

Mabe Parish Renewable Energy Neighbourhood Development Plan

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1. Wind Development Feasibility in Mabe Parish

1.1 Wind resource

The map below shows average wind speeds for Mabe Parish at a height of 45m using data from NOABL. It can be seen that Mabe Parish has a very strong wind resource with minimum average wind speeds of 6.5 m/s at 45m. In order for wind projects to be financially viable, average wind speeds must be at least 5 – 6 m/s at a height of 45m (Centre for Sustainable Energy, 2016). Therefore the entire parish has a suitable wind resource for wind turbines, the strongest winds can be seen in the north west of the parish where average wind speeds are above 8 m/s at 45m.

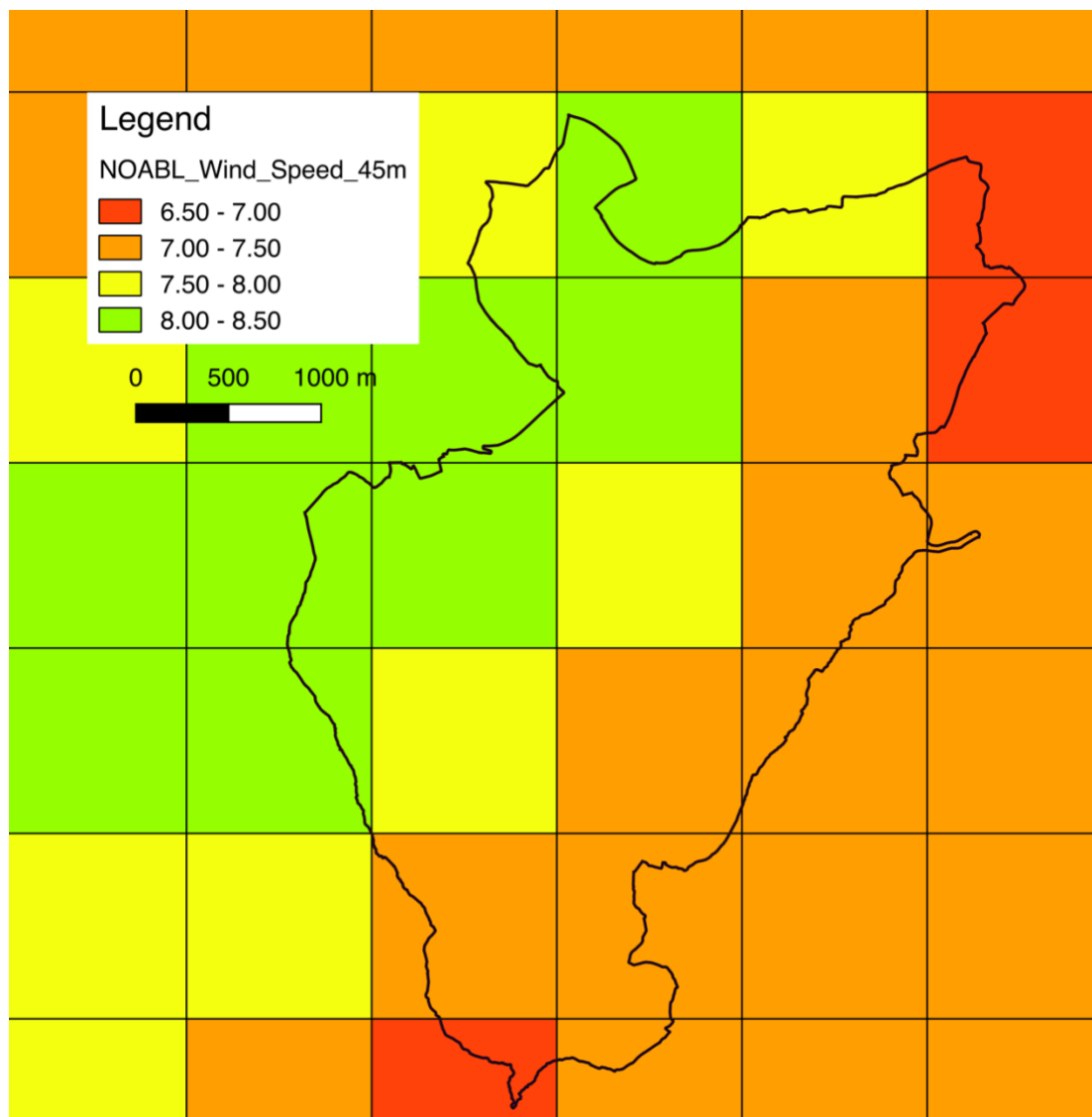


Figure 1. Map of the Wind Resource at 45m for Mabe Parish

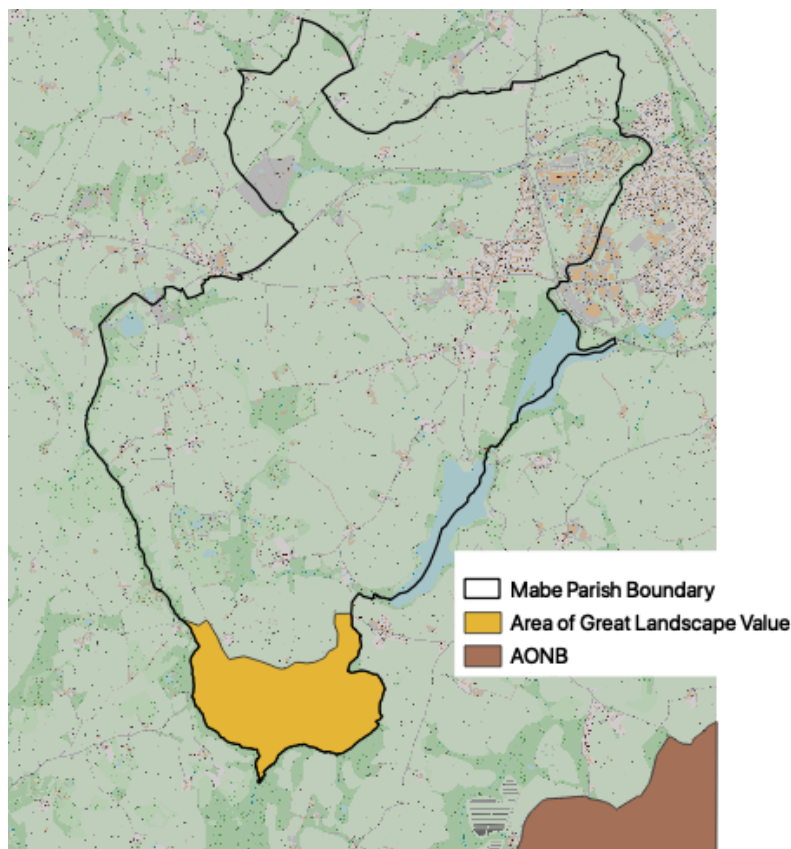
1.2 Landscape sensitivity to onshore wind energy for Mabe Parish

Cornwall is divided into 40 Landscape Character Areas (LCAs) in order for Cornwall Council to provide guidance for areas based on their landscape features. Almost all of Mabe Parish is within Carmenellis LCA with a small region in Fal Ria, Truro and Falmouth LCA. Due to the insignificant area in Fal Ria, Truro and Falmouth LCA and the low chance of wind developments due to the urban nature of this region it is assumed that Mabe Parish resides solely within Carmenellis.

Overall Cornwall Council characterise Carmenellis as having a moderate sensitivity to wind developments with higher sensitivity around Carn Brea, Porkellis and in the AONB to the South East of the LCA (all of these areas fall outside Mabe Parish).

The guidance states that the least sensitive areas to wind developments are those with large landform plateaux, simple landcover, rectilinear fields and strong human influence.

1.3 Visual impact of onshore wind energy for Mabe Parish



Wind turbines should not alter the character of Areas of Great Landscape Value (AGLV) or Areas of Outstanding Natural Beauty (AONB). This map shows the AGLV and AONB in the region around Mabe Parish. Please note that the AGLV shown is only the area within the parish and this protected area extends to the south of Mabe Parish.

Figure 2. Map of AONB and AGLV Around Mabe Parish

1.4 Cumulative impact of onshore wind turbines

As Carmenellis is characterised as having a moderate landscape sensitivity the landscape strategy is for occasional single turbines or small clusters of turbines up to the lower end of Band D (Cornwall Council, 2016). Small clusters of turbines are defined as five or less turbines and Band D turbines are those between 100 and 150m.

1.5 Ecological impact of onshore wind turbines

Wind developments can have large impacts on ecology in both construction and operation. In order to reduce this impact developments should:

- Avoid Special Protection Areas (SPA), Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSI) , National and Local Nature Reserves and County Wildlife Sites particularly for sites which are designated for birds and bats

There are no SPA, SSI, SAC, National Nature Reserves, or Local Nature Reserves in Mabe Parish.

There are four County Wildlife Sites within Mabe Parish which can be seen on figure 3, the habitats and species of these are given in Table 1 below;

Reference	Site Name	BAP Priority Habitats	BAP Priority Species	Other notable species
K51	Lestraines Moor	Purple Moor Grass and Rush Pastures, Lowland Fens and Wet Woodland	Brown long-eared bat and otter	Badger
K52	Halvasso Quarries	Wet Woodland, Purple Moor Grass and Rush Pastures, Lowland Heathland, Lowland Fens		
K25	Bosvathick Wood & Croft Plantation	Upland Oakwood, Lowland Fens and Hedgerows	Bullfinch, song thrush and otter	Amber listed green woodpecker, pipistrelle and badger
K15	Falmouth	Wet Woodland	Common toad, marsh tit, bullfinch, song thrush, herring gull, otter and three bat species including brown long-eared bat	Moss, liverwort, fringed water lily, perfoliate pondweed, badger, ten species of Odonata including black-tailed skimmer, lots of amber listed birds e.g. wigeon, tufted duck, pochard, black-headed gull, kingfisher and willow warbler

Table 1. Table of Habitats and Species Within County Wildlife Sites of Mabe

Based on these exclusion zones the only ecological reason that any of Mabe Parish should be excluded from wind developments subject to developers carrying out the appropriate surveys is the presence of County Wildlife Sites and semi-natural habitats which can be seen together on figure 3 below.

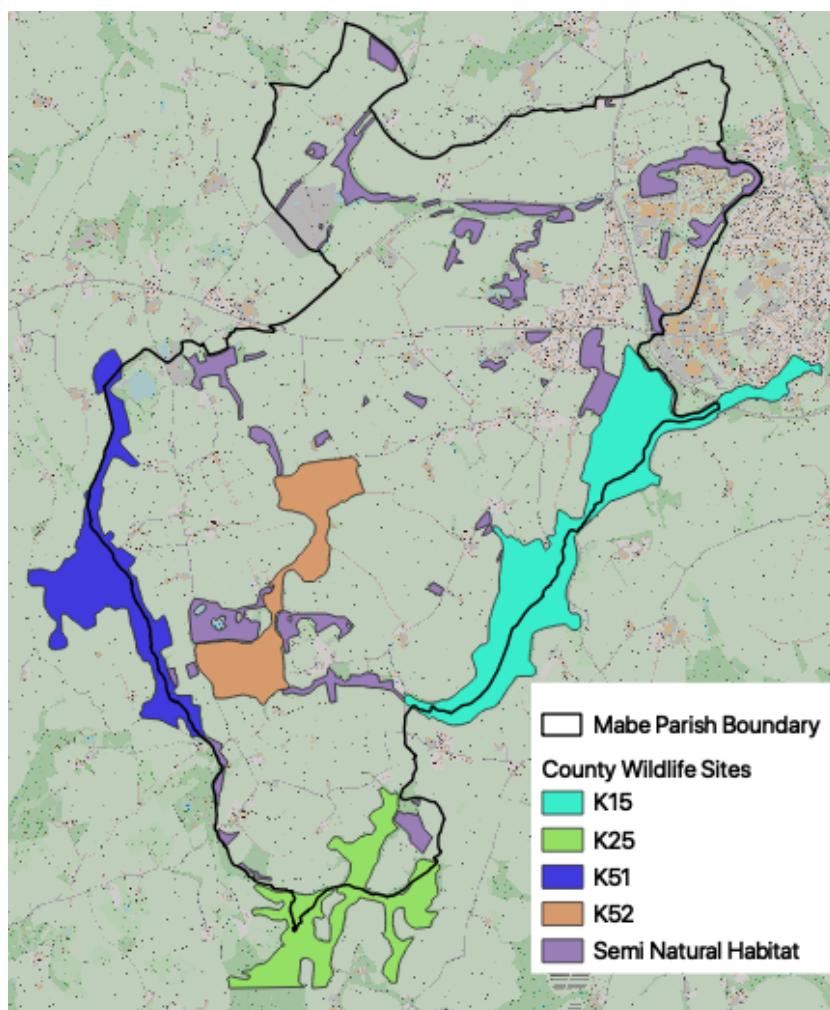


Figure 3. Map of County Wildlife Sites and Semi-natural Habitats Within Mabe Parish

1.6 Summary of Cornwall Council exclusion zones and buffers for onshore wind developments

The following exclusion zones and buffers should be applied to any wind development in Cornwall based on the analysis of Cornwall Renewable Energy Planning Advice.

Exclusion zones
Special Protection Areas (SPA)
Special Areas of Conservation (SAC)
Sites of Special Scientific Interest (SSI)
National and Local Nature Reserves
County Wildlife Sites
World Heritage Sites (WHS)
Conservation Areas

Buffered features	Distance (m)
Hedgerows	50
Electromagnetic links	100 plus blade radius
Roads and Railways	Smaller of height to tip plus 50m or 1.5x turbine height
Buildings, Public Open Spaces, PROW	Height to tip plus 10%

Table 2. Summary of Onshore Wind Exclusion Zones and Buffer Distances

1.7 Suitable regions for wind development in Mabe Parish methodology

Suitable regions for wind projects will depend on the size of the proposed development. For this reason this section is separated into suitable regions for small (around 100kW), medium (around 500kW), large (around 1MW) and very large (around 2MW) turbines. While these categories allow different regions to be mapped it is not a perfect way of grouping turbines. The planning restrictions are dependent on the height of a turbine to its tip. However, turbines of the same rated power can come in a variety of heights due to difference in manufacturer or optimisation for a specific site. The following table gives an idea of the range of tip heights that from a variety of turbine manufacturers.

Name of Turbine	Maximum Power	Available Diameters (m)	Available Hub Heights (m)	Potential Tip Heights (m)
AIR 19/100 (AIR 19/100 - 100 kW - Wind turbine, n.d.)	100 kW	19	25, 45	34.5 - 54.5
Danish Wind Turbines 100 kW (Danish Wind Turbines 100 kW - 100 kW - Wind turbine, n.d.)	100 kW	20.6	18, 24	28.3 - 34.3
ADES ADES 100 (ADES ADES 100 - 100 kW - Wind turbine, n.d.)	100 kW	29	27.5	42
Vestas V39 (Vestas V39 - 500 kW - Wind turbine, n.d.)	500 kW	39	40.5, 53	60 - 72.5
Enercon E-40/5.40 (Enercon E-40/5.40 - 500 kW - Wind turbine, n.d.)	500 kW	40.3	42, 48, 65	62.15 - 85.15
EWT DW 52-500 (EWT DW 52-500 - 500 kW - Wind turbine, n.d.)	500 kW	52	35, 40, 50, 75	61 - 101
Enercon E-58/10.58 (Enercon E-58/10.58 - 1 MW - Wind turbine, n.d.)	1 MW	58.6	59, 67, 70.5, 89	88.3 - 118.3
EWT DW 61-1MW (EWT DW 61-1MW - 1 MW - Wind turbine, n.d.)	1 MW	61	46, 69	76.5 - 99.5
NedWind NW 50/1000 (NedWind NW 50/1000 - 1 MW - Wind turbine, n.d.)	1 MW	52.6	55, 70	81.3 - 96.3
Enercon E-82 E2 (E-82 - 2 MW, n.d.)	2 MW	82	78, 84, 85, 98, 108, 138	119 - 179

Table 3. Table to Show Power and Size of a Variety of Wind Turbines

The lowest possible value of tip height will be used to estimate turbine height for analysis in order to not rule out sites particularly as technology improves and more energy can be extracted from the wind.

For the purposes of this analysis it is assumed that:

- Small turbines have a tip height of 30m and a rotor radius of 10m.
- Medium turbines have a tip height of 60m and a rotor radius of 15m.
- Large turbines have a tip height of 75m and a rotor radius of 25m.
- Very large turbines have a tip height of 120m and a rotor radius of 40m.

Based on the sample of turbine taken above. For very large turbines only the one model has been considered as this is was the turbine chosen by Cornwall Council and the Cornwall LEM project. This project was the first onshore wind turbine installed in Cornwall in five years.

In addition to the exclusion zones shown in section of planning considerations the following buffers should be applied:

Buffer	Small Turbine	Medium Turbine	Large Turbine	Very Large Turbine
Hedgerows (m)	50	50	50	50
Electromagnetic links (m)	110	115	125	140
Roads and Railways (m)	45	90	112.5	170
Buildings, Public Open Spaces, PROW (m)	33	66	82.5	132

Table 4. Table of Buffers for Turbines of Different Size

However, these buffers and exclusion zones do not fully reflect all the unsuitable regions as set out in the planning advice document. For example there are noise restrictions which dictate appropriate noise limits at sensitive locations. These limits are affected by a number of variables such as model of wind turbine and background noise level and therefore Cornwall Council cannot simply provide a buffer distance to site turbines from residential properties.

The Centre for Sustainable Energy provide some guidance on mapping suitable regions for onshore wind developments in neighbourhood plans. This guidance provides some further buffer and likely exclusion zones for onshore wind projects. This guidance is summarised in the tables below:

Based on the guidance above the additional buffers of 4 times rotor diameter from residential properties and tip height plus 10% for powerlines are thought to be appropriate for mapping wind projects in Mabe Parish. In addition to these buffers inland waterways will also be excluded from regions for wind developments.

Buffer	Small Turbine	Medium Turbine	Large Turbine	Very Large Turbine
Residential Properties (m)	80	120	200	320
Powerlines (m)	33	66	82.5	132

Table 5. Table of Suggested Buffers Based on CSE Guidance

1.8 Maps of suitable regions for wind developments in Mabe Parish

Based on the methodology shown and assumptions made the following map (figure 4) has been created to show appropriate regions for wind developments in Mabe Parish. Please note that these maps do not take into account hedgerows to reduce busyness of the map. In addition to these buffers developers should take care to ensure any proposal does not alter the character of the AGLV in the south of the Parish as shown in figure 2.

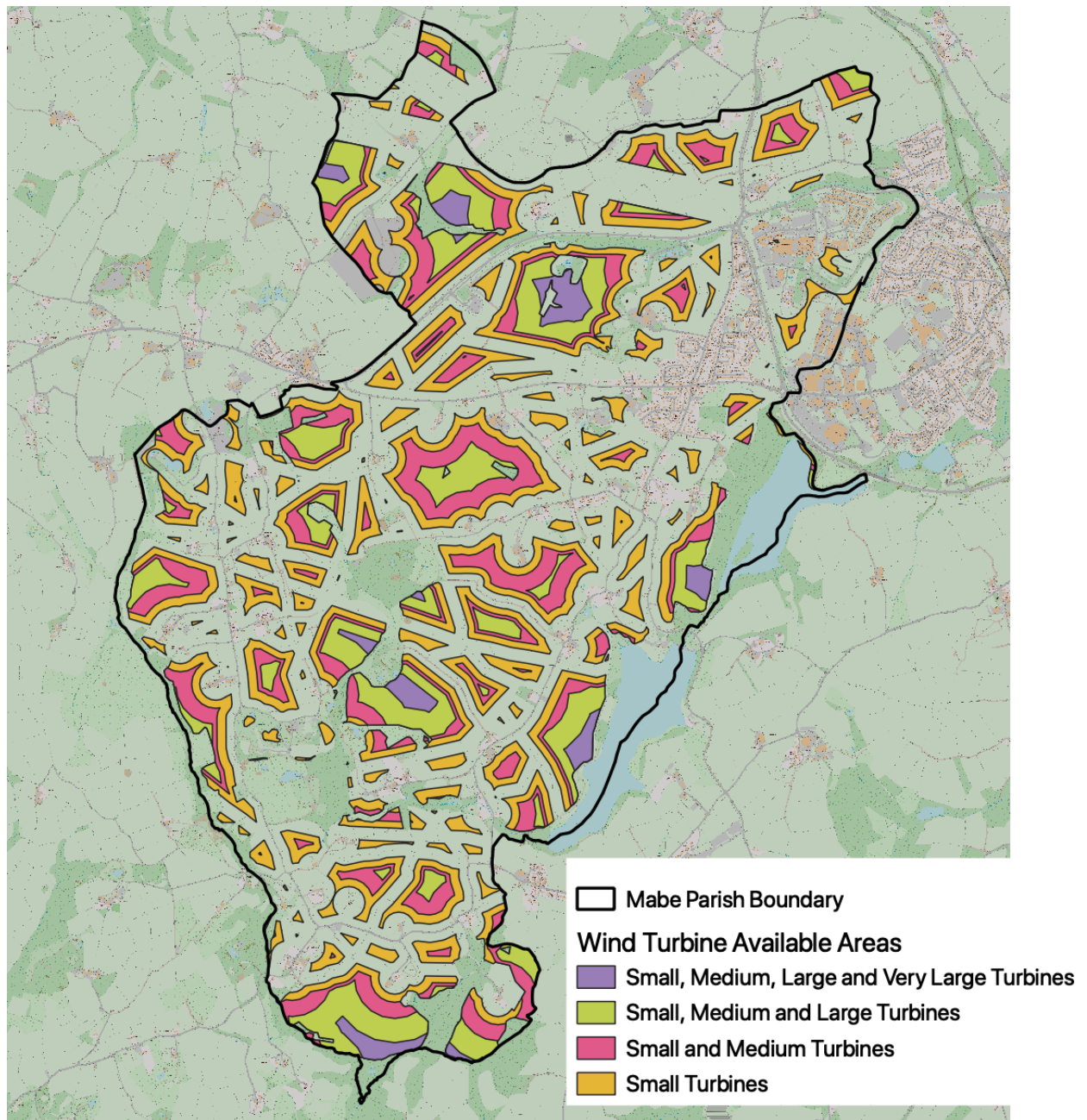


Figure 4. Map of Suitable Area for Wind Turbines of Varying Size in Mabe Parish

2. Solar Farm Feasibility in Mabe Parish

2.1 Landscape Sensitivity to Solar Farms in Mabe Parish

In annex 1 of the planning advice Carmenellis is characterised as having a moderate-high sensitivity to solar projects with greater sensitivity in areas of rough ground. The landscape strategy for this LCA is to have “occasional Band B and Band C size solar PV developments located in sheltered folds in the landscape” (Cornwall Council, 2016). The size of the bands can be seen in table 6 below:

Bands of Development for Solar PV	Area of land
A	<1 ha (2.5 acres)
B	1 – 5 ha (2.5 – 12.4 acres)
C	5 – 10 ha (12.4 – 25 acres)
D	10 – 15 ha (25 – 37 acres)

Table 6. Maximum Size of Solar Developments Based on Cornwall Council Bands

This means that Mabe Parish is suitable for developments between 1 and 10 ha provided they are “occasional”.

2.2 Historic landscape considerations for solar developments in Mabe Parish

Historic landscape – Solar developments should not be sited within Historic Landscape Classification (HLC) Types ‘Upland Rough Ground’, ‘Coastal Rough Ground’, ‘Prehistoric Enclosures’ and ‘Ornamental’ or areas with significant medieval remains. As can be seen in figure 5, Mabe does not contain any of these excluded HLCs.

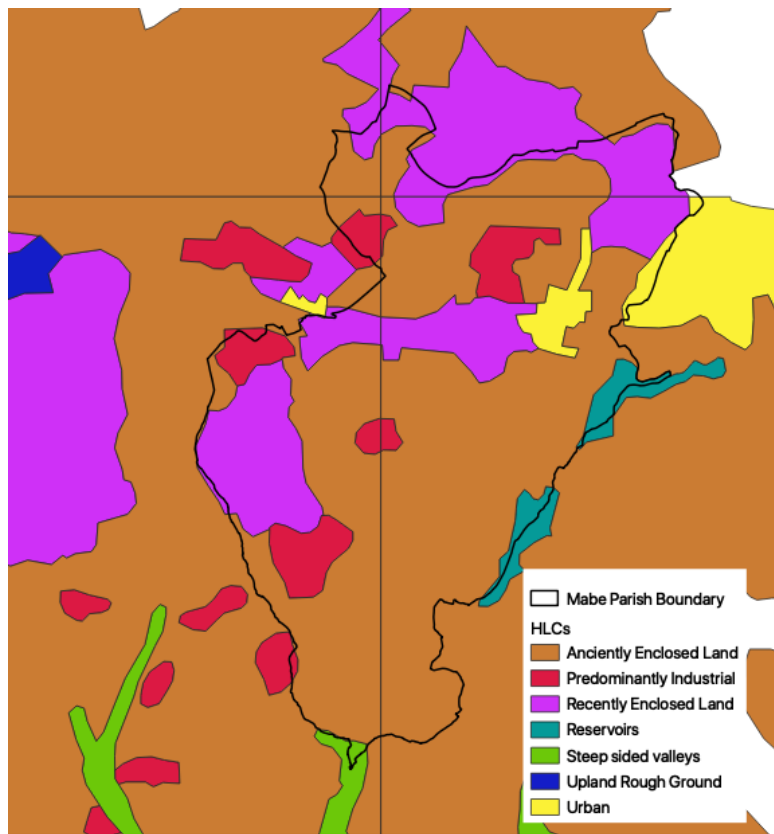


Figure 5. Historic Landscape Classifications of Mabe Parish

2.3 Agricultural Landscape Classification considerations for solar developments in Mabe Parish

Priority for solar farms should be given to land with the low environmental or other use value, for example brownfield sites or derelict land. In the case of agricultural land the following process should be followed:

1. Agricultural Land Classifications 1 – 3a (highest quality land) should be avoided for solar projects. If grade 3b land is proposed alternative locations should be considered with lower agricultural and environmental value
2. If development on grades 1 – 3b is unavoidable the proposal should be justified with very strong evidence including:
 - An explanation of why using this land is necessary.
 - Detail on the effect of the development on the regions agricultural land of the same grade.
 - If the proposal is located within a farm, detail on the farms agricultural potential once the solar project is operational. If the development will provide energy to the farm this should be considered in the application.
 - Cumulative impact assessment of the proposal and other large solar developments on agricultural land supply with the same grade in the region.
3. It may be possible to include small sections of the high grade land where its inclusion makes the project viable

The majority of Mabe Parish is made up of Grade 3 agricultural land with some Grade 4 and a very small area of Urban. Unfortunately this data source does not distinguish between Grade 3a and 3b land, however we can say that all else being equal the Grade 4 land should be prioritised for solar projects.

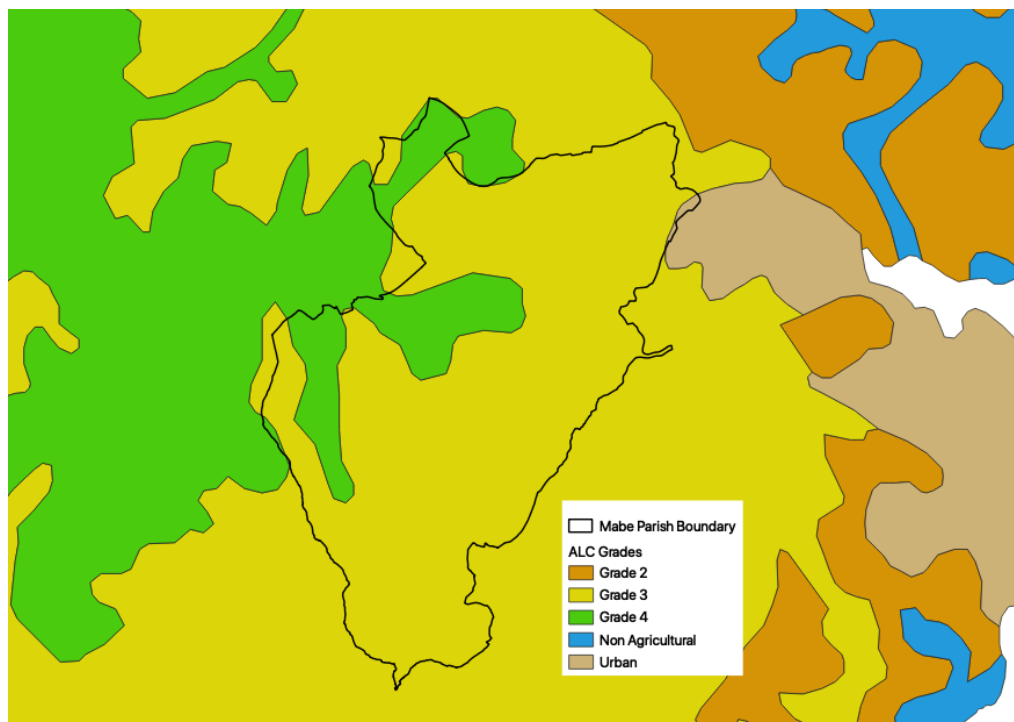


Figure 6. Map showing Agricultural Land Classifications for Mabe Parish

2.4 Suitable Regions for Solar Projects Within Mabe Parish

The Cornwall Council guidance for solar farms is less restrictive than that for wind turbines. This is due to a number of reasons, in particular solar projects are generally quieter, have a smaller area of visual impact and have no risk of toppling so avoid the safety buffers for PROW and infrastructure that wind turbines face. Solar projects should avoid Semi-natural habitats, Special Areas of Conservation (SAV), Special Protection Areas (SPA), National and Local Nature Reserves, Sites of Special Scientific Interest (SSI) and County Wildlife Sites. The only buffer zones given in the guidance are that a solar farm should be at least 5m from a river or 8m from a main river (of which there are none in Mabe Parish). Due to this unrestrictive guidance it has been decided to leave as much of the Parish open to solar developments provided that the Cornwall Council guidance is followed. In addition to the buffers mentioned it was decided that a 20m buffer around any residential properties as a minimum was sensible. Figure 7 shows all the constraints applied to obtain the region suitable for solar projects.

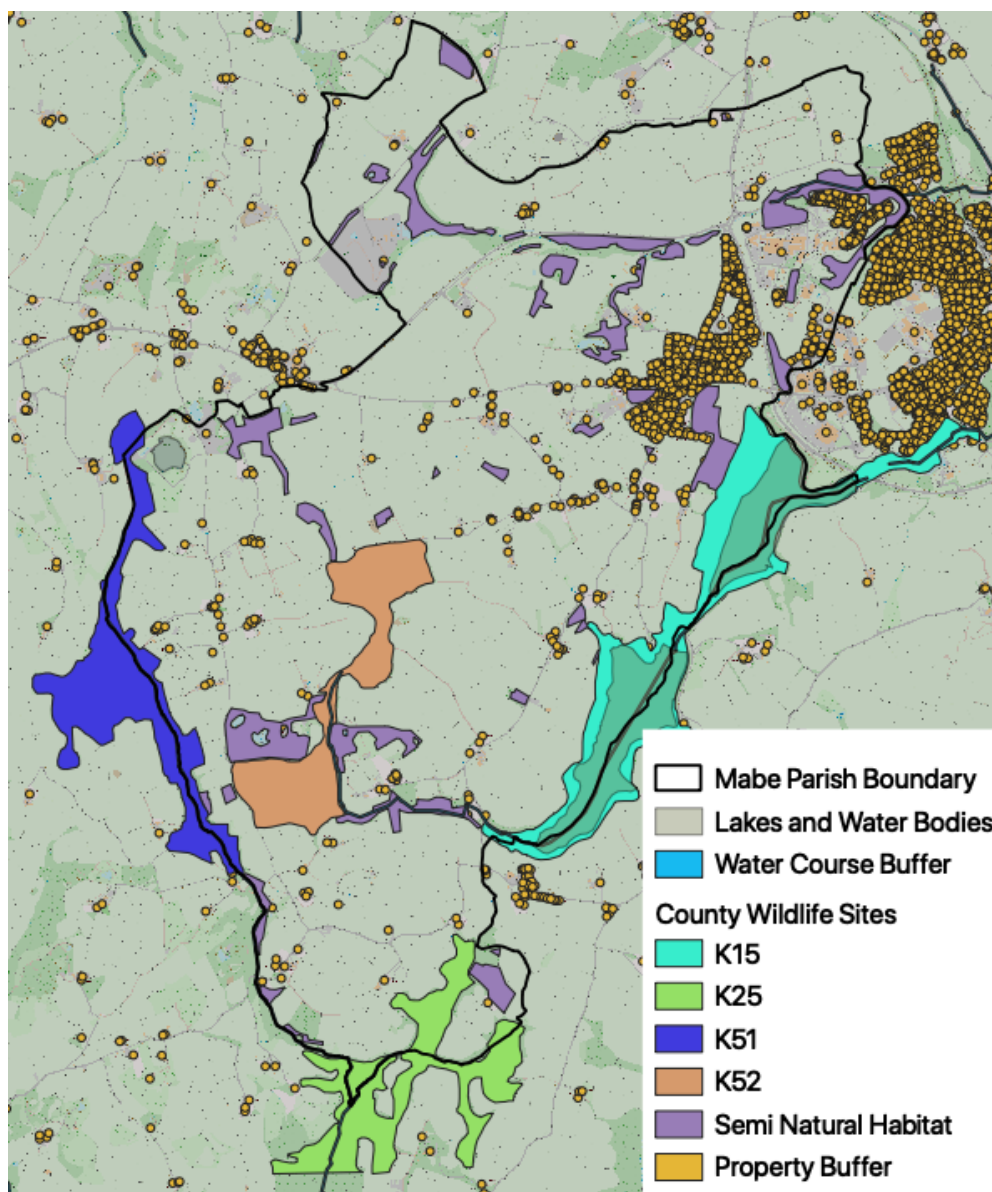


Figure 7. Map of Solar Development Constraints Within Mabe Parish

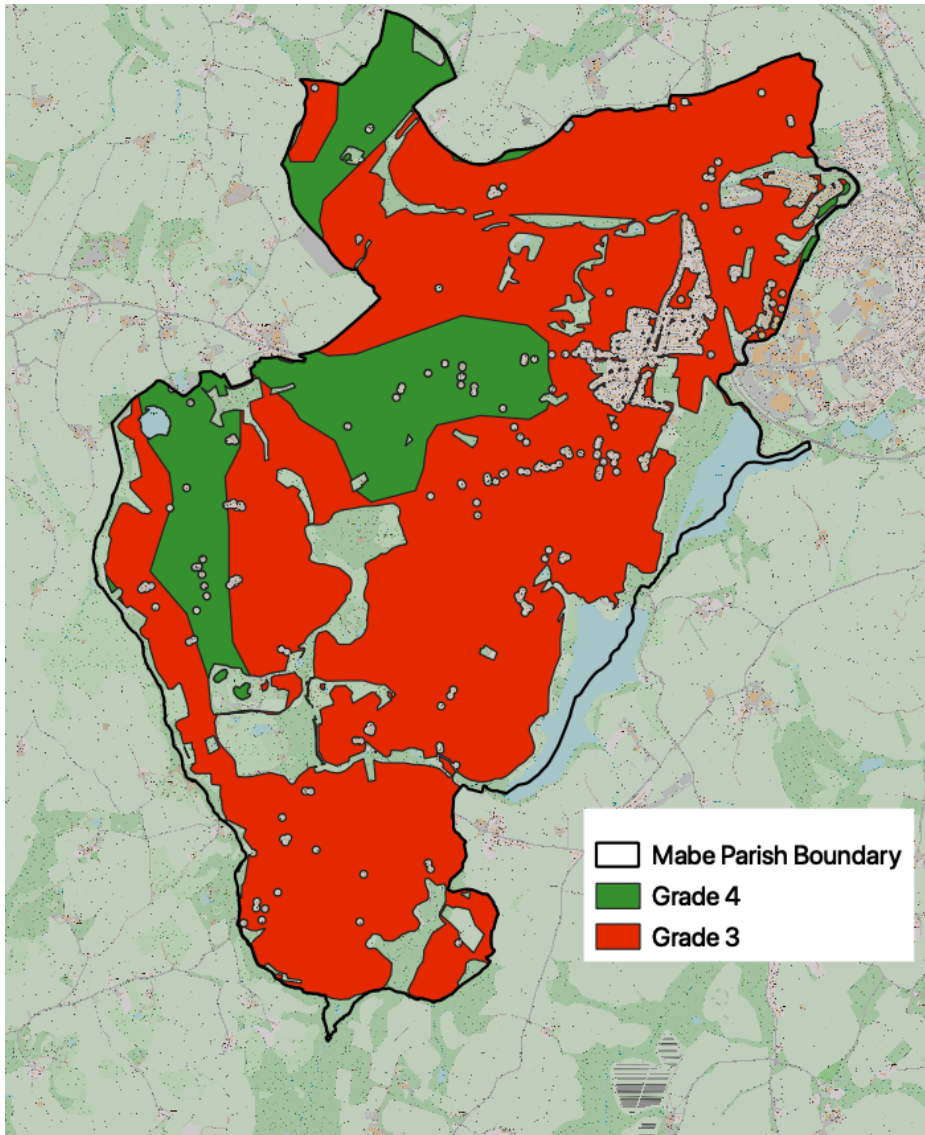


Figure 8 shows the available land for solar separated into Agricultural Land Classifications. Grade 4 land will be more likely to receive planning permission for solar projects due to a less arduous application process as set out in the Use of Land section of the planning considerations.

Figure 8. Map of Available Land for Solar Developments in Mabe Parish Separated into Agricultural Land Classifications

3. Public EV Charge Port Feasibility in Mabe Parish

Four locations in Mabe have been analysed initially for potential public EV charge ports. These are:

1. Mabe Primary School Car Park
2. B&Q Car Park
3. The New Inn Car Par
4. Mabe Community Hall Car Park

The main considerations in siting a charge port in Mabe Parish are:

1. Will the charge port be used enough to make it economically viable?
2. Is the grid connection likely to be problematic?

Analysis into usage projections is outside the scope of this project. However, the four sites have been selected as areas which receive significant traffic or are conveniently located for EV users. The approximate location of these sites can be seen on figure 9 below.

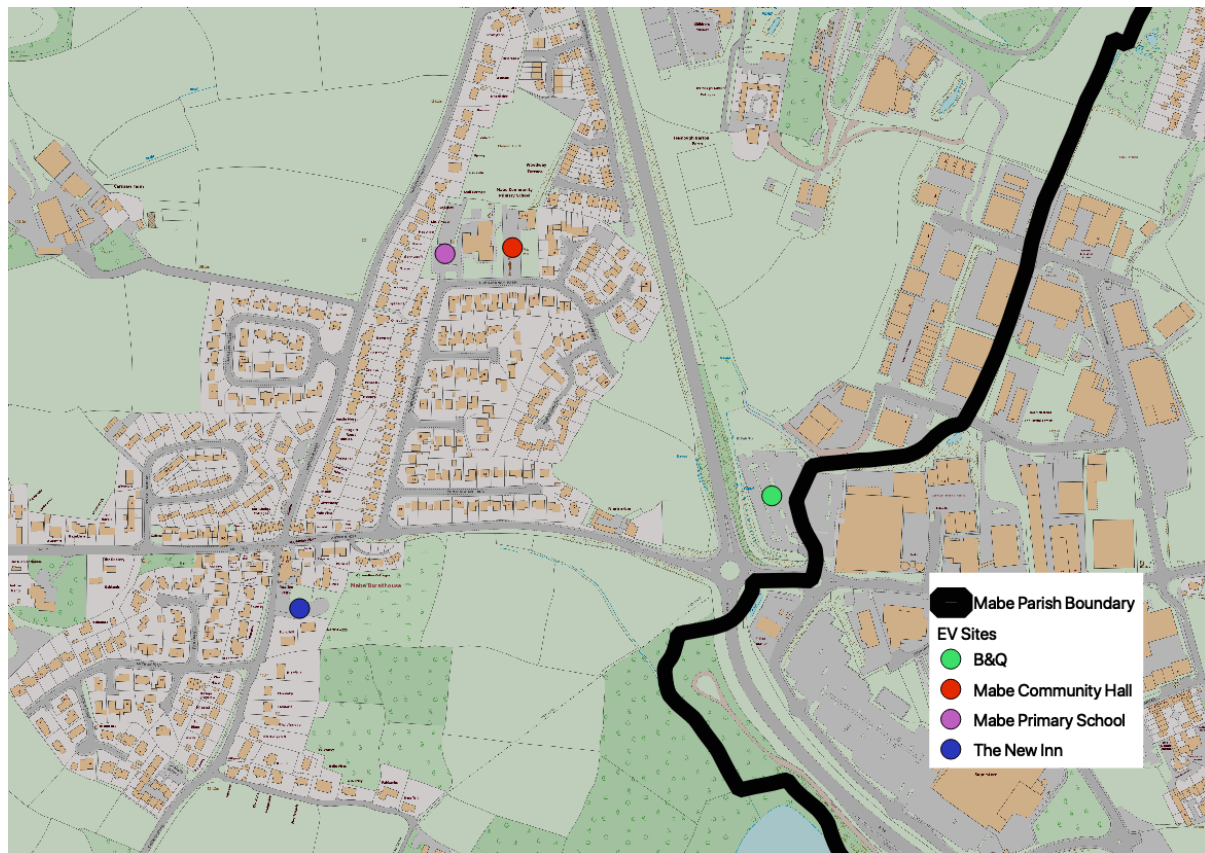


Figure 9. Map of Sites Considered for Public EV Charge Ports

3.1 Mabe Primary School

This could be an interesting opportunity as we may see more schools invest in EV charging infrastructure in order to generate a revenue stream. This would require some changes to the current set up which sees the school gates locked outside of school opening hours. The majority of EV charger usage is likely to be from either staff during the day or Mabe residents who live locally and have issues charging at home during the evening/overnight. However, there are no transformers nearby and the supply to the school is categorised as service signifying low power availability. Based on this map from WPD shown in figure 10 the costs of grid connection for any EV chargers with a high power are likely to be fairly high.

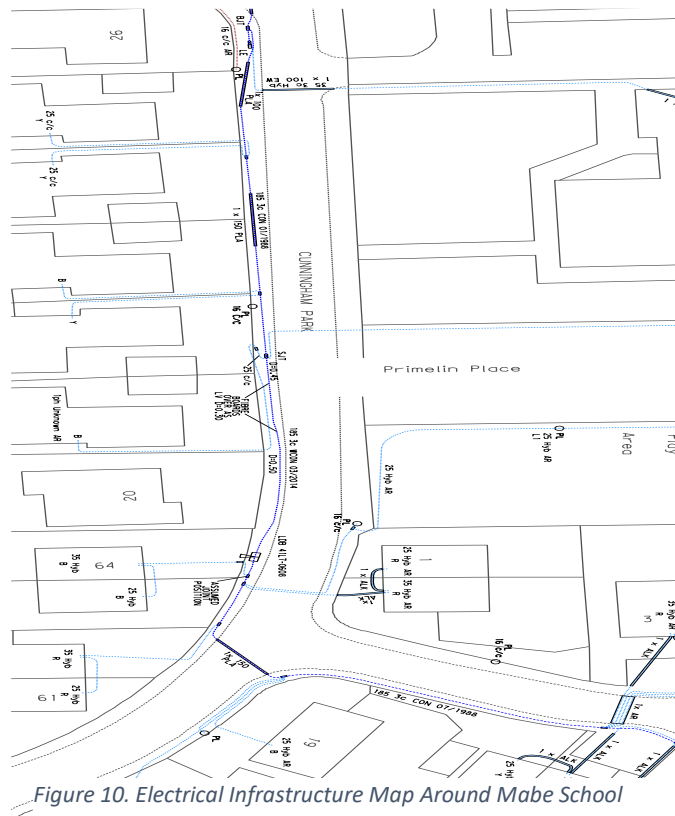


Figure 10. Electrical Infrastructure Map Around Mabe School

3.2 B&Q Car Park

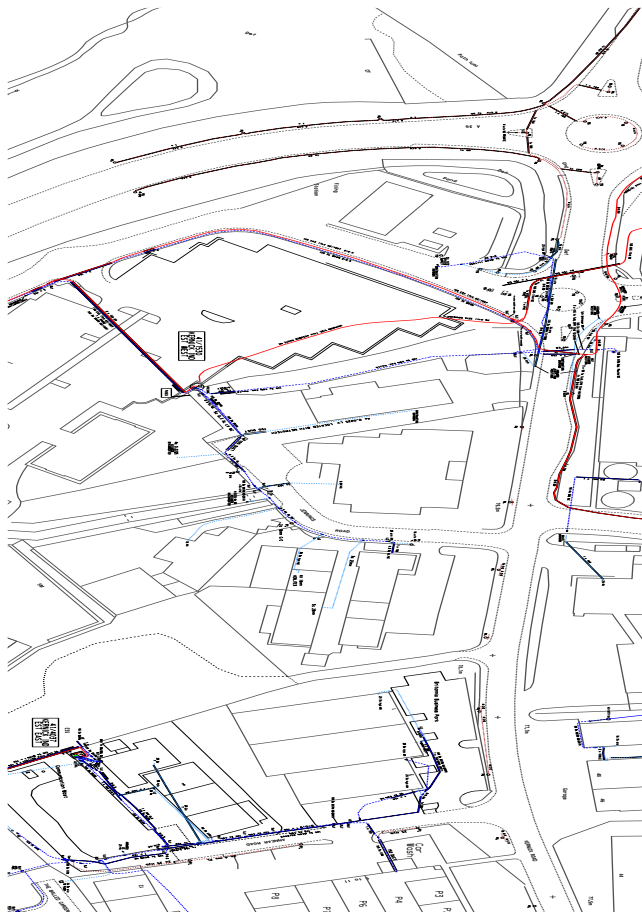


Figure 11. Electrical Infrastructure Map Around B&Q Car Park

EV charging at supermarkets or shops is typically a short charging window due to only charging while the EV owner is doing their shopping. For this reason chargers need a high power rating to make it worthwhile for consumers to bother charging their vehicles here. As shown on figure 11 the main supply to B&Q comes in the back of the store and there are no transformers in the car park. This is likely to result in high costs of installing EV chargers with significant power. The Asda car park appears to be more accommodating for EV charge ports, however this falls outside of Mabe Parish.

3.3 The New Inn Car Park

The New Inn is the only Pub situated in Mabe village it has been considered here as a potential site for EV charge ports due to its central location and parking facility which is large for Mabe. As can be seen in figure 12 the New Inn has limited access to significant power and is situated quite far from the nearest transformer.



Figure 12. Electrical Infrastructure Map Around The New Inn

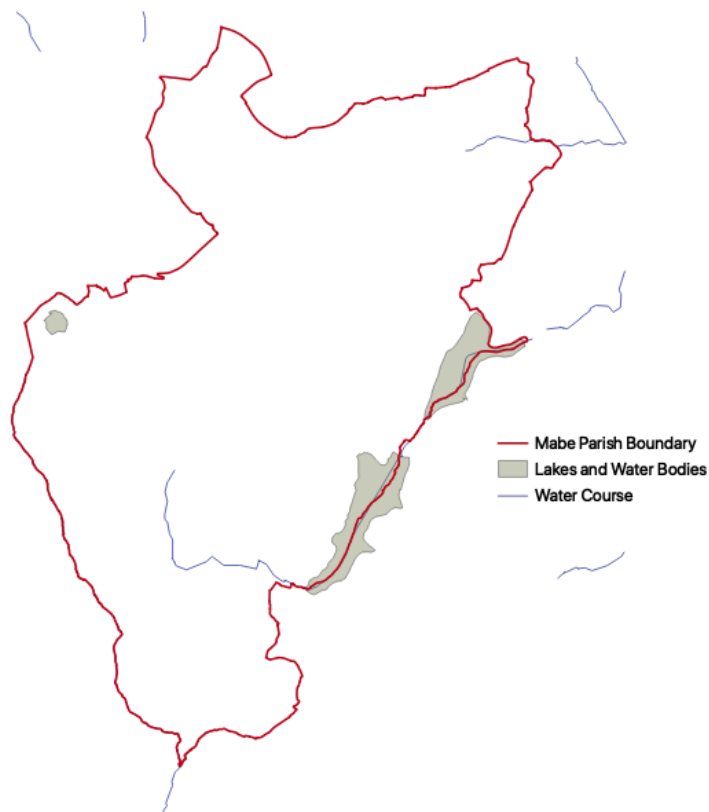


Figure 14. Map of Rivers and Water Bodies Mabe Parish

The Parish does however have one notable opportunity in the College Reservoir / Argal Lake region which can be seen on the map above as the two water bodies on the Eastern side of Mabe Parish. These regions of water are controlled and operated by South West Water, who are the water and wastewater service provider for Cornwall, Devon and parts of Somerset and Dorset. This presents an opportunity due to the difference in height between the two water bodies creating potential for funnelling of the flow through a pipe. The gravitational potential energy of the water is converted into kinetic energy as it flows through the pipe which can be used to turn a small turbine and generate electricity. This potential could be harnessed in a number of ways:

1. As a pure hydroelectric scheme generating electricity.
2. As an energy storage facility – using pumped hydro.
3. As a combination of traditional hydroelectric and pumped hydro.

Which option is best for this specific location is dependent on a variety of factors including the requirements of the local region and the budget available for a project.

4.1 Visual impact of a hydro development in Mabe Parish

Key views from important viewpoints, are of particular relevance. Areas of Outstanding Natural Beauty (AONB) and Areas of Great Landscape Value (AGLV) should generally be avoided however planning approval can still be received if these impacts have been properly considered. There are no AONB in Mabe Parish and as can be seen on the map below the only AGLV is located in the South of the Parish so would not impact a hydropower scheme between the two water bodies.

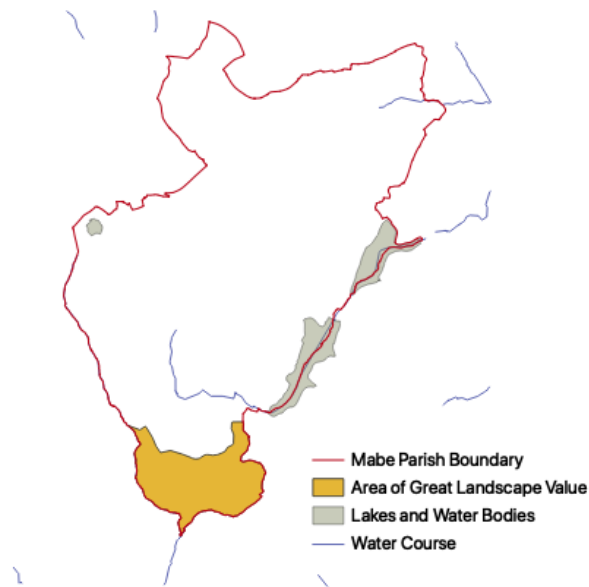


Figure 15. Map of AGLV in Relation to the Rivers and Water Bodies of Mabe

4.2 Ecological considerations for a hydro development in Mabe Parish

There are no Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) or National and Local Nature Reserves within Mabe Parish.

However, there are some areas which are designated as County Wildlife Sites including the area of Argal Lake and College Reservoir as shown in figure 16 below.

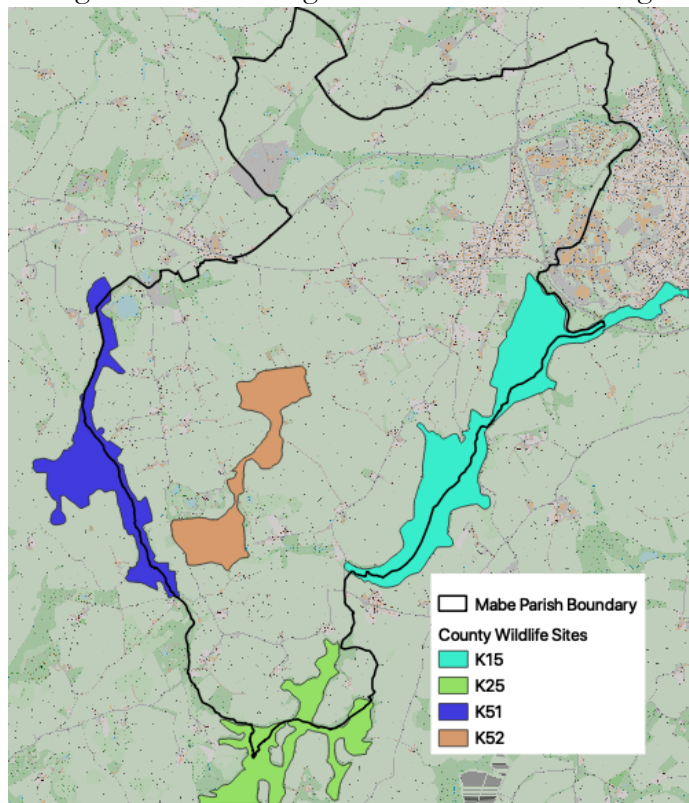


Figure 16. County Wildlife Sites of Mabe Parish

Further liaison with Cornwall Council is required to determine whether this will mean a hydropower scheme could ever be granted permission in this location. All other requirements will need to be evidenced as considered by a developer. Particularly as K15 – Falmouth Reservoirs is the habitat of many significant species (see table 1).

4.3 Historic environment considerations for a hydro development in Mabe Parish

In the map below the closest historic monuments can be seen with the five nearest the site labelled for further examination.



Figure 17. Map of Historic Features Near Argal Dam

1. Argal Post Medieval Corn Mill – The mill at Argal is recorded on the Tithe map of 1840 and now lies beneath Argal Reservoir.
2. Little Argal - Medieval field system / Post Medieval field system. A number of bank and ditched field boundaries are visible as cropmarks on vertical aerial photographs in fields between Little Argal, Argal Villa and Lamanver. These features appear to generally fit into the modern field pattern and are therefore considered likely to be medieval or later in date.
3. Argal Medieval Settlement - The settlement of Argal does not appear to be recorded in the medieval period, but may be of this date.
4. College Reservoir – This site is a Bronze Age findspot. A bronze "celt" was found at Jago's croft in the stump of a tree during construction of a reservoir, and exhibited in 1867 at the ric museum, Truro. Its present location is unknown.
5. Chynoweth Medieval settlement - The settlement of Chynoweth is first recorded in 1526.

In addition to these historic monuments to consider, the settlement located around historic monument 3 (Argal Medieval Settlement) is a grade 2 listed building, Argal Manor House.

The guidance does not set out suitable distances from historic monuments, just that both the physical and visual impacts on the monuments should be managed and avoided. For this reason it is assumed that these historic features would not prevent a hydropower scheme as long as the developer can evidence consideration of the monuments.

The proposed site is not within a conservation area or near any World Heritage Sites.

4.4 Noise considerations for a hydro development in Mabe Parish

Where possible the turbine of the hydropower facility should be located within a turbine housing which reduces noise emissions to an acceptable level.

As can be seen in the map below there are a number of residential properties within 500m of the proposed site, however only one within 200m. The detail required for a noise assessment depends on the likely flow of the waterway. In order to estimate this resource assessment data must be provided by South West Water.

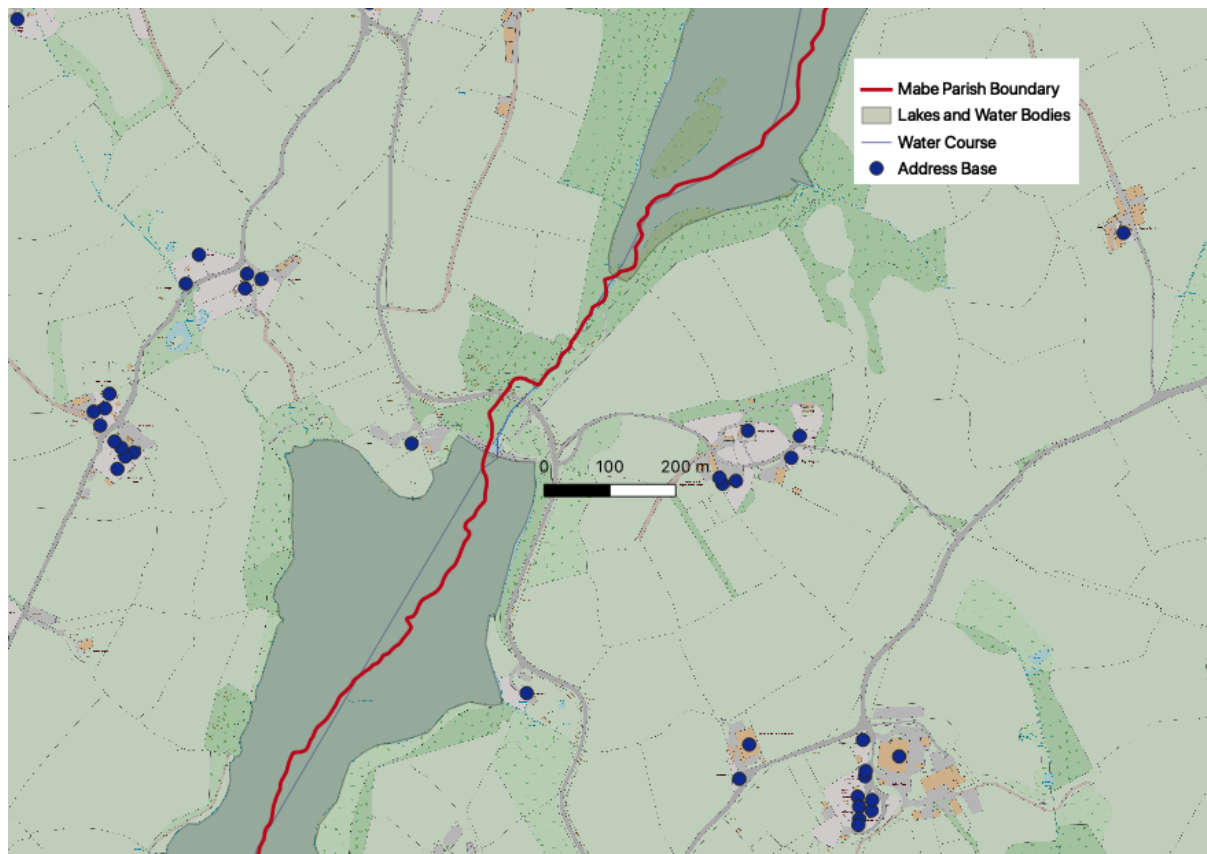


Figure 18. Map of Residential Properties Near Argal Dam

5. Suggested Renewable Energy Policies for Mabe Parish

1. Mabe NDP supports the efficient use of natural resources within the Parish and encourages re-use and re-cycling of resources. It also supports the production and consumption of renewable energy through:

- a) The adoption of technologies which lead to low and zero carbon energy production within the parish;
- b) Community led initiatives e.g. for joint heating projects and energy production;
- c) Encouraging the reduction in energy consumption within the parish whether that be electrical or thermal.

Provided that the scale of all projects are appropriate to the character of the area and provided that the natural beauty of the parish be conserved

2. Solar - Mabe NDP supports the use of roof mounted solar where projects are considered permitted development or applications meet planning tests set out by Cornwall Council. Ground mounted solar will be supported as long as proposals pass Cornwall Council planning tests and are sited within the regions set out as suitable for Solar Development. Projects should not exceed 10 hectares and should only be sited “occasionally” throughout the parish.

3. Wind - Energy production using wind power is supported by the NDP provided that turbines are sited appropriately in the region set out in the maps as suitable for wind energy production for the size of turbine. Clustering and repowering of existing turbine sites is supported as this is likely to have to the lowest impact on residents of Mabe Parish.

4. Low Carbon Heat - New developments within the parish are expected to incorporate a low carbon heat system where feasibly possible. Applications for planning approval will be regarded favourably for developments with a high proportion of heat coming from low carbon sources. Residents are encouraged to explore retrofitting low carbon heat options where possible.

5. Hydropower - Hydro energy generation is supported within Mabe Parish provided developments are consistent with guidance in Cornwall Renewable Energy Planning Advice.

6. Energy Efficiency - Efficiency improvements are of high importance and the NDP supports both retrofitting existing properties and the development of highly efficient new builds. Efficiency may be achieved through high levels of insulation, exploiting passivhaus techniques, energy efficient products or new innovations.

7. Electric Vehicle Charging – Mabe Parish supports the installation of public and private electric vehicle chargers. Public charge ports should be sited where there is sufficient demand.

All developments should follow Cornwall Council Renewable Energy Advice and the National Planning Policy Framework.

6. Conclusions

There is significant potential for deployment of renewable energy technologies in Mabe Parish. Mabe parish has a strong wind resource and some of the best solar resource in the UK. Argal Reservoir provides potential for a hydropower scheme on the border of Mabe and Budock parish, this should be investigated further in order to ascertain economic viability and likelihood of planning consent. There is unlikely to be significant demand for public EV charging infrastructure in this area with the majority of properties having off street parking. Furthermore, Mabe Parish has a significant amount of through traffic where EV owners want to stop briefly to recharge making it unlikely rapid and ultra-rapid chargers will be financially viable. However, there could be some interest in community owned electric vehicles for shared use, viability into this should be pursued further and locations for a scheme like this considered.

Abbreviations:

National Planning Policy Framework – NPPF
 Neighbourhood Development Plan – NDP
 Areas of Outstanding Natural Beauty – AONB
 Areas of Great Landscape Value - AGLV
 Sites of Special Scientific Interest – SSSI
 Special Areas of Conservation – SAC
 Landscape Character Area - LCA
 Public Rights of Way - PROW
 Over-head Line - OHL

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