, concrete, back fill	£36,000
Hard standing and access roads	£10,000
Removal of spoil	£2,000
Transport	£16,000
Crane hire	£8,000
Electrical	£140,500
Grid connection	£125,000
Power and data cabling from base of turbine	£12,000
Scada remote monitoring system	£3,500
Subtotal	1,061,900
VAT at 5%	53,095
TOTAL	1,114,995

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