



**NON TECHNICAL SUMMARY**

**LAND AT DUNDONALD, FIFE, SCOTLAND**

**SINGLE 500kW WIND TURBINE**

**for**

**European Energy Efficiency Fund, SICAV-SIF**

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# 1. Introduction

## 1.1. Introduction

This Non Technical Summary has been written by Loco2gen Consulting Ltd on behalf of European Energy Efficiency Fund, SICAV-SIF (the Lender). It has been prepared to support the application to the European Energy Efficiency Fund (EEEEF or the Fund) for project financing.

The Fund seeks to support the objectives of the European Union to promote a sustainable energy market and climate protection. The Fund invests in three categories of projects:

1. Energy saving and energy efficiency;
2. Renewable energy sources; and
3. Clean urban transport

The final beneficiaries of the Fund are municipal, local and regional authorities as well as public and private entities acting on behalf of those authorities such as utilities, public transportation providers, social housing associations, energy service companies etc.

## 1.2. Project Background

The Developer (Ore Valley Energy Limited) has obtained planning permission for the construction of a single 500kW wind turbine and associated works (the Development) at Dundonald, Fife, Scotland. The associated works include the upgrade of approximately 345m of existing access track and approximately 170m of new access track.

The aim of the Development is to develop wind energy to provide significant long-term economic benefit for communities in Fife. In this respect, the profit from the Development will be shared equally between a Community Trust and the Ore Valley Housing Association.

The Developer's share shall be used to provide new social housing stock and implement wider role projects (including energy efficiency measures for the existing social housing stock).

The remaining half of the turbine revenue will be managed by a Community Trust and used to fund a wide variety of projects to the benefit of local residents.

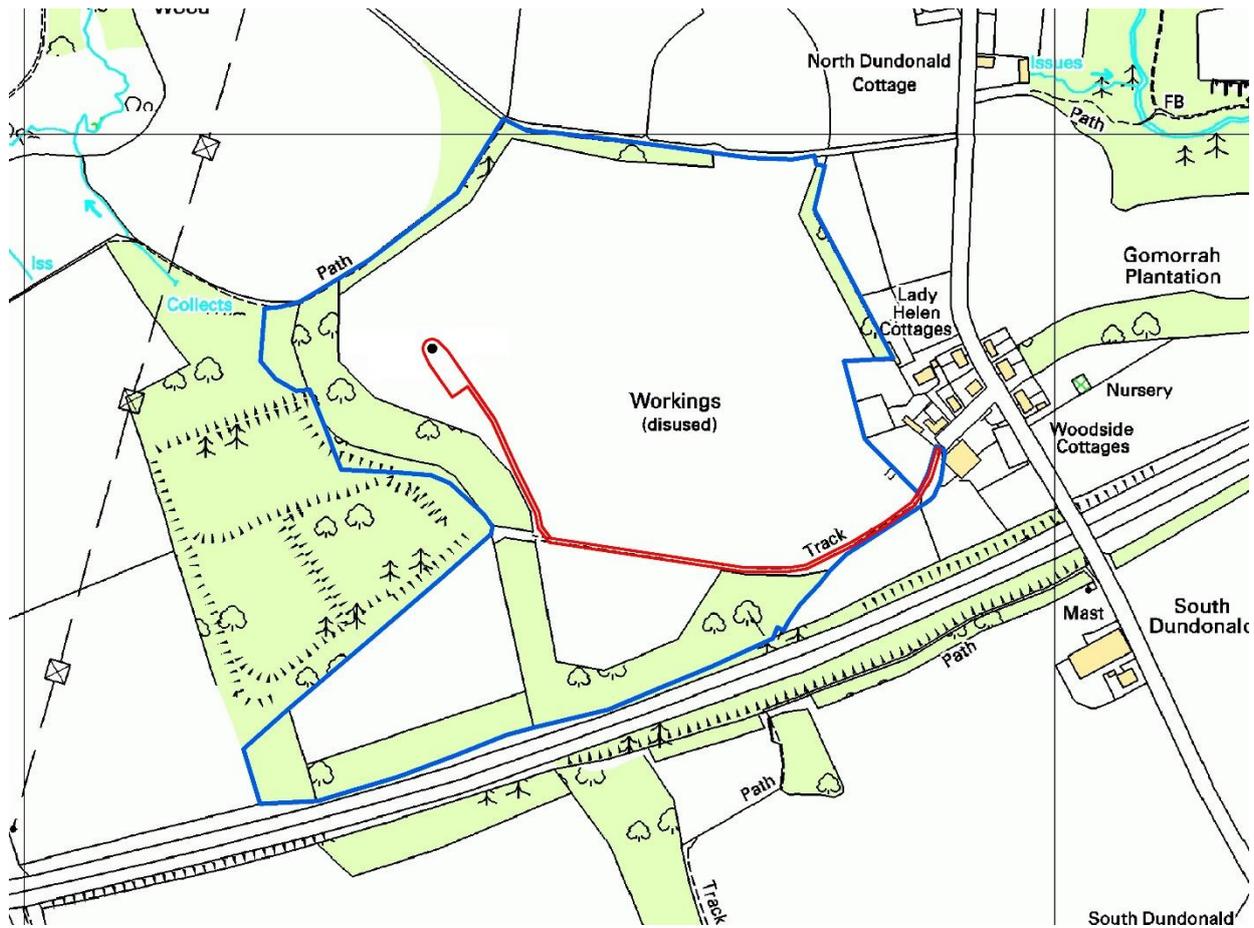
# 2. Site Description

The wind turbine will be located on grazing land (previously worked for coal extraction) to the west of Dundonald.

The Site is shown in Figure 1 below - the blue line represents the provided boundary of Fife Council's landownership and the red line represents the outline of the wind energy development footprint as per the planning permission.

The centrepont of the turbine is at grid reference 321396 693791.

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**Figure 1: Site location and development boundary**

### **3. Development Description**

#### **3.1. Ancillary Works**

In order to connect the wind turbine to the national electricity grid, ancillary buildings in which to house additional equipment are required.

The planning permission included a substation close to the turbine tower. It has since been established that a brick-built substation and a separate meter housing are needed. The LPA granted these amendments as a second NMV to the planning permission in September 2016.

### **4. Planning & Other Consents**

#### **4.1. Planning Permission**

Fife Council granted planning permission on 25<sup>th</sup> March 2016 for the "erection of a single 99.5m wind turbine and formation of access" (Reference: 12/04996/FUL).

There are fifteen approved documents and drawings associated with the planning permission. They are listed in Table 1 below, along with a brief description of their contents.

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LPA Reference	Drawing/Document Title	Description
09	Drawing DUN001	Site location plan (1:30,000 @ A3)
10	Drawing DUN004	Construction compound and external transformer (various scales @ A3)
11	Drawing DUN005	Turbine elevations (1:400 @ A3)
12	Drawing DUN006	Designated landscape areas (1:250,000 @ A3)
13	Drawing DUN007	Other landscape designations (1:250,000 @ A3)
14	Drawing DUN007b	Gardens and designed landscapes list (N/A)
15	Drawing DUN008	Cultural heritage sites (1:35,000 @ A3)
16	Drawing DUN009	Landscape character types (1:250,000 @ A3)
23	Drawing DUN016	Other landscape designations and ZTV (1:250,000 @ A3)
26	Drawing DUN019b	Cumulative base list (N/A)
01	Drawing DUN002	Site location plan (1:3,000 @ A3)
02	Drawing DUN003	Site block plan (1:500 @ A3)
42	SCT3717, Report No. 1 (dated 16 <sup>th</sup> September 2013)	Traffic Route Management Plan
43	Wind Turbine Noise Assessment (dated August 2012)	Noise Assessment
44	Drawing Noise Contours	Noise contour plan (no scale)

**Table 1: Approved documents and drawings**

## 4.2. Other Consents

### 4.2.1. Roads

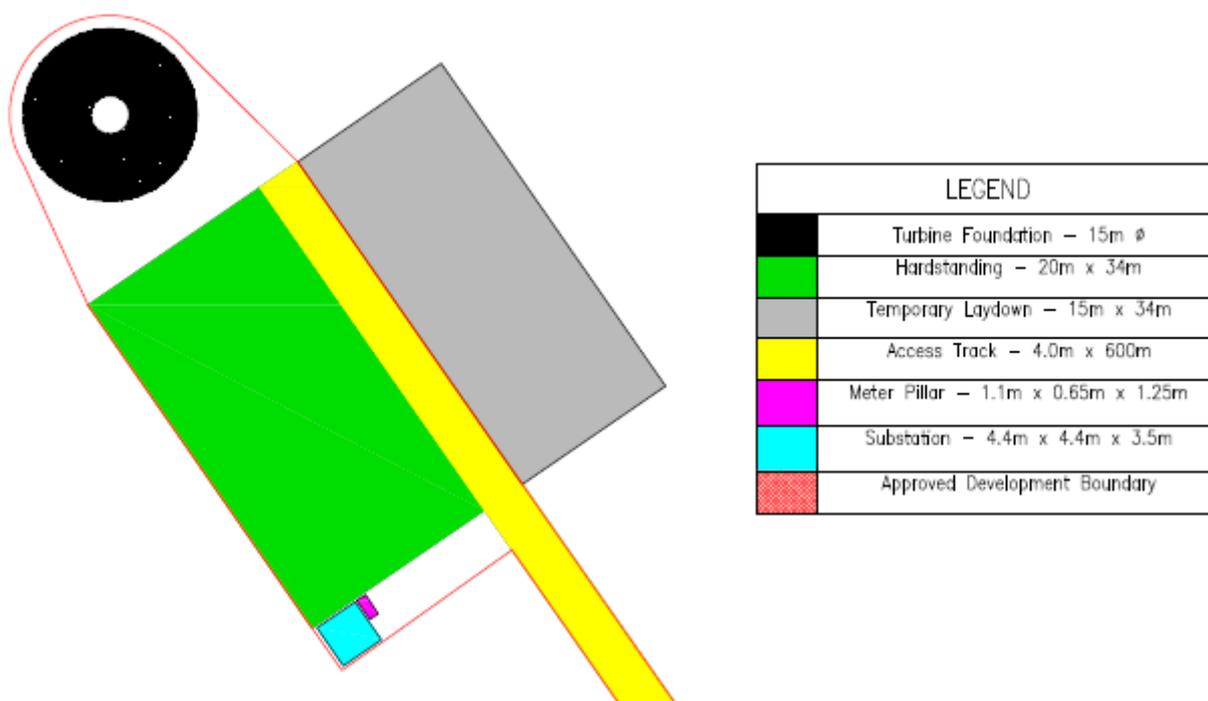
One of the conditions tied to the wind turbine planning permission requires a Traffic Management Plan to be provided for approval (further details are provided in Section 11 of this report).

Once the haulier's 'dry run' confirms the works required along the turbine delivery route, the Developer's appointed Civil Contractor will secure the necessary permissions or permits.

### 4.2.2. Grid

From the on-site substation (see Figure 2 below), the Distribution Network Operator (in this case, Scottish Power) will connect the wind turbine to the national electricity grid at a location to the north-east of the site. Scottish Power is in the process of securing consent for the new length of overhead line that will connect the development to the existing 11kV apparatus.

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**Figure 2: Detailed site layout**

## 5. Ecology & Ornithology

The planning application was supported by various reports, including:

- Ecological Survey Report by Machars Ecology (dated October 2012);
- Bird Survey Results by Direct Ecology (dated October 2012)

The findings of these studies are as follows:

- **Designated Sites** - There will be no direct or indirect adverse effects on designated sites of nature conservation or their qualifying features as a result of the development;
- **Habitats** – The turbine, access track and crane pad are all located within improved grassland, which is an abundant and low value habitat;
- **Mammals** - While there will be no direct impacts on the badger sett found in the woodland to the west of the site, it is assumed that badgers use the field in which the turbine is to be sited for foraging. Surveys found low levels of bat activity along the wooded plantation edges and shelterbelts. Away from these areas, bat foraging activity was negligible; and
- **Birds** - While the improved grassland has negligible value for breeding and wintering (feeding) birds, it is assumed that small numbers of skylark and meadow pipit breed in the field in which the turbine is to be located. Flight activity for target bird species was low – only three qualifying species for the Loch Leven and Firth of Forth SPA sites were recorded. Based on the surveys, there is no indication that SPA species regularly fly over the site.

In his report to the Council’s West Planning Committee, the planning officer concluded that:

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*"The proposed turbine and its associated equipment have been positioned 50 metres from any hedgerows and buildings to ensure that there are no negative impacts upon ecological species, including barn owls, birds and bats in accordance with SNH guidance. This provides adequate clearance for these species."*

And, with regard to ecological mitigation:

*"Badgers can move into new areas and dig setts over a short period of time. Therefore, prior to construction commencing a re-survey for badgers is required and mitigation identified if necessary. The survey work should be carried out no more than one month before works are due to commence."*

*"The possible impact upon bird species including breeding birds, species at risk from wind turbines and those associated with the Firth of Forth and Loch Leven SPAs has been considered with a variety of ornithological surveys undertaken. Mitigation measures (for nesting birds) will need to be secured by conditions."*

The above mitigation requirements are reflected in Conditions 9 and 10 of the planning permission.

To ensure compliance with legislation covering protected species (badgers in particular), an Ecologist was instructed to complete a pre-construction walkover of the site to confirm that the previous findings are still correct. This pre-construction survey has been completed and the Ecologist identified no other issues.

Other best practice measures, such as removing vegetation outwith the bird breeding season to protect nests and chicks, fencing off excavations to avoid animal injury, using quieter plant and machinery to minimise noise disturbance etc., will be followed during the construction works.

## **6. Landscape & Visual**

As part of the Supporting Environmental Document (SED) submitted to the LPA in support of the proposals, a thorough Landscape & Visual Impact Assessment was undertaken by a chartered member of the Landscape Institute.

In his Committee report, the planning officer found that:

*"The proposed development would be visible as a tall structure within the context of a rolling/sloping farmland landscape already containing tall structures such as above ground power lines and groups/individual trees which also break up the farmland characteristics of the area as well as views of the turbine itself. Therefore, it is considered that the impact of the turbine would be mitigated due to natural vegetation, intervening topography, existing built development, the separation distances involved between the turbine and receptors, the scale of the proposal, and the presence of other tall standalone man-made structures."*

And, in terms of visual amenity:

*"The visual amenity currently enjoyed by the limited number of existing nearby residential dwellings has also been considered. The location of the proposed development would be highly visible at a distance to closest residents but views would not be direct or overbearing and would be set against a backdrop of higher rolling topography with other tall structures (powerlines). In terms of overall visual impact it is considered that the wind turbine would not create an over bearing impact and would not unduly intrude on the quality of views of the greater area for residents."*

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## 7. Cultural Heritage

The development footprint currently comprises grazing land but was previously worked for coal extraction. Given the Site's history therefore, there will be no direct impacts on buried archaeological features or remains.

As part of the SED, the likely impact of the wind turbine on the setting of Listed buildings, Scheduled Monuments, Conservation Areas and Gardens & Designed Landscapes in the surrounding area was assessed. The effect of the turbine on the setting of these sites was found to be low due to a combination of distance and intervening landform and tree cover.

## 8. Noise

### 8.1. Construction

The construction of the Development will comply with all relevant legislation, regulation and best practice governing such matters. For example, the quietest plant and/or machinery will be employed and maintained in good working order with appropriate silencers, mufflers or acoustic covers fitted where applicable.

### 8.2. Operation

There are a number of conditions tied to the planning permission relating to operational noise. Specifically, Condition 12 details the maximum permissible day-time and night-time noise levels at various locations close to the site.

The technical assessments prepared in support of the planning application are based on a candidate turbine model (2.3MW Enercon E70) and the approved Noise Assessment shows that the limits specified in Condition 12 would not be exceeded.

It is intended that a 500kW Enercon E53 turbine be erected on the Site. Table 2 below compares the warranted sound power levels of both wind turbines.

Wind Speed V <sub>s</sub> in 10m height	Enercon E70 2300kW (64m to hub)	Enercon E53 800kW (73m to hub)
4m/s	88.4	92.5
5m/s	93.6	94.2
6m/s	98.8	97.7
7m/s	101.4	100.1
8m/s	103.1	101.5
9m/s	104.5	102.5
10m/s	104.5	102.5

**Table 2: Comparison of sound power levels (dB(A))**

It is acknowledged that the E53 is predicted to be slightly noisier than the E70 model at low wind speeds (4m/s and 5 m/s). Table 3 below shows the difference between the expected noise immission levels from the original E70 and the conditioned noise limits. This demonstrates that at 4m/s and 5m/s there is a significant margin of between 15.5 and 29.3 dB between the noise of the turbine at the properties and the upper limit of what would be considered acceptable within the conditions of the planning consent. The slight increase in turbine operational noise (<5 dB(A)) from the E53 model will therefore still be considerably below the allowable limits for

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these lower wind speeds. Based on this assessment there is not considered to be a risk in relation to the proposed turbine model meeting the noise condition attached to the planning permission.

	Standardised Wind Speed at 10 m AGL, ms <sup>-1</sup>								
	4	5	6	7	8	9	10	11	12
Noise Margin, dB									
<b>86 Bluebell Gardens</b>									
Quiet Daytime	-21.5	-18.5	-15.2	-14.1	-13.1	-11.3	-11.3	-11.3	-11.3
Night-time	-22.3	-17.1	-11.9	-9.3	-7.6	-7.4	-9.2	-9.2	-9.2
<b>Lomond View</b>									
Quiet Daytime	-29.3	-25.5	-21.7	-20.2	-19.3	-18.4	-18.5	-18.5	-18.5
Night-time	-20.3	-15.3	-11.4	-10.1	-9.7	-9.6	-10.8	-10.8	-10.8
<b>Muirhead Farm</b>									
Quiet Daytime	-22.8	-19.8	-16.5	-15.4	-14.4	-12.6	-12.6	-12.6	-12.6
Night-time	-23.6	-18.4	-13.2	-10.6	-8.9	-8.7	-10.5	-10.5	-10.5
<b>North Dundonald Farm</b>									
Quiet Daytime	-21.8	-18.8	-15.5	-14.4	-13.4	-12.0	-12.0	-12.0	-12.0
Night-time	-22.6	-17.4	-12.2	-9.6	-7.9	-7.7	-9.5	-9.5	-9.5
<b>Spittal Farm Cottage</b>									
Quiet Daytime	-21.6	-18.4	-15.3	-14.7	-14.9	-15.1	-16.4	-16.4	-16.4
Night-time	-20.7	-15.5	-10.3	-9.6	-10.9	-12.9	-16.6	-16.6	-16.6

**Table 3: Margin between predicted noise levels (E70) and conditioned limits at the nearest properties**

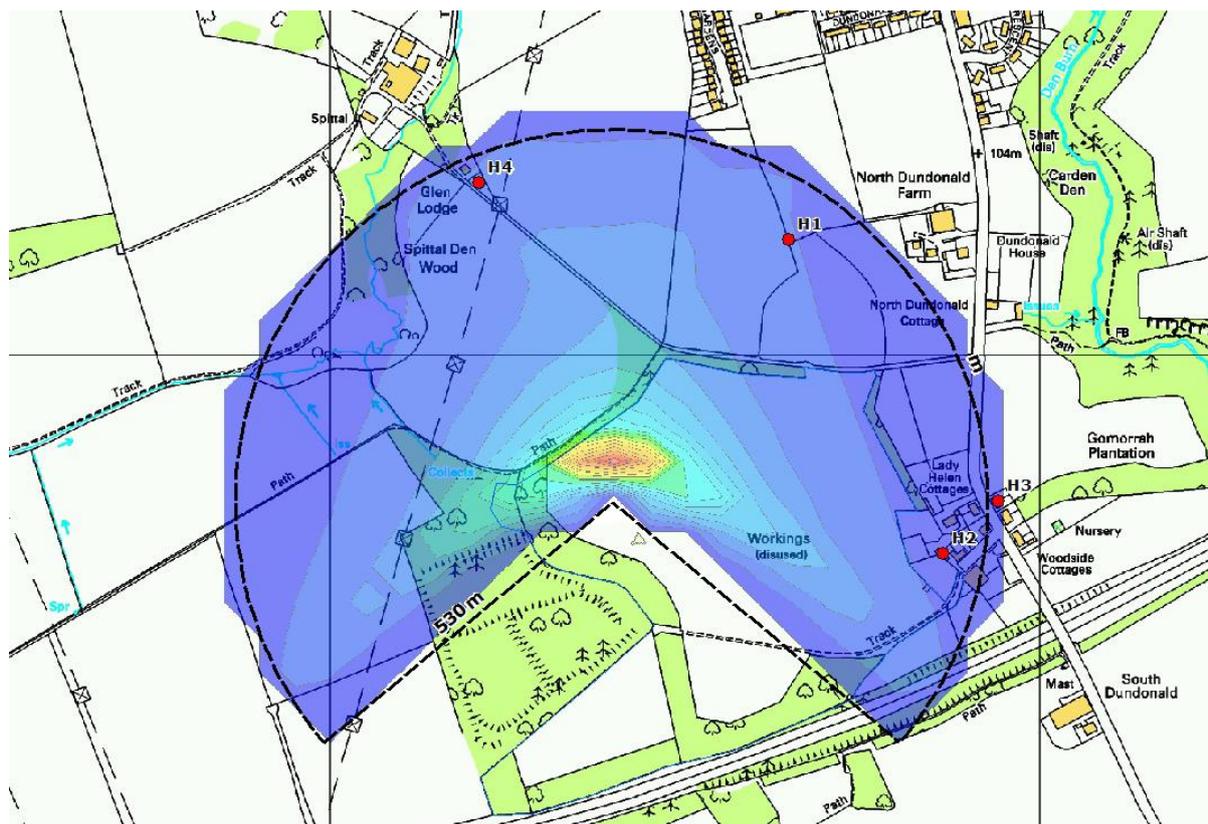
For example, at Muirhead farm during night-time hours at wind speeds of 7m/s, the margin between the maximum turbine noise and what the allowable noise limits is 10.6 decibels (dB). Overall this table shows that the area has high levels of background noise (most likely due to high noise levels from the adjacent A92 road) and there is a significant margin between the background noise and how much noise there could be from the wind turbine at the various properties.

## 9. Shadow Flicker

As the turbine model has changed, an updated desk-based assessment has been undertaken to model the shadow flicker profile of the chosen Enercon E53 model.

In Figure 3 below, the contours show total hours per year (in 20 hour intervals) of possible shadow flicker effects. It is important to note that the model is based on the 'worst case' in that it assumes 100% sunshine every day of the year and takes no account of obstructions that would lessen impacts such as trees and buildings.

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**Figure 3: Theoretical shadow flicker modelling**

Location	Days per year	Maximum flicker event length (hours)	Mean flicker event length (hours)	Total hours per year
H1	58	0.52	0.40	23.2
H2	42	0.48	0.38	15.9
H3 <sup>1</sup>	0	0.00	0.00	0.0
H4	75	0.49	0.42	31.8

**Table 4: Summary of theoretical flicker events**

The above table demonstrates that there is a total of circa 75 hours a year when shadow flicker may theoretically occur. Based on meteorological data it is considered that 35% of daylight hours in Scotland constitute sunshine hours and therefore this figure is expected to result in an estimated 25 hours of turbine shut down to mitigate shadow flicker occurring at nearby residential properties.

To ensure compliance with the planning permission, the wind turbine will be fitted with software that will assess whether the sun is bright enough to give rise to shadow flicker effects during

<sup>1</sup> Location H3 lies more than ten rotor diameters distance (in this case, 530m as shown by the dashed line in Figure 3) from the wind turbine and so shadow flicker is not predicted to occur

noted sensitive periods. If this is the case, the software will automatically shutdown the turbine and prevent the blades from turning until such time as the risk of shadow flicker has passed.

## 10. Aviation & Telecommunications

As part of the LPA's consideration of the planning application, comments were requested from the Ministry of Defence, the Civil Aviation Authority, National Air Traffic Service (NATS), Edinburgh and Dundee Airports and various telecoms operators – no objections or concerns were raised.

For reasons of safety, and as per the comments of the Ministry of Defence, the planning permission provides for the installation of an infrared aviation warning light on the turbine nacelle.

## 11. Transport & Access

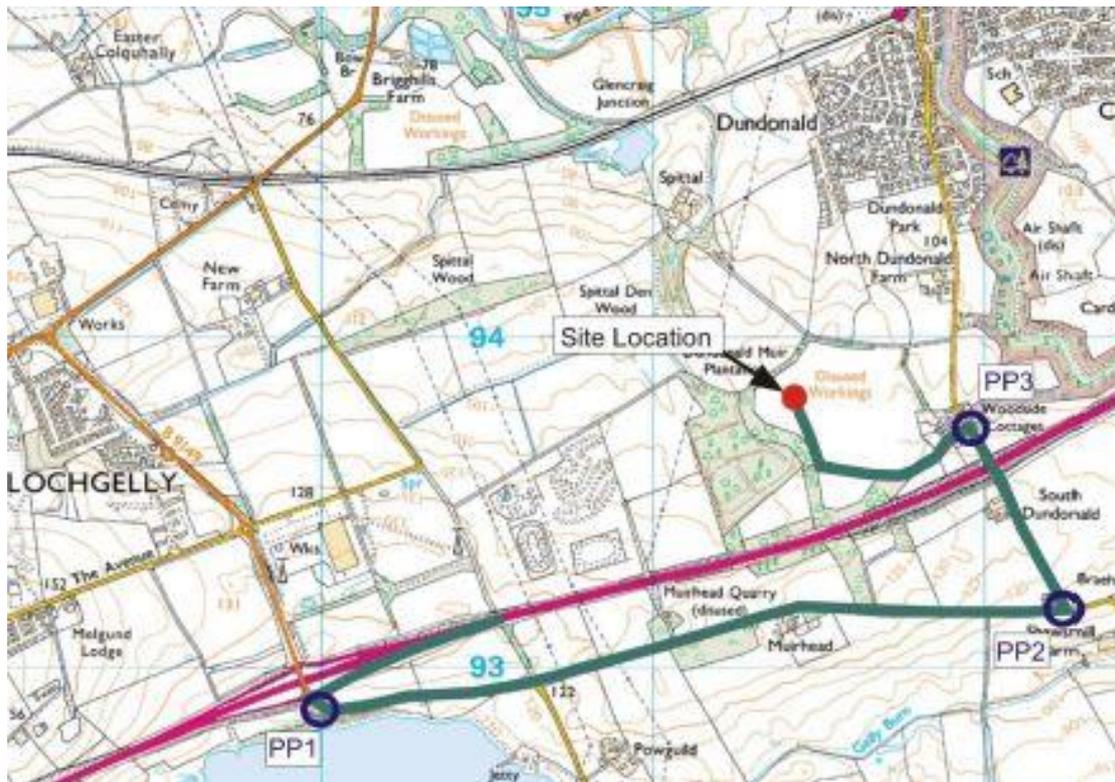
One of the conditions tied to the planning permission relates to the preparation of a Traffic Management Plan. A Plan has been prepared for the Development and has been submitted to the LPA for approval.

For the turbine components, the delivery route will be as follows:

1. A92;
2. B9149 to Kirkcaldy;
3. C2 to Cardenden;
4. Temporary route through garden at Lady Helen Road; and
5. New access track to site.

This route is illustrated at Figure 4 below. The approved wind turbine location is shown by the red circle.

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**Figure 4: Turbine component transport route**

Swept path analysis and site survey of potential 'pinch points' (i.e. the numbered locations shown above) along the delivery route indicates that works will be needed as follows:

1. Pinch point PP1 – Areas of oversail (one requiring the temporary removal of street furniture on a splitter island);
2. Pinch point PP2 – Aside from cutting back an existing hedge by 1-2m to allow for easier manoeuvring, the haulier's 'dry run' identified no issues at this junction; and
3. Pinch point PP3 – A temporary access track through a neighbouring garden - involving removal of the boundary wall/fence and vegetation and laying of a suitable load bearing surface. The track will be removed and the garden fully reinstated (including the boundary features) once construction is complete. Other temporary traffic measures such as a reduction in the speed limit, prohibition of car parking during abnormal load deliveries, use of a banksman at the site entrance etc. will also be put in place by the Developer's appointed Principal Contractor as required.

It is envisaged that other deliveries of materials, plant and equipment will follow the same route from the A92. The Principal Contractor will ensure that deliveries are generally limited to this route to enable any impacts (noise, air quality etc.) by construction traffic to be managed and monitored.

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## 12. Ground Conditions, Mining Legacy & Site Drainage

### 12.1. Ground Conditions & Mining Legacy

Given the Site's previous use, the Coal Authority requested that a condition be tied to the planning permission requiring intrusive site investigations be carried out to verify if there are any mining legacy issues to be addressed. If any remediation is required, the planning condition requires the works to be completed before construction of the wind turbine commences.

To address this requirement, investigations were undertaken in summer 2016. The boreholes and trial pits essentially encountered 0.1m – 0.3m of topsoil, overlying made ground, resting on bedrock. The made ground contained mudstone, sandstone and coal and fragments of metal, wood and burnt shale. Where encountered, groundwater was found at depths ranging from 7.0m – 8.0m.

The conclusions of the investigations are that remedial works in relation to previous mining activity on the Site are not needed.

The findings of these intrusive investigations have also informed the design of the turbine foundation - bored or driven piles are considered to be most suitable.

### 12.2. Site Drainage

Best practice will be followed during trenching and excavation works to ensure that new drainage pathways are not introduced and surface water is not contaminated through silt laden run-off or accidental fuel/chemical spills.

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