Environmental Research and Consultancy Department

Civil Aviation Authority

# Study on the population trends in the vicinity of ten UK civil airports

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# Summary

This report presents an assessment of population trends in the vicinity of ten UK civil airports. The analysis includes the use of census data from 1991 to 2011. The 2011 $L_{Aeq,16h}$ noise contours are used to represent the area around each airport that has been continuously covered by noise and planning guidance for the majority of this time period.

Data are reported in absolute and relative values for both population and household counts by 3 dB noise band for ten UK airports. Based on the evidence available, it is concluded that there have been no significant population increases at noise levels above 66 dB $L_{Aeq,16h}$.

Between 57 and 66 dB, where planning guidance permitted development provided appropriate noise protection was incorporated, some increases have occurred, mostly in the 57-60 dB band. However, the increases were sometimes found to be at lower growth rates than for the surrounding airport region (Gatwick and Manchester), with the exception of perhaps Edinburgh, Glasgow and London Heathrow. Despite population increases in the outer noise bands (57-60 dB), taking into account contour area reductions between 1991 and 2011, net populations exposed to noise levels above 57 dB $L_{Aeq,16h}$ have decreased significantly across almost every airport assessed.

Chapter 1

# Introduction

The Environmental Research and Consultancy Department (ERCD) of the Civil Aviation Authority (CAA) was commissioned by the Department for Transport (DfT) to undertake a study on the population trends in the vicinity of UK airports.

The Aviation Policy Framework[1] recognised the major contribution aviation makes to the UK economy. However, the benefits from aviation also come with adverse effects, principally local environmental impacts such as aircraft noise. Airports are, nevertheless, major employment centres and thus attract residential development towards them, despite these adverse effects often leading to population growth. This issue is not unique to airports, also applying to roads and railway stations, which are considered desirable in terms of the transport access they offer, yet generate noise pollution and therefore may lead to annoyance and other adverse noise effects.

Across the majority of UK airports (for which data exists), noise exposure contours reduced in size and the populations within them decreased between 1991 and 2011 (Table 1).

**Table 1: Population within 57 dB $L_{Aeq,\ 16h}$ noise contour in 1991 and 2011**

| Airport | 1991 | 2011 | Change |
|---|---|---|---|
| Birmingham | 87,900 | 18,800 | -79% |
| Edinburgh | 3,500 | 3,300 | -6% |
| Glasgow | 23,400 | 5,800 | -75% |
| London Gatwick | 23,100 | 2,700 | -88% |
| London Heathrow | 443,400 | 237,800 | -46% |
| London Stansted | 1,300 | 1,300 | 0% |
| Manchester | 49,500 | 27,500 | -44% |

1 Aviation Policy Framework, Department for Transport, 22nd March 2013.

In order to limit and control population increases towards noisy sources, national and local guidelines have been put in place to help promote compatible land-use and discourage inappropriate residential developments near existing sources of noise.

This document presents a summary of the legislative background in terms of historical and current international and UK land-use planning controls and noise policy. It then presents a methodology for assessing population trends and applies this to ten UK airports. The findings of the assessment are briefly reviewed.

A glossary of technical terms is provided in Appendix A.

Chapter 2

# Legislative background and methodology

## UK land-use planning controls and aircraft noise policy

### Planning Policy Guidance note 24 (PPG24)

From 1994 to 2012, PPG24[2] governed land-use planning around airports and other sources of noise (e.g. roads, railways and industrial noise) in England and Wales. Prior to 1994, DOE Circular 10/73 Planning and Noise, published in 1973, provided similar guidance. In Scotland, the relevant guidance was issued as Planning Advice Note (PAN) 56 Planning and Noise, which superseded earlier guidance going back to the early 1970s. Thus guidance has existed with regard to noise and planning since at least the early 1970s.

PPG24 provided guidance on compatible land use through the definition of four land-use planning zones called Noise Exposure Categories (NECs), which are related directly to noise exposure levels. The categories and their noise exposure levels (for aircraft noise) are presented in Table 2. Similar categories were also provided for road, rail and industrial noise, though they used different metrics to define noise exposure levels, since PPG24 pre-dated efforts to harmonise noise metrics across different noise sources.

The aim was to allow limited residential development in NEC B provided commensurate noise insulation was provided through the issue of conditions associated with any consent, whilst discouraging further development in NECs C and D. A clear feature of the controls is that because they were directly related to noise exposure levels, the zones would change over time as the noise exposure levels changed.

[2] PPG24 Planning Policy Guidance: Planning and Noise, Department of the Environment, September 1994.

As well as the four noise exposure categories discussed, PPG24 also recommended specifically for aircraft noise that "60dB $L_{Aeq,16h}$ should be regarded as a desirable upper limit for major new noise sensitive development".

**Table 2: PPG24 land-use planning zones under aircraft noise exposure**

| NEC | Noise exposure level (dB $L_{Aeq,16h}$) | Residential planning condition |
|---|---|---|
| A | < 57 | Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level. |
| B | 57 – 66 | Noise should be taken into account when determining planning applications, and, where appropriate, conditions imposed to ensure an adequate level of protection against noise. |
| C | 66 – 72 | Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise. |
| D | > 72 | Planning permission should normally be refused. |

## National Planning Policy Framework (NPPF)

The National Planning Policy Framework[3], published in March 2012, sets out the Government's planning policies for England and how these are expected to be applied. The NPPF superseded PPG24.

In relation to noise, paragraph 123 states that "*Planning policies and decisions should aim to:*

[3] National Planning Policy Framework, Department for Communities and Local Government, March 2012.

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

The term 'significant adverse impacts' used in the NPPF references Defra's Noise Policy Statement for England (NPSE)[4], published in March 2010 and which defined three critical levels:

- NOEL – No Observed Effect Level
- LOAEL – Lowest Observed Adverse Effect Level
- SOAEL – Significant Observed Adverse Effect Level

The NPSE goes on to note that "It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times."

## Aviation Policy Framework (APF)

The Aviation Policy Framework[5], published in March 2013 set out a balanced approach to securing the benefits of aviation. With regard to aircraft noise, the APF reaffirmed the existing policy that is to "continue to treat the 57 dB $L_{Aeq,16h}$ contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance", thus reaffirming the lower boundary for what was

4 Noise Policy Statement for England (NPSE), Department for Environment Food and Rural Affairs, March 2010.

5 Aviation Policy Framework, Department for Transport, March 2013.

NEC A in PPG24. It did not, however, provide additional guidance with respect to planning and noise, instead reiterating the NPPF policy of leaving it to local planning authorities to ensure that developments are appropriate for their locations, many of whom have continued to apply PPG24. The Department for Communities and Local Government (DCLG) issued Planning Practice Guidance in March 2014 to assist local authorities in this respect.

## Methodology

The ICAO Balanced Approach to Aircraft Noise Management, published in ICAO Doc. 9829, presents a methodology for assessing population change in the vicinity of an airport.

The methodology recognises that the assessment may be done in different ways, because both noise exposure and population are likely to vary over time, and thus the applicable land-use planning zone defined in PPG24 may also change over time.

Key to what is the most appropriate is to ensure that the assessment coverage area remains within the same land-use planning zone throughout the period assessed.

For each airport, ERCD holds population census data, provided by CACI Ltd, for the following years:

- 1991
- 2001
- 2011

Whilst data were also obtained for the 1971 and 1981 Censuses, examination of the data showed that population data were represented by far fewer data points. At many airports, the population in the higher noise exposure contours was represented by a handful of data points, which distorted comparisons with the granular data available for subsequent Censuses. Thus, data for 1971 and 1981 were excluded from the analysis.

Since 2001, inter-census estimates of population have also been generated by CACI Ltd, however these are subject to some uncertainty and thus this assessment has been limited to using only Census year data.

This study has considered the following ten UK airports for which the ERCD holds noise exposure data:

- Aberdeen
- Birmingham
- Edinburgh
- Glasgow
- London Gatwick
- London Heathrow
- London Stansted
- Manchester
- Newcastle
- Southampton

For the airports considered within this study, noise contours reached a maximum size during the 1970s and have since decreased in size, and so also have the associated land-use planning zones defined according to DOE 10/73 and PPG24.

Thus, to quantify the degree of population change, the populations and numbers of households enclosed by the 2011 average summer day standard modal split $L_{Aeq,16h}$ noise contours for each representative airport have been computed and compared, as the planning zones defined by the 2011 noise contours will represent the area that has remained continuously zoned throughout the assessment period (Figures 1 to 10).

Only at one airport, Manchester, for which a second runway opened in 2001, has there been a significant change in the shape of the land-use planning zones during the assessment period and thus in reviewing the findings, special consideration will be given to the results for Manchester.

## Confounding factors

Populations around UK airports are not homogeneous, with the majority of the population tending to be to one side of the airport. This would not ordinarily be an issue, except that flight operations at UK airports are also uneven with a clear westerly bias due to westerly prevailing winds. From time to time, wind patterns vary considerably, changing the typical mode of operation, and alternating the shape of noise contours. Because of the asymmetric population distribution, this consequently varies the population exposed around an airport in that year of operation compared with what would have occurred with typical wind patterns. To control this effect, standard modal split noise contours based on long-term average modal split data have been used where available.

Secondly, for airports other than Heathrow, the populations within the high noise exposure contours are typically small and, thus, a small change in absolute terms can represent a large percentage change. To address this point, percentage changes are not reported where the absolute numbers are less than 50 people, a pragmatic value chosen to enable comparison, but one that probably infers much greater precision on the census data than is warranted.

## Population changes in the area surrounding each airport

Between 1991 and 2011 the UK population grew by 10 percent[6]. Since airports are large centres of economic activity and employment, they can stimulate population growth. Whilst the methodology set out will enable the amount of population change to be quantified, it will not attempt to assess how effective planning controls have been in limiting increases. A potential way of assessing the effectiveness of controls is to compare population changes within the different noise contour bands against population changes in the broader region surrounding each airport.

The population in the region surrounding the airport was calculated for each Census year using a circle, centred on the aerodrome and sized on a case-by-case basis to incorporate the major urban areas in the vicinity of the airport (see figures 11 to 20). Consideration was given to using the agglomeration definitions defined for the Environmental Noise Directive (END), however, several of the airports are located outside of agglomerations and in other cases, the noise contours extend far beyond the agglomeration within which the airport is situated. Additionally, the increased definition associated with the precise agglomeration areas[7] would give little added value in this context.

6 Office for National Statistics estimates from www.ons.gov.uk.

7 An agglomeration is a specific area defined in accordance with the Environmental Noise (England) Regulations 2006.

Chapter 3

# Results

## Population changes in the region surrounding each airport

Population changes in the region surrounding the airport were calculated as set out in Chapter 2, and the results are shown in Table 3a in terms of absolute numbers and expressed as percentage changes in Table 3b. The relative changes reported in Table 3b are provided alongside the findings for each airport in the following section to aid interpretation of the results.

**Table 3a: Population and number of households in the area surrounding each airport**

| | 1991 | | 2001 | | 2011 | |
|---|---|---|---|---|---|---|
| | **Pop.** | **Households** | **Pop.** | **Households** | **Pop.** | **Households** |
| Aberdeen | 226,200 | 95,000 | 245,400 | 116,700 | 256,100 | 123,200 |
| Birmingham | 1,892,500 | 734,400 | 1,963,800 | 797,100 | 2,069,900 | 815,600 |
| Edinburgh | 710,300 | 298,100 | 778,200 | 345,500 | 823,900 | 373,700 |
| Glasgow | 1,160,900 | 482,300 | 1,182,600 | 521,300 | 1,155,200 | 537,900 |
| London Gatwick | 327,400 | 128,700 | 358,700 | 149,700 | 384,900 | 157,200 |
| London Heathrow | 8,669,100 | 3,541,400 | 9,677,800 | 4,166,700 | 10,508,000 | 4,200,100 |
| London Stansted | 237,300 | 91,900 | 256,500 | 105,800 | 280,800 | 114,300 |
| Manchester | 1,501,300 | 608,300 | 1,610,200 | 682,900 | 1,692,800 | 716,200 |
| Newcastle | 951,000 | 395,300 | 968,900 | 423,700 | 986,500 | 432,800 |
| Southampton | 435,000 | 173,600 | 497,900 | 207,600 | 524,200 | 217,400 |

**Table 3b: Population and household growth in the area surrounding each airport relative to 1991**

| | 2001 | | 2011 | |
|---|---|---|---|---|
| | Population change (%) | Household change (%) | Population change (%) | Household change (%) |
| Aberdeen | +8 | +23 | +13 | +30 |
| Birmingham | +4 | +9 | +9 | +11 |
| Edinburgh | +10 | +16 | +16 | +25 |
| Glasgow | +2 | +8 | 0 | +12 |
| London Gatwick | +10 | +16 | +18 | +22 |
| London Heathrow | +12 | +18 | +21 | +19 |
| London Stansted | +8 | +15 | +18 | +24 |
| Manchester | +7 | +12 | +13 | +18 |
| Newcastle | +2 | +7 | +4 | +9 |
| Southampton | +14 | +20 | +21 | +25 |

## Population changes within noise contour bands

The population and household changes within the year 2011 noise contour bands for Census years 1991, 2001 and 2011 are presented in Tables 4 to 13 as both absolute values and relative to the base year 1991. In each table, population and household changes for the wider region surrounding the airport (from Table 3b) are also provided to help in placing the changes within the noise contours in context.

### Noise exposure category D

Taking NEC D first, which is defined by a noise exposure of more than 72 dB $L_{Aeq,16h}$, all but Heathrow of the airports assessed have no population in this category in 2011. In many cases this represents a reduction in population in NEC D of 100%, effectively indicating retreating population. At Heathrow (Table 9), the 2011 population in NEC D is estimated to have decreased by 200 people (-39%), though the absolute numbers are small and could be influenced by the resolution of the underlying Census population data. Examination of the specific population changes suggests that airport boundary changes and expansion of airport-related commercial

activity may have displaced housing around the northern and southern boundaries and contributed to the population decrease.

## Noise exposure category C

NEC C represents aircraft noise exposure between 66 and 72 dB $L_{Aeq,16h}$. Because of the 3dB spacing between contours, data covering NEC C is presented in two bands, 66-72 dB $L_{Aeq,16h}$ and 69-72 dB $L_{Aeq,16h}$. Populations have decreased or remained at zero within the 69-72 dB $L_{Aeq,16h}$ band across all airports between 1991 and 2011, except at London Heathrow (Table 9). Between 1991 and 2001 the population at Heathrow is estimated to have risen from 1,900 people to 2,900 (+56%) before falling back to 2,800 people (+49%) in 2011. Detailed analysis by postcode shows that almost half of this population growth is due to increases in the Cranford area represented by just two postcode centroids. Further examination shows that the postcode centroids in the 1991 Census data are reported to the nearest 100 m (in contrast with data for 2001 and 2011, which are reported to the nearest metre). The 69 dB $L_{Aeq,16h}$ contour lobe varies from 100-150 m wide in this area and it is likely that rounding of the postcode centroid causes some postcodes to move outside the contour. The apparent population increase is more likely to be due to an underestimate of the 1991 population within the 69 dB $L_{Aeq,16h}$ contour.

Within the 66-69 dB $L_{Aeq,16h}$ category, across most airports between 1991 and 2011, the population change is either zero or an increase or decrease of less than 50 people. At Birmingham (Table 5) the population in the 66-69 dB $L_{Aeq,16h}$ band is estimated to have decreased by 200 people (-60%) between 1991 and 2011. At London Heathrow (Table 9), the 2011 population has increased by 350 people since 1991 (+4%), which compares favourably to the surrounding population growth of 21%. At Manchester (Table 11) the population has decreased by 150 people (-6%), compared with an increase of 13% for the area surrounding the airport. All of the decrease occurred between 2001 and 2011, indicating the opening of the second runway in 2001 may have been a contributory factor.

## Noise exposure category B

NEC B represents aircraft noise exposure between 57 and 66 dB $L_{Aeq,16hr}$. This is a wide range and covers three bands, each 3 dB in width. It should be emphasised

that NEC B guidance did not preclude development in this category; instead it recommended that noise should be taken into account when determining planning applications, and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.

The upper 3dB band, 63-66 dB $L_{Aeq,16h}$, is considered first. Across most airports assessed there has been a mixture of small increases and decreases. At Gatwick (Table 8), the population in the 63-66 dB band decreased by 350 people (-65%) between 1991 and 2011. At Heathrow (Table 9) populations have increased by 3,050 (+11%) since 1991, with over a half of that increase occurring between 1991 and 2001. The increase is below the regional growth of 21%.

Within the 60-63 dB $L_{Aeq,16h}$ band, at Birmingham (Table 5) the 2011 population has increased by 400 people (+8%) since 1991, consistent with population growth (+9%) in the region surrounding Birmingham Airport. At Heathrow (Table 9) populations are calculated to have increased by just over 5,400 people (+10%) since 1991. Although large in absolute terms, the rate of increase is half that in the region surrounding the airport (+21%). At the other airports (except Southampton), there were small changes in populations within the 60-63 dB band.

Within the 57-60dB $L_{Aeq,16h}$ band, at Aberdeen (Table 4) the population increased by 400 people (-8%), in contrast to the increase in the region surrounding the airport (+13%). At Birmingham (Table 5), the 2011 population decreased by 750 people (-6%), despite the surrounding region increasing by 9% over the twenty-year period. At Edinburgh (Table 6) the 2011 population in the 57-60 dB band increased by 500 people (+24%), compared with a surrounding region increase of +16%. At London Heathrow (Table 9) the 2011 population in the 57-60 dB band is calculated to have increased by over 27,000 people (+25%), a slightly higher increase than that of the surrounding region (+21%). At Manchester (Table 11) the 2011 population in the 57-60 dB band is estimated to have increased by 1,000 people (+5%), a rate of increase less than half that of the surrounding region (+13%).

**Table 4: Census populations and households for 1991 to 2011 within the Aberdeen 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 4,650 | - | - | |
| 1991 | 60-63 | 1,800 | - | - | |
| 1991 | 63-66 | 200 | - | - | |
| 1991 | 66-69 | 50 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 4,400 | -250 | -5% | |
| 2001 | 60-63 | 1,650 | -150 | -8% | |
| 2001 | 63-66 | 150 | -50 | -23% | |
| 2001 | 66-69 | 50 | <-50 | -14% | +8% |
| 2001 | 69-72 | 50 | <+50 | +230% | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 4,250 | -400 | -8% | |
| 2011 | 60-63 | 1,800 | <-50 | -1% | |
| 2011 | 63-66 | 250 | +50 | +28% | |
| 2011 | 66-69 | 50 | <-50 | -2% | +13% |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 1,800 | - | - | |
| 1991 | 60-63 | 700 | - | - | |
| 1991 | 63-66 | 100 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 2,050 | +250 | +14% | |
| 2001 | 60-63 | 800 | +100 | +12% | |
| 2001 | 63-66 | 100 | <-50 | -6% | |
| 2001 | 66-69 | 50 | <+50 | +30% | +23% |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 2,050 | +250 | +14% | |
| 2011 | 60-63 | 900 | +200 | +27% | |
| 2011 | 63-66 | 150 | +50 | +74% | |
| 2011 | 66-69 | 50 | <+50 | +30% | +30% |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 5: Census populations and households for 1991 to 2011 within the Birmingham 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 11,950 | - | - | |
| 1991 | 60-63 | 5,150 | - | - | |
| 1991 | 63-66 | 1,950 | - | - | |
| 1991 | 66-69 | 350 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 10,650 | -1,350 | -11% | |
| 2001 | 60-63 | 5,750 | +600 | +11% | |
| 2001 | 63-66 | 1,800 | -200 | -9% | +4% |
| 2001 | 66-69 | 150 | -200 | -58% | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 11,250 | -750 | -6% | |
| 2011 | 60-63 | 5,550 | +400 | +8% | |
| 2011 | 63-66 | 1,850 | -100 | -5% | +9% |
| 2011 | 66-69 | 150 | -200 | -60% | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 5,000 | - | - | |
| 1991 | 60-63 | 2,100 | - | - | |
| 1991 | 63-66 | 850 | - | - | |
| 1991 | 66-69 | 150 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 4,600 | -400 | -8% | |
| 2001 | 60-63 | 2,500 | +350 | +17% | |
| 2001 | 63-66 | 800 | -50 | -5% | +4% |
| 2001 | 66-69 | 50 | -100 | -58% | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 4,600 | -400 | -8% | |
| 2011 | 60-63 | 2,250 | +150 | +6% | |
| 2011 | 63-66 | 800 | -50 | -6% | +9% |
| 2011 | 66-69 | 50 | -100 | -61% | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 6: Census populations and households for 1991 to 2011 within the Edinburgh 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 2,150 | - | - | |
| 1991 | 60-63 | 450 | - | - | |
| 1991 | 63-66 | 350 | - | - | |
| 1991 | 66-69 | 50 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 2,200 | +100 | +4% | |
| 2001 | 60-63 | 200 | -250 | -52% | |
| 2001 | 63-66 | 350 | <-50 | -5% | +10% |
| 2001 | 66-69 | 50 | <+50 | +56% | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 2,650 | +500 | +24% | |
| 2011 | 60-63 | 300 | -150 | -33% | |
| 2011 | 63-66 | 300 | -100 | -21% | |
| 2011 | 66-69 | 100 | +50 | +102% | +16% |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 850 | - | - | |
| 1991 | 60-63 | 150 | - | - | |
| 1991 | 63-66 | 150 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 900 | +50 | +6% | |
| 2001 | 60-63 | 100 | -50 | -37% | |
| 2001 | 63-66 | 150 | <+50 | +6% | +16% |
| 2001 | 66-69 | 50 | <+50 | +113% | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 1,200 | +300 | +37% | |
| 2011 | 60-63 | 100 | <-50 | -14% | |
| 2011 | 63-66 | 100 | -50 | -18% | |
| 2011 | 66-69 | 50 | <+50 | +140% | +25% |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 7: Census populations and households for 1991 to 2011 within the Glasgow 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 4,500 | - | - | |
| 1991 | 60-63 | 1,200 | - | - | |
| 1991 | 63-66 | 0 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 4,050 | -400 | -9% | |
| 2001 | 60-63 | 900 | -300 | -24% | |
| 2001 | 63-66 | 0 | 0 | - | +2% |
| 2001 | 66-69 | 0 | 0 | - | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 4,650 | +150 | +4% | |
| 2011 | 60-63 | 1,100 | -100 | -8% | |
| 2011 | 63-66 | 0 | 0 | - | -0% |
| 2011 | 66-69 | 0 | 0 | - | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 1,800 | - | - | |
| 1991 | 60-63 | 500 | - | - | |
| 1991 | 63-66 | 0 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 1,900 | +100 | +5% | |
| 2001 | 60-63 | 500 | -50 | -5% | |
| 2001 | 63-66 | 0 | 0 | - | +8% |
| 2001 | 66-69 | 0 | 0 | - | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 2,050 | +300 | +16% | |
| 2011 | 60-63 | 500 | <-50 | -1% | |
| 2011 | 63-66 | 0 | 0 | - | +12% |
| 2011 | 66-69 | 0 | 0 | - | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 8: Census populations and households for 1991 to 2011 within the London Gatwick 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 1,350 | - | - | |
| 1991 | 60-63 | 700 | - | - | |
| 1991 | 63-66 | 500 | - | - | |
| 1991 | 66-69 | 100 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 1,400 | +50 | +3% | |
| 2001 | 60-63 | 900 | +200 | +30% | |
| 2001 | 63-66 | 150 | -350 | -68% | +10% |
| 2001 | 66-69 | 150 | +50 | +54% | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 1,500 | +150 | +12% | |
| 2011 | 60-63 | 850 | +150 | +22% | |
| 2011 | 63-66 | 200 | -350 | -65% | +18% |
| 2011 | 66-69 | 150 | +50 | +46% | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 550 | - | - | |
| 1991 | 60-63 | 250 | - | - | |
| 1991 | 63-66 | 200 | - | - | |
| 1991 | 66-69 | 50 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 550 | +50 | +5% | |
| 2001 | 60-63 | 350 | +100 | +40% | |
| 2001 | 63-66 | 50 | -150 | -66% | +16% |
| 2001 | 66-69 | 50 | +50 | +74% | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 700 | +150 | +30% | |
| 2011 | 60-63 | 350 | +100 | +36% | |
| 2011 | 63-66 | 50 | -100 | -63% | +22% |
| 2011 | 66-69 | 100 | +50 | +81% | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 9: Census populations and households for 1991 to 2011 within the London Heathrow 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 109,400 | - | - | |
| 1991 | 60-63 | 52,850 | - | - | |
| 1991 | 63-66 | 26,950 | - | - | |
| 1991 | 66-69 | 9,350 | - | - | |
| 1991 | 69-72 | 1,900 | - | - | |
| 1991 | >72 | 450 | - | - | |
| 2001 | 57-60 | 128,550 | +19,150 | +18% | |
| 2001 | 60-63 | 53,400 | +550 | +1% | |
| 2001 | 63-66 | 28,600 | +1,600 | +6% | +12% |
| 2001 | 66-69 | 9,250 | -100 | -1% | |
| 2001 | 69-72 | 2,900 | +1,050 | +56% | |
| 2001 | >72 | 150 | -300 | -67% | |
| 2011 | 57-60 | 136,700 | +27,350 | +25% | |
| 2011 | 60-63 | 58,250 | +5,400 | +10% | |
| 2011 | 63-66 | 30,000 | +3,050 | +11% | +21% |
| 2011 | 66-69 | 9,700 | +350 | +4% | |
| 2011 | 69-72 | 2,800 | +900 | +49% | |
| 2011 | >72 | 300 | -200 | -39% | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 46,000 | - | - | |
| 1991 | 60-63 | 20,000 | - | - | |
| 1991 | 63-66 | 10,100 | - | - | |
| 1991 | 66-69 | 3,350 | - | - | |
| 1991 | 69-72 | 650 | - | - | |
| 1991 | >72 | 200 | - | - | |
| 2001 | 57-60 | 56,200 | +10,200 | +22% | |
| 2001 | 60-63 | 21,600 | +1,600 | +8% | |
| 2001 | 63-66 | 11,650 | +1,550 | +16% | +18% |
| 2001 | 66-69 | 3,450 | +100 | +3% | |
| 2001 | 69-72 | 1,100 | +450 | +69% | |
| 2001 | >72 | 100 | -100 | -59% | |
| 2011 | 57-60 | 58,250 | +12,250 | +27% | |
| 2011 | 60-63 | 23,300 | +3,300 | +16% | |
| 2011 | 63-66 | 12,100 | +2,000 | +20% | +19% |
| 2011 | 66-69 | 3,600 | +250 | +7% | |
| 2011 | 69-72 | 1,050 | +350 | +57% | |
| 2011 | >72 | 150 | -50 | -32% | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 10: Census populations and households for 1991 to 2011 within the London Stansted 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 800 | - | - | |
| 1991 | 60-63 | 250 | - | - | |
| 1991 | 63-66 | 100 | - | - | |
| 1991 | 66-69 | 50 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 50 | - | - | |
| 2001 | 57-60 | 1,000 | +200 | +22% | |
| 2001 | 60-63 | 200 | -50 | -21% | |
| 2001 | 63-66 | 150 | +50 | +58% | |
| 2001 | 66-69 | 0 | -50 | -100% | +10% |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | -50 | +100% | |
| 2011 | 57-60 | 950 | +150 | +17% | |
| 2011 | 60-63 | 250 | -50 | -10% | |
| 2011 | 63-66 | 100 | <+50 | +7% | |
| 2011 | 66-69 | 50 | <-50 | -44% | +18% |
| 2011 | 69-72 | 0 | - | - | |
| 2011 | >72 | 0 | -50 | -100% | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 300 | - | - | |
| 1991 | 60-63 | 100 | - | - | |
| 1991 | 63-66 | 50 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 400 | +100 | +29% | |
| 2001 | 60-63 | 100 | <-50 | -22% | |
| 2001 | 63-66 | 50 | +50 | +80% | |
| 2001 | 66-69 | 0 | <-50 | -100% | +15% |
| 2001 | 69-72 | 0 | - | - | |
| 2001 | >72 | 0 | <-50 | -100% | |
| 2011 | 57-60 | 400 | +100 | +26% | |
| 2011 | 60-63 | 100 | -50 | -25% | |
| 2011 | 63-66 | 50 | <+50 | +3% | |
| 2011 | 66-69 | 0 | <-50 | -28% | +24% |
| 2011 | 69-72 | 0 | - | - | |
| 2011 | >72 | 0 | <-50 | -100% | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 11: Census populations and households for 1991 to 2011 within the Manchester 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 18,850 | - | - | |
| 1991 | 60-63 | 5,450 | - | - | |
| 1991 | 63-66 | 1,750 | - | - | |
| 1991 | 66-69 | 550 | - | - | |
| 1991 | 69-72 | 100 | - | - | |
| 1991 | >72 | 100 | - | - | |
| 2001 | 57-60 | 19,600 | +750 | +4% | |
| 2001 | 60-63 | 5,150 | -300 | -5% | |
| 2001 | 63-66 | 1,450 | -350 | -19% | +7% |
| 2001 | 66-69 | 550 | 0 | 0% | |
| 2001 | 69-72 | 100 | <-50 | -11% | |
| 2001 | >72 | 0 | -100 | -97% | |
| 2011 | 57-60 | 19,850 | +1,000 | +5% | |
| 2011 | 60-63 | 5,550 | +100 | +2% | |
| 2011 | 63-66 | 1,650 | -100 | -5% | |
| 2011 | 66-69 | 400 | -150 | -26% | +13% |
| 2011 | 69-72 | 50 | -50 | -59% | |
| 2011 | >72 | 0 | -100 | -100% | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 7,900 | - | - | |
| 1991 | 60-63 | 2,100 | - | - | |
| 1991 | 63-66 | 700 | - | - | |
| 1991 | 66-69 | 250 | - | - | |
| 1991 | 69-72 | 50 | - | - | |
| 1991 | >72 | 50 | | | |
| 2001 | 57-60 | 8,500 | +650 | +8% | |
| 2001 | 60-63 | 2,200 | +100 | +4% | |
| 2001 | 63-66 | 600 | -100 | -14% | |
| 2001 | 66-69 | 200 | <-50 | -3% | +12% |
| 2001 | 69-72 | 50 | <-50 | -18% | |
| 2001 | >72 | 0 | -50 | -100% | |
| 2011 | 57-60 | 8,750 | +900 | +11% | |
| 2011 | 60-63 | 2,350 | +250 | +11% | |
| 2011 | 63-66 | 700 | <-50 | -1% | |
| 2011 | 66-69 | 200 | -50 | -17% | +18% |
| 2011 | 69-72 | 0 | <-50 | -55% | |
| 2011 | >72 | 0 | -50 | -100% | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 12: Census populations and households for 1991 to 2011 within the Newcastle 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 700 | - | - | |
| 1991 | 60-63 | 50 | - | - | |
| 1991 | 63-66 | 0 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 700 | <+50 | +1% | |
| 2001 | 60-63 | 0 | -50 | -100% | |
| 2001 | 63-66 | 0 | 0 | - | +2% |
| 2001 | 66-69 | 0 | 0 | - | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 650 | -50 | -8% | |
| 2011 | 60-63 | 0 | <-50 | -11% | |
| 2011 | 63-66 | 0 | 0 | - | +4% |
| 2011 | 66-69 | 0 | 0 | - | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 300 | - | - | |
| 1991 | 60-63 | 0 | - | - | |
| 1991 | 63-66 | 0 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 350 | <+50 | +7% | |
| 2001 | 60-63 | 0 | 0 | - | |
| 2001 | 63-66 | 0 | 0 | - | +7% |
| 2001 | 66-69 | 0 | 0 | - | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 300 | <+50 | -2% | |
| 2011 | 60-63 | 0 | 0 | - | |
| 2011 | 63-66 | 0 | 0 | - | |
| 2011 | 66-69 | 0 | 0 | - | +9% |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

**Table 13: Census populations and households for 1991 to 2011 within the Southampton 2011 $L_{Aeq,16h}$ contour and region surrounding airport**

| Year | Contour band | Population | Population change relative to 1991 | | Regional population change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 2,850 | - | - | |
| 1991 | 60-63 | 800 | - | - | |
| 1991 | 63-66 | 100 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 2,800 | -100 | -3% | |
| 2001 | 60-63 | 950 | +150 | +18% | |
| 2001 | 63-66 | 50 | -50 | -58% | +14% |
| 2001 | 66-69 | 0 | 0 | - | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 2,550 | -300 | -11% | |
| 2011 | 60-63 | 1,100 | +300 | +40% | |
| 2011 | 63-66 | 50 | -50 | -60% | +21% |
| 2011 | 66-69 | 0 | 0 | - | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

| Year | Contour band | Households | Households change relative to 1991 | | Regional households change relative to 1991 |
|---|---|---|---|---|---|
| | | | (-) | (%)* | (%) |
| 1991 | 57-60 | 1,150 | - | - | |
| 1991 | 60-63 | 350 | - | - | |
| 1991 | 63-66 | 50 | - | - | |
| 1991 | 66-69 | 0 | - | - | |
| 1991 | 69-72 | 0 | - | - | |
| 1991 | >72 | 0 | - | - | |
| 2001 | 57-60 | 1,100 | -50 | -5% | |
| 2001 | 60-63 | 400 | +50 | +18% | |
| 2001 | 63-66 | 0 | <+50 | -55% | +20% |
| 2001 | 66-69 | 0 | 0 | - | |
| 2001 | 69-72 | 0 | 0 | - | |
| 2001 | >72 | 0 | 0 | - | |
| 2011 | 57-60 | 1,050 | -150 | -11% | |
| 2011 | 60-63 | 450 | +100 | +40% | |
| 2011 | 63-66 | 0 | <+50 | -60% | +25% |
| 2011 | 66-69 | 0 | 0 | - | |
| 2011 | 69-72 | 0 | 0 | - | |
| 2011 | >72 | 0 | 0 | - | |

* Percentages calculated prior to rounding and so do not precisely match numerical changes.

Chapter 4

# Conclusions

Across the majority of UK airports, noise exposure contours decreased in size between 1991 and 2011. Throughout most of this time, the relevant planning guidance aimed to limit population increases in areas experiencing the highest noise levels and ensure that appropriate protection was incorporated into new developments experiencing lower noise levels. The 2011 noise contours therefore represent the area that has been continuously covered by planning guidance. Census data for 1991, 2001 and 2011 were used to calculate population changes within 3 dB noise bands between 57 and 72 dB $L_{Aeq,16h}$ using the 2011 noise contours.

Data are reported in absolute and relative values for both population and household counts for ten UK airports. Only data for London Heathrow suggests there have been population increases above noise levels of 66 dB $L_{Aeq,16h}$. However, detailed investigations at the postcode spatial level indicate that the findings are more than likely a consequence of the relative precision of the Census population data, combined with the small size of the 69-72 dB noise band that has led to an underestimate of the 1991 population exposure. This is further supported by the fact that populations in the 69-72 dB band have declined since 2001 and that there have been only small increases in the 63-66 dB and 66-69 dB noise bands. Thus, based on the evidence available, it is our conclusion that there have been no significant population increases at noise levels above 66 dB $L_{Aeq,16h}$.

Between 57 and 66 dB, where planning guidance permitted development provided appropriate noise protection was incorporated, some increases have occurred, mostly in the 57-60 dB band. However, rises at Gatwick and Manchester were found to be at lower growth rates than for the surrounding airport region, with the exception of Edinburgh, Glasgow and London Heathrow. Despite population increases in the outer noise band (57-60 dB), after taking into account contour area reductions between 1991 and 2011, net populations exposed to noise levels above 57 dB $L_{Aeq,16h}$ have decreased significantly across almost every airport assessed.

Noting that the Aviation Policy Framework (para. 3.23) states “The Government will therefore take into account the trends in populations within the contours when monitoring the effectiveness of its overall policy on aviation noise”, it is recommended that when reporting populations exposed to aircraft noise, population growth is reported separately

Appendix A

# Glossary of technical terms

| | |
|---|---|
| **APF** | Aviation Policy Framework |
| **dB** | Decibel units describing sound level or changes of sound level |
| **dBA** | Units of sound level on the A-weighted scale, which incorporates a frequency weighting approximating the characteristics of human hearing |
| **DfT** | Department for Transport (UK Government) |
| **ERCD** | Environmental Research and Consultancy Department of the Civil Aviation Authority |
| **$L_{Aeq,16h}$** | Equivalent sound level of aircraft noise in dBA, often called 'equivalent continuous sound level'. For conventional historical contours this is based on the daily average movements that take place within the 16-hour period (0700-2300 local time) over the 92-day summer period from 16 June to 15 September inclusive |
| **NEC** | Noise Exposure Category (as defined in PPG24) |
| **NPPF** | National Planning Policy Framework |
| **NPSE** | Noise Policy Statement for England |
| **PPG24** | Planning Policy Guidance note 24: Planning and Noise |

Appendix B

# 2011 $L_{Aeq,16h}$ noise contours

**Figure 1: Aberdeen Airport 2011 $L_{Aeq,16h}$ noise contours**

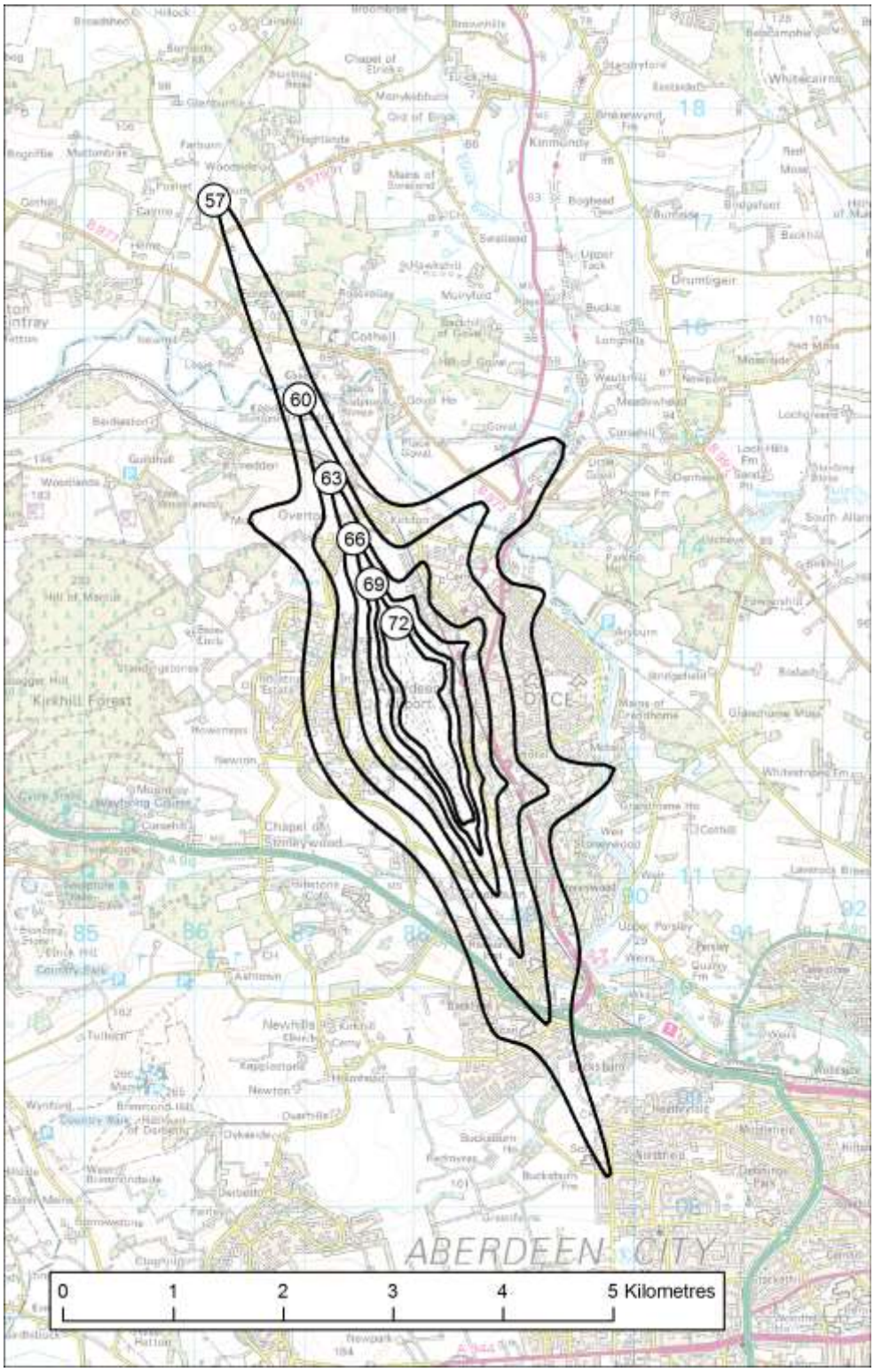


**Figure 2: Birmingham Airport 2011 $L_{Aeq,16h}$ noise contours**

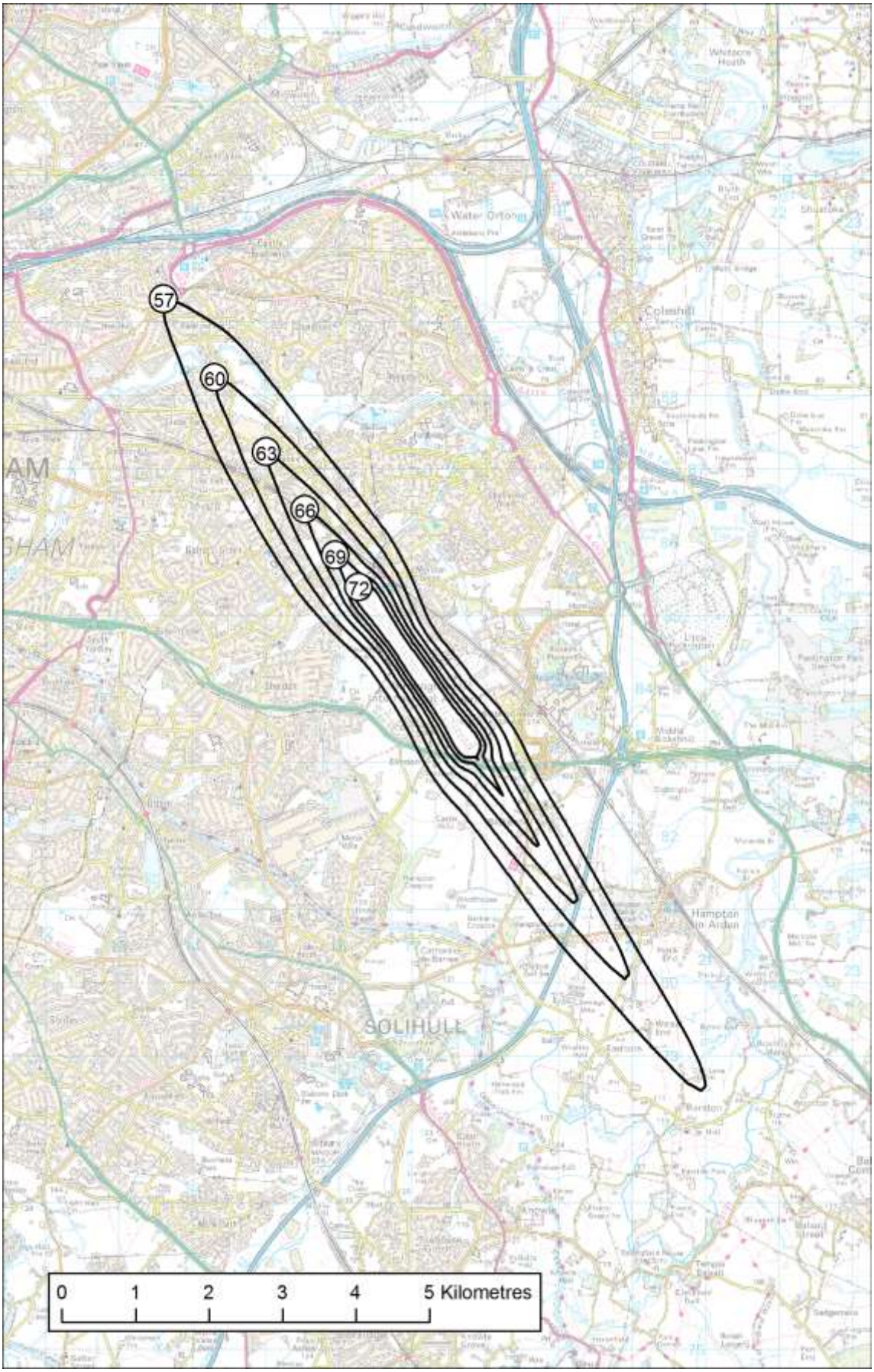


**Figure 3: Edinburgh Airport 2011 $L_{Aeq,16h}$ noise contours**

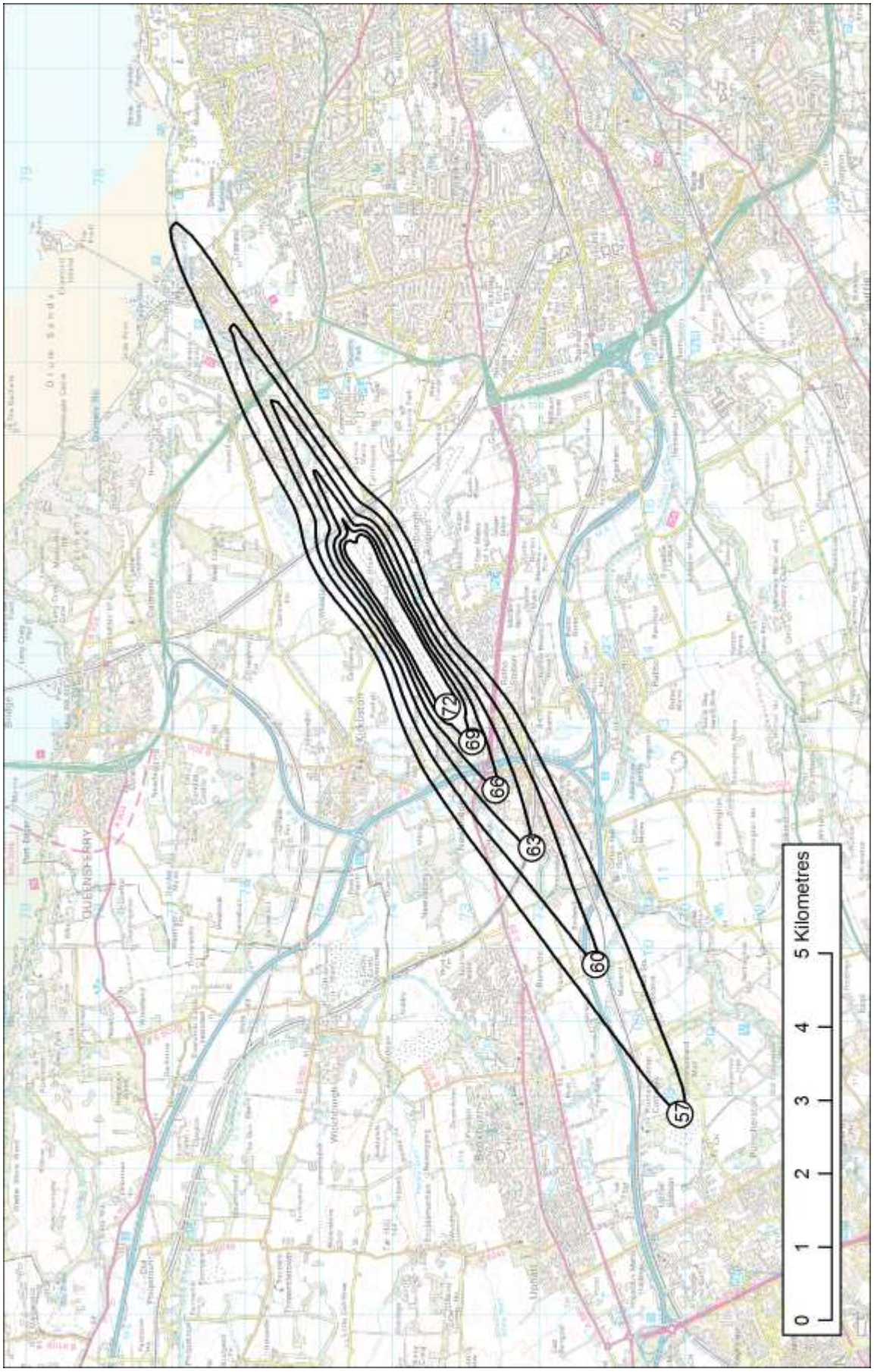


**Figure 4: Glasgow Airport 2011 $L_{Aeq,16h}$ noise contours**

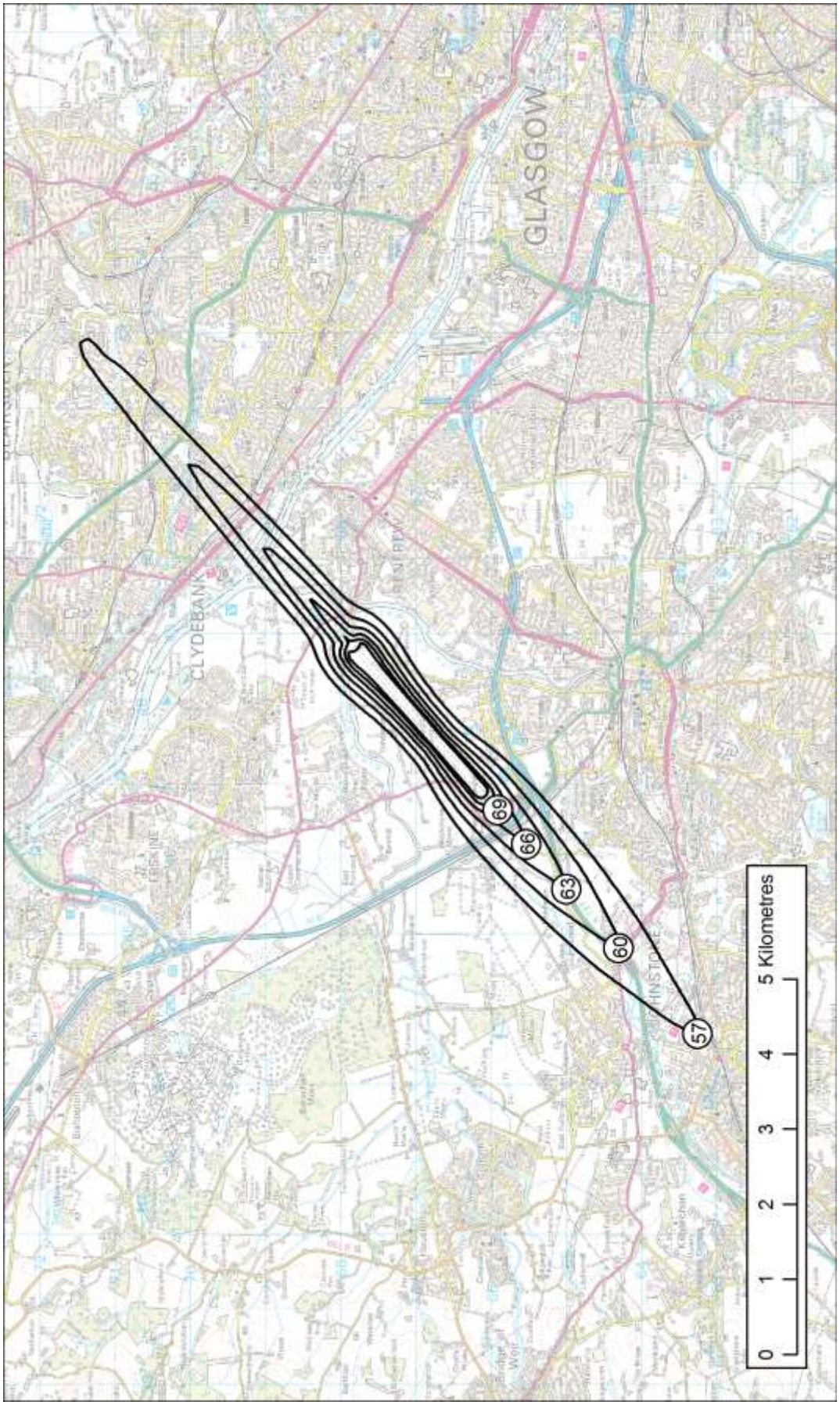


**Figure 5: London Gatwick Airport 2011 $L_{Aeq,16h}$ noise contours**

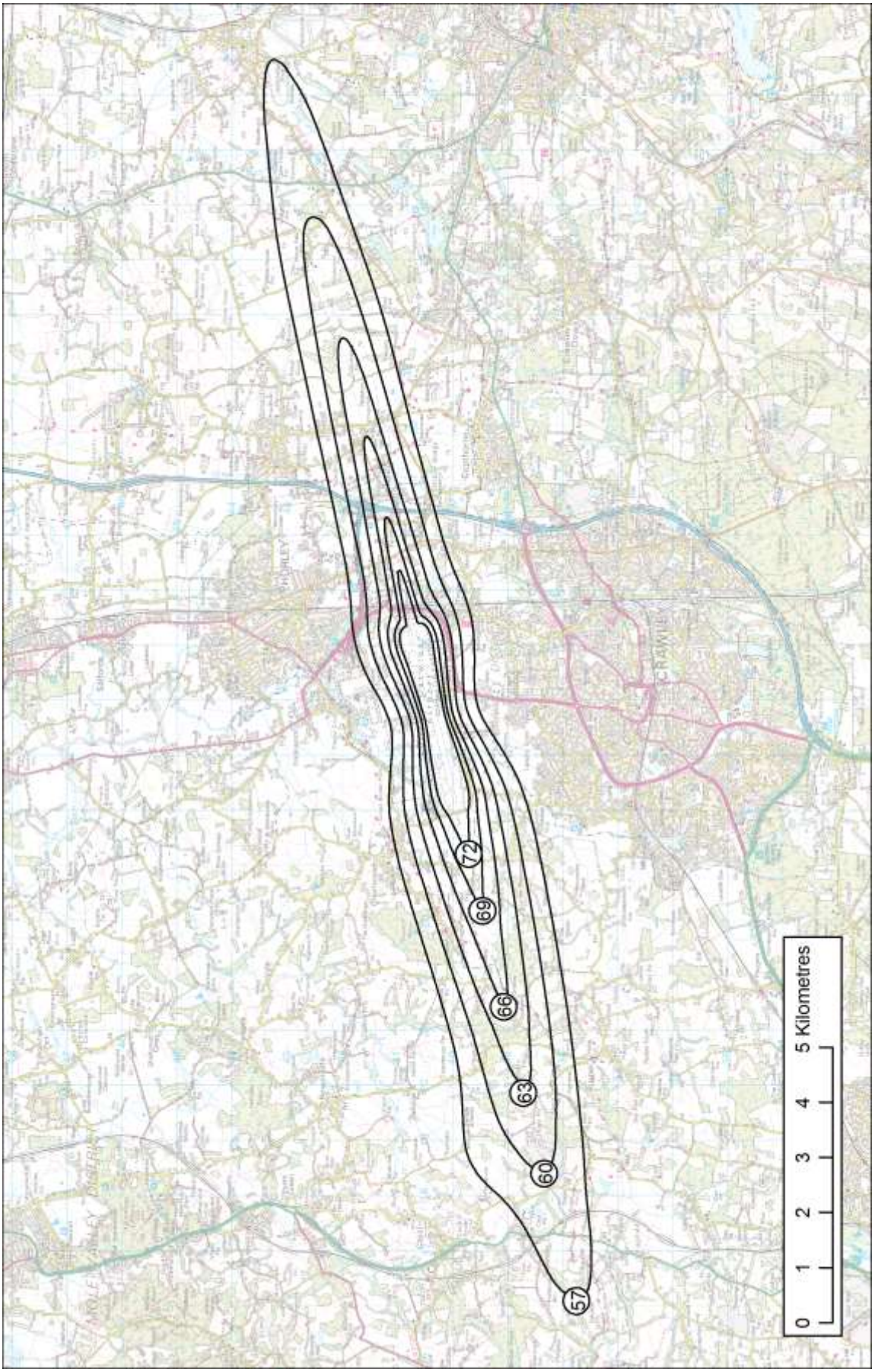


**Figure 6: London Heathrow Airport 2011 $L_{Aeq,16h}$ noise contours**

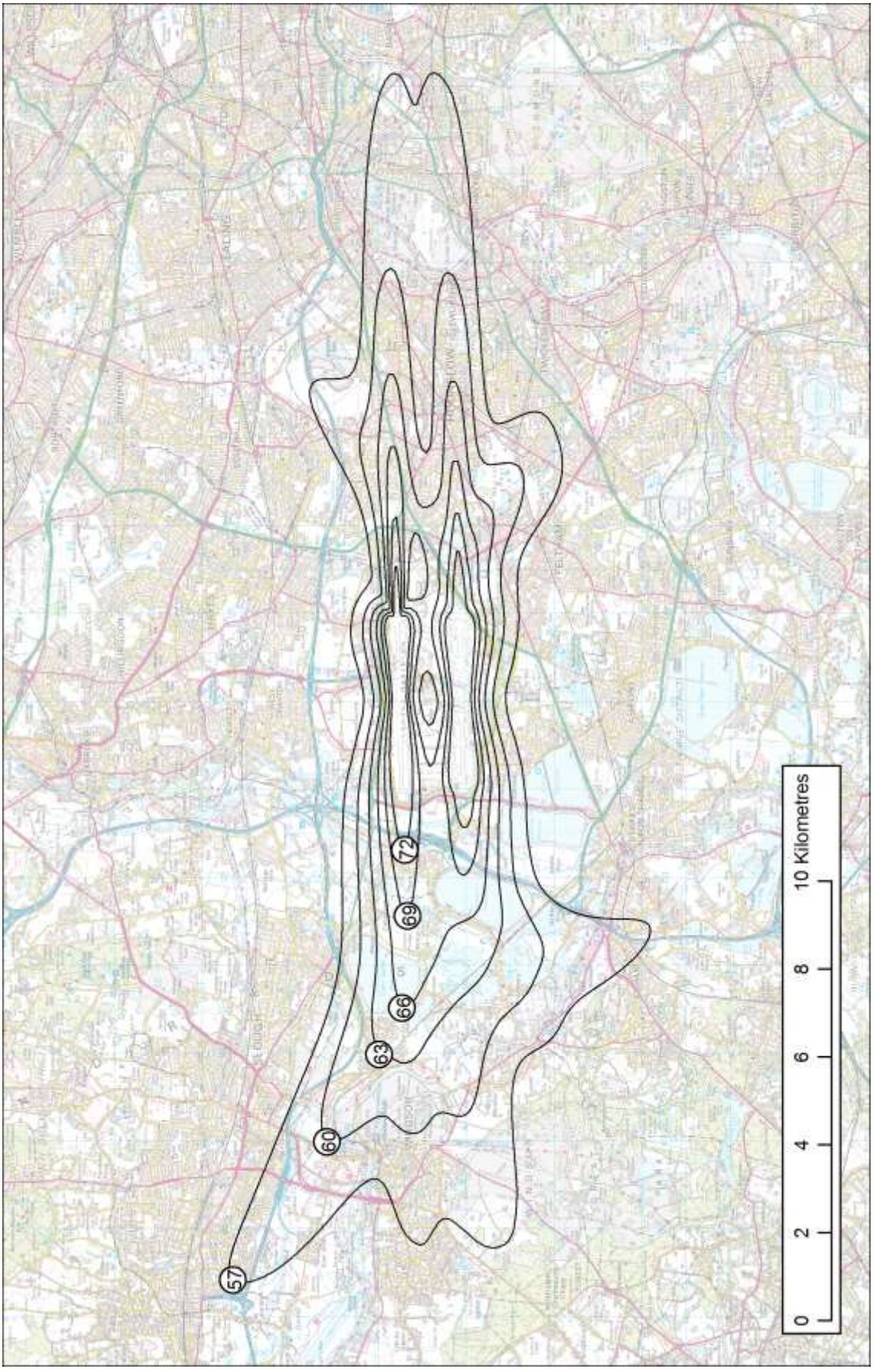


**Figure 7: London Stansted Airport 2011 $L_{Aeq,16h}$ noise contours**

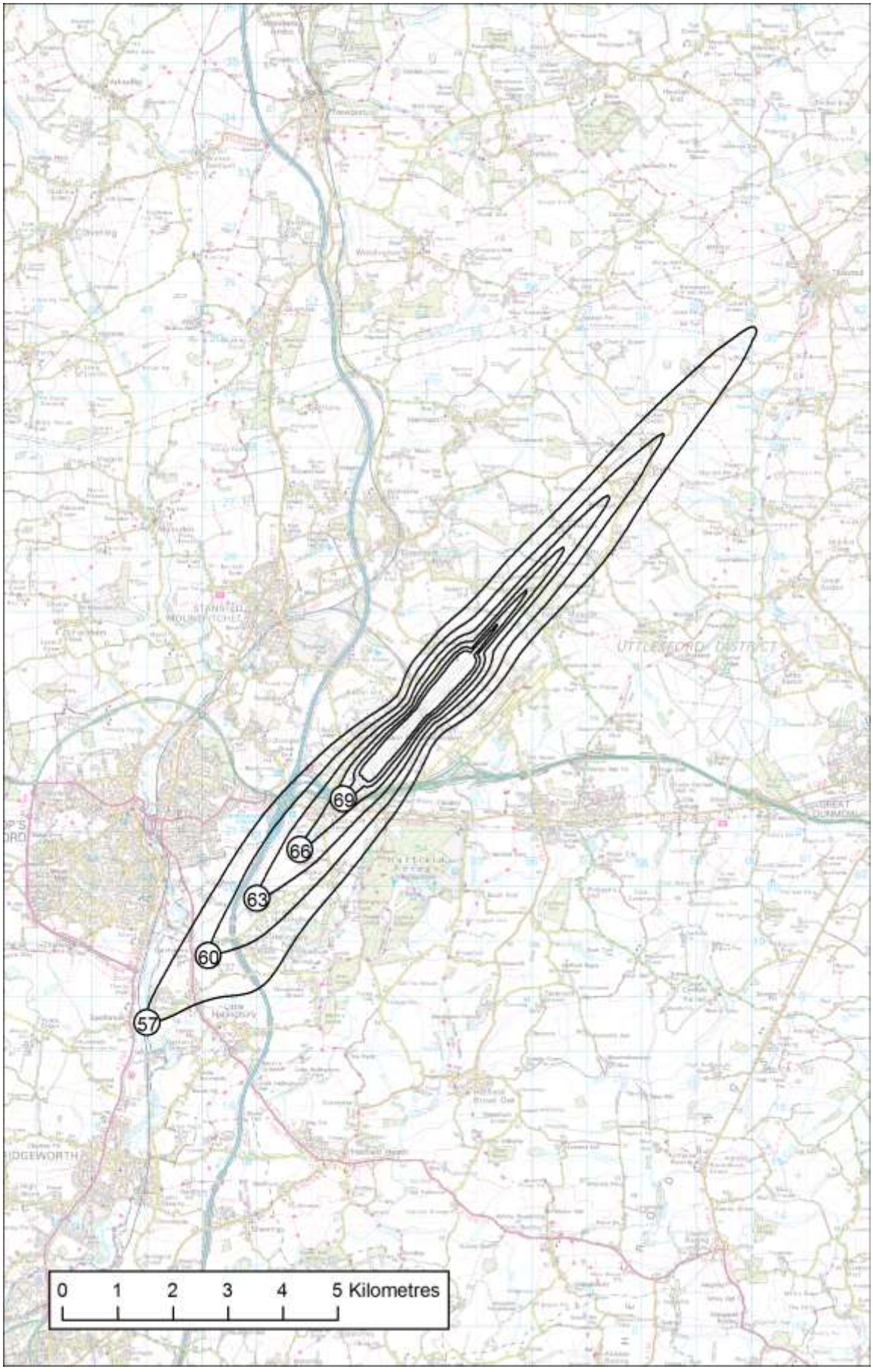


**Figure 8: Manchester Airport 2011 $L_{Aeq,16h}$ noise contours**

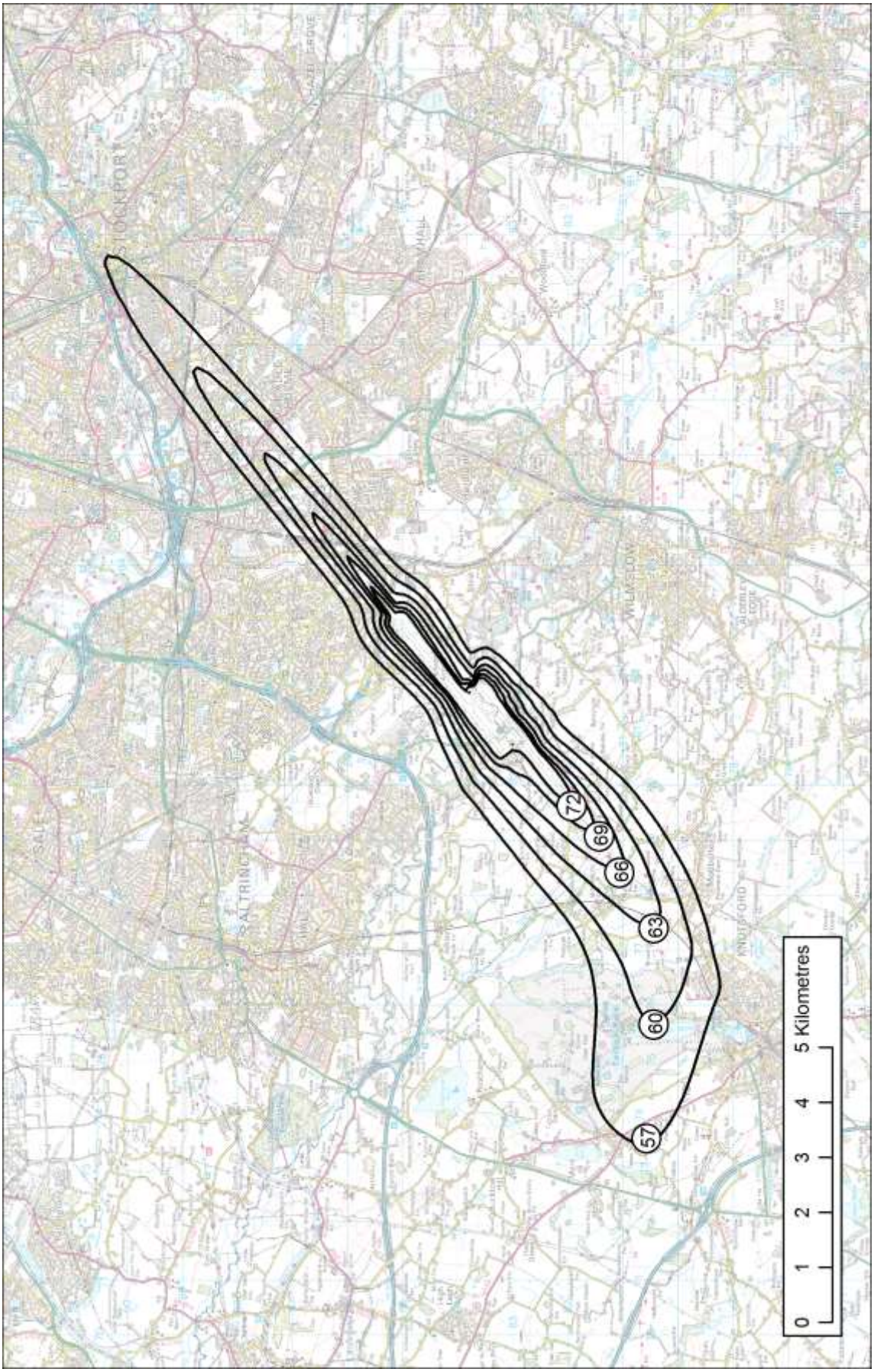


**Figure 9: Newcastle Airport 2011 $L_{Aeq,16h}$ noise contours**

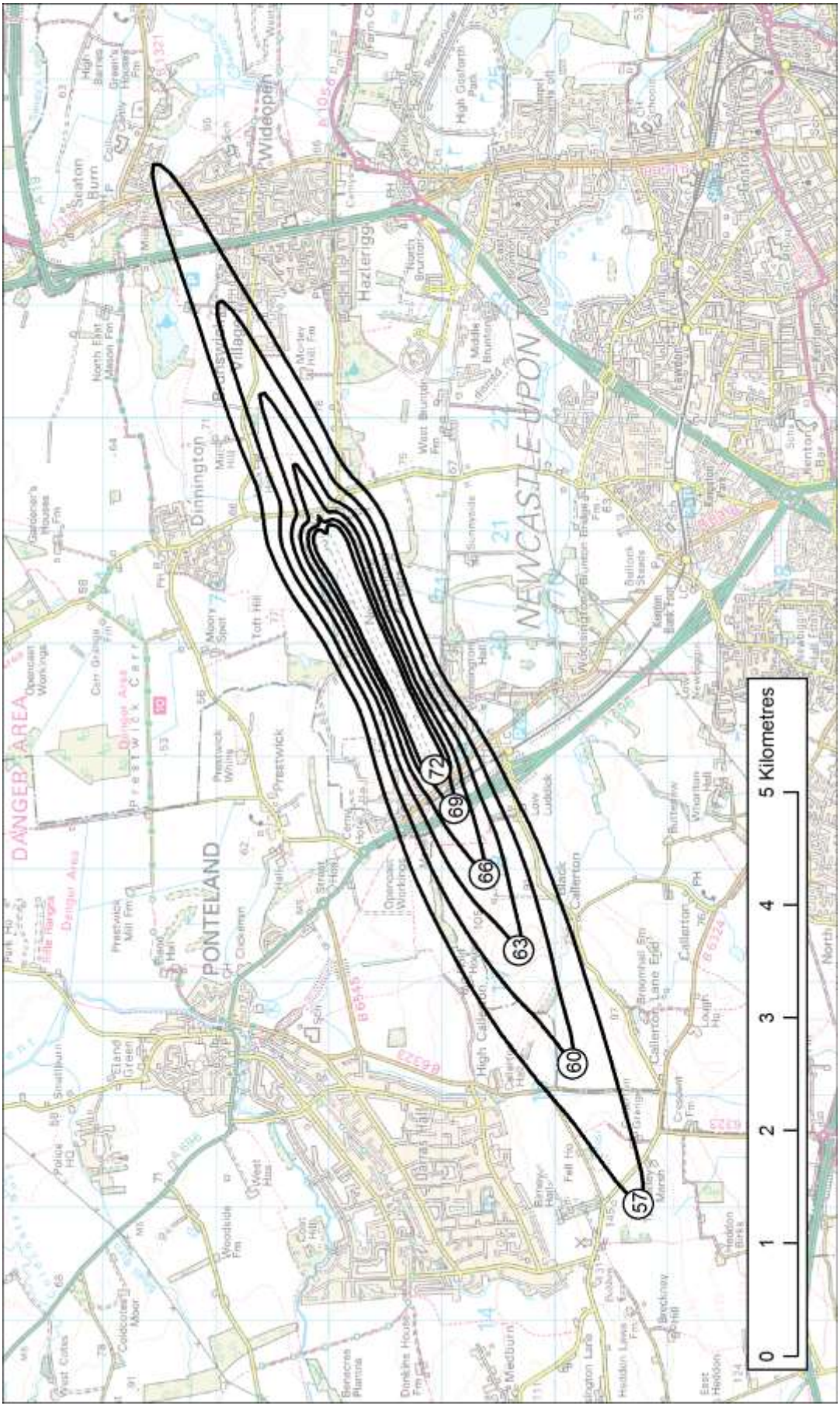
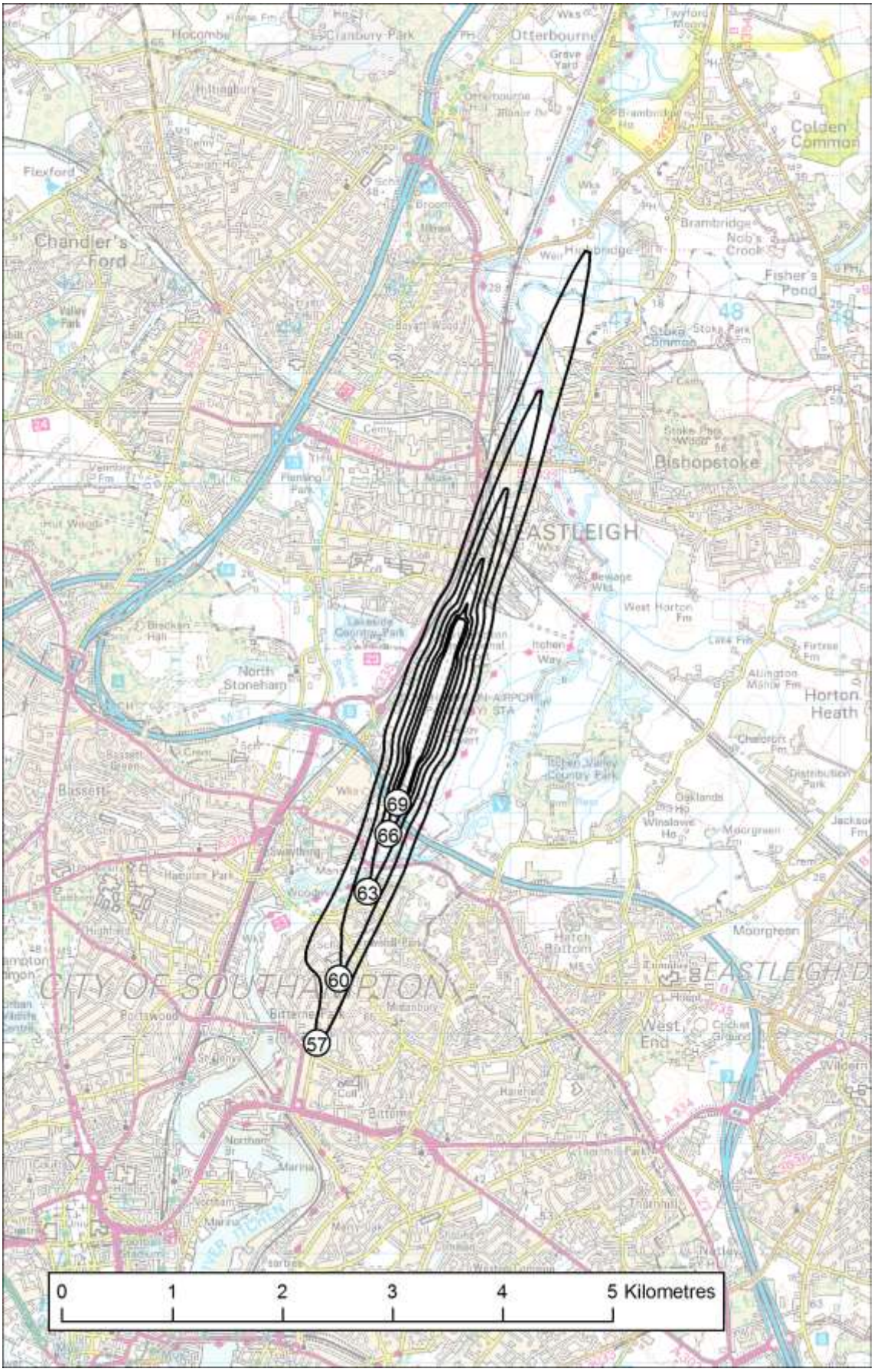


**Figure 10: Southampton Airport 2011 $L_{Aeq,16h}$ noise contours**



Appendix C

# Regional population assessments

**Figure 11: Aberdeen Airport regional population assessment**

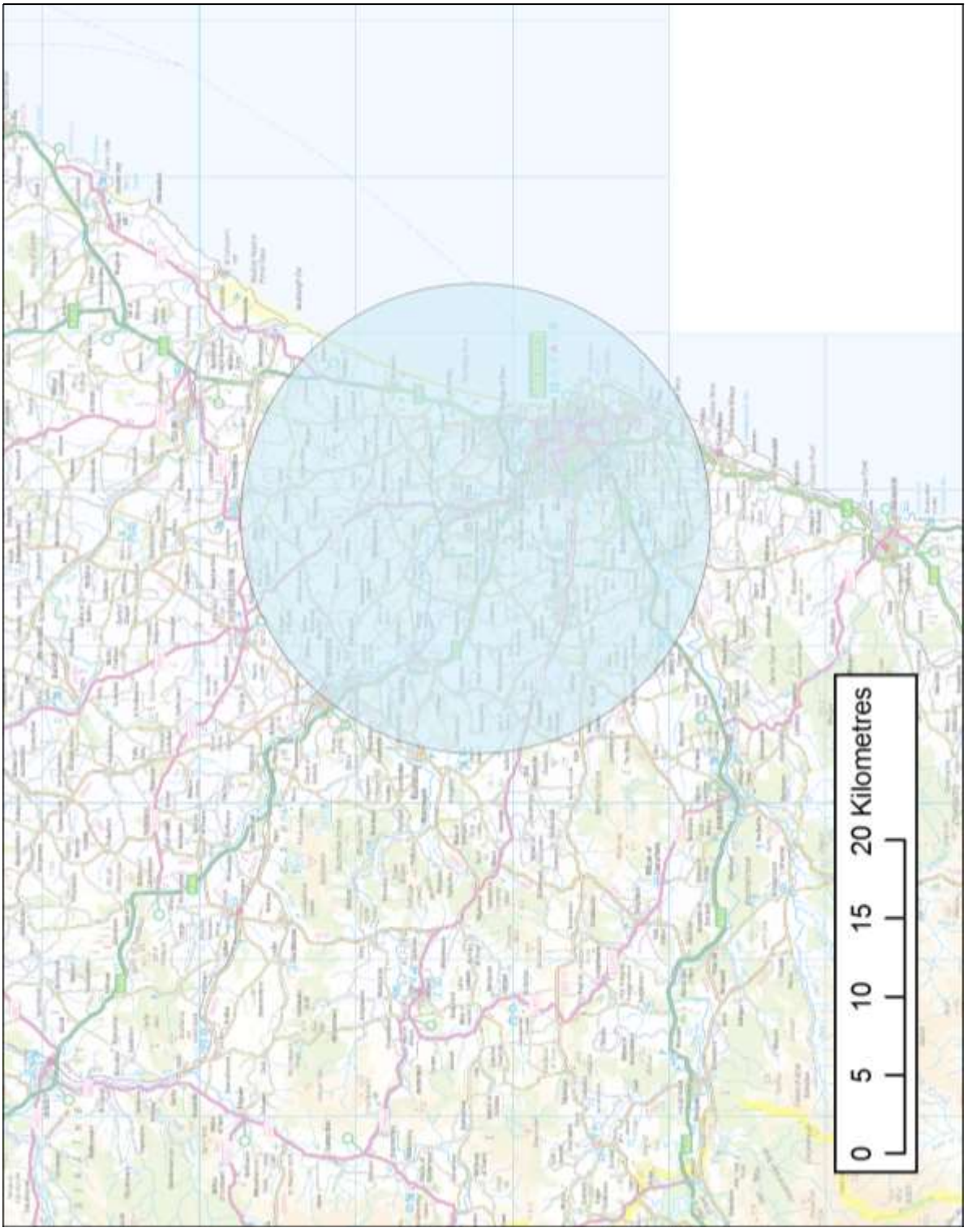


**Figure 12: Birmingham Airport regional population assessment**

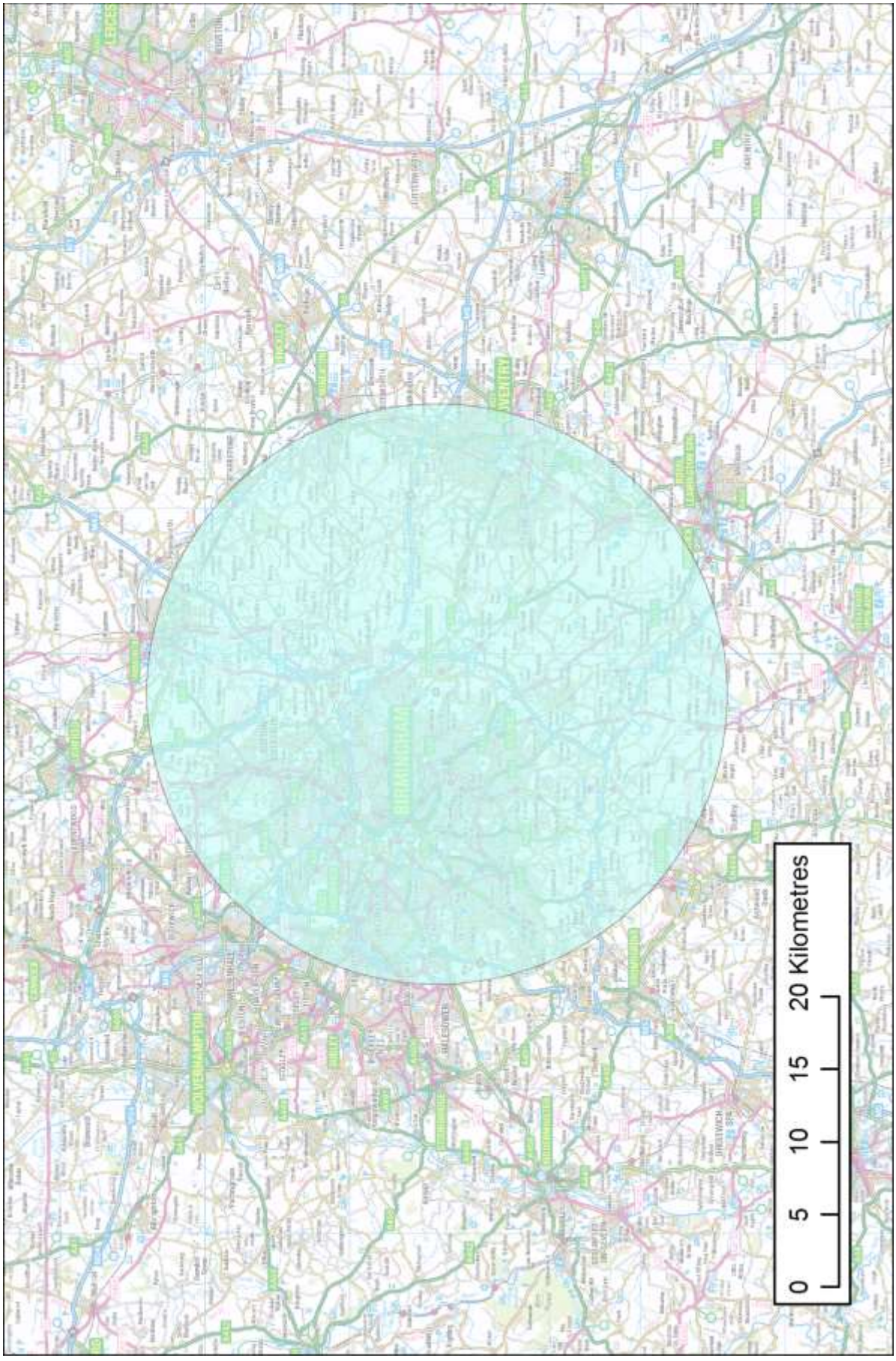


**Figure 13: Edinburgh Airport regional population assessment**

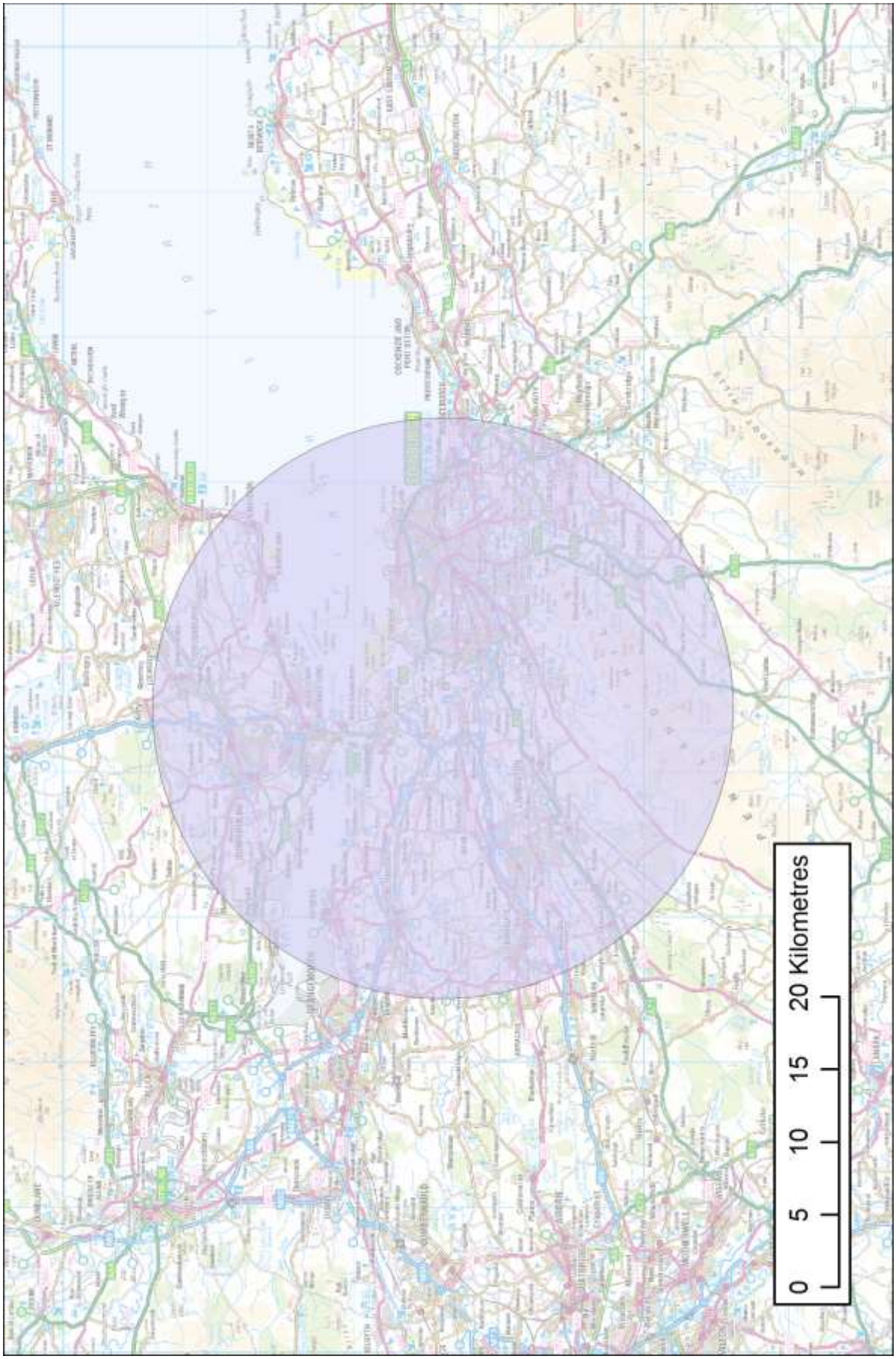


**Figure 14: Glasgow Airport regional population assessment**

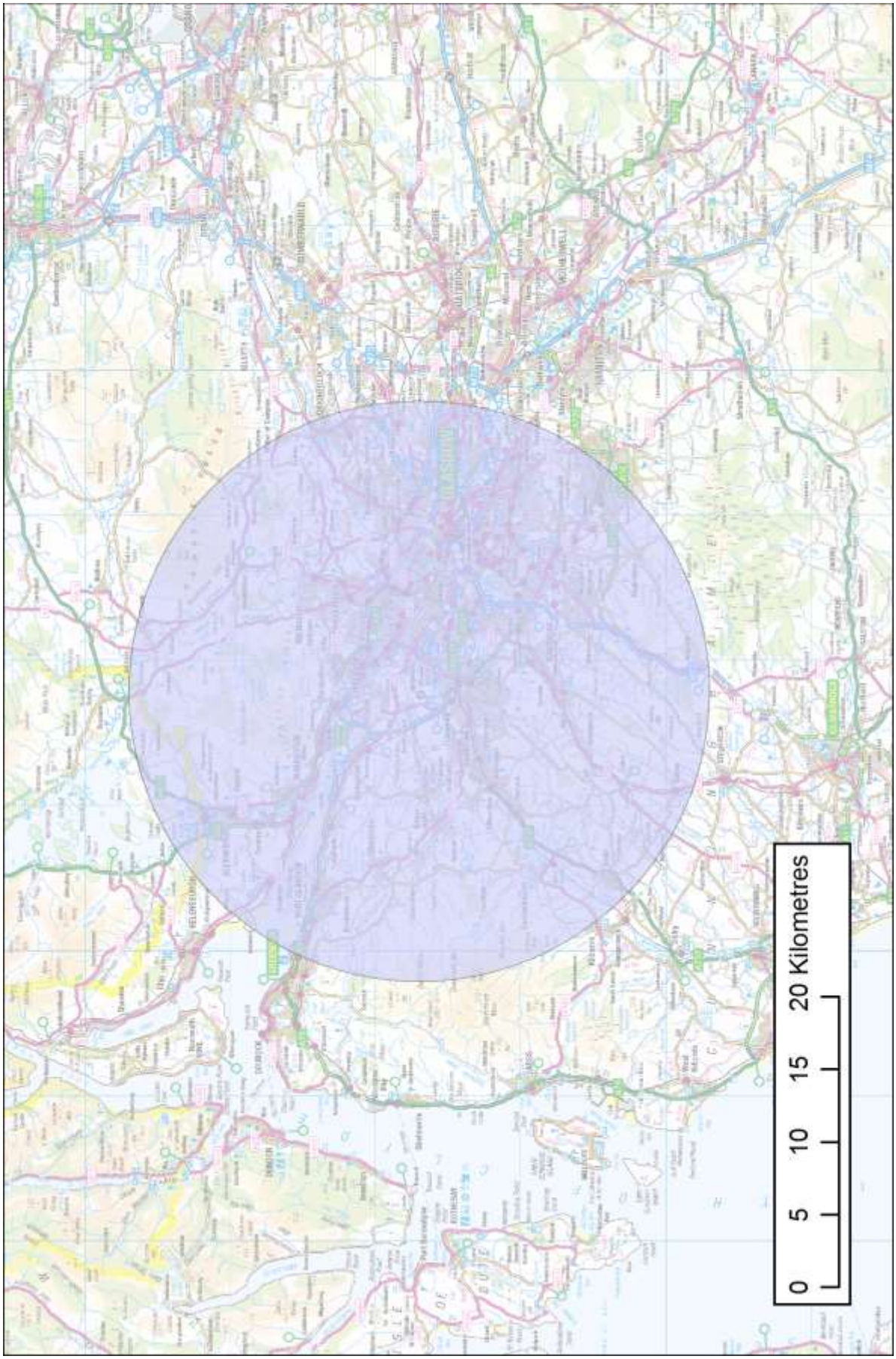


**Figure 15: London Gatwick Airport regional population assessment**

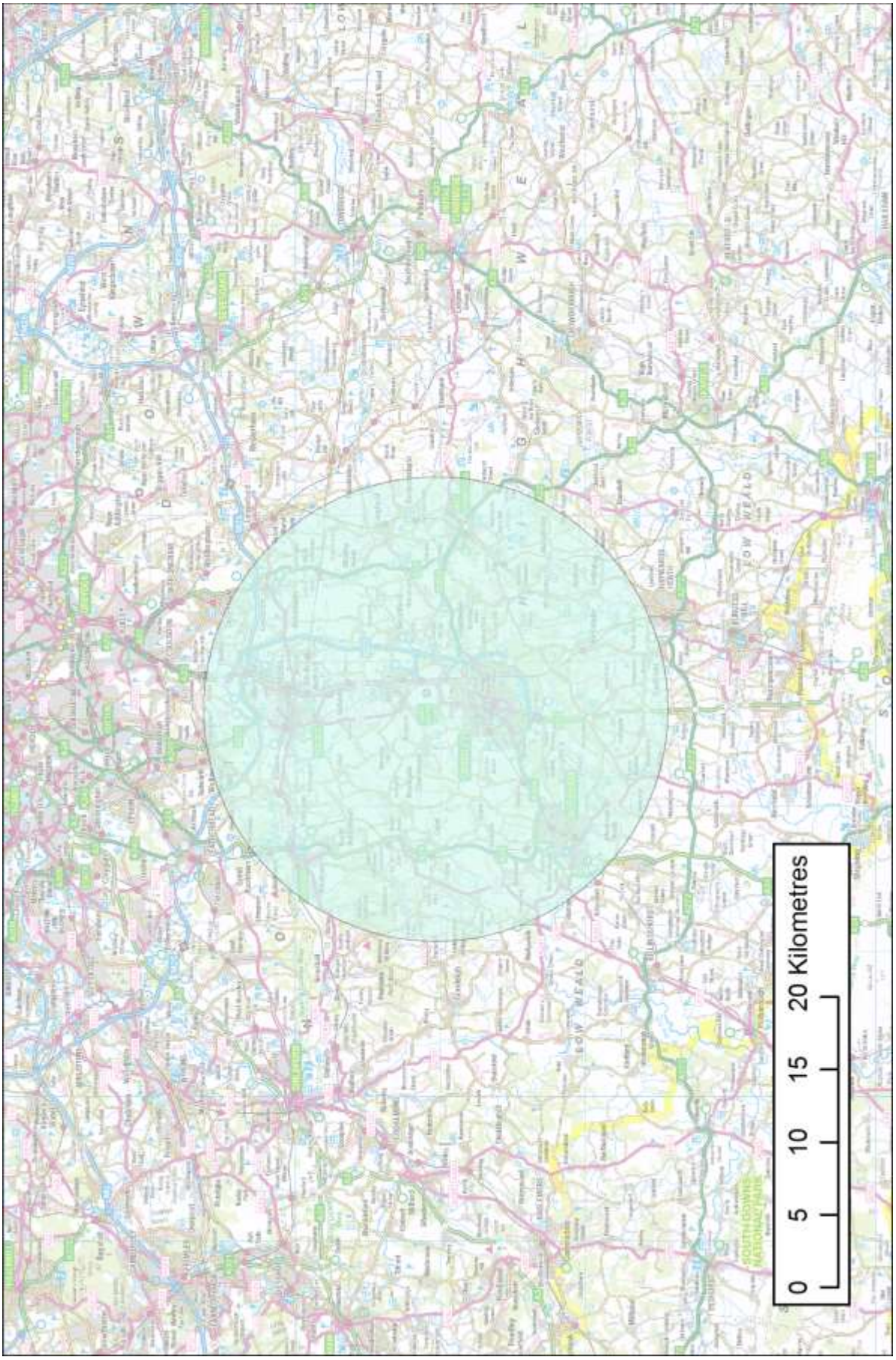


**Figure 16: London Heathrow Airport regional population assessment**

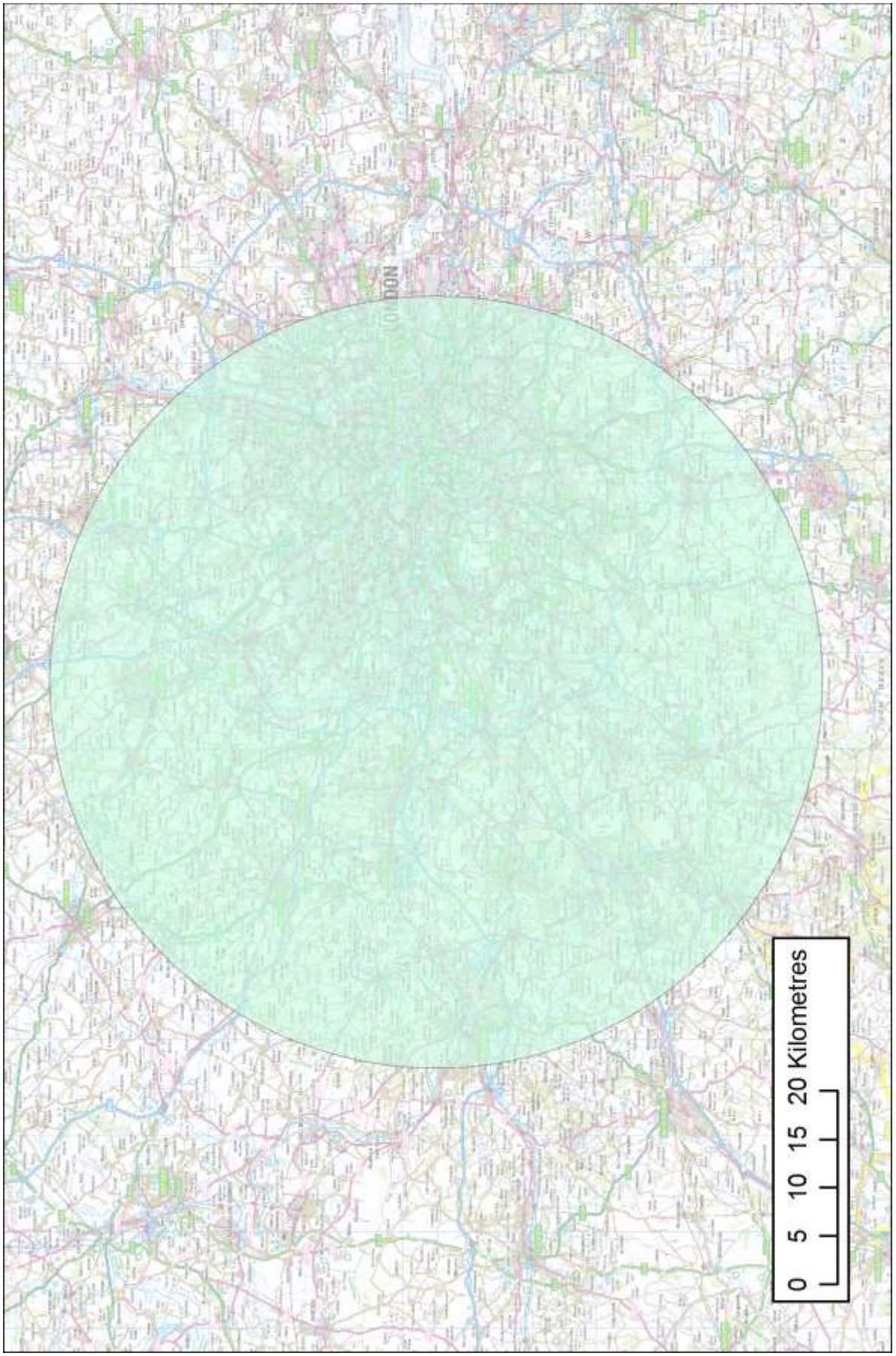


**Figure 17: London Stansted Airport regional population assessment**

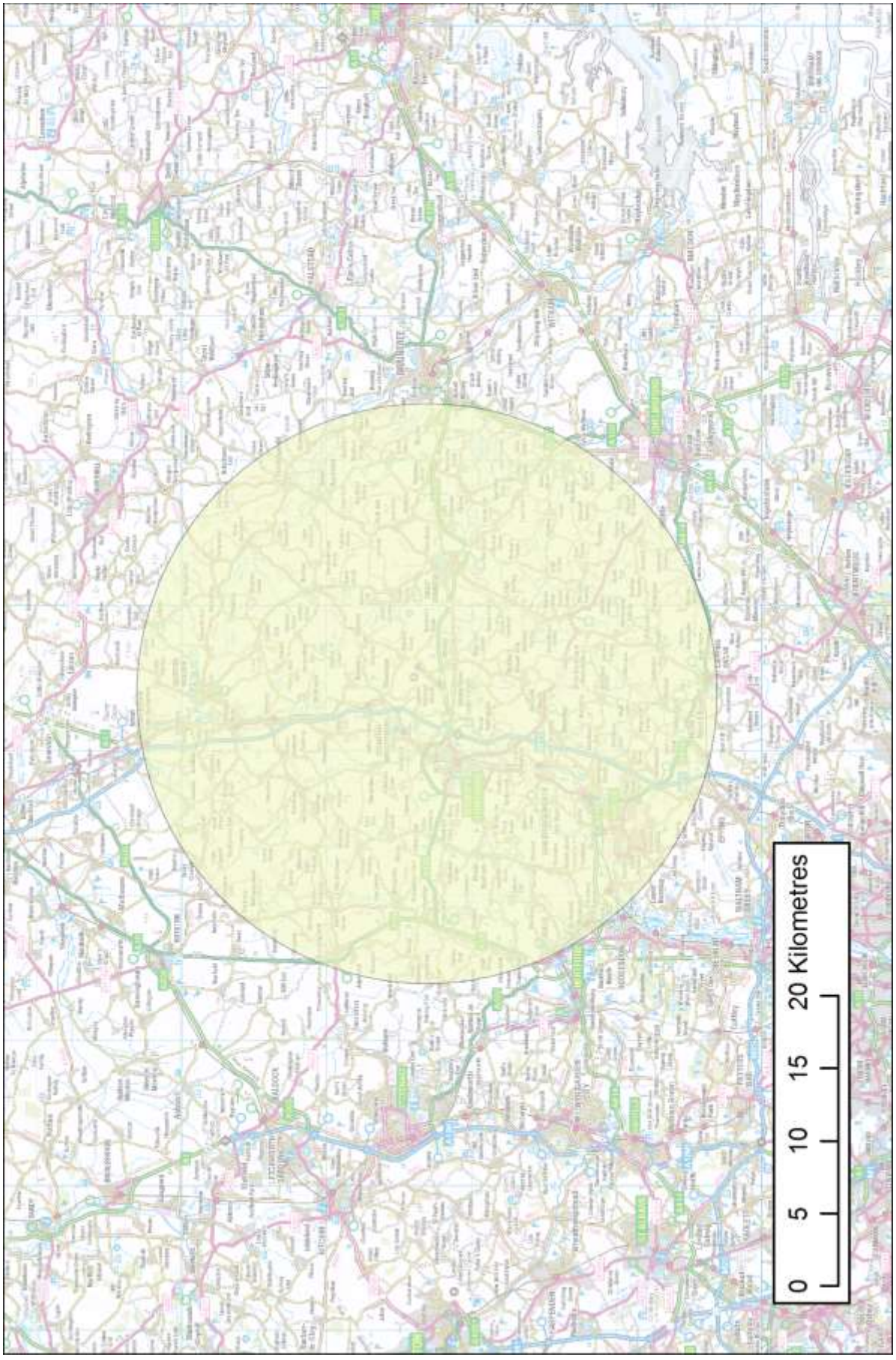


**Figure 18: Manchester Airport regional population assessment**

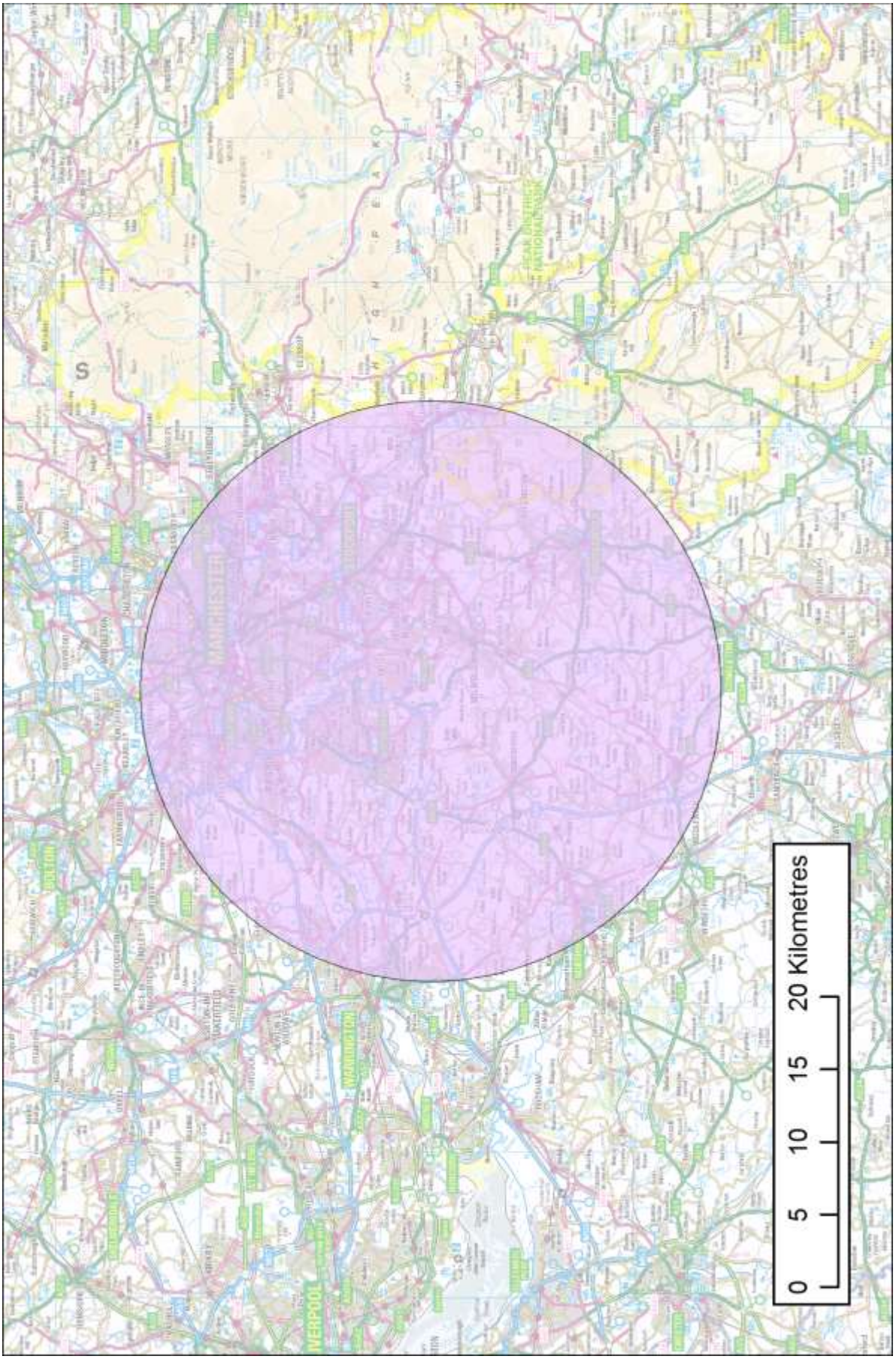


**Figure 19: Newcastle Airport regional population assessment**

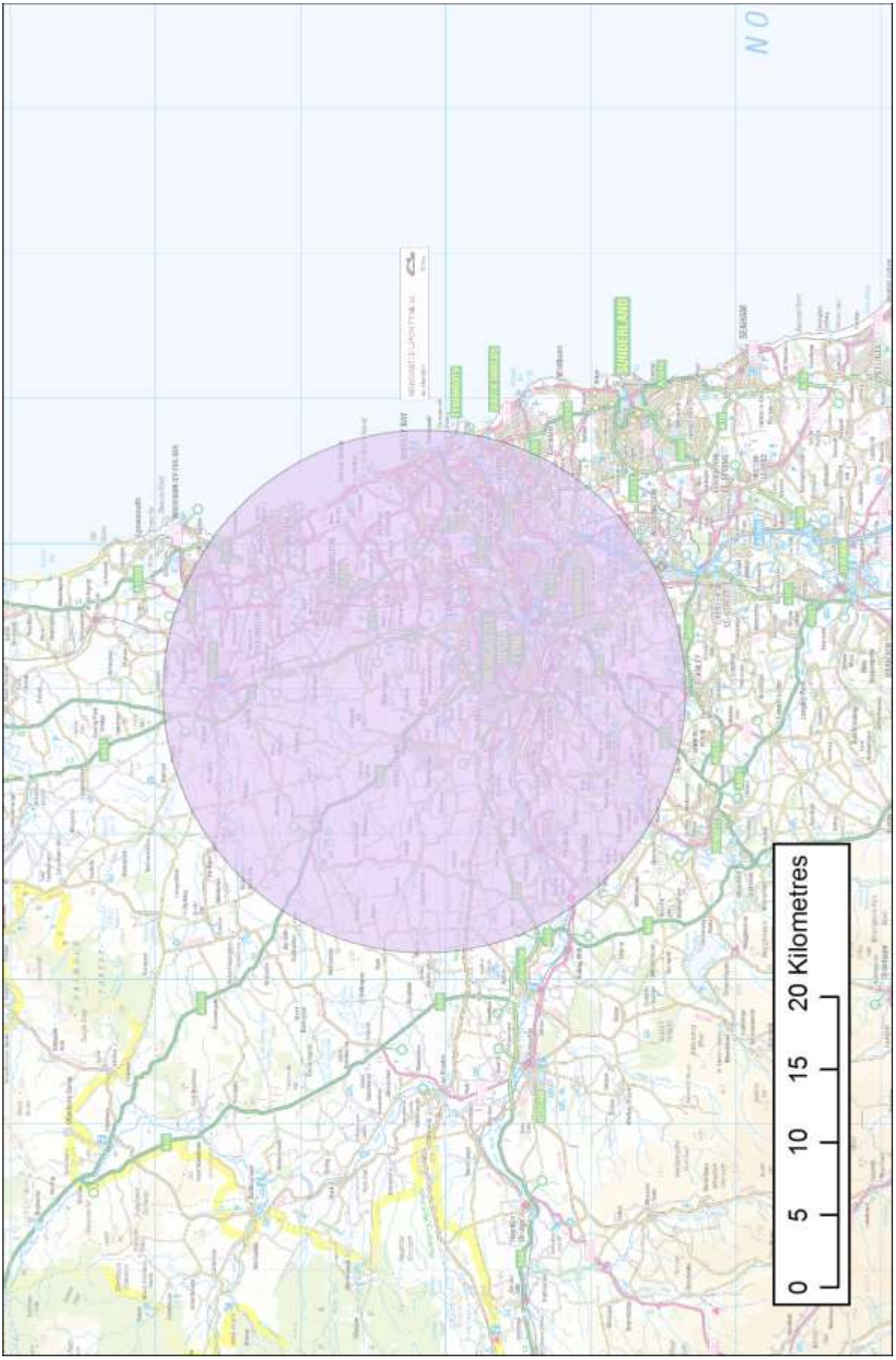


**Figure 20: Southampton Airport regional population assessment**