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8.36 Noise Envelope - Improvements and worked example

Infrastructure Planning (Examination Procedure) Rules 2010

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The Planning Act 2008

The Infrastructure Planning (Examination Procedure) Rules 2010

**London Luton Airport Expansion Development Consent
Order 202x**

8.36 Noise Envelope - Improvements and worked example

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1 PURPOSE OF THIS PAPER

- 1.1.1 The Noise Envelope (NE) within the **Green Controlled Growth (GCG) Framework [APP-218]**, combined with the expanded Noise Insulation policy (**Draft Compensation Policies, Measures and Community First [AS-128]**), are the principal control mechanisms for aircraft ‘air noise’ within the DCO. The noise assessment in **Chapter 16 of the Environmental Statement (ES) [REP1-003]** evidences how the NE and expanded noise insulation policy can be relied on to meet Government noise and aviation policy building on the work of the Noise Envelope Design Group (NEDG).
- 1.1.2 Nevertheless, the Host Authorities, through the Initial Statements of Common Ground (SoCGs) **[TR0200001/APP/8.13-8.18]**, their Relevant Representations **[RR-0876, RR-0210, RR-0558, RR-1119, RR-0297]**, their Written Representations **[REP1-069]** and their Local Impact Reports **[REP1-002, REP1A-003]** have requested further information on how the NE can effectively avoid breaches such as those that occurred in 2017-2019.
- 1.1.3 The Examining Authority (ExA) has raised GCG and the NE as one of the principal issues for the Examination of the DCO application in their **Rule 8 Letter [PD-008]**.
- 1.1.4 This paper therefore provides a worked example which can be used to reasonably conclude that the NE would have avoided the historic breaches that occurred in 2017-2019, and in response to representations received introduces three improvements to the NE that will be implemented at Deadline 3 to increase its effectiveness.
- 1.1.5 The content of this paper is as follows:
- a. Provides background on the NE and the already proposed components that would prevent breaches of noise Limits (**Section 2**);
 - b. Provides detailed reasons for the noise contour cap breaches in 2017-2019 (**Section 3**);
 - c. Sets out the actions taken by the airport operator to prevent noise contour limit breaches, and hence the lessons learnt from the 2017 – 2019 breaches in terms of the effectiveness of the noise conditions imposed by the current planning permission, and how this has informed improvement of the NE (**Section 4**);
 - d. **Identifies three improvements to the NE that will be implemented at Deadline 3 to increase the effectiveness of the NE in avoiding breaches (Section 5);** and
 - e. Provides, as requested, a worked example which can be used to reasonably conclude that the NE would have avoided the historic breaches that occurred in 2017-2019 (**Section 6**).

2 BACKGROUND

- 2.1.1 The NE is defined within the **Green Controlled Growth (GCG) Framework [APP-218]**.
- 2.1.2 In its Final Report, the NEDG noted at paragraph 57 (reference Annex A of **Appendix 16.2 of the ES [APP-111]**) “... *there had been some breaches of current noise limits at the airport in recent years. It suggested that LR (Luton Rising) might show how these breaches would not have occurred had the Noise Envelope process already been in place.*”
- 2.1.3 The Applicant responded to this suggestion in Annex B of **Appendix 16.2 of the ES [APP-111]**. The response sets out that:
- 2.1.4 “... *the NEDG welcomes the proposals for an independent group (the Environmental Scrutiny Group – ESG) that will hold the airport operator to account with regard to its environmental performance and the concept of setting up of a noise Technical Panel to inform ESG decision making.*”
- 2.1.5 “*A fundamental principle of the GCG Framework is that, as the magnitude of noise effect increases, a series of checks are implemented as the airport continues to grow. This is intended to ensure that the extent to which an effect is occurring can be controlled as it approaches a GCG Limit, with the ultimate intention that the Limit is not exceeded.*”
- 2.1.6 “*If noise rises above the Thresholds, increasing action and oversight by the ESG and noise Technical Panel is triggered to avoid the Limit being breached.*”
- 2.1.7 “*Forward planning is key to avoiding breaches as much as the retrospective annual compliance monitoring and reporting required by GCG. To support this ... the airport operator will adopt the AEDT noise model used to prepare the Environmental Statement. This ‘DCO noise model’ will then be maintained and used as the basis for planning for growth and noise control at the airport to ensure that future noise forecasts can be consistently compared with the noise Limits and Thresholds set by the DCO using the same model (comparing ‘like with like’). The model will also be subject to the periodic review ..., which creates the opportunity to supersede previously agreed monitoring methods where agreed between ESG and the airport operator (please refer to the Aircraft Noise Monitoring Plan in Appendix C of the Green Controlled Growth Framework.*” **[APP-221]**
- 2.1.8 “*...the airport operator will review, and as necessary update, the noise forecasts every five years. This review period aligns with the ongoing need under the Environmental Noise Regulations (Ref. 8) to publish strategic noise maps and a Noise Action Plan (NAP) every five years starting in 2008. The Noise Envelope five-year periods are aligned with NAP five-year periods (i.e. 2023-2028, 2029-2033, 2034-2038 etc).*”
- 2.1.9 “*The airport operator will review and as necessary update its noise forecasts around the mid-point of each five-year period (e.g. 2027, 2032, 2037 etc). This will support preparation for the following five year-period and, as necessary, any Level 2 Plan or Mitigation Plan required by the GCG Framework ...*”

- 2.1.10 *“By planning over a longer horizon, in line with GCG Framework Limits, the forecasts will support the airport operator working with the airlines to plan their growth and fleet deployment at the airport.”*
- 2.1.11 *The five-yearly noise forecast updates will be reviewed by the GCG Noise Technical Panel in relation to any Level 2 Plan or Mitigation Plan.”*
- 2.1.12 *“These are the key features of the Noise Envelope, combined with the ESG and noise Technical Panel oversight, that will ensure compliance with the Noise Envelope.”*
- 2.1.13 *“The Green Controlled Growth Explanatory Note [APP-217] also states that where the Noise Envelope Limits or the GCG Framework process is not complied with then the ESG should first provide formal notice to the airport operator that they consider a breach has taken place and attempt to resolve this issue directly with the airport operator prior to formal enforcement action being triggered. Where this does not resolve a breach then the ESG may initiate enforcement action.”*
- 2.1.14 *“The mechanism by which statutory planning enforcement takes place for development consent orders is set out in Part 8 of the Planning Act 2008 (Ref.14). It should be noted that the “relevant planning authority” (as defined in s173 of the Planning Act 2008) is able to take a number of steps. The “relevant planning authority” will be Luton Borough Council. However, it is also open for other planning authorities to bring action either through a private prosecution of an offence under section 161, or potentially by way of injunction under section 171 of the Planning Act 2008.”*
- 2.1.15 Nevertheless, the Host Authorities, through the Initial Statements of Common Ground (SoCGs) [TR020001/APP/8.13-8.18], their Relevant Representations [RR-0876, RR-0210, RR-0558, RR-1119, RR-0297], their Written Representations [REP1-069] and their Local Impact Reports [REP1-002, REP1A-003] have requested further information on how the NE can effectively avoid breaches such as those that occurred in 2017-2019.
- 2.1.16 Also, the Examining Authority (ExA) has raised GCG and the NE as one of the principal issues for the Examination of the DCO application in their **Rule 8 Letter [PD-008]**.
- 2.1.17 The following sections of this paper therefore identify why the breaches occurred in 2017 to 2019, the lessons learnt, the resulting proposed improvements to the NE and a worked example that shows how the improved NE could have avoided the previous breaches.

3 REASONS FOR THE 2017-2019 NOISE CONTOUR CAP BREACHES

3.1.1 The short-term noise contour limits for the night-time period were exceeded in 2017, 2018 and 2019; the daytime noise contour limit was exceeded in 2019.

3.1.2 The following sections focus on night-time noise (23:00 to 07:00) as the night-time contour limits were repeatedly breached from 2017 to 2019 and so provides the most historic data to understand why the noise contour limit was breached. The paper also notes how the lessons learnt apply to daytime noise (07:00 to 23:00).

3.2 Current night-time noise controls

3.2.1 Current consented short-term noise contour limits for the airport were established in 2014 under Condition 12 of granted planning consent 12/01400/FUL and restated in planning consent 15/00950/VARCON (with the relevant Condition numbering changed to 10). Short-term noise contour limits that are valid until the end of 2027¹ are set at 19.4 km² for the daytime 57dB LAeq,16h noise contour and 37.2 km² for the night-time 48 dB LAeq,8h noise contour.

3.2.2 Compliance with the noise contour limits has been reported annually based on the average day and night for the previous year's 92-day summer period. This is standard practice across UK aviation, and:

- a. It is in line with CAA guidance that the 16-hour day and 8-hour night LAeq,T for the average day in the 92-day summer period are still the most appropriate indicators of annoyance and self-reported sleep disturbance (Ref 1, Ref 2);
- b. it is typically the busiest 3 months of the year for aircraft movements (and hence highest air noise levels); and
- c. it is the period of the year where people are most likely to be outdoors and/or have windows open.

3.2.3 Condition 9 of the granted planning permission requires a Noise Control Scheme that applies other controls for night-time (2300-0700) aircraft noise: *"the airport shall be operated in accordance with the following controls:*

"i) Measures with the purpose of phasing out of night time (2300 to 0700) operations by aircraft with a QC value of greater than 1 on either departure or arrival.

ii) Monitoring and review of the scheme not later than the 1st and 4th year after its introduction and every subsequent five years.

iii) Limits during the night time period (2330 to 0600) of:

¹ After 2027, the current consented contour limits reduce to 15.2 km² for the daytime 57dB LAeq,16h noise contour and 31.6 km² for the night-time 48 dB LAeq,8h noise contour

a) Total annual movements by aircraft (per 12 month period) of no more than 9,650 movements; and

b) Total annual noise quota movements of no more than 3,500 which, using all reasonable endeavours, shall be reduced at each review until it reaches a point where it does not exceed 2,800 by 2028.

iv) Limits for the Early Morning Shoulder Period (0600 to 0700) of not more than 7,000 movements in any 12 month period.

v) Reporting of the actual and forecast total number of aircraft movements for the preceding and next 12 months to the Local Planning Authority every three months.

vi) Within six months of the commencement of the development, a progressive reduction in the night-time (2300-0700) maximum Noise Violation Limits (NVL) by the noisiest aircraft shall be implemented, as follows:

o 80dB(A) the date hereof

o 79dB(A) from 1st January 2020

o 77dB(A) from 1st January 2028”

3.2.4 In line with condition 9 iii) b), control of noise during the night quota period was reinforced by the airport operator through Slot Allocation Local Rule 1 that was introduced in 2015 to manage night flying within the seasonal night quota Limits. This local rule, imposed with the agreement of the Slot Coordination Committees, set a Quota Count (QC) limit during the night quota period of 23:30 – 06:00 in accordance with the planning condition.

3.2.5 It is important to note these extant controls and Local Rule 1 are only applicable to part of the night-time for noise assessment purposes (23:30 – 06:00)². Hence, such quota counts do not provide control of the combination of the number of aircraft movements and the fleet mix in noise emission terms for the early morning shoulder period of 06:00 – 07:00 and the late-night shoulder period of 23:00 – 23:30 (both of which are part of the full 23:00 – 07:00 night period used for the assessment of noise in **Chapter 16 of the ES [REP1-003]** upon which the Noise Envelope Limits and Thresholds are based).

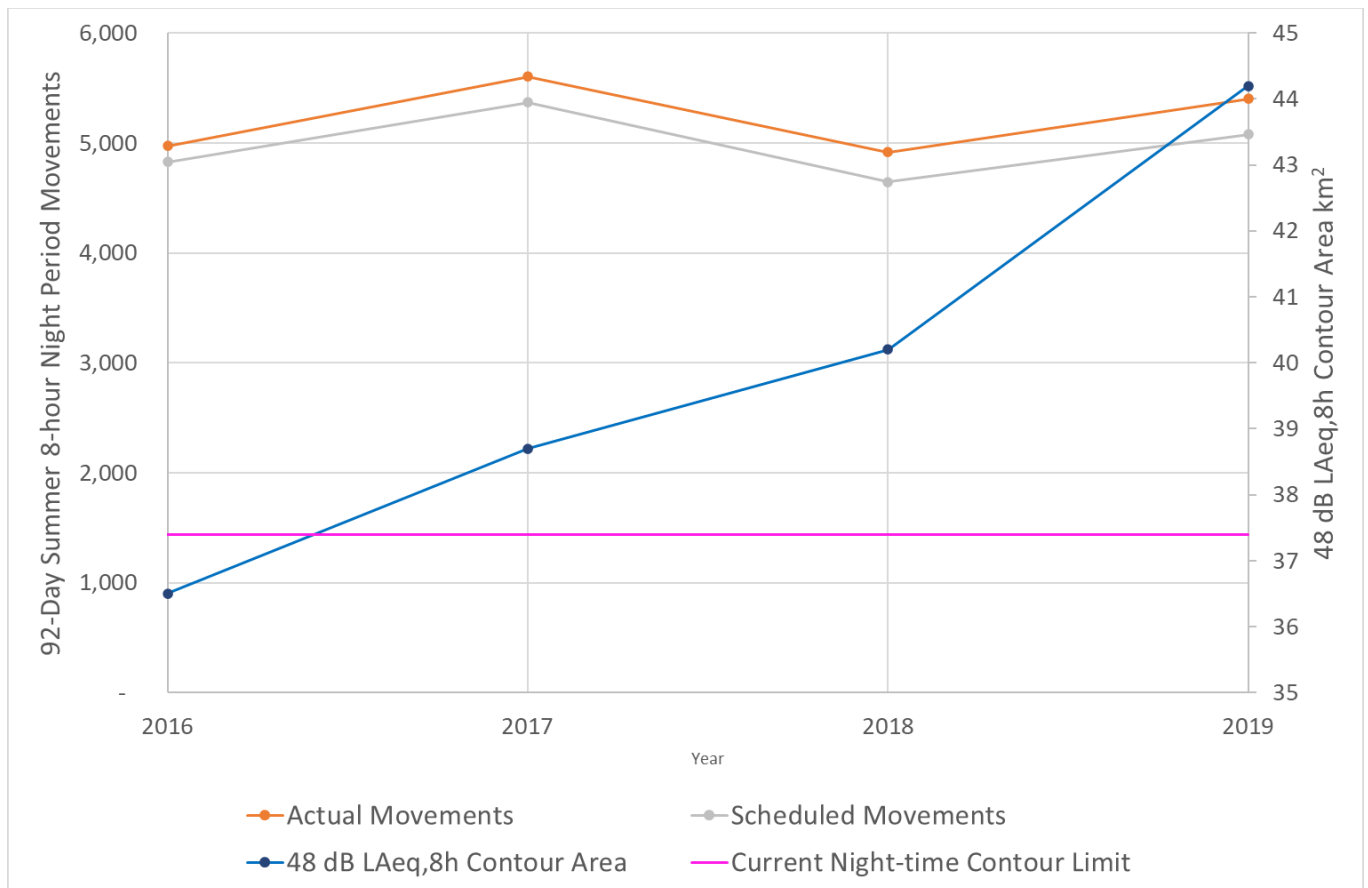
3.2.6 It is also relevant to note that total quota counts are also not applied by the current planning permission to any period that falls within the daytime.

² Albeit this is consistent with the night quota periods applied at the designated London airports for noise control purposes by the Secretary of State.

3.3 Analysis of night-time operations and noise contours for the summers of 2016 to 2019

3.3.1 **Inset 3.1** shows reported night-time aircraft movement for 2016 to 2019 compared to average summer night-time 48 dB LAeq,8h contour areas.

Inset 3.1: Night-time Aircraft Movements for 2016 to 2019 compared to night-time 48 dB LAeq,8hr contour areas



3.3.2 **Inset 3.1** shows that the increase in the night-time LAeq,8hr (23:00 to 07:00) noise contours reported for 2016 through to 2019 was not related to an increase in total number of movements that had been allocated slots (or scheduled to operate) or the actual number of aircraft movements. This highlights that aircraft movement caps can be a weak control of aircraft noise.

3.3.3 To explain why the noise contour areas increased year-on-year, the summer night-time operations in 2016 through 2019 have been analysed in three ways:

- a. The extent of off-schedule activity, particularly late departures and arrivals (**Table 3.1**);
- b. The breakdown of the types of night-time aircraft movements (freight, business and commercial) across the late-night shoulder (23:00 - 23:30), night quota period (23:30 – 06:00) and early morning shoulder period (06:00 – 07:00) (**Table 3.2**); and
- c. Mode split between easterly and westerly modes of operation (**Table 3.3**).

Table 3.1 Delay Factors between Scheduled and Actual Movements

Year	92-Day Summer night-time total aircraft movements (23:00-07:00)		Delay Factor
	Scheduled	Actual	
2016	4,826	4,974	3.1%
2017	5,368	5,603	4.4%
2018	4,645	4,914	5.8%
2019	5,079	5,400	6.3%

- 3.3.4 **Table 3.1** and **Inset 3.1** demonstrate an increasing number of off-schedule movements during the night-time over the 2016 to 2019 period. This is mainly due to late commercial (passenger) arrivals that are a result of delays, often due to wider air traffic management problems across Europe and beyond the airport operator's control, that build up throughout the day leading to late arrivals, particularly for based aircraft. The difference between scheduled and actual movements, due to movements that were scheduled to occur in the daytime but occurred during the night-time due to delays, was 3% in 2016, increasing to 4.4% in 2017 and more than doubling to 6.3% by 2019.
- 3.3.5 Following the noise contour limit breach in 2017 and the increasing proportion of off-schedule movements, in February 2018 controls were imposed on the allocation of additional slots during the full 8-hour night noise period. The interventions included restrictions on further allocation of slots, the re-timing of slots and no ad hoc movements to be permitted for the 92-day summer period. Hence, the number of business aviation movements (reliant on the availability of ad hoc slots) fell substantially in absolute and proportionate terms.
- 3.3.6 The results of the intervention were a reduction in the total number of movements in the night period in 2018, compared to 2017, due to a decrease in business aviation movements. However, these restrictions were imposed after the majority of slots had been allocated for summer 2018 to commercial passenger aircraft and overall growth in based aircraft at the airport meant that available slots were taken up, particularly in the shoulder periods, by commercial passenger aircraft that were noisier than the business flights, as evidenced in **Table 3.2**Error! Reference source not found..
- 3.3.7 In addition, an increasing number of off-schedule movements through 2018 to 2019 (see **Table 3.1**) resulted in increasing exceedance of the night-time noise limits.

Table 3.2 Percentage of aircraft movements by type of movement in the 92-day Summer Period between 2016 and 2019

Period	Type of movement	2016	2017	2018	2019
23:00-23:30 Late night shoulder period	Freight	0%	0%	0%	1%
	Business	13%	11%	3%	3%
	Commercial	87%	89%	97%	96%
	Actual movements	687	712	583	724
23:30-06:00 Night quota period	Freight	13%	13%	14%	13%
	Business	21%	20%	1%	1%
	Commercial	66%	67%	85%	86%
	Actual movements	2,656	2,994	2,686	2,924
06:00-07:00 Early morning shoulder period	Freight	1%	1%	0%	1%
	Business	9%	8%	1%	1%
	Commercial	91%	92%	99%	98%
	Actual movements	1,631	1,897	1,645	1,752
2300-07:00 Night period	Freight	7%	7%	8%	7%
	Business	16%	15%	1%	1%
	Commercial	77%	78%	91%	91%
	Actual movements	4,974	5,603	4,914	5,400

3.3.8 Another factor that may affect noise contour area is the actual summer period modal split, which changes from year-to-year as demonstrated in **Table 3.3**.

Table 3.3 92-day summer mode split (between easterly and westerly operational modes)

Year	Easterly operation	Westerly operation
2016	16%	84%
2017	17%	83%
2018	27%	73%
2019	26%	74%
Ten Year Average (2010-2019)	23%	77%

3.3.9 An indication of how the range of operational mode splits affects the 48 dB $L_{Aeq,8h}$ night-time noise contour area is presented in **Table 3.4**. These contour areas were calculated using 2019 ‘actuals’ from the 92-day summer period with only the mode split being modified between the scenarios to allow for direct comparison. The table shows that the change in mode split has only a small influence on the contour area and therefore is not a material consideration in understanding what caused the noise contour limit exceedances between 2017 and 2019.

Table 3.4 Change in noise contour area caused by different mode split

Mode split (easterly / westerly operations)	48 dB $L_{Aeq,8h}$ night-time contour area (all other parameters remaining constant)
16%/ 84%	45.2 km ²
23%/ 77%	45.3 km ²
27%/ 73%	45.3 km ²

3.3.10 An additional method of night-time control is the noise violation limits that were reduced from 80 dB L_{ASmax} to 79 dB L_{ASmax} . However, this change was not implemented until 2020, in line with condition 9 to the current planning permission, so was not effective at controlling night-time noise in the period from 2017 to 2019 when noise contour area limits were exceeded at night. It should be noted that the noise violation limits are in place to disincentivise the use of noisier aircraft and penalise flying in a way that would cause unreasonably high noise levels. However, this ‘peak capping’ does not provide a means to encourage the use of quietest aircraft types that operate below the noise violation level. Consequently, noise violation limits are not an effective means of controlling noise contours.

4 LESSONS LEARNT FROM HISTORIC BREACHES

4.1.1 Analysis of data from 2016 to 2019 indicates that the breach of the night-time noise contour limits in 2017 to 2019 was caused by:

- a. an increase year-on-year in off-schedule movements (particularly delayed commercial arrivals for reasons outside of the airport operator's control); combined with
- b. a transition over the three-year period, during both the late night and early morning shoulder hours, from a mix of commercial and business aviation movements to almost entirely commercial movements (that are generally noisier than business aviation movements).

4.2 Total quota counts

4.2.1 The Noise Control Scheme imposed by the current planning permission did not prevent the noise contour limit breaches from occurring because:

- a. The night-time total quota count condition (that controls the number of scheduled aircraft movements by reference to the noise level of each movement) only applies to 6.5 hours (23:30 to 06:00) of the 8-hour night-time period (23:00 to 07:00) and no total quota count was applied to daytime operations (07:00 to 23:00);
- b. The noise violation limits applied to the whole night period (23:00 to 07:00) and movement limits applied in the early morning shoulder period (06:00 to 07:00):
 - i. only limit the number of movements (a limit that has not been reached) not how noisy each movement is; and
 - ii. only disincentivise the use of noisier aircraft and flying in a way that would cause unreasonably high noise levels (noise violation limits). This 'peak capping' does not provide a means to encourage or require the use of quietest aircraft types that combined with the number of movements would keep below the noise contour area limits (in the same way that a total quota count would for example); and
- c. The voluntary interventions made by the airport operator in 2018 reduced night-time business aviation movements in response to the 2017 noise contour breach and increasing off-schedule movements. However, as the LTN Scheduling Declaration process requires an intervention to be made a year before it could take effect, it was not possible to introduce interventions early enough to prevent an increase in movements by commercial passenger aircraft, particularly in the shoulder periods. The delay in interventions taking effect combined with further increases in off-schedule movements, resulting in increased breaches of the noise contour limits in 2018 and 2019 as airlines were entitled to retain the slots already allocated during 2017 for summer season 2018.

4.2.2 The noise contour limits are necessarily a 'trailing indicator', in that evidencing compliance with the limits, or not, is only possible after the summer season has

finished. It also means that effectiveness of interventions is only understood after their implementation. Given that slot allocation is a process undertaken in advance and the allocation of a slot (other than an ad hoc slot) grants rights to an airline, this constrains the ability to act in arrears when a breach of a limit has occurred.

- 4.2.3 Following the breaches in 2017 to 2019 and the lessons learned from the failure of the corrective interventions implemented in 2018 to remedy the night-time problem, the airport operator has implemented changes that focus on forward planning to avoid contour breaches. These changes include placing the airport operator's operations and noise team at the heart of the slot management process. These measures have resulted in a faster transition to the use of new-generation aircraft using the airport. The benefits of these changes are expected to be seen when the 2023 summer period actual noise contours can be calculated, which are expected to be shown to comply with the current noise contour limits, despite aircraft movements being close to those handled in 2019.
- 4.2.4 As summarised in **Section 2** of this paper, the focus on forward planning to avoid noise limit breaches is at the centre of the proposed Noise Envelope within the GCG regime and is in contrast to the current controls, which only require historic testing against the Limits. The Noise Envelope requires forward planning over five-year horizons, in line with Noise Action Plans, with the addition of warning thresholds leading to escalating preventative action and oversight by the ESG and noise technical panel.
- 4.2.5 Nonetheless, there are further lessons to be learnt from the detailed understanding of what led to the noise contour breaches in 2017 to 2019. As discussed in the next section of this paper, the lessons learnt centre on the consideration of off-schedule movements and enhanced 'leading indicators' that can be used in the forward planning of airport operations to avoid future contour breaches.
- 4.2.6 Based on the lessons learned as set out at **paragraphs 4.1.1 to 4.2.1**, an appropriate candidate for a better 'lead indicator' to use as part of forward planning of night-time operations is the total quota count (QC) over the full eight-hour night-time period (23:00 to 07:00) and also daytime period (07:00 to 23:00). This would extend the consideration of total night quota count from the current 6.5 hours to the full 8 hour night-time period and would apply total quota counts to the daytime for the first time.
- 4.2.7 This aligns with Civil Aviation Authority advice, in CAP1869 (Ref 3), that Quota Count classifications are:
- a. *“generally considered to be reliable indicators of aircraft noise performance,*
 - b. *available for practically every civil transport aircraft in current operation*
 - c. *openly published and therefore readily applied by administrators of the scheme, and*
 - d. *correlated with noise footprint areas, which were taken to be appropriate measures of 'noise impact'.”*

- 4.2.8 The CAA tested the correlation between Quota Count, $L_{Aeq,T}$ contour areas and other noise control metrics in CAP1731 (Ref 4), concluding the following (emphasis added):

“The metric considered in this study for restricting noise emissions is Quota Count. It has the advantage of being easily calculated, it is already used at several airports and can be used both at national and local level, as well as in an absolute sense or be normalised by the volume of traffic. On the other hand, noise Quota Counts are not that easy to administrate and this needs to be taken into consideration if applied to smaller airports. There is good correlation between the number of daytime movements and daytime Quota Count, and a good correlation between night-time movements and night-time Quota Count. The daytime Quota Count correlates relatively well with L_{Aeq16h} contour area; however, the correlation of night-time Quota Count with L_{Aeq8h} noise contour area is not that clear. More detailed investigation highlighted that the poorer than expected correlation between night-time contour area and Quota Count is isolated to Gatwick airport and night-time fleet changes between 2006 and 2016.” ...

“Overall, Quota Count and average summer daytime and night-time noise contour area at a certain noise level are considered to represent the best correlation with other noise metrics and therefore to limit overall noise exposure.”

- 4.2.9 Building on the CAA tests, **Appendix A** provides a comparison of the total QC and 48 dB $L_{Aeq,8hr}$ actual contour areas for the average 8-hour night during the 92-day summer periods from 2016 to 2019 at Luton Airport. The analysis shows a very high correlation evidencing that the 8-hour total quota count would be a strong leading indicator to forward plan night-time operations in line with noise contour area limits. As the actual noise contours include delays, off-schedule aircraft movements are inherently included in the QC correlation³.
- 4.2.10 Appendix A also analyses the correlation between the 16-hour daytime total quota count and 54 dB $L_{Aeq,16hr}$ actual contour area. In this case, the correlation is not as strong as it is for the night-time period, but it is still considered to be sufficiently strong that QC based scheduling would be an effective means of pre-empting any potential exceedances of daytime noise contour limits.

4.3 Setting of noise Thresholds relative to Limit values

- 4.3.1 It is helpful to review how the proposed noise Thresholds proposed in the GCG Noise Envelope would have applied to the night-time noise contours from 2014, when the current planning permission was granted and its current night-time noise contour limit imposed, through to 2017, 2018 and 2019 when the Limit was breached. This review provides a check on the setting of the Thresholds relative to the Limit value to confirm whether Thresholds would have been triggered early enough to enable preventative action to have been taken to avoid the breaches in 2017 to 2019. Setting appropriate Thresholds once the DCO is implemented will provide confidence that the Thresholds would provide

³ Note that the quota count applied includes an allowance for a number of movements to be delayed into the night period but the actual number and aircraft type of movement actually delayed may vary.

sufficient time to take preventive action to avoid future breaches for the expanding airport operations.

4.3.2 **Table 4.1** presents the reported actual night-time contour areas for 2014 to 2019. The third column shows when the contours would have exceeded the Level 1 Threshold (yellow), Level 2 Threshold (amber) and Limit value (red) if the Thresholds were defined in line with the footnote to Table 3.1 of the **Green Controlled Growth Explanatory Note [APP-217]**⁴. This shows that the GCG Level 1 Threshold would not have been exceeded until 2016 ahead of the Limit being breached in 2017. The fourth column shows a proposed improvement to the thresholds (see **Section 5**), with the Level 1 Threshold at 85% and Level 2 Threshold at 95% of the Limit to test whether this would have allowed for action to be taken in time to prevent breaches of the noise contour limit from occurring. The proposed revision to the thresholds is in line with the recommendations of the Noise Envelope Design Group (see Annex A of **Appendix 16.2 of the Environmental Statement [APP-122]**).

Table 4.1 Reported night-time noise contour areas between 2014 and 2019 showing when noise Thresholds and Limit value would have been exceeded had the GCG Noise Envelope been implemented in 2014

Year	Night-time 48 dB L _{Aeq,8hr} reported contour area*	GCG Noise Envelope Threshold or Limit exceeded	
		As currently proposed**	Alternative***
2014	35.2 km ² (94.6%)	< Level 1 Threshold	> Level 1 Threshold
2015	35.3 km ² (94.9%)	< Level 1 Threshold	> Level 1 Threshold
2016	36.5 km ² (98.1%)	> Level 1 Threshold	> Level 2 Threshold
2017	38.7 km ² (104.0%)	> Limit	> Limit
2018	40.2 km ² (108.1%)	> Limit	> Limit
2019	44.2 km ² (118.8%)	> Limit	> Limit

* Percentages in parenthesis represent reported contour area as a percentage of the Limit, where the Limit is 37.2 km²

** Thresholds set as currently proposed, i.e. 90% and 95% of the difference between the Limit and the equivalent do-minimum noise contour area

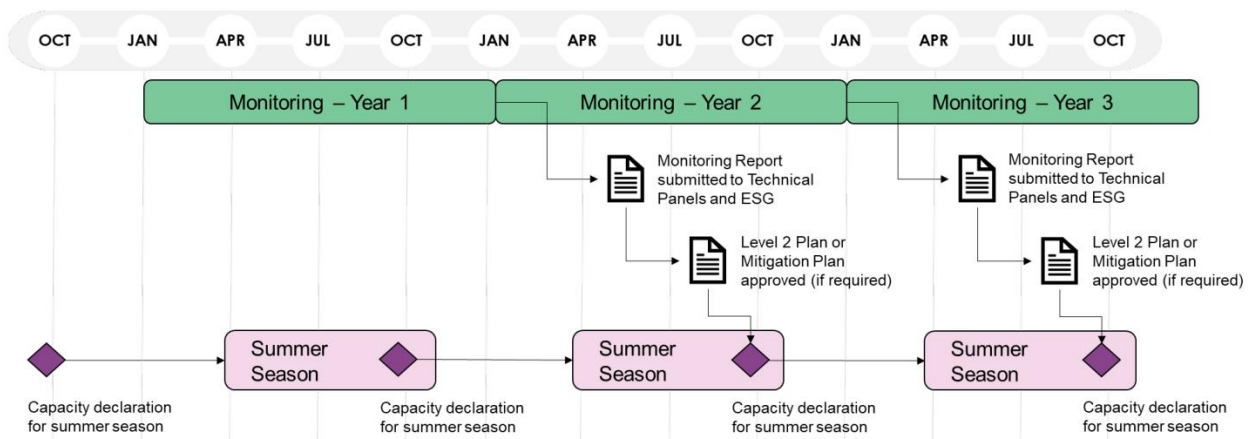
*** Level 1 Threshold set at 85% of Limit and Level 2 Threshold set at 95% of Limit, where the Limit is 37.2 km²

4.3.3 Figure 2.10 of the **GCG Explanatory Note [APP-217]** (represented here as **Inset 4.1**) shows that the capacity declaration for the following summer season

⁴ The GCG Level 1 Threshold was defined as 90% of the difference between the Limit and the equivalent do-minimum noise contour area for the same time period and the Level 2 Threshold was defined as 95%.

has already taken place before the conclusion of the monitoring and reporting against the current summer season noise contour Limits. Therefore, where the annual monitoring and reporting have identified that a Threshold or Limit has been exceeded, controls on growth through the slot allocation process cannot be implemented until the next summer capacity declaration. Two years will therefore (necessarily) elapse between a summer period where a backwards look Threshold or Limit exceedance is reported and the first summer period where quota count management (above a Level 1 Threshold), a Level 2 Plan (above a Level 2 Threshold) or Mitigation Plan (above a Limit) has effect.

Inset 4.1 GCG links between monitoring, reporting and summer season capacity declaration (Figure 2.10 in the GCG Explanatory Note)



4.3.4 As shown in **Table 4.1**, the proposed GCG Thresholds, as set out Table 3.1 of the **GCG Explanatory Note [APP-217]**, would have provided insufficient warning of the potential for a future breach and insufficient time to subsequently take preventive action to have avoided the breach in 2017. This analysis identifies two areas of potential improvements to the NE (see **Section 5**):

- a. Reducing the Level 1 and Level 2 Thresholds, as a percentage of the Limit, to provide earlier warning of potential future breaches of the Limit; and
- b. Increasing the obligations on the airport operator when a Level 1 Threshold is exceeded, to require further action and forward planning to be taken earlier and such actions to be reported through the Monitoring Report⁵, in order to address the time lag associated with actions taken through the slot allocation process.

4.3.5 The fourth column of **Table 4.1** shows how the Thresholds would have been exceeded had the Level 1 Threshold been defined at 85% and Level 2 Threshold defined at 95% of the Limit. Set in this way, there would have been sufficient time for the actions, revised as set out in **Section 5**, that followed the exceedance of the Level 1 Threshold in 2014/15 to have avoided the breach in 2017 had the GCG framework been in place.

⁵ As part of the existing requirements where an environmental effect is above a Level 1 Threshold.

5 IMPROVING THE NOISE ENVELOPE

5.1 Improvement #1: Total day and night-time quota count forward planning indicators

5.1.1 Building on the lessons learnt from the noise control breaches between 2017 and 2019, the Noise Envelope part of the **GCG Framework [APP-218]** and **GCG Explanatory Note [APP-217]** will be improved at Deadline 3 to explicitly require the airport operator to use 16 hour day and 8 hour night total quota counts as management tools in the forward planning of airport operations as soon as a Level 1 Threshold exceedance is identified. Forward planning will comprise a five year lookahead considering scheduled and forecast movements as follows:

- a. Scheduled movements - the aircraft movements scheduled for the following year having regard to the Declaration of Coordination Parameters⁶ for the summer season published in September of the preceding year; and
- b. Forecast movements – aircraft activity that is anticipated to happen in the four following years.

5.1.2 A new paragraph will be added between 3.2.14 and 3.2.15 of the GCG Explanatory Note at Deadline 3:

When a Level 1 Threshold is exceeded, the airport operator will convert current and future Level 2 Threshold and Limit noise contour areas (see Table 3.1) into equivalent total 16-hour daytime and total 8-hour night-time quota counts⁷. The airport operator will use total scheduled and forecast daytime and night-time quota counts (and their comparison to the relevant Level 2 Threshold Equivalent QC and the Limit Equivalent QC):

- to inform forward planning of airport operations (both annual and five-year forward plan);
- to incentivise airlines to operate the quietest aircraft available in response to the opportunity of growth;
- as part of the bi-annual process⁸ of slot management and capacity declaration; and
- where in the forward plan the Level 2 Threshold Equivalent QC or Limit Equivalent QC is exceeded, to prepare a Monitoring Report that includes proposals for slot management measures, additional interventions or mitigation to ensure that the Limit will not be exceeded.

5.1.3 A new section will be added to the start of Section 3 of GCG Framework (becoming a new Section 3.1) entitled Aircraft Noise Management. This section

⁶ The capacity declaration for the purpose of scheduling.

⁷ Based on regression analysis of the relationship between scheduled QCs and actual noise contours from the previous five-years of operation.

⁸ Twice each year, once for winter and once for summer

will comprise of paragraphs 3.2.10 to 3.2.15 for the current Explanatory Note as well as the new paragraph set out above.

5.2 Improvement #2: Off-schedule movements

5.2.1 Reporting in line with the noise Thresholds and reporting compliance with the noise Limits is currently proposed based on scheduled, rather than actual, movements (**GCG Framework Appendix C – Aircraft Noise Monitoring Plan [APP-221]**). The compliance reporting proposed by the GCG therefore does not take account of late or early running (off-schedule) aircraft movements.

5.2.2 This is because late running aircraft are generally not within the airport operator’s control (see **GCG Explanatory Note [APP-217]**, para 2.2.34 onwards).

5.2.3 However:

- a. the current consented noise Limit compliance process does include off-schedule movements (but not dispensed movements);
- b. late running aircraft are part of the reason for the historic noise contour Limit breaches in 2017-2019, as noted in the earlier sections of this paper;
- c. the forecasts used for the Environmental Statement (ES), and hence the setting of the Thresholds and Limits in the GCG Noise Envelope, do make an estimated allowance for a proportion of off-schedule movements (see paragraph 6.6.61 of the **Need Case [AS-125]** which notes that the night-time forecasts have been uplifted by 5%⁹ to allow for late arriving flights that are scheduled in the daytime period, but which fall into the night-time period due to delays); and
- d. late running aircraft influence the noise impact on the community, particularly during the night (and night flights have been identified as a principal issue by the ExA).

5.2.4 The **GCG Framework Appendix C – Aircraft Noise Monitoring Plan [APP-221]** will be amended as follows at Deadline 3 to bring off-schedule movements into the Noise Envelope compliance regime via the following amendment of paragraph C4.1.3:

“C4.1.3 For the purposes of compliance, the 92-day summer LAeq,T contours will be calculated using scheduled movements as and early and late running aircraft (daytime and night-time) and but not dispensed movements³ as these are not directly in the airport’s control.”

³ ‘Dispensed flights’ are those which, under the legal framework through which the government sets night flight operating restrictions at designated airports, meet specific criteria that allow them to be disregarded for the purposes of noise restrictions. The list of qualifying criteria is included in Night flight restrictions at Heathrow, Gatwick and Stansted: Annex F Guidelines on Dispensations, Department for Transport, July 2014”

⁹ 5% late running movements is around the upper quartile of range of late running movements that occurred between 2016 and 2019 (see Table 2.1)

5.3 Improvement #3: Setting of noise Thresholds relative to Limits

5.3.1 For the reasons set out in **Section 4.3** of this paper, the GCG Framework and Explanatory Note will be revised such that the Level 1 Threshold is set at 85% and Level 2 Threshold is set at 95% of the relevant Limit value. Table 3.1 of the **GCG Framework [APP-218]** and Table 3.1 with accompanying footnote in the **GCG Explanatory Note [APP-217]** will be revised accordingly at Deadline 3, as per **Table 5.1** here.

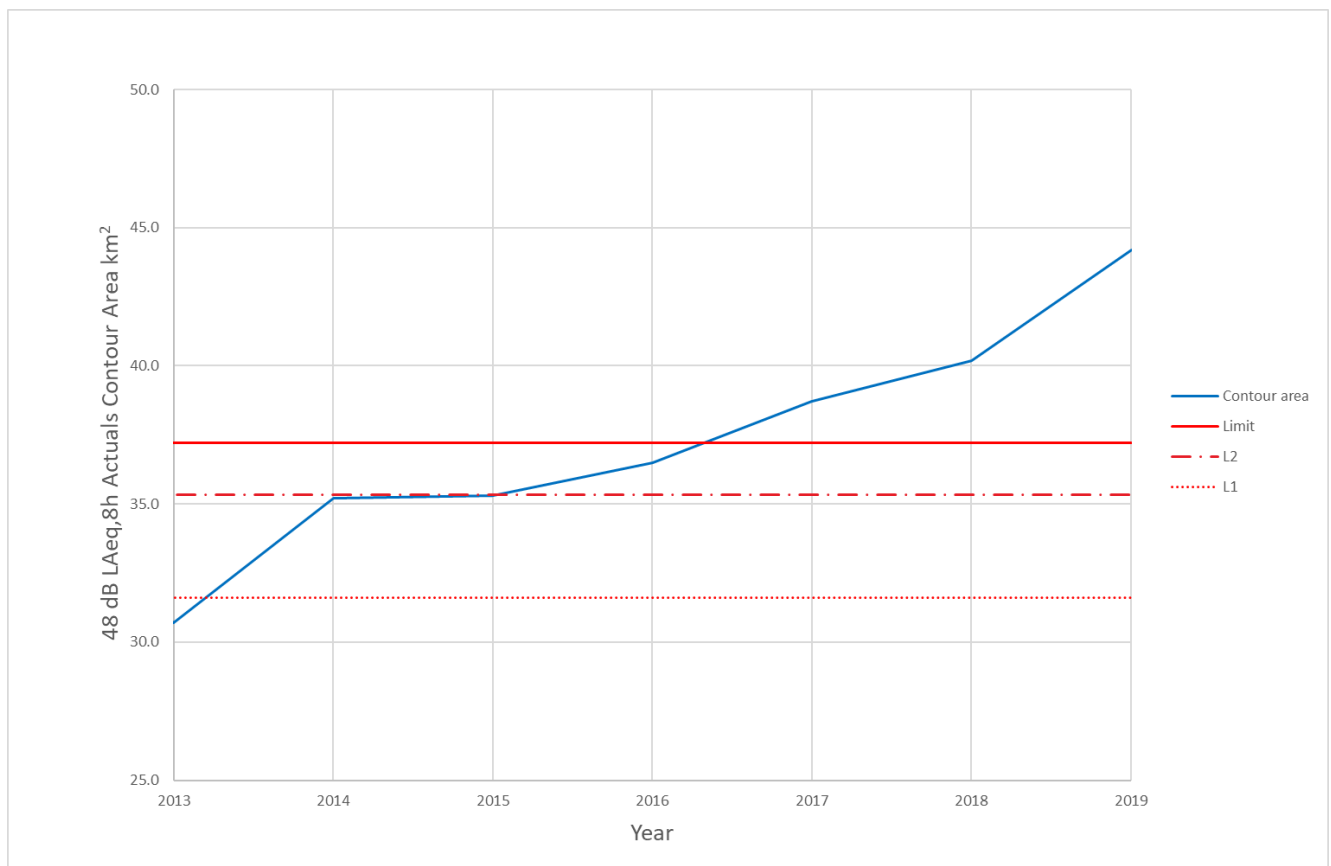
Table 5.1: Revised Level 1 and Level 2 noise contour thresholds

Limit	Up to 2028	2029-2033	2034-2038	2039-2043	2044 onwards (in 5 year cycles)
Average summer day-time noise levels, as measured by size (km ²) of 54 dB LAeq,16hr noise contour	Limit				
	33.6	32.8	30.7	32.6	32.6
	Level 2 Threshold (95% of Limit)				
	33.3 <u>31.9</u>	32.4 <u>31.2</u>	30.4 <u>29.2</u>	32.1 <u>31.0</u>	32.1 <u>31.0</u>
	Level 1 Threshold (85% of Limit)				
	33.0 <u>28.6</u>	32.1 <u>27.9</u>	30.0 <u>26.1</u>	31.6 <u>27.7</u>	31.6 <u>27.7</u>
Average summer night-time noise levels, as measured by size (km ²) of 48 dB LAeq,8hr noise contour	Limit				
	44.8	42.8	40.1	43.2	43.2
	Level 2 Threshold (95% of Limit)				
	44.3 <u>42.6</u>	42.3 <u>40.7</u>	39.6 <u>38.1</u>	42.5 <u>41.0</u>	42.5 <u>41.0</u>
	Level 1 Threshold (85% of Limit)				
	43.7 <u>38.1</u>	41.7 <u>36.4</u>	39.1 <u>34.1</u>	41.7 <u>36.7</u>	41.7 <u>36.7</u>

6 WORKED EXAMPLE FOR AVOIDING 2017 TO 2019 NIGHT-TIME NOISE CONTOUR BREACHES

- 6.1.1 This worked example assumes that the proposed GCG Noise Envelope and its prevention and control measures, as revised in **Section 5** of this paper, were applied to the operation of the airport from 2014, when the current planning permission was granted.
- 6.1.2 The reported summer average night-time 48 dB $L_{Aeq,8hr}$ noise contour for 2014 was 35.2 km² (see **Inset 3.1** and **Table 4.1**). This would have exceeded the Level 1 Threshold (which would have been set at 31.6 km² – i.e. 85% of the Limit - 37.2 km²), as illustrated in **Inset 6.1**.

Inset 6.1: Night-time Actuals 48 dB $L_{Aeq,8h}$ contour area against revised noise Thresholds



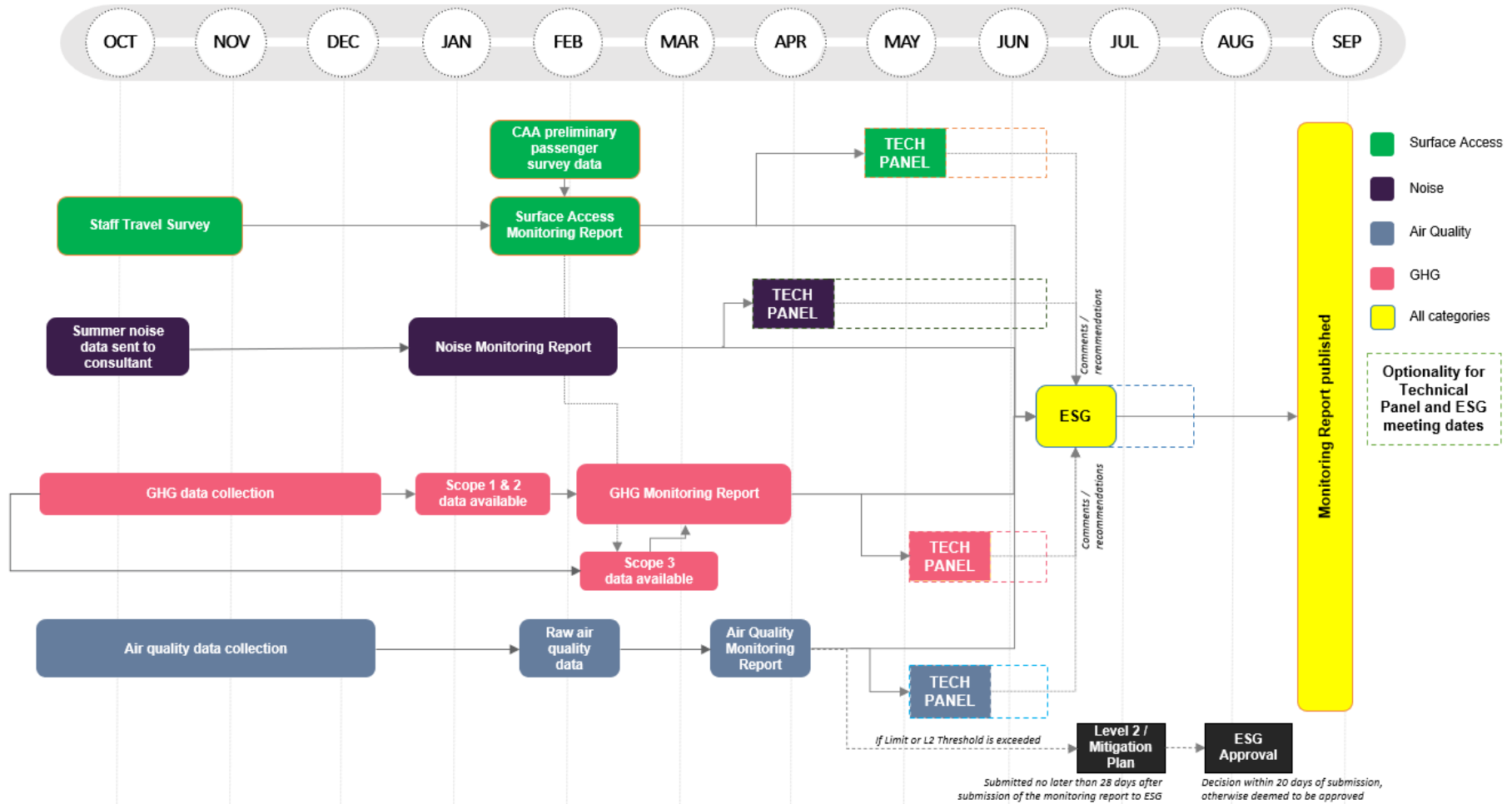
- 6.1.3 As required by the GCG Framework, that will be updated in line with **Section 5** of this paper, because the reported 2014 night-time contour exceeding the Level 1 Threshold, the airport operator would have converted “*current and future Level 2 Threshold and Limit noise contour areas ... into equivalent total 16hr daytime and total 8hr night-time quota counts.*” The airport operator would then have used “*total forecast daytime and night-time quota counts (and their comparison to the Level 2 Threshold Equivalent QC and the Limit Equivalent QC)*”:

- *to inform forward planning of airport operations (both annual and five-year forward plan);*

- *to incentivise airlines to operate the quietest aircraft available in response to the opportunity of growth;*
- *as part of the annual process of slot management and capacity declaration; and*
- *where the Level 2 Threshold Equivalent QC or Limit Equivalent QC is exceeded, to prepare a Monitoring Report that includes proposals for slot management measures, additional interventions or mitigation to ensure that the Limit will not be exceeded.”*

- 6.1.4 The 2014 night-time contour would have been reported, and hence the requirement above would have been initiated, by March 2015 when the 2014 Noise Monitoring Report was received by the airport operator (see Figure 2.11 of the GCG Explanatory Note – reproduced at **Inset 6.2** in this paper). This would have triggered implementation of QC management controls for 16 -hour day and 8-hour night periods as part of annual and 5-year forecast forward plans for 2015 onwards as will be set out in the GCG Noise Envelope.
- 6.1.5 The scheduled and forecast QC information would have been available in time for planning the 2016 summer operations and input to the drafting and negotiation of the LTN Declaration of Coordination Parameters for summer 2016, that would have then been published in September 2015, and subsequent declarations of capacity for the following scheduling seasons. This action would have been subject to review and scrutiny by the Noise Technical Panel when it received the 2014 Noise Monitoring Report in April 2015 (see **Inset 6.1** and **Inset 6.2**).
- 6.1.6 For the purpose of the worked example, the Limit Equivalent QC is based on the conversion of the 37.2 km² night-time contour Limit into a QC using regression analysis formula in **Inset A.1** of Appendix A. The Level 2 Threshold Equivalent QC is set at 95% of the limit. The equivalent QC values would therefore have been as follows:
- a. Limit Equivalent QC – 1898.
 - b. Level 2 Threshold Equivalent QC – 1803.
- 6.1.7 The Level 2 Threshold and Limit Equivalent QCs are defined based on a regression analysis between the actual noise contours areas reported annually (which include off-schedule movements) and the scheduled QC for each year. This means that off-schedule movements over the 2015-2019 period are inherently accounted for in the Level 2 Threshold Equivalent QC and Limit Equivalent QC values as they have been derived from the regression analysis.
- 6.1.8 As this is a retrospective exercise, for this case study the regression analysis was undertaken over the years concerned, 2015-2019. In the future operation of the GCG Noise Envelope, the regression analysis relied on would be between the actual noise contour areas and the scheduled QC for the previous five years, allowing this analysis to be updated as needed in line with ongoing changes in fleet mix.

Inset 6.2 GCC outline for annual monitoring and reporting (Figure 2.11 from the GCG Explanatory Note)



6.1.9 Assuming the forward plans for the five years from 2015 were as actually flown in those years, then the total night-time QC values calculated in 2015 for 2016 schedule and forecasts for the following four summer periods would have been as shown in **Table 6.1**. The Table shows that in 2015 it would have therefore been predicted that the Level 2 Threshold Equivalent QC would be exceeded in 2016, and the Limit Equivalent QC would be exceeded from 2017 to 2019. This would have required the airport operator to develop slot management measures to be implemented in 2016 onwards to avoid the forecast breach in 2017 onwards. These mitigation measures would have been included in the airport operator’s 2015 Monitoring Report which would have been subject to scrutiny by the Noise Technical Panel from April 2015 ahead of its submission to the ESG in June/July 2015.

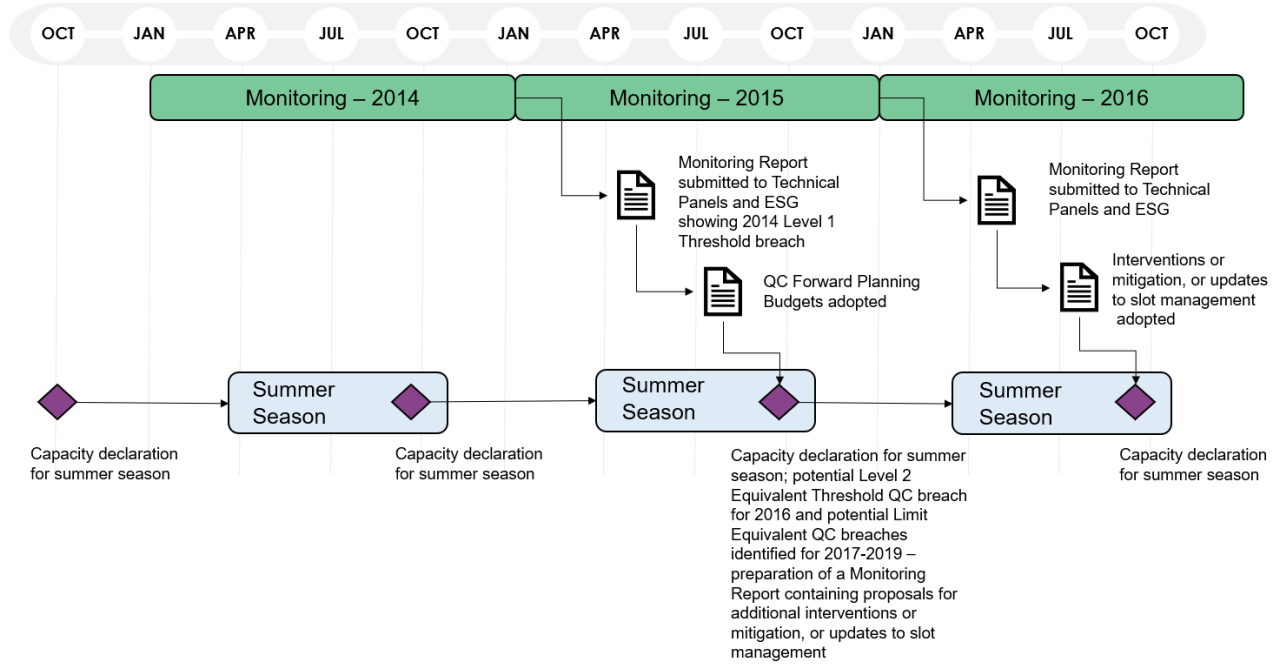
Table 6.1: total night-time quota counts forecast in 2015 for the five-years forward (assuming what was forecast was the same as actually flown in those years)

Year	Scheduled average 92-day summer night-time 8hr quota count	Threshold or Limit exceeded?
2015 (as scheduled)	1,820 (95.9%)	> Level 2 Threshold Equivalent QC
2016 (as forecast)	1,827 (96.2%)	> Level 2 Threshold Equivalent QC
2017 (as forecast)	2,004 (105.6%)	> Limit Equivalent QC
2018 (as forecast)	2,069 (109.0%)	> Limit Equivalent QC
2019 (as forecast)	2,205 (116.1%)	> Limit Equivalent QC

6.1.10 A summary of steps that would have been taken as a result of the 2014 noise contours exceeding the Level 1 Threshold are set out in **Inset 6.2**. These steps would have meant a Monitoring Plan containing measures to prevent the night-time Limit being breached in the summers of 2017 to 2019 would have been adopted in 2016.

6.1.11 Similarly, the equivalent steps applied to daytime noise would have implemented measures via the Monitoring Plan to prevent the daytime noise Limit being breached in 2019.

Inset 6.2 : GCG steps (adjusted from Figure 2.10 in the GCG Explanatory Note) to prevent historic 2017 noise contour exceedance



7 CONCLUSION

- 7.1.1 GCG and the NE are principal issues for the Examination of the DCO application and the Host Authorities have requested further information on how the NE can effectively avoid breaches such as those that occurred in 2017-2019.
- 7.1.2 Analysis of historic aircraft movement data has identified that the primary reason for night-time noise contour breaches in 2017 to 2019 was due to a year-on-year increase in off-schedule movements and a transition of fleet mix during the night period from a mix of commercial and business aviation movements to almost entirely commercial movements.
- 7.1.3 The Noise Control Scheme adopted to control the night-time contour area was not effective because it covered only 6.5 hours (23:30 to 06:00) of the 8-hour night-time period (23:00 to 07:00). Additionally, voluntary interventions that were made in 2018 as a response to the 2017 contour limit breach were too late to prevent increased breaches in 2018 and 2019. No daytime controls were introduced.
- 7.1.4 Lessons learned from historic breaches identified the need for noise control measures to control the full 8-hour night period and 16-hour day period. Noise contours were also identified as ‘trailing indicators’ and the need to adopt a ‘leading indicator’ was identified so noise control measures could be implemented prior to a contour limit breach occurring.
- 7.1.5 Three refinements to the Noise Envelope are therefore proposed to be made at Deadline 3 to enhance the NE avoiding breaches:
- a. Once the Level 1 Threshold is exceeded, the airport operator is required to use 16-hour day and 8-hour night total quota counts as management tools in the forward planning of airport operations to allow measures to prevent a contour Limit breach occurring to be implemented in time to be effective. Such preventative measures would be included in the annual Monitoring Plan and would therefore be subject to scrutiny by the Noise Technical Panel and ESG.
 - b. Off schedule movements will be included into the Noise Envelope compliance regime to control the risk of off-schedule movements causing a contour Limit breach.
 - c. The Level 1 Threshold will be set at 85% of the Limit and the Level 2 Threshold will be set at 95% of the Limit. This will allow for action to be taken in time to prevent breaches of the noise contour limit from occurring.
- 7.1.6 A worked example has been provided which can be used to reasonably conclude that the NE would have avoided the historic breaches that occurred in 2017-2019. The worked example identifies how the 2015 Monitoring Report would have included slot management measures, additional interventions or other mitigation that would have been implemented in planning and agreeing the 2016 and subsequent schedule declarations to prevent night-time noise contour Limit breaches from occurring in 2017 to 2019. The equivalent steps

applied to daytime operations would also have implemented earlier steps to prevent the breach of the daytime Limit breach in 2019.

8 APPENDIX A

8.1 Analysis of total day and night quota counts and noise contour areas

8.1.1 A review of total Quote Counts (QCs) based on scheduled aircraft movements against noise contour areas based on actual aircraft movements has been undertaken for the years 2015 to 2019. This analysis has been used to determine whether total day and night time QCs, based on scheduled movements, are appropriate as a forward-looking management tool to control noise contour areas based on actual movements.

8.1.2 In order to undertake the review exercise, a number of assumptions were required when defining QCs for historic movement schedules as follows:

- a. For the purpose of this worked example, the most up to date QC points¹⁰ have been applied to each commercial aircraft (passenger and freight) that operated in each year in order to provide a consistent approach.
- b. The scheduled time of the flights has been used in this analysis as a proxy for the forward planning and control role of QC budgets. It should be noted these may vary from the originally proposed times when the schedule coordination planning took place given that there was no control in place to prevent flight re-timings, which means that there is some inevitable tolerance for error in the results.
- c. Whilst the contours are based on actual flown times not those scheduled, we have not attempted to consider any specific allowance for delay. This analysis, therefore, essentially assume a systematic level of delay (as well as late departures in the morning which would move outside the night periods). The airport already holds a pool of QC points which are designed to allow for some delayed activity when the final 'post-event' QC points are calculated for the year.
- d. A block of QC points was included for business aviation, although these are difficult to project from year to year specifically due to the variance in this fleet. Therefore, the business aviation QC allowance is consistent across all scenarios, which aligns with the broadly similar number of movements in the sector over recent years.

8.1.3 Analysis of the following periods has been undertaken to determine whether QCs could be an appropriate tool for controlling noise contour area in respect of:

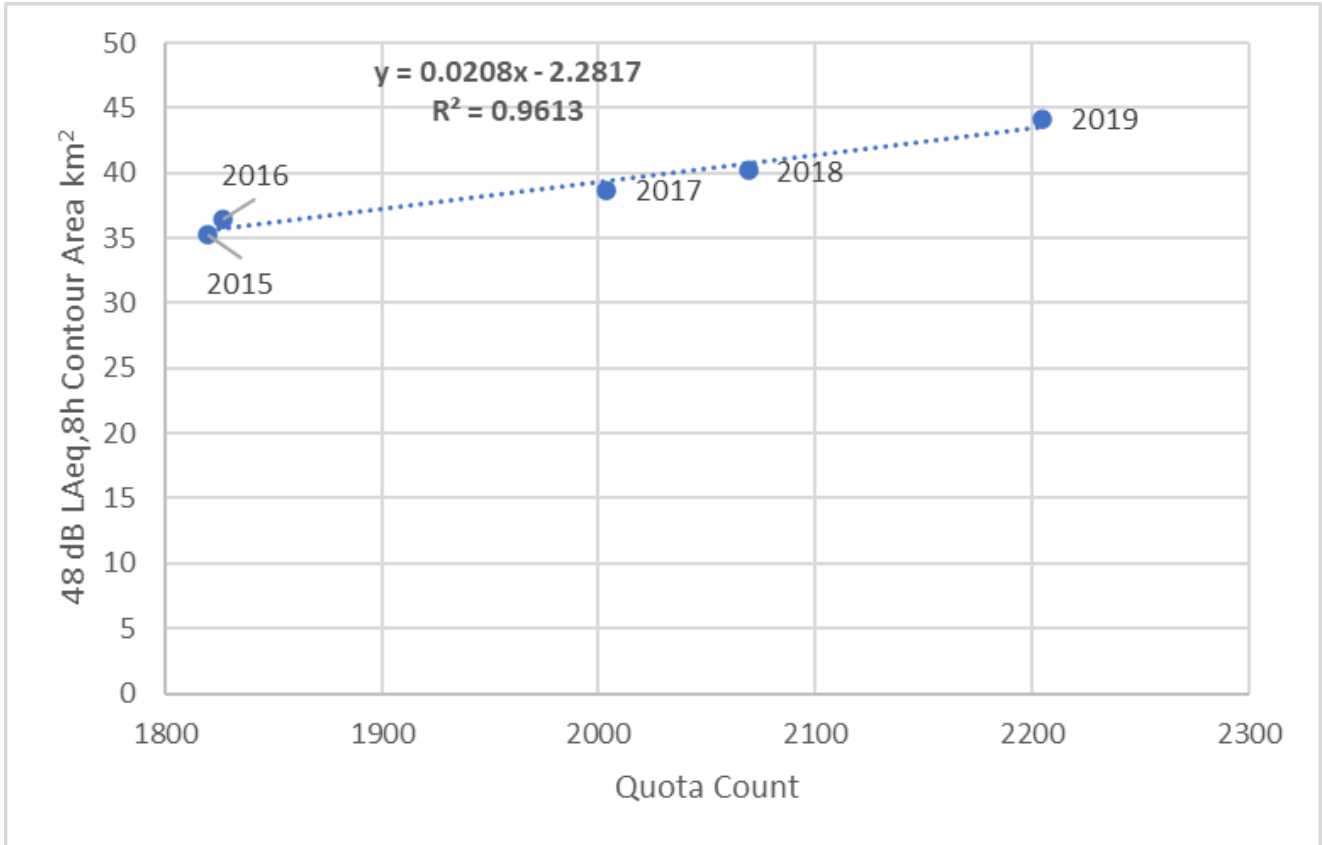
- a. 92-day summer night-time period; and
- b. 92-day summer daytime period.

8.1.4 **Inset A.1** shows the relationship between the 92-day summer night-time period QC Count and the 92-day summer night-time contour areas in each year. The

¹⁰ Note that the QC point categories have been changed periodically by the DfT. The version used was AIP Supplement 058/2022 published by NATS/CAA and implemented on 30th October 2022

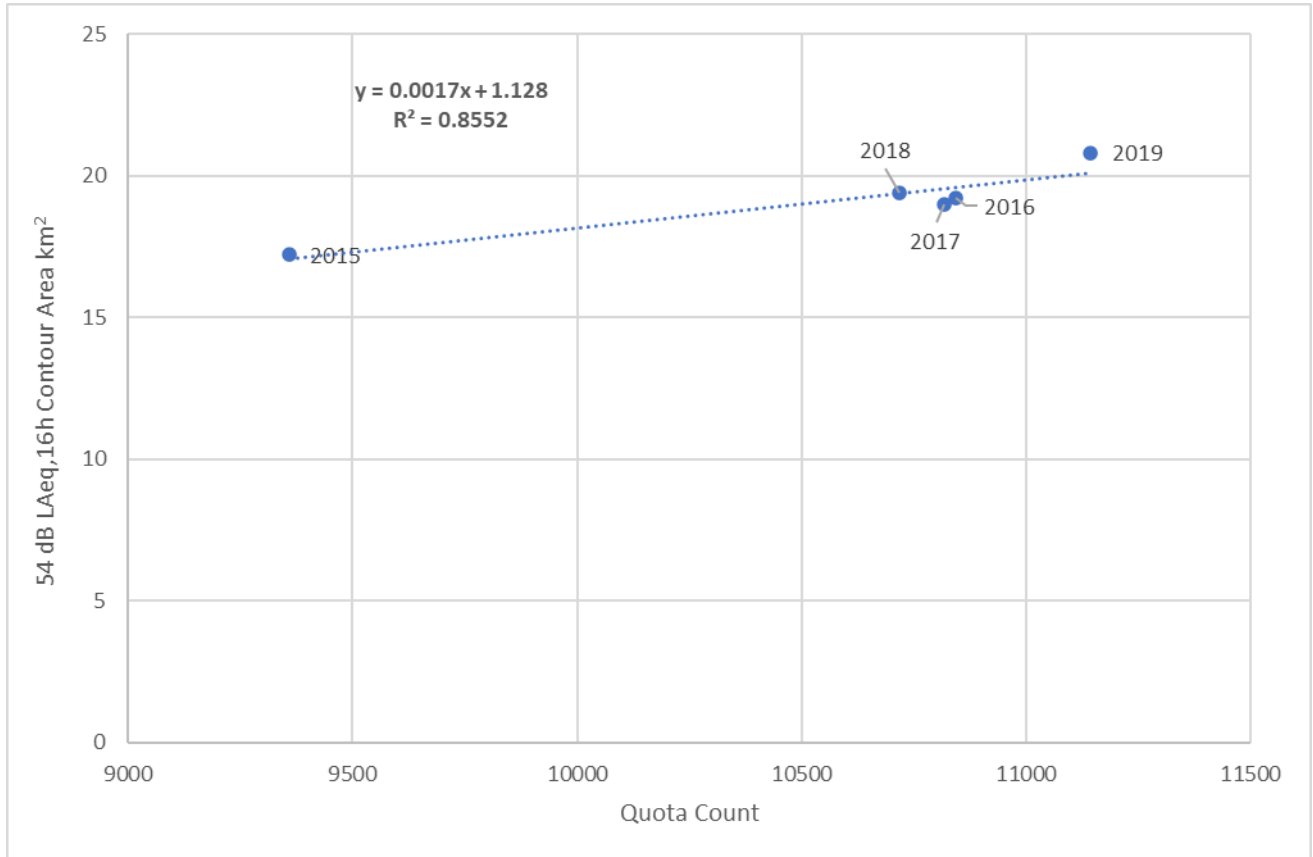
R² value of 0.96 shows a strong correlation between the 92-day summer period noise contour and QC count.

Inset A.1 92-day Summer Period Scheduled Night-time QC vs. 48 dB L_{Aeq,8h} 92-day Summer Period Contour



8.1.5 **Inset A.2** shows the relationship between the 92-day summer daytime period QC Count and the 92-day summer daytime contour areas in each year. The R² value of 0.86 does not show quite as strong a correlation with contour area as noted in **Inset A.1** for night-time, but it is a strong relationship overall giving confidence that total day as well as night quota counts are a reliable leading indicator of actual day and night noise contour areas.

Inset A.2 92-day Summer Period Scheduled Daytime QC vs. 54 dB LAeq,16h 92-day Summer Period Contour



GLOSSARY AND ABBREVIATIONS

Term	Definition
CAA	Civil Aviation Authority
DCO	Development Consent Order
ESG	Environmental Scrutiny Group
ExA	Examining Authority
GCG	Green Controlled Growth
NAP	Noise Action Plan
NE	Noise Envelope
NEDG	Noise Envelope Design Group
NVL	Noise Violation Limit
SoCG	Statement of Common Ground
QC	Quota Count

REFERENCES

Ref 1 Civil Aviation Authority (2021) CAP1506: Survey of Noise Attitudes 2014: Aircraft Noise and Annoyance, Second Edition. Online

Ref 2 Civil Aviation Authority (2021), CAP2161: Survey of Noise Attitudes 2014: Aircraft Noise and Sleep Disturbance. Online

Ref 3 Civil Aviation Authority (2020) CAP1868: Quota Count validation study at Heathrow Airport. Online.

Ref 4 Civil Aviation Authority (2019) CAP1731: Aviation Strategy – Noise Forecast and Analyses. Online.