Department for Transport

Draft Heathrow Expansion National Policy Statement Appraisal of Sustainability (AoS) Noise Annex

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1. Introduction

Overview

1.1 The DfT commissioned the Civil Aviation Authority's (CAA) Environmental Research and Consultancy Department (ERCD) to undertake local noise modelling using the UK Civil Noise Contour Model (ANCON) version 2.4 model[1].

1.2 Modelling has been undertaken using two scenarios from the DfT's 2026 UK Aviation Forecasts[2]. This assesses the noise impacts from air transport movement (ATM) forecasts, which are part of these updated forecasts

- Current Trends (CT) – **the central scenario** which uses the central economy inputs and presumes passenger behaviour does not change from current trends and patterns.

- Technology Development (TD) – a scenario which represents the impact of potential further developments in technology, particularly with respect to aviation decarbonisation.

1.3 The modelling considers both the **two-runway (2R)** scenario (the 'do minimum' case with no Heathrow expansion) and the **three-runway (3R)** scenario (the 'do something' case involving Heathrow expansion), based on the Northwest Runway proposal.

1.4 Sensitivity modelling for a scheduled night flight ban and lower noise levels has been conducted on the CT scenario only.

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[1] https://www.caa.co.uk/data-and-publications/publications/documents/content/rd-report-9842/
[2] https://www.gov.uk/government/publications/uk-aviation-forecast-2026

1.5 No modelling has been undertaken using the High Economy ATM forecast, which would be expected to represent a worst-case noise scenario. This is because model outputs do not extend sufficiently far into the future to enable an assessment[3].

1.6 For the CT scenario, the assessment was undertaken for the years 2035, 2045 and 2055. By 2035, the third runway is assumed to be operational, with 2045 representing an intermediate future year and 2055 the longer-term future year, by which time maximum terminal capacity is expected to be reached following the completion of infrastructure work. These years were selected to reflect anticipated changes in aviation traffic demand, operations and fleet composition over time, thereby providing a robust basis for contour analysis.

1.7 For the TD scenario, the assessment was undertaken for the same years and, in addition, for 2060, as the aviation model outputs for this scenario extend further into the future, capturing technology developments between 2055 and 2060.

1.8 National noise has not been assessed because the focus is on the expanded Heathrow. However, noise reduction could occur at other airports if demand shifts to Heathrow and the released capacity is not backfilled.

Metrics

1.9 The noise exposure metric used is the A-weighted Equivalent Continuous Sound Level (LAeq). This is a standard metric that represents individual noise events as a single decibel (dB) value, expressing the average continuous sound level experienced over a defined period: for example, 07:00 to 23:00 (LAeq,16h[4]) and 23:00 to 07:00 (LAeq,8h). For aviation noise assessments, this has historically been calculated over a 92-day summer period[5], from 16 June to 15 September, when aviation traffic is typically highest. As noise is measured on a logarithmic scale, a change of 3 dB corresponds broadly to a doubling or halving of aircraft movements, while a 1 dB change broadly corresponds to approximately a 25% increase or 20% decrease in aircraft movements.

1.10 The use of a summer-average period represents a conservative (worst-case) approach, reflecting peak traffic conditions and therefore higher noise exposure than at other times of the year.

1.11 The analysis of the core modelling results presented in this annex focuses on the current Lowest Observed Adverse Effect Levels (LOAELs) used in UK Government noise policy as a threshold to assess adverse impacts: 51 dB LAeq,16h for daytime and 45 dB LAeq, 8h for night-time. The LOAEL is the level above which noise can be considered to have adverse effects on health and quality of life can be detected[6] on a community level.

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[3] This is due to the level of demand reaching a sufficiently high point which means the model fails to establish a stable solution to allow later years to be modelled.

[4] LAeq metrics also be denoted with hr rather than h

[5] https://assets.publishing.service.gov.uk/media/5f624adae90e072bbae22c2c/air-navigation-guidance-2017.pdf

[6] https://assets.publishing.service.gov.uk/media/5a7956e0ed915d0422067947/pb13750-noise-policy.pdf

2. Methodology

Overview

2.1 The noise modelling was undertaken in accordance with the CAP2091[7], the CAA's policy on minimum standards for noise modelling, to a Category A standard. This is the most sophisticated level, requiring the model to reflect local circumstances. Local data was therefore used for flight operational parameters (vertical flight profiles, route mean tracks, lateral dispersion, and route usage).

2.2 The primary operational evidence base for the modelling was the ERCD's most recently available Heathrow noise model, for 2024[8], which was informed by Heathrow's 2024 operational data.

Runway Location and Airspace Designs

2.3 The modelling requires the physical geometry of the airport and route structure to be defined before forecast traffic can be assigned and modelled.

2.4 The runway geometry used was based on the red line boundary (expanded airport limits) and runway coordinates provided by Heathrow Airport Limited (HAL), as the scheme selected to inform the Airports National Policy Statement (ANPS) review.

2.5 As future 2R airspace designs are not yet defined, this modelling adopted the current Heathrow airspace structure. The overall route framework was maintained, with lateral dispersion adjusted to represent future RNAV (satellite-based navigation) operations using radar data from past Heathrow RNAV trials.

2.6 For 3R, the airspace design structure was based on the **indicative** "Minimise Newly Affected" airspace designs from noise modelling carried out for the 2015 Airports

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[7] CAP2091
[8] ERCD2501

Commission[9]. This design was intended to minimise the additional population exposed to aviation noise as a result of Heathrow expansion through a Northwest Runway. Of the three airspace designs used in this work, this design was assessed to currently be the most realistic by DfT policy officials in discussion with the CAA, NERL[10] and HAL (in their capacity as current airport operator). There have not been any suitable airspace designs developed since the review carried out by the Airports Commission which could support this analysis. Work is currently underway to design modernised airspace for the whole London region in line with the CAA's airspace change processes. This design will include the airspace needed for any third runway at Heathrow Airport and, if development consent is granted, would need to reflect any relevant conditions. This work will take a number of years to complete, including consultations with those who might be affected by any change in airspace use, before it is submitted to the CAA for approval.

2.7 Whilst this is considered a reasonable assumption for analysis at this stage, it should be noted that airspace design assumptions are a key input to noise modelling, and the spatial impacts of Heathrow expansion would be expected to be different under different designs.

2.8 A 3.0-degree arrival glideslope was assumed for all assessment years, consistent with current operations.

Runway Modal Split and Alternation

2.9 Contours were produced using a standardised long-term modal split of 78% westerly and 22% easterly operations, based on the 2024 Heathrow 20-year rolling average. This standard split was applied to ensure a consistent basis for comparing contour areas and their associated impacts between years.

2.10 The actual 2024 split was not considered appropriate for this assessment, as it reflects only a single year and does not represent longer-term operational trends.

2.11 For 2R, the 78% of westerly flights and 22% of easterly flights were shared evenly between the two runways. For 3R, the same westbound and eastbound percentages were shared evenly across the three runways, meaning each runway is assumed to take one-third of the operations.

2.12 Both the 2R and 3R scenario assume full easterly runway alternation, enabled by the granting of planning permission by Hillingdon London Borough Council in December 2025 for the required infrastructure following the ending of the "Cranford Agreement"[11] in 2009.

2.13 In the 3R scenario, runways are assumed to operate in an alternating pattern across four distinct modes, which vary depending on whether operations are westerly or

[9] https://www.gov.uk/government/publications/airports-commission-final-report-noise
[10] NATS (En Route) plc
[11] https://www.heathrow.com/company/local-community/noise/operations/easterly-alternation

easterly. Each mode has two arrival and two departure streams at any one time, with the central runway never used simultaneously for both arrivals and departures (mixed-mode) for safety reasons.

2.14 As noted earlier, under the 3R scenario, the detailed timing or sequencing of runway alternation is therefore not explicitly modelled, because the long-term noise exposure results are determined by the total number of operations allocated to each runway over the assessment period.

Aircraft Types

2.15 The ATM forecasts distinguish between existing aircraft types and future aircraft categories representing aircraft expected to enter commercial service in future years.

2.16 Existing aircraft were modelled using their defined ANCON noise performance and were not given any further noise improvement.

2.17 Future aircraft categories were defined by the DfT and align with those discussed in Revised fuel efficiency assumptions for future aircraft[12], developed in conjunction with the Aerospace Technology Institute, a leading, independent organisation with cross-sector expertise, that develop the national technology strategy for the UK's civil aerospace sector. The research is up to date, reflecting evidence available in 2025, and represents both evolutionary improvements to conventional aircraft and the introduction of zero-emission aircraft.

2.18 Different entry into service (EIS) year assumptions for these future aircraft were defined under both the CT and TD scenarios, explained in further detail in the 2026 UK Aviation Forecasts,[13] with the latter reflecting more optimistic entry into service timelines.

2.19 Future aircraft were represented in the ANCON model using proxy aircraft with established noise profiles, selected based on their closest expected operational and noise performance characteristics. The actual EIS year of each proxy aircraft was used as the baseline from which annual noise improvements were calculated up to the EIS year of the corresponding future aircraft. This improvement was quantified as 0.1 dB per year for larger jet aircraft and 0.033 dB per year for commuter, regional turboprop, and regional jet aircraft. No further noise improvement was applied beyond the future aircraft's EIS year.

2.20 The value of 0.1 dB per year for large jet aircraft is taken from the ICAO's recent Environmental Trends assessments[14,15] and the most recent ICAO Noise

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[12] Revised fuel efficiency assumptions for future aircraft
[13] https://www.gov.uk/government/publications/uk-aviation-forecast-2026
[14] ICAO 2025 Environmental Report
[15] ICAO 2022 Environmental Report

Technology Independent Expert Panel[16], which assumed noise improvements of 0.1–0.2 dB per year. Given future technology development is inherently uncertain, this modelling uses the lower bound of the ICAO estimate for larger jet aircraft. The lower, 0.033 dB per year, figure for other aircraft reflects slower technology uptake in these segments, consistent with the ICAO expert panel findings.

2.21 Overall, the introduction of zero emission aircraft, while subject to greater uncertainty, has a limited impact on the fleet by the last modelled year 2055, as the aircraft introduced by this point are primarily smaller types not typically used at Heathrow.

2.22 Future aircraft noise performance will be influenced through both airframe and engine technologies. Improvements in aerodynamics, materials, and engine technology are expected to continue reducing fuel burn, thereby reducing the mass of an aircraft for a given operation. Reducing aircraft mass means the engines required are smaller, which in turn further reduces aircraft mass, wing size, and engine size. With respect to engine technology, the main driver is engine bypass ratio. Increasing the bypass ratio reduces jet exhaust velocity and thus jet noise. Whilst higher bypass ratios require larger fans, technologies continue to evolve to reduce fan noise through blade design and more advanced acoustic nacelle liners. The Rolls Royce Ultrafan, when it comes to market, is expected to set new standards for turbofan engine bypass ratio.[17]

2.23 Freight-only operations are not modelled in detail within the aviation forecasts as the number of these operations tend to be volatile with no clear pattern between years or airports. To account for them within the ATM forecasts, the number of freight-only ATMs from 2024 is held constant for all future modelled years and is assigned a generic freight-only aircraft classification. Given that they accounted for less than 1% of Heathrow operations in 2024, any future increase in freight-only operations is unlikely to result in a material increase in noise.[18]

2.24 To represent these operations in the ANCON model, aircraft types have been assigned using scaled 2024 CAA data on freight-only aircraft at Heathrow.

Forecast Processing

2.25 For each scenario, the DfT provided the CAA with annualised aviation forecasts, defining the volume and type of operations. As the noise modelling metric represents a 92-day summer period, these aviation forecasts needed to be disaggregated into appropriate model inputs.

2.26 This was done using Heathrow 2024 summer traffic data to convert the annualised forecasts into representative 92-day summer daytime and night-time inputs, including route allocation, seasonal scaling, and temporal ratios.

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[16] Report By the Second CAEP Noise Technology Independent Expert Panel - Novel Aircraft-Noise Technology Review and Medium- and Long-Term Noise Reduction Goals – Report, ICAO Doc. 10017, International Civil Aviation Organization, 2014.

[17] The next evolution of aviation | Rolls-Royce.

[18] https://www.caa.co.uk/data-and-analysis/uk-aviation-market/airports/uk-airport-data/

2.27 In undertaking this process, Heathrow's current night flight movement restrictions[19] were not explicitly retained. Instead, night-time movements depend on Heathrow temporal ratios and the forecast fleet mix and traffic composition, consistent with the CAP 1731 Aviation Strategy[20].

Impacts Data

2.28 The analysis presented in this annex uses population and household estimates (by Output Area level) supplied to CAA/ERCD by CACI Limited[21] under licence[22]. These were derived from the Census 2021, with population change projection provided by CACI for the assessment years of 2035, 2045 and 2055. Output Area level is the smallest statistical geography used by the Office for National Statistics. However, the modelling requires postcode-level data. To address this, the forecast Output Area totals were apportioned to postcodes using the distribution in the current year 2025 data, for which postcode-level data are available.

2.29 The analysis presented in this annex uses noise-sensitive building data supplied to CAA/ERCD by Landmark under licence. Noise-sensitive buildings (NSBs) are buildings whose occupants or users are typically more sensitive to environmental noise. The NSB dataset was derived from Landmark Information Group's PointX points-of-interest dataset, which identifies the location and type of relevant buildings and facilities using address and location data[23]. As forecast NSB, data are not available; the 2024 baseline dataset has been applied across all modelled years.

2.30 For both CACI and Landmark data, this annex reports derived modelling outputs only and does not reproduce the underlying datasets.

2.31 Table 2-1 summarises what are considered NSBs for the purposes of this modelling. This list is in line with the assumptions typically used by CAA for annual noise exposure reporting, as well as the previous airport expansion noise assessment for Gatwick Airport.

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[19] https://www.heathrow.com/company/local-community/noise/operations/night-flights
[20] CAP1731
[21] https://www.caci.co.uk/
[22] The applicable copyright notices can be found at http://www.caci.co.uk/copyrightnotices.pdf
[23] https://www.landmark.co.uk/products/pointx-dataset/

Category	Description
Hospital	"Hospitals"
Hospital	"Hospices"
School	"Broad Age Range and Secondary State Schools"
School	"Special Schools and Colleges"
School	"Unspecified and Other Schools"
School	"Pupil Referral Units"
School	"Independent and Preparatory Schools"
School	"First, Primary and Infant Schools"
School	"Nursery Schools and Pre and After School Care"
Higher Education	"Further Education Establishments"
Higher Education	"Higher Education Establishments"
Place of Worship	"Places of Worship"

Table 2-1: Noise-sensitive building categories

2.32 Figures for area presented in this report are rounded to the nearest km^2, while population and household figures are rounded to the nearest hundred. Percentage changes between impacts are rounded to the nearest whole number to improve clarity.

3. Historical Trends and Baselines

3.1 Aviation noise at Heathrow has decreased significantly between 2006 and 2024 (the latest year for which data are available) due to fleet modernisation. The estimated area covered by the 51 dB LAeq,16h contour decreased by 36%, from 364 km² in 2006 to 232 km² in 2024. In recent years, improvements have accelerated with the introduction of the latest-generation aircraft and the phasing out of the Boeing B747-400 series[24]. A substantial proportion of this reduction occurred in the later period, with the contour shrinking by 19% between 2019 and 2024, from 287 km².

3.2 Aircraft movements in 2024 were close to pre-pandemic levels. Average summer 16-hour day movements were 1,253.5, just 0.5% below the 1,260.4 recorded in 2019. Average summer 8-hour night movements were 89.8, which is 4% higher than the 86.7 recorded in 2019.[25]

3.3 For the modelling results presented in subsequent sections, results are presented both as a comparison between the Do-Something (3R) and Do-Minimum (2R) as well as compared to 2024 noise levels described in paragraph 3.1, which is the baseline year used in the draft Heathrow Expansion National Policy Statement (HENPS)[26]. Where data is available for 2019 this is also presented, however for some tables/graphs 2019 data is not currently available.

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[24] ERCD2501
[25] ERCD2501
[26] https://www.gov.uk/government/consultations/draft-heathrow-expansion-national-policy-statement-proposed-amendments

4. Summary of Current Trends (Central) Results

4.1 Section 4 covers modelled summer daytime (LAeq,16h) and night-time (LAeq,8h) noise for the CT scenario, comparing 3R, 2R and 2024 in terms of contour area, population, households and NSBs. It includes supporting figures and tables and outlines key drivers and changes across forecast years.

Summer Day (LAeq,16h)

4.2 At 51 dB LAeq,16h, the modelling results show that whilst the estimated impacts (total affected area, population, households and NSBs) by 2055 in the 3R are worse than in the 2R, they are expected to be no worse than in 2024.

4.3 By 2055, in the 3R scenario, the 51 dB LAeq,16h contour covers an estimated area of 211 km². This is 50% larger than the 140 km² covered under the 2R scenario, but 9% smaller than the 232 km² covered in 2024. Figure 4-1 compares these contours on a map, whilst Figure 4-2 compares the estimated area covered across modelled years.

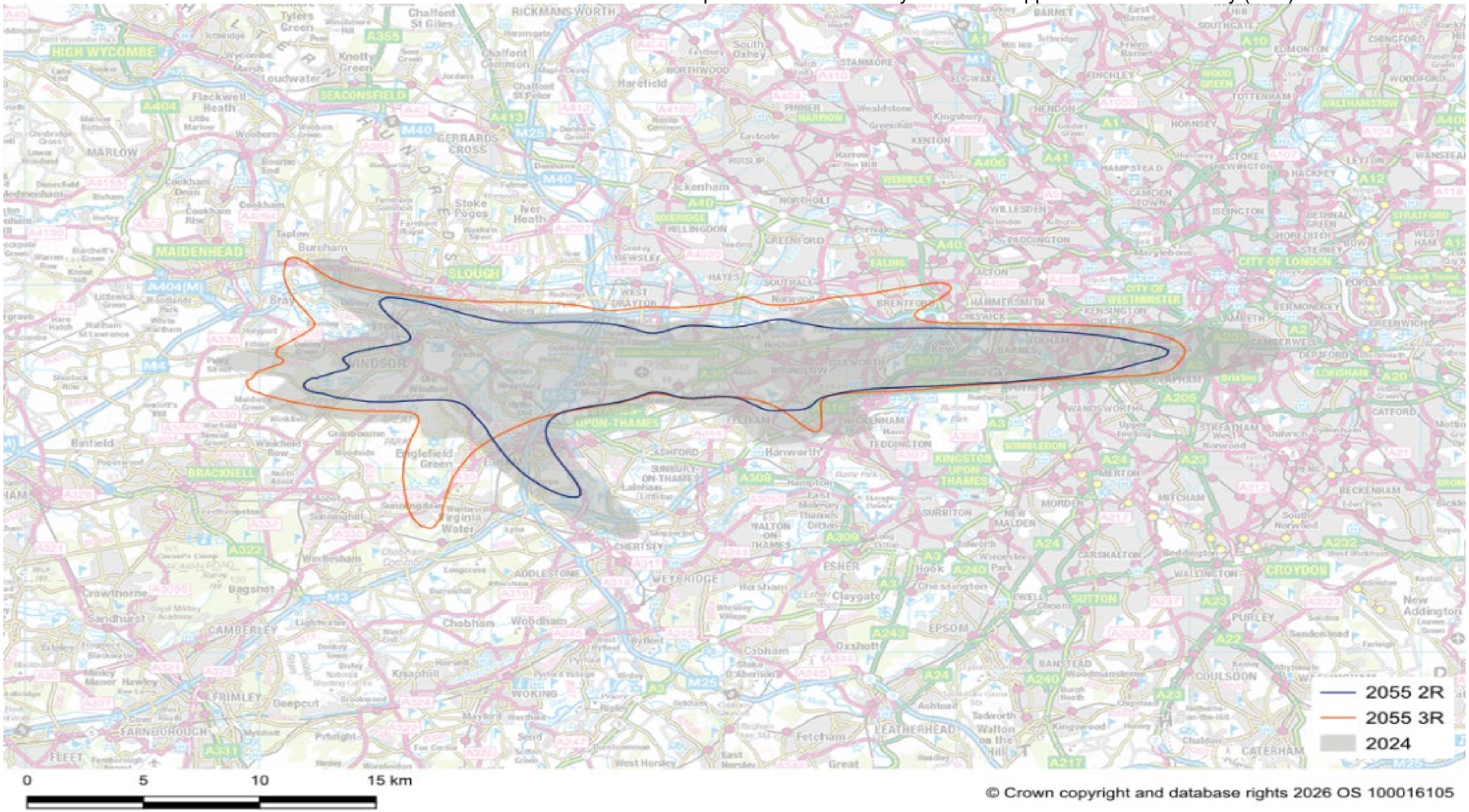

Figure 4-1: Comparison of 51 dB LAeq,16h Noise Contours for 2024 and 2055 (CT)

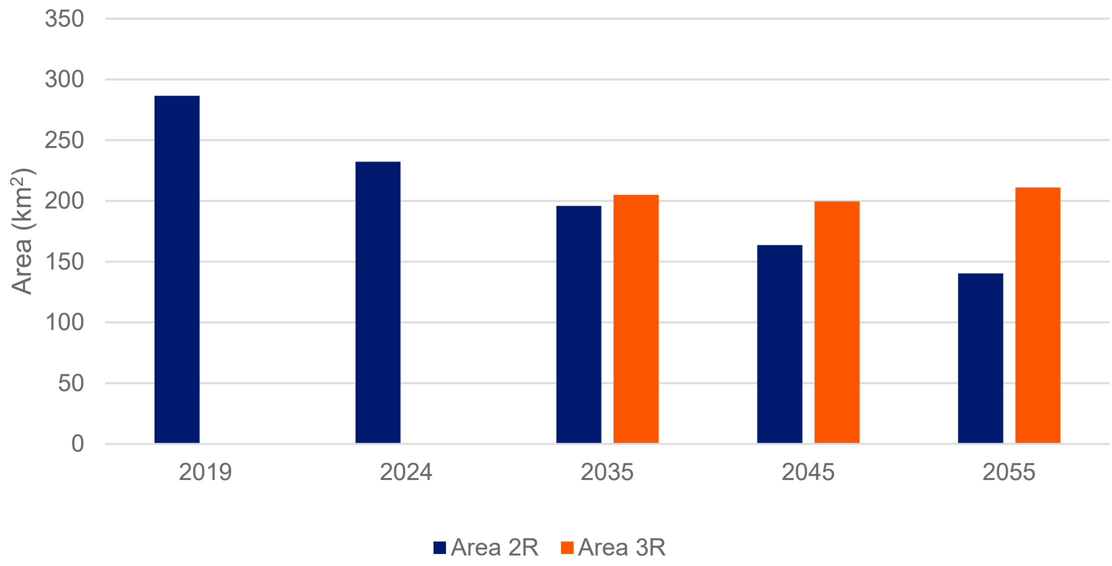

Figure 4-2: Comparison of Estimated Area Exposed to >51 dB LAeq,16h (CT)

4.4 By 2055, under the 3R scenario, the 51 dB LAeq,16h contour is estimated to include 741,600 individuals and 315,100 households, representing increases of 41% and 42% compared with the 2R scenario, which includes 526,500 individuals and 222,500 households. However, this remains below the 2024 estimates of 884,000 people and 359,700 households, a decrease of 16% in total individuals and 12% in total households. Figure 4-3 presents a comparison of the estimated exposed population, while Figure 4-4 compares the estimated number of households across modelled years. Table 4-1 summarises area, population and households impacted across the scenarios modelled.

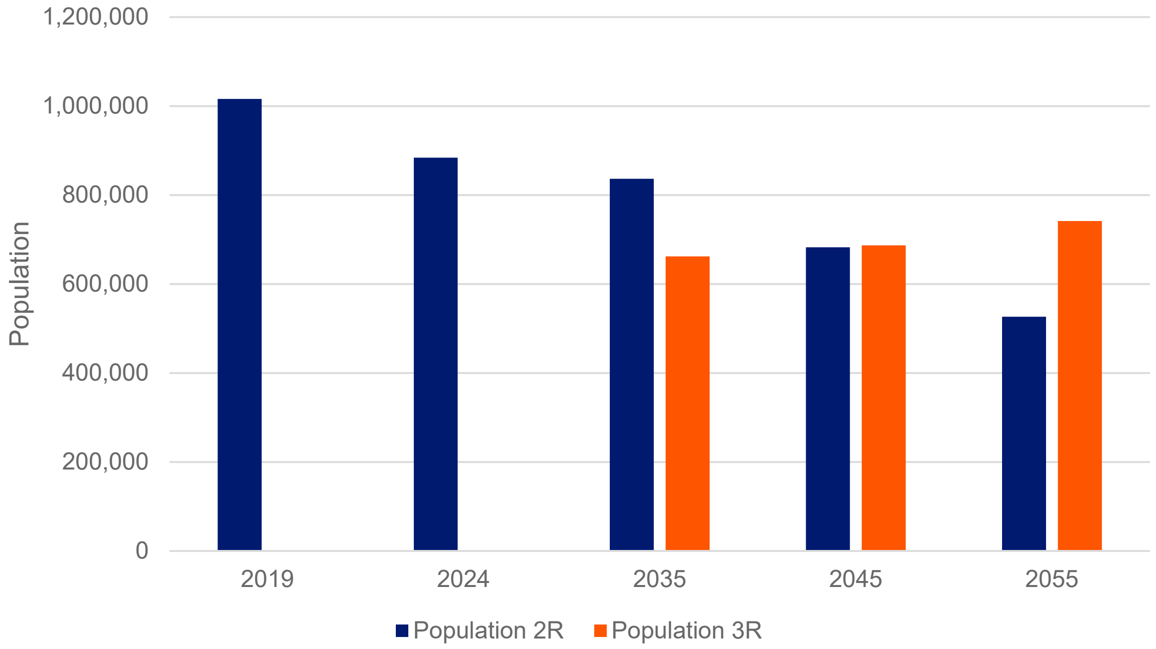

Figure 4-3: Comparison of Estimated Population Exposed to >51 dB LAeq,16h (CT)

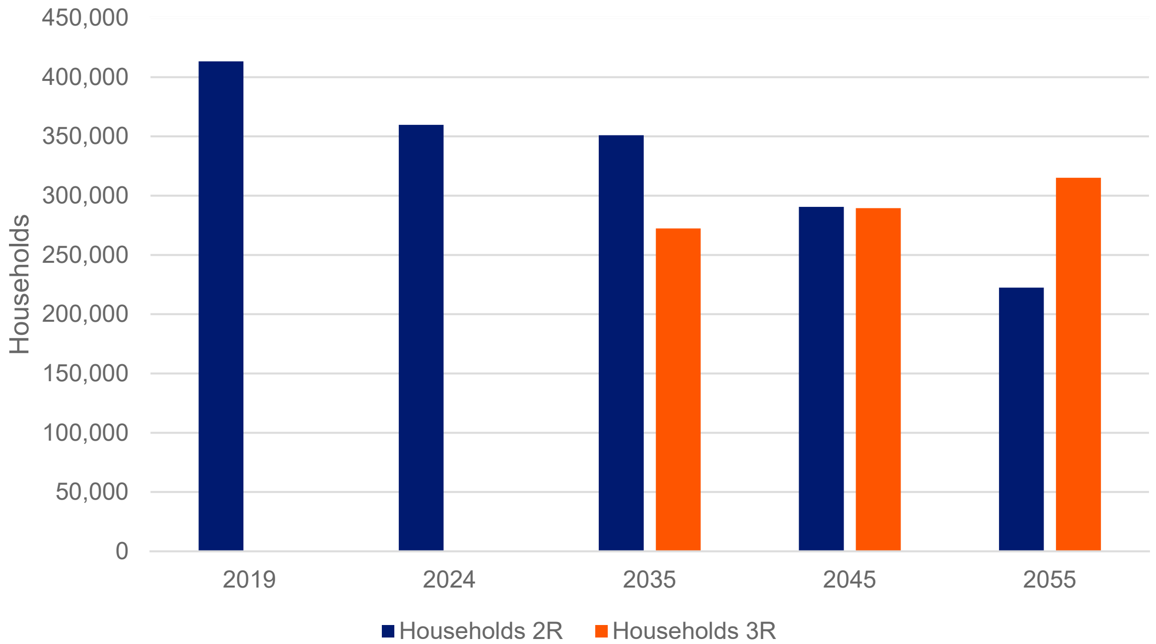

Figure 4-4: Comparison of Estimated Households Exposed to >51 dB LAeq,16h (CT)

Scenario	Area (km^2)	Population	Households
2019	287	1,016,000	413,300
2024	232	884,000	359,700
2035 2R	196	836,600	351,000
2045 2R	164	682,600	290,500
2055 2R	140	526,500	222,500
2035 3R	205	662,200	272,400
2045 3R	200	687,000	289,500
2055 3R	211	741,600	315,100

Table 4-1: Full Comparison of Estimated Exposure (Area, Population, and Households) to >51 dB LAeq,16h (CT)

4.5 By 2055, under the 3R, hospital buildings show the largest percentage increase (83%) compared to the 2R, with the number exposed rising from 6 to 11, while Higher Education buildings experience the greatest percentage decrease (48%) compared to 2024, falling from 25 to 13. Overall, all categories show increases relative to 2R and decreases relative to 2024. Table 4-2 summarises the impacts on NSBs. It should be noted that buildings located within the 3R red line boundary[27] have been excluded from the 3R scenario and have not been redistributed elsewhere. A comparison to 2024 only is presented here due to the 2019 data not being available for this category.

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	15	569	25	392	1,001
2035 2R	11	489	22	346	868
2045 2R	7	386	14	272	679
2055 2R	6	294	11	200	511
2035 3R	9	379	13	251	652
2045 3R	10	386	13	263	672
2055 3R	11	413	13	277	714

Table 4-2 Comparison of Estimated NSBs Exposed to >51 dB LAeq,16h (CT)

4.6 Improvements are largely driven by fleet modernisation, as the introduction of newer, quieter aircraft mitigates the increased noise associated with greater aviation demand. Fleet modernisation comprises two elements: the increased uptake of newer existing aircraft types and the introduction of future aircraft. In this modelling, much of the reduction in aviation noise around Heathrow can be attributed to the former.

4.7 For certain metrics, noise impacts in 2035 are lower in the 3R scenario than in the 2R scenario. For example, in 2035, the number of individuals exposed to 51 dB LAeq,16h is approximately 21% lower under the 3R scenario, with approximately 662,200 individuals affected, compared to 836,600 in the 2R scenario. Although the third runway is assumed to be operational by 2035, the associated increase in capacity is not realised until later years, when terminal capacity is expanded. As a result, a broadly similar number of ATMs is distributed across three runways rather

[27] Proposed boundary of expanded Heathrow

than two. This improves noise outcomes at the assessment levels by increasing operational flexibility through runway alternation and route dispersion. In some cases, this improvement persists into 2045.

Summer Night ($L_{Aeq,8h}$)

4.8 At 45 dB $L_{Aeq,8h}$, the modelling results show a similar overall outcome. By 2055, in the 3R scenario, the 45 dB $L_{Aeq,8h}$ contour covers an estimated 147 km². This is 41% larger than the 105 km² covered under the 2R scenario, but 4% smaller than the 154 km² covered in 2024. Figure 4-5 compares these contours on a map, whilst Figure 4-6 compares the area covered across modelled years.

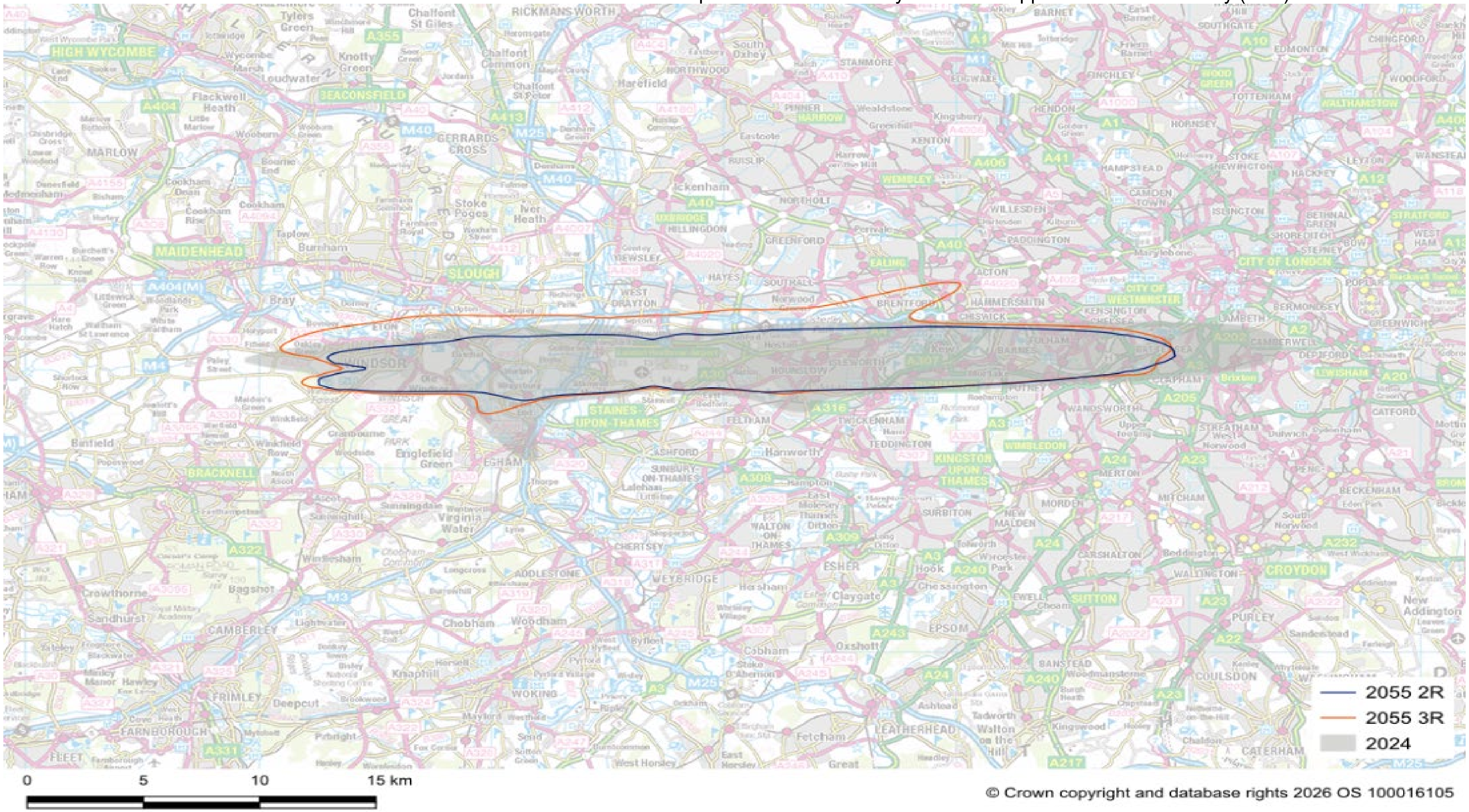

Figure 4-5: Comparison of 45 dB LAeq,8h Noise Contours for 2024 and 2055 (CT)

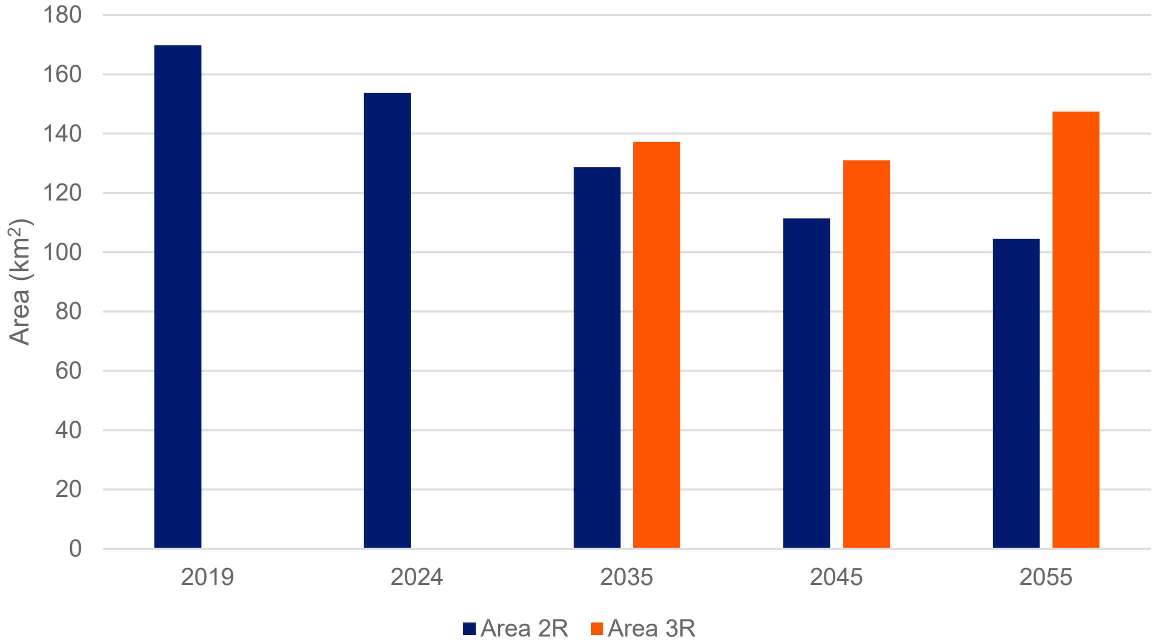

Figure 4-6: Comparison of Estimated Area Exposed to >45 dB LAeq,8h (CT)

4.9 By 2055, under the 3R scenario, the 45 dB LAeq,8h contour is estimated to include 614,400 individuals and 264,000 households, representing increases of 24% for both individuals and households compared with the 2R scenario, which includes 495,000 individuals and 213,100 households. However, this remains below the 2024 estimates of 740,000 people and 305,400 households, a decrease of 17% in total individuals and 14% in total households. Figure 4-7 presents a comparison of the estimated exposed population, while Figure 4-8 compares the estimated number of households across modelled years.

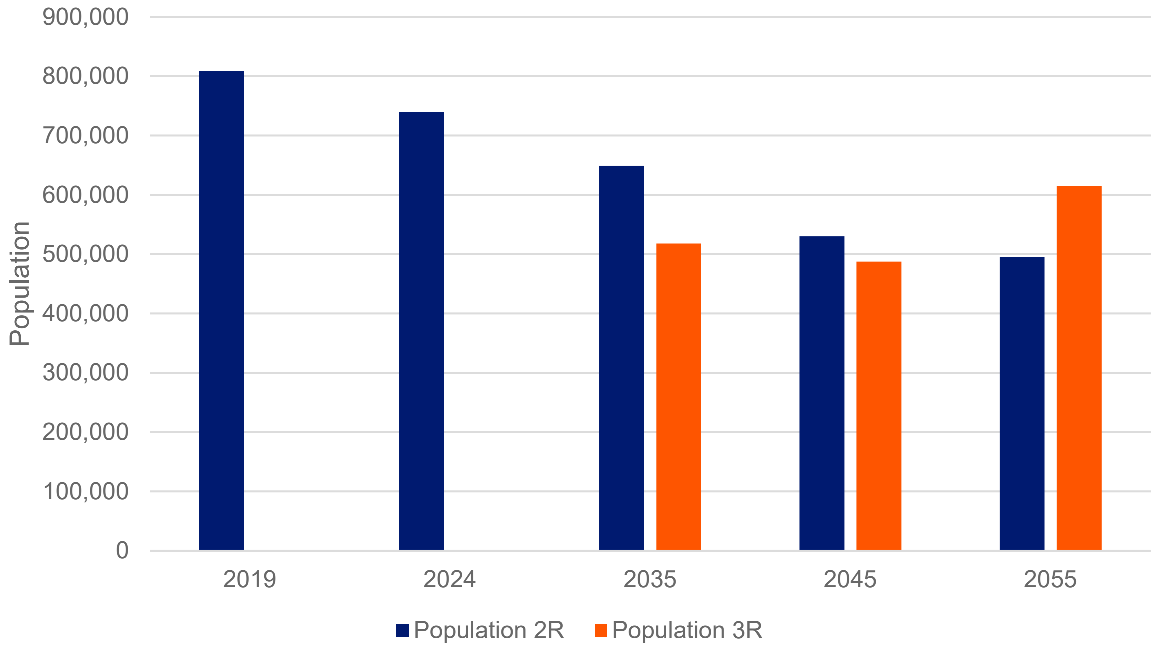

Figure 4-7: Comparison of Estimated Population Exposed to >45 dB LAeq,8h (CT)

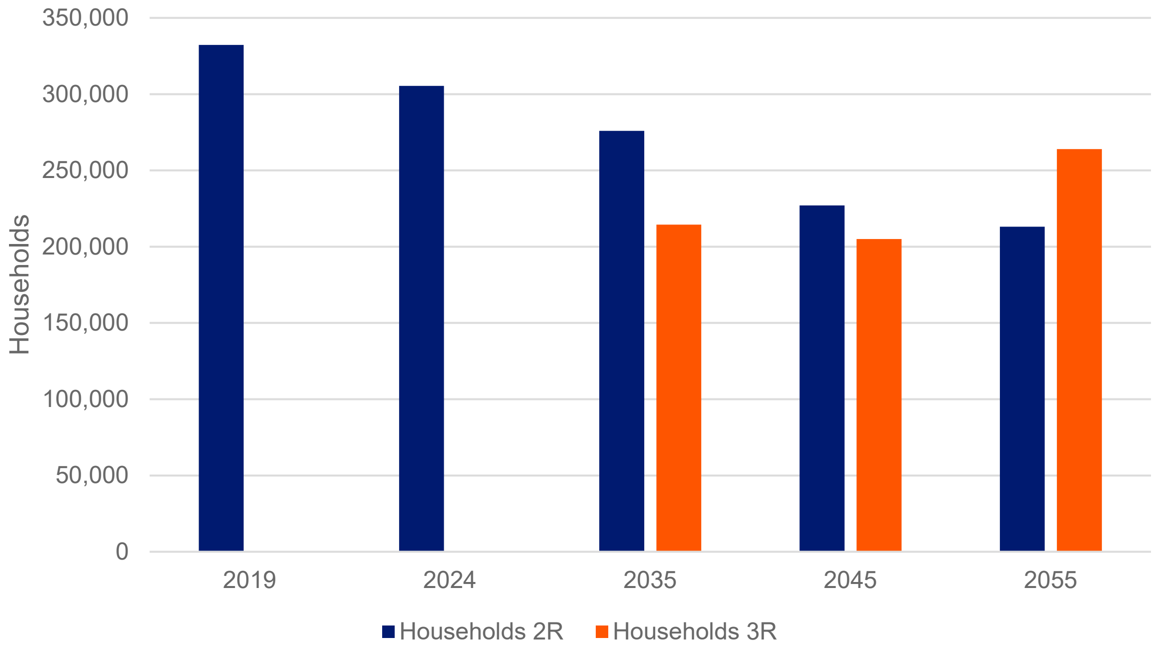

Figure 4-8: Comparison of Estimated Households Exposed to >45 dB LAeq,8h (CT)

4.10 Under the 3R scenario in 2055, the 45 dB LAeq,8h contour is estimated to include 595 NSBs, representing a 22% increase compared with 2R (486), but a 30% decrease relative to 2024 (848). Hospital buildings experience the largest percentage increase (50%) compared to the 2R, with the number exposed rising from 6 to 9, while Higher Education buildings exhibit the greatest percentage decrease (35%) compared to 2024, falling from 20 to 13. Overall, all categories show increases relative to 2R and decreases relative to 2024.

Scenario	Area (km^2)	Population	Households
2019	170	808,500	332,300
2024	154	740,000	305,400
2035 2R	129	649,000	275,900
2045 2R	111	530,000	227,000
2055 2R	105	495,000	213,100
2035 3R	137	517,900	214,500
2045 3R	131	487,500	205,000
2055 3R	147	614,400	264,000

Table 4-3: Full Comparison of Estimated Exposure (Area, Population, and Households) to >45 dB LAeq,8h (CT)

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	13	477	20	338	848
2035 2R	11	370	15	271	667
2045 2R	6	298	11	210	525
2055 2R	6	275	11	194	486
2035 3R	8	296	12	210	526
2045 3R	7	276	11	198	492
2055 3R	9	334	13	239	595

Table 4-4: Comparison of Estimated NSBs Exposed to >45 dB LAeq,8h (CT)

5. Sensitivity Tests (Current Trends Scenario)

5.1 Section 5 covers modelled night-time (LAeq,8h) noise contours for the 3R Current Trends (CT) scenario with a scheduled night flight ban. It presents contour area, population, households and NSBs for this scenario, alongside an overview of key changes.

5.2 It also discusses sensitivity testing based on Current Trends modelling, examining additional contours at lower assessment levels.

Scheduled Night Flight Ban

5.3 As with the previous ANPS, the draft HENPS [28]includes the expectation of a 6.5-hour scheduled night flight ban between 23:00 and 07:00.

5.4 To account for this, a sensitivity test for a scheduled night flight ban (NFB) has been carried out on the 3R LAeq,8h (CT) scenario only, as it is assumed that the ban will only be required with expansion.

5.5 As the ban period is not explicitly defined the Airports Commission's 2015 recommendation of a 6.5-hour ban (23:30 to 06:00)[29], aligned with Heathrow's current night restrictions, has been used as a proxy in the modelling. As of 2026, Heathrow has no scheduled runway departures between 22:50 and 06:00 and no scheduled arrivals between 22:55 and 04:50[30]. These times refer to aircraft stand (gate) times rather than actual runway movements.

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[28] https://www.gov.uk/government/consultations/draft-heathrow-expansion-national-policy-statement-proposed-amendments

[29] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/440316/airports-commission-final-report.pdf

[30] https://www.heathrow.com/company/local-community/noise/operations/night-flights

5.6 A limitation of using LAeq,8h for the sensitivity test is that the metric still captures the 06:00 to 07:00 period, a period to which most flights affected by the ban are expected to be rescheduled.

5.7 Therefore, across the 8-hour night metric, the ban is not expected to significantly reduce impacts in practice, as most flights would move within the final hour. However, the assumed ban does reduce exposure during the most sensitive night-time periods (before 06:00).

5.8 Therefore in the modelling, rather than moving the flights from the assumed ban period to 06:00 to 07:00 (which would not show any impacts across the 8h metric), it's assumed that flights are removed altogether[31] in order to better reflect the reality of noise improvements during the night-time period in the absence of being able to assess noise impacts on a shorter metric).

5.9 The results show that, across all modelled years, the NFB reduces estimated impacts across all metrics within the 45 dB LAeq8h contours compared to a scenario without the ban. By 2055, the ban will reduce the affected area by 7%, from 147 km² to 137 km². The number of affected individuals decreases by 13%, from 614,400 to 536,800, while the number of affected households also decreases by 13%, from 264,000 to 228,600.

5.10 Figure 5-1 compares the 2055 45 dB LAeq,8h 3R contours with and without NFB as the sensitivity is intended to assess the change between these scenarios. Figures 5-2, 5-3, and 5-4 similarly show the resulting changes in estimated affected area, population, and households, respectively, for all modelled years.

[31] These flights were not remodelled during the daytime because their impact would be insignificant given the scale of flights during the day.

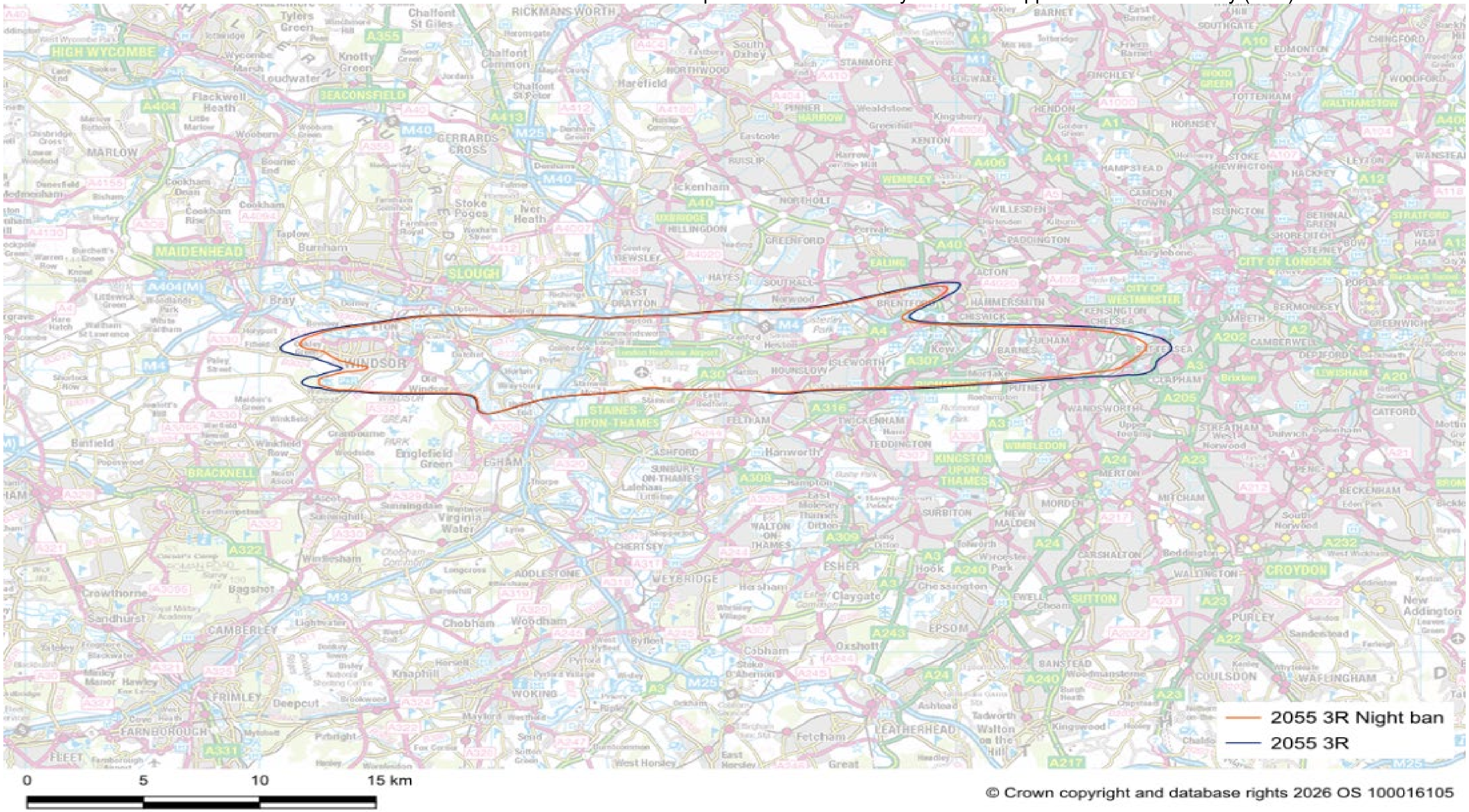

Figure 5-1: Comparison of 2055 45 dB LAeq,8h Contours between 3R With and Without NFB (CT)

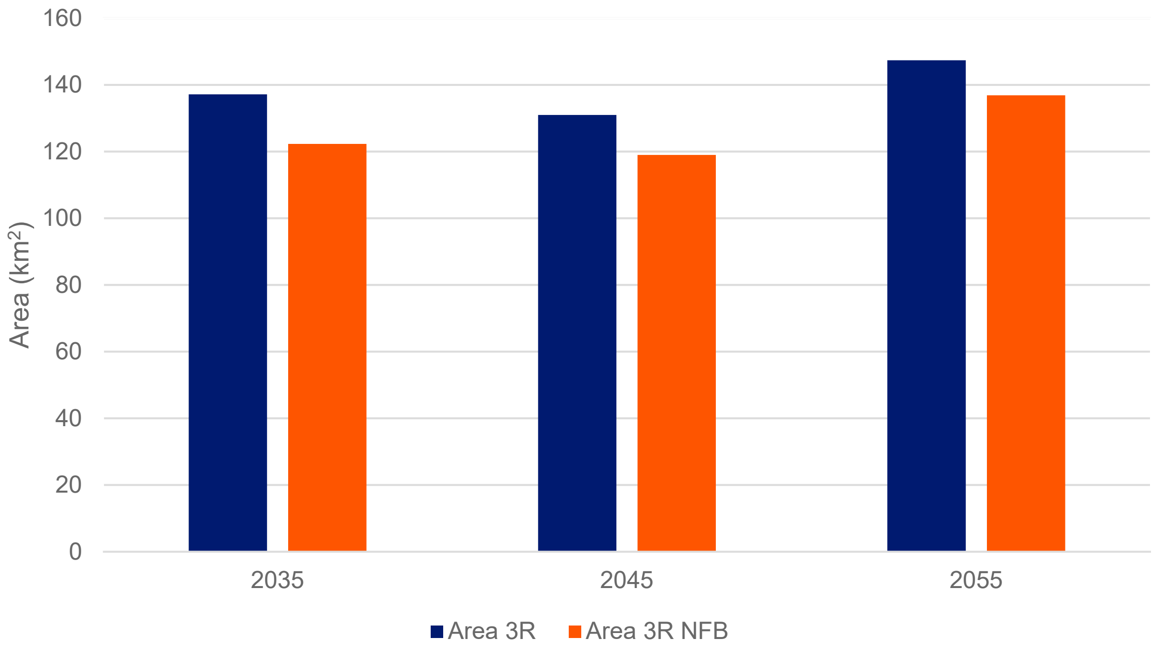

Figure 5-2: Comparison of Area Exposed to >45 dB LAeq,8h between 3R With and Without NFB (CT)

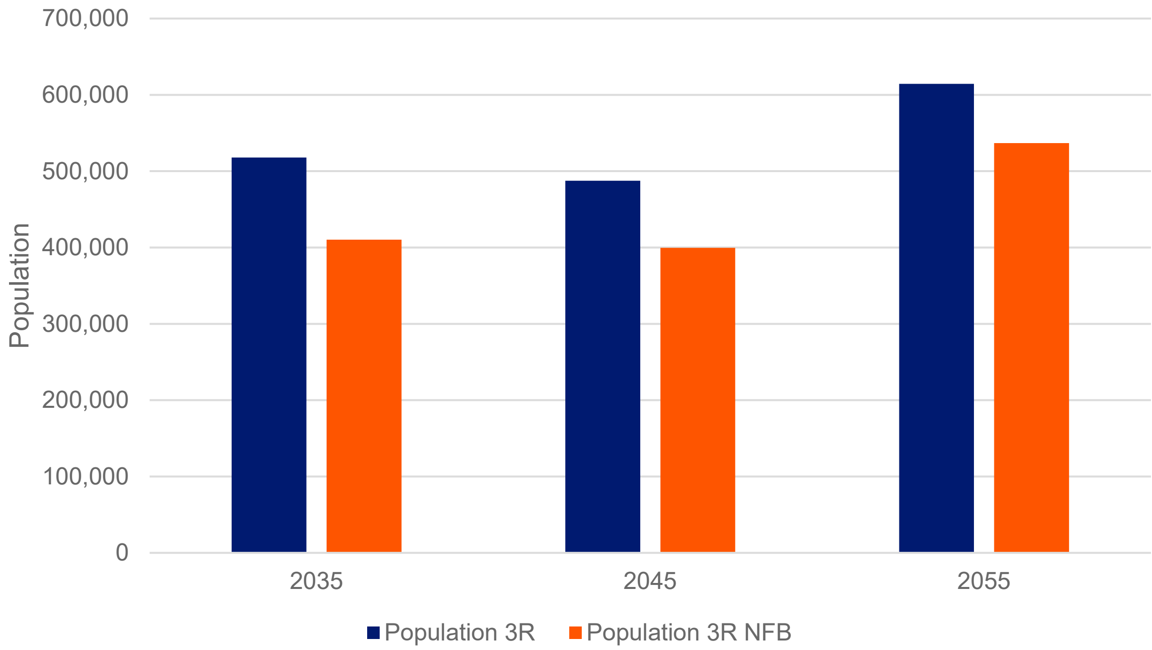

Figure 5-3: Comparison of Population Exposed to >45 dB LAeq,8h between 3R With and Without NFB (CT)

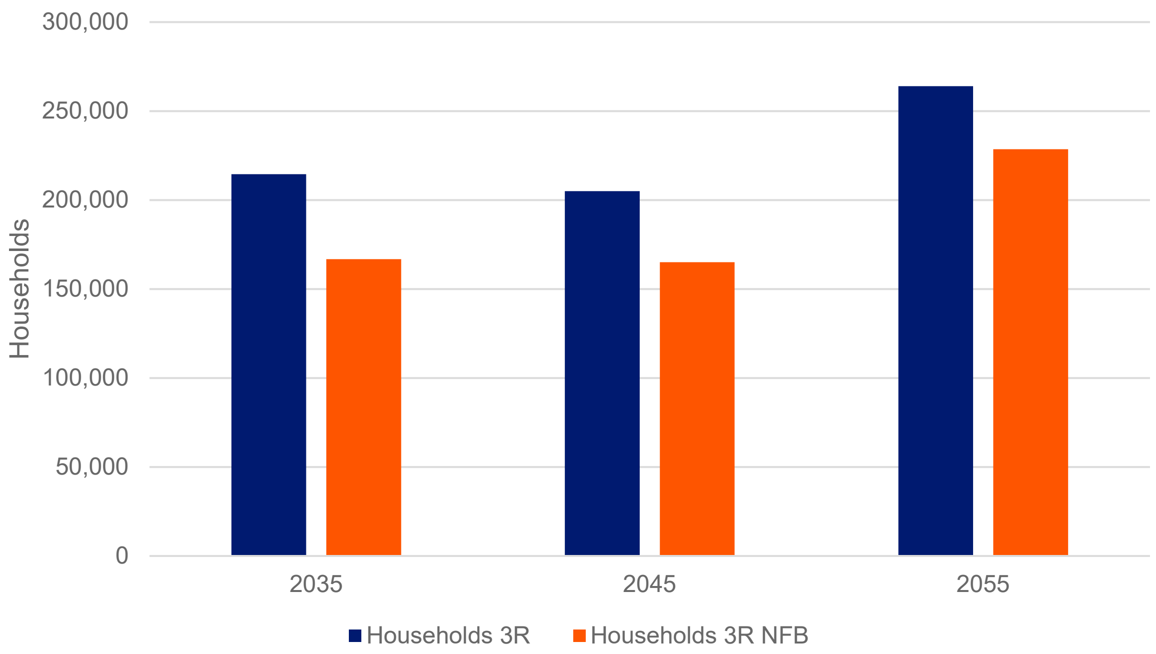

Figure 5-4: Comparison of Households Exposed to >45 dB LAeq,8h between 3R With and Without NFB (CT)

5.11 By 2055, the ban reduces the number of NSBs exposed by 12%, from 595 to 525. Places of worship experience the largest percentage decrease, at 13%. There was a decrease across all categories, except hospital buildings.

5.12 Tables 5-1 and 5-2 together provide a comprehensive comparison of the 3R scenarios across modelled years at 45 dB LAeq,8h, with and without NFB. Table 5-1 covers area, population, and households, while Table 5-2 presents NSBs by type.

Scenario	Area (km^2)	Population	Households
2019	170	808,500	332,300
2024	154	740,000	305,400
2035 3R	137	517,900	214,500
2045 3R	131	487,500	205,000
2055 3R	147	614,400	264,000
2035 3R NFB	122	410,400	166,800
2045 3R NFB	119	399,600	165,100
2055 3R NFB	137	536,800	228,600

Table 5-1: Full Comparison of Estimated Exposure (Area, Population, and Households) at >45 dB LAeq,8h with and without NFB (CT)

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	13	477	20	338	848
2035 3R	8	296	12	210	526
2045 3R	7	276	11	198	492
2055 3R	9	334	13	239	595
2035 3R NFB	7	233	8	166	414
2045 3R NFB	7	224	8	157	396
2055 3R NFB	9	297	12	207	525

Table 5-2: Comparison of NSBs Exposed to >45 dB LAeq,8h between 3R With and Without NFB (CT)

Testing Lower Noise Assessment Levels

5.13 The findings of the Aviation Noise Attitudes Survey (ANAS)[32] and Aviation Night Noise Effects (ANNE)[33] study indicate that individuals are more annoyed by aviation noise at lower levels of exposure than previous evidence indicated.

5.14 World Health Organisation guidance introduces the concept of setting the adverse effects threshold where 10% of people are highly annoyed.[34] On this basis, findings from ANAS suggest that adverse effects could be measured at 43 dB LAeq,16h, while evidence from ANNE indicates a threshold of 43 dB LAeq,8h. Previous evidence informing current Government policy sets exposure levels at a higher level of 51 dB LAeq,16h and 45 LAeq,8h and results presented so far in this report have been to these levels.

5.15 Although the Government aviation noise policy has yet to be reviewed in light of the newly published evidence, modelling has been undertaken at these levels as a sensitivity test to demonstrate the potential effects of lowering the assessment thresholds.

5.16 Analysis of the results at these levels shows that, although the area assessed (and therefore the corresponding impacts) is greater, the noise impact in a 3R scenario in 2055 is still lower than in 2024.

5.17 For instance, in the 2055 3R, the estimated affected area assessed increases nearly fourfold, from 211 km² at 51 dB LAeq,16h to 840 km² at 43 dB LAeq,16h. However, at the same time, the area affected in 2024 increases nearly fivefold, from 232 km² at 51 dB LAeq,16h to 1,110 km² at 43 dB LAeq,16h.

5.18 The increase in area assessed and corresponding impacts is greater for daytime (LAeq,16h) than for night-time (LAeq,8h) because the movement from current policy to the assessment thresholds that the findings of these studies suggest is larger.

[32] https://www.caa.co.uk/data-and-publications/publications/documents/content/cap3131/
[33] https://www.gov.uk/government/publications/aviation-night-noise-effects-anne-study
[34] WHO 2018

5.19 By 2055, under the 3R scenario, the 43 dB $L_{Aeq,16h}$ contour covers an estimated 840 km². This is 42% larger than under the 2R scenario (591 km²) but 24% smaller than in 2024 (1,110 km²). The contour is estimated to include 3,405,000 individuals and 1,495,000 households, representing increases of 33% for both metrics compared with the 2R scenario (2,560,000 individuals and 1,125,000 households). However, this remains below 2024 estimates (4,650,000 people and 1,876,000 households), a decrease of 27% in total individuals and 20% in total households. Figure 5-5 compares these contours on a map.

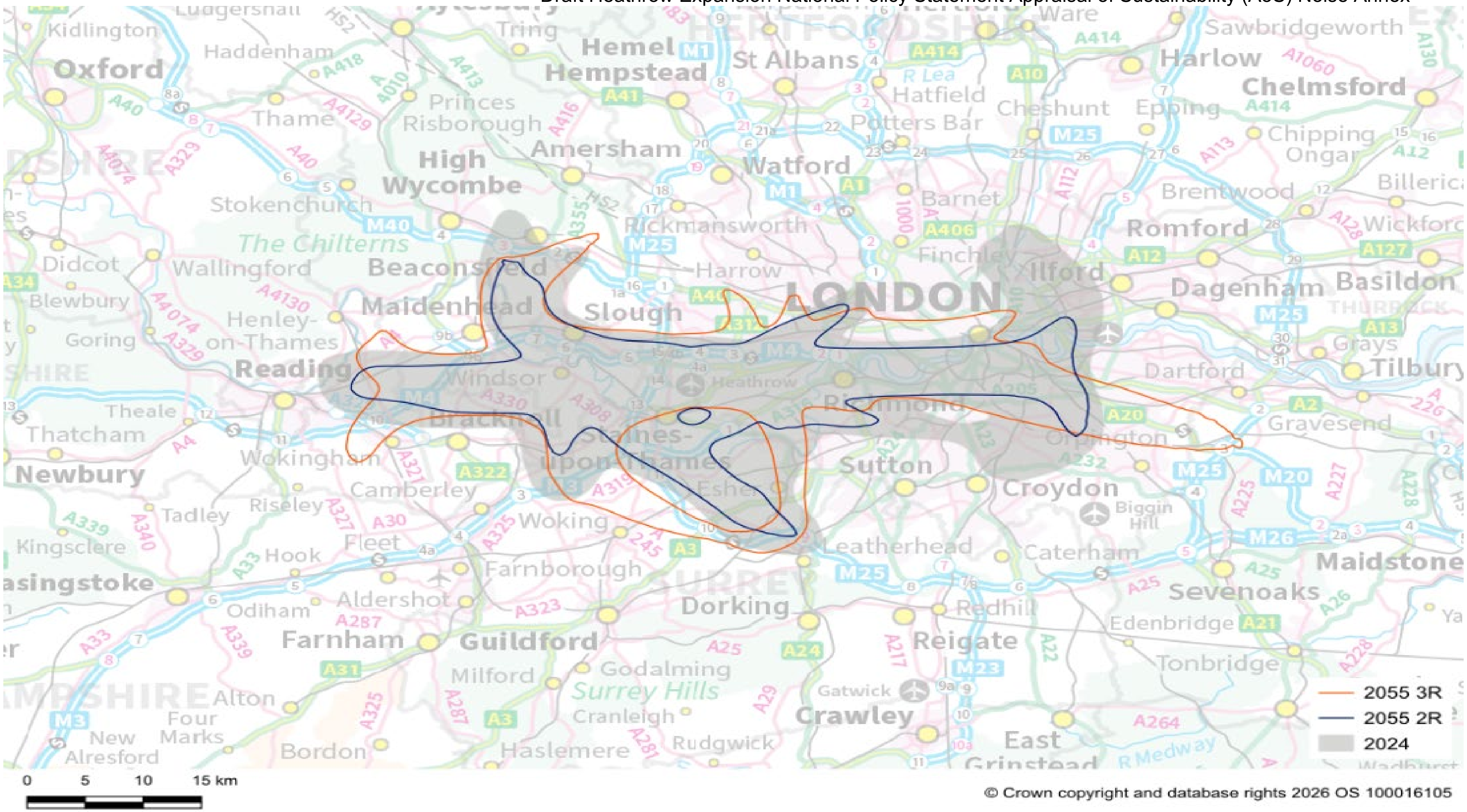

Figure 5-5: Comparison of 43 dB LAeq,16h Noise Contours for 2024 and 2055 (CT)

5.20 The contour is estimated to include 3,775 NSBs, a 46% increase on the 2R (2,580) but a decrease of 30% on 2024 (5,421). Higher Education buildings experience the largest percentage increase (155%) compared with the 2R, with the number exposed rising from 77 to 196, while Schools exhibited the greatest percentage decrease (33%) compared with 2024, falling from 3,094 to 2,073. Overall, all categories show increases relative to 2R, although Hospital buildings and Higher Education buildings also show increases compared with 2024, rising from 36 to 88 and from 177 to 196, respectively. As with all results, the number of NSBs affected is geospatially sensitive; consequently, some categories record more NSBs in the 3R compared to 2024, despite a smaller overall contour area, due to their uneven spatial distribution.

5.21 Tables 5-3 and 5-4 together provide a comprehensive comparison between scenarios across modelled years at 43 dB LAeq,16h, with Table 5-3 covering area, population, and households, and Table 5-4 presenting NSBs by type.

Scenario	Area (km^2)	Population	Households
2024	1,110	4,650,000	1,876,000
2035 2R	881	3,602,000	1,528,000
2045 2R	710	3,031,000	1,319,000
2055 2R	591	2,560,000	1,125,000
2035 3R	826	3,184,000	1,360,000
2045 3R	801	3,248,000	1,416,000
2055 3R	840	3,405,000	1,495,000

Table 5-3: Full Comparison of Estimated Exposure (Area, Population, and Households) to >43 dB LAeq,16h (CT)

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	77	3,094	177	2,073	5,421
2035 2R	49	2,209	107	1,455	3,820
2045 2R	40	1,787	89	1,167	3,083
2055 2R	36	1,494	77	973	2,580
2035 3R	76	2,023	186	1,392	3,677
2045 3R	79	2,003	187	1,377	3,646
2055 3R	88	2,073	196	1,418	3,775

Table 5-4: Comparison of Estimated NSBs Exposed to >43 dB LAeq,16h (CT)

5.22 By 2055, under the 3R scenario, the 43 dB LAeq,8h contour covers an estimated 199 km². This is 42% larger than under the 2R scenario (140 km²) but 4% smaller than in 2024 (209 km²). The contour is estimated to include 936,100 individuals and 408,100 households, representing increases of 22% in total individuals and 21% in total households compared with the 2R scenario (769,000 individuals and 337,200 households). However, this remains below 2024 estimates (1,018,000 people and 421,200 households), a decrease of 8% in total individuals and 3% in total households. Figure 5-6 compares these contours on a map.

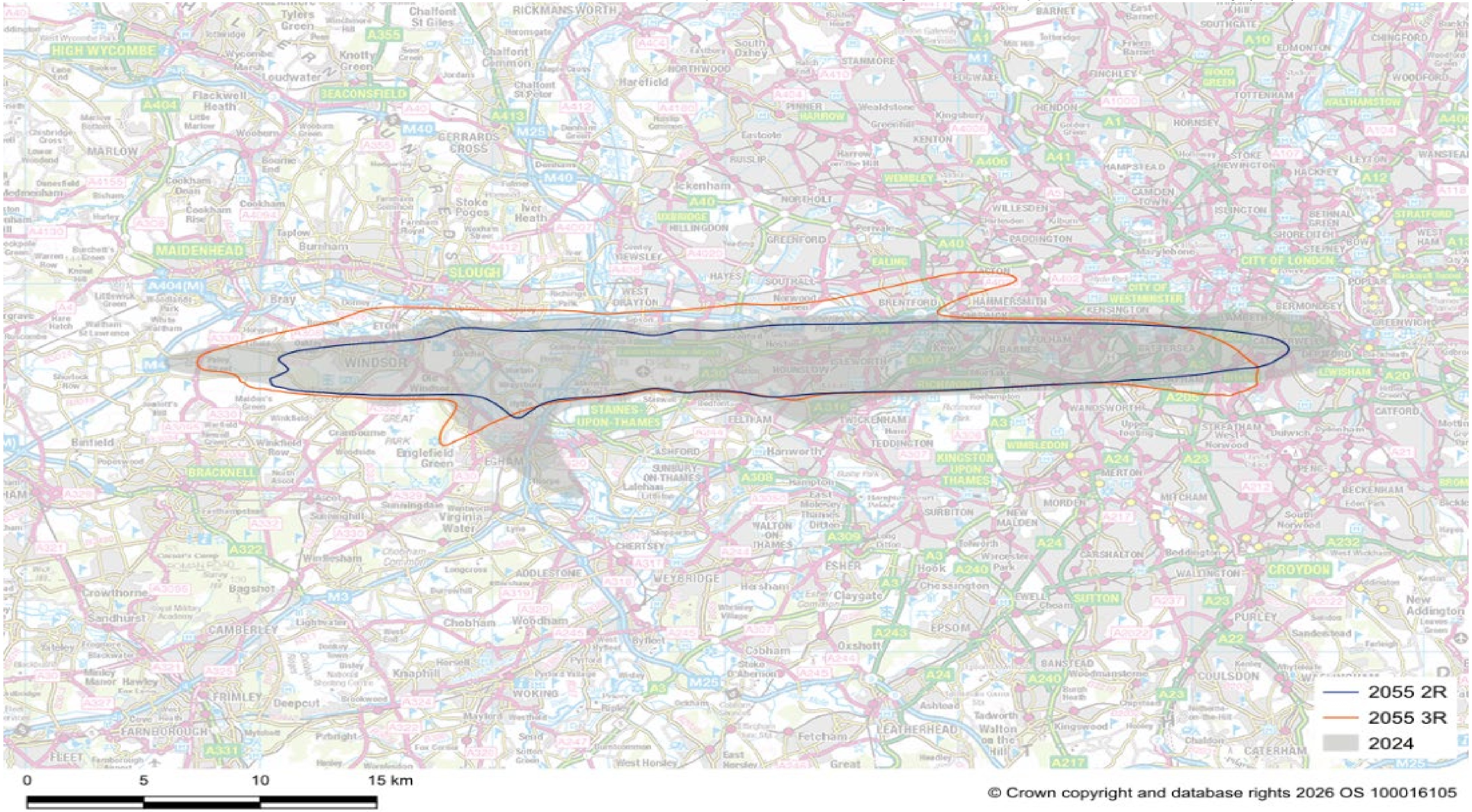

Figure 5-6: Comparison of 43 dB LAeq,8h Noise Contours for 2024 and 2055 (CT)

5.23 The contour is estimated to include 944 NSBs, a 21% increase on 2R (780) but a decrease of 20% relative to 2024 (1,178). Places of Worship experience the largest percentage increase (23%) compared to the 2R, with the number exposed rising from 315 to 388, while Higher Education buildings exhibit the greatest percentage decrease (26%) compared to 2024, falling from 31 to 23. Overall, all categories show increases relative to 2R and decreases relative to 2024.

5.24 Tables 5-5 and 5-6 together provide a comprehensive comparison between scenarios across modelled years at 43 dB LAeq,8h, with Table 5-5 covering area, population, and households, and Table 5-6 presenting NSBs by type.

Scenario	Area (km^2)	Population	Households
2019	233.5	1,121,000	462,600
2024	209	1,018,000	421,200
2035 2R	173	936,300	400,600
2045 2R	150	812,800	353,900
2055 2R	140	769,100	337,200
2035 3R	186	806,800	342,200
2045 3R	176	754,700	325,000
2055 3R	199	936,100	408,100

Table 5-5: Full Comparison of Estimated Exposure (Area, Population, and Households) to >43 dB LAeq,8h (CT)

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	16	662	31	469	1,178
2035 2R	15	566	23	397	1,001
2045 2R	14	461	21	341	837
2055 2R	12	434	19	315	780
2035 3R	13	462	22	346	843
2045 3R	13	430	17	316	776
2055 3R	13	520	23	388	944

Table 5-6: Comparison of Estimated NSBs Exposed to >43 dB LAeq,8h (CT)

6. Summary of Technology Development Results

5.25 Section 6 sets out the results for the Technology Development (TD) scenario, which assumes further advancements in aviation technology. It compares outcomes for TD 3R primarily with the CT 3R scenario to show the variance in impacts relative to the central case. A comparison to the TD 2R and the 2024 baseline outputs is in the data tables. Results are presented for the standard assessment years, with an additional year (2060) included to reflect extended demand forecast outputs under the TD scenario.

5.26 For this noise modelling, the TD scenario affects:

- Demand forecasts, by increasing the rate at which newer existing aircraft variants are introduced.
- Demand forecasts through future aircraft entry-into-service timelines, with more optimistic assumptions accelerating the rate at which future aircraft enter the fleet mix.
- Noise performance assumptions, as changes in entry-into-service dates alter the level of noise improvement applied to future aircraft, as outlined in Section 2.

5.27 Using TD inputs in place of CT inputs results in only minor variations in the estimated area, population, households, and NSBs within the modelled 3R contour bands for the standard assessment years, as the more optimistic assumptions do not materially influence the overall outcomes.

5.28 In some cases, earlier entry-into-service dates result in lower levels of ongoing technological improvement being applied to certain future aircraft compared to the CT Scenario, consistent with the methodology outlined in Section 2. This means that, despite the fleet composition shifting earlier towards these future aircraft, overall noise improvements may not necessarily exceed those in the CT Scenario.

5.29 It should be noted that the TD scenario also affects the 2R, thereby influencing the relative change between the 3R and the 2R.

5.30 By 2055, the 3R TD is comparable to the daytime 3R CT values; however, there are relatively significant decreases during the night-time period.

5.31 By 2060, the 3R TD scenario shows a clearer reduction in estimated exposure compared with the 2055 3R CT scenario. As 2060 is not modelled under the CT scenario, it is not possible to determine the extent to which similar improvements might have occurred by that point in any case. In addition, the population and household data used for the 2060 modelling are based on 2055 figures, so the 2060 estimates for these metrics may be slightly underestimated.

Summer Day (LAeq,16h)

5.32 By 2055, under the TD 3R scenario, the estimated contour area for the 51 dB LAeq,16h is 208 km². This represents a 1% reduction compared with CT 3R (211 km²). It also represents a 49% increase compared with TD 2R (140 km²) and a 10% reduction compared with 2024 levels (232 km²). Figure 6-1 compares these contours on a map, whilst Figure 6-2 compares the estimated area covered throughout all modelled years.

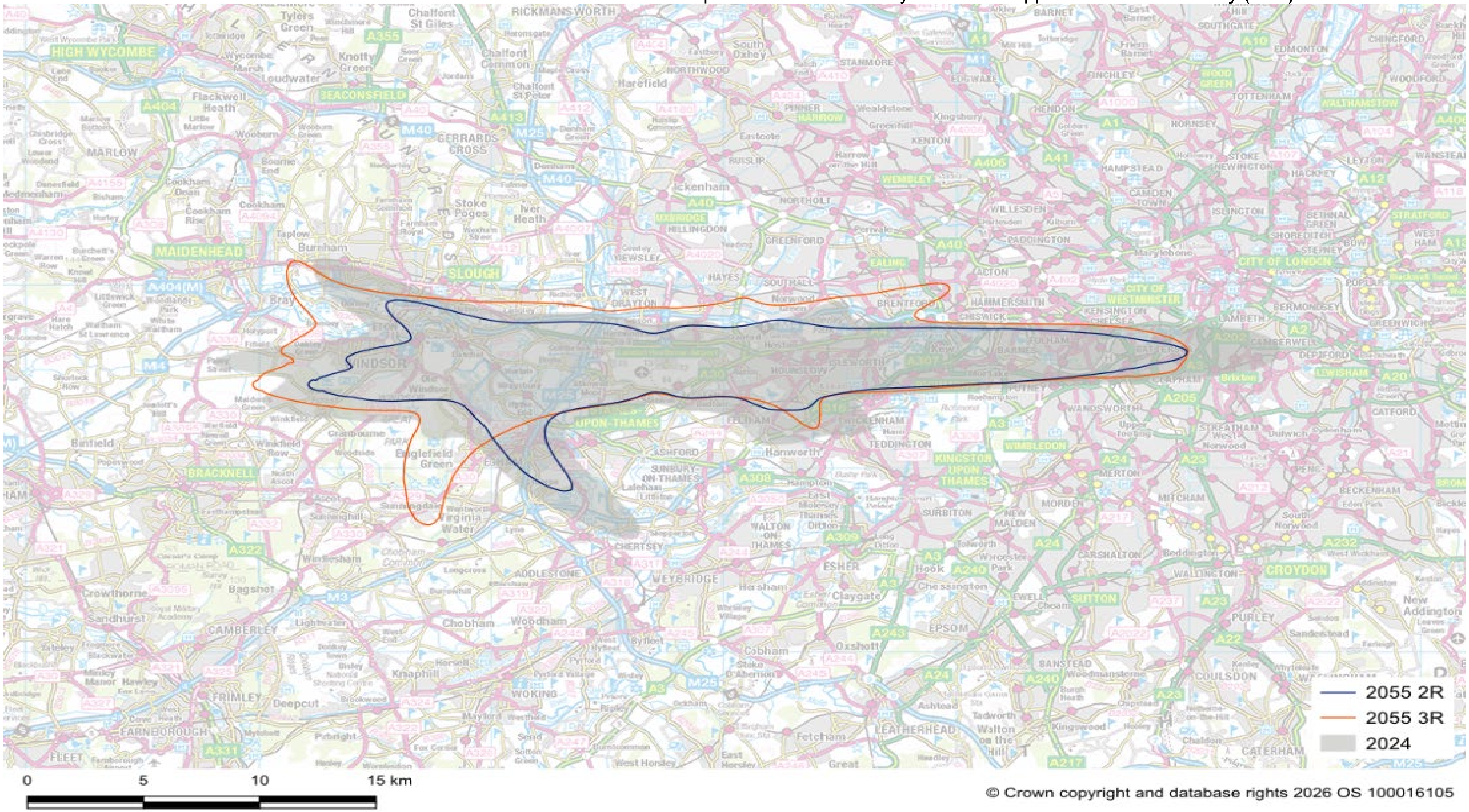

Figure 6-1: Comparison of 51 dB LAeq,16h Noise Contours for 2024 and 2055 (TD

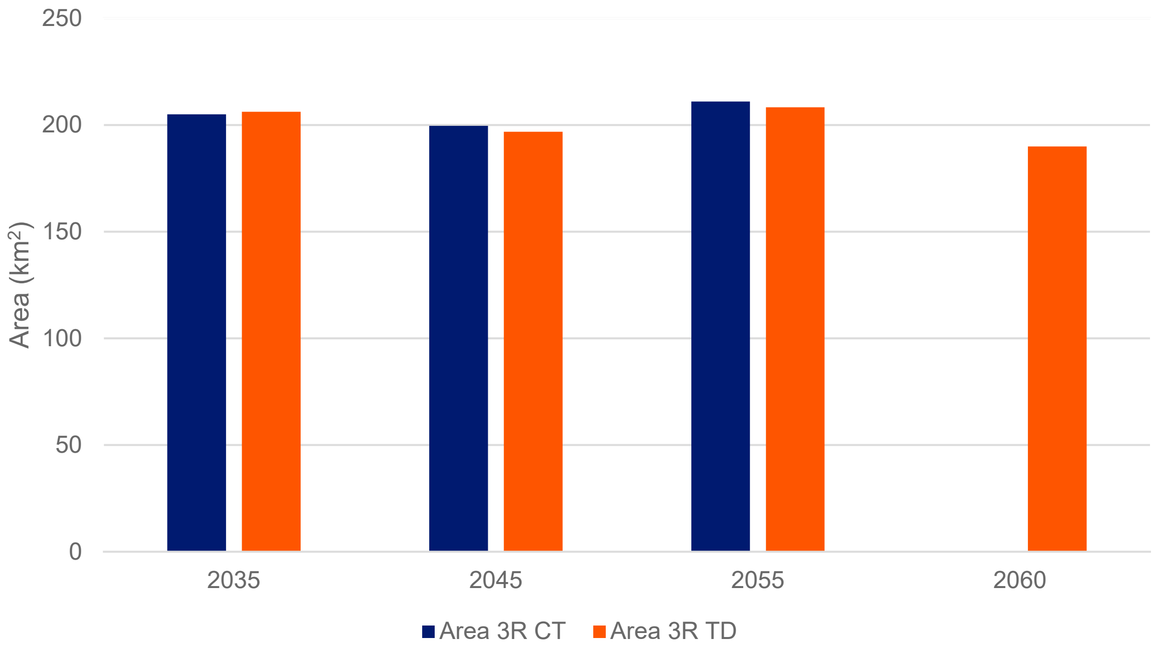

Figure 6-2: Comparison of Estimated Area Exposed to >51 dB LAeq,16h (TD)

5.33 This contour is estimated to include 741,600 individuals and 315,400 households. For the number of affected individuals, this represents no change compared with CT 3R, a 35% increase compared with TD 2R (550,100), and a 16% decrease compared with 2024 (884,000). For the number of affected households, this represents a 0.1% increase compared with CT 3R (315,100), a 35% increase compared with TD 2R (233,500) and a 12% decrease compared with 2024 (359,700). Figure 6-3 compares the estimated exposed population across modelled years, while Figure 6-4 compares the estimated number of households.

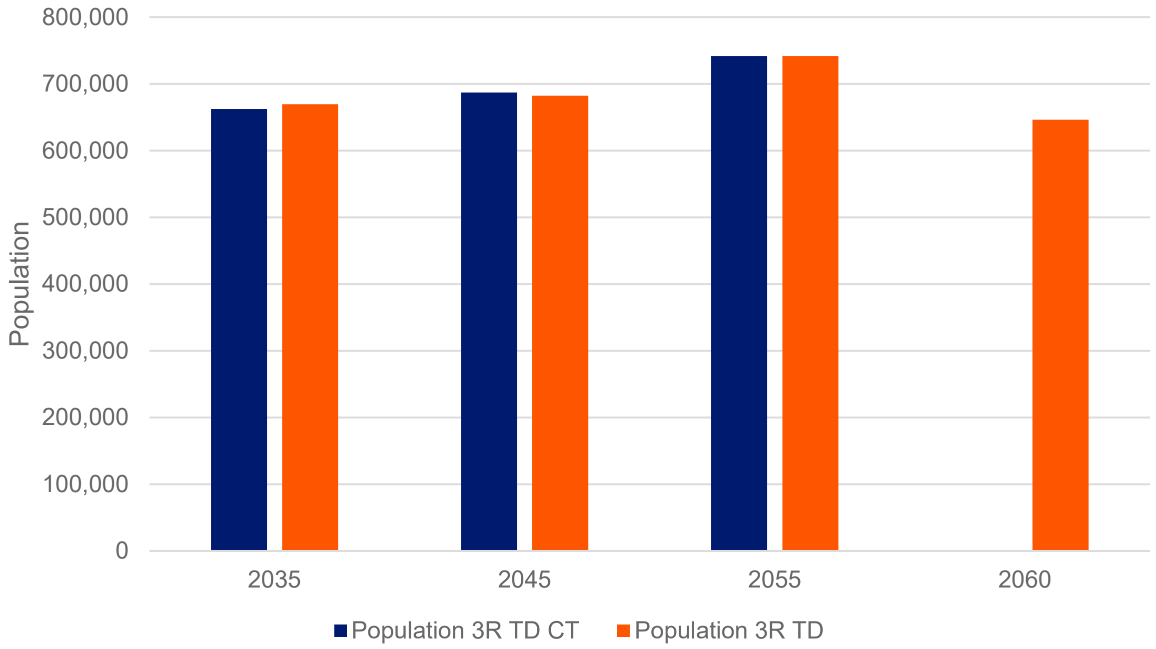

Figure 6-3: Comparison of Estimated Population Exposed to >51 dB LAeq,16h (TD)

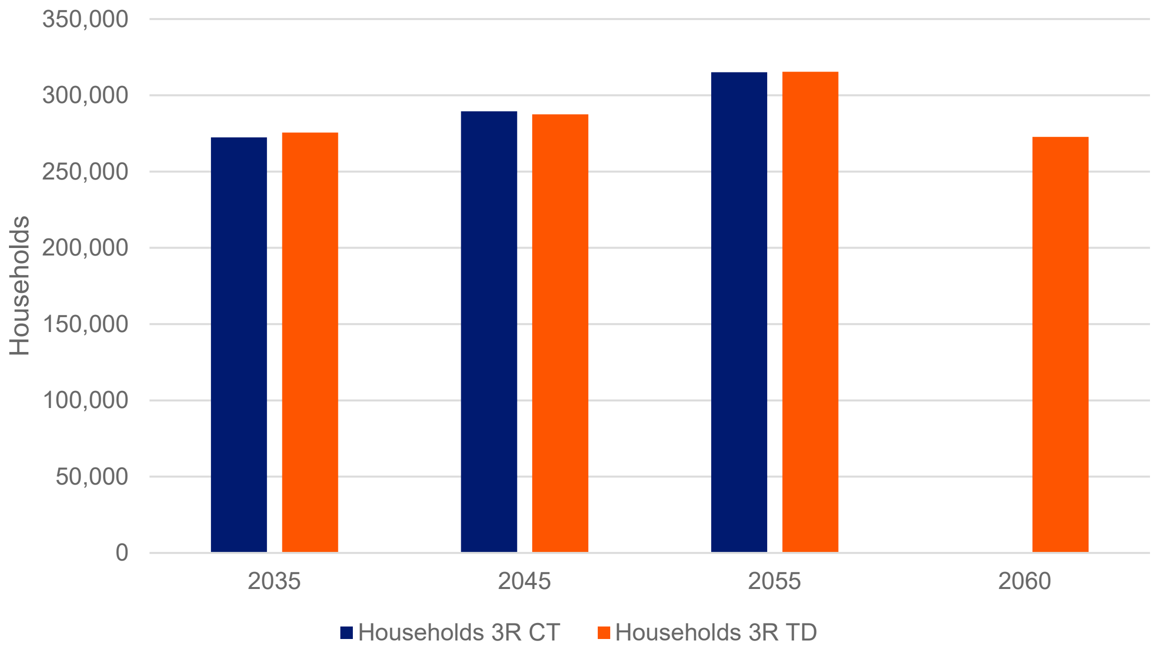

Figure 6-4: Comparison of Estimated Households Exposed to >51 dB LAeq,16h (TD)

5.34 The contour is estimated to include 716 NSBs, representing a marginal 0.3% increase on the CT 3R (714), a 34% increase on the 2R (536), and a 28% decrease on 2024 (1,001). Overall, all categories show increases relative to 2R and decreases relative to 2024.

5.35 Tables 6-1 and 6-2 together provide a comprehensive comparison between scenarios across modelled years at 51 dB LAeq,16h, with Table 6-1 covering area, population, and households, and Table 6-2 presenting NSBs by type.

Scenario	Area (km^2)	Population	Households
2019	287	1,016,000	413,300
2024	232	884,000	359,700
2035 2R	195	834,300	350,100
2045 2R	161	667,800	284,000
2055 2R	140	550,100	233,500
2060 2R	128	478,800	201,700
2035 3R	206	669,400	275,600
2045 3R	197	682,100	287,500
2055 3R	208	741,600	315,400
2060 3R	190	646,300	272,700

Table 6-1: Full Comparison of Estimated Exposure (Area, Population, and Households) to >51 dB LAeq,16h (TD)

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	15	569	25	392	1001
2035 2R	11	487	22	345	865
2045 2R	7	380	14	264	665
2055 2R	6	309	11	210	536
2060 2R	6	265	10	185	466
2035 3R	9	381	13	254	657
2045 3R	10	384	13	265	672
2055 3R	11	413	13	279	716
2060 3R	9	352	13	240	614

Table 6-2: Comparison of Estimated NSBs Exposed to >51 dB LAeq,16h (TD)

Summer Night (LAeq,8h)

5.36 By 2055, under the TD 3R scenario, the estimated contour area for the 45 dB LAeq,8h is 141 km^2. This represents a 4% reduction compared with CT 3R (147 km^2), a 43% increase compared with TD 2R (98 km^2), and an 8% reduction compared with 2024 levels (154 km^2). Figure 6-5 compares these contours on a map, whilst Figure 6-6 compares the estimated area covered throughout all modelled years.

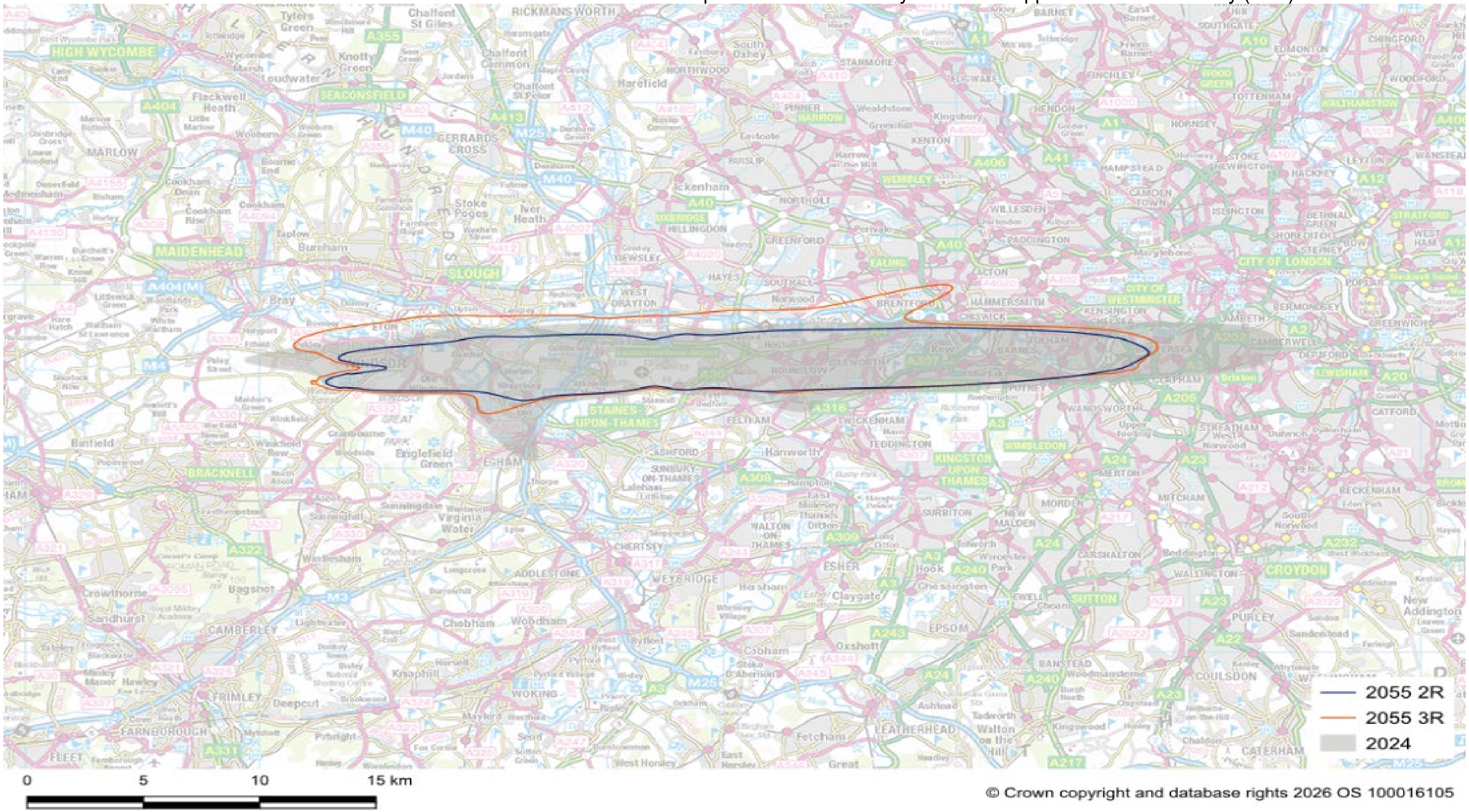

Figure 6-5: Comparison of 45 dB LAeq,8h Noise Contours for 2024 and 2055 (TD)

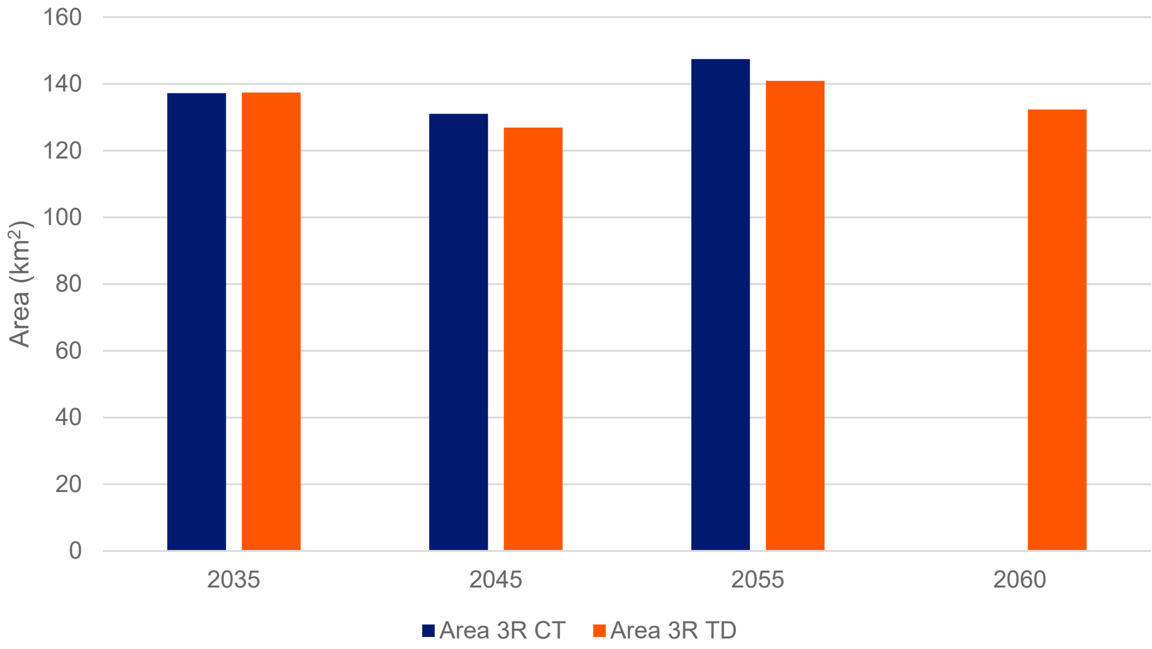

Figure 6-6: Comparison of Estimated Area Exposed to >45 dB LAeq,8h (TD)

5.37 This contour is estimated to include 564,500 individuals and 240,900 households. For the number of affected individuals, this is a decrease of 8% on the CT 3R (614,400), a 28% increase on the TD 2R (440,100) and a 24% decrease compared with 2024 (740,000). For the number of affected households, this is a decrease of 9% on the CT 3R (264,000), a 28% increase on the TD 2R (188,100) and a 21% decrease compared with 2024 (305,400). Figure 6-7 compares the estimated exposed population across modelled years, while Figure 6-8 compares the estimated number of households.

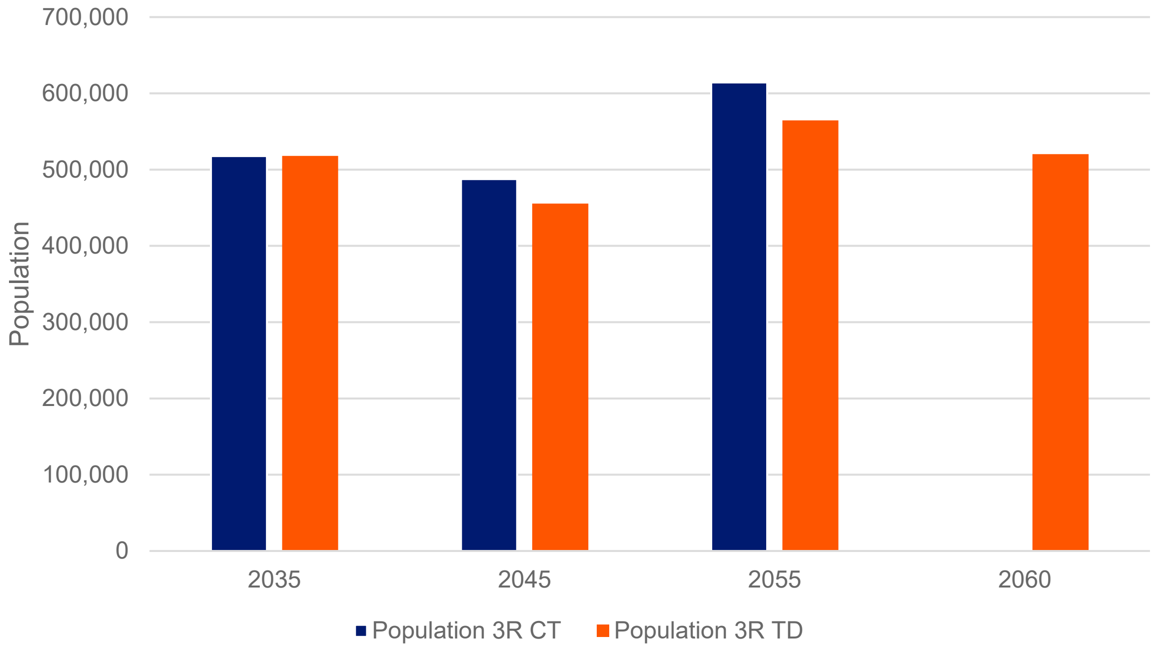

Figure 6-7: Comparison of Estimated Population Exposed to >45 dB LAeq,8h (TD)

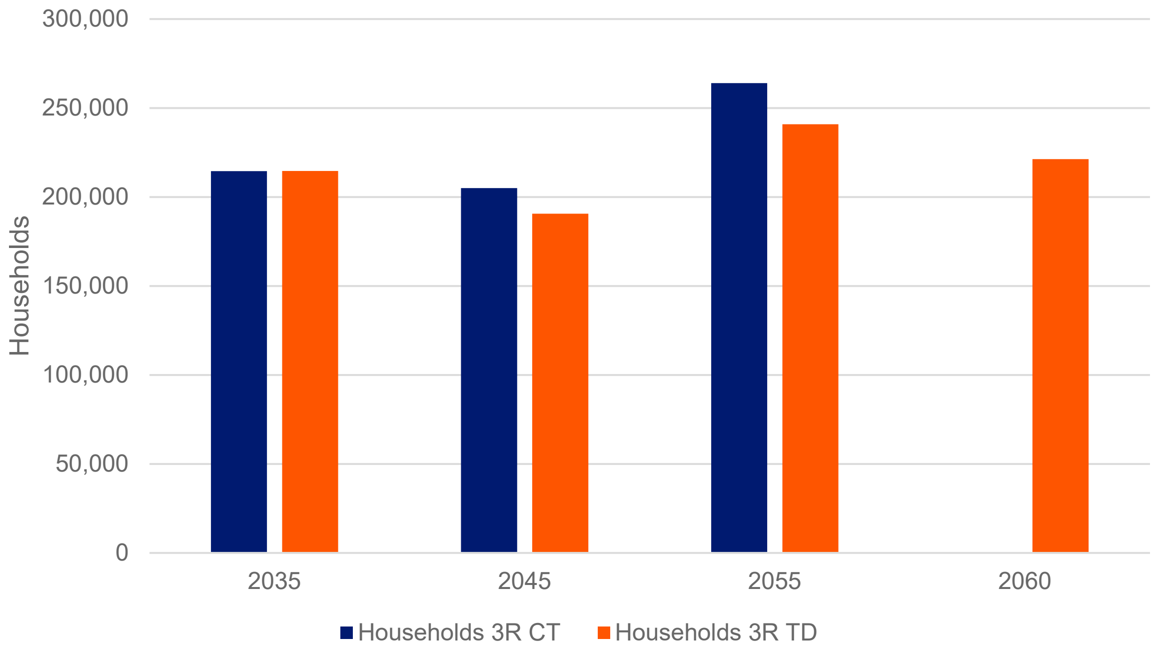

Figure 6-8: Comparison of Estimated Households Exposed to >45 dB $L_{Aeq,8h}$ (TD)

5.38 The contour is estimated to include 546 NSBs, representing an 8% decrease on the CT 3R (595), a 26% increase on the 2R (435), and a 36% decrease on 2024 (848). Overall, all categories show increases relative to 2R and decreases relative to 2024.

5.39 Tables 6-3 and 6-4 together provide a comprehensive comparison between scenarios across modelled years at 45 dB LAeq,8h, with Table 6-3 covering area, population, and households, and Table 6-4 presenting NSBs by type.

Scenario	Area (km^2)	Population	Households
2019	170	808,500	332,300
2024	154	740,000	305,400
2035 2R	128	643,500	273,400
2045 2R	110	518,600	221,700
2055 2R	98	440,100	188,100
2060 2R	93	400,500	170,200
2035 3R	137	518,100	214,600
2045 3R	127	455,400	190,600
2055 3R	141	564,500	240,900
2060 3R	132	520,300	221,300

Table 6-3: Full Comparison of Estimated Exposure (Area, Population, and Households) to >45 dB LAeq,8h (TD)

Scenario	Hospital	School	Higher Education	Place of Worship	Total
2024	13	477	20	338	848
2035 2R	11	366	14	266	657
2045 2R	6	292	11	206	515
2055 2R	6	248	9	172	435
2060 2R	6	225	9	155	395
2035 3R	8	297	12	210	527
2045 3R	7	263	8	186	464
2055 3R	9	311	12	214	546
2060 3R	8	284	11	203	506

Table 6-4: Comparison of Estimated NSBs Exposed to >45 dB LAeq,8h (TD)

Glossary

Term	Description
ANCON	UK Civil Noise Contour Model used to undertake local noise modelling.
ATM	Air Transport Movement - The total number of aircraft take-offs and landings at an airport.
CAA	UK Civil Aviation Authority
Current Trends (CT)	Central scenario assuming passenger behaviour follows current trends and patterns.
dB (Decibel)	A logarithmic unit used to measure sound levels or changes of sound level.
EIS	Entry into service year of aircraft used to model future fleet composition.
ICAO	International Civil Aviation Organization
LAeq	A-weighted Equivalent Continuous Sound Level representing the average noise level experienced over a defined period. Measurements are always in decibels (dB).
LAeq,16h	The LAeq for daytime noise measured between 07:00 and 23:00. Historically measured over the 92-day summer period from 16 June to 15 September inclusive.
LAeq,8h	The LAeq for night-time noise measured between 23:00 and 07:00. Historically measured over the 92-day summer period from 16 June to 15 September inclusive.
LOAEL	Lowest Observed Adverse Effect Level – The level above which noise can be considered to have adverse effects on

Term	Description
	health and quality of life at a community level.
Noise Contours	Lines or circles on a map showing where equal levels of noise are experienced.
NSBs	Noise-sensitive buildings such as hospitals, schools, and places of worship.
Technology Development (TD)	Scenario representing impacts of further aviation technology development, particularly decarbonisation.