



**Havering**  
LONDON BOROUGH

**CABINET MEETING  
19<sup>th</sup> JULY 2017**

**HAVERING LOCAL PLAN  
WIND RESOURCE EVIDENCE BASE 2016**

wardell-armstrong.com

ENERGY AND CLIMATE CHANGE  
ENVIRONMENT AND SUSTAINABILITY  
INFRASTRUCTURE AND UTILITIES  
LAND AND PROPERTY  
MINING AND MINERAL PROCESSING  
MINERAL ESTATES  
WASTE RESOURCE MANAGEMENT



**LONDON BOROUGH OF HAVERING**

**LOCAL PLAN WIND RESOURCE EVIDENCE BASE**

**SEPTEMBER 2016**

*your earth our world*



**Wardell Armstrong**

Baldhu House, Wheal Jane Earth Science Park, Baldhu, Truro, Cornwall, TR3 6EH, United Kingdom  
Telephone: +44 (0)1872 560738 Fax: +44 (0)1872 561079 www.wardell-armstrong.com



**DATE ISSUED:** 14<sup>th</sup> September 2016  
**JOB NUMBER:** PE10658  
**REPORT NUMBER:** REN/829  
**VERSION:** V0.2  
**STATUS:** FINAL

**LONDON BOROUGH OF HAVERING**

**LOCAL PLAN WIND RESOURCE EVIDENCE BASE**

**SEPTEMBER 2016**

**PREPARED BY:**

Sam Clarke Senior Renewable Energy  
Consultant

**REVIEWED BY:**

Paul Evans Technical Director

**APPROVED BY:**

Haydn Scholes Regional Director

*This report has been prepared by Wardell Armstrong LLP with all reasonable skill, care and diligence, within the terms of the Contract with the Client. The report is confidential to the Client and Wardell Armstrong LLP accepts no responsibility of whatever nature to third parties to whom this report may be made known.*

*No part of this document may be reproduced without the prior written approval of Wardell Armstrong LLP.*



Wardell Armstrong is the trading name of Wardell Armstrong LLP, Registered in England No. OC307138.

Registered office: Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom

UK Offices: Stoke-on-Trent, Cardiff, Carlisle, Edinburgh, Greater Manchester, London, Newcastle upon Tyne, Sheffield, Taunton, Truro, West Bromwich. International Offices: Almaty, Moscow

ENERGY AND CLIMATE CHANGE  
ENVIRONMENT AND SUSTAINABILITY  
INFRASTRUCTURE AND UTILITIES  
LAND AND PROPERTY  
MINING AND MINERAL PROCESSING  
MINERAL ESTATES  
WASTE RESOURCE MANAGEMENT

## CONTENTS

1	INTRODUCTION.....	1
2	METHODOLOGY .....	1
3	RESULTS.....	6
4	CONCLUSION.....	8
5	RECOMMENDATION .....	8

## TABLE OF TABLES

Table 2.1: Definitions for Wind Turbine Scales and Indicative Candidate Wind Turbines.....	2
Table 2.2: Wind Turbine Constraints .....	2
Table 2.3: Environmental Constraints .....	5
Table 3.1: Potential Number of Wind Turbines and Indicative Installed Capacity.....	7

## FIGURES

Figure 1: Radar
Figure 2: Wind Resource Areas
Figure 3: Small Scale
Figure 4: Medium Scale
Figure 5: Large Scale
Figure 6: Key

## 1 INTRODUCTION

Wardell Armstrong (WA) have been commissioned to prepare a Wind Energy Assessment for the London Borough of Havering. This commission is in response to the Written Ministerial Statement (HCWS42) on the 18th June 2015 and the subsequent amendments to the Planning Practice Guidance which state:

*“When determining planning applications for wind energy development involving one or more wind turbines, local planning authorities should only grant planning permission if: – the development site is in an area identified as suitable for wind energy development in a Local or Neighbourhood Plan; and – following consultation, it can be demonstrated that the planning impacts identified by affected local communities have been fully addressed and therefore the proposal has their backing.”*

This Wind Energy Assessment has identified areas within the London Borough of Havering which are potentially suitable for the development of three different scales of wind turbine based on a Geographical Information system analysis of physical, environmental and planning constraints. These areas will form a key part of the evidence base for the Borough’s emerging Local Plan and will help the Council to designate suitable areas for wind energy development in the Plan. The areas identified will not constitute areas of permitted development and will still require full planning approval subject to suitable environmental assessment, public engagement and support.

## 2 METHODOLOGY

This assessment seeks to identify areas within the London Borough of Havering which are suitable for the development of wind power. The Borough is diverse in current land use and therefore suitability of various scales of wind turbine needs to be recognised. Constraints for different scales of wind turbine vary greatly and therefore this assessment has sought to identify suitable areas for development of three scales of wind turbine which have been termed Small, Medium and Large.

The wind speeds for the London Borough of Havering are generally quite low at around 6m/s on average at a reference height of 45m above ground level. This will necessitate a

class 2 or 3 turbine which is geared toward lower wind speeds. Generally, this means that turbines will be larger in both rotor diameter and hub height for their respective power output. The three scales of turbine considered are defined below in Table 2.1 in terms of their dimensions and approximate output.

	<b>Rotor Diameter (m)</b>	<b>Hub Height (m)</b>	<b>Tip Height (m)</b>	<b>Power Output (MW)</b>	<b>Representative Turbine</b>
<b>Small</b>	33	43	59	<0.3	KWT300 IEC 61400 Class IIIA
<b>Medium</b>	54	50	77	<0.9	EWT900 IEC 61400 Class IIIA
<b>Large</b>	80	60	100	<1.8	Leitwind LTW80 Class IIA

Larger turbines necessitate larger separation distances from sensitive receptors (constraint offsets) and therefore it was important to limit the maximum size of the turbine in order to ensure at least some turbines at the large scale could still be accommodated within the Borough. Mapping the constraints allowed the maximum size of large turbines to be determined at about 100m to tip. The Medium and Small cut offs for turbines have been selected based on the availability of turbines. Some of the constraints used to define areas for wind turbine suitability are shown in Table 2.2 below. These constraints have been given offsets or minimum distances where the development of turbines would not usually be proposed. These offsets are applied to the constraints giving a good graphical illustration of where suitable scales of wind turbines may or may not be implemented.

<b>Constraint</b>	<b>Small Turbines</b>	<b>Medium Turbines</b>	<b>Large Turbines</b>
	<b>Additional Offsets Applied (m)</b>		
Residential Properties & Schools	300	500	700
Commercial Properties	200	200	200
Farm Properties	200	200	200
Hedges	50	50	50
Woodland & Tree Belts	60	60	60
Railway	76	83.6	110
Roads	76	83.6	110
Electrical Transmission Grid	76	83.6	110
River, streams and other water bodies	25	25	25
Listed Building Grade 1	500	700	900
Listed Building Grade 2*	400	600	800
Listed Building Grade 2	300	500	700

The assessment for each scale of wind turbine was started from a GIS layer comprising the London Borough of Havering boundary. This polygon was then constrained to identify suitable areas in which each scale of wind turbines could be deployed. There are many combinations of turbine hub height and blade diameter which may reduce or increase the offsets distance selected for this study. The areas identified within this evidence base can only be used to help understand where suitable applications for wind turbines might be brought forward. Applications for wind turbines close to the areas identified might also be suitable, especially where they are smaller than the candidate turbines selected for this study.

### **Residential Properties & Schools**

Residential properties and Schools are noise sensitive receptors and therefore offsets were created around non-commercial addresses as identified in the Ordnance Survey's AddressBase layer to exclude areas that would otherwise generate noise in excess of background levels at residential receptors. The offset distances have been selected based on WA's experience of modelling noise levels for these scales of turbine and comparison with likely background noise levels in the Borough. The offsets selected are expected to be a good approximation, however the actual offset required for a planning application will need to be confirmed and will depend on the results of specific background noise monitoring and turbine modelling.

### **Commercial Properties and Farms**

Noise from wind turbines also has the potential to impact people while at work however background noise levels are generally much higher in these locations and the noise from turbines is masked. Farms which host residential properties could have financial involvement in wind turbine developments and as such tolerate higher noise levels. To show consideration to occupants of commercial properties and farms, without overly restricting potential development areas, an offset of 200m has been selected for all scales of turbine development. Actual offsets required will depend on specific noise assessments and financial involvement.

### **Hedges, Tree Belts & Woodland**

Natural England has issued guidance for wind turbines regarding their proximity to hedges / tree belts and woodlands. Bat activity (including commuting and foraging) has been seen to decline significantly at distance of 50m or less. Natural England's advice is to ensure that

wind turbines blade tips cannot intrude within a 50m offset from hedges / tree belts and woodlands. The corresponding ground level offset is a function of the turbine tower height and rotor diameter. Based on the selected candidate turbines for each scale of development, the offsets at ground level to the turbine centres from these features would need to be 53m (Small turbines), 59m (Medium turbines) and 69m (Large turbines), assuming a hedge height of 2.5m. For trees these buffers would need to be 58m, 65m and 75m respectively, assuming a tree height of 10m. These distances would vary depending on the combinations of turbine geometry and tree / hedgerow height. Because of this and for simplicity a relatively small offset of 50m for hedges and 60m for trees has been selected as an approximation of what will be required by Natural England.

### **Roads, Railway and Electrical Transmission Grid**

The safety record for wind turbines is excellent however the highways agency, local authority highways departments, Network rail, National Grid and regional Electricity Distribution Network Operators would as a minimum require topple offsets from existing and planned infrastructure of turbine tip height + 10%.

### **River, Streams and Other Water Bodies**

There is currently no guidance on minimum distances between wind turbines and water bodies. However, it is not practical to construct wind turbines immediately adjacent to them. For this reason, an offset of 25m (typically the size of a large turbine foundation) has been selected to prevent excessive run off from the construction area, subsidence and potential contamination of the water body. Much larger offsets may be required if specific ecological concerns are relevant and raised as part of the planning application process.

### **Listed Buildings**

Listed buildings can be vulnerable to impacts from turbines with regard to their setting within their local context. There are three grades of nationally listed buildings which reflect the value of the building and inferred setting. The highest ranking buildings are known as Grade 1 follow by Grade 2\* and lastly Grade 2. Locally Listed Buildings are classified as of less importance and have not been considered in this assessment, but will need to be considered at the planning application stage. There is no specific guidance on minimum separation distances between wind turbines and listed buildings. Impacts would normally be assessed as part of landscape and visual impact, heritage and noise assessments for a specific planning application. This is beyond the scope of this study and a simpler approach

of assigning constraint offsets to them has been taken. The higher the listing the greater the offset required. It also follows that due to dominance in the landscape, the larger the turbine the greater the offset required. This is reflected in the offsets selected as shown in the constraint table (Table 2.2), which are based on Wardell Armstrong’s experience in previous wind resource assessments.

**Environmental Constraints**

Wind turbines can have an impact on birds and bats either through direct strike or displacement. To limit the potential for this, environmental designations and certain habitat type such as woodlands / orchards have been removed from the potential wind turbine areas layer, see Table 2.3 below.

RSPB Reserves	Marine Conservation Areas
RSBP Important Bird Areas	Doorstep Greens
World Heritage Sites	Country Parks
Battlefields	Local Nature Reserves
Parks and Gardens	National Nature Reserves
Traditional Ordchards	Special Protected Areas
Areas of Outstanding Natural Beauty	Special Areas of Conservation
Open Country	Ramsar Sites
Nature Improvement Areas	Special Sites of Scientific Interest
Millennium Greens	Heritage Coast
National Parks	

**Other Constraints Considered but not Included in the Assessment**

**Radar**

Wind turbine developments are often prone to objections arising from concerns regarding radar interference. Such objections from the Civil Aviation Authority or Ministry of Defence can be difficult, costly or impossible to resolve. These economic risk considerations should be explored by the developer prior to an application for planning being made. In order to understand where radar interference may occur, Wardell Armstrong has created “viewsheds” or zones of theoretical visibility for primary surveillance radar (PSR) within consultation distance of the London Borough of Havering. These viewsheds shows where the consultation zone is and also how much clearance there is between the ground and radar visibility. The consultation zone depends on whether the radar is used for civil or military operations. Civil radars are perceived to have coverage of 35km in any given

direction whilst military radars cover approximately 65km. If a desired site is within or close to the consultation zone for a radar it will be necessary to consult the operator of the radar. Consultation should always be sought with the relevant airport/radar operator when developing a wind project. This GIS layer has not therefore been applied as an additional constraint to wind resource. Instead it has been supplied to provide information on where difficulties due to radar interference may arise.

The viewsheds show that only the Stansted and Southend indicative radar consultation areas extend into the Borough. The clearance with the Southend radar is in excess of 300m and is therefore unlikely to restrict development of wind turbines. The clearance with the Stansted radar varies between 100m and 35m. Detailed consultation with Stansted will therefore be required by any developer.

### **Green Belt**

The Green Belt covers 53% of the London Borough of Havering however adding the Green Belt to the constraint list would leave no suitable areas for wind development with the exception of the existing site at Dagenham. The National Planning Policy Framework (NPPF) states that;

*“When located in the Green Belt, elements of many renewable energy projects will comprise inappropriate development. In such cases developers will need to demonstrate very special circumstances if projects are to proceed. Such very special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources.”*

Developers wishing to develop wind projects within the Borough will therefore need to demonstrate these special circumstances to allow permission to be granted for wind developments.

## **3 RESULTS**

The areas potentially suitable for Small, Medium and Large turbines development (based on the methodology described above) are highlighted on Figure 2 without the constraints used to identify them. The layers of constraints are somewhat complicated and are shown on Figures 3, 4 and 5 respectively. The key to the constraint layers is shown on Figure 6.

No cut off for lower wind speeds has been derived. The developer of any wind project will first consider the prevailing wind regime combined with the energy yield profile of a turbine best suited to the wind regime. The financial viability of the development may also be dependent on the electricity price. In the future this may or may not include a top up subsidy or an onsite end user power purchase agreement. For reference purposes a wind speed up log law calculation was applied to the UK Wind Speed database to estimate the wind speed at the candidate turbine hub heights for the Small, Medium and Large turbines. These are shown on the respective maps (Figures 3-5).

The areas assessed as suitable for large wind turbines would also be suitable for Medium and Small turbines and areas assessed as suitable for Medium sized turbines would also be suitable for Small turbines. Consideration within the Local Plan should be given as to whether to allow smaller turbines to sterilise areas which would otherwise be suitable for larger wind turbines as this could reduce the potential for wind energy production within the London Borough of Havering.

To estimate the number of turbines and resulting installed capacity that could be developed in these areas, it has been assumed that areas suitable for larger scale turbines will be populated by large turbines and that these areas are mutually exclusive with Medium and small scale turbines. The estimates for each area were based on the land area occupied by a single turbine and the land take required for each scale of turbine ellipses set at 5 rotor diameters downwind and 3 rotor diameters across the wind aligned along a south west axis to match the prevailing wind direction for London<sup>1</sup>. These buffers are to ensure optimum wind resource extraction based on wind flow between adjacent turbines and are the minimum spacing expected to be acceptable by the turbine manufacturers. The results are summarised in Table 3.1 below.

<b>Turbine Scale</b>	<b>Total Area (ha)</b>	<b>Indicative Turbines/ha (5Dx3D spacing)</b>	<b>No of mutually exclusive turbines</b>	<b>Indicative capacity (MW)</b>
Small	268.3	0.81	217	65
Medium	102	0.36	37	18
Large	24.5	0.16	4	8

<sup>1</sup> [https://www.meteoblue.com/en/weather/forecast/modelclimate/london\\_united-kingdom\\_2643743](https://www.meteoblue.com/en/weather/forecast/modelclimate/london_united-kingdom_2643743).

The number of turbines estimated from the areas available is conservative in that if the areas are fragmented, which they generally are (see Figure 2), it would be possible to apply higher density turbine packing. Nevertheless, the areas identified are likely not to be suitable for wind development for a number of reasons, which may include:

- Existing land use
- Landowner willingness
- Justification of special circumstances in the Green belt
- Turbine uneconomic without a suitable end user for the electricity generated
- Grid connection limitations
- Landscape and heritage concerns
- Ecology and archaeology outside of areas currently designated
- Radar and aviation issues
- Public amenity

It would therefore be sensible to assume less than 10% of the sites could be developed.

#### **4 CONCLUSION**

The study has identified a number of potentially unconstrained locations for the development of Small, Medium and Large wind turbines in the Borough. The majority of these can accommodate small scale turbines. There is some scope for medium scale turbines and very few opportunities to implement large scale turbines.

#### **5 RECOMMENDATION**

We would recommend that the Local Plan highlights the locations identified within this study and invites developers to bring forward well planned projects which have carefully considered the scale and appropriate constraints, and can be justified in terms of Green belt policies.

## FIGURES

STOKE-ON-TRENT  
Sir Henry Doulton House  
Forge Lane  
Etruria  
Stoke-on-Trent  
ST1 5BD  
Tel: +44 (0)178 227 6700

BIRMINGHAM  
Two Devon Way  
Longbridge Technology Park  
Longbridge  
Birmingham  
B31 2TS  
Tel: +44 (0)121 580 0909

CARDIFF  
22 Windsor Place  
Cardiff  
CF10 3BY  
Tel: +44 (0)292 072 9191

CROYDON  
Melrose House  
42 Dingwall Road  
Croydon  
Surrey  
CR0 2NE  
Tel: +44 (0)20 8680 7600

CUMBRIA  
Cocklakes Yard  
Carlisle  
Cumbria  
CA4 0BQ  
Tel: +44 (0)122 856 4820

EDINBURGH  
Great Michael House  
14 Links Place  
Edinburgh  
EH6 7EZ  
Tel: +44 (0)131 555 3311

GLASGOW  
2 West Regent Street  
Glasgow  
G2 1RW  
Tel: +44 (0)141 433 7210

LONDON  
46 Chancery Lane  
London  
WC2A 1JE  
Tel: +44 (0)207 242 3243

MANCHESTER (City Centre)  
76 King Street  
Manchester  
M2 4NH  
Tel: +44 (0)161 817 5038

MANCHESTER (Greater)  
2 The Avenue  
Leigh  
Greater Manchester  
WN7 1ES  
Tel: +44 (0)194 226 0101

NEWCASTLE UPON TYNE  
City Quadrant  
11 Waterloo Square  
Newcastle upon Tyne  
NE1 4DP  
Tel: +44 (0) 191 232 0943

SHEFFIELD  
Unit 5 Newton  
Business Centre Newton  
Chambers Road Thorncliffe  
Park Chapeltown  
Sheffield  
S35 2PH  
Tel: +44 (0)114 245 6244

TAUNTON  
Victoria House  
Victoria Street  
Taunton  
Somerset  
TA1 3JA  
Tel: +44 (0)182 370 3100

TRURO  
Baldhu House  
Wheal Jane Earth  
Science Park Baldhu  
Truro  
TR3 6EH  
Tel: +44 (0)187 256 0738

International offices:  
ALMATY  
29/6 Satpaev Avenue  
Regency Hotel Office  
Tower Almaty  
Kazakhstan  
050040  
Tel: +7(727) 334 1310

MOSCOW  
21/5 Kuznetskiy Most St.  
Moscow  
Russia  
Tel: +7(495) 626 07 67



- Havering Borough Boundary
- LargeWind
- MediumWind
- SmallWind



BNG Ref: 555032 : 186650 OS 100km Grid: TQ Landranger Ref: 177  
 Long : Lat DD 0.2366° : 51.5569° Long : Lat DMS 0° 14' 11.8" : 51° 33' 24.9"



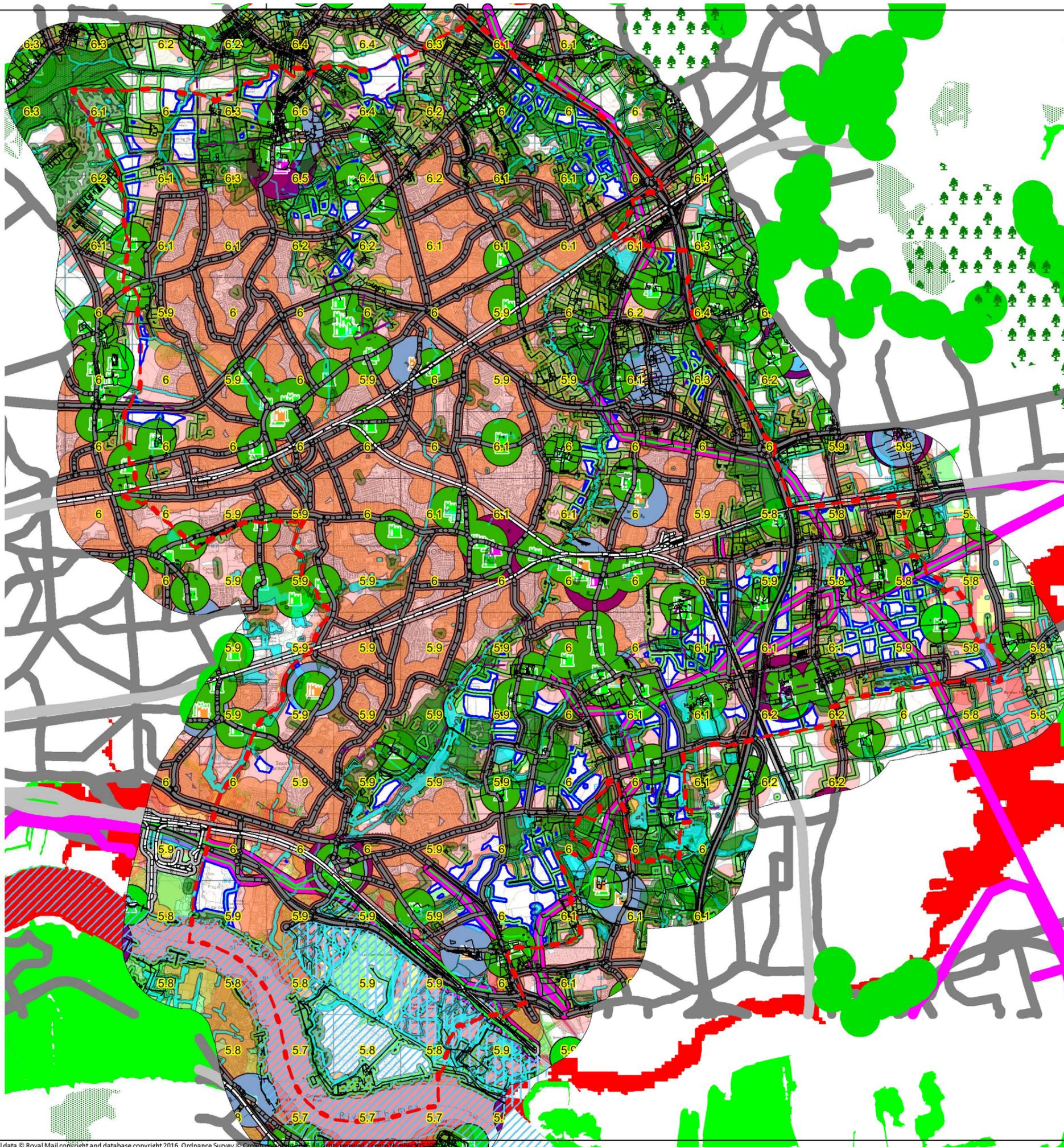
Wardell Armstrong LLP  
 Wheal Jane Earth Science Park  
 Baldhu, Truro, TR3 6EH  
 Tel: +44 (0) 1872 560738  
 email: info@wardell-armstrong.com  
 web: www.wardell-armstrong.com

Drawn By: SC Date: 15/07/16  
 Checked By: SA Date: 15/07/16

Potential for Large, Medium & Small Wind Turbines  
 Local Plan Evidence Base for Wind Farm Development  
 Havering London Borough

POT\_WIND\_PE10658 Figure

Contains Royal Mail data © Royal Mail copyright and database copyright 2016, Ordnance Survey © Crown copyright 2016 All rights reserved. Licence Number: OS 100033950 or eMapSite 0100031673 or Open OS Data



- Havering Borough Boundary
- LargeWind
- MediumWind
- SmallWind



Scale: 1 : 1 000 000  
 Scale: 1 : 60 000 @ A3

BNG Ref: 555032 : 186650 OS 100km Grid: TQ Landranger Ref: 177  
 Long : Lat DD 0.2366° : 51.5569° Long : Lat DMS 0° 14' 11.8" : 51° 33' 24.9"

--	--

Wardell Armstrong LLP Wheal Jane Earth Science Park Baldhu, Truro, TR3 6EH	Tel: +44 (0) 1872 560738 email: info@wardell-armstrong.com web: www.wardell-armstrong.com
--	---

Drawn By: SC	Date: 15/07/16
Checked By: SA	Date: 15/07/16

**Constraints to medium scale wind turbine development  
 Local Plan Evidence Base for Wind Farm Development  
 Havering London Borough**

SMALL_WIND_PE10658	Figure
--------------------	--------

Contains Royal Mail data © Royal Mail copyright and database copyright 2016, Ordnance Survey © Crown Copyright and database right 2016



- Havering Borough Boundary
- LargeWind
- MediumWind
- SmallWind



Scale: 1 : 1 000 000  
 Scale: 1 : 60 000 @ A3

BNG Ref: 555032 : 186650 OS 100km Grid: TQ Landranger Ref: 177  
 Long : Lat DD 0.2366° : 51.5569° Long : Lat DMS 0° 14' 11.8" : 51° 33' 24.9"



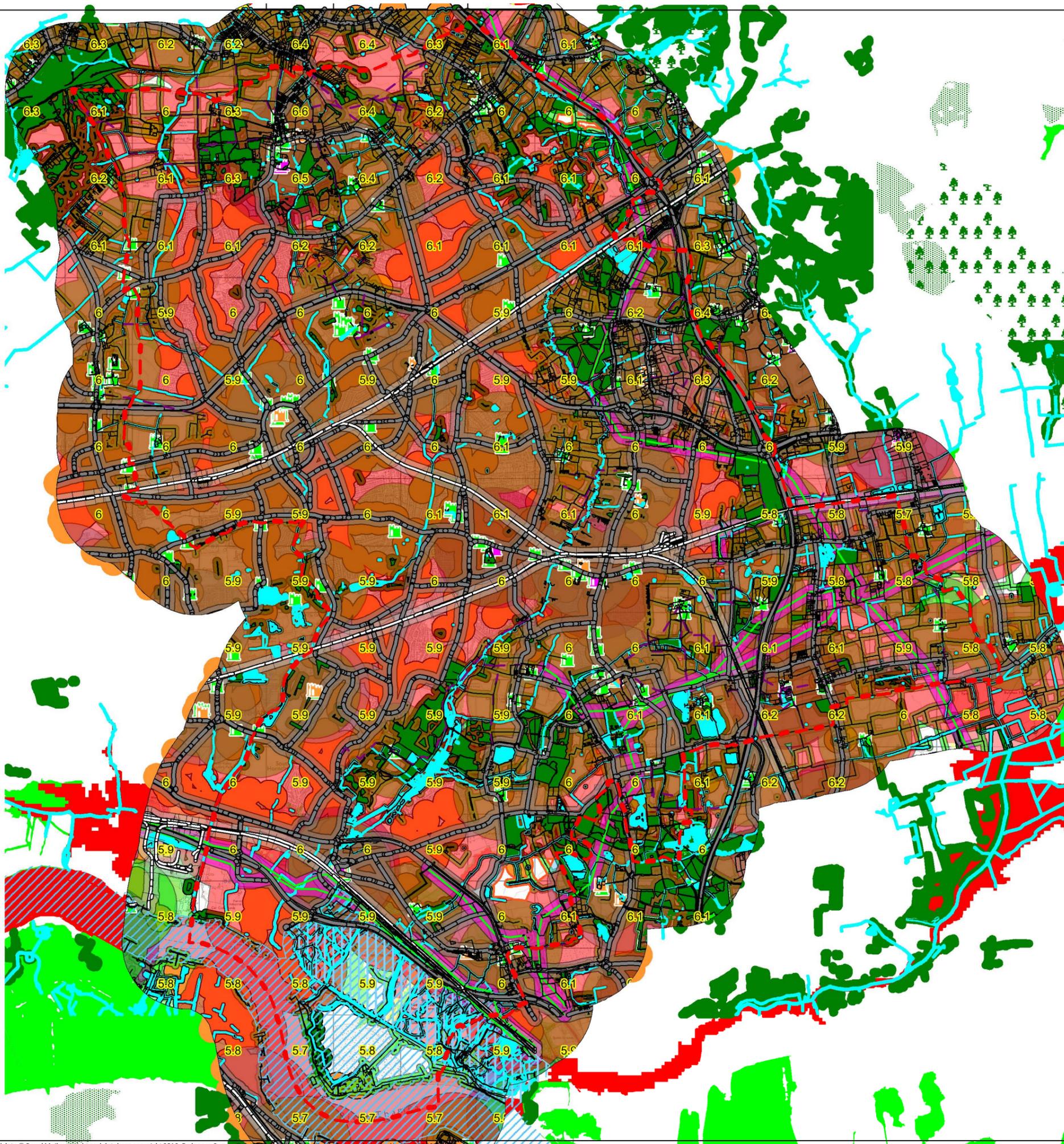


Wardell Armstrong LLP  
 Wheel Jane Earth Science Park  
 Baldhu, Truro, TR3 6EH  
 Tel: +44 (0) 1872 560738  
 email: info@wardell-armstrong.com  
 web: www.wardell-armstrong.com

Drawn By: SC	Date: 15/07/16
Checked By: SA	Date: 15/07/16

**Constraints to medium scale wind turbine development  
 Local Plan Evidence Base for Wind Farm Development  
 Havering London Borough**

MED\_WIND\_PE10658 Figure



- Havering Borough Boundary
- LargeWind
- MediumWind
- SmallWind



Scale: 1 : 1 000 000  
 Scale: 1 : 60 000 @ A3

BNG Ref: 555032 : 186650 OS 100km Grid: TQ Landranger Ref: 177  
 Long: Lat DD 0.2366° : 51.5569° Long: Lat DMS 0° 14' 11.8" : 51° 33' 24.9"



Wardell Armstrong LLP  
 Wheal Jane Earth Science Park  
 Baldhu, Truro, TR3 6EH  
 Tel: +44 (0) 1872 560738  
 email: info@wardell-armstrong.com  
 web: www.wardell-armstrong.com

Drawn By: SC Date: 15/07/16  
 Checked By: SA Date: 15/07/16

**Constraints to large wind turbine development  
 Local Plan Evidence Base for Wind Farm Development  
 Havering London Borough**

LARGE\_WIND\_PE10658 Figure

-  SmallWind
-  Havering\_Borough\_Boundary
-  Havering\_Borough\_Buff1kmV2
-  Hedges
-  all\_railway
-  footpath
-  all\_roads
-  electric\_transmission\_grid
-  water
-  water
-  all\_wood
-  RSPBreserves\_UK
-  iba
-  \_13May2016\_ListedBuildingGI
-  \_13May2016\_ListedBuildingGIsta
-  \_13May2016\_ListedBuildingGII
-  \_13May2016\_CertificateOfImmunit
-  \_13May2016\_WorldHeritageSite
-  \_13May2016\_ScheduledMonument
-  \_13May2016\_ProtectedWreck
-  \_13May2016\_ParkAndGarden
-  \_13May2016\_Battlefield
-  Ancient\_Woodland\_Inventory\_v3\_
-  AddressBase\_residential\_300mBU
-  ListedBuildingGII\_BUF300m
-  ListedBuildingGIstar\_BUF400m
-  ListedBuildingGI\_BUF500m
-  all\_railway\_76mBUF
-  electric\_transmission\_grid\_76m
-  all\_roads\_76mBUF
-  water\_25mBUF
-  Hedges\_50mBUF
-  all\_wood\_60mBUF
-  AddressBase\_Farms\_200mBUF
-  AddressBase\_company\_200mBUF
-  Flood\_Zones\_EA\_ENG
-  Flood\_Zones\_EA\_ENG
-  Flood\_Zones\_EA\_ENG
-  Flood\_Zones\_EA\_ENG
-  WS\_Havering