



**SCOTT WILSON Planning, Environment & Landscape**  
**Environmental Appraisal of the**  
**Proposed London Low Emission Zone**

# ENVIRONMENTAL REPORT

November 2006



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**Environmental Appraisal of the Proposed London Low  
Emission Zone**  
Environmental Report  
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## TABLE OF CONTENTS

1	Introduction.....	4
2	The Proposed Scheme .....	8
3	Alternatives .....	13
4	Policy Context and Project Need .....	16
5	Method of Assessment .....	24
6	Traffic.....	29
7	Air Quality.....	33
8	Noise and Vibration .....	57
9	Landscape and Visual Amenity.....	63
10	Ecology .....	72
11	Cultural Heritage .....	82
12	Waste.....	88
13	Climate Change.....	97
14	Conclusions.....	101
	Appendix 5-A: Scoping Tables .....	105
	Appendix 7-A: Projected Air Quality Impacts Summary ..	112
	Appendix 10-A: Epping Forest SSSI .....	113
	Maps .....	116

## 1 Introduction

### 1.1 Introduction

- 1.1.1 Scott Wilson, with support from Air Quality Consultants, has been commissioned by Transport for London (TfL) to undertake an Environmental Appraisal of the proposed London Low Emission Zone (LEZ).
- 1.1.2 In summary, the proposed LEZ would cover all of Greater London. The boundary would be as close as practicable to the Greater London Authority administrative boundary, although it would not include the M25. The LEZ would operate 24 hours a day, 365 days a year, to maximise the air quality and health benefits. Appropriate diversionary routes would be available to allow drivers of non-compliant vehicles to avoid driving within the LEZ.
- 1.1.3 From early 2008 the LEZ would apply to Heavy Goods Vehicles (HGVs) over 12 tonnes and from mid-2008 the LEZ would apply to HGVs over 3.5 tonnes, buses and coaches. From 2010 the LEZ would also apply to heavier Light Goods Vehicles (LGVs) and minibuses. From 2012 all HGVs, buses and coaches would have to meet a tighter emission standard of Euro IV for PM. The aim is to deter the most individually polluting, diesel vehicles from the Greater London area.
- 1.1.4 Full details of the proposed LEZ are given in Chapter 2 of this Environmental Report.

### 1.2 The Reasons for Environmental Appraisal

- 1.2.1 The revisions to the Mayor's Air Quality and Transport Strategies (TfL, 2006) to allow for the proposed LEZ have already undergone a process of Strategic Environmental Assessment (SEA), as defined by the Environmental Assessment of Plans and Programmes Regulations 2004. The outcomes of this process were documented in the Environmental Report (Scott Wilson, 2005), published in January 2006, and the SEA Statement, published in September 2006 (Scott Wilson, 2006a).
- 1.2.2 The statutory Environmental Report discussed the likely significant effects of the so-called LEZ core option (a LEZ which would include lorries, buses and coaches with a standard of Euro III for PM from 2008, tightened to Euro IV for PM in 2010), as well as two variants. It focussed principally on the following topics, where significant effects were thought to be likely:
- Air; and
  - Human Health.
- 1.2.3 It also gave brief consideration to potential effects on the following topics, where significant effects were not thought likely but may occur:
- Biodiversity (including flora and fauna);
  - Climate;

- Material assets;
- Cultural heritage; and
- Landscape / townscape.

- 1.2.4 Since the completion of the SEA, and in the light of comments received from consultees, the proposed LEZ has been refined. New details have also become available, such as the indicative locations of enforcement infrastructure. The revised LEZ scheme proposals are set out in the LEZ Scheme Order and associated consultation documents. A second round of environmental appraisal will help clarify further the likely environmental effects of the revised scheme.
- 1.2.5 In order to provide a structured approach to the appraisal, TfL is adopting the standard Environmental Impact Assessment (EIA) technique for project assessment. This represents a tried and tested approach to examine the environmental effects of a project and to propose mitigation measures for any adverse effects identified.
- 1.2.6 Government Circular 2/99 on Environmental Impact Assessment (DETR, 1999) defines EIA as '*A means of drawing together, in a systematic way, an assessment of the project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision*'.
- 1.2.7 EIA is a statutory requirement for certain classes of project prior to obtaining development consent, however the proposed LEZ is not among the classes subject to EIA. Nevertheless TfL are undertaking a voluntary appraisal, guided by the EIA approach, as a best-practice measure.

### 1.3 Scoping Report

- 1.3.1 A Scoping Report (Scott Wilson, 2006b) was prepared in September 2006. This was produced to facilitate informal, non-statutory, consultation with the Environment Agency, English Nature, English Heritage and the Countryside Agency, and the London Sustainable Development Commission on the scope of the Environmental Appraisal.
- 1.3.2 The responses in Table 1.1 were received following this informal consultation.

**Table 1.1: Responses to consultation on the scope of the Environmental Appraisal**

Organisation & Comments	Response
<b>Environment Agency</b>	
Although section 2.3.1 of the [scoping] report suggests that there will be "very limited" infrastructure associated with the scheme, the number of proposed cameras and road signs listed in sections 2.3.2, 3 and 4 is substantial. It should also be noted that not all of these are shown on the three maps at stated in section 2.3.5. We acknowledge	Likely impacts are discussed in Chapter 02 - Proposed Scheme and in Chapter 9 - Landscape & Visual.

Organisation & Comments	Response
that, as far as possible, existing structures will be used to support cameras and signs. However, bearing in mind the number proposed, we feel that the likely impacts of construction works to install these structures should not be 'scoped out' until more detail is available on the extent and scale of the proposed works.	
In light of our comments on the proposed works, we feel that there are gaps in the potential impacts identified in Appendices 1 and 2 and described in section 3.3 [of the scoping report]. Additional construction impacts have the potential to be significant depending on the extent and scale of the proposed works.	TfL has commissioned a separate economic impact assessment of the proposed LEZ.
The cumulative impacts of the works have not been considered in the report. Consideration of these is likely to result in the identification of additional impacts. The impacts that should be 'scoped in' include socio-economic impacts associated with earthworks and excavations and use of machinery.	It is felt that the terms 'earthworks' and 'excavations' overstate the scale of construction activities, which would be very small scale and temporary. Cumulative impacts are not likely to be significant.
Socio-economic impacts that should be added to section 3.3 [of the scoping report] and assessed further include: disruption to services, impacts such as noise and visual intrusion on pedestrians and residents and traffic delays which can also cause localised air quality impacts.	TfL has commissioned separate economic and health impact assessments of the proposed LEZ. However the scale of the works would be such as to be unlikely to lead to significant noise or delays
<b>English Nature and Countryside Agency (response received from Natural England)</b>	
As the LEZ does not affect any priority interests of Natural England within Greater London, no formal representation was made.	
However, commended TfL for using existing infrastructure wherever possible, and welcomed inclusion of landscape/ townscape and ecology issues within the Report.	
<b>English Heritage</b>	No response received at the time of writing
<b>London Sustainable Development Commission</b>	No response received at the time of writing

## 1.4 Content of the Environmental Report

### 1.4.1 The Environmental Report consists of the following introductory chapters:

- Chapter 1 - Introduction
- Chapter 2 - The Proposed Scheme
- Chapter 3 - Alternatives
- Chapter 4 - Policy Context and Project Need
- Chapter 5 - Method of Assessment

1.4.2 For each main environmental topic included in the scope of the environmental appraisal, a separate chapter describes the baseline conditions, impact assessment, significance, mitigation and monitoring measures, and residual effects:

- Chapter 6 - Traffic
- Chapter 7 - Air Quality
- Chapter 8 - Noise
- Chapter 9 - Landscape and Visual Assessment
- Chapter 10 - Ecology
- Chapter 11 - Cultural Heritage / Built Environment
- Chapter 12 - Waste
- Chapter 13 - Climate Change

1.4.3 The following summary chapter is also included:

- Chapter 14 - Conclusions

1.4.4 A non-technical summary of the above information is also available.

## 1.5 References

DETR, 1999	Department of the Environment, Transport and the Regions, <i>Environmental impact assessment: guide to procedures</i> , TSO, March 1999.
Scott Wilson, 2005	Scott Wilson, <i>Strategic Environmental Assessment of the Proposed Revisions to the Mayor's Transport Strategy and the Mayor's Air Quality Strategy to Introduce a Low Emission Zone: Scoping Report</i> , October 2005.
Scott Wilson, 2006a	Scott Wilson, <i>Strategic Environmental Assessment of the Proposed Revisions to the Mayor's Transport Strategy and the Mayor's Air Quality Strategy to Introduce a Low Emission Zone: Environmental Report</i> , January 2006.
Scott Wilson, 2006b	Scott Wilson, <i>London Low Emission Zone: Environmental Appraisal: Scoping Report</i> , September 2006.
TfL, 2006	Transport for London, <i>The Mayor's Transport and Air Quality Strategy Revisions: London Low Emission Zone</i> , 2006

## 2 The Proposed Scheme

### 2.1 Introduction

2.1.1 This chapter describes the aims and objectives of the proposed LEZ, along with the means by which it would be implemented, subject to the outcome of consultation. It discusses the works necessary to create the infrastructure associated with the scheme. It also describes how the proposed LEZ would operate and the classes of vehicles subject to its standards.

### 2.2 The Proposed London Low Emission Zone

2.2.1 During Spring 2006, on behalf of the Mayor, TfL consulted on draft revisions to the Mayor's Transport and Air Quality Strategies. These revisions sought to take forward the Mayor's commitment made in his 2004 election manifesto, subject to consultation, to designate the whole of Greater London a Low Emission Zone. The LEZ would achieve improvements in air quality and health by deterring the most individually polluting, heavy diesel engine vehicles from the Greater London area.

2.2.2 Following the consultation period, the Mayor published the revisions in amended form in July 2006. TfL are now consulting on detailed scheme proposals in the form of a Scheme Order. Formal public, business and stakeholder consultation is scheduled to run from November 2006 - February 2007.

#### The Objectives of the Proposed Low Emission Zone

The LEZ is intended to improve the quality of air in London, reducing the concentrations of harmful pollutants, by accelerating the introduction of cleaner vehicles, and reducing the numbers of older, more individually polluting vehicles driving within the LEZ

This would mean:

- **Improvements to people's health and quality of life:** poor air quality can cause premature death, worsen serious respiratory and cardio-vascular illness, and potentially larger numbers of cases of ill health from exacerbation of asthma and other respiratory symptoms
- **Work towards the achievement of national and EU statutory air quality objectives:** across a wider area of London than at present

*Figure 2.1: The Objectives of the Proposed Low Emission Zone*

2.2.3 The proposed LEZ would, with some limited exceptions, cover the whole of Greater London (all 33 London Boroughs - see Figure 2.2, below). Detailed maps of the proposed boundary can be viewed on the TfL website and at TfL offices..



2.2.4 On the basis of TfL's analysis and in the absence of any suitable national initiatives, the proposed LEZ represents the most effective option for achieving reductions of the most harmful road transport generated emissions in London between 2008 and 2015. If implemented, the LEZ would target the reduction of particulate matter, as these are thought to have the greatest impact on human health.

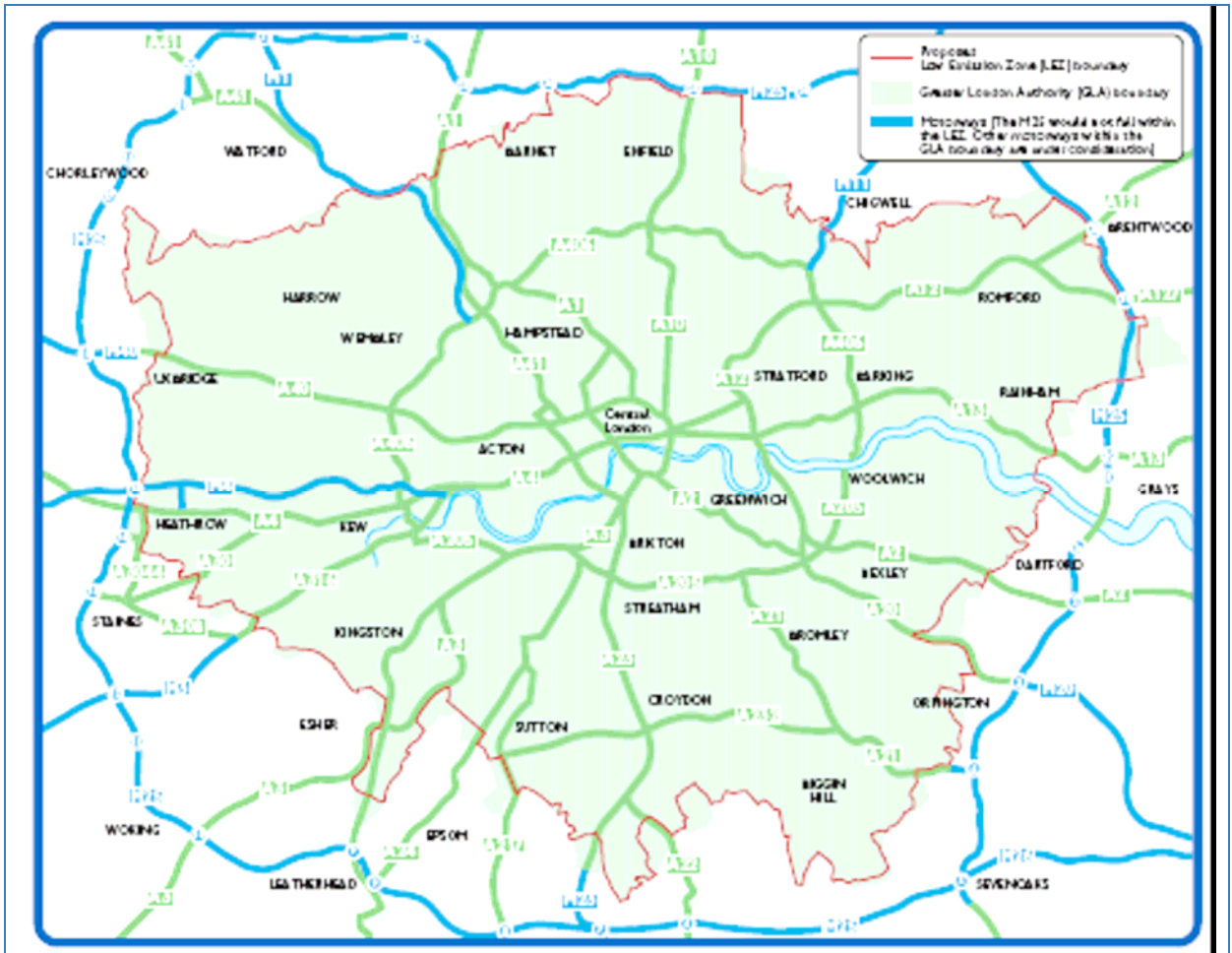


Figure 2.2: The Proposed Low Emission Zone Boundary

2.2.5 The proposed LEZ is designed to discourage the use in Greater London of the most individually polluting diesel-engined vehicles - generally older HGVs, buses, coaches, heavier LGVs and minibuses. Heavier HGVs would be included in the LEZ from early 2008. Lighter HGVs and buses and coaches would be included in the LEZ from mid 2008. Heavier LGVs and minibuses would be included in the LEZ from autumn 2010.

2.2.6 The LEZ would apply to both UK and non-UK registered vehicles. Vehicle emission standards would be defined using Euro standards to ensure a legal basis that applies equally across the EU. Non-compliant vehicles could still drive within the LEZ but their owners would have to pay a charge to do so.

2.2.7 Table 2.1 below indicates when each vehicle class would be included in the LEZ and the minimum emission standard that the vehicle would be required

to meet in order to enter the LEZ without paying a charge.

- 2.2.8 It is proposed that a small number of vehicles would be exempt from the LEZ. These include construction machinery, agricultural vehicles, military vehicles and historic vehicles (registered before 1973) not used for commercial activities.

*Table 2.1: The Proposed Low Emission Zone Emission Standards*

Vehicle type	Definition	European vehicle classification	LEZ scheme inclusion	Minimum emission standard (for PM <sub>10</sub> )*
<b>Heavier HGVs</b>	Goods vehicles exceeding 12 tonnes (gross vehicle weight)	N <sub>3</sub>	Early 2008	Euro III
<b>Lighter HGVs</b>	Goods vehicles between 3.5 and 12 tonnes (gross vehicle weight)	N <sub>2</sub>	Mid 2008	Euro III
<b>Buses and coaches</b>	Passenger vehicles with more than 8 seats plus the driver's seat and exceeding 5 tonnes (gross vehicle weight)	M <sub>2</sub>	Mid 2008	Euro III
<b>Heavier LGVs</b>	Goods vehicles between 1.205 tonnes (unladen) and 3.5 tonnes (gross vehicle weight)	N <sub>1</sub> – class II and class III	Autumn 2010	Euro III
<b>Minibuses</b>	Passenger vehicle with more than 8 seats plus the drivers seat below 5 tonnes (gross vehicle weight)	M <sub>2</sub>	Autumn 2010	Euro III
<b>All HGVs</b>	Goods vehicles between 3.5 and 12 tonnes (gross vehicle weight)	N <sub>3</sub> , N <sub>2</sub>	Early 2012	Euro IV

\* There are two types of Euro standards – heavy-duty standards for engines fitted to vehicles over 5 tonnes and light duty standards for engines fitted to vehicles below five tonnes. The LEZ would include vehicles with engines approved to either the light-duty or heavy-duty emission standards.

- 2.2.9 A daily charge of £200 is proposed for non-compliant HGVs, buses and coaches to drive in the LEZ, and £100 for non-compliant heavier LGVs and minibuses. The level of charge has been set to provide an economic incentive for operators to clean up their fleets, while at the same time allowing operators of non-compliant vehicles to drive within the LEZ on an exceptional basis, albeit at a cost.
- 2.2.10 Should an operator of a non-compliant vehicle not pay the daily charge for driving within London, a penalty charge would apply. This would be £1,000 (reduced to £500 if paid within 14 days) for HGVs, buses and coaches and £500 (reduced to £250 if paid within 14 days) for heavier LGVs and minibuses.
- 2.2.11 TfL is considering the option of including the motorways (excluding the M25) and trunk roads in London (i.e. the M1, M4, M11 and A3113) within the LEZ. The Department for Transport (DfT) is responsible for these roads, and their inclusion would require the approval of the Secretary of State for Transport. If Secretary of State approval is given before the confirmation of the Scheme

Order by the Mayor then these roads could be included via a modification to the Scheme Order as consulted upon.

## 2.3 The Proposed Works

- 2.3.1 Infrastructure associated with enforcement of the proposed scheme would be limited, consisting principally of road signs and enforcement cameras. Road signs would be placed at strategic locations to warn drivers of the affected classes of vehicles that they are about to enter the LEZ, affording the option to divert to another route. Cameras would be used to recognise the registration mark of vehicles driving within the LEZ, and to check either that they are compliant or that the appropriate daily charge has been paid.
- 2.3.2 Some sixty-three indicative sites for fixed enforcement cameras have been proposed on major roads within the Capital. Map 2.1 (at the end of this report) illustrates their indicative locations. Note that many of the sites are in pairs located very close to one another. For this reason it is difficult to see all sixty-three sites on the map.
- 2.3.3 The indicative sites would host cameras utilising ANPR (Automatic Number Plate Recognition) technology for detecting vehicles. The new ANPR cameras would be supplemented by the existing congestion charging camera network in central London, together with a number of mobile enforcement cameras.
- 2.3.4 Discussions are being held with the Highways Agency to place advance information signs on motorways and trunk roads approaching the M25 and on the M25 itself to advise drivers that the M25 is the most appropriate route to take to avoid entering the LEZ. It is currently envisaged that there would be around 60 signs of this type.
- 2.3.5 Advance information signs would be placed on other main roads approaching the boundary, where the locations can be agreed with the relevant highway authority. The advance signs would be similar in appearance to those used for the congestion charging zone (white lettering on a dark blue background) and their size would be dictated by the speed of traffic using the road.
- 2.3.6 In addition, the current proposals generally assume two entry signs at each point that a public road crosses the LEZ boundary. There would be a few exceptions where only one sign may be required but these would only be the narrowest, most lightly trafficked country roads. Approximately 190 such locations have been identified. There may also be a requirement at each entry point for a camera / 'C' repeater sign. There would be one such sign at each boundary point, perhaps 100m inside the entry point.
- 2.3.7 The zone entry signs would be similar in size and appearance to those for the central London congestion charging zone. A white on green 'C', similar to the white on red 'C' used for the congestion charging zone, is being considered. There would be no road markings or other traffic management measures.

## 2.4 Project Activities and Impacts

- 2.4.1 Construction of the LEZ enforcement infrastructure is not likely to result in any significant environmental effects. The cameras would require the installation of new poles and communications cabinets but these would be carefully located to minimise visual intrusion. As far as possible for signs, existing posts would be replaced with new posts to support both new and existing signs combined. Where this is not feasible, limited excavation may be necessary to anchor new structures in place. Electricity and data connections would, in most cases, be available at the camera sites. Where this is not the case, trenches would be dug to connect the cameras to services.
- 2.4.2 Limited impacts are expected from these works. There may be some brief, localised increases in noise or temporary disruption to traffic. Best practice measures would be followed in all cases to reduce resulting effects to a minimum, including the application of GLA guidance on dust generated by construction works (GLA, 2006).
- 2.4.3 Following the implementation of the enforcement infrastructure and signing, the principal ongoing impacts would be likely to include:
- Improvements in air quality, leading in the long-term to beneficial effects on human health and possibly also on biodiversity
  - Limited visual intrusion from signs and cameras
- 2.4.4 These impacts and their effects are discussed in further detail in Chapter 7: Air Quality, Chapter 9: Landscape and Chapter 10: Ecology.

## 2.5 References

- GLA, 2006                      Greater London Authority, The control of dust and emissions from construction and demolition (draft best practice guide), 2006

## 3 Alternatives

### 3.1 Introduction

3.1.1 During the development of the LEZ proposals a number of alternative approaches were considered. These were set out in the revisions to the Mayor's Air Quality and Transport Strategies as well as in the SEA carried out as part of the revisions to these Strategies (Scott Wilson, 2006).

3.1.2 TfL has developed the current detailed scheme proposals for the LEZ following extensive consultation with stakeholders and the public. This chapter briefly explains how the current detailed scheme proposals were selected.

### 3.2 Approaches other than a Low Emission Zone

3.2.1 The LEZ Feasibility Study (AEA, 2003) concluded that a London LEZ was the most effective policy available to the Mayor that could realistically move London significantly closer towards meeting its air quality objectives. TfL has reviewed alternative ways at both the national and local levels for addressing road transport related emissions.

3.2.2 Among the alternative methods considered for achieving reductions in road transport related emission were:

- Relying on the natural vehicle replacement cycle and tighter Euro standards to produce the same air quality improvements as the proposed LEZ
- Higher levels of Vehicle Excise Duty (VED) for more polluting vehicles
- The introduction of national road user charging with higher charges for more polluting vehicles
- Grants for retro-fitting emissions reducing equipment to vehicles
- Scrapping of older vehicles
- Roadside emissions testing of vehicles

### 3.3 Variant LEZ scenarios

3.3.1 As well as the current detailed LEZ scheme proposals covering the whole of Greater London, TfL also considered a range of other geographical configurations, including:

- A variant with a boundary at the M25
- A variant applying to the Transport for London Road Network (TLRN) only
- A variant covering the existing Central London Congestion Charging Scheme area and the area of the western extension

### 3.4 Proposals assessed in the SEA of the draft Strategy Revisions

- 3.4.1 In addition to the geographical variants outlined above, the draft Strategy Revisions presented three key options:
- **The LEZ core option** – commencing in 2008, and including HGVs, buses and coaches. The emission standard was Euro III for PM from 2008 and Euro IV for PM from 2012
  - **The core plus NO<sub>x</sub> option** - this was the same as the LEZ core option, but with emission standards of Euro IV for both PM<sub>10</sub> and NO<sub>x</sub> from 2010
  - **The core plus LGV option** – again, this was the same as the LEZ core option but included LGVs from 2010. The standard for LGVs was a rolling age-based limit of 10 years
- 3.4.2 The SEA also considered these three options together with a 'business as usual' scenario (i.e. no LEZ implemented).
- 3.4.3 Following consideration of the representations received during the consultation and TfL's report on the consultation, the Mayor published on 25 July 2006 amended Strategy Revisions. These revisions set out a LEZ along the following lines:
- From 2008, HGVs, buses and coaches to meet a standard of Euro III for PM
  - From 2012, buses and coaches to meet a standard of Euro IV for PM
  - From 2010, heavier LGVs and minibuses to meet appropriate standards (to be defined)

### 3.5 Reasons for TfL modifying the LEZ proposals

- 3.5.1 Given the significant concerns of operators regarding the original proposal to tighten the LEZ standard to Euro IV for PM in 2010, TfL recommended moving implementation of this standard back to 2012 to reduce compliance costs to operators, and make the scheme more acceptable.
- 3.5.2 Whilst there has been some success in fitting NO<sub>x</sub> abatement equipment to some of the London bus fleet and Black Cabs, there remain a number of important unresolved issues around NO<sub>x</sub> certification and testing, such that TfL did not recommend extending the LEZ standards to NO<sub>x</sub> at this stage. TfL is continuing to consider, with the pollution abatement equipment industry and central government, how a NO<sub>x</sub> standard might be implemented and will consider moving to implement a NO<sub>x</sub> standard in the future should this be feasible
- 3.5.3 TfL considered the implications of including LGVs within the scope of the LEZ. It is forecast that by 2010 LGVs will be responsible for a significant contribution of some 24 per cent of road transport emissions of PM<sub>10</sub> within London. On the basis of these investigations, TfL recommended that the most-polluting heavier LGVs should be included in the LEZ proposals. This

definition excludes 'car-derived vans' as TfL judges that it would be unfair to include such vehicles as they retain the same characteristics as the diesel-engined cars they are based on and hence have similar emission levels. TfL recommended that minibuses should also be included within the LEZ at the same time as the most-polluting heavier LGVs as they use very similar chassis and engines and have similar emissions levels.

### 3.6 Alternative means of implementation

3.6.1 In 2005 TfL undertook a strategic review of the Feasibility Study. This re-examined, among other things, the legal framework for implementation of the LEZ under three main options:

- A Scheme Order
- A Traffic Regulation Order (TRO) jointly undertaken on behalf of the London boroughs and TfL
- A Parliamentary Bill

3.6.2 The strategic review recommended a LEZ covering the whole of the GLA area and introduced through a Scheme Order under the GLA Act 1999. This was considered to achieve the best balance between the costs of the scheme and health and air quality benefits. In addition, it would be simpler to implement than the other options.

### 3.7 References

- |                    |   |
|--------------------|---|
| AEA, 2003          | AEA Technology, London Low Emission Zone Feasibility Study Phase II Final Report, 2003.   |
| Scott Wilson, 2006 | Scott Wilson, <i>Strategic Environmental Assessment of the Proposed Revisions to the Mayor's Transport Strategy and the Mayor's Air Quality Strategy to Introduce a Low Emission Zone: Environmental Report</i> , January 2006. |

## 4 Policy Context and Project Need

### 4.1 Introduction

4.1.1 This chapter provides background on the European, national and regional policies relevant to the LEZ proposal. These policies set the goals for the LEZ and have informed the development of the proposal. The chapter also explores the justification for the proposed scheme in the light of legislative and regulatory provisions.

### 4.2 Policy Context

4.2.1 The Mayor has powers to introduce road user charging schemes granted by the Greater London Authority Act (1999) and the Transport Act (2000). The proposed LEZ would be implemented using a Scheme Order under the GLA Act, which allows TfL to charge vehicles for use on roads within Greater London.

4.2.2 The proposed LEZ supports the *Air Quality Strategy for England, Wales, Scotland and Northern Ireland - Working Together for Clean Air* (2000), which states that the Government and devolved administrations consider particulate matter to be *'the most important air quality challenge for the period covered by this Strategy'*.

4.2.3 In addition, this strategy recognises linkages between emissions of particulate matter and health problems and identifies a number of measures designed to reduce emissions from heavily trafficked areas, in order to meet new air quality objectives. Section 440, Chapter 5, discusses the implementation of low emissions zones as a measure to reduce particle emissions from traffic. Clearly, therefore the proposed LEZ would accord with this strategy and help move towards meeting its objectives.

4.2.4 The proposed LEZ also supports a range of regional and local strategies for transport, air quality and land use planning, including:

- The Mayor's Transport Strategy (TfL, 2001)
- Cleaning London's Air: The Mayor's Air Quality Strategy (GLA, 2002)
- The London Plan (GLA, 2004)
- London Borough Air Quality Action Plans

#### **The Mayor's Transport Strategy**

4.2.5 The Mayor's Transport Strategy Policy 3.10 states that, *'where possible, Transport for London (TfL) will lead by example by adopting and promoting cost-effective environmental best practice, particularly where this will contribute to seeking to meet the National Air Quality Strategy Objectives'* amongst other objectives. Implementation of the LEZ clearly takes an active step towards this achieving this policy goal.



### **Cleaning London's Air: The Mayor's Air Quality Strategy**

- 4.2.6 Policy 6 of the Mayor's Air Quality Strategy states that *'the Mayor will encourage and promote the benefits of the more rapid adoption of cost effective cleaner engines, technologies and fuels, non-fossil fuels and zero emission technologies for all road vehicles, concentrating first on the most individually polluting vehicles'*. Implementation of the London LEZ would directly work towards this policy by providing an incentive to replace more polluting vehicles with those using cleaner technologies.
- 4.2.7 Moreover, the LEZ also accords with Policy 13, which affirms that *'the Mayor and Transport for London will work with the boroughs and the Highways Agency to adopt a co-ordinated approach to reducing air pollutant emissions on London's roads'*. The LEZ is designed to bring forward air quality improvements and would promote a co-ordinated approach to air quality management.
- 4.2.8 The LEZ would also contribute to the realisation of Policy 11 which states that *'the Mayor and Transport for London will work with others to ensure the needs of business and Londoners for the movement of goods and services are met, whilst minimising congestion and environmental impacts in accordance with the objectives of the Mayor's Strategies'*. The LEZ would result in environmental benefits, particularly in terms of air pollution.
- 4.2.9 As the proposed LEZ covers all of London it incorporates Heathrow airport and some of the surrounding area. The scheme therefore accords with Policy 15, which asserts that *'the Mayor will work to minimise emissions at and around Heathrow, within the limitations of the Mayor's powers and responsibilities, and expects other stakeholders to do the same'*.

### **The London Plan**

- 4.2.10 The London Plan sets out policies to protect and enhance the environment including Policy 4A.6- 'Improving air quality'. In addition, a key objective is to make London a better city for people to live in (Objective 2). The LEZ should work towards these goals through the expected improvements in air quality that would result from the proposed scheme.

### **London Borough Air Quality Action Plans**

- 4.2.11 A number of Boroughs have declared AQMAs for particulate matter (PM<sub>10</sub>) and NO<sub>2</sub> and Air Quality Action Plans are required in order to help meet air quality objectives for these pollutants. The LEZ would complement these Air Quality Action Plans through helping reduce small particle and NO<sub>x</sub> emissions across the London Boroughs.
- 4.2.12 In addition to the plans and strategies identified above, there are also a

number of regulations and policies relating specifically to the topic areas assessed in this Environmental Report. The project should complement the objectives of these policies and comply with relevant regulations. Table 4.1 below provides an overview of key regulations and policies.

**Table 4.1: Additional relevant regulations and policies**

Topic	Relevant Regulations and Policy
Traffic	<ul style="list-style-type: none"> <li>The Mayor's Transport Strategy proposal 3.2</li> </ul>
Air Quality	<ul style="list-style-type: none"> <li>Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002</li> <li>The Air Quality Limit Values Regulations 2003</li> </ul>
Noise	<ul style="list-style-type: none"> <li>The London Plan policy: 4A.14</li> <li>The Mayor's Transport Strategy: Policy 3.10, Proposal 3.4</li> <li>The Mayor's Ambient Noise Strategy: Sounder City 2004, especially Policies 7 and 13 and Proposal 10</li> <li>The Environmental Noise (England) Regulations 2006</li> </ul>
Landscape and Visual	<ul style="list-style-type: none"> <li>The London Plan policies: 4B.15 – 4B.17</li> </ul>
Ecology	<ul style="list-style-type: none"> <li>The UK Biodiversity Action Plan</li> <li>London Biodiversity Action Plan 2001</li> <li>The Mayor's Biodiversity Strategy 2002</li> <li>The London Plan 2004, Policy 3D.12</li> </ul>
Cultural Heritage/Built Environment	<ul style="list-style-type: none"> <li>The Planning (Listed Buildings and Conservation Areas) Act 1990</li> <li>Planning Policy Guidance 15 PPG15 - Planning and the Historic Environment</li> <li>London Plan policies 4B.1, 4B.10 – 4B.14</li> </ul>
Waste	<ul style="list-style-type: none"> <li>Waste Strategy 2000 for England and Wales</li> <li>End of Life Vehicles (Producer Responsibility) Regulations 2005</li> <li>London Plan policies 4A.1, 4A.2 and 4A.3</li> </ul>

### Traffic

4.2.13 The Mayor's Transport Strategy proposal 3.2 states that TfL and the GLA will take the lead in ensuring that transport initiatives and plans will contribute to improving air quality. The LEZ therefore supports this proposal.

### Air Quality

4.2.14 The EU's Framework Directive on ambient air quality assessment and management (96/62/EC) covers the revision of previously existing legislation and the introduction of new air quality standards for previously unregulated air pollutants. The Directive requires the European Commission to propose several Daughter Directives, the first two of these have been transcribed into UK legislation by the Air Quality Limit Values Regulations (2003). These limit

values have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole.

- 4.2.15 Limit Values have been set for nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), particulates (expressed as PM<sub>10</sub>), 1,3 butadiene, benzene, carbon monoxide (CO), and lead. In addition, aspirational target values have been set for ozone (O<sub>3</sub>), polycyclic aromatic hydrocarbons (PAH), arsenic (As), cadmium (Cd) and nickel (Ni). Introduction of a Low Emission Zone would help work towards targets set for particulate matter and nitrogen dioxide. The other pollutants are within their Limit Values.
- 4.2.16 In London, road transport is the single biggest source of emissions of the pollutants PM<sub>10</sub> and oxides of nitrogen (NO<sub>x</sub>), although a significant proportion of the pollution originates outside the capital. Levels of pollution can be dramatically affected by prevailing weather conditions and this makes year-on-year comparisons potentially misleading. Nevertheless air pollution has improved significantly for most of the pollutants covered by the Air Quality Strategy: carbon monoxide, lead, sulphur dioxide, benzene, polycyclic aromatic hydrocarbons and 1,3-butadiene.
- 4.2.17 Concentrations of nitrogen dioxide and particulate matter continue to exceed the national statutory air quality objectives, as evidenced by the number of authorities within London with Air Quality Management Areas declared to tackle them. The major source of these pollutants is road transport and some vehicles create considerably more pollution than others, depending on type, model, age and use of vehicle. New vehicles are much cleaner than a decade ago, but older, poorly maintained and poorly driven vehicles of all types create a disproportionate amount of pollution.
- 4.2.18 The proposed LEZ aims to move London closer to achieving the statutory and provisional air quality objectives (and EU limit values) for particulate matter. It should also improve concentrations of nitrogen dioxide. This supports the Air Quality Limit Values Regulations (2003), the Air Quality Strategy and the EU Air Quality Framework and Daughter Directives (EC 1996, EC 1999, EC 2000, EC 2002).
- 4.2.19 Statutory air quality objectives for particulate matter (PM<sub>10</sub>) from the Air Quality Strategy (in Regulations) are as follows:
- 40 µg/m<sup>3</sup> (annual mean) by 31st December 2004
  - 50 µg/m<sup>3</sup> (twenty-four hour mean) not to be exceeded more than 35 times per year by 31st December 2004
- 4.2.20 Provisional air quality objectives for particulate matter (PM<sub>10</sub>) from the Air Quality Strategy (for London) are as follows:
- 23 µg/m<sup>3</sup> (annual mean) by 31st December 2010
  - 50 µg/m<sup>3</sup> (twenty-four hour mean) not to be exceeded more than 10 times per year by 31st December 2010

- 4.2.21 Aspirational air quality target for particulate matter (PM<sub>10</sub>) from the Air Quality Strategy (for London) are as follows:
- 20 µg/m<sup>3</sup> (annual mean) by 2015
- 4.2.22 The statutory air quality objectives for nitrogen dioxide (NO<sub>2</sub>) from the Air Quality Strategy (in Regulations) are as follows:
- 40 µg/m<sup>3</sup> (annual mean) by 31st December 2005
  - 200 µg/m<sup>3</sup> (one hour mean) not to be exceeded more than 18 times per year by 31st December 2005
- 4.2.23 It should be noted that the Air Quality Strategy is currently under review<sup>1</sup>, and a consultation draft was published for consultation in April 2006. This proposes a number of options for new long-term particle objectives, including the introduction of a new backstop (or concentration cap) objective and a new exposure-reduction objective for PM<sub>2.5</sub>. Options are currently being evaluated, but may result in the provisional PM<sub>10</sub> objectives being replaced by new PM<sub>2.5</sub> objectives. The potential implications of this are discussed in Chapter 8.

### Noise

- 4.2.24 The LEZ supports policy 4A.14 in the London Plan and policies within the Mayor's Ambient Noise Strategy: Sounder City (especially policies 4, 5 and 6) as newer Euro III and IV vehicles are generally quieter than older vehicles meeting Euro 0, I and II standards (see chapter 9: Noise). The LEZ encourages the use of newer vehicles and could therefore have a small potential indirect benefit of reducing noise. Any other effects on noise are assessed in detail in Chapter 9, in order to minimise any adverse effects that may arise.

### Landscape and Visual Amenity

- 4.2.25 London Plan policies 4B.15 to 4B.17 set out the Mayor's approach to designating and protecting strategic views in London. The LEZ would not directly impact upon any strategic views in London and therefore the LEZ would accord with these policies. Policy 4C.4 seeks to protect and enhance natural landscapes in London and the LEZ would not conflict with this policy.

### Ecology

- 4.2.26 The effects of the LEZ are not expected to be significant for sites or species of nature conservation value within Greater London. The relevant legislation, national and regional policies would therefore be supported. Details of the legislative and policy context and the assessment of impacts can be found in Chapter 10.

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<sup>1</sup> The Mayor's response is found at: [www.london.gov.uk/mayor/environment/air\\_quality/docs/naqs-review.pdf](http://www.london.gov.uk/mayor/environment/air_quality/docs/naqs-review.pdf)

## Cultural Heritage/Built Environment

4.2.27 The proposed LEZ is not anticipated to have significant adverse effects on the setting of listed buildings or conservation areas as the proposed works are small in scale and would generally be confined to the transport network (i.e. roadways and pavements). The LEZ therefore accords with the requirements of the Planning (Listed Buildings and Conservation areas) Act 1990 and Planning Policy Guidance Note 15 (PPG15) 'Planning and the Historic Environment'. The LEZ is likely to lead to a decrease in soiling of buildings or structures of cultural value within the Greater London area therefore the LEZ also supports policies in the London Plan (e.g. 4B.1 '*respect London's built heritage*', and Policy 4B.10 '*protection and enhancement of historic assets in London*').

## Waste

4.2.28 The operation of the LEZ is expected to lead to a small but non-significant increase in the rate of vehicle scrapping. The End of Life Vehicles Directive and End of Life Vehicles (Producer Responsibility) Regulations require increased proportions of end of life vehicles to be recycled or re-used. This should help ensure that any increases in scrapping of non-compliant vehicles associated with the LEZ would result in the majority of materials being re-used and recycled, thereby working towards the objectives set out in the Waste Strategy 2000 for England and Wales and London Plan policies 4A.1, 4A.2 and 4A.3.

## 4.3 Project Need

4.3.1 The Low Emission Zone Feasibility Study commissioned by the Greater London Authority (GLA), the Association of London Government (ALG), TfL, the Department for Transport (DfT), and the Department for Environment, Food and Rural Affairs (DEFRA) concluded in 2003 that a London-wide LEZ was the most cost-effective policy available to the Mayor that could realistically move London significantly closer towards meeting its air quality objectives.

4.3.2 TfL estimates that by 2012 the introduction of a London LEZ would bring forward reductions in emissions of particulate matter compared with the reductions that would come through the natural vehicle replacement cycle. Results from modelling<sup>2</sup> show that the LEZ would give rise to lower emissions of nitrogen oxides and PM<sub>10</sub>, especially in the early years, which would translate to lowered exposure to nitrogen dioxide and PM<sub>10</sub>, especially alongside main roads. In addition, there would be lowered exposure in background areas away from roads especially in central London, where concentrations are highest. The LEZ would also help London move towards meeting the statutory national air quality objectives and EU limit values. In 2010, there would be a reduction of about 11% in the area of London and

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<sup>2</sup> See Chapter 7.

number of people exposed to annual mean nitrogen dioxide levels above the objective and limit value, with this increasing to an 18-19% reduction in the case of PM<sub>10</sub>.

- 4.3.3 Lower concentrations of particulate matter would improve the quality of life for people who live in, work in and visit London, especially those already suffering from respiratory symptoms that restrict their daily activities. The SEA of the proposed revisions to the Mayor's Air Quality and Transport Strategies (Scott Wilson, 2006) demonstrated that the proposed LEZ would result in reductions in mortality and morbidity caused by high concentrations of particulate matter within Greater London. The proposed LEZ is also projected to reduce the number of respiratory hospital admissions and the need for medication for adults and children suffering from respiratory diseases.
- 4.3.4 Air pollution is believed to have an adverse effect on semi-natural habitats and species and the LEZ would be expected to improve air quality. In general the beneficial ecological effects that result from the predicted improvements in air quality are likely to be insignificant. One possible exception is Epping Forest Special Area of Conservation, a site where air pollution has been identified as a contributory factor in the unfavourable status of elements of the site. With sites of international importance for nature conservation, even small improvements may be perceived as being significant.
- 4.3.5 Equally, it is likely that effects on cultural heritage assets from acid damage and soiling would be limited. However, these effects would be experienced to varying degrees by many buildings and monuments, some of which may be venerable and very sensitive to pollution impacts.

#### 4.4 References

EC, 1996	Framework Directive 96/62/EC on ambient air quality assessment and management ('The EU Air Quality Framework Directive')
EC, 1999	Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide, and oxides of nitrogen, particulate matter and lead in ambient air ('The first Daughter Directive')
EC, 2000	Council Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air ('The Second Daughter Directive')
EC 2002	Council Directive 2002/3/EC relating to ozone ('The Third Daughter Directive')
DCLA 1994	Planning Policy Guidance Note 15 (PPG15) 'Planning and the Historic Environment' (1994)
DCLA 2005	Planning Policy Statement 9 – Biodiversity and Geological Conservation
DEFRA, 2000	Department of the Environment, Food and Rural

	Affairs, <i>The Air Quality Strategy for England, Wales, Scotland and Northern Ireland Working Together for Clean Air</i> , DEFRA, 2000.
DEFRA, 2000	Department of the Environment, Food and Rural Affairs, <i>Waste Strategy 2000</i>
GLA, 2002	Greater London Authority: The Mayor's Biodiversity Strategy
GLA, 2002	Greater London Authority, <i>Cleaning London's Air: The Mayor's Air Quality Strategy</i> , GLA, February 2004.
GLA, 2004	Greater London Authority, <i>The London Plan</i> , GLA, February 2004.
GLA, 2004	Greater London Authority: <i>The Mayor's Ambient Noise Strategy: Sounder City</i>
HM Government, 1990	The Planning (Listed Buildings and Conservation Areas) Act 1990
HM Government, 2003	End of Life Vehicles (Producer Responsibility) Regulations (2003)
HM Government 2006	Statutory Instrument 2006 No. 2238 The Environmental Noise (England) Regulations 2006
London Biodiversity Partnership	London Biodiversity Partnership: <i>The London Biodiversity Action Plan</i>
Scott Wilson, 2006	Scott Wilson, <i>Strategic Environmental Assessment of the Proposed Revisions to the Mayor's Transport Strategy and the Mayor's Air Quality Strategy to Introduce a Low Emission Zone: Environmental Report</i> , January 2006.
TfL, 2001	Transport for London, <i>The Mayor's Transport Strategy</i> , TfL, July 2001.
UK BAP	The UK Biodiversity Action Plan accessible via: <a href="http://www.ukbap.org.uk/">http://www.ukbap.org.uk/</a>

## 5 Method of Assessment

### 5.1 Introduction

- 5.1.1 This chapter provides information on the procedures adopted to carry out the environmental appraisal of the proposed LEZ. It includes information on:
- The legislative requirement for Environmental Impact Assessment (EIA) and why EIA is not required for the proposed LEZ
  - The general approach to assessment, including an explanation of how environmental effects are identified, their significance judged and how mitigation measures are employed

### 5.2 The Low Emission Zone and EIA

- 5.2.1 EIA is a procedure designed to ensure that the likely significant environmental effects of a new development are fully understood and taken into account, together with mitigation measures, before it is allowed to proceed. EIA is mandatory for certain classes of development.
- 5.2.2 The source of the requirement is the European Directive on 'The assessment of certain public and private projects on the environment' (85/337/EEC), which was transposed into UK legislation in July 1988. This was subsequently amended by Directive 97/11/EC, transposed in March 1999 by Statutory Instrument 1999 no. 293 (the EIA Regulations).
- 5.2.3 The Regulations apply to two separate lists of projects:
- 'Schedule 1 projects', for which EIA is required in every case
  - 'Schedule 2 projects', for which EIA may be required, but only if the particular project in question is judged likely to give rise to significant environmental effects
- 5.2.4 The proposed LEZ is not among the categories of project that appear in either of these schedules and therefore is not subject to the EIA Regulations.
- 5.2.5 However TfL have decided to undertake a voluntary environmental appraisal as a best practice measure. The appraisal is making use of EIA procedures and methods in order to ensure that it is robust.

### 5.3 Identifying Environmental Effects

- 5.3.1 EIA identifies environmental effects on *resources* and *receptors*, which are defined as follows:
- *Resources* are defined as bio-physical features or items of 'environmental capital'; examples include habitats, aquifers, access routes, and community facilities



- *Receptors* comprise human beings, either individually or collectively, and the socio-economic systems on which they depend; for example, residents, employees, communities and economies

5.3.2 An environmental 'effect' (beneficial or adverse) results from a change (or impact) influencing a resource or receptor. The precise nature of the effect and its 'significance' will depend on the interaction between the degree of impact (for example, its extent, duration, magnitude or permanence) and the *sensitivity, value* or *number* of the resources or receptors in each case. Where appropriate, thresholds of significance are identified in the individual topic chapters.

5.3.3 Effects may also be temporary or permanent, and some effects, including those generated by other projects, may act cumulatively. There can also be secondary effects that arise as a result of an initial effect of a scheme.

## 5.4 Mitigating Adverse Effects

5.4.1 Schedule 4 of the EIA Regulations states that an Environmental Statement should include "*a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment*" (Para 5). Such measures, referred to as mitigation, may include the following:

- Mitigation incorporated into the design of the works during the design development process
- Additional mitigation applied to the project by means of physical measures
- Mitigation through controls on operational or construction procedures

5.4.2 The approach to mitigation in this environmental report follows guidance published by the Department for Environment, Transport and the Regions (DETR, 1998).

5.4.3 The approach adopted is to integrate appropriate measures within the design as it emerges rather than to provide 'bolt-on' solutions at the end of the design process. This is demonstrated within the relevant specialist chapters although it is not possible to describe or reproduce each iteration of the scheme as it has evolved in response to predicted environmental effects.

5.4.4 The fundamental aim of mitigation is to reduce the significance of the environmental effects; where mitigation fails to eliminate entirely any (adverse) environmental effect, the remaining component of the effect is known as the residual effect.

## 5.5 Technical Scope

- 5.5.1 The general requirements for the content of the environmental report are contained in Schedule 4 of the EIA Regulations. This, *inter alia*, requires the ES to include a “description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors”.
- 5.5.2 To define more closely the range of issues to be addressed by the appraisal, a Scoping Report (Scott Wilson, 2006) was produced. This included an inventory of topics selected using guidance produced by the Environment Agency (EA, 2002), together with a summary of issues usually associated with each. The inventory showed those issues that were to be included in the EA ('scoped-in'), and those that were to be excluded ('scoped out').
- 5.5.3 The Scoping Report was presented to key stakeholders for informal consultation. Table 5.1 includes all of the issues that were 'scoped in' to the EA and reflects the results of discussion with the consultees (see Chapter 1). The full set of issues considered is given in Appendix 5-A. Many of these issues are clearly irrelevant to the proposed LEZ and this reflects the generic nature of the Environment Agency guidance.
- 5.5.4 It is usual to 'scope out' topics where the environmental effects on a particular type of resource or receptor will be below significance thresholds. The definition of when an effect is significant is a key aspect of the scoping process, because only significant effects need to be reported. Topics unlikely to give rise to significant effects (ascertained through reasoned professional judgement) were therefore omitted at the scoping stage. These omitted topics are reviewed and their significance re-evaluated in response to new information.

**Table 5.1: Key issues considered in the environmental appraisal**

Topic	Key Issues
<b>Air Quality</b>	Changes in exhaust emissions leading to improved concentrations of airborne pollutants
	Improvements in air quality
<b>Noise</b>	Noise from construction traffic and operations
	Possible decrease in noise from newer vehicles
<b>Landscape</b>	Change in character of landscape
	Obvious visual intrusion of the camera infrastructure, signage and associated structures
<b>Ecology</b>	Disturbance to, or loss of, species (including rare and sensitive species)

	Alteration (and potential improvement) of terrestrial habitats
<b>Cultural Heritage</b>	Damage to known or unknown features of archaeological or cultural importance
<b>Waste</b>	Increase in volume of waste resulting from early scrapping of vehicles

## 5.6 Determining Significance

- 5.6.1 A significant effect may be very broadly defined as one that should be brought to the attention of those involved in the decision-making process. This definition is prescribed to varying degree by statute (including EC and national guidelines and standards) and influenced by the precedents established in previous EIAs.
- 5.6.2 Guidance on significance has been mainly of a generic nature such as Circular 2/99 (DETR, 1999), and practitioners have been obliged to develop definitions for specific topics and projects. It is broadly accepted, however, that significance reflects the relationship between two factors:
- The magnitude or severity of an impact (i.e. the actual change taking place to the environment); and
  - The sensitivity, importance or value of the affected resource or receptor
- 5.6.3 The magnitude of an impact is often quantifiable in terms of, for example, extent of land take, or predicted change in noise levels, and can be either positive or negative. The sensitivity, importance or value of the resource or receptor is normally derived from:
- Its designated status within the land use planning system
  - The number of individual receptors such as residents
  - An empirical assessment on the basis of characteristics such as rarity or condition
  - Its ability to absorb change without impact
- 5.6.4 Significant effects occur where valuable or sensitive resources, or numerous receptors, are subject to impacts of considerable magnitude. Effects are unlikely to be significant where low value or non-sensitive resources, or a small number of receptors, are subject to minor impacts. Allocation of significant effects in intermediate situations will be a matter for professional judgement in each topic area.
- 5.6.5 Where an effect is considered to be significant, this significance will generally be classified as Severe, Moderate, Low or Negligible (with these descriptions again being based on precedent or current guidance). Within this report, the following generic matrix (Table 5.2) is used to define the level of significance of effects. In some cases analogous matrices for the various specialist topics are used.

**Table 5.2: Significance Matrix**

Sensitivity (value) of resource / receptor	Magnitude of Impact		
	High	Medium	Low
High	Substantial	Substantial/ Moderate	Moderate
Medium	Substantial/ Moderate	Moderate	Moderate/ Low
Low	Moderate	Moderate/ Low	Low/Negligible

- 5.6.6 The four levels of significance defined by the generic matrix are therefore:
- Substantial - An effect which in isolation could have a material influence on the decision making process
  - Moderate - An effect which on its own could have some influence on decision making, particularly when combined with other similar effects
  - Low - An effect which on its own is likely to have a minor influence on decision making but when combined with other effects could have a more material influence
  - Negligible - An effect that is likely to have a negligible influence on decision making, irrespective of other effects

## 5.7 Spatial and Temporal Scope

- 5.7.1 In general, the spatial scope of the appraisal is limited to Greater London and effects outside of Greater London are not investigated. The temporal scope covers effects that are likely to occur between 2008 and 2015.

## 5.8 References

DETR, 1998	Department of Environment, Transport and the Regions, <i>Mitigation Measures in Environmental Statements</i> , 1998.
DETR, 1999	Department of Environment, Transport and the Regions, <i>Circular 02/99: Environmental Impact Assessment</i> , 1999
EA, 2002	Environment Agency, <i>Scoping guidelines on the Environmental Impact Assessment (EIA) of projects</i> , May 2002
Scott Wilson, 2006	Scott Wilson, <i>London Low Emission Zone: Environmental Appraisal: Scoping Report</i> , September 2006.

## 6 Traffic

### 6.1 Introduction

6.1.1 This chapter discusses the potential implications of the proposed LEZ for traffic.

6.1.2 It is proposed that from early 2008 certain emission standards would apply to diesel-engine Heavy Goods Vehicles (HGVs) over 12 tonnes and from mid-2008 these would apply to HGVs over 3.5 tonnes, buses and coaches. From 2010 the standards would also apply to diesel-engine heavier Light Goods Vehicles (LGVs) and minibuses. The aim is to deter the most individually polluting, diesel engine vehicles from driving within the Greater London area.

### 6.2 Methodology

6.2.1 TfL expects the main impacts on traffic as a result of the proposed LEZ to be in the form of a change in the vehicle stock profile, rather than on traffic volumes or patterns per se. The only exception to this relates to the possibility of a small number of vehicles seeking to divert away from the LEZ boundary to avoid paying the daily charge. However, TfL's analysis indicates that this impact is expected to be marginal, even on the key diversion route – the M25.

6.2.2 For the purposes of this assessment, the traffic implications of the LEZ have been considered qualitatively. No additional modelling has been commissioned or undertaken to support this environmental appraisal and accordingly: (i) the assessment is based on previous analyses and studies of likely traffic implications; and (ii) the traffic implications of the LEZ have been considered at a strategic level only.

6.2.3 The effects of the following have been considered:

- Temporary disruption during the installation of enforcement infrastructure
- Non-compliant vehicles seeking to avoid the LEZ charging zone
- Vehicles with no origin or destination within London but that currently pass through London (through trips)

### 6.3 Impact Assessment

#### *Construction*

6.3.1 The impacts of construction activities associated with the possible implementation of the proposed LEZ are likely to be insignificant. While there are several hundred sites in and around London identified for the installation of cameras or traffic signs, in most instances these would not affect the carriageway itself. The small scale of the associated works would mean that any temporary road or lane closures required to (for instance) connect cameras to power or data cables would be very short in duration and

restricted to just a few sites.

*Non-compliant Vehicles seeking to avoid the LEZ charging zone*

6.3.2 TfL has undertaken an analysis into the possibility of the LEZ diverting non-compliant vehicles onto routes around Greater London.

6.3.3 The analysis considered the impact of the LEZ on three types of trip:

- A long distance trip
- A trip with an origin and destination inside the M25/GLA boundary but outside the LEZ
- A short distance trip that appeared unlikely to use the M25

6.3.4 In its conclusion, the report identifies that the analysis demonstrates that:

*'...for the routes examined, a route through London is always slower than using the M25, adding at least 25% to the journey time. Only drivers with a low value of time would find the shorter route through London worth taking.'*

*Through Trips*

6.3.5 Supporting analysis, using a combination of data sources, including the LTS traffic model, was also undertaken. This considered the effect of the LEZ on non-compliant vehicles that currently travel through London. The analysis concluded:

*'The M25 is likely to experience only a negligible increase in total daily traffic volumes of LLEZ non-compliant vehicles as a result of rerouting due to the LLEZ.'*

6.3.6 The analysis indicates that it is unlikely that significant numbers of HGVs or LGVs would choose to take the significantly slower inside-M25 route rather than use the M25.

Earlier work (AEA, 2003) undertaken using an earlier version of the LTS model supports the TfL analysis.

6.3.7 Most traffic with no origin or destination within London (i.e. through trips) would already be using the M25 and therefore be unaffected by the LEZ.

6.3.8 It is understood that enforcement of the LEZ would be by a number of fixed and mobile camera enforcement sites. As with all schemes of this nature a level of non-compliance would occur. The likely implications on the road network of non-compliance are as follows:

- Avoid known fixed camera sites by re-routing (rat-running)
- Minimise risk of detection by mobile sites by using routes less likely to be subject to mobile camera enforcement

6.3.9 The impact of re-routing to avoid known camera sites is difficult to quantify

and the main impact in terms of the Environmental Appraisal would be where traffic uses a local diversion on an unsuitable route. The driver would need to make a number of decisions for this result to materialise, primarily based on cost, all of which would diminish the likelihood of occurrence. The decisions are:

- Not to comply with the LEZ
- To (potentially) not comply with the London Lorry Control Scheme (applies only to vehicles covered by the LLCS)
- To incur the (potential) additional journey time cost as a result of the diversion onto an unsuitable route

6.3.10 The LLCS has been in existence since 1986 and was established to address the disturbance caused by heavy lorries at night and at weekends. Its objective is to reduce noise nuisance at these times by eliminating through traffic and minimising the environmental effects of heavy lorries. It is enforced and administered by London Councils, (formerly known as the Association of London Government or ALG). Lorries are banned from 9pm-7am Monday-Saturday and from 1pm Saturday to 7am Monday.

6.3.11 The LLCS applies to the whole of the Greater London area. However, there is an Exempt Route Network (ERN), which is outside of the ban, consisting of the North and South Circular Roads and major radials leading to the above and some continuing further towards Central London. The lorry weight limit for the LLCS is set at over 18 tonnes. Exemptions are provided for lorries with essential business in London during the controlled hours.

6.3.12 The LLCS has the effect of reducing the alternative routes for non-LEZ compliant vehicles during its times of operation.

6.3.13 TfL's LEZ operator survey (TfL, 2006) of LGVs, HGVs, Buses and Coaches is a potentially useful indicator of potential levels of operator non-compliance. The figures below are the percentages choosing the response: '*Continue to use non-compliant buses or coaches into the zone and risk being fined*'. This work indicated that the level of non-compliance would depend upon the timescale for implementation of the LEZ. However, for LGVs the stated level of non-compliance was some 2%; for HGVs between 1% and 3%; and for Buses and Coaches between 1% and 5%.

6.3.14 Based upon the above, the likelihood of local re-routing onto unsuitable roads to avoid fixed camera sites is likely to be negligible. Smaller vehicles are more likely to be able to physically negotiate the 'unsuitable' alternative routes and are also not constrained by the LLCS, so any avoidance might be mostly accounted for by this type of vehicle.

6.3.15 Strategic re-routing to avoid camera sites may also occur. This would involve longer journeys making more strategic diversions away from known camera sites. The likelihood is that these would remain on 'suitable' routes (notwithstanding the LEZ) and therefore have negligible environmental

impacts.

## 6.4 Mitigation

6.4.1 No mitigation measures are proposed at this stage.

## 6.5 Monitoring

6.5.1 Should the overall impact of the LEZ on traffic patterns be as negligible as anticipated, global monitoring of the implications would be difficult. Traffic volumes for the Greater London area that are currently monitored and readily available would provide a useful source of information relating to traffic flows by vehicle type on main routes into London and also on the M25.

6.5.2 It is suggested that a monitoring strategy be developed that is also focused upon representative areas, such as those around camera sites, to assess any local impacts.

## 6.6 Conclusions

6.6.1 The following table summarises the implications discussed in this chapter:

**Table 6.1: Traffic Implications of LEZ**

Implication	Likely Impact
Vehicles with no origin or destination within London diverting	Negligible impact
Rat-running on unsuitable roads due to non-compliant vehicles avoiding enforcement camera sites	No quantified impact but liable to be negligible
Change in the transportation of goods and people in and around London by road	No quantified impact but unlikely to have negative environmental impacts

## 6.7 References

- |            |   |
|------------|---|
| AEA, 2003  | AEA Technology, <i>London Low Emission Zone Feasibility Study Phase II Final Report</i> , 2003.           |
| TfL, 2006  | Transport for London, <i>Low Emission Zone Vehicular Operator Research</i> , August 2006                  |
| TfL, 2006a | Transport for London, <i>Analysis of LLEZ diverting vehicles onto DfT orbital routes</i> , September 2006 |



## 7 Air Quality

### 7.1 Introduction

- 7.1.1 This air quality assessment is based upon the modelling study carried out by King's College Environmental Research Group (ERG) on behalf of TfL. The focus of the assessment is on nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub>). It is concentrations of these two pollutants that currently exceed the air quality objectives set out within the Air Quality Strategy, and are forecast to continue to do so well into the future unless additional measures are applied.
- 7.1.2 The ERG study has defined existing air quality conditions in 2005, and baseline air quality in 2008, 2010, 2012 and 2015 assuming a Low Emission Zone is not implemented. This baseline incorporates national and international measures that are currently in place or have already been agreed, in particular those measures to reduce emissions from new vehicles, as well as local measures including congestion charging (including the Western Extension), bus fleet upgrades and the Mayor's taxi emissions strategy. It does not include specific measures that are being introduced as part of local authority action plans.
- 7.1.3 The proposed LEZ is then evaluated against these baseline projections. The LEZ is designed to bring forward the already agreed national and international measures to reduce emissions from the most polluting vehicles on London's roads, and would initially target heavy goods vehicles (HGVs), buses and coaches. At a later stage, the Scheme would include heavier light goods vehicles (LGVs) and minibuses.
- 7.1.4 The modelling study has considered the impact of the proposed LEZ in future years for the following scenarios:
- 2008 - Euro III for PM only (HGVs, buses and coaches)
  - 2010 - Euro III for PM only (HGVs, buses and coaches, heavy LGVs and minibuses)
  - 2012 - Euro IV for PM only (HGVs, buses and coaches) and Euro III for PM (heavy LGVs and minibuses)
  - 2015 - Euro IV for PM only (HGVs, buses and coaches) and Euro III for PM (heavy LGVs and minibuses)

### 7.2 Methodology

- 7.2.1 The assessment reported within this chapter is based upon the modelling studies carried out by ERG on behalf of TfL. The basis of assessment is the London Atmospheric Emissions Inventory (LAEI), which is compiled and updated annually by the Greater London Authority (GLA). The most up to

date version (2003) of the LAEI has been used for this study (GLA, 2006)<sup>3</sup>. The geographical area covered by the LAEI 2003 includes the 32 London Boroughs and the City of London, as well as parts of 19 surrounding districts that lie between the M25 motorway and the Greater London boundary.

- 7.2.2 The ERG model is based on a GIS system including a link-based road network. For each road link, the emissions are calculated taking into account the traffic flows, link length and traffic speed. Consideration is given to both vehicle exhaust emissions, and emissions arising from brake and tyre wear and vehicular resuspension particulates. Other non-traffic emissions sources are also included, including those from industrial processes and commercial and domestic heating. The emissions data are fed into a dispersion model that calculates the pollutant concentrations. The model recognises the dominance of road traffic sources at most locations in London, and allows a more detailed treatment to be given to these emissions (Beevers et al., 2006).
- 7.2.3 The model also requires information on meteorology in order to describe the dispersion of emissions within the atmosphere. The modelling has been carried out using a constant 2002 meteorology, which was an “average” pollution year. In contrast, 2003 is recognised to be a high pollution year, due to the lower wind speeds and more frequent winds from continental Europe. Had 2003 meteorology been used, then the modelled absolute pollutant concentrations predicted for the future years would have been higher, and the differences between the baseline and LEZ scenarios somewhat greater.
- 7.2.4 Emissions are calculated for oxides of nitrogen (NO<sub>x</sub>) and fine particles (PM<sub>10</sub>). The resulting air quality impacts are modelled for NO<sub>x</sub>, nitrogen dioxide (NO<sub>2</sub>) and PM<sub>10</sub>, both in terms of the absolute predicted concentrations, and the changes in concentration.

### **Consideration of primary NO<sub>2</sub> emissions**

- 7.2.5 Nitrogen oxides are emitted from road vehicles mainly in the form of nitric oxide (NO), which then reacts with ozone (O<sub>3</sub>) to form nitrogen dioxide (NO<sub>2</sub>). In areas where NO<sub>x</sub> emissions are high, such as in many parts of central London and close to busy roads, the reaction to form nitrogen dioxide may be limited by the availability of ozone in the atmosphere.
- 7.2.6 A proportion of NO<sub>x</sub> is also directly emitted as nitrogen dioxide (known as “primary NO<sub>2</sub>”) and is included in the dispersion modelling approach. There is recent evidence to suggest that the proportion of primary NO<sub>2</sub> emissions may be increasing, which has important implications for predicting concentrations from road traffic emissions (AQEG, 2006). The precise reason for this increase is not known, but it is thought to be linked to the greater number of diesel vehicles in the London fleet, the effect of more vehicles being fitted with various exhaust after-treatment technologies

<sup>3</sup> The LAEI has been updated since the SEA was published in January 2006. There is an inevitable timelag in compiling these data, and the current inventory for emissions in 2003 was published in 2006.

including catalytically regenerative particulate traps and oxidation catalysts.

7.2.7 In order to take account of this potential effect, each baseline and LEZ scenario has also been modelled assuming an increasing proportion of NO<sub>x</sub> emitted as primary NO<sub>2</sub> in each year. For each LEZ scenario, a further adjustment to the proportion of primary NO<sub>2</sub> emission has also been made to take account of the brought-forward technologies (e.g. newer vehicles). Although the proportion of NO<sub>x</sub> emitted as NO<sub>2</sub> may go up, overall NO<sub>x</sub> levels are predicted fall over this period this effect is predicted to be sufficiently large for the absolute levels of NO<sub>2</sub> to also fall. These assumptions regarding the proportion of NO<sub>x</sub> emitted as NO<sub>2</sub> are set out in Table 7.1 below.

*Table 7.1: Proportion of primary NO<sub>2</sub> emissions assumed for each modelling scenario (source: ERG)*

Year	Baseline	With LEZ
2005	16.3%	N/A
2008	17.8%	18.7%
2010	19.4%	20.1%
2012	19.9%	21.5%
2015	20.9%	21.7%

### 7.3 Baseline

7.3.1 An indication of existing air quality in London can be gauged from the number of Local Authorities that have identified areas that will not meet the air quality objectives, and consequently have declared Air Quality Management Areas (AQMAs). It should be noted that some London Authorities, such as Enfield, have declared the entire Borough as an AQMA, although the actual areas of exceedence are smaller than this. AQMAs have now been declared in 32 of the 33 London Boroughs, 28 of which cover both nitrogen dioxide and PM<sub>10</sub>. With the exception of one Borough, which has declared on the basis of re-suspended dust from an industrial operation, all of the AQMAs are predominantly associated with road traffic emissions. By the end of 2006, it is expected that all Boroughs will have declared AQMAs.

7.3.2 The existing (2005) and future baseline emissions of nitrogen oxides and PM<sub>10</sub> from road traffic in Greater London and the surrounding area are set out in Table 7.2. In this context the study area is defined as that up to and including the M25, and is consistent with the scale of the LAEI 2003. Emissions of both nitrogen oxides and PM<sub>10</sub> decline in future years as a result of measures that are already in place, or have been agreed.

**Table 7.2: Emission of nitrogen oxides and total PM<sub>10</sub> (vehicle exhaust plus tyre and brake wear) from traffic in Greater London and external area, without the LEZ (source: ERG)**

Year	Nitrogen oxides (tonnes)	PM <sub>10</sub> (tonnes)
2005	39180	2750
2008	33851	2460
2010	27050	2180
2012	25360	2140
2015	21630	2040

7.3.3 These emissions, when input to the dispersion model, produce the baseline concentrations for both nitrogen dioxide and PM<sub>10</sub>. Figures 7.1 to 7.4 describe nitrogen dioxide concentrations in 2005, 2010, 2012 and 2015. Figures 7.5 to 7.12 describe the PM<sub>10</sub> concentrations in the same years.

7.3.4 The following key features are apparent in the baseline data:

**Nitrogen dioxide (Figures 7.1 to 7.4)**

- The predicted concentrations for 2005 are broadly consistent with the AQMAs that have been declared by the London Boroughs
- Concentrations are generally higher in central London, and alongside the main roads throughout Greater London, i.e. within about 20 to 30 m of the carriageway. The influence of the motorways and major trunk routes including the M4, M1, M40, A406 (North Circular Road) and the A12 to A102 (north-south route through the Blackwall tunnel) can be clearly seen, as can the M25 where sections run within the Greater London boundary e.g. to the northeast of London
- Concentrations decline in future years as a result of measures that are currently in place or have already been agreed and as a result of the natural turnover in the fleet.
- Concentrations remain above the annual mean objective and EU limit value (40 µg/m<sup>3</sup>) at some locations even in 2010 and 2015 (see Figures 7.2 and 7.4). These locations are mainly alongside main roads, but more widespread exceedences occur in central London in 2010, and are still evident by 2015
- Heathrow airport stands out as a nitrogen dioxide hotspot, but the elevated concentrations are mostly within the airport boundary

### PM<sub>10</sub> (Figures 7.5 to 7.10)

- Concentrations are generally higher in central London, and alongside the major roads. The influence of the A406 (North Circular Road), the A12 to A102 (north to south of the Blackwall tunnel) and the A13 can be clearly identified
- Concentrations decline in future years as a result of measures that are currently in place or have already been agreed
- The statutory 2004 daily mean objective and 2005 daily mean limit value, both set at no more than 35 days above 50 µg/m<sup>3</sup> in any year, are exceeded close to sections of main road. In 2005 (see Figure 7.5) this includes sections of the A406 (North Circular Road), A4, A40, A40(M), A13 and the A12 to A102 (north to south of the Blackwall tunnel). Exceedences remain in 2015, but the sections of roads affected are much reduced (see Figure 7.6)
- The provisional 2010 annual mean objective set at 23 µg/m<sup>3</sup>, is widely exceeded in central London and alongside many main roads in 2005 (see Figure 7.7). By 2010 these exceedences are limited to areas adjacent to main roads in central London, and other major routes such as the A406, A12 and A102 (see Figure 7.8), and to much reduced sections of these road links in 2012 and 2015 (see Figures 7.9 and 7.10)

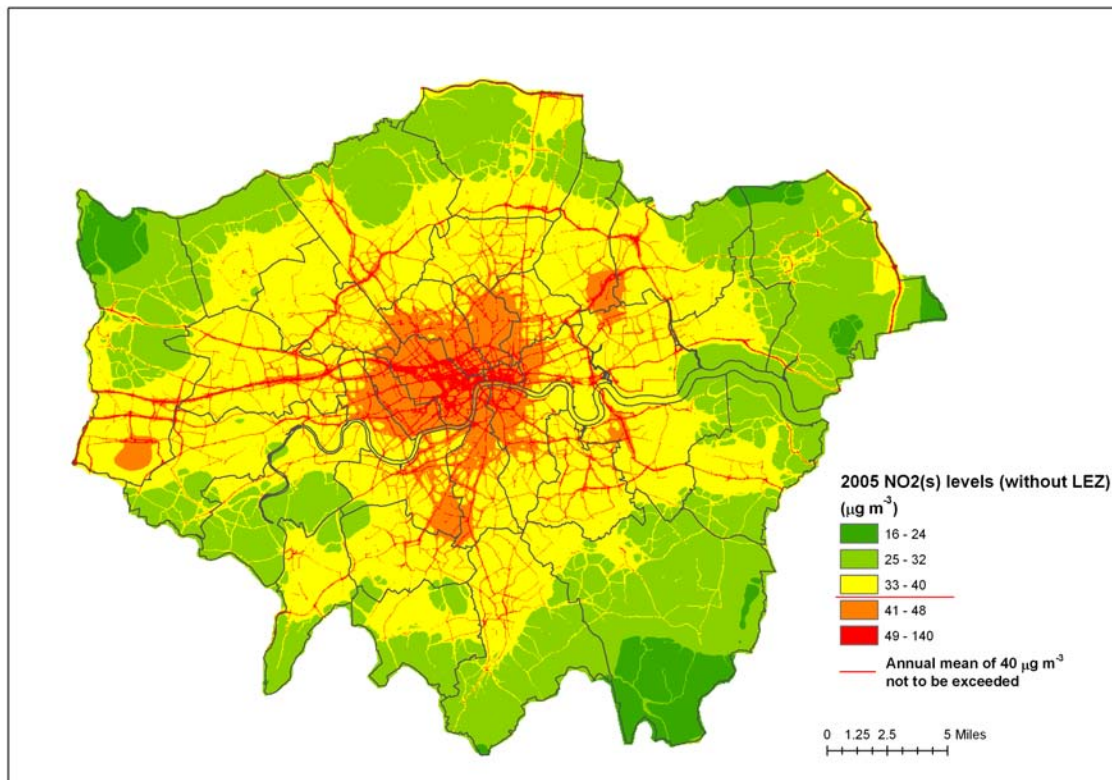


Figure 7.1: Baseline annual mean nitrogen dioxide in Greater London in 2005 (source: AEA)

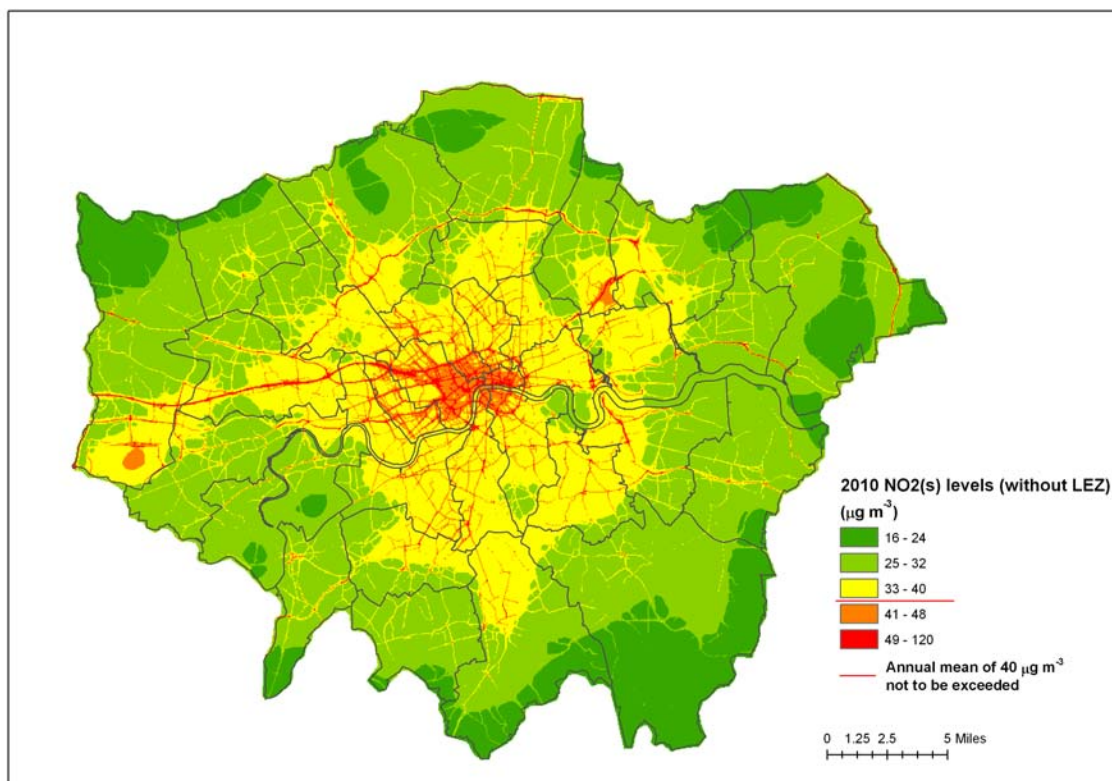


Figure 7.2: Baseline annual mean nitrogen dioxide in Greater London in 2010 (source: AEA)

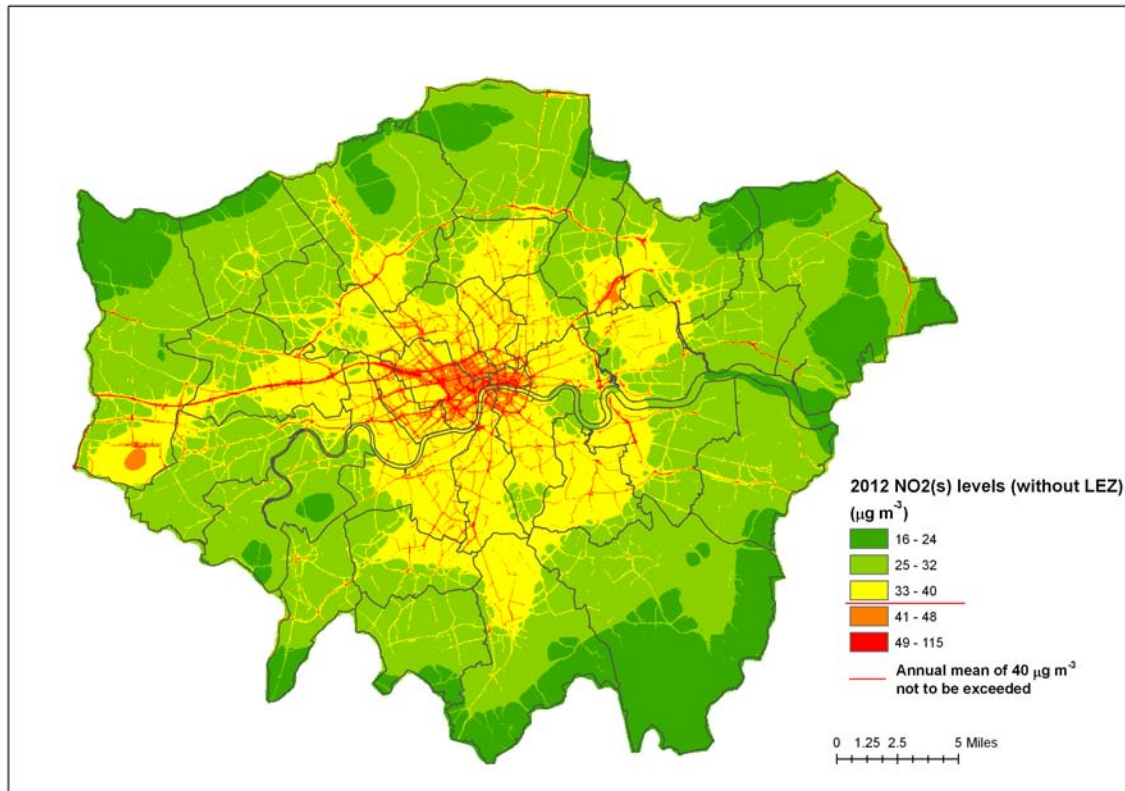


Figure 7.3: Baseline annual mean nitrogen dioxide in Greater London in 2012 (source: AEA)

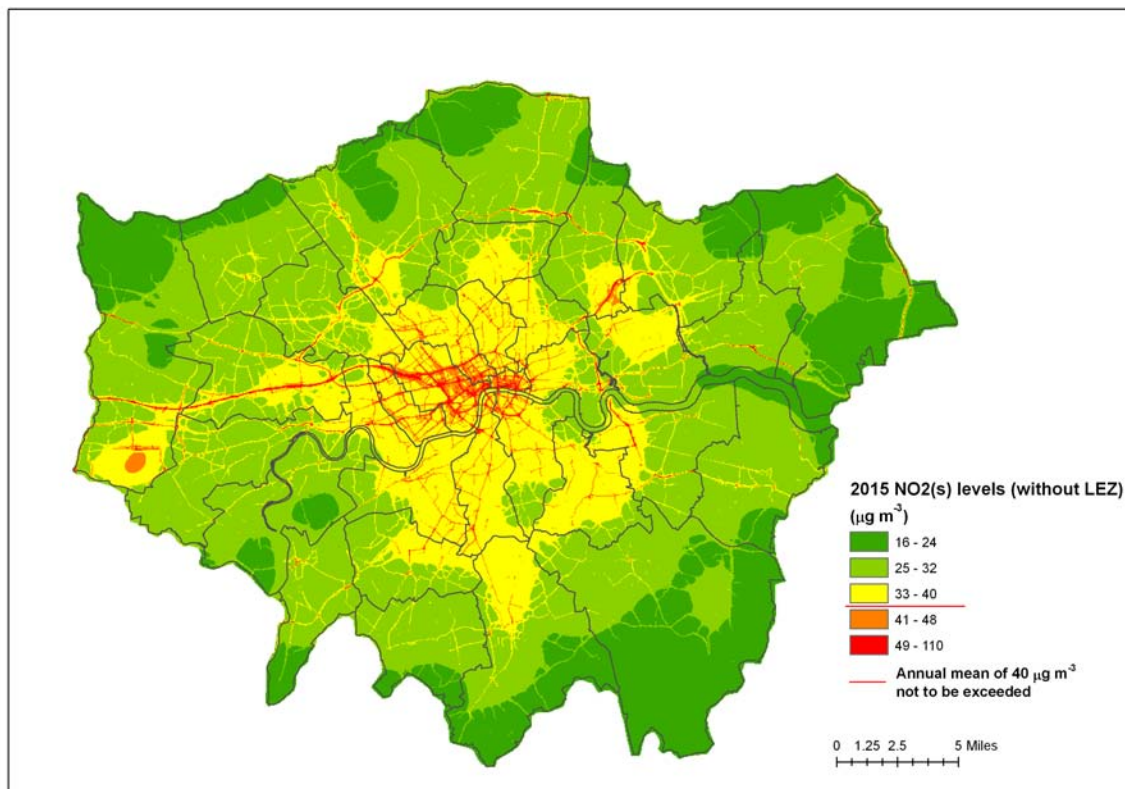


Figure 7.4: Baseline annual mean nitrogen dioxide in Greater London in 2015 (source: AEA)

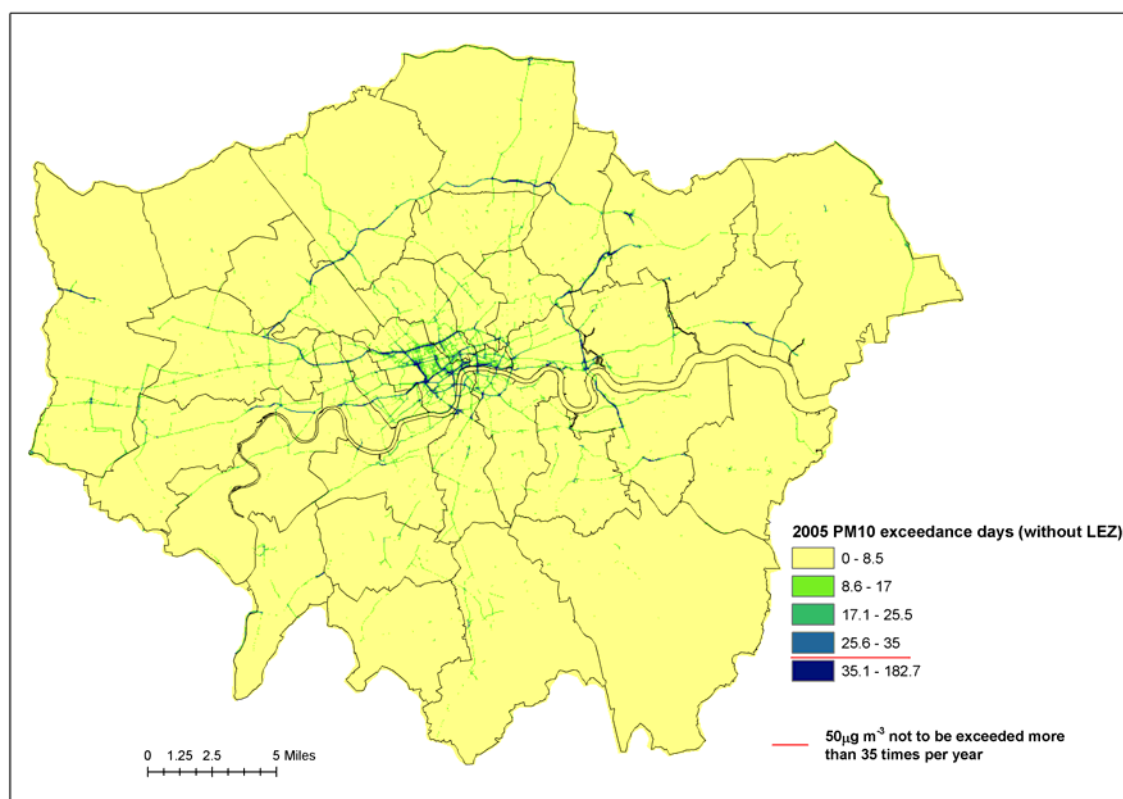


Figure 7.5: Baseline number of days  $>50 \mu\text{g}/\text{m}^3$   $\text{PM}_{10}$  in Greater London in 2005 (source: AEA)

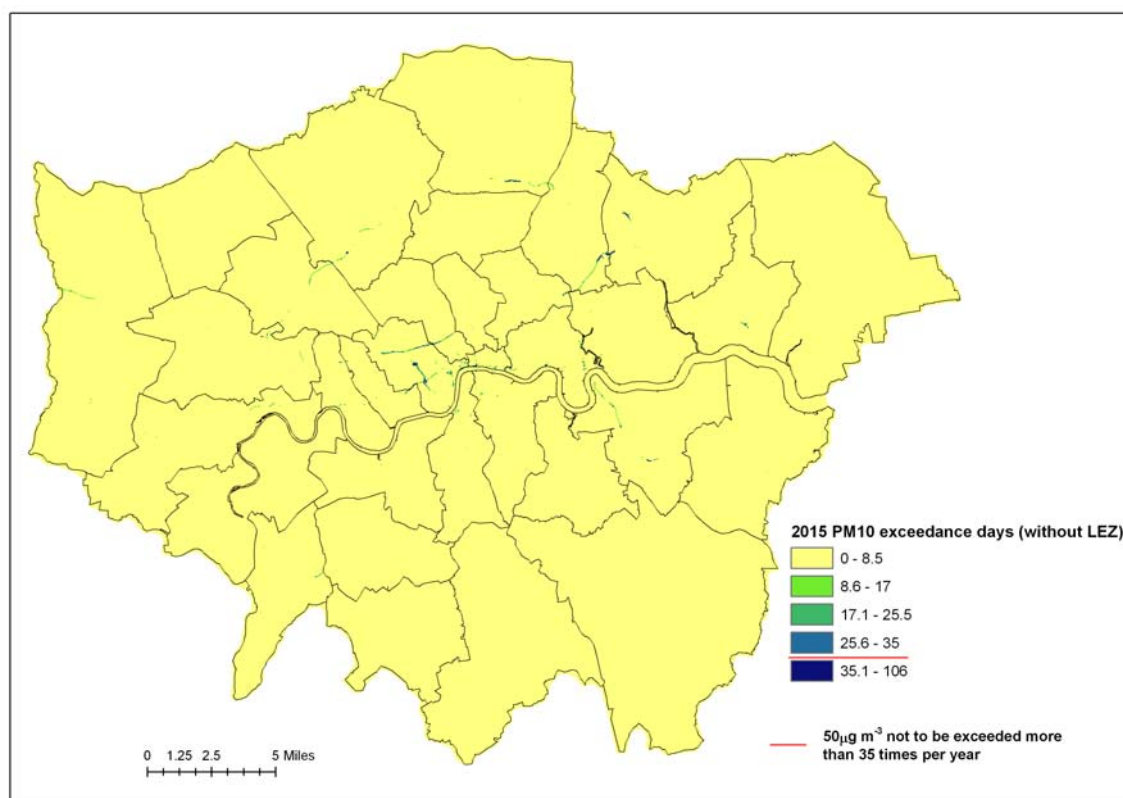


Figure 7.6: Baseline number of days  $>50 \mu\text{g}/\text{m}^3$   $\text{PM}_{10}$  in Greater London in 2015 (source: AEA)



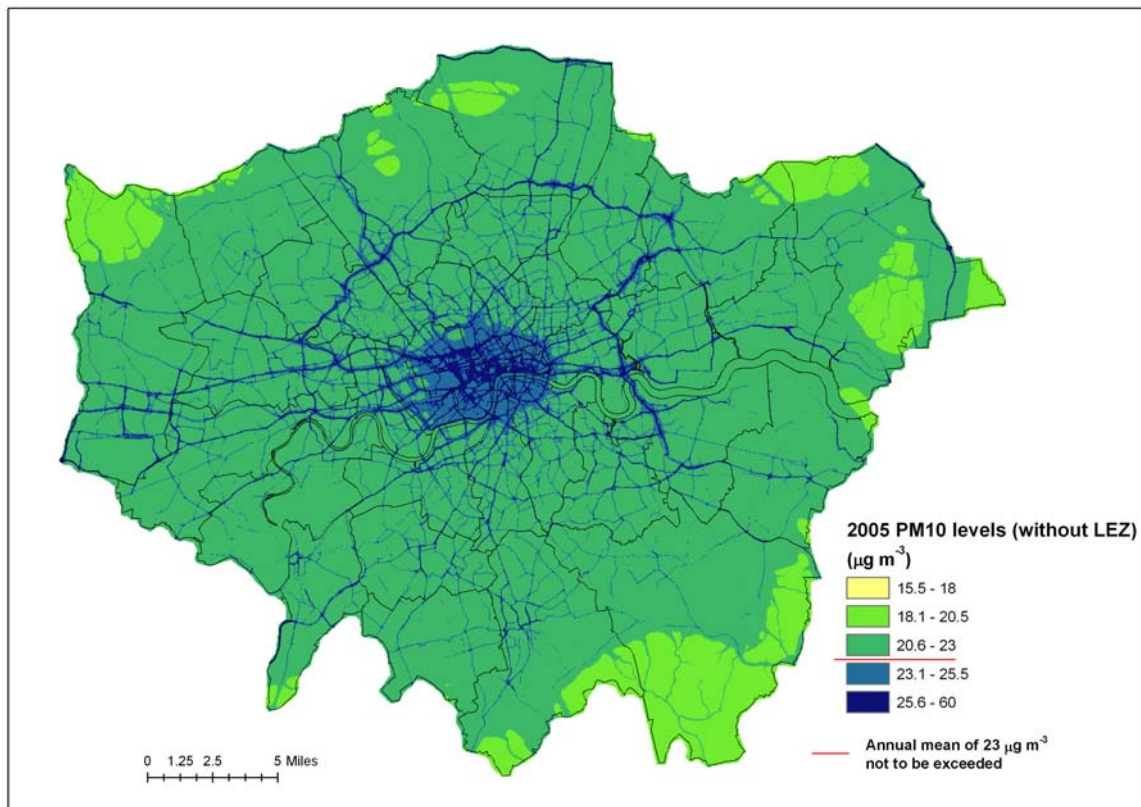


Figure 7.7: Baseline annual mean  $\text{PM}_{10}$  in Greater London in 2005 (source: AEA)

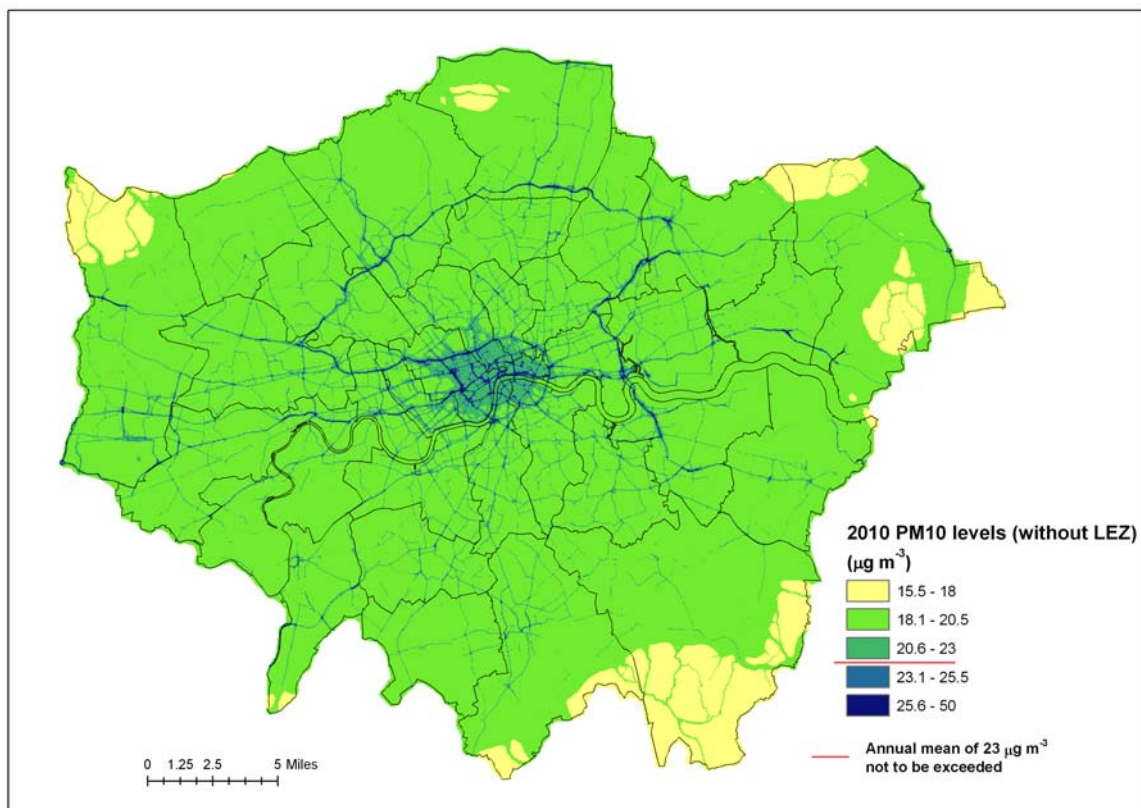


Figure 7.8: Baseline annual mean  $\text{PM}_{10}$  in Greater London in 2010 (source: AEA)

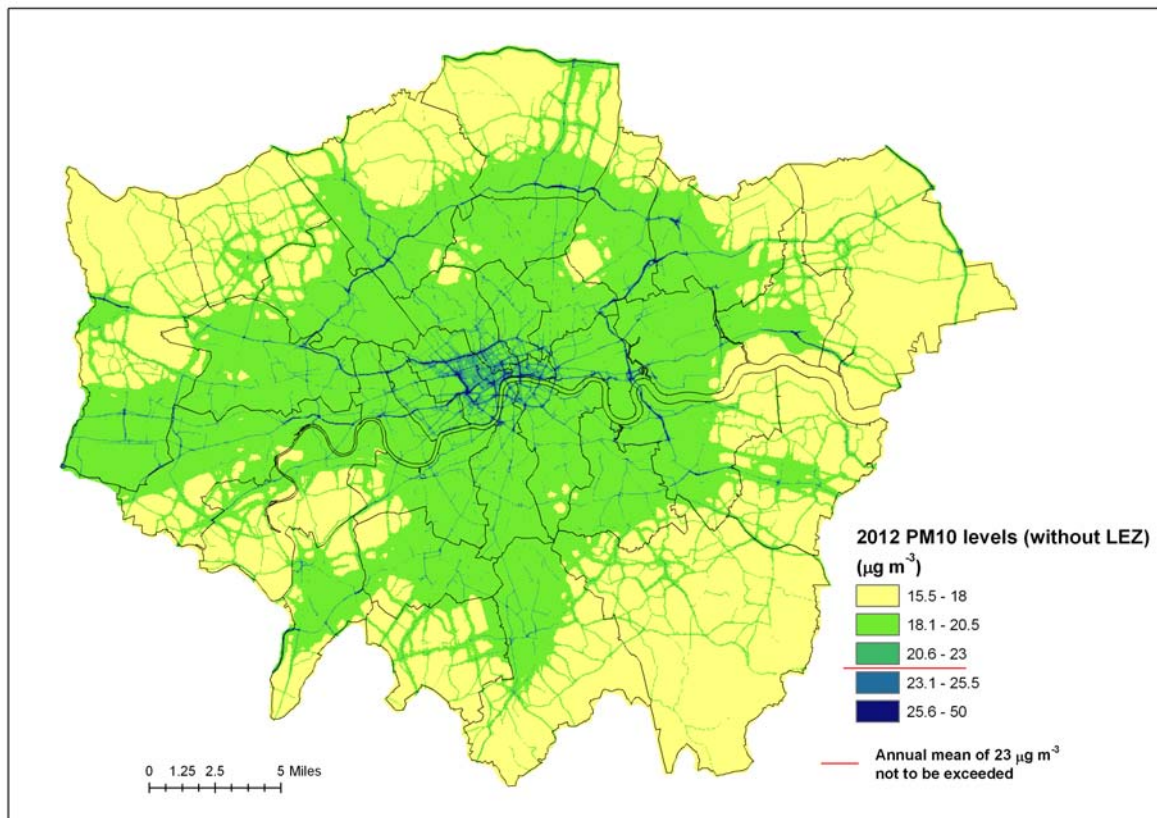


Figure 7.9: Baseline annual mean  $\text{PM}_{10}$  in Greater London in 2012 (source: AEA)

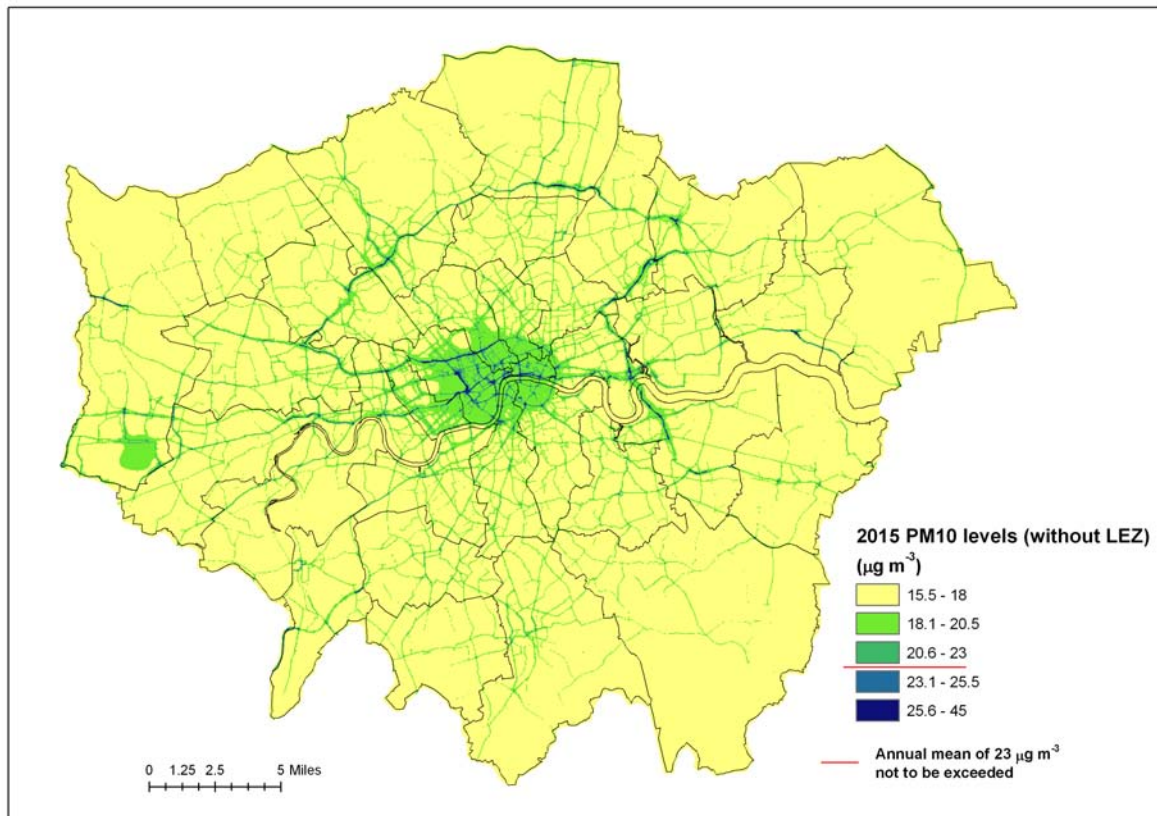


Figure 7.10: Baseline annual mean  $\text{PM}_{10}$  in Greater London in 2015 (source: AEA)

## 7.4 Projected impacts of the proposed LEZ on emissions

7.4.1 The projected impact of the LEZ is first described in terms of the change in emissions of nitrogen oxides and PM<sub>10</sub> from road traffic in London. The results are summarised in Table 7.3.

*Table 7.3: Emissions of nitrogen oxides and total PM<sub>10</sub> from traffic (vehicle exhaust plus tyre and brake wear) in Greater London and external area, with and without the LEZ (source: ERG)*

Year	Nitrogen oxides (tonnes)		PM <sub>10</sub> (tonnes)	
	Baseline	With LEZ	Baseline	With LEZ
2008	33850	32560	2460	2400
2010	27050	26390	2180	2120
2012	25360	22880	2140	2002
2015	21630	20680	2040	1990

7.4.2 The data summarised in Table 7.3 shows that the LEZ would bring forward the reduction in traffic emissions of nitrogen oxides, such that the 2012 emissions with the LEZ would not be met until several years after without the Scheme. Similarly, the LEZ would bring forward the reduction in traffic emissions of PM<sub>10</sub> such that the 2012 emissions with the LEZ would not be achieved even by 2015 without the Scheme.

7.4.3 The projected percentage reductions in emissions of nitrogen oxides and PM<sub>10</sub> brought about by the proposed LEZ for each year are also set out in Tables 7.4 and 7.5 respectively, broken down by area. In this context, the “Central” area encompasses the Congestion Charging Zone; the “Inner” area, the region between the Central area, up to and including the North/South Circular roads; the “Outer” area, the region beyond the North/South Circular roads up to the GLA boundary; and the “External” area, the area beyond the GLA boundary, up to and including the M25.

*Table 7.4: Percentage reduction in emissions of nitrogen oxides from traffic in London with LEZ, for different zones (Source: ERG). Percentages are relative to the baseline in each of the years.*

Year	Nitrogen oxides (% reduction)				
	Central	Inner	Outer	External	Total area
2008	-2.60%	-3.22%	-3.49%	-4.56%	-3.81%
2010	-2.15%	-2.53%	-2.51%	-2.37%	-2.45%
2012	-6.64%	-8.24%	-9.01%	-11.78%	-9.76%
2015	-3.19%	-3.82%	-4.10%	-5.29%	-4.42%

**Note:** the Central, Inner and Outer areas lie within the GLA boundary. The External area extends from the GLA boundary up to, and including the M25.

**Table 7.5: Percentage reductions in emissions of total PM<sub>10</sub> (exhaust plus tyre and brake wear) from traffic in London with LEZ, for different zones (Source: ERG). Percentages are relative to the baseline in each of the years.**

Year	PM <sub>10</sub> (% reduction)				
	Central	Inner	Outer	External	Total area
2008	-2.07%	-2.17%	-2.21%	-3.64%	-2.60%
2010	-2.64%	-2.79%	-2.77%	-3.33%	-2.92%
2012	-4.94%	-5.34%	-5.63%	-9.41%	-6.56%
2015	-1.83%	-1.88%	-1.95%	-3.28%	-2.28%

**Note:** the Central, Inner and Outer areas lie within the GLA boundary. The External area extends from the GLA boundary up to, and including the M25.

- 7.4.4 It can be seen from both Tables 7.4 and 7.5 that the greatest reductions brought about by the LEZ are for nitrogen oxides, particularly in 2012 reflecting the introduction of Euro IV standards early that year. The greatest reductions of both nitrogen oxides and PM<sub>10</sub> emissions occur within the External area, which lies outside of the Greater London administrative boundary and the LEZ zone. These reductions are largely attributed to traffic on the M25. Although the M25 would not fall within the LEZ, it is anticipated that the scheme would bring about the earlier introduction of cleaner vehicles onto roads in the wider network outside of the GLA boundary.
- 7.4.5 The greatest reductions occur in 2012, when the Euro IV emissions limits are introduced, but fall thereafter. This is because the LEZ is designed to bring forward measures that are already programmed to be introduced in future years.

## 7.5 Projected impacts of the proposed LEZ on concentrations

- 7.5.1 The emission data described above have been input into the ERG dispersion model to predict future concentrations of nitrogen dioxide and PM<sub>10</sub>, both with and without the proposed LEZ. The changes in overall concentrations are different to those observed for the emissions:
- The emissions data described above relate to road traffic only. There are many other sources of both NO<sub>x</sub> and PM<sub>10</sub>, both in London and outside, which contribute to concentrations. The projected changes in concentrations would therefore be lower than changes in road traffic emissions
  - The formation of nitrogen dioxide is governed by complex chemistry in the atmosphere, and the relationship between nitrogen oxides emissions, and nitrogen dioxide concentrations, is not linear but also a function of meteorology, ozone availability and other factors.
- 7.5.2 The concentrations have been calculated for the 2008, 2010, 2012 and 2015 LEZ scenarios. The changes in predicted concentrations in both nitrogen

dioxide and PM<sub>10</sub> are illustrated in Figures 7.11 to 7.20.

7.5.3 The following key features are apparent from these figures:

#### **Nitrogen dioxide (Figures 7.11 to 7.14)**

- The greatest reductions in nitrogen dioxide concentrations with the LEZ occur in central London, and along specific main route corridors. These are the roads with the greatest proportion of HGVs, and include the A406 (North Circular Road), A12 to A102 (north to south of the Blackwall Tunnel), and the A13 extending eastwards towards the Dartford Bridge. The reductions associated with traffic on the M25 can also be clearly seen in those parts of Greater London where the motorway crosses, or is close to the boundary.
- The greatest reductions in nitrogen dioxide concentrations occur in 2012, coincident with the introduction of Euro IV standards (see Figure 7.13).
- The reductions in annual mean concentrations of nitrogen dioxide are mostly in the 0 to 0.35 µg/m<sup>3</sup> range (2008 and 2010), rising to 0.35 to 0.7 µg/m<sup>3</sup> in 2012. The reductions in central London in 2012 are in the range 0.7 to 1.05 µg/m<sup>3</sup>.

#### **PM<sub>10</sub> (Figures 7.15 to 7.20)**

- The greatest reductions in annual mean PM<sub>10</sub> concentrations occur in central London, and along specific main route corridors. These are the roads with the greatest proportion of HGVs, and include the A406 (North Circular Road), A12 to A102 (north to south of the Blackwall Tunnel), and the A13 extending eastwards towards the Dartford Bridge. The reductions associated with traffic on the M25 can also be clearly seen in those parts of Greater London where the motorway crosses, or is close to the boundary.
- The greatest reductions in annual mean PM<sub>10</sub> concentrations occur in 2012, coincident with the introduction of Euro IV standards (see Figure 7.19).
- The reductions in annual mean concentrations of PM<sub>10</sub> are mostly in the less than 0.1 µg/m<sup>3</sup> range (2008 and 2010), rising to 0.1 to 0.2 µg/m<sup>3</sup> in 2012.
- The change in the number of days above 50 µg/m<sup>3</sup> PM<sub>10</sub> is confined to locations alongside main roads with the greatest proportion of HGVs. Reductions are generally of the order of 2-3 days at these locations (see Figures 7.15 and 7.16).

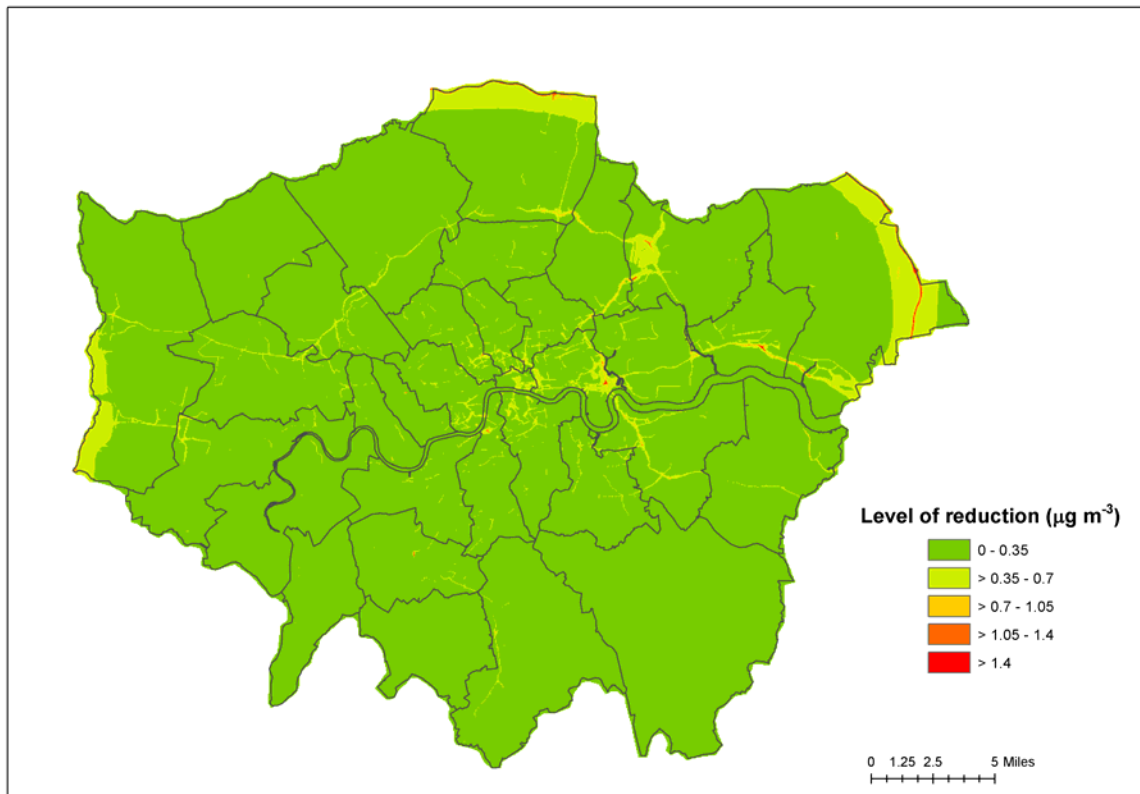


Fig 7.11: Difference in annual mean nitrogen dioxide in Greater London in 2008 with LEZ (Source: AEA)

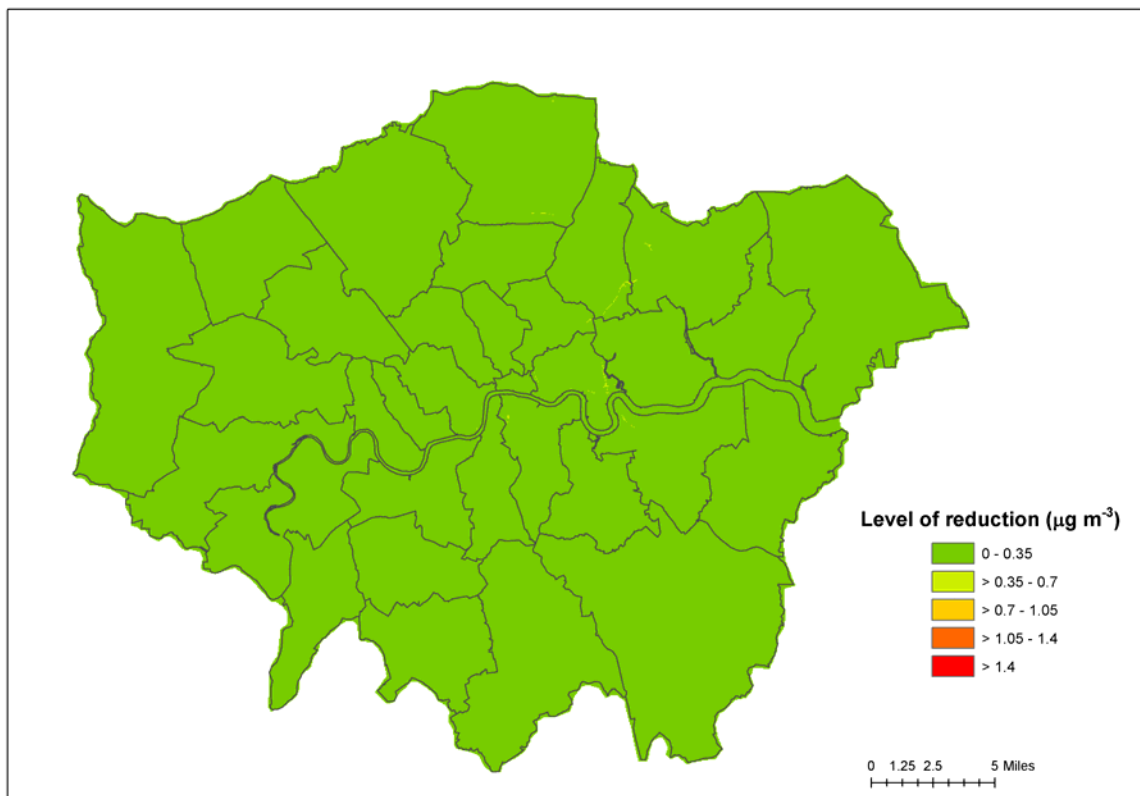


Fig 7.12: Difference in annual mean nitrogen dioxide in Greater London in 2010 with LEZ (Source: AEA)

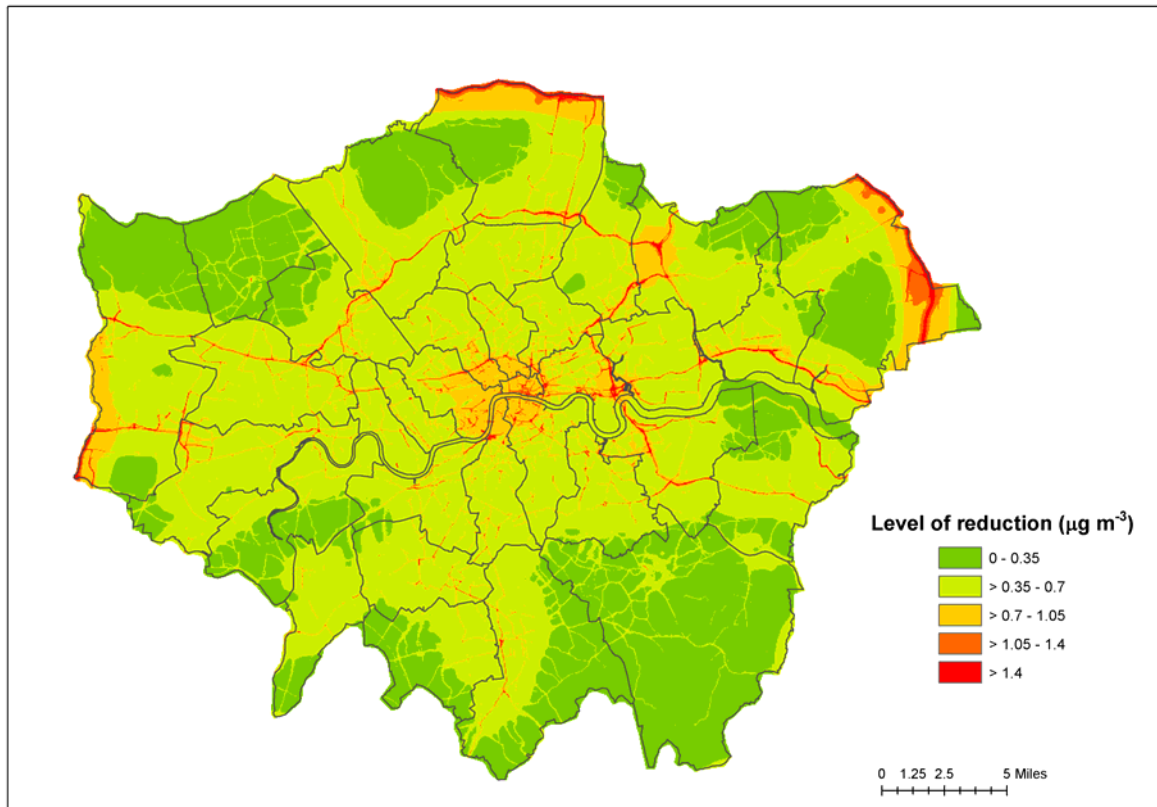


Fig 7.13: Difference in annual mean nitrogen dioxide in Greater London in 2012 with LEZ (Source: AEA)

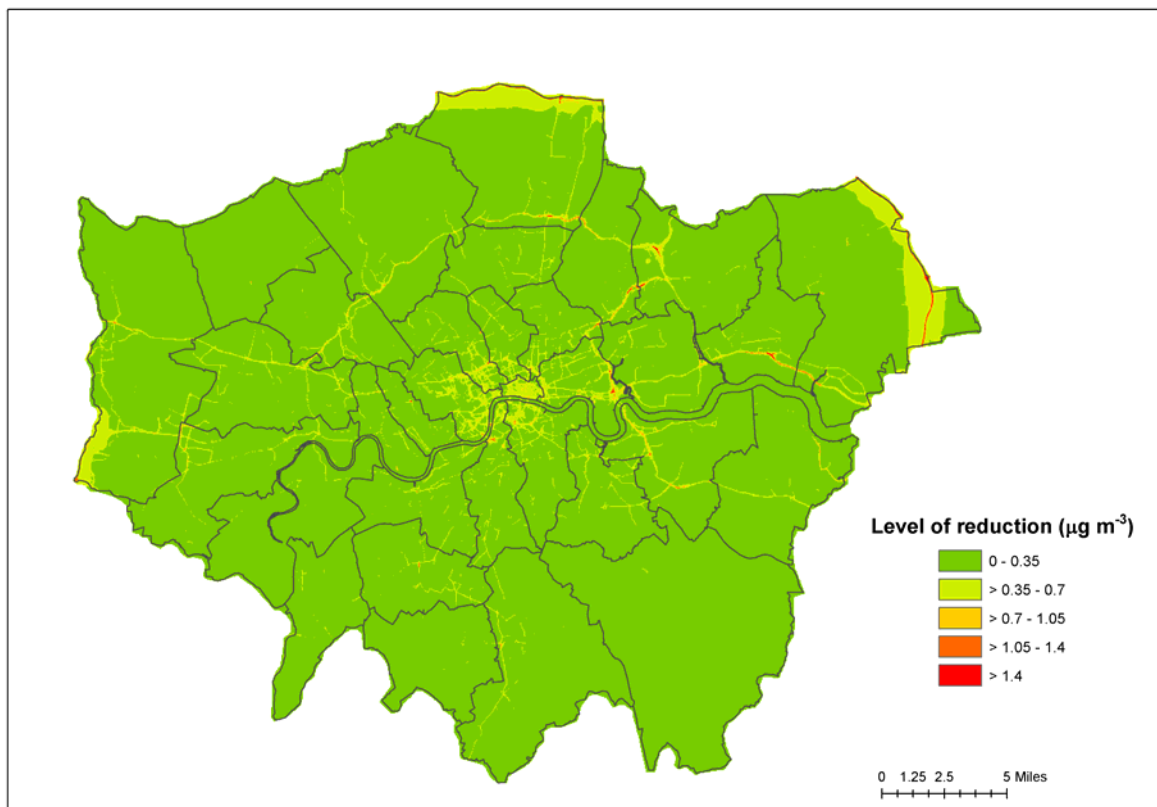


Fig 7.14: Difference in annual mean nitrogen dioxide in Greater London in 2015 with LEZ (Source: AEA)

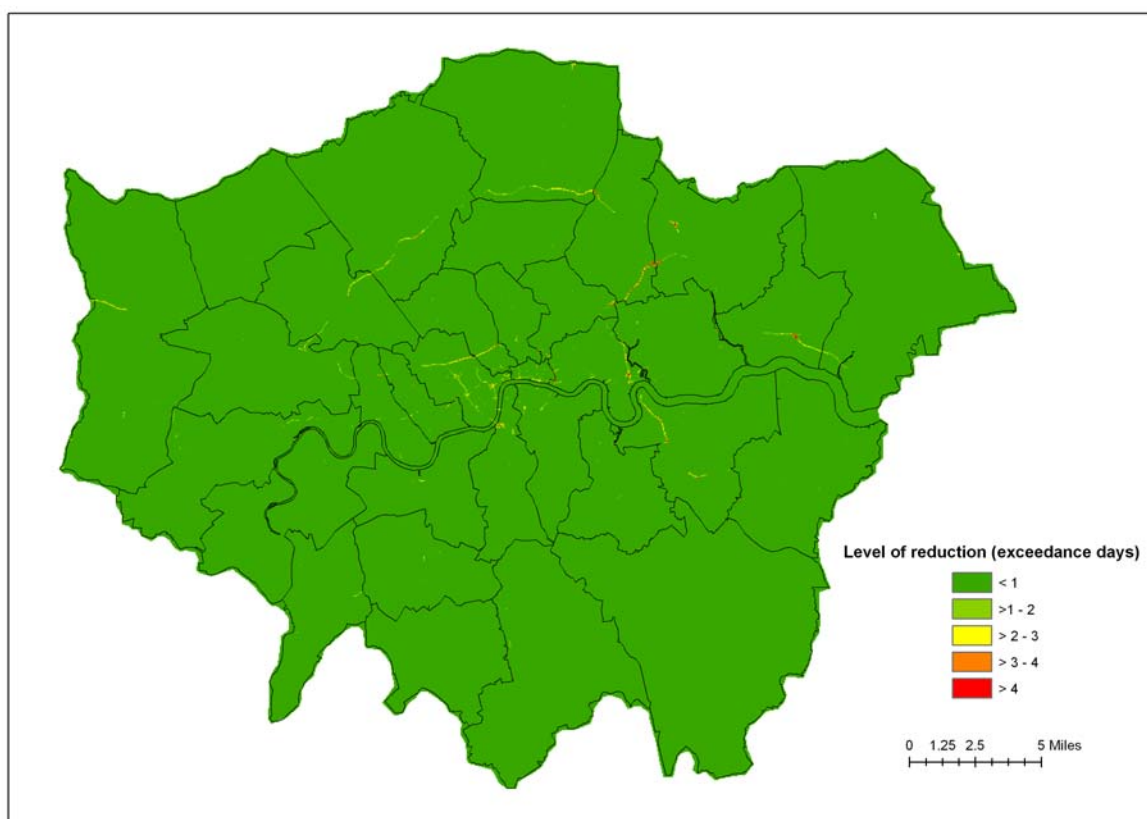


Fig 7.15: Difference in number of days  $>50 \mu\text{g}/\text{m}^3$   $\text{PM}_{10}$  in Greater London in 2008 with LEZ (Source: AEA)

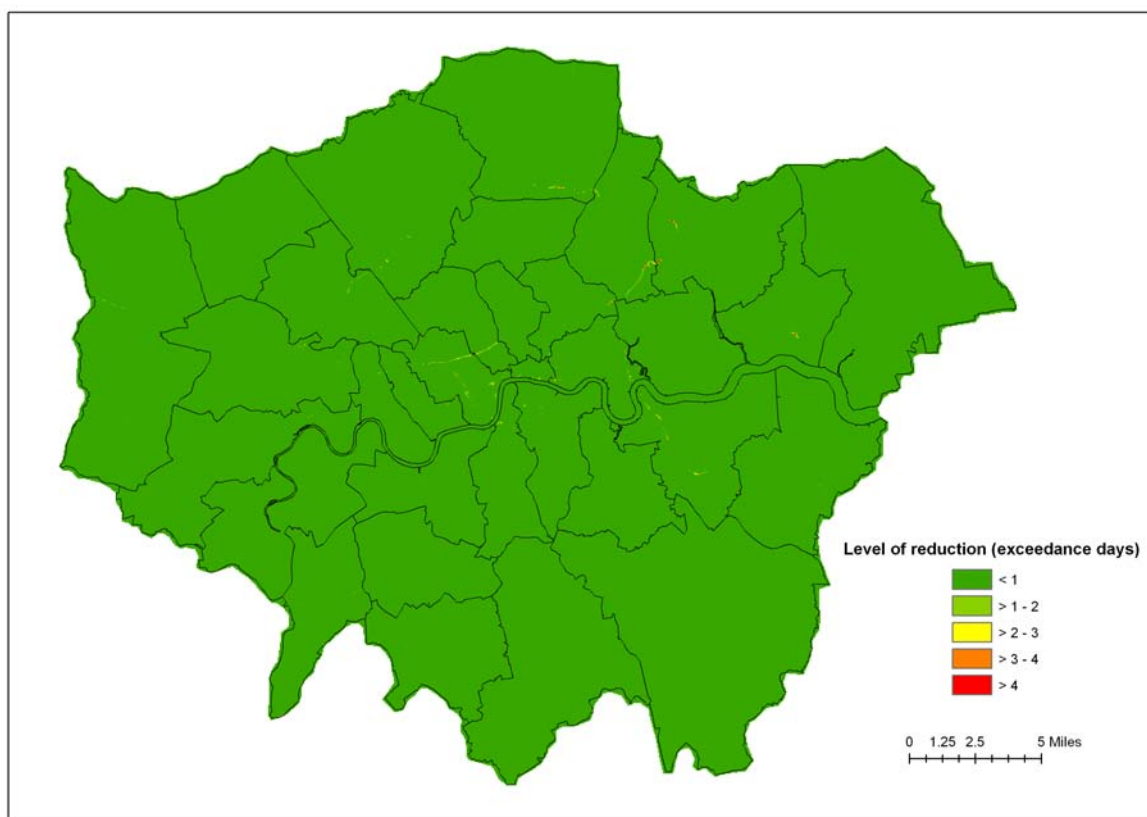


Fig 7.16: Difference in number of days  $>50 \mu\text{g}/\text{m}^3$   $\text{PM}_{10}$  in Greater London in 2015 with LEZ (Source: AEA)



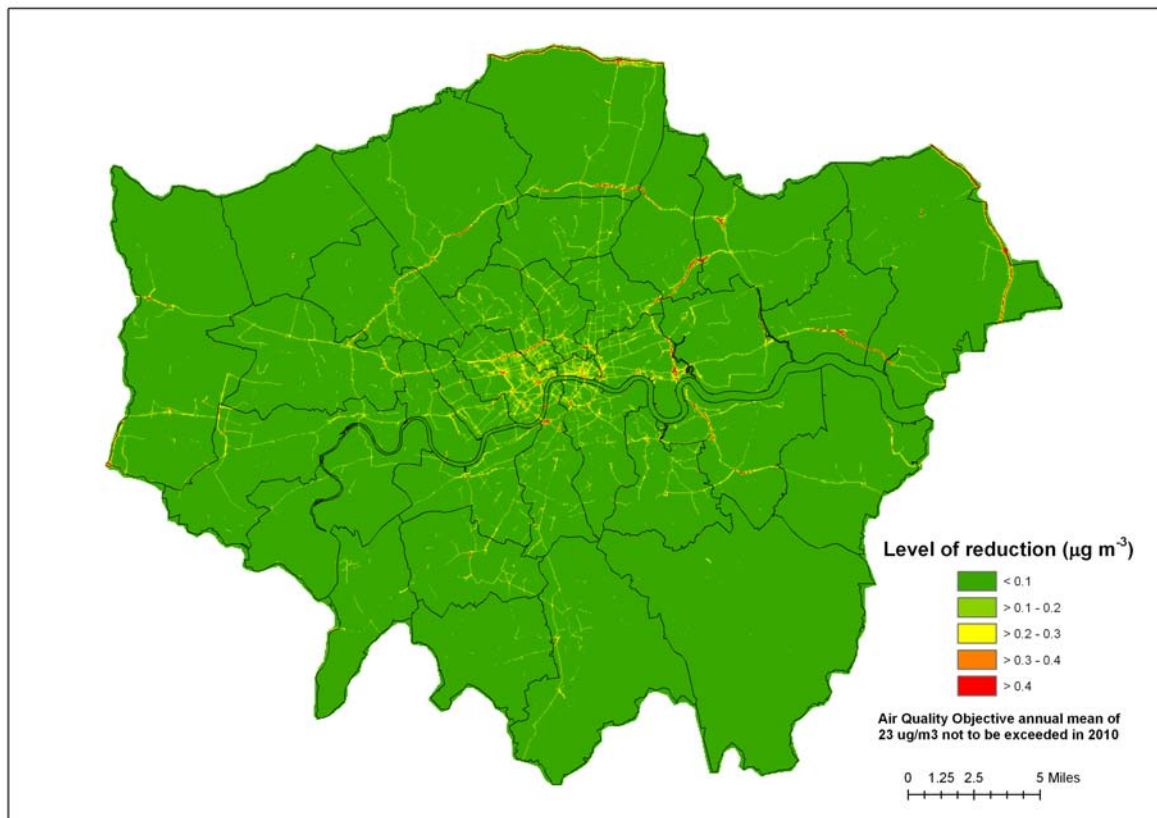


Fig 7.17: Difference in annual mean  $PM_{10}$  in Greater London in 2008 with LEZ (Source: AEA)

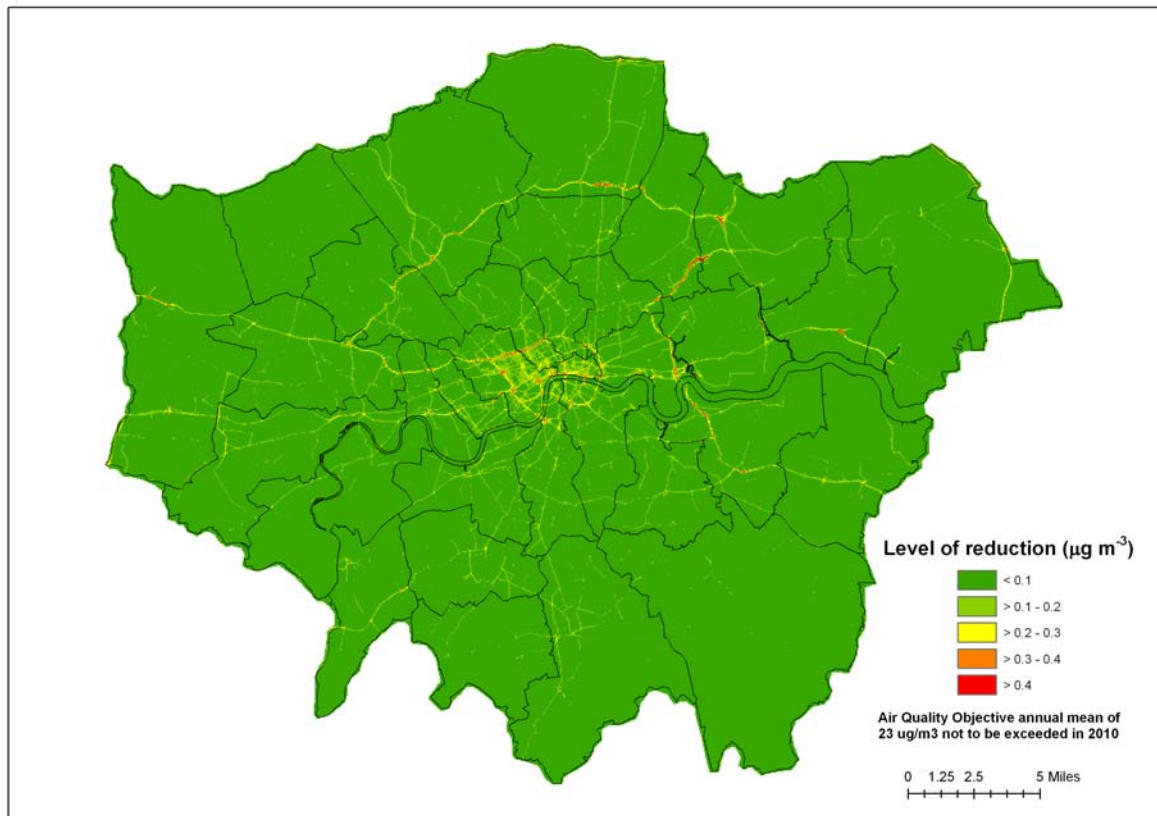


Fig 7.18: Difference in annual mean  $PM_{10}$  in Greater London in 2010 with LEZ (Source: AEA)

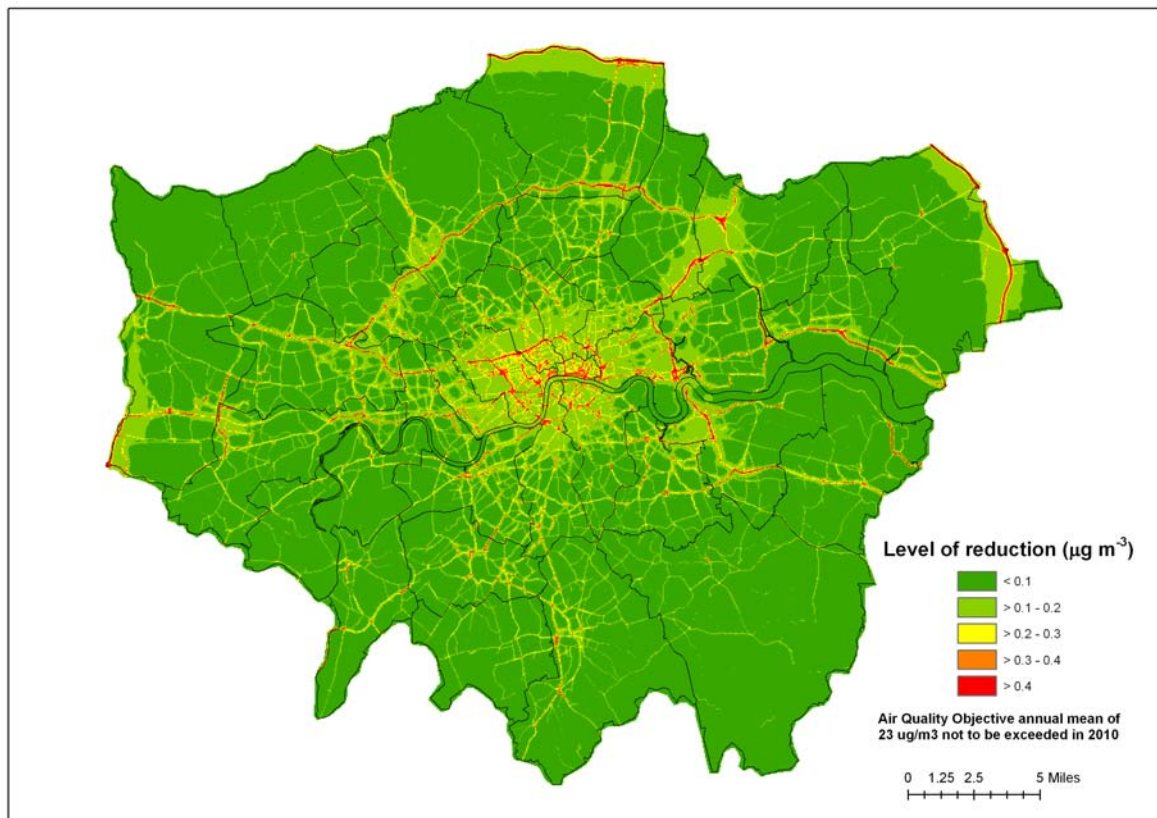


Fig 7.19: Difference in annual mean  $PM_{10}$  in Greater London in 2012 with LEZ (Source: AEA)

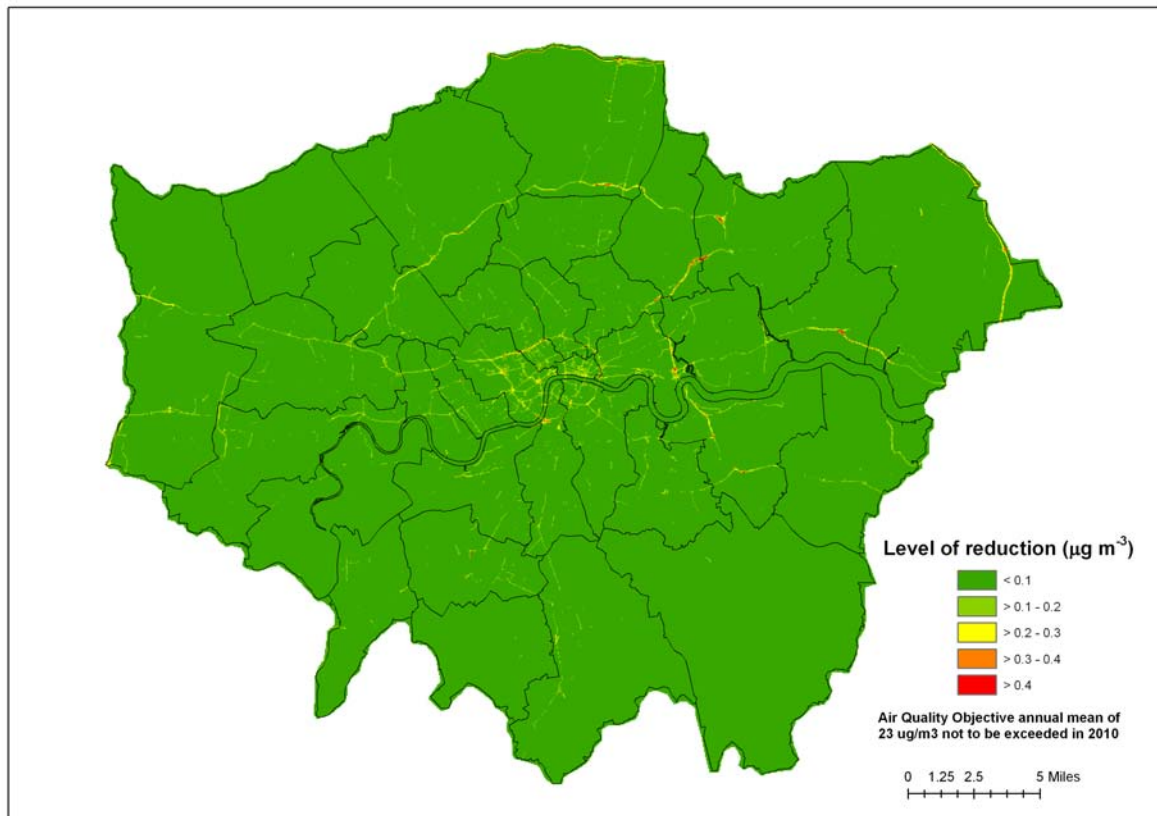


Fig 7.20: Difference in annual mean  $PM_{10}$  in Greater London in 2015 with LEZ (Source: AEA)

7.5.4 The impact of the LEZ on the area of Greater London that is predicted to be above the air quality objectives, and the number of people that would be exposed to these exceedences, is set out in Tables 7.6 and 7.7 for nitrogen dioxide and PM<sub>10</sub> respectively. These tables show the reduction in the areas and populations exposed above the annual mean objective for nitrogen dioxide (40 µg/m<sup>3</sup>) (Table 7.6), the 2004 daily mean objective for PM<sub>10</sub> (no more than 35 days above 50 µg/m<sup>3</sup>), the 2010 provisional daily mean objective for PM<sub>10</sub> (no more than 10 days above 50 µg/m<sup>3</sup>) and the 2010 provisional annual mean objective for PM<sub>10</sub> (23 µg/m<sup>3</sup>) (Table 7.7). A more detailed summary of the data is provided in Appendix 7-A.

**Table 7.6: Reduction in areas and populations exposed to concentrations above the annual mean nitrogen dioxide objective with LEZ in Greater London (Source: AEA Technology)**

Year	Area >40 µg/m <sup>3</sup>		Reduction in Population Exposed >40 µg/m <sup>3</sup>	
	km <sup>2</sup>	% reduction	1,000s	% reduction
2008 + LEZ	8.2	5.2%	81	5.9%
2010 + LEZ	3.3	3.7%	33	4.6%
2012 + LEZ	12.2	15.6%	107	17.1%
2015 + LEZ	4.1	7.4%	36	8.1%

**Note:** this analysis is presented for the area within the GLA boundary only.

**Table 7.7: Reduction in areas and populations exposed to concentrations above the 2004 daily mean PM<sub>10</sub> objective and the 2010 provisional daily mean and annual mean PM<sub>10</sub> objective with LEZ in Greater London (Source: AEA Technology)**

Year	Reduction in Area >35 days above 50 µg/m <sup>3</sup>		Reduction in Population Exposed >35 days above 50 µg/m <sup>3</sup>	
	km <sup>2</sup>	% reduction	1,000s	% reduction
2008 + LEZ	0.2	7.4%	0.7	4.9%
2010 + LEZ	0.2	12.4%	0.9	12.6%
2012 + LEZ	0.3	26.7%	1.1	21.4%
2015 + LEZ	<0.1	11.0%	0.4	11.3%

Year	Reduction in Area >10 days above 50 µg/m <sup>3</sup>		Reduction in Population Exposed >10 days above 50 µg/m <sup>3</sup>	
	km <sup>2</sup>	% reduction	1,000s	% reduction
2008 + LEZ	2.9	6.0%	18.5	6.4%
2010 + LEZ	1.2	6.8%	7.7	7.6%
2012 + LEZ	1.4	14.7%	8.3	16.1%

2015 + LEZ	0.4	7.3%	1.8	6.8%
Year	Reduction in Area >23 µg/m <sup>3</sup>		Reduction in Population Exposed >23 µg/m <sup>3</sup>	
	km <sup>2</sup>	% reduction	1,000s	% reduction
2008 + LEZ	4.4	5.8%	31	6.3%
2010 + LEZ	2.0	7.5%	12	7.8%
2012 + LEZ	2.7	16.2%	17	17.8%
2015 + LEZ	0.5	6.4%	4	7.8%

**Note:** this analysis is presented for the area within the GLA boundary only.

- 7.5.5 These data are shown in a slightly different way in Appendix 7-A, which illustrate the absolute areas and populations exposed above the objectives, and compare the baseline and LEZ projections.
- 7.5.6 Table 7.6 shows that the LEZ would reduce the area within Greater London predicted to be above the annual mean objective for nitrogen dioxide, and the number of people exposed above this level, by around 16% and 17% respectively in 2012. As can be seen from Appendix 7-A, the absolute population exposed to nitrogen dioxide concentrations above the objective in 2012 would be reduced from about 625,000 to about 518,000.
- 7.5.7 Table 7.7 shows that the LEZ would reduce the area within London predicted to be above the statutory daily mean objective for PM<sub>10</sub>, and the number of people exposed above this level, by around 27% and 21% respectively in 2012. As can be seen from Appendix 7-A, the absolute population exposed to PM<sub>10</sub> concentrations above the statutory daily mean objective in 2012 would be small, and reduced from about 5,000 to about 4,000 people.
- 7.5.8 The number of people exposed to PM<sub>10</sub> concentrations above the provisional annual and daily mean objectives is much higher, reflecting the more stringent criteria. The LEZ would reduce the population exposed to PM<sub>10</sub> concentrations above the provisional annual mean objective from about 96,000 to 79,000 (see Appendix 7-A), representing a reduction of about 18% in 2012. The population exposed to PM<sub>10</sub> levels above the provisional daily mean objective would be reduced from about 52,000 to about 44,000 people, representing a reduction of about 16% in 2012<sup>4</sup>.

<sup>4</sup> These calculations take account of forecast population increases in future years (4% in 2008, 5.7% in 2010, 6.8% in 2012 and 8.7% in 2015). The population estimates are based on the census data for residents, and do not take account of the transient population, including people who work in London and tourists. The actual reduction in the number of people exposed as a result of the LEZ will therefore be greater than shown in these tables.

### Implications for PM<sub>2.5</sub>

- 7.5.9 As set out in Chapter 4, there is a possibility that the provisional 2010 objectives for PM<sub>10</sub> may be replaced by new objectives for PM<sub>2.5</sub>. These new objectives may include an annual mean concentration cap and an exposure-reduction target. The latter would be based on a reduction in PM<sub>2.5</sub> concentrations averaged across the major UK urban areas<sup>5</sup>. However, given that the population of Greater London represents about 23% of the UK urban population, measures taken to reduce PM<sub>2.5</sub> concentrations in Greater London would play a very important role in meeting any UK exposure-reduction target.
- 7.5.10 The impact of the LEZ upon PM<sub>2.5</sub> emissions and concentrations has not been explicitly considered within this assessment. In part, this is due to the lack of a reliable PM<sub>2.5</sub> emissions inventory that would be needed to support the study. However, road traffic emissions of particulate matter are predominantly within the PM<sub>2.5</sub> fraction, representing some 85 to 90% of the exhaust emission, and some 55% of the emission from brake and tyre wear. Road traffic therefore makes a much higher percentage contribution to PM<sub>2.5</sub> emissions than it does to PM<sub>10</sub> (AQEG, 2005). It is therefore concluded that the LEZ would reduce concentrations of PM<sub>2.5</sub> by a greater percentage than has been calculated for PM<sub>10</sub>.

## 7.6 Effects

- 7.6.1 The LEZ would reduce exposure to concentrations of both nitrogen dioxide and PM<sub>10</sub>, and would affect people who live and work in, and visit London. The effects would extend beyond the boundary of the LEZ zone, out to and including the M25 corridor. It would also bring London closer to achieving the statutory and provisional air quality objectives and EU limit values. These achievements comply with the objectives of the proposed LEZ, as described in Chapter 2.
- 7.6.2 The spatial extent of the improvements is large, extending to 1,470 km<sup>2</sup> and a population of 7.6 million residents. In 2010, it is forecast that the PM<sub>10</sub> provisional annual mean objective will be exceeded in a 27 km<sup>2</sup> area equating to some 159,000 residents being exposed<sup>6</sup>. The introduction of LEZ would reduce this area to 25 km<sup>2</sup> and lower the number of residents exposed to PM<sub>10</sub> concentrations above the objective to 146,000. In 2012, the effect of the LEZ is greater as the Euro IV standards come in, and the area exceeding the provisional annual mean PM<sub>10</sub> objective would be reduced to 14 km<sup>2</sup> and the residents exposed to PM<sub>10</sub> concentrations above the provisional objective would decline from 96,000 to 79,000, as shown in Figure 7.23.
- 7.6.3 It is usual practice to provide some measure of the significance of impacts

<sup>5</sup> Identified within the consultation review of the AQS as all agglomerations above 100,000 population.

<sup>6</sup> As noted in paragraph 7.5.8 the actual population exposed would be much higher, as no account has been taken of the transient population including workers and tourists.

within an Environmental Statement. There is no official guidance in the UK for defining the significance of air quality impacts, but judgements are normally made with reference to changes in pollutant concentrations.

- 7.6.4 In the case of nitrogen dioxide, the LEZ would reduce annual mean concentrations in central London by between 0.7 and 1  $\mu\text{g}/\text{m}^3$  in 2012. This scale of reduction is judged as Low/Negligible, based upon the criteria set out in Chapter 1. More importantly however, the Scheme would reduce the number of people exposed to levels above the objective and limit value by some 17% in 2012, and is judged as Moderate/Low.
- 7.6.5 The absolute reductions in  $\text{PM}_{10}$  concentrations are much lower than for nitrogen dioxide, and it is not straightforward to apply a measure of significance. The LEZ would reduce the population exposed to levels above the provisional annual mean objective by some 18% in 2012, but more importantly would reduce concentrations across a wide area of Greater London and beyond, albeit by 0.1  $\mu\text{g}/\text{m}^3$  or less. As it is widely considered that  $\text{PM}_{10}$  is a non-threshold pollutant<sup>7</sup>, even very small reductions in exposure across a large population would be expected to deliver significant benefits. The outcome is expected to be Moderate, but can only be reliably quantified with an assessment of health impacts. The outcome of the Health Impact Assessment is provided in a separate report being carried out in parallel with this work by AEA Technology.
- 7.6.6 In the event that the provisional  $\text{PM}_{10}$  objectives are replaced with new objectives for  $\text{PM}_{2.5}$ , it is anticipated that the LEZ would be effective in helping London to achieve these new targets (see para. 7.5.10). In particular, as the spatial scale of the proposed scheme is large, it would prove highly beneficial in reducing average population exposure to  $\text{PM}_{2.5}$  concentrations and the achievement of any exposure-reduction targets.

## 7.7 Mitigation

- 7.7.1 The proposed LEZ scheme is itself a mitigation measure designed to improve air quality in London. The modelling studies presented in this report show that this would be the case. No other mitigation measures are required.
- 7.7.2 The only *potential* negative air quality impact of the LEZ would be an increase in the proportion of primary  $\text{NO}_2$  emissions. The precise reasons for this are not fully understood, but it is thought to be linked to the greater number of diesel-engined vehicles and the fitting of some types of particle traps that generate  $\text{NO}_2$  as part of the cleaning process. Set against this negative impact are the major benefits brought about by reducing exposure to particulate matter.
- 7.7.3 TfL would need to continue assessing any increases to the  $\text{NO}_2/\text{NO}_x$  ratio

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<sup>7</sup> There is no threshold below which health effects do not occur. Any decrease in exposure will have a positive impact on health.

(above that expected due to the decline in NO<sub>x</sub> concentrations<sup>8</sup>) if the LEZ scheme were implemented. However this should be understood in the context of an overall decline<sup>9</sup> in levels of NO<sub>x</sub> and NO<sub>2</sub>.

7.7.4 The proposed LEZ is not expected to have any major impact on concentrations of ozone. Ozone is not emitted from road vehicles, but it does play an important role in the conversion of NO<sub>x</sub> to NO<sub>2</sub>. As NO<sub>x</sub> emissions decrease in future years, there is potential for urban ozone concentrations to rise by a small amount. Given the complexities and uncertainties in these processes, no attempt has been made to quantify the impacts. It is therefore recommended that ozone concentrations are monitored if the Scheme is implemented.

7.7.5 Proposals for monitoring are set out in section 8.8 below.

## 7.8 Monitoring

7.8.1 The following measures are proposed to monitor the impacts of the LEZ:

*Table 7.8: Proposed monitoring measures for air quality impacts*

Measure	Justification
Model pollutant emissions and air quality concentrations using observed data	Modelling allows the emission changes to be controlled, so that changes attributable to the LEZ can be compared to changes in the background or to other sources.
Measure ambient concentrations of NO <sub>2</sub> , PM <sub>10</sub> and PM <sub>2.5</sub> , and ozone in inner and outer zones with LEZ compared to data outside London. Analyse data from these sites (as annual means and 3-year rolling means) to identify long term changes	These are the key pollutants associated with traffic emissions for which there are statutory objectives. Due to the impact of the LEZ in reducing NO <sub>x</sub> emissions, there is potential to cause small increases in ozone.
Measure NO <sub>2</sub> /NO <sub>x</sub> ratios and analyse data against expected trends	Measure potential impacts of the increasing proportion of primary NO <sub>2</sub> emissions
Number of local authorities with AQMAs for NO <sub>2</sub> and/or PM <sub>10</sub> due to traffic emissions	Measure of the extent of poor air quality
Number of HGVs and LGVs entering the LEZ	LEZ may create an incentive for operators to switch from HGVs to smaller vehicles
Changes to Euro emission standards of observed vehicles in the LEZ	LEZ should encourage operators to switch to newer vehicles, thereby bringing forward newer Euro standards into the fleet.

## 7.9 Conclusions

7.9.1 The air quality impacts of the proposed LEZ have been assessed using the results of the modelling carried out by Kings College ERG. These results

<sup>8</sup> The NO<sub>2</sub>/Nox ratio would be expected to increase with decreasing NO<sub>x</sub> emissions, as a greater proportion of NO<sub>x</sub> is oxidised to NO<sub>2</sub> by the available ozone.

<sup>9</sup> Whilst the proportion of primary NO<sub>2</sub> emissions may increase, total emissions of NO<sub>x</sub> are predicted to fall, and the LEZ is expected to deliver a net reduction in nitrogen dioxide concentrations.

show that the LEZ would deliver reduced emissions of both nitrogen oxides and PM<sub>10</sub>, particularly after 2012 following the implementation of the Euro IV standard. This would be translated into reduced concentrations of both nitrogen dioxide and PM<sub>10</sub>, and associated exposure to the general population. The effects would be greatest along main roads, and in background areas within central London where the concentrations are the highest. The positive effects would also extend beyond the boundary of the LEZ, out to and including the M25 corridor.

- 7.9.2 The LEZ would contribute to achieving the air quality objectives and the EU limit values. By 2010, there would be a reduction of about 5% in the number of people exposed to annual mean nitrogen dioxide levels above the objective, rising to a 17% reduction in 2012. In the case of PM<sub>10</sub>, the scheme would deliver a 13% reduction in the population exposed to concentrations above the statutory daily mean objective in 2010, rising to about 21% in 2012, and an 8% reduction in the population exposed to concentrations above the provisional annual mean objective in 2010, rising to 18% in 2012. The proposals therefore meet the key objectives for the proposed LEZ.
- 7.9.3 In the event that the provisional objectives for PM<sub>10</sub> are replaced with new objectives for PM<sub>2.5</sub>, it is considered that the LEZ would reduce concentrations of PM<sub>2.5</sub> (and the corresponding population exposed) by a greater percentage than has been calculated for PM<sub>10</sub>. This is because emissions of particulate matter from road traffic exhausts are predominantly within the PM<sub>2.5</sub> fraction. The LEZ would therefore be equally, or even more effective in contributing towards the delivery of these new objectives.

## 7.10 References

- |  |   |
|--|---|
| AQEG, 2005                               | Particulate Matter in the UK. Defra, London   |
| AQEG, 2006                               | Trends in Primary Nitrogen Dioxide in the United Kingdom. Consultation Draft, August 2006. Defra. London                                  |
| Beevers.S, Dajnak.D. and Mittal.H., 2006 | Air Pollution Modelling of the London Low Emissions Zone. A report prepared on behalf of TfL. Kings College Environmental Research Group. |
| GLA, 2006                                | London Atmospheric Emissions Inventory 2003   |



## 8 Noise and Vibration

### 8.1 Introduction

8.1.1 This chapter assesses the impacts of likely changes in noise and vibration levels arising from the LEZ.

### 8.2 Scope

8.2.1 The assessment examines potential impacts of the LEZ scheme within the proposed boundary i.e. the Greater London area. Any impacts or effects identified outside of the Greater London area are also addressed where appropriate.

8.2.2 The potential implications of the LEZ on noise and vibration are considered from the present to beyond 2012.

8.2.3 Potential key issues relating to noise and vibration arising from the LEZ include:

- Localised and short term increases in noise due to construction
- Increase owing to diversion of traffic to alternative routes during operation of the LEZ
- Potential for improvements as a result of the use of newer vehicles

8.2.4 The key receptors that may be sensitive to changes in noise and vibration levels include:

- Residential areas
- Schools, hospitals or places of worship
- Amenity land
- Sensitive Listed buildings/monuments
- Commercial land properties
- Pedestrians and cyclists

### 8.3 Methodology

8.3.1 A qualitative assessment was carried out to assess the impacts of the potential change in noise and vibration resulting from the implementation of the LEZ in the Greater London area.

8.3.2 The proposed construction works are unlikely to require any activities that are a potentially significant source of vibration, such as piling. No specific details of the construction works are currently available therefore a quantitative assessment of construction noise impacts is not possible.

### 8.4 Defining significance

*Noise*

- 8.4.1 Noise levels generated by construction activities are regulated by guidelines and subject to local authority control. No UK national limits exist for construction noise. Guidance on acceptable noise levels is provided in British Standard BS 5228: Noise and vibration control on construction and open sites. Short-term construction noise levels of up to 70 – 75 dB LAeq<sup>10</sup>, 1hr are likely to prove acceptable for residential properties.
- 8.4.2 Changes in the 18 hour traffic flows of less than +25 / -20 percent (DoT 1994), result in a change in traffic noise levels of less than 1dB, LA<sub>10,18hr</sub><sup>11</sup>. Such changes are regarded as of negligible significance.

#### *Vibration*

- 8.4.3 Traffic vibration can be a source of disturbance to residents living close to roads. Passing vehicles can induce vibrations in buildings through both airborne and ground-borne vibrations. Vibrations can cause problems to building occupants because of annoying physical sensations produced in the human body, interference with activities such as sleep and conversation, audible rattling of window panes and loose objects and fear of damage to the building and its contents.
- 8.4.4 BS7385: Part 2: 1993 'Guide to damage levels from ground-borne vibration' provides guidance on acceptable levels of vibration to avoid damage to structures.

## 8.5 Legislative and Policy Context

- 8.5.1 The following documents are of relevance to the LEZ in relation to noise and vibration. The LEZ must work towards the objectives and policies contained within them.
- The London Plan
  - The Mayor's Ambient Noise Strategy
- 8.5.2 London Plan policies 4A.14 Reducing Noise outlines the Mayor's policies for reducing noise in London:

*'The Mayor will and boroughs should reduce noise by:*

- *Minimising the existing and potential adverse impacts of noise on, from, within, or in the vicinity of, development proposals*
- *Separating new noise sensitive development from major noise sources*

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<sup>10</sup> The equivalent continuous A-weighted sound pressure level, LAeq,T, is the single number that represents the average sound energy measured over that period (T). The LAeq,T is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). Audibility of sound covers a range of approximately 0 to 140 dB. The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A).

<sup>11</sup> dB LA<sub>10, 18hr</sub> is the A-weighted noise level exceeded for 10% of the time over an 18hr period.

*wherever practicable*

- *Supporting new technologies and improved practices to reduce noise at source, especially in road, rail and air transport*
- *Reducing the impact of traffic noise through highway management and transport policies*
- *Containing noise from late night entertainment and other 24-hour activities, and where appropriate promoting well-managed designated locations.'*

8.5.3 The Mayor's Ambient Noise Strategy, 'Sounder City' aims to reduce noise emissions through '*better management of transport systems, better town planning and better design of buildings*'. Policies 4, 5 and 6 aim to reduce vehicle noise by encouraging the use of quieter vehicles.

## 8.6 Baseline Conditions

8.6.1 The main sources of ambient noise and vibration in London are roads, rail and aircraft. Key sources of noise and vibration disturbances other than from transport include: noisy neighbours, road works, construction/demolition, pubs/clubs/entertainment; and industrial/commercial premises (GLA, 2004a).

8.6.2 The London Housing Survey carried out in 2002 showed that 13% percent of respondents rated noise from road transport as a serious problem (Table 9.1 below).

**Table 8.1: Responses to the London Housing Survey: Sources of noise rated as a serious problem**

Source of noise	% Rating source as a serious problem
Road transport	13%
Aircraft noise	6%
Noisy neighbours	4%
Road works/construction/demolition	4%
Trains/tubes	2%
Pubs/clubs/entertainment	2%
Industrial/commercial	2%

Source: GLA (2004) Sounder City – The Mayor's Ambient Noise Strategy accessible via: <http://www.london.gov.uk/mayor/strategies/noise/docs/summary.pdf>

8.6.3 A MORI Poll carried out in 2003, reported in the Mayor's Air Quality Strategy, showed that 24% of respondents identified noise as one of their top three priorities for improving the quality of the London environment and 46% considered noise to be a problem (GLA, 2004b). According to a recent DEFRA study, the highest noise levels from road traffic are on and around major roads (DEFRA, 2004).

## 8.7 Impact Assessment

*Generation of noise and vibration from construction*

- 8.7.1 As far as possible, for signs, existing posts would be replaced with new posts to support both new and existing signs combined. Establishing cameras will require new cabinets and civil works.
- 8.7.2 There may be some brief, localised increases in noise and vibration as a result of these works. The increases in noise and vibration are not expected to be large in magnitude as the scale of works is fairly small. In addition works would be short in duration. Best practice measures would be followed in all cases to keep impacts to a minimum (see the Mitigation section in this chapter).

*Increased generation of noise and vibration from diversion to alternative routes*

- 8.7.3 The Low Emission Zone Vehicle Operator Research (TfL, 2006a) showed that a small proportion of operators would risk fines due to entering the LEZ with non-compliant vehicles, potentially leading to extra noise and vibration on alternative routes. A larger proportion would use routes that avoid Greater London. This could lead to increases in noise and vibration in areas surrounding the LEZ.
- 8.7.4 However the impacts of the LEZ on increasing levels of diversions to alternative routes are likely to be limited by a number of constraints:
- Larger vehicles would be restricted to wide roads
  - HGV, bus and coach operators are likely to be sensitive to increases in journey times and should alternative routes be congested potential economic losses may act as a deterrent (for some)
- 8.7.5 Long term monitoring of traffic movement carried out since the implementation of the Congestion Charging Zone in Central London, has not shown any significant increases in traffic on the Inner Ring Road. Implementation of traffic management measures, to counter expected increases in traffic, on this route have contributed to mitigating negative impacts of diverted traffic e.g. increased noise/vibration (TfL, 2006b). Potential increases in diverted traffic associated with the LEZ could therefore follow a similar trend to the Congestion Charging Zone.

*Increased number of quieter vehicles*

- 8.7.6 Euro III vehicles comply with 1996 noise emissions regulations and are thus quieter than older vehicles. The LEZ is likely therefore, to have small-scale positive impacts on noise levels by encouraging the use of vehicles that meet this standard.

## 8.8 Significance

- 8.8.1 The generation of noise and vibration from construction activities is not

expected to have a significant effect as the works would be small in scale, duration and magnitude and existing infrastructure would be used wherever possible. The effects are therefore expected to be of negligible significance.

8.8.2 There could potentially be very small increases in traffic from diverted traffic, which could increase noise and vibration levels in sensitive areas and therefore have minor adverse effects. The effects are therefore considered to be negligible significance.

8.8.3 The LEZ is likely to contribute to reduced ambient noise and vibration levels across Greater London due to increased use of vehicles that meet Euro III standards and later Euro IV standards. This could have a minor beneficial effect although they are likely to be of negligible significance.

## 8.9 Mitigation

8.9.1 The impacts arising from construction noise and vibration generation are not expected to have significant effects but best practice measures would be implemented to ensure any noise is minimised. Measures to be used include:

- Working hours would be restricted to daytime hours
- Plant would be switched off when not in use
- All equipment would comply with EU noise emissions limits
- All equipment would be well maintained to ensure noise and vibration emissions are limited

## 8.10 Monitoring

8.10.1 In order to determine the level of noise and vibration reduction associated with the LEZ, long term monitoring would be undertaken at appropriate positions. TfL should consider undertaking monitoring for a period of several weeks prior to the launch of the LEZ and for a prolonged period after it is active. Noise and vibration monitoring locations could be identified and placed on the major routes within the LEZ.

8.10.2 Monitoring could also make use of the LEZ monitoring cameras, which will record information on traffic types and volumes that could then be used to assess changes in noise levels.

## 8.11 Conclusion

8.11.1 The effects of the LEZ on noise and vibration levels in and around Greater London are likely to be negligible as impacts are low in magnitude and extent.

## 8.12 References

- |         |  |
|---------|--|
| BS 5228 | British Standards Institute, BS 5228: Noise and vibration control on construction and open sites, 1997           |
| BS 7385 | British Standards Institute, <i>BS 7385: Evaluation and measurement for vibration in buildings Part 2. Guide</i> |

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	<i>To Damage Levels From Ground-Borne Vibration, 1993</i>
DEFRA, 2004	Department of the Environment, Food and Rural Affairs, <i>Noise Mapping England: The London Road Traffic Noise Map, 2004</i>
DoT (1994)	Department of Transport, <i>Design Manual for Roads &amp; Bridges, Volume 11, Section 3, Part 7, 1994</i>
GLA, 2004	Greater London Authority, <i>Souder London: The Mayor's Ambient Noise Strategy, 2004</i>
TfL, 2006a	Transport for London, <i>Low Emission Zone Vehicle Operator Survey, August 2006</i>
TfL, 2006b	Transport for London, <i>Congestion Charging Zone: Impacts Monitoring: Forth Annual Report, 2006</i>

## 9 Landscape and Visual Amenity

### 9.1 Introduction

- 9.1.1 The purpose of this chapter is to assess the likely effects of the proposed London Low Emission Zone (LEZ) upon townscape and visual amenity. Specifically, it is concerned with the effect of the LEZ enforcement cameras and scheme signage on the receiving environment.
- 9.1.2 The infrastructure for enforcement cameras typically consists of camera and pole, control cabinet and feeder pillar; each of these items is assessed.



Plate 9.1: Best case scenario camera pole



Plate 9.2: Worst case scenario camera pole

- 9.1.3 The design of the pole is dependent on the number of cameras required in any one location; in some circumstances it may be necessary to include an 'outrigger'. As the design of each pole is still to be determined, the

assessment draws upon the best and worst case scenario, as shown in Plates 9.1 - 9.3, and assumes a design appropriate for the width of the road.



Plate 9.3:  
Example of  
control cabinet  
and feeder pillar

- 9.1.4 The chapter also includes commentary on the likely impact of traffic signs, both 'zone entry' signs and 'advance informatory' signs, based on sign types provided by Transport for London (TfL).
- 9.1.5 For the purpose of this chapter the term 'camera pole' refers to all aspects of the post design, including horizontal post, vertical arm, and the camera itself. The term 'townscape' is used to describe spatial context and character, assumed as having the same meaning of the term 'urban landscape'. In addition the term 'street furniture' is used to describe particular items within a 'townscape'. This includes benches, bins, lighting columns, signs, cabinets and traffic control measures, such as traffic lights and speed cameras.
- 9.1.6 It should also be noted that this assessment only covers Phase 1 camera installations. These are cameras to be installed by November 2007. There may be a further phase of camera installations to be installed by February 2008 but these sites are still to be determined by TfL. If necessary, further appraisal will be undertaken to update the assessment at the relevant time.

## 9.2 Methodology

### *Context*

- 9.2.1 Sixty-three enforcement camera sites are planned under the Phase 1 proposals. TfL has produced a set of 'Design Brief and Risk Assessments', detailing the indicative location and infrastructure requirements for each camera, including site photographs, completed between June – October 2006. TfL is still finalising the enforcement infrastructure design so some of these locations could still be subject to change.
- 9.2.2 Using the site photographs and mapped information on townscape planning



designations, a desk-based study has been undertaken. This includes a description of the baseline landscape and an assessment of the impact of the indicative enforcement cameras on townscape and key visual receptor groups.

- 9.2.3 While the assessment is primarily desk based, it has the benefit of the extensive fieldwork undertaken for the TfL Design Briefs and Risk Assessments. The study should therefore be considered in this context.

#### *General Approach*

- 9.2.4 The method of townscape and visual impact assessment adopted for the LEZ assessment has been devised to address the specific issues raised by a project of this scale and nature. The methodology draws upon established practice set out in the Guidelines for Landscape and Visual Impact Assessment, produced by the Landscape Institute and Institute of Environmental Management and Assessment (2002).

- 9.2.5 The methodology makes a clear distinction between the effects of a project upon townscape resources and visual receptors:

- Townscape resources are the combination of elements that contribute to townscape character, for example buildings, street furniture and vegetation
- Visual receptors are people who will experience an effect, for example local residents or motorists passing through the area.

#### *Definition of impacts*

- 9.2.6 Townscape impacts relate to the impacts of development upon the physical components of the townscape, which together form the character of that townscape.

- 9.2.7 Criteria used to define the impact upon townscape resources include:

- The character, quality and features of existing townscape
- The ability of the townscape to accommodate change (i.e. sensitivity)
- The degree of change (i.e. magnitude)

- 9.2.8 Visual impacts result from change to the appearance of the townscape as a result of development proposals either intruding into, or obstructing existing views, or by their overall impact on visual amenity.

- 9.2.9 Criteria used to define impacts upon visual receptors include:

- The value of existing views
- The degree of change to existing views
- The availability and amenity value of the alternative views
- Degree of exposure to views
- The receptor's function.

9.2.10 The significance of impacts on landscape character and visual receptors is evaluated as follows:

*Table 9.1: Significance of Impacts*

Significance of Impact	Townscape Description	Visual Description
Negligible	The scheme will cause no discernible deterioration or improvement to the existing townscape.	The scheme will cause no discernible deterioration or improvement in the existing view.
Low	The scheme will not quite fit the scale, landform and pattern of the townscape, and/or will cause minor damage to quality or characteristic features.	The scheme will cause minor deterioration in the existing view.
Moderate	The scheme will be out of scale with the scale, landform and pattern of the townscape, and/or will damage quality or characteristic features.	The scheme will cause noticeable deterioration in the existing view.
Substantial	The scheme will be at considerable variance with the scale, landform and pattern of the townscape, and/or will be detrimental to quality or characteristic features.	The scheme will cause significant deterioration in the existing view.

9.2.11 Due to the close interrelationship between townscape and visual amenity, for the purpose of this assessment, a single impact has been determined for each enforcement camera (i.e. negligible, low, moderate or substantial) to cover both townscape and visual impact.

9.2.12 Generally the significance of impact is likely to be greater where an enforcement camera is located within or adjacent to a designated townscape (e.g. conservation area) and there are many and/or high sensitivity visual receptors e.g. residents (who have permanent views).

9.2.13 The significance of impact is likely to be less where an enforcement camera is located within or adjacent to a townscape of low value, and there are few and/or low sensitivity visual receptors e.g. motorists (who have temporary views).

9.2.14 The amount of existing street furniture also affects the level of both the townscape and the visual impact.

*Baseline Conditions*

9.2.15 Landscape and visual impacts are assessed against the baseline environment. For each of the sixty-three indicative enforcement camera locations, through the use of existing site photographs and reference to townscape planning designations, the broad townscape character is described in relation to the key visual receptors.

- 9.2.16 The key townscape and conservation designations included in this study are:
- Registered Parks and Gardens
  - Conservation Areas
  - Listed Buildings
- 9.2.17 Areas of Outstanding Natural Beauty, World Heritage Sites and Scheduled Ancient Monuments were also considered as part of the initial assessment, however it was concluded that none of the indicative enforcement camera locations were located within or near sites covered by these designations.
- 9.2.18 Only designations considered to be relevant to the townscape quality have been included. Specifically, Green Belt and Metropolitan Open Land, which are primarily designated to safeguard open space and prevent urban sprawl regardless of quality, have been excluded. In addition, local designations established by individual London Boroughs have been excluded in order to ensure consistency of approach across the whole of the LEZ area.

*Temporal Scope*

- 9.2.19 Construction activities are of a limited scale and scope. The temporary nature of the activities associated with construction would result in no long-term disruption to streetscape character or visual amenity. The significance of impact is therefore considered during the operational phase only of the enforcement cameras and associated control cabinets and feeder pillars.

### 9.3 Landscape and Visual Impacts

- 9.3.1 The majority of predicted impacts are considered to be low or negligible; i.e. the scheme would cause minor change to existing views and townscape character.
- 9.3.2 This is a consequence of the location of the majority of indicative enforcement cameras, along major road corridors, characterised by extensive existing street furniture and vehicular activity. In such instances, the indicative enforcement camera and associated equipment would be appropriate to the existing townscape character, and any change to the existing views would be largely insignificant.
- 9.3.3 Similarly, in certain locations, the indicative enforcement camera would utilise existing poles, control cabinets and feeder pillars. This would cause very little change to the baseline environment, resulting in a negligible impact.
- 9.3.4 Moderate impacts would occur where the indicative enforcement camera and associated equipment would result in a more pronounced change to existing townscape character and visual amenity, as a consequence of limited existing street furniture and/or the presence of high sensitivity visual receptors i.e. residents.
- 9.3.5 In a few cases, the indicative enforcement camera and associated equipment

is adjacent to a Conservation Area and/or close to Listed Buildings. However, in all cases, the townscape is 'cluttered' by existing street furniture. As a result the additional proposed items would be in context with the existing townscape character and would cause minor change to views and vistas.

## 9.4 Signage

- 9.4.1 In addition to the indicative enforcement cameras, the London LEZ proposals include signage; please see Figure 9.1 for illustrations and estimated dimensions (width x height) of signs types. In all instances, the text size on the sign would be appropriate to the speed of traffic using the road. For sign types 1-3 the sizes shown are appropriate for use on motorways. Smaller text sizes would be used on roads with a lower speed limit.

### *Advance Warning Signs*

- 9.4.2 It is proposed that 'advance informatory' signs (example sign types 1 – 3), advising drivers of the boundary of the LEZ ahead, would be placed at strategic locations outside London. The zone entry signs would be similar to those used for the central London congestion charging zone.
- 9.4.3 The size and appearance of the signs would be similar to existing signage and appropriate to the speed of the traffic. Positioned along major road corridors, already characterised by a variety of signage, it is unlikely that the proposed advance warning signs would have a significant impact on townscape character or visual amenity.

### *Entry Signs*

- 9.4.4 In addition, the current proposals generally assume two entry signs (sign type A) at each point that a public road crosses the LEZ boundary. There would be a few exceptions where only one sign may be required but these would only be the narrower, lightly-trafficked roads. In comparison to the 'advance informatory' signs, these would be of smaller scale.



Sign Type 1  
Advance Informatory

Min size: 2220 x 4530cm  
Max size: 2960 x 6040 cm



Sign Type 3  
Advance Informatory

Min size: 3200 x 1300 cm  
Max size: 4260 x 1740 cm



Sign Type 2  
Advance Informatory

Min size: 1590 x 4200 cm  
Max size: 2120 x 5600 cm



Sign Type A  
Entry Zone

Min size: 710 x 1770 cm  
Max size: 2270 x 5600 cm

Figure 9.1: Signage types and dimensions

9.4.5 It is also considered that these signs would have a negligible impact on townscape character and visual amenity. Positioned along road corridors already characterised by a variety of street clutter, including lighting columns, speed cameras and traffic signs, additional signage would cause only minor change to townscape and visual quality.

## 9.5 Mitigation Measures

9.5.1 Despite the minimal adverse impacts there are a number of measures, which would ensure that the proposals can be appropriately integrated into the townscape.

9.5.2 It should be ensured that in all instances, the enforcement camera and associated infrastructure is finished to an appropriate standard in relation to existing street furniture.

9.5.3 Where possible the length of the horizontal camera 'arm' extending from the pole should be minimised to reduce the landscape and visual impact. Similarly the impact of the enforcement cameras can be reduced by careful positioning next to existing built structures of a similar height e.g. gantries, lighting columns and signs, or fixed to existing infrastructure.

9.5.4 All new control cabinets and feeder pillars should ideally be located to the edges of footpaths to prevent physical and visual disruption to pedestrians and other road users. Positioning control cabinets and feeder pillars against existing walls, fences, and cabinets would also reduce the townscape and visual impact, as would the re-use of existing equipment.

9.5.5 After the removal of old equipment and/or the installation of new, contractors should make-good hard and soft surfacing.

9.5.6 Contractors should also avoid damage to tree roots; work in the vicinity of trees should be carried out in accordance with the guidance set out in BS5837: Trees in Relation to Construction.

## 9.6 Monitoring

9.6.1 No monitoring measures are proposed. Subject to final design and location of the enforcement cameras, the predicted impacts would not vary over time and would not therefore require future review.

## 9.7 Conclusion

9.7.1 As can be seen from the Table 9.2, none of the proposed enforcement cameras and associated equipment are considered to have a substantial impact. Furthermore, only seven of the sixty-three cameras (11%) are considered to have a moderate impact.

9.7.2 The majority (89%) of the predicted impacts are considered to be low or negligible, i.e. the scheme would cause only minimal change to existing views

and townscape character.

*Table 9.2: Breakdown of Impacts*

Significance of Impact	Number of Enforcement Cameras	Percentage of Enforcement Cameras
Negligible	7	11%
Low	49	78%
Moderate	7	11%
Substantial	0	0%

- 9.7.3 Where moderate impacts do occur, they should be considered in the context of the scale of the development proposed. While the cameras predicted as having a moderate impact are correctly assessed in relation to those having a low or negligible impact, a moderate impact still only represents a relatively insignificant change to townscape character and visual amenity.

## 10 Ecology

### 10.1 Introduction

10.1.1 This chapter discusses the likely significant effects of the proposed LEZ on biodiversity.

### 10.2 Scope of Assessment

#### *Spatial Scope*

10.2.1 The scope of the assessment in terms of biodiversity extends to the GLA boundary.

10.2.2 The spatial scope of the assessment is considered at two separate levels. Initially the study area is considered to include all ecological receptors with potential to be directly or indirectly affected by the LEZ at a regional scale, namely those present within Greater London.

10.2.3 On a separate spatial scale, the potential impact of the installation of enforcement cameras and traffic signs is examined, at a site-by-site level.

#### *Temporal Scope*

10.2.4 The assessment at the regional scale compares effects with and without the LEZ proposals. The current baseline is taken from information available in 2006. Future impacts are assessed at the time of implementation (assumed to be 2008) and during subsequent operation of the zone and its associated infrastructure.

#### *Technical Scope*

10.2.5 Clearly the ecological resources of London are extensive and complex. As such, it has been decided that the ecological impacts on London can be best evaluated through consideration of effects on those sites of European or national importance within Greater London, namely:

- Special Areas of Conservation (SACs)<sup>12</sup>;
- Special Protection Areas (SPAs)<sup>13</sup>;
- Ramsar sites<sup>14</sup>; and
- Sites of Special Scientific Interest (SSSIs)<sup>15</sup>

<sup>12</sup> As defined within Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora ('The Habitats Directive').

<sup>13</sup> As defined within Council Directive 79/409/EEC on the conservation of wild birds ('The Birds Directive').

<sup>14</sup> As defined within the Convention on Wetlands, 1971

<sup>15</sup> As defined within the National Parks & Access to the Countryside Act, 1949 and the Wildlife & Countryside Act, 1981 (as amended)



10.2.6 In addition the presence of Sites of Metropolitan Importance (SMIs) is also considered in relation to the proposed location of the enforcement cameras.

### 10.3 Legislative and Planning Policy Context

10.3.1 This assessment has been undertaken taking into account legislation and the guidance set out in national, regional and local plans. Planning policy documents of relevance to consideration of the ecological resource are as follows:

#### *Legislation*

10.3.2 The following national conservation legislation is relevant to sites within the LEZ:

- The National Parks & Access to the Countryside Act 1949;
- The Wildlife and Countryside Act 1981(as amended);
- The Conservation (Natural Habitats, &c.) Regulations 1994; and
- The Countryside & Rights of Way Act 2000 (CRoW).

#### *National Policy*

- The UK Biodiversity Action Plan (BAP) – This is the UK Government's response to the Convention on Biological Diversity (1992). It describes the country's important biological resources and has resulted in the production of detailed plans for the protection of key habitats and species.
- Planning Policy Statement 9: Biodiversity and Geological Conservation (including the explanatory notes provided in ODPM Circular 06/05) highlights that 'development proposals provide many opportunities for building-in beneficial biodiversity...as part of good design. When considering such proposal, local planning authorities should maximise such opportunities in and around developments'.

#### *Regional Policy*

- London Biodiversity Action Plan (2001) – This document ensures that the targets and priorities within the UK BAP are implemented at local level for those habitats and species present in London.
- Mayor's Biodiversity Strategy (2002) - This strategy supports the conservation of non-statutory designated sites and of habitats and species of biodiversity value. It also encourages the positive management of habitats for nature conservation.
- Design for Biodiversity (undated) – This document is produced by the London Development Agency and provides broad guidance concerning issues relating to development and biodiversity in London.
- The London Plan (2004) – This document details the Mayor of London's

spatial development strategy; the London Plan replaces existing strategic guidance, and boroughs' local plans must be in 'general conformity' with it.

## 10.4 Background

### *Atmospheric Pollutants and Ecology*

10.4.1 The following anthropogenic air pollutants are of greatest importance for their adverse effect upon ecological resources:

- Oxides of Nitrogen ( $\text{NO}_x$ ) - Oxides of nitrogen are formed during high temperature combustion processes from the oxidation of nitrogen in the air. The principal source of nitrogen oxides – nitric oxide (NO) and nitrogen dioxide ( $\text{NO}_2$ ) - is road traffic, which is responsible for approximately half the emissions in Europe. NO and  $\text{NO}_2$  concentrations are therefore greatest in urban areas where traffic is heaviest. An increase in the deposition of nitrogen from the atmosphere to soils is generally regarded to lead to an increase in soil fertility, which can have a serious deleterious effect on the quality of semi-natural, nitrogen-limited terrestrial habitats.
- Sulphur dioxide ( $\text{SO}_2$ ) – this is an acidic gas that combines with water vapour in the atmosphere to produce acid rain. Both wet and dry depositions have been implicated in the damage and destruction of vegetation and in the degradation of soils and watercourses. Major  $\text{SO}_2$  problems now only tend to occur in cities in which coal is still widely used for domestic heating, in industry and in power stations.
- Dust – on tarmac roads this is generally not an issue, but if the road is subject to heavy vehicle movements substantial quantities of dust can be deposited on vegetation lining the road, generally within 25 m of the roadside. If present in sufficient quantities dust can smother vegetation, preventing light penetration to the chloroplasts and blocking stomata thus interrupting photosynthesis and transpiration. In prolonged cases, death can result.
- Low-level ozone ( $\text{O}_3$ ) – this is unlike the other pollutants mentioned, in that it is not emitted directly into the atmosphere, but is a secondary pollutant produced by a complex reaction between nitrogen dioxide ( $\text{NO}_2$ ), hydrocarbons and sunlight. Unlike the other pollutants, it cannot therefore be directly related to increases in housing, traffic etc. Typical effects on plants include fine pale yellow or brown spots on the leaves and reduced seed production.
- Heavy metals – Lead, cadmium and mercury are the heavy metals of greatest ecological concern, for the same reasons that they are of medical concern; they accumulate within plants and can then enter the

foodchain causing deterioration of the immune system, the metabolic system and the nervous system. They also lead to behavioural changes and some heavy metals are suspected to be carcinogenic.

- 10.4.2 NO<sub>x</sub> and SO<sub>2</sub> act primarily at short-range, but individual sources of pollution will also contribute to an increase in the general background levels of pollutants at a wider scale, as small amounts of NO<sub>x</sub> and other pollutants from the pollution source are dispersed more widely by the prevailing winds. Despite the general association with NO<sub>2</sub>, ozone levels are not as high in urban areas (where high levels of NO<sub>2</sub> are emitted) as in rural areas. This is largely due to the long-range nature of this pollutant, which is sufficiently great that the source of emission and location of deposition often cross national boundaries. As such, low-level ozone can only be practically addressed at the national and international level.
- 10.4.3 The only heavy metal for which road traffic emissions are traditionally a major source is lead; in 1997, 61% of all lead emissions in the UK came from road transport. However, this contribution has declined massively since the removal of lead from petrol.
- 10.4.4 From this review of atmospheric pollutants it can be seen that the major contribution of road transport to atmospheric pollutants that are harmful to ecological resources is through the emission of NO<sub>x</sub>.
- 10.4.5 There is currently no accepted method for relating biodiversity to air quality. Atmospheric nitrogen deposition represents a threat to naturally nutrient-poor plant communities. In the past, regulatory assessment of these impacts has focused on the critical loads approach, where estimated atmospheric deposition loads are compared with 'critical loads' below which environmental effects do not occur, according to present understanding. Hence, where exceedence occurs on nature conservation sites, ecological impacts are expected.
- 10.4.6 Critical loads are available for most UK habitats of nature conservation significance and are presently exceeded across London. The modelled future NO<sub>x</sub> levels are used to predict where improvements in biodiversity may be expected. This approach provides a risk assessment that can indicate the likelihood of future change on a large (supra-regional) scale.
- 10.4.7 However, there are limitations to applying the critical loads and levels approach to site-based assessment. Exceedence does not indicate whether changes are already occurring, nor does it provide a means of monitoring the extent of any actual change.
- 10.4.8 Although air pollution is likely to be a contributing factor to habitat degradation and consequently to the decline in some species, it is impossible to separate out air pollution from the range of factors influencing habitat quality or condition. Neglect or inappropriate management, and pressure from recreational use are likely to be much more significant influences on habitat

quality at most sites of nature conservation importance within London (Peter Massini, English Nature, *personal communication*). For this reason no attempt is made to quantify impacts on individual sites.

## 10.5 Methodology

- 10.5.1 The ecological resource of the Greater London area was assessed from existing data, (provided by Natural England, formerly English Nature). This provides the location and extent of internationally and nationally designated sites of nature conservation value, such as SACs, SPAs, Ramsar and SSSIs.
- 10.5.2 Data were also obtained on the extent and location of SMIs. These are non-statutory designated sites of county importance. SMIs are those sites that contain the best examples of London's habitats, sites that contain particularly rare habitats, rare assemblages of species or important populations of species, or sites which are of particular importance within otherwise built areas. They are not specifically protected under law, but are covered under the relevant development policies.
- 10.5.3 Where it was noted that a designated site boundary crossed the proposed LEZ boundary, the whole site was included in the assessment, as the integrity of the site would be affected if some of the site was in the LEZ.
- 10.5.4 Published data on the condition of individual sites were also consulted to assess whether air pollution is known to be a contributory factor in the condition status of each site or habitat.
- 10.5.5 The location of the enforcement cameras and traffic signs were plotted on the same figure as the sites of conservation importance. This allowed the potential impact of the installation of these features upon sites of interest to be determined.
- 10.5.6 In addition, the proposed locations of the cameras were examined using photographs to assess the potential ecological impact associated with the installation of these features.
- 10.5.7 The majority of the traffic signs are located outside the proposed LEZ boundary. There is also some discrepancy in the locations of the traffic signs when plotted on the map. Several appear to be over 100m from the edge of the road. For the purpose of this assessment it has been assumed that signs would be located within the highway boundary and not on adjacent land, so the presence of designated sites is not deemed significant.

## 10.6 Baseline Conditions

### *Sites at a Regional Scale*

- 10.6.1 From the data collated there are a total of seven internationally designated sites within the proposed LEZ boundary. It should be noted that the two SPAs

sites and the Ramsar sites cover the same areas. There are also 35 SSSI and 132 SMIs as summarised in Table 10.1, and depicted on Map 10.1.

**Table 10.1: The number and extent of designated sites within the Greater London Area.**

Designation	Number	Total Area Covered (km <sup>2</sup> )
SAC	3	17.2
SPA	2	2.74
Ramsar	2	2.74
SSSI	35	40.88
SMI	132	156.93

10.6.2 The internationally designated sites and SSSIs are briefly described in Table 10.2a and 10.2b, with an indication as to the reason for their designation and an explanation as to the current level of understanding with regard to the effects of air pollution on the site.

**Table 10.2a: Internationally designated sites within the Greater London area and an indication to the effects of air pollution.**

Site	Reason for selection	Adversely effected by air pollution?
<b>SACs</b>		
Epping forest	Beech <i>Fagus sylvatica</i> forests with holly <i>Ilex</i> , growing on acid soils, in a humid Atlantic climate	<b>Yes:</b> Epping Forest represents Atlantic acidophilous beech forests in the north-eastern part of the habitat's UK range. Although the epiphytes at this site have declined, largely as a result of air pollution, it remains important for a range of rare species, including the moss <i>Zygodon forsteri</i> . The long history of pollarding, and resultant large number of veteran trees, ensures that the site is also rich in fungi and dead-wood invertebrates.
Essex Estuaries	Estuaries, mud/sandflats not covered by seawater at low tide, <i>Salicornia</i> and other annuals colonising mud and sand, extensive stand of native small cord-grass <i>Spartina maritima</i> , Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritimae</i> ), Mediterranean and thermo-Atlantic halophilous scrubs ( <i>Sarcocornetea fruticosi</i> )	No
Wimbledon Common	Northern Atlantic wet heaths with <i>Erica tetralix</i> , European dry heaths	No
<b>SPAs and Ramsar Sites</b>		
Lee Valley	Supports internationally important numbers of gadwall and shoveler	No

South West London Waterbodies	Supports internationally important numbers of gadwall and shoveler	No
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*Table 10.2b: SSSIs within the Greater London area and an indication to the effects of air pollution.*

Site	Reason for citation	Adversely affected by air pollution?
Abbey Wood	Palaeontological interest	No
Barn Elms Wetland Centre	Wetland	No
Bentley Priory	Grassland, ancient woodland, scrub, wetland, open water	No
Brent Reservoir	Breeding wetland birds	No
Chingford Reservoirs	Wintering wildfowl & wetland birds	No
Crofton Woods	Ancient woodland	No
Croham Hurst	Ancient woodland	No
Denham Lock Wood	Mire and wet woodland	No
Downe Bank And High Elms	Woodland, chalk grassland (tree preservation order)	No
Elmstead Pit	Geological interest	No
Epping Forest	Ancient wood pasture	Yes
Farthing Downs And Happy Valley	Semi natural downland habitat	No
Fray's Farm Meadows	Unimproved wet, alluvial grassland	No
Gilbert's Pit (Charlton)	Palaeontological interest	No
Hampstead Heath Woods	Forest woodland	No
Harefield Pit	Palaeontological interest	No
Harrow Weald	Geological interest	No
Hornchurch Cutting	Geological interest	No
Ingrebourne Marshes	Diverse freshwater marshland	No
Inner Thames Marshes	Wetland, diverse ornithological interest	No
Kempton Park Reservoirs	Wintering gadwell and shoveler	No
Keston And Hayes Commons	Heathland, valley mire and grassland	No
Mid Colne Valley	Significant ornithological interest	No
Old Park Wood	Floristically rich ancient wood	No

Site	Reason for citation	Adversely affected by air pollution?
Oxleas Woodlands	Long established woodland	No
Richmond Park	Royal deer park, range of habitats	No
Riddlesdown	Largest single expanse of long-established calcareous scrub	No
Ruislip Woods	Ancient semi-natural woodland	No
Ruxley Gravel Pits	Diverse freshwater habitat	No
Saltbox Hill	Chalk grassland, open scrub, diverse flora	No
Syon Park	Unique tall grass washland	No
Walthamstow Marshes	Semi-natural wetland	No
Walthamstow Reservoirs	Major heronry and important for breeding wildfowl	No
Wimbledon Common	Open wet heath	No

#### *Existing effects of Air Pollution*

- 10.6.3 It would appear from the information currently available that only Epping Forest SSSI, which is also designated as a SAC, is in an unfavourable condition due to air pollution, in particular NO<sub>x</sub>. However, as can be seen from Map 10.2 and Appendix 10.1, the condition status is not uniform across the entire SSSI. This may be a factor of habitat heterogeneity across the site, with some habitats being more sensitive to NO<sub>x</sub> levels or it may be due to differential levels of NO<sub>x</sub> across the site.
- 10.6.4 Of the unit areas that have classified as unfavourable and declining, the condition of only two of these, areas 12 and 28 can be attributed to air pollution, both of which are outside the proposed LEZ boundary.
- 10.6.5 Areas 30 and 36, which are classified as being in unfavourable and declining condition, are both within the proposed LEZ boundary. The declining state of both these areas has been attributed to inappropriate management, with little or no deleterious effects as a result of air pollution.
- 10.6.6 The majority of the SSSI, when considered by area, is in favourable condition, or unfavourable but recovering. There also seems to be little overall correlation between the condition of the SSSI and proximity to major roads such as the M11 and M25. However, it is believed that increased levels of NO<sub>x</sub> are placing an environmental stress on the state of the SSSI. NO<sub>x</sub> for the forest have been estimated to be at least one and a half times critical loads in the least affected areas to more than three times in the worst affected areas.
- 10.6.7 Whilst current knowledge suggests that only Epping Forest is suffering as a

result of increases  $\text{NO}_x$  levels, perhaps due to the presence of more sensitive habitats present, the effects could be extrapolated to suggest that the majority of the natural vegetation within the Greater London area would be under some kind of environmental stress as a result of air pollution.

#### *Camera and Sign Locations*

- 10.6.8 None of the proposed camera or sign locations are within any protected site. From reviewing photographs of the proposed camera locations all appear to be situated on existing hard standing or in highly improved grassland adjacent to road. This habitat type can be said to have no biodiversity value.
- 10.6.9 No information is currently available on the exact proposed location of the traffic signs, although indicative placements have been provided. For the purposes of this assessment it has been assumed that they would be placed on the roadside verge. This is generally highly improved, intensely managed grassland of negligible conservation value.

## **10.7 Impact Assessment**

#### *Reduction of $\text{NO}_x$ and $\text{PM}_{10}$ Levels*

- 10.7.1 The predicted reduction in  $\text{NO}_x$  levels, with the general expectation that the amount of  $\text{NO}_x$  would undergo a 47% reduction by 2015, would result in large areas of Epping Forest falling below critical load levels. It could also be assumed that a similar effect would be extended over much of the proposed LEZ area. This would lead to a reduction in the environmental stress placed on these vegetative communities, which would allow for a more rapid recovery of the condition of the habitats.
- 10.7.2 However, the predicted future levels of both  $\text{NO}_x$  and  $\text{PM}_{10}$  would be significantly reduced with or without the LEZ, with the predicted level of reduction being brought forward by two years for  $\text{NO}_x$  and three years for  $\text{PM}_{10}$  with the LEZ in place compared to no LEZ (see Chapter 7 for more details).
- 10.7.3 It should be noted, that a reduction in the amount of  $\text{NO}_x$  and  $\text{PM}_{10}$  alone is unlikely to cause any noticeable improvement in the state of the protected sites or associated habitats. Air pollution is only one of many factors that have lead to a reduction in the favourability status of these sites. If the biodiversity resources within protected sites network is to recover, numerous activities such as appropriate management and visitor control, must also be implemented.

#### *Camera and Sign Locations*

- 10.7.4 From the information currently available, the installation of the enforcement cameras and traffic signs would have no impact on the biodiversity resource,



either adversely or beneficially.

## 10.8 Significance

10.8.1 The implementation of the LEZ would result in an improvement of air quality, which would no doubt benefit the biodiversity resource with the Greater London area. However, this benefit to the protected site network and the habitats they contain would be masked by the numerous other deleterious activities that are currently on going. However, a monitoring scheme specifically designed to identify changes in air quality by examining plants species could be used to gauge the success of the LEZ.

## 10.9 Mitigation

10.9.1 As there are no negative effects as a result of the implementation of the LEZ, no mitigation is required.

## 10.10 Residual Effects

10.10.1 The likely residual effect would be a improvement in air quality, which could lead to a reduction in the environmental stress on the protected site networks and other areas of natural vegetation

## 10.11 Monitoring

10.11.1 TfL could consider monitoring programme that would build upon the research currently being co-ordinated by Air Pollution Research in London (APRIL). This might monitor any changes in lichen and moss abundance and distribution, as is this likely to yield the greatest results.

## 10.12 Conclusions

10.12.1 The introduction of a LEZ in London, which would be predicted to lead to a reduction in NO<sub>x</sub> and PM<sub>10</sub>, has the potential to have a positive effect of the biodiversity resource within London, albeit by a minimal amount.

10.12.2 The installation of the enforcement cameras and traffic signs would have no significant effects on biodiversity.

## 11 Cultural Heritage

### 11.1 Introduction

- 11.1.1 This chapter identifies and characterises the built heritage and archaeological assets within the London area. The potential significant effects of the LEZ scheme are then assessed within this context. This chapter should be read in conjunction with Chapter 9 - Landscape & Visual.
- 11.1.2 This chapter initially outlines the scope and method of assessment and sets out the national and local planning policy context with respect to the historic environment. The nature and extent of features of cultural heritage value are described in the baseline section.
- 11.1.3 The LEZ scheme is then assessed for any potential impacts and resultant significant effects on cultural heritage. Mitigation and monitoring measures are suggested for any significant effects identified during the assessment.

### 11.2 Scope and Methodology

- 11.2.1 The objective of this assessment is to identify the potential for significant effects on historic structures and archaeology.

#### *Scope*

- 11.2.2 The extent of the study area was informed by the proposed boundary of the LEZ. Potential implications of the scheme on the wider area surrounding the LEZ boundary were also taken into consideration where appropriate.
- 11.2.3 Impacts of the proposed LEZ upon London's cultural heritage were considered in terms of direct, indirect, and cumulative impacts. A direct impact is considered to constitute a direct physical impact upon a structure, such as damage or demolition. An indirect impact, although not physically affecting the feature, would impact upon the setting of the feature. Cumulative impacts may be caused by an interaction of different impacts to constitute a larger, more significant impact.
- 11.2.4 The works to be carried out during the construction phase are not expected to have impacts on built heritage or archaeology they are small in scale and would be limited to the road-side. Any direct or indirect effects, which may arise in relation to the condition or setting of sites of cultural value, from construction, are not, therefore, considered to be significant. This issue has therefore been scoped out of this assessment.
- 11.2.5 Operation of the LEZ has the potential to indirectly affect cultural heritage through improvements in air quality. Sulphur and nitrogen emissions from vehicles have the potential to cause damage to buildings and other structures, through gases dissolving in rainwater causing acid deposition and

subsequent decay of buildings. This effect is thought to be magnified by synergistic interaction with ozone. However, the proposed LEZ is not designed to reduce the levels of sulphur in the atmosphere and sulphur is not a major component of vehicle exhaust emissions. In addition, the reductions in oxides of nitrogen are not in the order of magnitude sufficient to have an impact on wet deposition. Impacts on wet deposition have therefore been scoped out of this assessment.

- 11.2.6 In addition to wet acid deposition, emissions of oxides of nitrogen are also deposited on building surfaces as dry deposition. This threatens buildings when rainwater dissolves the deposited nitrogen oxides creating acidic solutions that cause building decay. Emissions of oxides of nitrogen could potentially be reduced as a result of the scheme and therefore the impacts of this on dry deposition have been scoped into the assessment.
- 11.2.7 There are also potential effects that could arise through changes to features of cultural importance from soiling during operation of the proposed LEZ. Emissions of particles can lead to the soiling of sensitive receptors such as important Listed Buildings and Scheduled Monuments, which then require cleaning with the risk of damage to irreplaceable architectural detail. One of the key objectives of the LEZ is to reduce emissions of particles and therefore effects on soiling may be evident.
- 11.2.8 Soiling of buildings and materials by particles ( $PM_{10}$  and  $PM_{2.5}$ ) is one of the most obvious signs of pollution in urban areas. The analysis of building soiling is concerned with the deposition of particles on external surfaces and the discolouration of stone and other materials. Different types of particle emission have different soiling characteristics. Diesel emissions, for instance, have a much higher soiling factor relative to petrol due to their particulate elemental carbon (PEC) content.
- 11.2.9 There are a number of sensitive receptors of cultural heritage value to soiling and dry deposition and principally, these include:
- World Heritage Sites
  - Scheduled Ancient Monuments
  - Listed Buildings
- 11.2.10 Other buildings that are not listed but are of cultural value have not been considered due to the low sensitivity to soiling and dry deposition of these buildings. Sites of archaeological value have low sensitivity to soiling due to their nature and to their ground or below ground level location.

#### *Methodology*

- 11.2.11 Changes in soiling and dry deposition were assessed qualitatively, although air quality data produced by ERG (see Chapter 7) was used for the assessment. The data from the modelling showed predicted changes in concentrations of  $PM_{10}$  (an indicator of the changes in black carbon that

contributes to the soiling) and NO<sub>x</sub>. The impacts of the changes with time on the sensitive receptors were then assessed.

11.2.12 There are a number of methods that have been developed to quantify the significance of effects of building soiling. One approach is to examine the costs of building cleaning. However, *'it is impossible to include estimates of damage to historically valuable buildings because there is neither a good database of materials nor good means of valuing damage to cultural artefacts'* (Royal Commission on Environmental Pollution 1998). Assessing the impacts of building soiling in terms of economic costs/benefits is therefore difficult for cultural heritage feature due to the lack of data.

11.2.13 Another approach to assessing the impacts of soiling is to calculate the loss of reflectance of building surfaces using a dose response function. Different surfaces are however affected differently by soiling and therefore using such an approach for an area the size of London is inappropriate. There are also quantitative methods to examine the effects of dry deposition. Again, however, these are inappropriate for the geographical scale of this study and for the level of data available. Owing to the limitations with these approaches in the context of the LEZ, the effects of changes in emissions have therefore been assessed qualitatively.

### 11.3 Legislative Context and London Policy

11.3.1 The main regulations and policies relating to cultural heritage include:

- The Planning (Listed Buildings and Conservation Areas) Act 1990
- Planning Policy Guidance Note 15 (PPG15) 'Planning and the Historic Environment'
- The London Plan

11.3.2 The Planning (Listed Buildings and Conservation Areas) Act 1990 imposes a duty on the Secretary of State to compile lists of buildings of special architectural or historic interest. Schedule 7 states that:

*'No person shall execute or cause to be executed any works for the demolition of a listed building or for its alteration or extension in any manner which would affect its character as a building of special architectural or historic interest, unless the works are authorised'.*

11.3.3 In consideration of proposals within the setting of listed buildings the Act establishes a requirement to have special regard to the desirability of preserving that setting.

11.3.4 Section 69 of the Act imposes a duty on local planning authorities to designate conservation areas. Section 72 requires that planning controls be used so to preserve or enhance the character or appearance of a conservation area.

11.3.5 Planning Policy Guidance Note 15 (PPG15) 'Planning and the Historic

Environment' (1994) outlines Government's advice to developers and local authorities etc. in their consideration of development proposals affecting Listed Buildings and their setting, Conservation Areas and other historic buildings.

- 11.3.6 The London Plan sets out a number of policies that are designed to protect and enhance London's cultural heritage. London Plan policy 4B.1 recommends that all developments '*respect London's built heritage*'. Policies 4B.10 to 4B.14 all relate to cultural heritage and archaeology. Policy 4B.10 requires that the '*protection and enhancement of historic assets in London*' are ensured.
- 11.3.7 The Mayor also supports the '*identification, protection, interpretation and presentation of London's archaeological resources*' in Policy 4B.14. The London Plan also requires the protection of World Heritage Sites (4B.13) and the protection and enhancement of historical heritage through conservation (4B.11 and 4B.12).
- 11.3.8 The LEZ would not result in the demolition, alteration or extension of any World Heritage Sites, Listed Buildings or Scheduled Ancient Monuments. Furthermore, this chapter examines any potential impacts and significant effects in detail in order to ensure any adverse effects are minimised and that requirements of the regulations and policies are met.

#### 11.4 Baseline Conditions

- 11.4.1 London possesses a rich cultural heritage. The United Nations has designated four World Heritage Sites within the capital: Greenwich, Westminster Abbey, the Tower of London and the Royal Botanic Gardens in Kew. The Greater London Sites and Monuments Record lists more than 73,000 sites, artefacts and Listed Buildings.
- 11.4.2 There are approximately 40,000 Listed Buildings in England, which are considered to be of national importance and 700 of these are considered 'at risk', although it is not known if any of these have been affected by air pollution. Between 2005 and 2006, 13 buildings in London were removed from the Buildings At Risk register (BAR)<sup>16</sup> and currently there are 90 entries remaining on the BAR.
- 11.4.3 Buildings of architectural or historic importance are more vulnerable to the long-term damage from air pollution described above, in part because damage may already have accumulated over time but also because threshold for significant impacts would be lower, owing to the venerability of such structures.

<sup>16</sup> <http://www.english-heritage.org.uk/server/show/ConWebDoc.6731>

## 11.5 Impact Assessment

- 11.5.1 Owing to particles being the major source of building soiling, trends in total PM<sub>10</sub> emissions are examined in this section in order to establish the impacts of the proposed LEZ on soiling. Trends in oxides of nitrogen are also examined in order to examine the impacts of the LEZ on dry deposition. The air quality modelling was carried out by ERG and the full set of results is in Chapter 8.
- 11.5.2 The data suggest that implementation of the LEZ would result a greater reduction of PM<sub>10</sub> concentrations than are evident in the base case scenario where the LEZ is not in operation. This suggests that there could potentially be reductions in soiling resulting from particulate emissions. The largest differences are experienced in 2012 where the LEZ is expected to result in lower emissions of approximately 145 tonnes than the predicted baseline scenario where the LEZ would not be in operation.
- 11.5.3 The modelling results for different areas of Greater London (Central, inner and outer London and external to London) all show the same trend of greater reductions in total PM<sub>10</sub> levels should the LEZ be implemented. Areas outside of the Greater London area would be likely to experience higher percentage reductions in particles than other areas suggesting benefits to these areas.
- 11.5.4 The percentage reduction in emissions of oxides of nitrogen with the LEZ scheme in operation show that there would be a larger reduction in emissions of oxides of nitrogen with the LEZ than without. As was evident for particle emissions, the largest difference is predicted to be in 2012 when the LEZ would be expected to produce 2,480 tonnes fewer emissions of NO<sub>x</sub> than would be the case if the LEZ was not in place. Geographically, changes are expected to be highest in the outer London areas and areas external to Greater London.
- 11.5.5 The modelling results suggest that the reductions on emissions of oxides of nitrogen that are expected to result, indirectly, from the LEZ would have a positive impact on dry deposition. Cumulative impacts of the LEZ on soiling and dry deposition are therefore likely to be positive. A greater percentage reduction is also anticipated for oxides of nitrogen than particulates however it is unclear whether this would correspond directly to greater positive impacts for buildings from dry deposition than soiling.

## 11.6 Significance

- 11.6.1 The reductions in particulates and oxides of nitrogen resulting from the LEZ, while likely to have a low beneficial effect are not expected to be of sufficient magnitude to cause a significant beneficial effect in relation to London's cultural heritage and in particular World Heritage Sites, Listed Buildings or Scheduled Ancient Monuments. This is further supported by the fact there

are other causes of building soiling and of dry deposition in the Greater London area, which would not be impacted on by the LEZ e.g. industrial processes and other types of vehicular transport. Effects on cultural heritage from the LEZ are therefore expected to be non significant.

## 11.7 Mitigation

11.7.1 No mitigation measures are proposed since the effects of the LEZ on soiling and dry deposition levels are likely to be beneficial rather than adverse.

## 11.8 Residual Effects

11.8.1 No residual effects are expected to arise in relation to cultural heritage.

## 11.9 Monitoring

11.9.1 English Heritage monitors the condition of Listed Buildings and publishes a publicly available 'at risk' register annually. No additional monitoring is proposed, as the effects of the LEZ on soiling and dry deposition would not be expected to be significant.

## 11.10 Conclusion

11.10.1 The proposed LEZ would have a beneficial effect of reducing the soiling and decay, due to dry deposition, of cultural heritage assets in London due to reductions in PM<sub>10</sub> emissions. However the scale of reductions and the large geographical area covered by the LEZ means that effects are unlikely to be significant.

## 11.11 References

GLA, 2004	Greater London Authority, <i>The London Plan</i> , GLA, February 2004
HM Government, 1990	The Planning (Listed Buildings and Conservation Areas) Act 1990
PPG15, 1994	Planning Policy Guidance Note 15 (PPG15) 'Planning and the Historic Environment' (1994)
RCEP, 1998	Royal Commission on Environmental Pollution, <i>Study on Energy and the Environment</i> , 1998
Watkiss, 2000	Watkiss, P, Eyre, N, Holland, M, Rabl, A and Short, S, <i>Impacts of Air Pollution on Building Materials</i> , 2000

## 12 Waste

### 12.1 Introduction

12.1.1 This chapter aims to identify significant effects that may arise in relation to waste, following the implementation of the proposed LEZ. The approach to the assessment, the legislative context and the baseline conditions are outlined in the first sections. These are followed by the impact assessment and the identification of any significant effects. Recommendations for mitigation and monitoring are provided in the final sections.

12.1.2 'Waste' is defined in Section 75 (2) of the Environmental Protection Act 1990 as: *"any substance or object...which the holder discards or intends or is required to discard."* The commonly adopted framework for working towards sustainable waste management is the Waste Management Hierarchy. The Waste Management Hierarchy sets out the preferred approach to managing waste sustainably which, in order of preference is prevention, minimisation, reuse, recycling, energy recovery and disposal.

### 12.2 Methodology

12.2.1 Significant waste arisings are not expected to result from the construction phase as wherever possible signs and cameras would make use of existing infrastructure. Where new infrastructure needs to be provided, waste arisings would be negligible. Waste arisings during construction are not therefore considered to be significant and have been scoped out of the assessment.

12.2.2 The key issue with respect to waste associated with the LEZ is the potential for early scrapping of vehicles that do not meet the Euro III standard. Therefore this assessment aims to characterise the nature and likely amount of materials that might be generated as a result. The assessment has been carried out using the results of the TfL Vehicle Operator Survey ('the survey') (TfL 2006) carried out between July and August 2006.

12.2.3 The survey involved carrying out 778 telephone interviews across the UK (consisting of 269 HGV, 303 LGV and 206 bus and coach operators). 107 of HGV and 82 of bus and coach operators interviewed were based in Greater London. The initial focus of the LEZ on HGVs, buses and coaches meant that results for LGVs were not relevant for the assessment. A total of 60,150 contacts were made in order to obtain the final interview tally. The data provide an indication of the proportion and nature of operators affected by the LEZ.

12.2.4 Additional materials being sent to landfill could have adverse effects upon sensitive receptors, such as groundwater or soils, owing to potential leaching of substances. There may also be a possible increase in pressure on already limited landfill capacity.



12.2.5 There are no specific criteria for assessing the magnitude or significance of impacts arising from the generation or management of waste. Generally, each project is evaluated according to its individual characteristics. For the purposes of this assessment a large increase in materials being sent to landfill as a result of early scrapping of vehicles was regarded as a significant effect.

### 12.3 Legislative and Policy Context

12.3.1 There are a number of relevant regulations and policies to the LEZ which include:

- Waste Oils Directive 75/439/EEC
- The End of Life Vehicles (Producer Responsibility) Regulations (2003)
- Hazardous Waste Regulations (England & Wales) 2005
- The Waste Strategy 2000 for England and Wales
- Planning Policy Guidance 10 – Planning and Waste Management
- Regional Planning Guidance 9
- The London Plan

12.3.2 The Waste Oils Directive 75/439/EEC set out requirements for the safe management of waste lubricating oils. Member states are required to prioritise the regeneration of these oils and where this is not feasible, combustion is to be carried out under circumstances that are within environmentally acceptable limits.

12.3.3 The End of Life Vehicles (Producer Responsibility) Regulations (2003) aim to '*promote the prevention of waste*' from vehicles and transpose the EC Directive on End of Life Vehicles 2000/53/EC (The 'ELV Directive') into national law. The ELV Directive requires Member States to meet new re-use, recycling and recovery targets for materials from end of life vehicles and for end of life vehicles to be treated to a new, higher, set of standards (DTI 2005) Article 7 of the ELV Directive requires operators to attain a reuse and recovery target of 80% for ELVs by January 2006, and within this a target of 80% for reuse and recycling, increasing to 95% and 85% respectively, by 2015 (DTI 2005).

12.3.4 The Hazardous Waste Regulations (England & Wales) 2005 provide definitions of hazardous and non-hazardous wastes and set out the procedures for disposing of, carrying and receiving hazardous waste. The regulations supersede the Special Waste Regulations 1996 which transposed the requirements of the European Hazardous Waste Directive (91/689/EEC), requiring the controlled management of hazardous wastes.

12.3.5 The implementation of the ELV Directive, the End of Life Regulations (2003), the Hazardous Waste Regulations should mean that waste arising from the LEZ would be dealt with following the Waste Management Hierarchy. The LEZ would also accord with other national and regional policies.

## 12.4 Baseline Conditions

- 12.4.1 The Waste Strategy 2000 states that approximately 1.5 million vehicles per year reach the end of their life (DEFRA 2000). In 2000, over 2 million cars and vans were scrapped (Waste Online 2004), principally due to accidents and vehicles reaching the end of their natural life (the average expectancy is 12 to 13 years) (DTI 2002). Over 2 million tonnes of materials are generated (Waste Online 2004) from end of life vehicles per year. There are no data available at present however, for the proportions of different vehicle types that are scrapped per year. This makes differentiation between the rate of scrapping of private cars, HGVs, LGVs, coaches and buses problematic.
- 12.4.2 Data providing the average mass of the components of 70 popular car models shows that over 76% of materials are metals (DTI 2002). Information is not currently available for HGVs, buses and coaches so it is unclear the extent to which the material breakdown differs from cars, although the total mass is likely to be greater.

### *Disposal*

- 12.4.3 Data collected for 2000 suggest that on average, over 75% of the mass of end of life vehicles are recycled, mainly through recycling metals and the re-use of parts. Other materials such as rubber, glass and plastic tend to be sent to landfill as recycling and reuse is more technically complex and costly (DEFRA 2000).
- 12.4.4 In 2005 there were 37 shredder facilities operated by 13 businesses, although two companies own half of these facilities. These two companies shred approximately 70% of the end of life vehicles in the UK (DTI 2005). There are 1,200 reprocessors and recyclers in the UK but not all accept materials from end of life vehicles (DTI 2005).

### *Future Trends*

- 12.4.5 Technological developments in vehicle design could have implications for the types and quantities of materials arising from end of life vehicles in the future. Implementation of the End of Life Vehicles Directive and End of Life Vehicles Regulations (2003) are likely to lead to increases in the amount of materials recycled and improvements to the scrapping process.

## 12.5 Impact Assessment

- 12.5.1 The results from the survey show that of all the companies surveyed for all regions, a greater proportion of HGVs met the Euro III standard than of Euro 0, I or II standards (Figure 12.1).

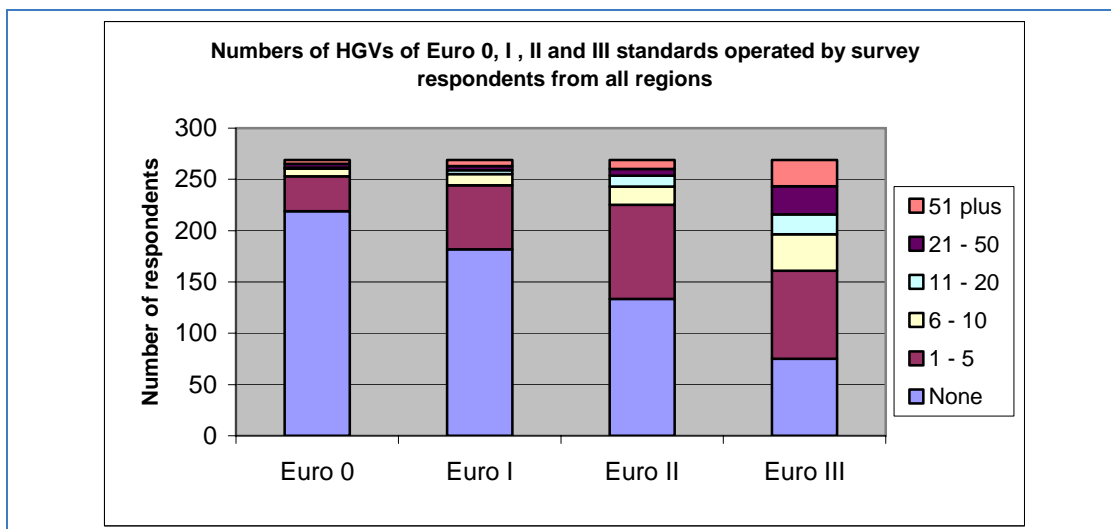


Figure 12.1: Numbers of HGVs of Euro 0, I, II and III standards operated by survey respondents in all regions

12.5.2 There is a more even distribution of total number of buses and coaches achieving each of the standards with a slightly larger proportion having a rating of Euro III (Figure 12.2).

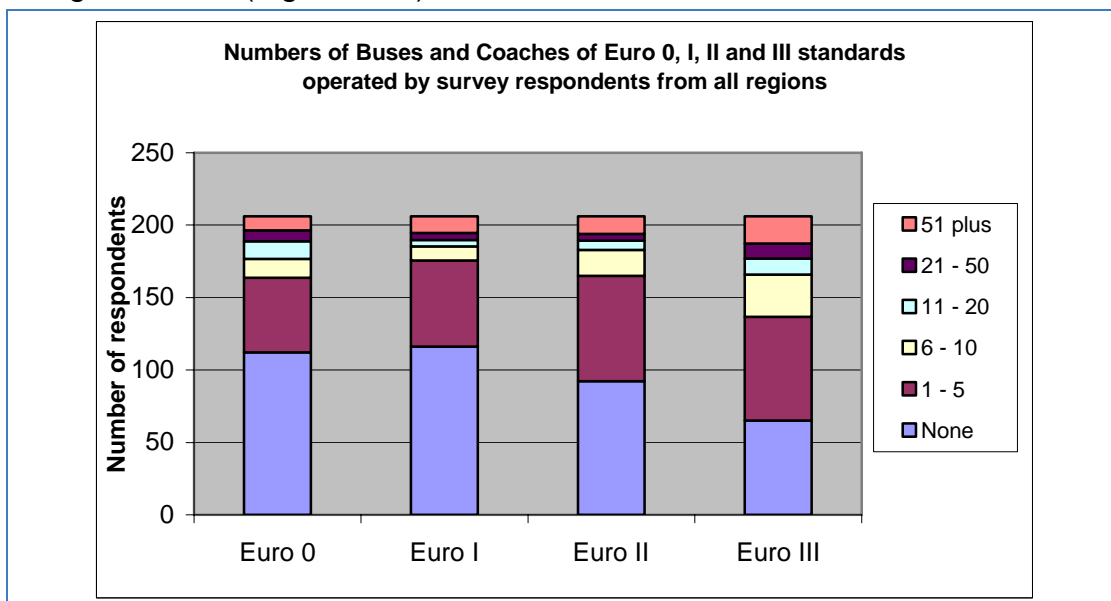


Figure 12.2: Numbers of buses and coaches of Euro 0, I, II and III standards operated by survey respondents in all regions

12.5.3 The data suggest that although Euro III vehicles are used by some operators, a sizeable number use Euro I / Euro II vehicles and to a lesser extent Euro 0.

12.5.4 Similarly, the results of the survey show that in general more HGV operators based outside London, making over 51 journeys in and around Greater London per year, use Euro III vehicles than use Euro 0, I and II (Figure 12.3).

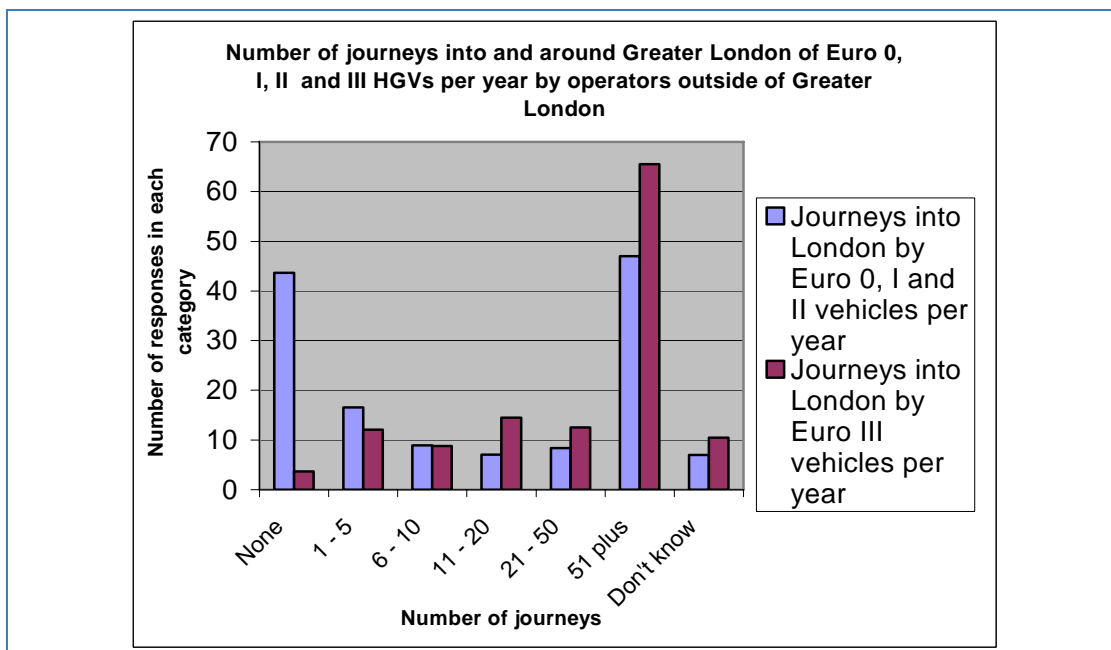


Figure 12.3: Number of journeys into and around Greater London of Euro 0, I, II and III HGVs per year by operators based in regions outside of Greater London

12.5.5 Bus and coach operators based outside London making more than 51 journeys per year, use slightly more Euro 0, I and II vehicles however, than Euro III (Figure 12.4).

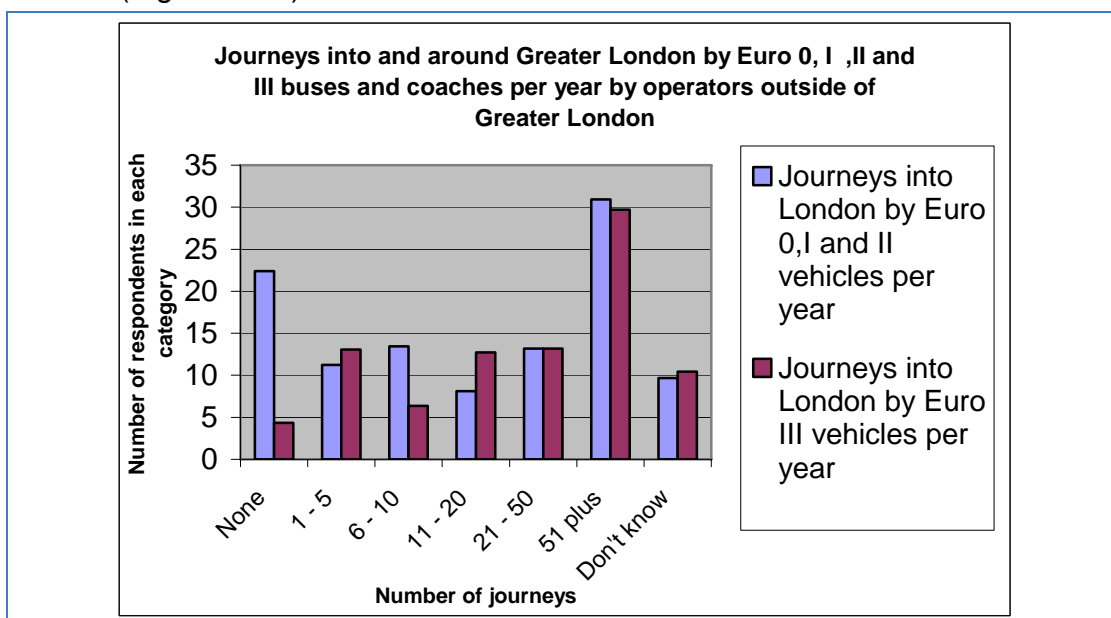


Figure 12.4: Number of journeys into and around Greater London of Euro 0, I, II and III buses and coaches per year by operators based in regions outside of Greater London

12.5.6 A larger number of respondents said that they make no journeys into and around Greater London in Euro 0, I or II standard HGVs, buses and coaches than made no journeys with Euro III standard vehicles. The data suggest, however, that some operators would be impacted on by the LEZ.

12.5.7 The survey also collected data for journeys made by operators based in Greater London. London based HGV operators making more than 51 journeys per week into and around greater London use a larger number of Euro 0, I or II standard vehicles than Euro III standard vehicles (Figure 12.5).

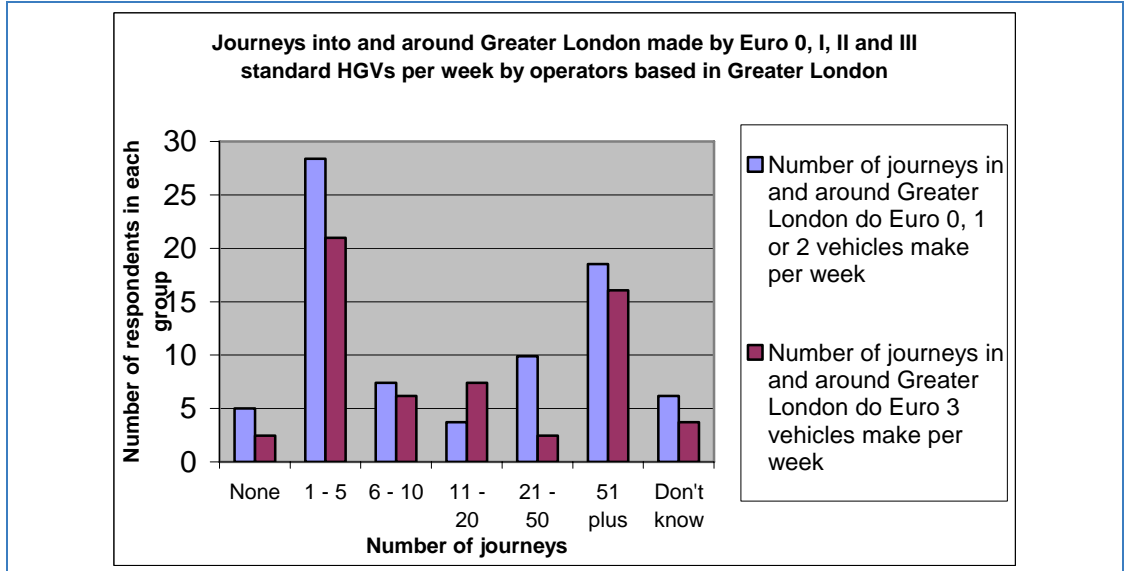


Figure 12.5: Journeys in and around Greater London made by Euro 0, I, II and III standard HGVs per week by operators based in Greater London

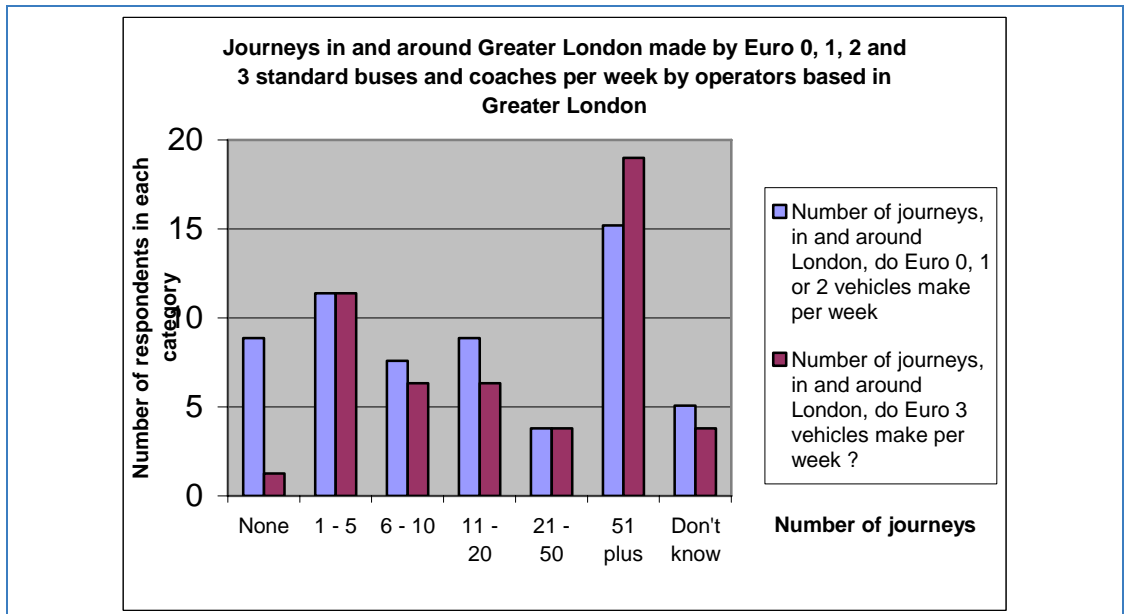


Figure 12.6: Journeys in and around Greater London made by Euro 0, I, II and III standard buses and coaches per week by operators based in Greater London

12.5.8 However, bus and coach operators based in London making more than 51 journeys per week use more Euro III standard vehicles than Euro 0, I or II vehicles (Figure 12.6). For operators of HGVs, buses and coaches making fewer trips into and around Greater London slightly more use Euro 0, I or II vehicles than Euro III.

12.5.9 The survey also provides an indication of the likely response by operators following the implementation of the LEZ. The results (see Table 12.1) show that in total, 34% of HGV operating companies and 29% of bus and coach operating companies surveyed would replace non-compliant vehicles. A smaller proportion would change plans to get newer vehicles quicker than would have done otherwise, with 15% of both HGV and bus and coach operators proposing this approach. The results suggest however that respondents, following the implementation of the LEZ, would select a variety of options. For example, 20% of HGV operators and 19% of buses and coach operators would fit pollution abatement equipment or re-engine vehicles. Note that the totals in Table 12.1 will exceed 100% as respondents were able to give more than one answer.

**Table 12.1: Likely responses of companies operating HGVs following implementation of the LEZ**

It is proposed that from 2008 all Euro III diesel HGVs/buses and coaches would be able to operate in the Low Emission Zone without a charge. What would your company do if the proposal was implemented?	HGV Operators	Bus / coach Operators
Replace non-compliant vehicles with compliant vehicles	34%	29%
Only use compliant vehicles in London and use others elsewhere	23%	27%
Fit pollution abatement equipment to noncompliant vehicles	20%	19%
Nothing - as only ever have newer or compliant vehicles	20%	14%
Change plans to get newer vehicles quicker than would have done otherwise	15%	15%
Use routes that avoid Greater London	15%	21%
Don't know	10%	9%
Re-engine the vehicles	5%	5%
Other	4%	5%
Close business/sell business	3%	7%
Assess costs	3%	Not in survey
Switch to using vehicles under 3.5 tonnes	2%	1%
Continue to use non-compliant HGVs into the zone and risk being fined	2%	5%

12.5.10 The survey showed that 23% of HGV and 27% of bus and coach operators would use only compliant vehicles in London and would use others elsewhere. It is however unclear what the implications would be for rates of vehicle scrapping.

12.5.11 The results from the survey show that a number of operators would need to change behaviour in order to avoid charges imposed by operation of the LEZ. Approximately a third of those surveyed suggested that they would take

action to replace vehicles or to replace vehicles quicker than would have done otherwise. These actions have the potential to increase the likelihood of scrapping vehicles either immediately or quicker than would otherwise be the case. It is however anticipated that large proportions of vehicles scrapped would be recycled. Operators might also sell on non-compliant vehicles to operators who do not travel in London.

12.5.12 The LEZ is likely therefore to have a moderate adverse impact on waste arisings.

*Assumptions and uncertainties*

12.5.13 The survey collected discrete samples for HGV, and bus and coach operators, with the goal of each one being representative of the respective populations. The sample structure was based on geographical location, fleet profile and sector.

12.5.14 The sample structure was based on data sourced from the Department for Transport, and from data supplied by TfL from the previous operator survey conducted in 2005. All quotas were achieved apart from geographical area, which was slightly biased in favour of the regions for each of the operator groups. In order to ensure that the results are representative in terms of the geographical profiles provided by TfL, the data were weighted to bring the geographical location quotas in line with the population structure.

12.5.15 Data should therefore be representative of all HGV, bus and coach operators. Uncertainties exist and it cannot be known in advance what course of action operators will actually take.

12.5.16 The lack of data for the proportions of different types of vehicles that are scrapped per year also means establishing the effect of the LEZ on scrapping rates is difficult. The lack of information on the capacity of planned and existing scrap yards also makes it difficult to establish the implications of additional waste arisings from the LEZ. Within these limitations the following conclusions have been drawn.

## 12.6 Significance

12.6.1 Significant adverse effects are not expected to result from the LEZ by changes to vehicle scrapping rates. This is because although the TfL Vehicle Operator Survey (TfL 2006) implied that an increase in end of life vehicles is likely, it is not expected that this would be significant in relation to total numbers of end of life vehicles per year. In addition, implementation of the End of Vehicle Life Regulations (2003) and Hazardous Waste Regulations (2005) should also ensure that the majority of vehicles' materials are re-used, recycled and recovered, further mitigating any adverse effects associated with potential increased scrapping rates.

12.6.2 Based on the available information, the effects of the LEZ on vehicle

scrapping rates are likely to be moderate adverse but negligible.

## 12.7 Mitigation

12.7.1 The implementation of the End of Vehicle Life Regulations (2003) should act as a sufficient mitigation measure. No others are considered necessary based on the results of the TfL Vehicle Operator Survey.

## 12.8 Monitoring

12.8.1 No monitoring measures are proposed.

## 12.9 Residual Effects

12.9.1 No residual effects are anticipated to result from the LEZ in relation to waste.

## 12.10 Conclusions

12.10.1 Based on the TfL Transport Operator Survey, the proposed LEZ is not expected to have significant adverse effects resulting from increased scrapping of vehicles. Effects are not expected to be significant provided the requirements of the ELV Directive and End of Life Vehicle Regulations (2003) and Hazardous Waste Regulations (2005) are adhered to, although this is beyond the control of TfL

## 12.11 References

DEFRA 2000	Department of Environment, Food and Rural Affairs, <i>Waste Strategy for England and Wales, 2000</i>
DTI 2002	Department of Trade and Industry, <i>End of Life Vehicles: End of Life Vehicles (ELV) Waste Arisings and Recycling Rates, 2002</i>
DTI 2005	Department of Trade and Industry, <i>Regulatory Impact Assessment for the department of trade and industry's statutory instrument – the End of Life Vehicles (Producer Responsibility) Regulations, 2005</i>
HMG 2003	<i>Statutory Instrument 2003 No. 2635, the End-of-Life Vehicles Regulations, 2003</i>
HMG 2005	<i>Statutory Instrument 2005 No. 894 the Hazardous Waste (England and Wales) Regulations, 2005</i>
TfL 2006	Transport for London, <i>Low Emission Zone Vehicle Operator Survey, August 2006</i>



## 13 Climate Change

### 13.1 Introduction

- 13.1.1 In recent decades evidence has accumulated to demonstrate that an unprecedented rise in global temperatures has occurred over the last century or so. Scientific opinion is now virtually unanimous in attributing this change to emissions of greenhouse gases, primarily carbon dioxide from combustion of fossil fuels for energy generation or transport.
- 13.1.2 Other greenhouse gases (GHGs) now present in the atmosphere include methane, nitrous oxide, chlorofluorocarbons, hydrochlorofluorocarbons and sulphur hexafluoride. These gases are found in far smaller quantities in the atmosphere than carbon dioxide but have much greater 'global warming potential', or weight-for-weight cause more warming than carbon dioxide.
- 13.1.3 This chapter discusses the effect of the proposed LEZ on emissions of greenhouse gases.

### 13.2 Methodology

- 13.2.1 The quantification of carbon dioxide (CO<sub>2</sub>) emissions formed part of the modelling study carried out by King's College ERG on behalf of TfL. Estimates of the likely carbon dioxide emissions from traffic within the study area were made for the following scenarios:
- 2005 Baseline
  - 2008 Baseline, and With LEZ
  - 2010 Baseline, and With LEZ
  - 2012 Baseline, and With LEZ
  - 2015 Baseline, and With LEZ
- 13.2.2 Comparison of the baseline with the scenario for LEZ in each year shows the estimated change in CO<sub>2</sub> emissions associated with the proposed LEZ.
- 13.2.3 The modelling made carefully determined assumptions about operator response to the introduction of the proposed LEZ, i.e. whether to acquire new vehicles or to retrofit existing vehicles with particle abatement equipment, based on the operator surveys (described in outline in Chapters 6 and 12).

### 13.3 Baseline

- 13.3.1 Estimates given in the Mayor's State of the Environment Report indicate that emissions of greenhouse gases in London<sup>17</sup> between 1999 and 2000 amounted to 40,323,777 tonnes carbon dioxide equivalent, from all sources. The contribution from transport sources was around 8,500,000 tonnes carbon dioxide equivalent (21% of the total).

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<sup>17</sup> This relates to the Greater London administrative boundary

- 13.3.2 Estimates for the UK as a whole show a steadily rising trend until 2003 in greenhouse gas emissions from transport, to 127,824,000 tonnes carbon dioxide equivalent. Emissions from all sources appeared to peak in the period 1999-2002, although the most recent estimates show a further increase in national emissions in 2003. The latest UK total from all sources is 722,328,000 tonnes carbon dioxide equivalent.
- 13.3.3 London therefore emits around 5.6% of the UK total of greenhouse gases and around 6.7% of gases from transport sources.

### 13.4 Impacts

- 13.4.1 The predicted emissions of traffic-related carbon dioxide in each year, with and without the proposed LEZ, are summarised in Table 13.1. In this context, the “Central” area encompasses the Congestion Charging Zone; the “Inner” area, the region between the Central area, up to and including the North/South Circular roads; the “Outer” area, the region beyond the North/South Circular roads up to the GLA boundary; and the “External” area, the area beyond the GLA boundary, up to and including the M25.
- 13.4.2 Table 13.1 shows that emissions rise (with or without the LEZ) up to 2015, such that total emissions are about 3.3% higher by 2015. This general increase in emissions is associated with projected traffic growth in the Greater London and surrounding area (including the M25).

*Table 13.1. Predicted carbon dioxide emissions (tonnes per year) in Greater London and external area. Source: ERG*

Scenario	2005	2008	2010	2012	2015
<b>Baseline (no LEZ)</b>					
- Central	260,300	261,297	260,115	261,175	261,692
- Inner	2,399,721	2,313,338	2,320,995	2,340,910	2,365,606
- Outer	5,126,190	5,175,497	5,234,797	5,294,155	5,375,040
- External	3,773,641	3,818,871	3,857,197	3,893,512	3,944,489
<b>- Total</b>	<b>11,559,852</b>	<b>11,569,003</b>	<b>11,673,104</b>	<b>11,789,753</b>	<b>11,946,826</b>
<b>With LEZ</b>					
- Central	-	261,401	260,060	261,154	261,690
- Inner	-	2,313,875	2,320,760	2,340,888	2,365,622
- Outer	-	5,176,282	5,234,407	5,294,237	5,375,113
- External	-	3,817,566	3,856,665	3,893,711	3,944,594
<b>- Total</b>	<b>-</b>	<b>11,569,125</b>	<b>11,671,893</b>	<b>11,789,991</b>	<b>11,947,019</b>

<b>% Change in Total emissions with LEZ</b>	-	<b>+0.001%</b>	<b>-0.010%</b>	<b>+0.002%</b>	<b>+0.002%</b>

13.4.3 Table 13.1 also shows a very small predicted change in total carbon dioxide emissions in each year due to the impact of the LEZ. In all years, with the exception of 2010, this shows a slight increase in carbon dioxide emissions associated with the LEZ. Such changes in CO<sub>2</sub> emissions would happen as a result of the response of operators. Modelling shows that operators would comply with the proposed LEZ, with some retro fitting and some purchasing newer vehicles. Retrofitting pollution abatement equipment (e.g., particle traps) to an existing vehicles typically leads to a small (c.1%) fuel consumption (and therefore CO<sub>2</sub>) penalty. Purchasing an entirely new vehicle would yield a significant fuel economy and CO<sub>2</sub> emission improvement of up to 10% (switching from a Euro II to a Euro IV HGV).

13.4.4 The scale of the percentage change in CO<sub>2</sub> (both positive and negative) is insignificant compared with the total CO<sub>2</sub> emissions of the traffic. Furthermore it is more likely that a change in operator response to that assumed in the model will lead to a reduction in the percentage change modelled than to an increase.

13.4.5 Road transport is also responsible for emissions of nitrous oxide (N<sub>2</sub>O), which is a potent greenhouse gas, which has a global warming potential 296 times that of carbon dioxide (IPCC, 2001). In 2004, road transport was responsible for contributing about 12% of the total UK nitrous oxide emissions.

13.4.6 Road transport emissions of nitrous oxide increased significantly over the period 1990 to 2000, but have since remained relatively unchanged. The increase is linked to the impact of three-way catalytic converters. New abatement technologies that reduce emissions of NO<sub>x</sub> (such as Selective Catalytic Reduction) may lead to increases the percentage emissions of nitrous oxide but there is no evidence to suggest that particle trap technologies would have any such effect.

13.4.7 In determining whether levels of N<sub>2</sub>O would increase or decrease account must be taken of the opposing effects described above (i.e. a reduction in overall NO<sub>x</sub> with a potential increase caused by new abatement technologies). In order to determine which effect would have greater influence a detailed model would be required coupled with more detailed information on how operators would respond to the proposed LEZ. Whilst this has not been undertaken it is considered that the results would be of little significance in the context of overall emissions of greenhouse gases from London's traffic.

### 13.5 Effects and significance

13.5.1 The effect of the LEZ in terms of emissions related to climate change is likely to be small. Modelling predicts no significant increases in CO<sub>2</sub> emissions compared with baseline (without LEZ) scenario.

13.5.2 The actual impacts of the proposed LEZ on emissions of carbon dioxide would be subject to, and is sensitive to, operator behaviour on the introduction of the LEZ. For example, if more operators than expected upgrade to newer vehicles rather than fitting particulate traps, there would likely be a reduction in CO<sub>2</sub> emissions. If however, fewer operators bought newer vehicles, there may be an increase in emissions.

13.5.3 There are a number of other uncertainties in the modelled outputs, which make it difficult to predict the impact of the proposed LEZ on greenhouse gas emissions. These include the performance of particulate trap technology and factors that affect the fuel consumption of vehicles, including weight of the vehicle, driving conditions and driving style.

### 13.6 Mitigation and monitoring

13.6.1 It is expected that the proposed LEZ would have a negligible impact CO<sub>2</sub> emissions and a negligible effect, or possibly a small reduction in GHG emissions. TfL will consider undertaking further modelling to quantify any effect on other GHG emissions such as N<sub>2</sub>O that the proposed scheme might have.

13.6.2 TfL will consider the benefits of monitoring GHG emissions after the implementation of the proposed LEZ.

### 13.7 Conclusions

13.7.1 The effect of the proposed LEZ on climate change is expected to be negligible.

### 13.8 References

- |            |  |
|------------|--|
| IPCC, 2001 | Intergovernmental Panel on Climate Change, <i>Third Assessment Report</i> , 2001 |
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## 14 Conclusions

### 14.1 Introduction

14.1.1 TfL have undertaken a voluntary environmental appraisal, guided by the EIA approach, as a best-practice measure to consider the likely significant environmental effects of the proposed LEZ. This chapter summarises the conclusions of the study.

### 14.2 Legislative Context and London Policy

14.2.1 The Mayor has powers to introduce road user charging schemes granted by the Greater London Authority Act (1999) and the Transport Act (2000). The proposed LEZ would, subject to the outcome of consultation, be implemented using a Scheme Order under the GLA Act.

14.2.2 The proposed LEZ supports the EU's Framework Directive on ambient air quality assessment and management (96/62/EC) and daughter directives. It is also consistent with the Air Quality Strategy for England, Wales, Scotland and Northern Ireland Working Together for Clean Air (DEFRA, 2000).

14.2.3 It also supports other key strategies and initiatives including:

- The Mayor's Transport Strategy (TfL, 2001)
- Cleaning London's Air: The Mayor's Air Quality Strategy (GLA, 2002)
- The London Plan (GLA, 2004)
- London Borough Air Quality Action Plans

### 14.3 Traffic

14.3.1 TfL's analysis indicates that the LEZ is likely to have a negligible impact in terms of diverting trips with no origin or destination within London and 'rat-running' on unsuitable roads owing to non-compliant vehicles attempting to avoid LEZ enforcement camera sites. Equally the LEZ is unlikely to significantly affect the numbers of people or volumes of goods transported by road in London.

### 14.4 Air Quality

14.4.1 The proposed LEZ would reduce PM<sub>10</sub> and NO<sub>x</sub> emissions from road traffic. The effects would extend beyond the boundary of the LEZ, out to and beyond the M25 corridor. It would bring London closer to achieving the statutory and provisional air quality objectives and EU limit values. The LEZ is thought likely to have a significantly beneficial effect given the number of people affected by the air quality benefits.

### 14.5 Noise

14.5.1 The impacts arising from construction noise and vibration are not expected to

have significant effects but best practice measures would be implemented to ensure that any noise generated is minimised. Once operational, the LEZ could have potential small benefits on noise, as it removes older noisier vehicles from the fleet. It is estimated that the environmental benefits are likely to be real but marginal.

#### **14.6 Landscape**

14.6.1 Most of the proposed enforcement cameras and associated equipment are likely to have visual effects of low or negligible significance. Similarly the associated traffic signs would have a negligible effect on townscape character and visual amenity.

#### **14.7 Ecology**

14.7.1 The introduction of a LEZ within Greater London, which is predicted to lead to a reduction in concentrations of nitrogen dioxide and particulate matter, has the potential to have a small beneficial effect on biodiversity within London.

14.7.2 The installation of the enforcement cameras and traffic signs would have no significant effects on biodiversity.

#### **14.8 Cultural Heritage**

14.8.1 The LEZ would have a beneficial effect of reducing the soiling and decay, due to dry deposition, of cultural heritage assets in London due to reductions in emissions of particulate matter. However the effects are unlikely to be significant.

#### **14.9 Waste**

14.9.1 The proposed LEZ is not expected to have significant adverse effects resulting from increased scrapping of vehicles.

#### **14.10 Climate Change**

14.10.1 The effect of the proposed LEZ on climate change is expected to be negligible.

#### **14.11 Mitigation**

14.11.1 The principal effect of the LEZ would be to improve air quality. Other effects on the environment are not likely to be significant. Mitigation measures to offset significant adverse effects are therefore unnecessary.

#### **14.12 Monitoring**

14.12.1 The following monitoring is proposed in the Environmental Report:

**Table 14.1: Proposed monitoring**

Chapter	Proposed Monitoring
Chapter 6 - Traffic	Headline traffic figures for the Greater London area that are currently monitored and readily available would provide a useful source of information relating to traffic flows by vehicle type on main routes into London and also on the M25
	It is suggested that a monitoring strategy be developed that is also focused upon representative areas, such as those around camera sites, or those identified in the modelling, to assess the local impacts
Chapter 7 - Air Quality	Model pollutant emissions and air quality concentrations using observed data
	Measure ambient concentrations of NO <sub>2</sub> , PM <sub>10</sub> and PM <sub>2.5</sub> , and ozone in inner and outer zones with LEZ compared to data outside London. Analyse data from these sites (as annual means and 3-year rolling means) to identify long term changes
	Measure NO <sub>2</sub> /NO <sub>x</sub> ratios and analyse data against expected trends
	Number of local authorities with AQMAs for NO <sub>2</sub> and/or PM <sub>10</sub> due to traffic emissions
	Number of HGVs and LGVs entering the LEZ
Chapter 8 - Noise and Vibration	Changes to Euro emission standards of observed vehicles in the LEZ
	TfL should consider undertaking monitoring for a period of several weeks prior to the launch of the LEZ and for a prolonged period after it is active
Chapter 10 - Ecology	Monitoring could also make use of the LEZ monitoring cameras, which will record information on traffic types and volumes
	TfL could consider monitoring any changes in lichen and moss abundance and distribution, as is this likely to yield the greatest results

### 14.13 References

- EC, 1996 Framework Directive 96/62/EC on ambient air quality assessment and management ('The EU Air Quality Framework Directive') accessible via: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0062:EN:HTML>
- EC, 1999 Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide, and oxides of nitrogen, particulate matter and lead in ambient air ('The first Daughter Directive') accessible via: <http://eurlex.europa.eu/LexUriServ/LexUriServ>.

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EC, 2000	do?uri= CELEX:31999L0030:EN:HTML Council Directive 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air ('The Second Daughter Directive') accessible via: <a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0069:EN:HTML">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0069:EN:HTML</a>
EC 2002	Council Directive 2002/3/EC relating to ozone ('The Third Daughter Directive') accessible via: <a href="http://ec.europa.eu/environment/air/ambient.htm#2">http://ec.europa.eu/environment/air/ambient.htm#2</a>
DEFRA, 2000	Department of the Environment, Food and Rural Affairs, <i>The Air Quality Strategy for England, Wales, Scotland and Northern Ireland Working Together for Clean Air</i> , DEFRA, 2000.
GLA, 2002	Greater London Authority, <i>Cleaning London's Air: The Mayor's Air Quality Strategy</i> , GLA, February 2004.
GLA, 2004	Greater London Authority, <i>The London Plan</i> , GLA, February 2004.
TfL, 2001	Transport for London, <i>The Mayor's Transport Strategy</i> , TfL, July 2001.



## Appendix 5-A: Scoping Tables

The following table is reproduced from the Scoping Report and lists the issues that were considered when defining the scope of the Environmental Appraisal.

### Construction Issues

Environmental Topic	Issue	Scoped in?
<b>Water</b>		
<b>Surface water hydrology and channel morphology</b>	<b><u>Use of vehicles and machinery</u></b>	
	1. Increase in surface runoff from soil compaction	No - few if any sites will be close to surface waters
	<b><u>Works next to or near watercourses</u></b>	
	2. Change in flow velocities	No - few if any sites will be close to surface waters
	3. Increased erosion and subsequent changes in bed and bank stability	No - few if any sites will be close to surface waters
	4. Increased flood risk	No - few if any sites will be close to surface waters
	<b><u>Earthworks</u></b>	
	5. Increased sedimentation of watercourses	No - few if any sites will be close to surface waters
<b>Surface water quality</b>	<b><u>Earthworks</u></b>	
	6. Pollution from suspended material	No - few if any sites will be close to surface waters
	7. Disturbance of contaminated soil and subsequent pollution of watercourses	No - few if any sites will be close to surface waters

Environmental Topic	Issue	Scoped in?
	<b><u>Materials management</u></b>	
	8. Pollution from spills or leaks of fuel, oil and construction materials	No - few if any sites will be close to surface waters
<b>Groundwater quality</b>	<b><u>Earthworks</u></b>	
	9. Disturbance of contaminated soil and subsequent groundwater pollution	No - extent of works is limited
	<b><u>Materials management</u></b>	
	10. Pollution from spills or leaks of fuel, oil and construction materials	No - extent of works is limited and best construction practice will be followed
<b>Land</b>		
<b>Landscape</b>	<b><u>Excavations and earthworks</u></b>	
	11. Possible creation of a new landform	No - extent of works is limited
<b>Soils</b>	<b><u>Use of vehicles and machinery</u></b>	
	12. Compaction	No - extent of works is limited
	13. Erosion	No - extent of works is limited
	<b><u>Earthworks</u></b>	
	14. Further erosion of exposed soil	No - extent of works is limited
	15. Digging of holes and foundations in the soil on site for pylon or tower construction	No - extent of works is limited
<b>Geology</b>	<b><u>Excavations</u></b>	

Environmental Topic	Issue	Scoped in?
	16. Removal of rock	No - extent of works is limited
<b>Air</b>		
<b>Local Air Quality</b>	<b><u>Use of vehicles and machinery</u></b>	
	17. Emissions from construction site traffic	No - extent of works is limited
	18. Dust generation	No - extent of works is limited
<b>Terrestrial Ecology</b>	<b><u>Earthworks and excavations</u></b>	
	19. Habitat removal, fragmentation or severance	No - extent of works is limited
	20. Disturbance to, or loss of, species (including rare and sensitive species)	Yes - possible disturbance to species or sensitive sites
<b>Human Environment</b>		
<b>Socio-economic</b>	<b><u>Earthworks and excavations</u></b>	
	21. Disruption of services such as electricity, gas, water, or telecommunications due to the construction works	No - extent of works is limited
	22. Construction-related employment	No - extent of works is limited
	23. Traffic delays	No - extent of works is limited
<b>Health and Safety</b>	<b><u>Earthworks and excavations</u></b>	
	24. Risk of injury on construction site	No - extent of works is limited and best construction practice will be followed
<b>Amenity</b>	<b><u>Restricted access</u></b>	

Environmental Topic	Issue	Scoped in?
	25. Conflicts of interest may arise with land users	No - extent of works is limited and best construction practice will be followed
<b>Nuisance</b>	<b><u>Use of vehicles and machinery</u></b>	
	26. Traffic delays	No - extent of works is limited
	27. Noise from construction traffic and operations	No - extent of works is limited
<b>Architectural and archaeological heritage</b>	<b><u>Construction</u></b>	
	28. Damage to known or unknown features of archaeological or cultural importance	No - extent of works is limited and best construction practice will be followed

### Operational Issues

Environmental Topic	Issue	Scoped in?
<b>Water</b>		
<b>Surface water hydrology and channel morphology</b>	<b><u>Use of materials</u></b>	
	29. Negligible impact	No - negligible impact
	<b><u>Site drainage</u></b>	
	30. Negligible impact	No - negligible impact
<b>Surface water quality</b>	<b><u>Materials management</u></b>	
	31. Pollution from spills or leaks	No - few if any sites will be close to surface waters

Environmental Topic	Issue	Scoped in?
	<b><u>Use of machinery</u></b>	
	32. Negligible impact	No - negligible impact
<b>Groundwater hydrology</b>	<b><u>Physical presence of post foundations</u></b>	
	33. Negligible impact	No - number and extent of sites very small
<b>Groundwater quality</b>	<b><u>Materials management</u></b>	
	34. Pollution from spills or leaks	No - spills or leaks not likely to be associated with maintenance of LEZ infrastructure
	<b><u>Use of machinery</u></b>	
	35. Negligible impact	No - negligible impact
<b>Land</b>		
<b>Landscape</b>	<b><u>Physical presence of posts</u></b>	
	36. Change in character of landscape	Yes - potentially adverse townscape effects
	37. Obvious visual intrusion of the posts and associated structures	Yes - potentially adverse townscape effects
<b>Soils</b>	<b><u>Use of vehicles and machinery</u></b>	
	38. Soil compaction	No - number and extent of sites very small
<b>Air</b>		
<b>Local Air Quality</b>	<b><u>Ongoing use of road</u></b>	
	39. Changes in exhaust emissions leading to altered levels of airborne pollutants	Yes - LEZ is expected to have a beneficial effect on emissions

Environmental Topic	Issue	Scoped in?
	40. Potential for highly polluted “hotspots”	No - LEZ is expected to have a beneficial effect on emissions, so no new hotspots are likely to be created
<b>Regional / global air quality</b>	<b><u>Ongoing use of road</u></b>	
	41. Increased contribution to greenhouse gases	No - the earlier SEA established that effects on greenhouse gas emissions will be small
	42. Change in air quality	Yes - LEZ is expected to improve air quality
<b>Terrestrial Ecology</b>	<b><u>Physical presence of posts</u></b>	
	44. Alteration or loss of terrestrial habitats	Yes - effects from improvements to air quality will be investigated
<b>Human Environment</b>		
<b>Socio-economic</b>	<b><u>Operations</u></b>	
	45. Small employment opportunities associated with ongoing maintenance of the infrastructure	No - LEZ not likely to have significant direct employment effects
	46. Reduction in property value immediately adjacent to posts	No - number and extent of sites very small
	47. Economic effects from the changes in fleet profile	Yes - however this issue will be addressed in the separately produced Economic Impact Assessment
<b>Amenity</b>	<b><u>Access</u></b>	
	48. Alteration of rights of way or reduction in access	No - number and extent of sites a very small
<b>Nuisance</b>	<b><u>Use of vehicles and machinery</u></b>	
	49. Noise from construction traffic and operations	Yes - possible increase in noise resulting from rat running to avoid charge, also possible decrease from newer vehicles
<b>Architectural and archaeological heritage</b>	<b><u>Operation</u></b>	

Environmental Topic	Issue	Scoped in?
<b>heritage</b>	50. Damage to known or unknown features of archaeological or cultural importance	Yes - reduced soiling effects from PM will be investigated
<b>Waste</b>	<b><u>Operation</u></b>	
	51. Increase in volume of waste resulting from early scrapping of vehicles	Yes - potential increase in number of vehicles

## Appendix 7-A: Projected Air Quality Impacts Summary

Scenario	Oxides of Nitrogen							PM <sub>10</sub> - annual						PM <sub>10</sub> - daily					
	Emissions of NO <sub>x</sub>		Area exceeding annual mean NO <sub>2</sub> objective for 2010 (40ug/m <sup>3</sup> )		Population in area exceeding objective			Emissions of PM <sub>10</sub>		Area exceeding annual mean PM <sub>10</sub> objective for 2010 (23ug/m <sup>3</sup> )		Population in area exceeding annual mean PM <sub>10</sub> objective			Area with >35 (pre-2010) and >10 (2010) exceedances p/a of daily PM <sub>10</sub> objective (50ug/m <sup>3</sup> )		Population in area exceeding objective		
	Tonnes emitted	% reduction	Area (km <sup>2</sup> )	% reduction	Population exposed	Reduction in population exposure	% reduction	Tonnes emitted	% reduction	Area (km <sup>2</sup> )	% reduction	Population exposed	Reduction in population exposure	% reduction	Area (km <sup>2</sup> )	% reduction	Population exposed	Reduction in population exposure	% reduction
Base Line 2005	39181		227		1930			2754		191		1392			6		32		
Base Line 2008	33851		160		1370			2462		75		495			3		14		
2008 LEZ (HGVs: Euro III for PM <sub>10</sub> only)	32563	3.8	152	5.2	1289	81	5.9	2398	2.6	71	5.8	464	31	6.3	3	7.4%	13	0.7	4.9
Base Line 2010	27054		88		707			2184		27		159			18		102		
2010 LEZ (HGVs & LGVs: Euro III for PM <sub>10</sub> only)	26390	2.5	85	3.7	675	33	4.6	2120	2.9	25	7.5	146	12	7.8	16	6.8%	94	7.7	7.6
Base Line 2012	25358		78		625			2142		17		96			10		52		
2012 LEZ (HGVs: Euro IV for PM <sub>10</sub> & LGVs: Euro III for PM <sub>10</sub> only)	22883	9.8	66	15.6	518	107	17.1	2002	6.6	14	16.2	79	17	17.8	8	14.7%	44	8.3	16.1
Base Line 2015	21634		56		443			2042		8		46			5		27		
2015 LEZ (HGVs: Euro IV for PM <sub>10</sub> & LGVs: Euro III for PM <sub>10</sub> only)	20677	4.4	52	7.4	408	36	8.1	1995	2.3	8	6.4	43	4	7.8	5	7.3%	25	1.8	6.8



## Appendix 10-A: Epping Forest SSSI

### Epping Forest SSSI

**Team** - Essex, Hertfordshire And London - **SSSI name** - Epping Forest - **Staff member responsible for site** - Gordon Wyatt

**Habitat affected (in all cases):** Broadleaved, mixed and yew woodland – lowland

Unit number	Unit ID	Unit area (ha)	Latest assessment date	Assessment description	Condition assessment comment	Reason for adverse condition
East Of England, Essex, Epping Forest						
6	1014288	67.61	03 Dec 2002	Unfavourable no change	Generally OK but almost no beech regeneration. Possibly deer, but ivy and hornbeam NOT badly browsed - MAY be effect of air pollution; OR of climate change?	Other - specify in comments
7	1014279	26.16	19 Aug 2005	Unfavourable no change	Visited 16 July 2005. Reintroduction of extensive grazing working well with good heathland/acid grassland recovery. However, many trees, especially beech and oak, exhibiting obvious signs of poor health, presumably due to air pollution.	Air pollution
8	1014243	95.72	15 Jan 2003	Unfavourable no change	Wet heath dominated by Molinia. Another point of concern is the degree of beech mortality and lack of regen (possibly as a result of climate change and/or air pollution).	Other - specify in comments, Undergrazing, Air pollution
9	1014298	76.18	11 Mar 2003	Unfavourable no change	Unfavourable for two reasons: 1) lack of grazing on wet heath (due to be addressed through reintroduction of grazing); 2) excessive mortality of old beech pollards with very little seedling regeneration (believed to be at least partially due to air pollution).	Air pollution, Undergrazing
10	1014271	41.94	26 Mar 2003	Unfavourable no change	Heathland requires grazing. Concerns re low level of beech regen, possibly due to air pollution. Toads breeding in Wake Valley Pond. Adder seen just to sw of Pond.	Air pollution, Undergrazing

Unit number	Unit ID	Unit area (ha)	Latest assessment date	Assessment description	Condition assessment comment	Reason for adverse condition
12	1014289	43.76	18 Mar 2003	Unfavourable declining	Unfavourable for two reasons: 1) lack of grazing of heath; 2) excessive mortality of old beech pollards and lack of seedling regeneration (believed to be at least partially due to air pollution).	Air pollution, Undergrazing
13	1014290	78.54	18 Mar 2003	Unfavourable no change	Unfavourable for two reasons: 1) excessive mortality of old beech pollards and lack of seedling regeneration (believed to be at least partially due to air pollution); 2) Rhododendron problem at western and northeastern corners of unit.	Inappropriate scrub control, Air pollution
28	1014299	35.07	17 Apr 2002	Unfavourable declining	1. N deposition from air pollution. 2. sycamore invasion. 3. damage due to burst private sewer (flow stopped within 7-8 days, following service of Enforcement Notice by LPA).	Inappropriate scrub control, Air pollution
32	1014297	37.06	17 Apr 2002	Unfavourable no change	N deposition from air pollution.	Air pollution
London, Greater London, Waltham Forest						
33	1014283	36.61	09 Jan 2003	Unfavourable no change	Lack of regeneration in The Sale, possibly due to excessive squirrel population. Area also known to have excessively high NOx levels.	Other - specify in comments, Inappropriate pest control, Air pollution
36	1014287	58.74	20 Mar 2002	Unfavourable declining	Problems: 1) too much visitor pressure - all paths heavily eroded, especially around hollow Pond; 2) not enough woodland regeneration - at least partly due to most acorns being knopperised; 3) most trees unhealthy (air pollution?), but not enough dead wood retained when they die; 4) acid grassland is species poor (air pollution?) and not grazed (most is cut); 5) invaded by broom and some gorse - only control appears to be arson. "Other" in reasons for adverse condition relates to knopper gall problem affecting regeneration. The fundamental problem is road traffic - 1) air	Other - specify in comments, Public access/disturbance, Inappropriate scrub control, Undergrazing, Air pollution

Unit number	Unit ID	Unit area (ha)	Latest assessment date	Assessment description	Condition assessment comment	Reason for adverse condition
					pollution; 2) prevents grazing (can't fence site due to legal constraints).	
London, Greater London, Redbridge						
31	1014296	16.13	17 Apr 2002	Unfavourable declining	1) N deposition from air pollution, 2) alien species (legacy from Victorian plantings)	Air pollution, Inappropriate weed control