S.37

File With

SECTION 131 FORM

Appeal No
ABP— 314885-22

Defer Re O/H

To
SEO

Having considered the contents of the submission dated/received 2/10/2022
from STEPHEN SMYTH I recommend that section 131 of the Planning
and Development Act, 2000 be/~~not be~~ invoked at this stage for the following reason(s):
No new issues raised.

Signed
EO

Date
14/10/22.

To
EO

Section 131 not to be invoked at this stage. ☐
Section 131 to be invoked — allow 2/4 weeks for reply. ☐

Signed
SEO

Date

Signed
SAO

Date

M

Please prepare BP ..... — Section 131 notice enclosing a copy of the attached submission.

To

Task No

Allow 2/3/4 weeks
BP

Signed
EO

Date

Signed
AA

Date

An Bord Pleanála

Planning Appeal Online Observation

Online Reference
NPA-OBS-001344

Online Observation Details

Contact Name
Stephen Smyth

Lodgement Date
02/10/2022 21:31:17

Case Number / Description
314485

Payment Details

Payment Method
Online Payment

Cardholder Name
Stephen Smyth

Payment Amount
€50.00

Processing Section

S.131 Consideration Required

☐ Yes — P.T.O. ☐ N/A — Invalid

Signed

An Bord Pleanála

Observation on a Planning Appeal: Form.

Your details

1. Observer's details (person making the observation)

If you are making the observation, write your full name and address.

If you are an agent completing the observation for someone else, write the observer's details:

Your full details:

(a)	Name	Stephen Smyth
(b)	Address	Newpark, The Ward, Co. Dublin, D11EF2R

Agent's details

2. Agent's details

If you are an agent and are acting for someone else **on this observation**, please **also** write your details below.

If you are not using an agent, please write "Not applicable" below.

(a)	Agent's name	Not applicable
(b)	Agent's address	Not applicable

Postal address for letters

3. During the appeal process we will post information and items to you **or** to your agent. For this observation, who should we write to? (Please tick ✓ one box only.)

You (the observer) at the address in Part 1	✓	**The agent at the address in Part 2**	☐

Details about the proposed development

4. Please provide details about the appeal you wish to make an observation on. If you want, you can include a copy of the planning authority's decision as the observation details.

(a) Planning authority

(for example: Ballytown City Council)

Fingal County Council

(b) An Bord Pleanála appeal case number (if available)

(for example: ABP-300000-19)

PL06F.314485

(c) Planning authority register reference number

(for example: 18/0123)

F20A/0668

(d) Location of proposed development

(for example: 1 Main Street, Baile Fearainn, Co Abhaile)

Dublin Airport, Co Dublin

Observation details

5. Please describe the grounds of your observation (planning reasons and arguments). You can type or write them in the space below or you can attach them separately.

We support the current appeals lodged with An Bord Pleanála and wish to add the following comments listed below.

1.0 HEALTH IMPACTS OF THE PROPOSAL ARE NOT ADEQUATELY ADDRESSED

When the North Runway was assessed by An Bord Pleanála in 2007 it concluded that the noise and associated health impact of night-time flights was too significant to allow unrestricted airport operations at night. In the intervening years further evidence of the health impacts of night-time noise exposure has been developed. Not least the 2009 WHO Night Noise Guidelines for Europe https://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf and the 2018 WHO European Noise Guidelines for the European Region https://www.who.int/europe/publications/i/item/9789289053563.

Additional research by Basner et a land others [1] has also developed strong links between aircraft noise and health.

These and other studies have shown clear exposure response relationships between the maximum level of individual noise events and impacts during sleep. Therefore, when assessing the impact of noise on sleep it is necessary to consider the noise from individual events such as L_{AFmax} and SEL, as well as the overall average noise level such as L_{night}.

The EIAR fails to fully assess the severe health impacts the proposed development will have on dwellings nearby and in particular does not assess impacts on sleep as a result of the individual noise events as discussed above. Instead, Chapters 7 and 13 of the EIAR only use average noise descriptors such as L_{den} and L_{night} to assess population exposure response to noise. This approach is inadequate and fails to consider the impact as a result of maximum noise levels experienced by dwellings nearby.

The $L_{Aeq,T}$ metric which L_{den} and L_{night} are based on is an average which aggregates the number of noise events and their duration over a time period. It is insensitive to changes in these factors, for example flight numbers need to double for a 3dB increase in average noise levels to be determined. However, people do not hear noise as an average and instead the perception of noise impact is more related to the intensity of the noise and the duration of the event. Further evidence of the maximum noise levels experienced by dwellings since the opening of the North Runway is presented in Section 5.0 of this document.

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1 Basner M, Müller U, Elmenhorst EM. Single and combined effects of air, road, and rail traffic noise on sleep and recuperation. Sleep 2011; 34: 11–23;
Basner M, Müller U, Griefahn B. Practical guidance for risk assessment of traffic noise effects on sleep. Appl Acoust 2010; 71: 518–22;
Basner M. Nocturnal aircraft noise increases objectively assessed daytime sleepiness. Somnologie 2008; 12: 110–17;
Elmenhorst EM, Elmenhorst D, Wenzel J, et al. Effects of nocturnal aircraft noise on cognitive performance in the following morning: dose- Jarup L, Babisch W, Houthuijs D, et al, and the HYENA study team.
Hypertension and exposure to noise near airports: the HYENA study. Environ Health Perspect 2008; 116: 329–33. Response relationships in laboratory and field. Int Arch Occup Environ Health 2010; 83: 743–51.

I would direct An Bord Pleanála to recent UK developments such as the HS2 rail project and the expansion of Bristol Airport. The HS2 project adopted the following criteria for Lowest Observable Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL).

Table 1 - Noise effect levels for permanent residential buildings

Time of day	Lowest Observed Adverse Effect Level (dB)	Significant Observed Adverse Effect Level (dB)
Day (0700 – 2300)	50 $L_{pAeq,\ 16hr}$	65 $L_{pAeq,\ 16hr}$
Night (2300 – 0700)	40 $L_{pAeq,\ 8hr}$	55 $L_{pAeq,\ 8hr}$
Night (2300 – 0700)	60 L_{pAFMax} (at the façade, from any nightly noise event)	80 L_{pAFMax} (at the façade, from more than 20 nightly train passbys), or 85 L_{pAFMax} (at the façade, from 20 or fewer nightly train passbys)

Table 2 - Noise impact levels for noise sensitive non-residential buildings and external amenity spaces

Examples	Day 0700-2300	Night 2300-0700
Large and small auditoria; concert halls; sound recording & broadcast studios; and theatres	60 dB L_{pAFMax} or 50 dB $L_{pAeq,\ 16hr}$	60 dB L_{pAFMax} or 50 dB $L_{pAeq,\ 8hr}$
Places of meeting for religious worship; courts; cinemas; lecture theatres; museums; and small auditoria or halls	50 dB $L_{pAeq,\ 16hr}$	n/a
Schools; colleges; hospitals; hotels; and libraries	50 dB $L_{pAeq,16hr}$	45 dB $L_{pAeq,8hr}$
Offices and external amenity spaces	55 dB $L_{pAeq,16hr}$	n/a

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672395/E20_-_Control_of_Airborne_Noise_v1.5.pdf

The planning decision to grant permission for HS2 specifies in the register of undertakings and assurances that the developer is to take all reasonable steps to ensure that the LOAEL values listed above are not exceeded.

https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F1076072%2FPhase_1_Register_of_Undertakings_and_Assurances_v.1.8.15.xlsx&wdOrigin=BROWSELINK

For the Bristol Airport expansion project the following criteria were adopted in the appeal decision to grant permission.

https://gat04-live-1517c8 a4486c41609369c6 8f30c8-aa81074.divio-media.org/file r_public/b2/0 9/b20947a3-b2e3-467a-b3fd-90a7 e438c112/ appeal_decision_3259234.pdf

Daytime Criteria $L_{Aeq,16h}$	Night-time Criteria		
	$L_{Aeq,8h}$	L_{ASmax}	SEL
51dB (LOAEL)	45dB (LOAEL)	60dB	70dB(A)
63dB (SOAEL)	55dB (SOAEL)	80dB	90dB(A)
69dB (UAEL)	63dB (UAEL)	90dB	100dB(A)

It is perhaps worth noting that the noise consultant for Bristol Airport is also Bikerdale Allen Partners who are the consultants for DAA. However, they do not propose the same criteria at Dublin Airport.

For both projects it was found that the Environmental Statements initially submitted to the planning authorities were inadequate as they did not assess the potential health impacts of individual noise events using L_{AFmax} or SEL parameters.

I ask An Bord Pleanála to investigate if the EIAR submitted by DAA is in fact adequate in terms of the assessment it has conducted on the negative health impacts of the North Runway. I can attest from direct experience since the runway was opened that the noise levels from individual flights are excessively loud and the thought of having such high noise levels during the night at my house is frankly appalling. I invite any inspectors from An Bord Pleanála or any technical experts they may consult with to visit my house and experience for themselves the noise levels being generated.

It will not need any expertise in noise or medical training to understand how the operation of the North Runway at night will have significant health impacts on my family.

2.0 FLIGHT PATHS

The flight paths taken by aircraft arriving and departing Dublin Airport are clearly a major input into the impact assessments. However, as you will see in the following sections there are very significant differences between the flight paths assessed in the original North Runway application that was granted permission in 2007, what the DAA ask for in the current application and what they are actually doing since the North Runway opened. In summary the following table describes the basic flight paths for westerly departures from the North Runway in each of these cases.

Source	Flight Path Description
North Runway 2007 Granted Permission	Category A & B (i.e. propellor and small jets) departures fly straight out until 750ft is reached before turning. Category C & D (i.e. jets) departures fly straight out for 5nm or until 3000ft is reached before turning.
Relevant Action EIAR – Current Application	Category A & B (i.e. propellor and small jets) departures fly straight out until 750ft is reached before turning. Category C & D (i.e. jets) departures fly straight out for 1.18nm before diverging north by 30-degrees or 75-degrees
Actual Operations since North Runway Opened in August 2022	Aircraft of any category turn immediately on takeoff once 650ft altitude is reached diverging north by 30-degrees or 75-degrees

The following sections discuss in more detail the flight paths for each scenario in this table.

2.1 2007 North Runway Flight Paths

In 2007 the North Runway application presented all impacts on the basis of flights that were straight out from the runway for at least 5 nautical miles or until the aircraft reached 3,000ft.

This is what was granted permission by An Bord Pleanála and is also what formed the basis of the noise insulation contours produced by DAA in compliance submissions to Fingal Co Co.

2.2 EIAR Flight Paths

In the current application the DAA are changing the flight paths for departures. This change of flight path cannot be underestimated for the people living under the proposed flight path. The DAA's application does not appropriately assess the environmental or health impacts of changing the flight path in isolation.

The issue of divergent flight paths is only briefly discussed in the EIAR. In summary DAA describe the proposed flight paths for the North Runway as follows:

NA-10	Accepted NPR for North Runway	*Three-Runway Noise Preferential Routes (NPRs) or Environmental Corridor (ECs) and Track Keeping* – Intent is to minimise disruption by routing aircraft away from built-up areas, where possible. Unless directed otherwise by IAA-ANSP, all aircraft taking off from Dublin Airport are required to follow specific NPRs. To minimise impact, NPRs are designed to avoid overflight of built-up areas, where possible. An NPR is a path or corridor (1.8 kilometres at its widest point) that aircraft follow from take-off until being directed by IAA- ANSP onto their main air traffic route, typically at 3,000 feet altitude above mean sea level. Aircraft flying inside the NPR corridor are flying on-track. The preferred departure flight path NPR is straight out on the South Runway and divergence paths of 30-degrees and 75-degrees for the North Runway for westerly flow and straight out on the South Runway and a divergent path of 15-degrees for easterly flow.	×	✓	×

This very brief entry states that westerly departures for the North Runway will operate divergent flight paths of 30-degrees and 75-degrees while easterly departures will diverge 15-degrees.

This is a very significant difference to what was originally granted permission and the DAA's application documents do not make clear statements of this change. Therefore, many families will be unaware of the fact that the flight paths are different to what they may have expected based on all information provided in 2007 and subsequently in noise insulation contour information. Figure 1 taken from the compliance submission from DAA to Fingal for Condition 7 demonstrates that the flight paths used for the generation of the noise insulation contours are based on departures flying straight out. Divergence does not occur until flights cross the R135 regional road approximately 3.6km from the end of the North Runway following a similar approach to how the South Runway has historically operated.

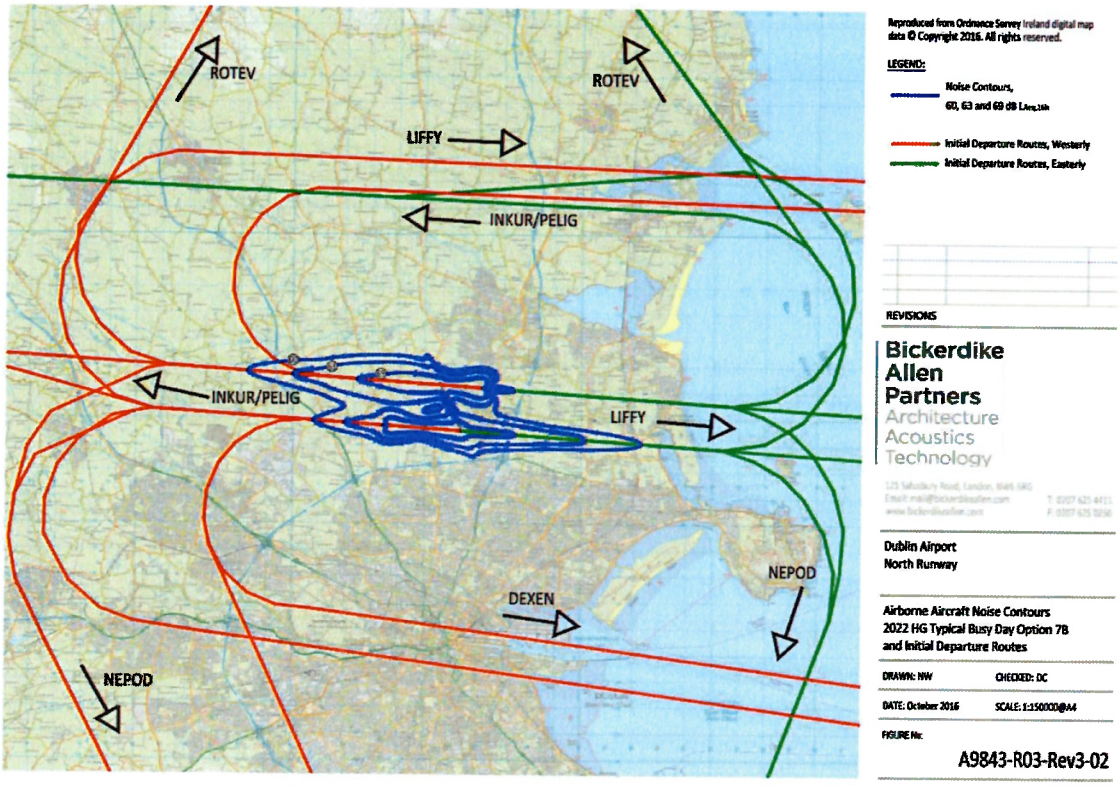

Figure 1 DAA Compliance Submission Flight Paths

The current application does not assess the change in impacts that would occur on the ground as a result of these new divergent flight paths. Instead, the DAA application presents its impacts as if the straight out flight paths used in 2007 no longer exist.

I argue that because the flight paths are so fundamental to the impact assessment it is necessary for the new flight paths to be assessed in terms of their environmental impact before any conclusions can be made. This has not been done by the DAA and they are assuming acceptance of the new divergent flight paths in their assessment. This is inadequate and no impact assessment is presented of the new flight paths across both daytime and night-time.

My question for An Bord Pleanála is should the new divergent flight paths not be assessed from first principals also as part of the current application. Flight paths taken are fundamental to the noise and health impacts experienced on the ground. If DAA are changing the flight path from what was assessed in 2007 and also changing the flight path from what they used in compliance documents submitted to Fingal then the compliance documentation is incorrect. The impacts discussed in 2007 are clearly no longer valid. The clear intent of Conditions 6 and 7 of the original grant of permission is that qualifying dwellings and schools are insulated from noise before the North Runway is operational. Based on the divergent flight path numerous additional residences and potentially schools would most likely now qualify for noise insulation as per Conditions 6 and 7 of the original grant for permission. Therefore, at a minimum these properties should also be noise insulated before the North Runway

became operational. A reasonable argument could be made that the current Northern Runway operations are not in compliance wit hthe intent of Conditions 6 and 7 of the original grant of permission.

Furthermore, the Do Nothing scenario presented in the EIAR is inaccurate as it is not representative of the permitted situation as assessed with straight out flight paths in 2007. In addition to this the DAA have failed to assess the noise impact of changing the flight path both during daytime operations and night-time operations. In fact, DAA have failed to assess the real flight paths they are operating since the North Runway became operational. Noise impact assessments are not accurate as they are based on a fictional flight path that does not exist in practice.

The DAA have claimed that their application is only to change Conditions 3(d) and 5 an d nothing else. However, changing the flight paths changes the impacts across the entire day and this has not been assessed on its own. An Bord Pleanála should refuse the current application on the basis that the environmental assessment is incomplete.

2.2.1 EIAR Noise Assessment Flight Paths

To determine the noise impact of North Runway operations a model was developed, and a key input are the flight paths being taken. Appendix 13B details the assumptions used as follows,

> 13B.3.42 A setof departureroutes from the North Runwaywas then developedthat re plicatedthe current routes as closely as possible, while allowingfor these initialturns . The resultis routes withan earlyturn to the north. When headingeast all of theroutes turn 15 ° at 1.06nmfrom the end of the runway.When heading to thewest theroutes to DEXEN, INKUR,NEPOD, PELIG andSUROX turn 30°, whilethose to ABBEY and ROTEV turn75°, all at 1.18nm from the endof the runway.

These flight paths are illustrated in Figure 13B-3 of the EIAR appendix 13B is reproduced here in Figure 2. I also refer An Bord Pleanála to Section 2.3 of t his report which discusses the difference between what the EIAR proposes and the act ua flight paths being flown.

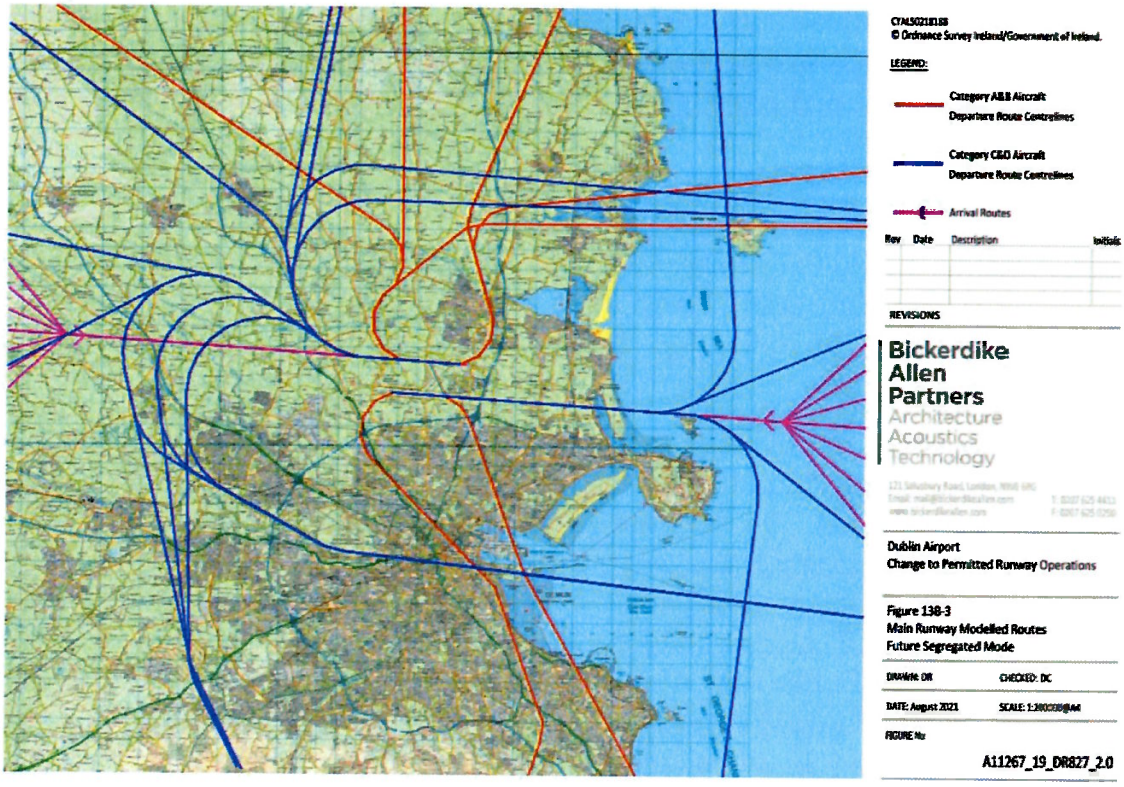

Figure 2 EIAR Noise Model Flight Paths

2.2.2 EIAR Crash Risk Assessment Flight Paths

Chapter 8 of the EIAR deals with Major Accidents and Disasters, essentially presenting risk contours of unacceptable risks to individuals or society as a result of an accident. In the case of an airport operation the risk of aircraft crashes is one of the items examined. In order to assess this risk the authors prepared a model which is described in detail in Appendix 8A. Inputs to the model include the flight paths to be taken and Section A8.2.6 states,

> A8.2.12 In order to ensure an adequate lateral separation between aircraft using the Southern Runway and those using the North Runway, proposed future Northern Runway departure routes for larger aircraft within PANS-OPS Categories C and D include a course divergence of at least 15° to the north, shortly after
>
> A8.4
>
> Classification: Class 1 - General
>
> take-off at 1.06 and 1.18 nautical miles for easterly and westerly take-offs, respectively. During departures from the Northern Runway, Category A and B aircraft are expected to execute an earlier turn and leave the extended runway centreline to the north shortly after the end of the runway.

This description is clearly at odds to the flight paths described in other areas of the DAA submission. It would therefore appear that the Crash Risk Assessment is incorrect and incomplete. I ask An Bord Pleanála to consider this in their assessment.

2.2 Actual Flight Paths

Since the North Runway became operational on 24th August 2022 it is apparent that the flight paths being used are very different to any of the flight paths presented to date by DAA in their public consultation or planning documentation.

The actual operation of the North Runway since opening on 24th August 2022 has westerly departures diverging once a height of 650ft above sea level has been reached. This information is from the IAA Standard Instrument Departure charts, for example the one presented in Figure 3 for Category C & D jets. This chart is directing all departures from the North Runway to turn onto headings of 308° or 339° once a height above sea level of 650ft is reached. It should be noted that Dublin Airport is 217ft above sea level so aircraft are only 433ft above the ground when making this turn. For some of the larger aircraft, wingtips are less than 1.5 wingspans above the ground when turning. Pilots have commented that they are pointing their wings directly at houses the turns are so severe.

To summarise the following table describes the flight paths for westerly departures from the North Runway for what was granted permission in 2007 versus what is happening today.

Source	Flight Path Description
North Runway 2007 Granted Permission	Category A & B (i.e. propellor and small jets) departures fly straight out until 750ft is reached before turning. Category C & D (i.e. jets) departures fly straight out for 5nm or until 3000ft is reached before turning.
Actual Operations since North Runway Opened in August 2022	Aircraft of any category turn immediately on takeoff once 650ft altitude is reached diverging north by 30-degrees or 75-degrees

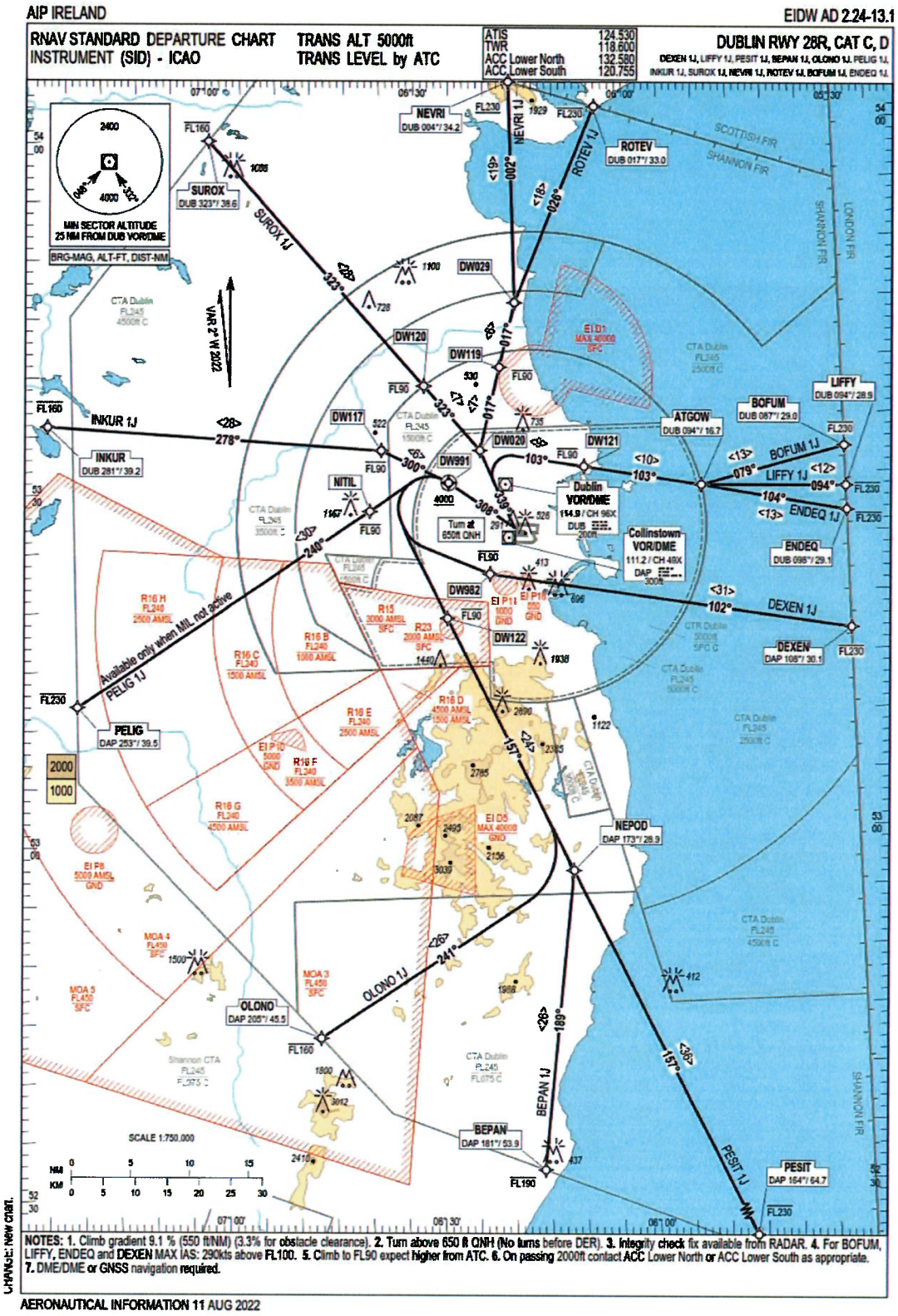

Figure 3 SID For North Runway Westerly Departures

Figure 4 presents the actual departure flight tracks from the North Runway since opening on the 24th August, in green, overlaid onto the flight paths proposed by the DAA in this EIAR. Each green line represents a flight, and it is

very clear that the departures from the North Runway are diverging much earlier than the flight paths used by the DAA in all noise contour production. This earlier turn places the flight path directly above properties, including my own, never identified as being impacted by the flight paths in the submitted planning documents. Therefore, no impact assessment has been completed for the manner in which the North Runway has been operated since opening on 24 August 2022.

This can only mean that DAA made significant errors in the inputs to their assumed flight paths, or the IAA have made an error in how the runway should operate. An Bord Pleanála should declare the current planning application invalid as it is clearly not representative of how the DAA are operating or how they propose to operate the North Runway.

The centreline of the actual departure flight paths are in some cases well over 3km away from the centreline of the flight paths in the DAA documentation. This has very significant implications for the noise impacts in particular. It is no different to An Bord Pleanála granting permission for the M50 motorway and the roads authority deciding to build it 3km from where they said they would.

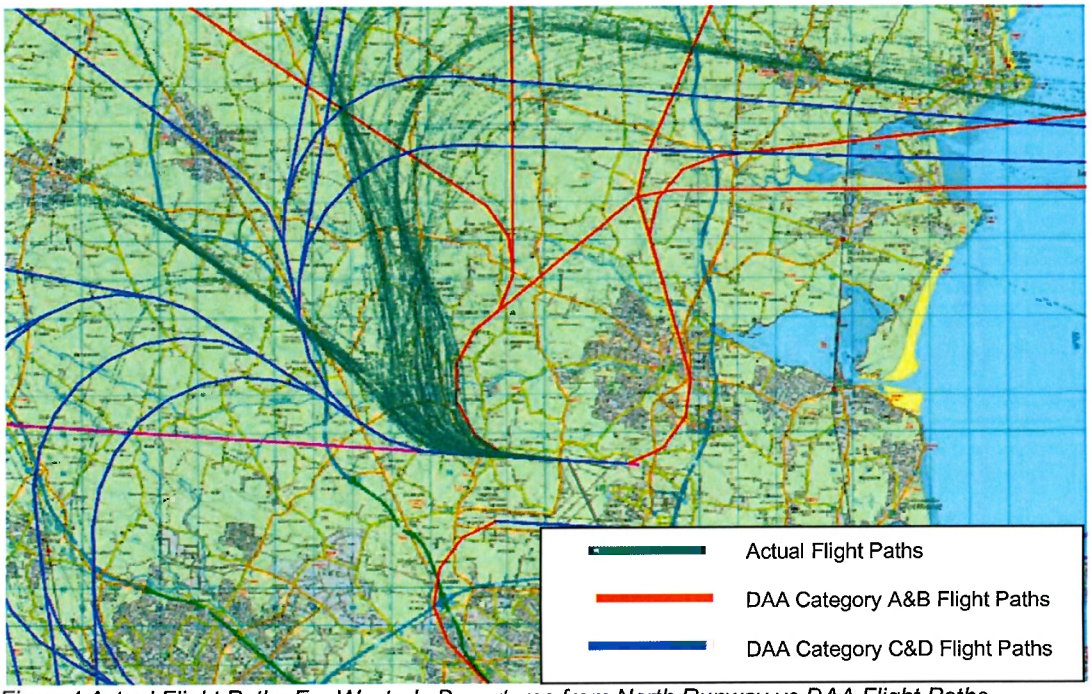

Figure 4 Actual Flight Paths For Westerly Departures from North Runway vs DAA Flight Paths

Figure 5 illustrates the actual flight paths above my house since the North Runway became operational versus the flight paths being proposed by the DAA in this application. The dispersion and wide area that is now under a flight path is shocking and wildly different to the information put forward by DAA. An Bord Pleanála need look no further than this to understand that the current application is invalid and not representative of what the DAA intend to do. Permission should be refused for night flight and the DAA should be made to close the North Runway or operate it within the planning permission they were granted in 2007.

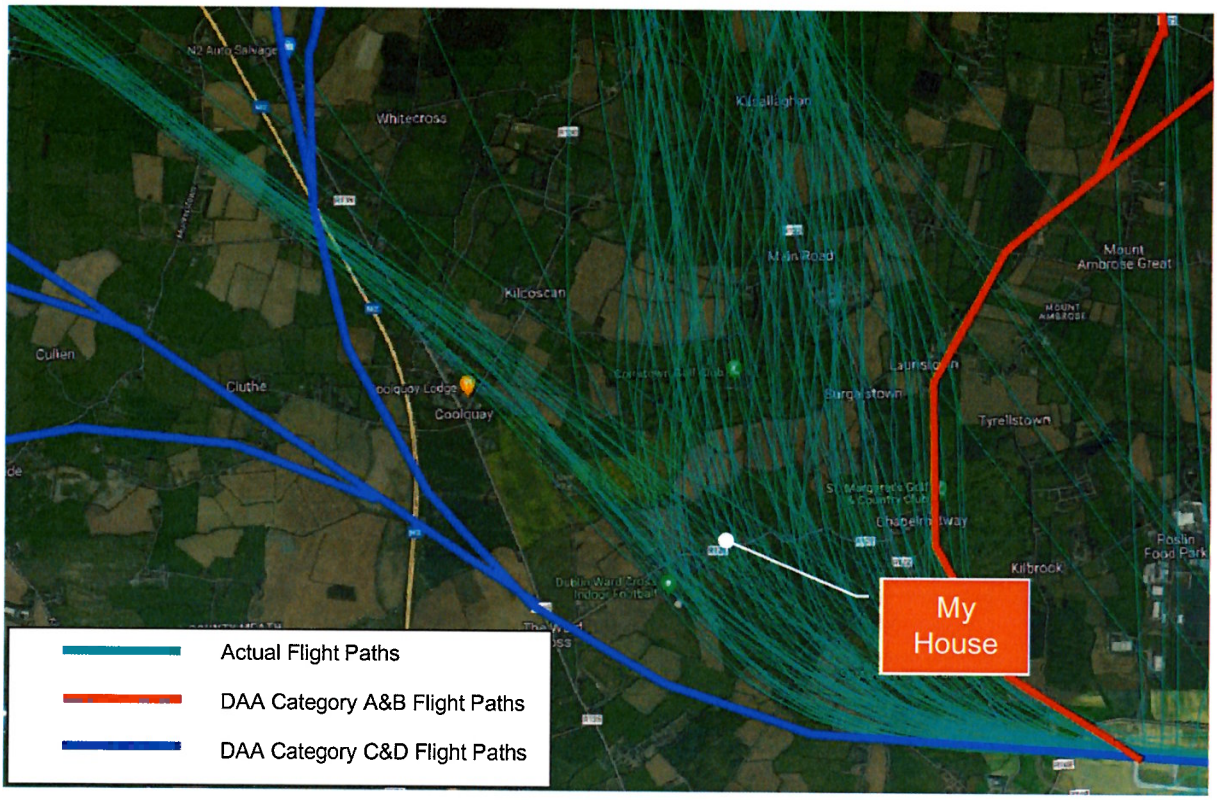

Figure 5 Actual Flight Paths versus DAA EIAR Flight Paths at My House

3.0 QUOTA SYSTEM

The noise quota system proposed by the DAA in place of a movement cap is fundamentally in favour of the airport operator only and does not limit the environmental impact in any way on the surrounding communities.

The quota system assigns a Quota Count (QC) value to each aircraft type depending on the certified noise levels of each aircraft. However, while an aircraft may only be marginally less noisy than one in an adjacent quota band the QC count is halved.

As an example, the table below produces the Quota Count set by ANCA in their decision for aircraft of various Noise Classification Levels.

Noise Classification Level	Quota Count (QC)
Greater than 10 1.9 E PNdB	16.0
99-101.9 E PNdB	8.0
96-9 8 9 EPNdB	4.0
93-95.9 EPNdB	2.0
90-92.9 E PNdB	1.0
87-89.9 EPNdB	0.5
84-86.9 EPNdB	0.25
81 -83.9 EP NdB	0.125
Less than 81 EPNdB	0

If two specific aircraft are considered as follows:

- QC/1.0 aircraft with a noise classification of 92.9dB
- QC/2.0 aircraft with a noise classification of 93dB

According to the quota system it is acceptable to have twice as many of the QC/1.0 aircraft movements within the quota system than the QC/2.0 aircraft while in fact there is only 0.1dB of a difference between them. That noise difference is imperceptible to the huma n ear. Despite each plant being marginally less noisy when the number of flights doubles this will increase the noise impact on the ground by 3dB.

Ultimately the quota system without any movement cap is a method that will only allow increased flights in future as aircraft make marginal reductions in their noise emissions to drop down a QC category. This approach cannot be considered a noise mitigation measure as the DAA would promote it. It is simply another way to describe the DAA getting exactly what they want which is unrestricted night-time flight numbers.

An Bord Ple anála should refuse the quota system as proposed and instead review the systems in use in other airports where the quota count is lower than that proposed by DAA and there is a movement limit in place also. Note the following from the Heathrow website describing how a movement limit and quota can work together.

How the quota count and movement limit work together

The movement limit and quota count restrictions work together to make sure the overall number of night flights are limited and that the quietest planes are used:

- If newer quieter planes are used their night quota scores will be low – but the total number will be restricted by the movement limit.
- If noisier aircraft are used their night quota scores will be high and their number will be restricted by the quota count limit.

The quota count combined with the movement limit ensure the total number of night flights are restricted at Heathrow and the use of the quietest planes is encouraged.

The following table summarises the differences in Quota Count and Movement Limit across several London airports and what DAA want for Dublin.

Table 1: Summary of Noise Quota Scheme for London Airports and that proposed for Dublin

		Movement Limit	Noise Quota Limit	Ban on QC4 rated aircraft	Time Period
Heathrow	Winter	2,550	2,415	Yes	23:30 – 06:00
	Summer	3,250	2,735		
Gatwick	Winter	3,250	1,785	Yes	23:30 – 06:00
	Summer	11,200	5,150		
Stansted	Winter	5,600	3,310	Yes	23:30 – 06:00
	Summer	8,100	4,560		
Dublin	Winter	None	16,260	Yes	23:00 – 07:00
	Summer				

It is clear that the DAA approach is effectively unrestricted movements. This cannot be allowed as it would have huge negative impacts on the surrounding communities.

Furthermore, there is evidence from the CAA in the UK in their document Review of the Quota Count (QC) System:Re-analysis of the Differences between Arrivals and Departures https://publicapps.caa.co.uk/docs/33/ERCD0204.PDF that the actual noise levels measured from arrivals and departures to London airports can in many cases be high enough for the QC count to be doubled for certain aircraft. This calls the merits of the quota system in significant doubt and provides no certainty to the local communities affected that there will be any restriction on operations.

Finally, simply put DAA cannot be trusted to operate within the quota system which can only be calculated at the end of the years operation. Will DAA shut down the airport when they have reached their quota early? This is clearly not going to happen so if that is the case what restriction does the quota system actually apply?

I ask An Bord Pleanála to refuse permission for the Quota Count system and instead replace it with a simplified movement limit for each night. This would be easy to police and would provide certainty to the local communities that aircraft

movements at night will not increase over time which is precisely what the Quota Count system allows.

4.0 NOISE INSULATION SCHEME

The proposed noise insulation scheme for night-time flights is a lesser scheme when compared to the daytime insulation scheme currently in place. The proposed €20,000 grant will not be sufficient to adequately insulate affected houses. In all other infrastructure developments in Ireland, be they roads or rail, the developer pays for the mitigation required .In this instance DAA and ANCA are proposing a scheme where the affected homeowner must pay towards the mitigation. This flies in the face of the polluter pays principal that is well established in Ireland.

A cursory search online found that 50dB L_{night} or 55dB L_{night} are both used as a threshold for insulation depending on the airport. Vienna Airport uses 65dB day and 57dB night as relocation thresholds. 60dB day is used as a threshold for insulation in Gatwick. The following table summarises some of the thresholds in place in other locations.

Airport	Insulation Thresholds	Relocation/Voluntary Purchase
Dublin	63dB $L_{Aeq,16hr}$ 55dB L_{night}	69dB $L_{Aeq,16hr}$
Vienna	54dB L_{day} 45dB L_{night}	65dB L_{day} 57dB L_{night}
Gatwick	60dB $L_{Aeq,16hr}$	66dB $L_{Aeq,16hr}$
Germany (New/Expanding Airfield)	55-60dB L_{day} 50dB L_{night} & 6 x 68dB(A) L_{Amax}	

Almost all schemes cover the full cost of insulation. Interestingly the aircraft noise exposure document published by the European Commission in 2007 https://tran sport.eceuropa.eu/system/files/2016-09/2007_10_aircraft_noise_exposure_en.pdf has several quotes from Dublin Airport in it, including that the average cost of insulating houses was €20,000 in 2007. If insulation cost €20,000 in 2007 it must be multiples of that now in terms of costs to account for inflation and increased building regulation requirements?

As the newest runway in the EU, Dublin Airport should be aiming for the highest standards of insulation schemes. They have had decades of land use planning to restrict new housing in the noise zones so the numbers of properties they need to insulate is already controlled from what it could have been. Also, insulation is a once off , pay for it fully and it is done.

An Bord Pleanála should review the noise insulation scheme against other jurisdictions and apply the highest standards internationally to Dublin Airport. It is also important that An Bord Pleanála insist that the DAA assess the qualification for insulation on the basis of the Single Mode noise contours. These would represent the noise levels when the airport is operating in a specific mode depending on the prevailing winds. For example the single mode noise contours for westerly winds would represent a typical noise exposure on a day when takes offs from the North Runway are in a westerly direction. What the DAA currently present is actually a composite average scenario where noise levels are reduced by a percentage to compensate for the ratio of westerly to easterly winds normally experienced at Dublin Airport over the modelling period of 92 days in the Summer. That is to say that the wind blows westerly 70% of the time and easterly 30% of the time. So noise contours presented by the DAA for properties to the west of the airport are only 70% of the actual noise level that would be experienced in this area when westerly departures occur. An Bord Pleanála should note that Fingal Co Co demanded Single Mode contours from the DAA to create the Dublin Airport Noise Zones that were introduced in Variation No. 1 to the Fingal County Development Plan 2017 – 2023. A report verifying this approach is included at the rear of this observation. Fingal Co Co demanded this to ensure that all new development around Dublin Airport considered the worst-case noise levels that may occur on a given day.

5.0 MEASURED NOISE LEVELS AT MY DWELLING

Since the North Runway became operational flight paths used are dramatically different to those presented in the DAA documents and EIAR predicted contours. This has resulted in my house being directly under the flight path for westerly departures on the North Runway. The noise impacts were immediately noticeable both in our garden and inside the house the first morning that the runway came into operation.

To quantify the noise levels at my house I carried out a noise survey. I am a qualified acoustician and member of the Institute of Acoustics with over 20 years of experience in the field of acoustics both as an academic and a consultant.

Measurements were taken in accordance with *ISO1996-2:2017 Acoustics - Description, Measurement and Assessment of Environmental Noise -- Determination of Environmental Noise Levels* using a fully calibrated Class 1 sound level meter. The measurements were taken externally in my garden at a height of approximately 1.5m above ground in free field conditions. Figure 6 shows the microphone with windshield and bird spikes attached to the garden fence.

Figure 6 Noise Monitor Location

Figure 7 identifies the approximate location of my house relative to Dublin Airport. It is located 3km from the end of the North Runway.

Figure 7 Measurement Location Relative to North Runway

Measurements were logged at both 1 second and 1 hour intervals by the sound level meter for a period between 17th Septe mber and 22nd September. During this time the North Runway was operating westerly departures between 9am and 1pm each day except for the 21st September when the North Runway was not used.

Figure 8 plots the average hourly $L_{Aeq,1hr}$ values measured across the survey period as well as plotting the average overall $L_{Aeq,T}$ value for the period between 00:00hrs and 09:00hrs before the runway is operational, the period between 09:00hrs and 13:00hrs when the runway is operational, and the period between 13:00hrs and 23:59hrs after the runway is operational.

$L_{Aeq,\,T}$ is the equivalent sound pressure level that is an average of all sound measured over a particular reference period, T.

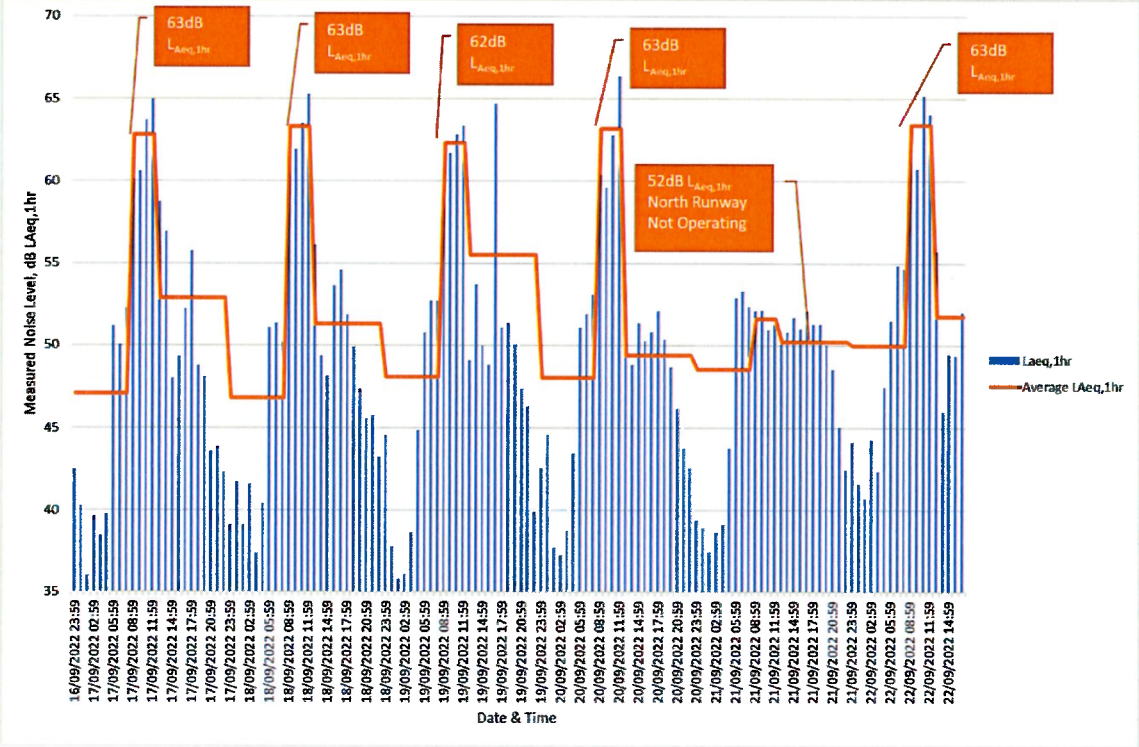

Figure 8 L_{Aeq} Noise Levels Measured

Figure 8 shows that when the North Runway is operational the average noise level at my house is of the order of 63dB $L_{Aeq,4hr}$. Without the North Runway in operation the average noise level is of the order of 52dB $L_{Aeq,4hr}$. This 11dB increase would be classified as a very high change according to the EIAR produced by the DAA. The EPA Guidelines on Information to be Contained an EIAR would require this to be described as a permanent, negative, significant and irreversible effect.

The EIAR produced by the DAA does not comment on the very significant increase in daytime noise I experience at my house due to the flight paths being used at the North Runway for westerly departures. This is also a very significant impact. In the Future Years Noise Forecast Report submitted to ANCA https://northrunway.exhibition.app/assets/pdf/documents/9_Future_Years_Noise_Forecast_Report.pdf noise contours for the expected L_{day}, $L_{evening}$ and $L_{Aeq,16hr}$ are presented for a variety of assessment years and scenarios. Perhaps the most appropriate contours to compare to the measurements taken at my house are the $L_{evening}$ contours as these are also for a 4hour period. Using

the opening year of 2022 contours for Scenario 01 which represents the Do Nothing and Scenario 02 which represents the proposed operation, my house is located at approximately 55dB $L_{evening}$. This is considerably lower than the 63dB $L_{Aeq,4hr}$ I measured at my prope rty.

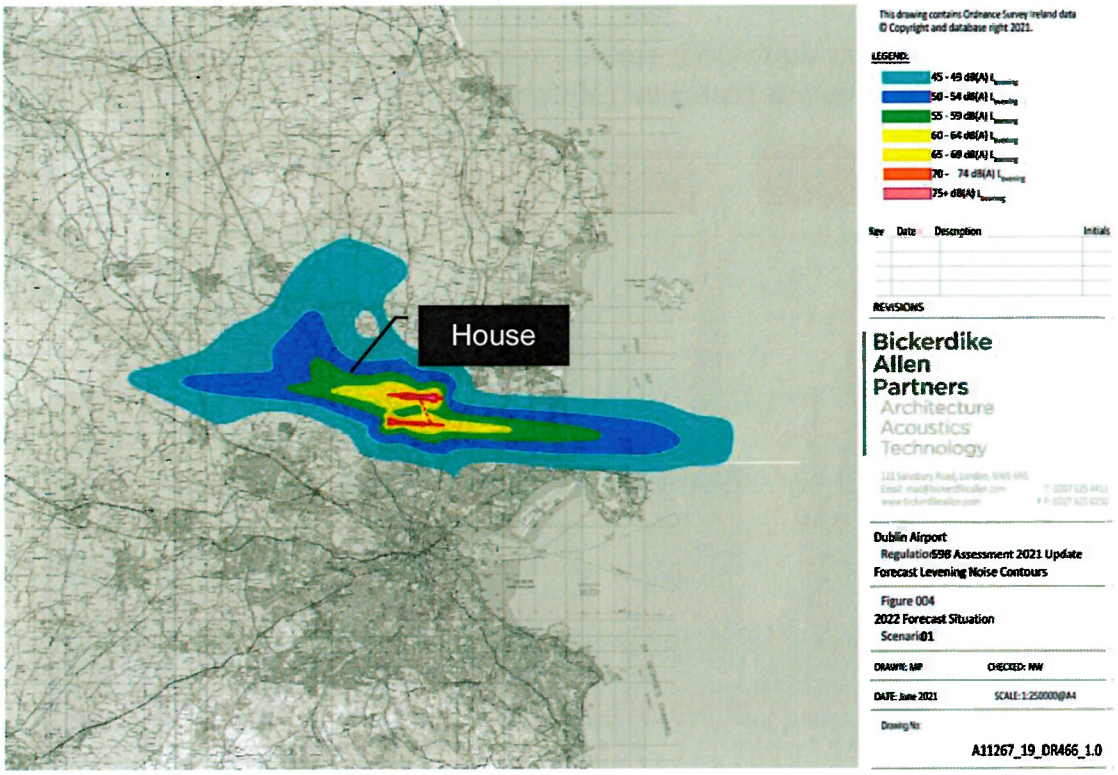

Figure 9 Scenario 01 $L_{evening}$ Contours

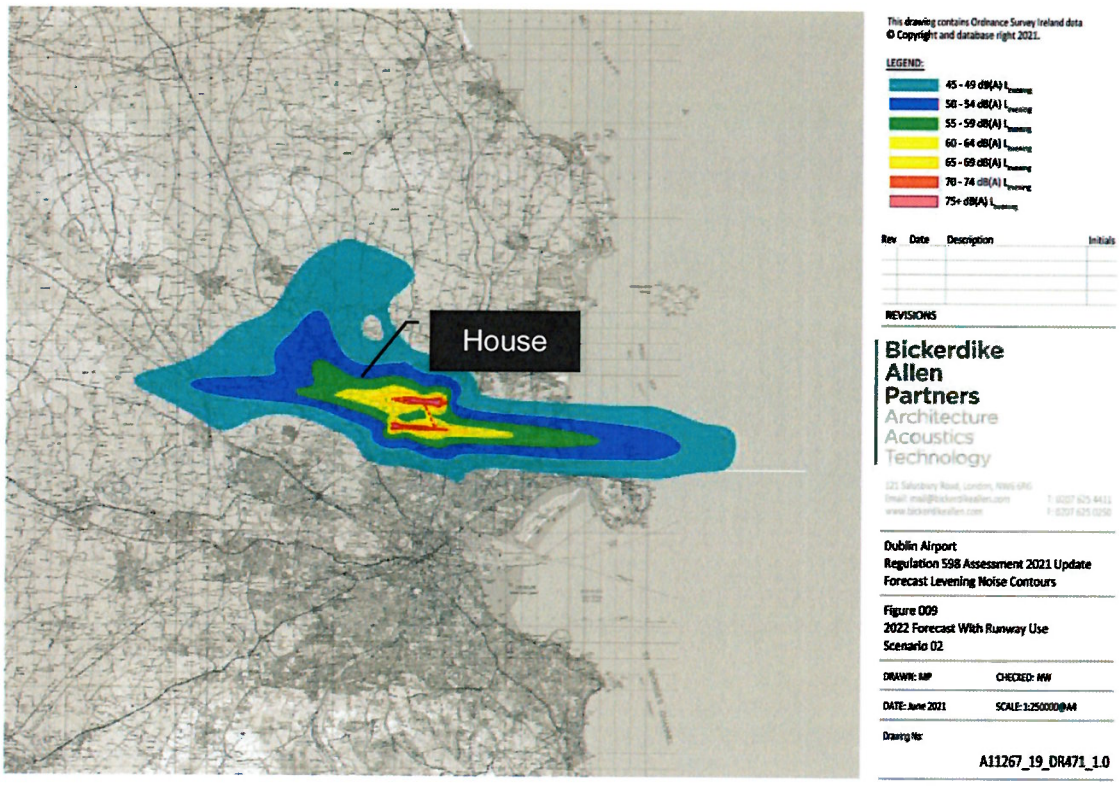

Figure 10 Scenario 02 $L_{evening}$ Contours

Furthermore, an average daytime noise level of 63dB $L_{Aeq,4hr}$ would qualify for whole dwelling noise insulation under the scheme offered by DAA to comply with Condition 7 of the planning permission for the North Runway. My property is not within this scheme according to compliance information submitted by DAA, yet I am exposed to this level of noise. Again, this would support the contention that the compliance documentation submitted to Fingal County Council in relation to Condition 7 is deficient and that the DAA are not in compliance with the requirements of this condition (i.e. all properties within a certain contour are to be sound insulation before the runway becomes operational).

ANCA have signed off on this mitigation measure as being compliant, yet it is clearly incorrect based on how the runway is being operated.

The survey I carried out also measured maximum noise levels at my property from individual aircraft movements. I was able to correlate each event with flight track information available to assign an aircraft type to each event. Figures 11 to 12 present the L_{AMax} levels for the most popular aircraft types of Airbus A320, Boeing 737-800 and Airbus A330.

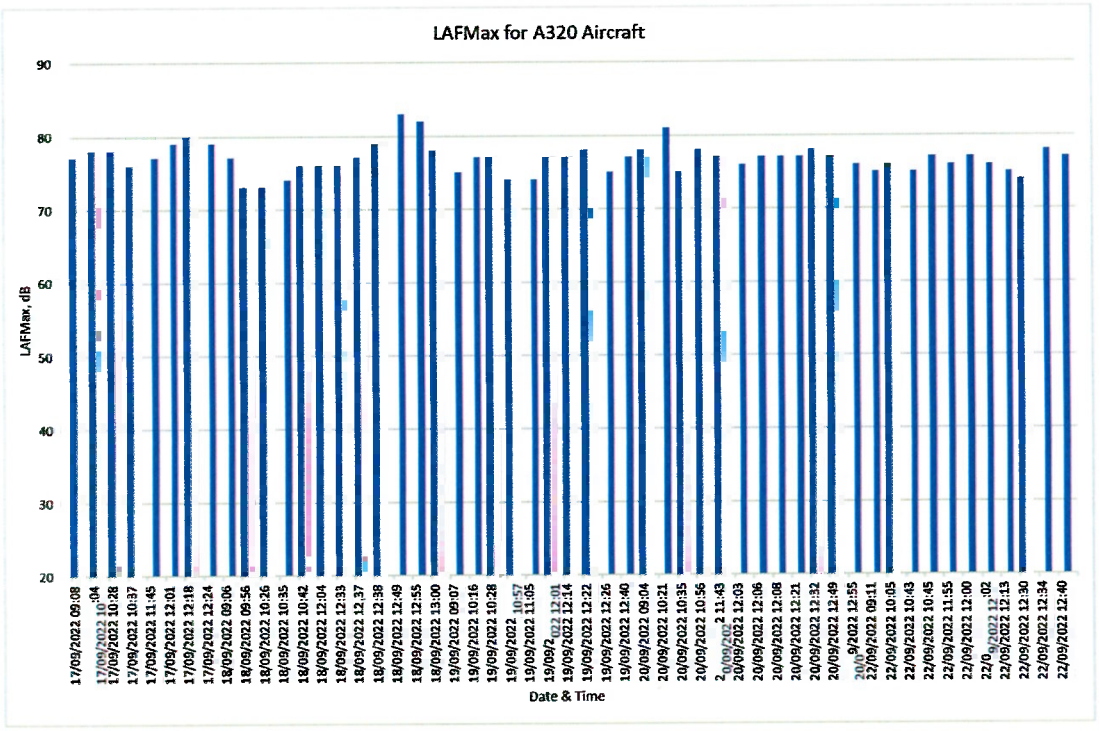

Figure 11 A320 L_{AMax} Levels Measured

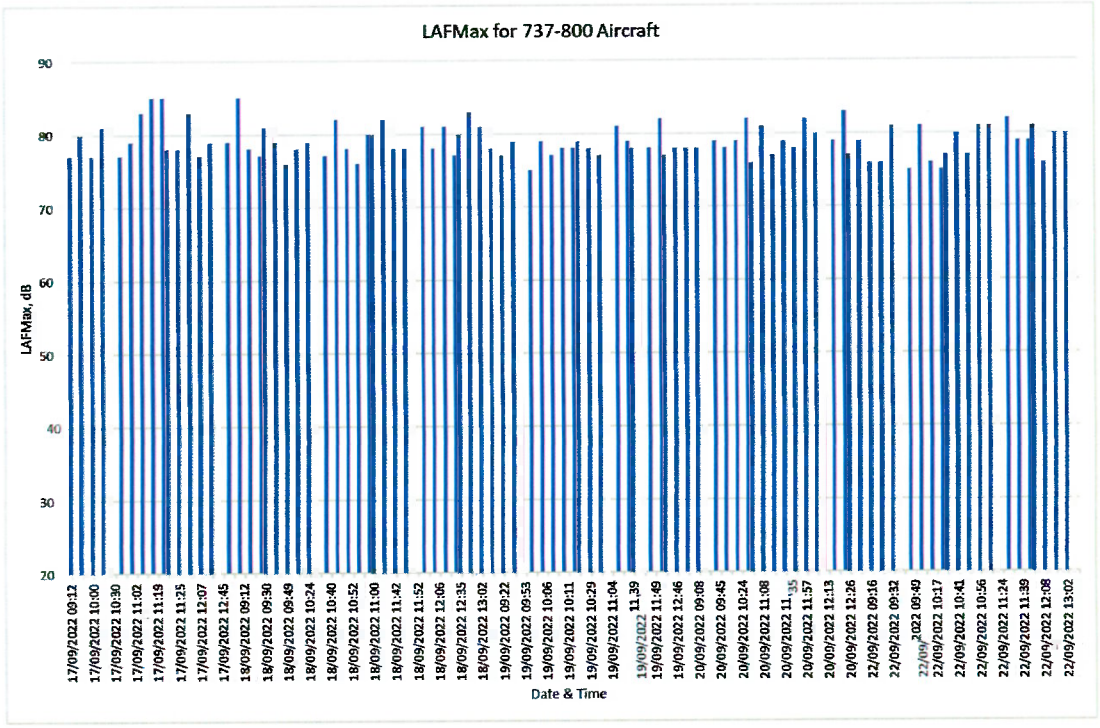

Figure 12 737-800 L_{AMax} Levels Measured

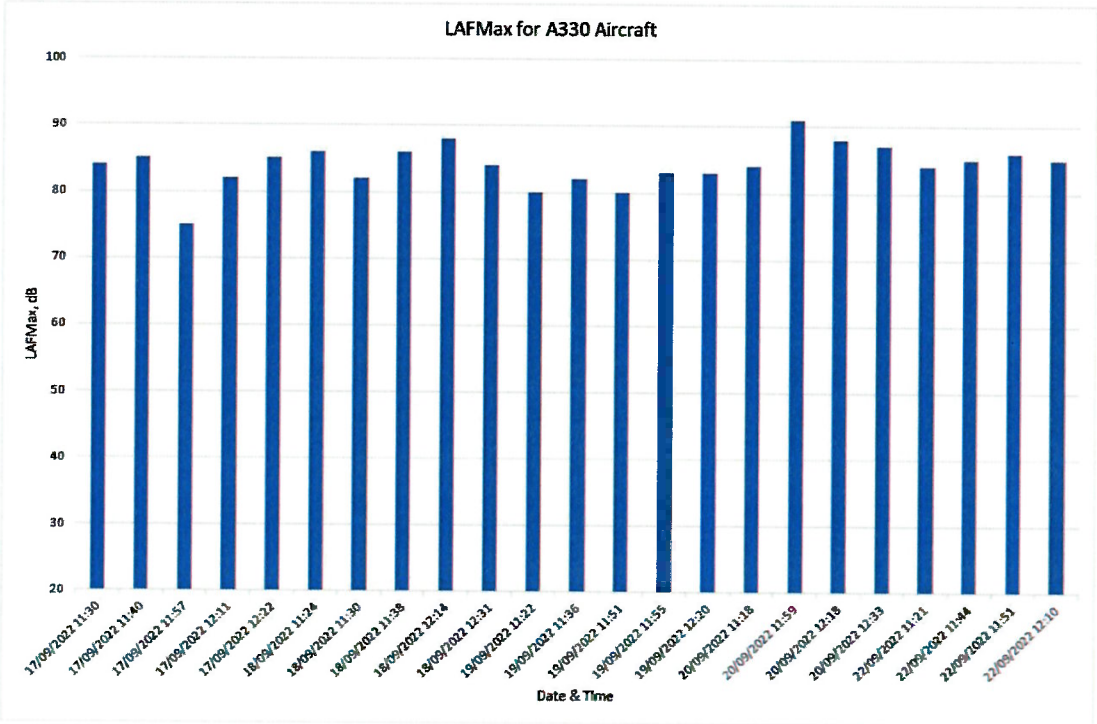

Figure 13 A330 L_{AMax} Levels Measured

For comparison purposes DAA's noise consultants prepared the following L_{AMax} contours for westerly departures from the North Runway in the document entitled

Dublin Airport North Runway Relevant Action Application

Draft - Initial Response to ANCA Request for Further Information

June 2021

Bickerdike Allen Partners
Architecture
Acoustics
Technology

TOM PHILLIPS + ASSOCIATES
PLANNING FOR THE FUTURE

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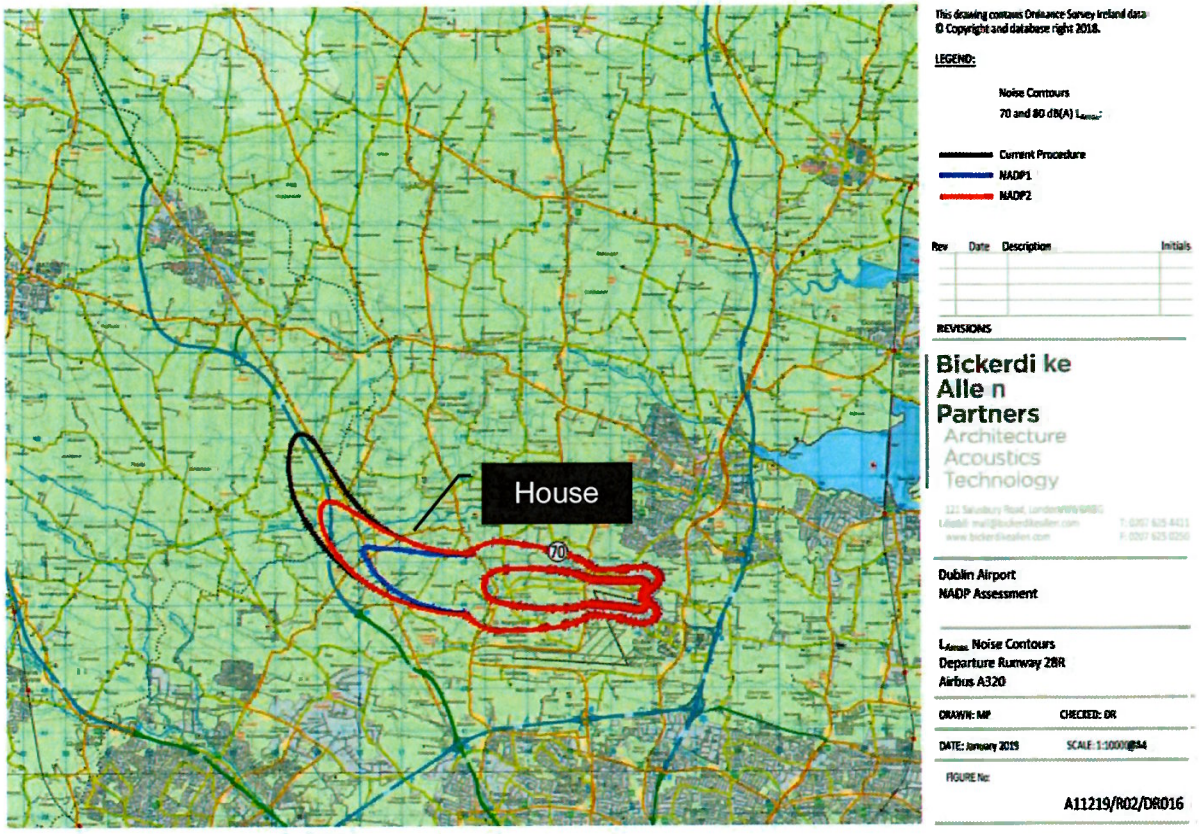

Figure 14 A320 DAA L_{Amax} Contours

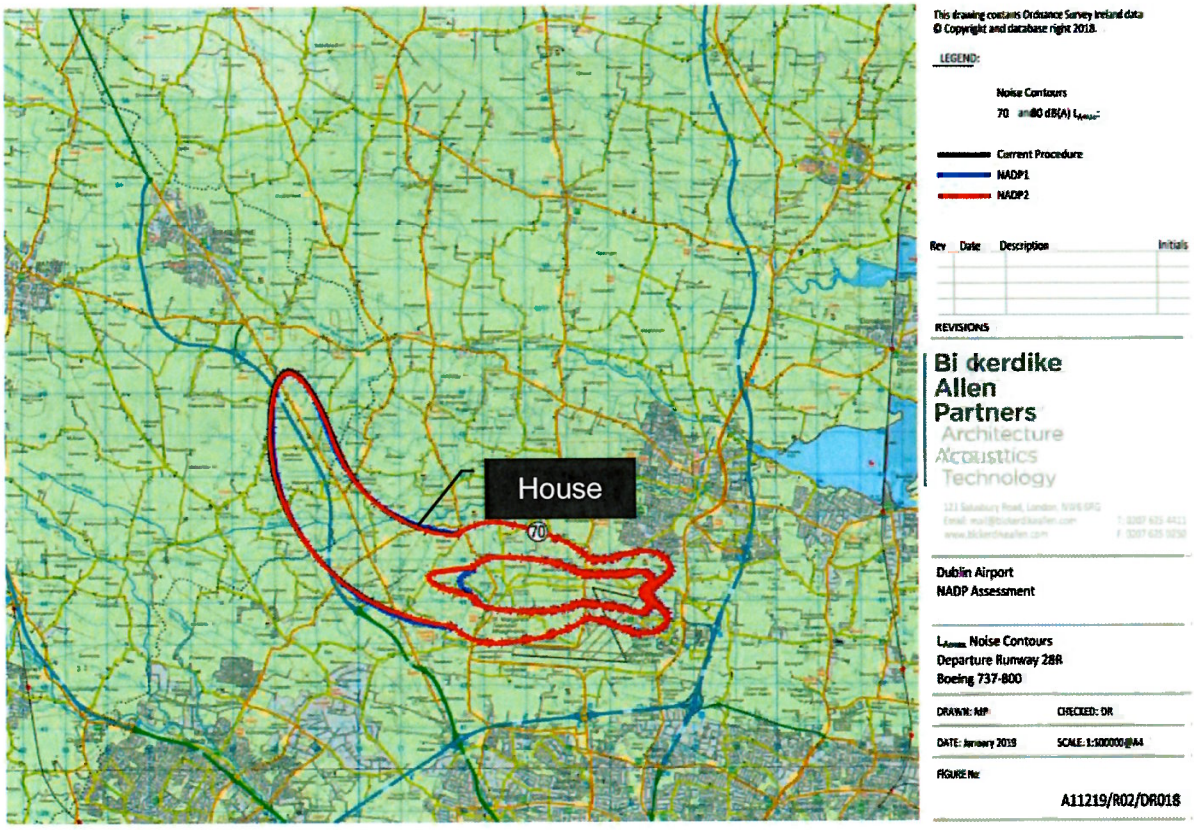

Figure 15 737-800 DAA L_{Amax} Contours

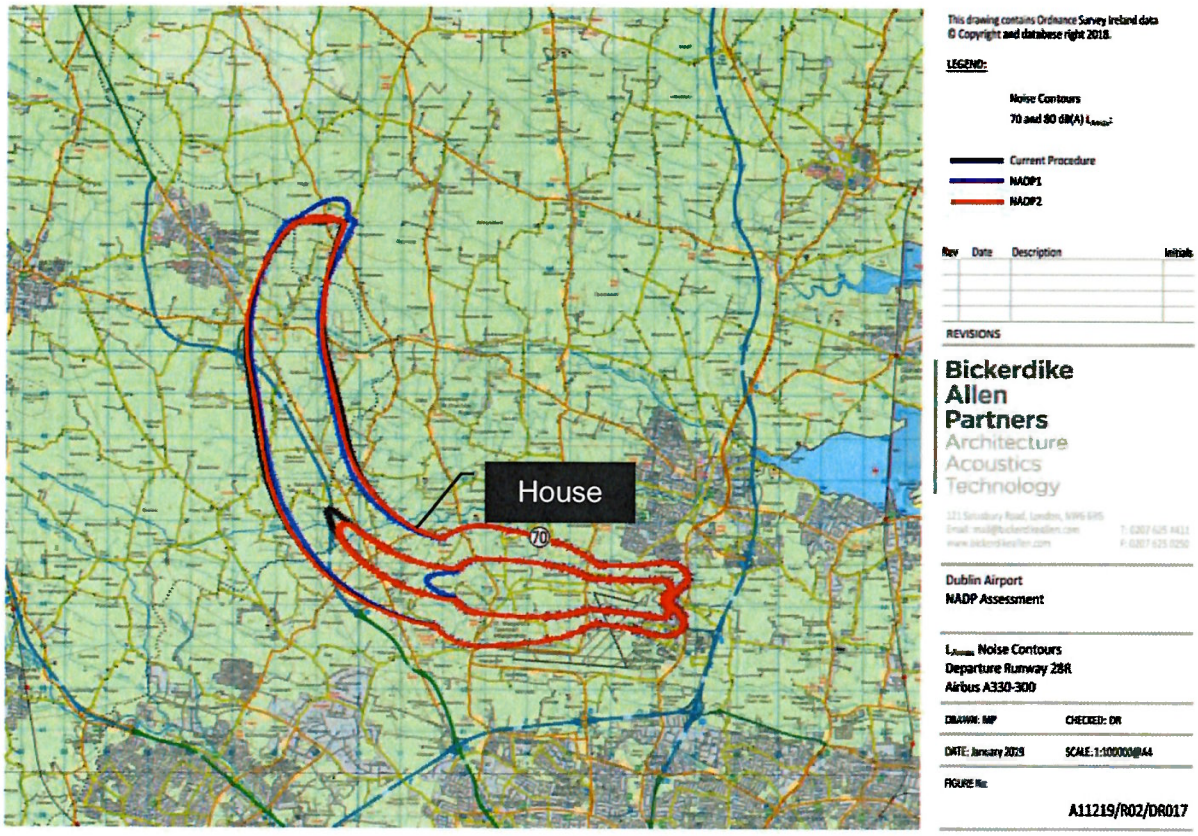

Figure 16 A330 DAA L_{Amax} Contours

Based on these charts the approximate L_{AFmax} level expected at my house for each aircraft type is,

- A320 - <70dB L_{AFmax}
- 737-800 - 70dB L_{AFMax}
- A330 - 70dB L_{AFmax}

The measured L_{Amax} levels at my house for each aircraft type are,

- A320 – 73 to 83dB L_{AFmax}
- 737-800 – 75 to 85dB L_{AFMax}
- A330 – 75 to 91dB L_{AFmax}

Figure 17 presents a dB scale to put these values into context while the table below summarises the difference in noise level between measured values and EIAR predictions.

Aircraft	Difference between Measurement and EIAR	Comment on Subjective Impact
A320	>13dB	Twice as loud
737-800	5 to 15dB	Up to twice as loud
A330	5 to 21dB	Up to four times as loud

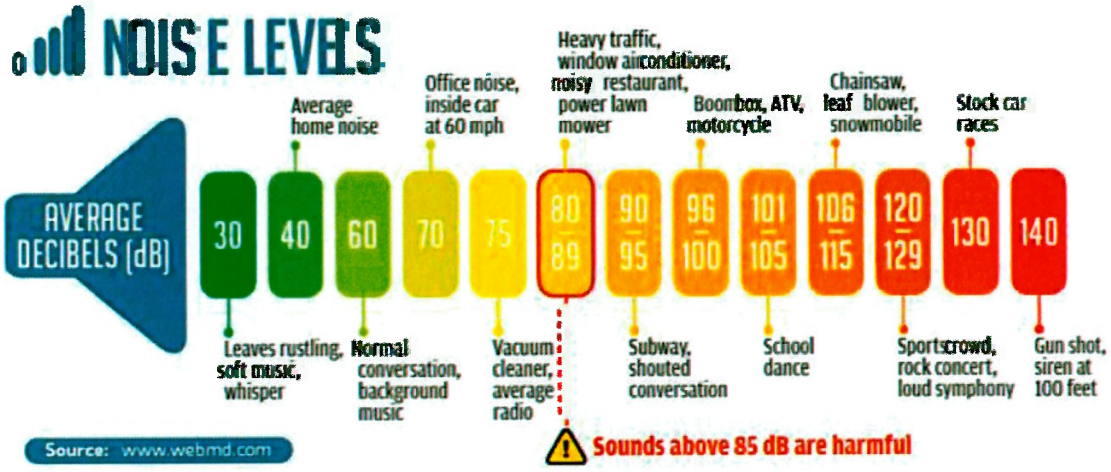

Figure 17 Decibel Scale

It is clear that the DAA modelled values are inaccu rate This inaccuracy could be due to a number of issues, however, most likely it is down to inaccurate input data. Inaccurate input data with respect to the flight paths as discussed earlier and also inaccurate input data with respect to t he noise emission value from the aircraft.

An Bord Pleanála should declare the application invalid on the basis that the noise models presented by DAA are clearly based on different flight paths and it is also questionable if the emission values used for the models are accurate. Perhaps the very aggressive and early divergence from the North Runway during westerly departures is requ iring the aircraft to operate at higher thrust and therefore higher noise output than the assumptions made by DAA?

Given that the North Runway is open and operationa lAn Bord Pleanála should direct DAA to resubmit the entire application with more realistic data from the runway operations.

I invite the An Bord Pleanála inspector and any technical experts they will use to visit my house and experience for themselves what L_{AFMax} levels regularly above 80dB and sometimes above 90dB sounds like. I can tell you that it wil l be plainly evident that noise levels of this magnitude will disturb our sleep significantly. The fact that the DAA application does not discuss the severe impacts on sleep that individual noisy aircraft movements have, is a clear omission from their assessment.

The only mitigation for dwellings exposed to L_{AFMax} levels of this magnitude is to have no night-time fights or for the DAA to provide relocation to a house of the same specification and dimensions at another location away from aircraft noise. This would be a smal l number of properties and a small cost in the context of the turnover at Dublin Airport.

6.0 DAA LONGITUDINAL STUDY

In 2018 responding to a request from St Margaret's Concerned Residents Group DAA's aviation noise consultants Bickerdale Allen Partners (BAP) produced a Longitudinal Analysis of L_{Amax} and SEL noise levels. BAP predicted the noise from six key aircraft types departing and arriving at Dublin Airports North Runway at eight points ranging from 0.5km to 4 km in 0.5 km steps. The report is included in this observation.

Figure 18 shows the calculation points used.

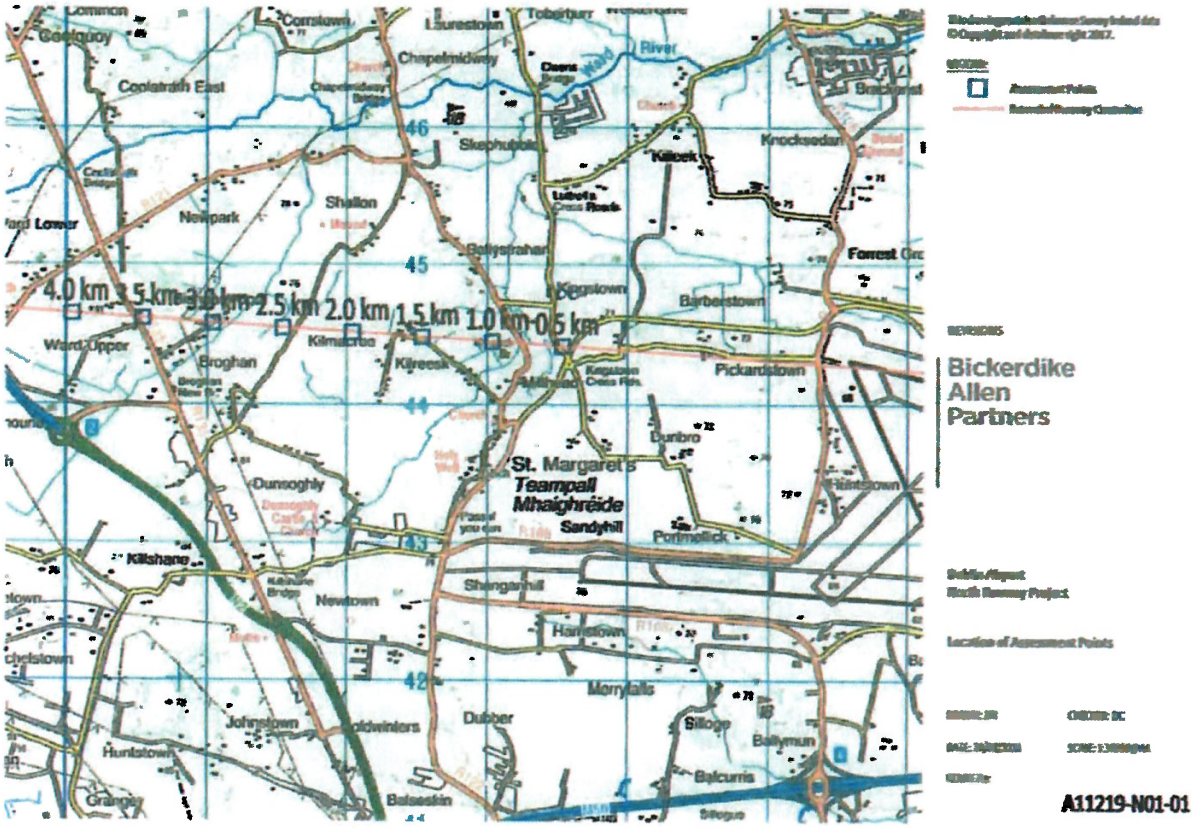

Figure 18 Longitudinal Analysis Assessment Points

The methodology used by BAP is described in their report and they state that noise levels are modelled using the Federal Aviation Administration (FAA) Integrated Noise Model (INM) version 7.0d.

For this assessment straight flight paths were modelled, again noting that in 2018 when this report was prepared DAA had already openly stated that divergence would be required for departures on the North Runway.

Figure 19 presents the results of this assessment in terms of L_{Amax} levels from each aircraft type considered at each assessment point.

Operation	Aircraft Type	Noise Level, dB L_{Amax}							
		0.5 km	1.0 km	1.5 km	2.0 km	2.5 km	3.0 km	3.5 km	4.0 km
Departure	Airbus A320	86	83	78	78	77	77	76	76
	Airbus A330-300	91	90	89	88	87	83	82	81
	AirbusA380	89	88	87	86	85	84	83	83
	Boeing737 Max8	87	84	81	79	78	77	77	76
	Boeing 737-800	90	87	83	81	80	80	79	79
	Boeing737-200	96	94	93	92	90	87	86	85
Arrival	AirbusA320	94	90	87	85	83	81	80	79
	Airbus A330-300	97	93	90	87	86	84	83	82
	AirbusA380	95	91	89	87	85	83	82	81
	Boeing 737 Max8	94	90	87	85	83	81	80	79
	Boeing 737-800	94	90	87	85	83	81	80	79
	Boeing 737-200	94	90	88	86	84	82	81	80

Table2: L_{Amax} Noise Levels at Assessment Locations

Figure 19 Longitudinal Analysis of L_{Amax} Levels

Some interesting points to note here,

- The results presented in Figure 19 indicates that for 737-800 aircraft L_{Amax} levels of 80dB are expected on departures for up to 3km from the runway and they only reduce by 1dB to 79dB at 4km from the runway.
- Comparing this to the L_{Amax} contours also produced by BAP for the Relevant Action EIAR as discussed earlier in Section 5.0 it would appear that the noise model results for the Relevant Action EIAR are considerably quieter with the 80dB L_{Amax} level not extending more than 2.4km from the North Runway.
- L_{AMax} levels measured at my house as shown in Figure 10 are regularly above 80dB L_{AMax} with an average value of 79dB L_{Amax}. My house is 3km from the end of the runway.
- Similar trends are noted for the other aircraft types.
- A difference that is perhaps worth noting is that BAP changed the noise model software used between the 2018 longitudinal study and the Relevant Action EIAR. In 2018 it was the INM version 7.0d. For the EIAR it is the 'Federal Aviation Authority Aviation Environmental Design Tool (AEDT) version 2d SP2'.

An Bord Pleanála should question why there are such different L_{Amax} levels predicted for the same aircraft type by the same consultants from the same runway but only 4 years apart using different software packages. Is it possible that the EIAR model inputs using the new software are simply incorrect and the older INM model was more accurate? The accurate prediction of L_{Amax} and SEL levels underpins the entire noise assessment as the SEL values are used to determine the average noise metrics used for the DAA assessment, despite their inadequacies at assessing night noise impacts.

7.0 CONCLUSION

I request that An Bord Pleanála provide their findings to the following questions as part of their assessment of the application,

1. Compare the applicant's proposal for additional night flights and quota system to other European and UK airports where movement limits apply in addition to quota systems. This is the newest runway in the world, and it should be operated to the highest standards of noise mitigation within the Balanced Approach.
2. Examine how the applicant derived the Noise Quota System proposed. It would appear that the quota count provided was simply selected to allow DAA unrestricted movements. DAA propose a quota of 16,230 without any movement cap which is many multiples of Heathrow airport which also includes a movement limit. Heathrow is currently limited to 5,800 night-flights per year which equates to ~15 flights per night. DAA are asking for 31,885 night-flights per year which equates to ~87 flights per night. Heathrow one of the largest airports in the world can operate with a limit on night flights and Dublin Airport cannot? This makes no sense. An Bord Pleanála should refuse permission on the basis of the application being unnecessary.
3. The adverse health impacts of additional night-time noise should be thoroughly investigated. The applicant's EIAR has a very limited view of health impacts and fails to consider the impact of awakenings from noise events at night.
4. Divergent flight paths are proposed but these are dramatically different to the flight paths being implemented at Dublin Airport since the North Runway opened. How can any of the applicant's forecasts be trusted if they cannot in this case determine the flight paths to use on their own runway? An Bord Pleanála should investigate the impact of changing the flight paths on the environment.
5. Is it plausible that an airport can simply change the flight paths and therefore impact on an entirely different area without requiring the environmental impacts to be reassessed for those areas in advance? The IAA's website suggests that changes to airspace will commonly require consultation as well as environmental assessments

   https://www.iaa.ie/commercial-aviation/airspace/airspace---pbn-ta-acp-fua

   This has not occurred for the changes to the Dublin Airport airspace being operated now.
6. The night-time noise insulation scheme proposed by the applicant is not a fully compensated noise insulation scheme and instead is a grant. This is a lesser scheme when compared to the daytime insulation scheme already agreed with Fingal. There are no other examples of developers describing that mitigation is needed but then expecting the sensitive location to pay for the mitigation. An Bord Pleanála should provide a detailed critical assessment of this proposal as it is contrary to the polluter pays principal.
7. The qualification criteria for night noise insulation should be compared to progressive European Airports. No mention has been made in the document of how the proposed scheme ranks compared to other locations. This is the newest runway in the world,

and it should be operated to the highest standards of noise mitigation within the Balanced Approach. Noise insulation is a key element of the Balanced Approach that should be maximised if an airport wishes to avoid restrictions of operations as DAA do in this case.

In conclusion I request that permission is refused for this relevant action application on the basis that it will seriously impact on the health of communities closest to the airport and adequate mitigation has not been provided by the applicant.

I also support the request for an Oral Hearing.

FINGAL CO CO NOISE ZONE REPORT ON CONTOURS

Bickerdike Allen Partners
Architecture Acoustics Technology

DUBLIN AIRPORT

LOCAL AREA PLAN

NOISE CONTOURS AND GRIDS

Report to

[redacted]
Environmental Manager Dublin Airport and North Runway
daa
Cargo 1
Dublin Airport
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A11219-R01-DR
November 2018

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1.0 INTRODUCTION

To support the development of the upcoming Dublin Airport Local Area Plan, Fingal County Council (FCC) have requested noise information for future activity. Noise contours and noise level grids have been prepared, based on the 2037 proposed operations forecasts, prepared as part of the North Runway Project, with various modes of runway operation. The modelling software used is the same as for the North Runway Project, and the associated modelling assumptions have been retained as far as possible.

daa have retained Bickerdike Allen Partners LLP (BAP) to produce these noise contours and grids. This report sets out the methodology used in their production and includes figures of the resulting noise contours.

Section 2.0 of this report gives details of the various requested scenarios and highlights areas where the methodology differs from that used for the North Runway Project, due to the different modes of runway operation. Section 3.0 gives details of the forecast movements used for all of the scenarios.

Section 4.0 includes details of the methodology used in the production of the noise contours and grids. This section also describes, and where possible quantifies, the additional uncertainties due to the modelling being down to low values, and so extending to locations distant from the airport. This issue was noted by the UK Civil Aviation Authority in their guidance relating to airspace changes[1] where they state that:

Contours should not be produced at levels below 54 dBA Leq, 16 hours because this corresponds to generally low disturbance to most people, and indeed aircraft noise modelling at such levels is unlikely to generate accurate and reliable results.

Whilst a check on the accuracy of the modelling process has been undertaken utilising measured noise levels at fixed terminals, these are located around 3.8 km from the ends of the existing main runway. The check does not therefore ensure the accuracy of predictions at must greater distances from the airport.

Section 5.0 introduces the resulting noise contours and noise level grids.

[1] CAA Guidance on the Application of the Airspace Change Process CAP 725
https://publicapps.caa.co.uk/docs/33/CAP%20725%20update%20March%202016%20amend.pdf

2.0 SCENARIOS

FCC have requested noise information for three modes of runway operation, related to the existing main (South) runway and the future North Runway. These comprise segregated mode, where one runway is used by arriving aircraft and the other by departing aircraft; mixed mode, where each runway is used by arriving aircraft and departing aircraft; and current operating restrictions, where a set of preferences drive how the movements are distributed.

For each mode of runway operations there are scenarios to allow for wind direction. Westerly Operations occur when the wind is predominantly from the west and Easterly Operations occur when the wind is predominantly from the east.

FCC have requested specific noise parameters and minimum values of them, including 50 dB L_{den} and 40 dB L_{night}. These low noise levels extend to areas outside those modelled for the North Runway Project. Consequently aspects of that modelling, which is utilised here, may introduce some additional uncertainties for locations distant from the airport. The key areas where this is the case are the arrival and departure routes, flight profiles and terrain. These issues are discussed in more detail in the relevant methodology sections; 4.3, 4.4 and 4.5 respectively.

Except where otherwise stated three noise metrics have been calculated for each of the scenarios, these are L_{den}, $L_{Aeq,16h}$ and L_{night}.

2.1 Segregated Mode

Four segregated mode scenarios have been modelled, these are listed below:

- Westerly Operations, arrivals on the North Runway, departures on the South Runway.
- Westerly Operations, arrivals on the South Runway, departures on the North Runway.
- Easterly Operations, arrivals on the North Runway, departures on the South Runway.
- Easterly Operations, arrivals on the South Runway, departures on the North Runway.

Based on the airport's existing runway and taxiway layout and the planned design of the North Runway and associated infrastructure, future Airbus A380 activity is forecast as limited to the North Runway. However for these scenarios, which represent a fully segregated mode of operation, the A380 has been modelled in the same way as all other aircraft and so some movements by it have been modelled as using the South Runway. Given the A380 is forecast as undertaking less than 1% of the movements, this is not considered to have a significant effect on the predictions.

Capacity constraints mean that a single runway cannot accommodate more than 35 arrivals or 44 departures in one hour. In the 2037 forecast there are five hours where mixed mode operation is required due to these capacity constraints. However for these scenarios which represent a fully segregated mode of operation the hourly runway capacity constraints have not been allowed for in the modelling. Overall the runways have sufficient capacity for the forecast movements, so the modelling relates to a situation where they occur but some not at their forecast times within each of the day, evening and night periods.

2.2 Mixed Mode

Two mixed mode scenarios have been modelled, these are listed below.

- Westerly Operations, equal arrivals and departures on the North and South Runways.
- Easterly Operations, equal arrivals and departures on the North and South Runways.

To accommodate the A380 only operating from the North Runway as forecast, movements by all other aircraft have been modelled with a slightly higher proportion of movements on the South Runway to ensure an overall equal split.

When the runways are operated in mixed mode the IAA have said that departure runway would be selected based on the compass based departure principle. This means the runway used by a departure is based on the route it is going to fly, however this does not result in an equal split of departures between the North and South Runways and so has not been allowed for in the modelling of these scenarios. While this does not alter the total amount of noise predicted it will alter the distribution, as under the compass based departure principle approximately 60% of departures would use the North Runway. Not allowing for this results in noise levels being approximately 1 dB higher where noise is primarily due to departures on the South Runway and conversely is approximately 1 dB lower from North Runway departures.

2.3 Current Operating Restrictions

2.3.1 Daytime

Two daytime current operation restrictions scenarios have been modelled, as listed below. These scenarios relate to the daytime period, so only the $L_{Aeq,16h}$ metric has been calculated.

- Westerly Operations, departures on the South and North Runways, arrivals on the South Runway, limited arrivals on the North Runway.
- Easterly Operations, arrivals on the South and North Runways, departures on the South Runway, limited departures on the North Runway.

For these scenarios the runways are operated in segregated mode whenever possible. For westerly operations, departures mainly use the North Runway and arrivals mainly use the South Runway. For easterly operations the reverse mainly occurs, with departures using the South Runway and arrivals using the North Runway. All Airbus A380 movements have been modelled as using the North Runway.

When mixed mode operations are required due to capacity constraints, the departure runway is selected based on the compass based departure principle. Arrivals on westerly operations use the South Runway as much as possible. Arrivals on easterly operations are assigned based on the number of departures on each runway, to result in as even a use of the two runways as possible.

The IAA have said that once a period of mixed mode operations begins, it will continue for a minimum of 2 hours. Based on this IAA advice and restriction discussed above, Table 1 and Table 2 below set out the hourly usage of each runway for westerly and easterly operations respectively.

Start of Hour	Mixed Mode	South Runway		North Runway	
		Arrivals	Departures	Arrivals	Departures
7:00	Y	15	30	5	24
8:00	Y	31	9	0	14
9:00	Y	35	10	8	21
10:00	N	29	0	0	35
11:00	N	32	0	1	37
12:00	Y	29	16	17	28
13:00	Y	26	19	2	21
14:00	N	28	0	0	29
15:00	N	25	0	0	25
16:00	N	33	0	0	37
17:00	N	32	0	0	39
18:00	N	29	0	0	33
19:00	N	26	0	0	32
20:00	N	18	0	1	23
21:00	N	23	0	0	7
22:00	N	29	0	0	9
Total		**440**	**84**	**34**	**414**

Table 1: Westerly Operations Runway Usage by Hour for 2037 Proposed Operations Scenario

Start of Hour	Mixed Mode	South Runway		North Runway	
		Arrivals	Departures	Arrivals	Departures
7:00	Y	10	30	10	24
8:00	Y	15	9	16	14
9:00	Y	21	10	22	21
10:00	N	0	35	29	0
11:00	N	0	37	33	0
12:00	Y	29	16	17	28
13:00	Y	14	19	14	21
1400	N	0	28	28	1
15:00	N	0	25	25	0
16:00	N	0	37	33	0
17:00	N	0	39	32	0
18:00	N	0	33	29	0
19:00	N	0	32	26	0
20:00	N	0	23	19	0
21:00	N	0	7	23	0
22:00	N	0	8	29	1
Total		**89**	**388**	**385**	**110**

Table 2: Easterly Operations Runway Usage by Hour for 2037 Proposed Operations Scenario

2.3.2 Night-time

Two night-time current operating restrictions scenarios have been modelled, as listed below. These scenarios relate to the night-time period, so only the L_{night} metric has been calculated.

- Westerly Operations, all movements on the South Runway.
- Easterly Operations, all movements on the South Runway.

The A380 has been modelled as using the South Runway as required under these scenarios, although the planned airport layout will not permit this.

There are two night-time hours where the 2037 forecast movements exceed the single runway capacity limit. However for these scenarios which require only the South Runway to be used, the capacity constraints have not been allowed for in the modelling. Overall the South Runway has sufficient capacity for the forecast night movements, so the modelling relates to a situation where they occur but some not at their forecast times.

3.0 AIRCRAFT OPERATIONS

A detailed forecast provided for 2037 has been provided which includes an annual movement total and the breakdown for a typical busy day. Combining these gives the set of annual movements which have been used for the modelling.

A summary of the daytime and night-time annual movements by the key aircraft types in 2037 is given below in Table 3.

Aircraft Type	Daytime	Evening	Night-time
Airbus A306	298	298	596
Airbus A319neo	4,172	1,192	0
Airbus A320neo	50,953	10,131	9,237
Airbus A321neo	8,045	596	3,278
Airbus A330	4,470	1,490	596
Airbus A350	11,621	2,384	3,278
Airbus A380	894	596	298
ATR 72	19,666	4,470	894
Boeing 737-400	0	596	596
Boeing 737 MAX 8	98,032	21,752	20,262
Boeing 767	0	596	596
Boeing 777	596	0	1,192
Boeing 787	10,429	298	2,384
Bombardier Dash 8	2,384	596	0
Dornier 328	0	0	596
Embraer E190-E2	10,131	1,788	298
Other	17,878	3,278	596
Total (excluding helicopters)	**239,567**	**50,059**	**44,695**

Table 3: Summary of 2037 Forecast Annual Movements by Key Aircraft Types

Helicopters have been excluded from this assessment as they have historically been excluded from noise contours at Dublin. As they make up only 0.5% of movements in the 2037 forecasts their exclusion is not considered significant.

4.0 METHODOLOGY

The noise contours and grids have been predicted using the Integrated Noise Model (INM) version 7.0d software, which evaluates aircraft noise in the vicinity of airports using flight track information, aircraft fleet mix, standard defined aircraft profiles, user-defined aircraft profiles and terrain.

This worldwide recognised software is produced by the Federal Aviation Administration, and is compliant with *ECAC.CEAC Doc 29 3rd Edition Report on Standard Method of Computing Noise Contours around Civil Airports*. The software has been used with the assumptions set out below.

4.1 Airport Layout

The North Runway (10L/28R) will be 3,110m long and located approximately 1.7 km north of and parallel to the existing main (South) runway (28/10).

4.2 Runway Usage

The scenarios each set out the split of movements between the North and South Runway. Once the North Runway is built the cross runway (16/34) will continue to be used when winds are strongly from the north or south, however to a lesser degree than currently. As all of the scenarios modelled are for exclusively westerly or easterly operations, no activity has been modelled on the cross runway.

4.3 Flight Routes

4.3.1 Arrival Routes

Due to the size of the contours they reach beyond the point at which all aircraft will be aligned with the extended runway centreline, this has not been allowed for in the modelling. All approach routes have been modelled as straight and in line with the runway, with aircraft approaching along a glide slope of 3 degrees.

The effect of this in areas where arrival noise is dominant, such as the eastern end of the contours for westerly operations (e.g. Figures 04-06), will be to shorten but widen the end of the contours as aircraft are dispersed. For westerly operations this occurs over the sea so if of no consequence, but for easterly operations the effect is over land.

4.3.2 Departure Routes

Figure 01 shows the modelled departure routes for segregated mode operations. Figure 02 shows the modelled departure routes for mixed mode operations. Figure 03 shows the modelled departure routes for South Runway only operations, which match those used currently with early turns allowed to the north and south.

Category A & B Aircraft – Departures

Category A & B aircraft, which are predominantly turboprops such as the ATR 72, are not required to remain within the environmental corridors to the same extent as the larger jet aircraft types. They therefore turn off the extended runway centreline shortly after the end of the runway, however they will not be allowed to turn early across the other runway. Where they do need to turn across the other runway they will use the corresponding Category C & D aircraft departure route.

The Category A & B aircraft departure routes from the South Runway are based on a review of radar tracks. Similar tracks have been modelled from the North Runway.

Category C & D Aircraft – Departures

Category C & D aircraft comprise almost all the jet aircraft. Their departure routes from the South Runway are based on the existing SIDs, with equivalent routes modelled from the North Runway. In order to achieve a safe minimum separation between flights from the two main runways, when both are in operation, departure routes have been used which include a course divergence of at least 15°. A set of departure routes from the North Runway was developed with an initial turn to the north, at around 1.1nm from the end of the runway. When heading east all of the routes turn 15°, whereas when heading to the west those to INKUR, NEPOD and DEXEN turn 15°, while those to LIFFY and ROTEV turn 75°.

The departure routes to the west are supplemented by routes with an early turn, although not as early as Category A & B aircraft routes. The early turns routes from the South Runway are based on a study of radar data, similar early turns have also been modelled on the North Runway. As with the Category A & B aircraft routes, these early turns are not permitted to cross the other runway.

4.3.3 Dispersion

Aircraft on departure are allocated a departure route to follow. In practice, this route is not followed precisely by all aircraft allocated to this route. The actual pattern of departing aircraft is dispersed about the route's centreline. The degree of dispersion is normally a function of the distance travelled by an aircraft along the route after take-off and also on the form of the route.

When considering many departures, it is commonly found that the spread of aircraft approximates to a "normal distribution" pattern, the shape or spread of which will vary with distance along the route. A simplified mathematical model can be adopted to represent a normal distribution of events, based on standard deviations. Five "dispersed" tracks have been modelled for each departure route, these comprise the Centreline of each route and the two Sub Tracks either side.

The allocation of movements adopted in this case to each track is as follows: -

- 38.6% of departures along the Centreline;
- 24.4% of departures along each of the two inner Sub Tracks either side of the Centreline and offset by a distance of 1 standard deviation;
- 6.3% of departures along each of the two outer Sub Tracks either side of the Centreline and offset by a distance of 2 standard deviations.

This dispersion model has been applied with a departure offset profile, which comprises the standard deviations of the magnitude of the dispersion for lengths of straight and curved track. These have been determined from radar tracks for operations in 2015 at Dublin. The resulting Sub Tracks are shown in Figures 01-03.

4.4 Flight Profiles

For departure movements the INM software offers a number of standard flight profiles for most aircraft types, and in particular for the larger aircraft types. These relate to different departure weights which are greatly affected by the length of the flight, and consequently the fuel load. In the INM software this is referred to as the stage length and is in increments of 500 nm up to 1,500nm and then in increments of 1,000nm. The INM software assumes all aircraft take off with a full passenger load irrespective of stage length. As the stage length increases the aircraft has to depart with greater fuel and so its flight profile is slightly lower than when a shorter stage length is flown.

For some of the aircraft types, their small size results in only one stage length being available. For the remainder, including the larger jet aircraft that carry the majority of the passengers, the stage length was chosen based on the destination.

Based on information provided by the airlines and daa and noise data from the noise monitoring system at the airport, the most common aircraft have had custom departure profiles created that more closely replicates the procedure used by aircraft departing from Dublin airport.

The arrival and departure profiles are reasonably accurate in the vicinity of the airport, however at greater distances they can differ substantially from what occurs in practice, in particular the standard INM profiles often include level sections that do not occur at every airport. For example the Airbus A320 arrival profile includes a level section at 3,000ft for approximately 7 km. This does not occur at Dublin airport and results in the A320 being modelled at a substantially lower height than occurs in practice. This level section occurs inside the area of the contours and grids due to their large size.

4.5 Terrain data

Terrain data has been included for an area extending from 5 km south of the airport to 10 km north and from 40 km west of the airport to 18 km east. This was provided by emapsite in the form of a 90m Digital Terrain Model dataset and has been incorporated within the noise model to allow predictions to reflect actual noise levels on the ground accurately.

This terrain data is however not as large as the contours and grids reported here. They cover an area approximately extending from 10 km south of the airport to 12 km north and from 42 km west of the airport to 42 km east. To the east this will not have a significant effect as the terrain data reaches the coast and the default terrain height outside of the terrain area is sea level. Everywhere else that the contours and grids exceed the terrain area, there will be a sudden small drop in noise level as the modelled ground height will reduce from the correct height to sea level, increasing the effective distance between the aircraft and the ground.

The effect of the missing terrain data can be seen on Figure 12 at the western end on the contours, where the outermost contour suddenly narrows. At this location the effect causes a drop in predicted noise level of around 0.5 dB.

4.6 Modernisation

By 2037 many of the passenger jet aircraft types currently operating at Dublin airport are expected to have been replaced by new quieter types. The A320neo is currently being delivered to customers and the Boeing 737-8 Max is expected to begin being delivered to Ryanair, the largest operator of Boeing 737-800s at Dublin, in 2019. By 2037 it is expected that almost all Airbus A319s, A320s, A321s, Boeing 737-7/8/900s and Embraer E170s, E190s and E195s will have been replaced by these modernised types or other quieter aircraft.

The degree of expected improvement in noise levels for arrivals and departures from these modernised types is shown in Table 4 below.

Current Aircraft Type	Modernised Aircraft Type	Expected Change in Noise Levels between Current and Modernised Aircraft Types (dB)	
		Arrival	Departure
Airbus A319	Airbus A319neo	-1.9	-2.6
Airbus A320	Airbus A320neo	-2.2	-2.6
Airbus A321	Airbus A321neo	-1.0	-2.7
Boeing 737-700	Boeing 737 Max 7	-1.0	-3.5
Boeing 737-800	Boeing 737 Max 8	-0.4	-2.5
Boeing 737-900	Boeing 737 Max 9	-0.1	-1.2
Embraer E170	Embraer E175-E2	-2.7	-6.0
Embraer E190	Embraer E190-E2	-1.5	-6.8
Embraer E195	Embraer E195-E2	-0.9	-6.3

Table 4: Expected Change in Noise Levels between Current and Modernised Aircraft Types

5.0 RESULTS

The noise contours are presented in Figures 04 to 25 and are attached below. The noise level grids have been produced using the same method as that used to produce the 2016 Environmental Noise Directive mapping grids. They are provided in ESRI Shapefile format, on Irish Transverse Mercator projection IRENET95. The grid shapefiles have been issued separately.

[redacted] [redacted] [redacted]

for Bickerdike Allen Partners LLP **Associate** **Partner**

LEGEND:

Departure Route Centerlines:

North Runway Departures,

Category A & B Aircraft

Category C & D Aircraft

South Runway Departures,

Category A & B Aircraft

Category C & D Aircraft

Subtracks

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

Modelled Departure Routes
Segregated Mode

DRAWN: MP CHECKED: DR

DATE: November 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR001

LEGEND:

Departure Route Centerlines:

North Runway Departures,

Category A & B Aircraft

Category C & D Aircraft

South Runway Departures,

Category A & B Aircraft

Category C & D Aircraft

Subtracks

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Local Area Plan

Modelled Departure Routes
Mixed Mode

DRAWN: MP CHECKED: DR

DATE: November 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR002

LEGEND:

Departure Route Centerlines:

South Runway Departures,

Category A & B Aircraft

Category C & D Aircraft

Subtracks

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Dublin Airport
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Modelled Departure Routes
South Runway Only

DRAWN: MP CHECKED: DR

DATE: November 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR003

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB L_{den} in 5 dB steps

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Local Area Plan

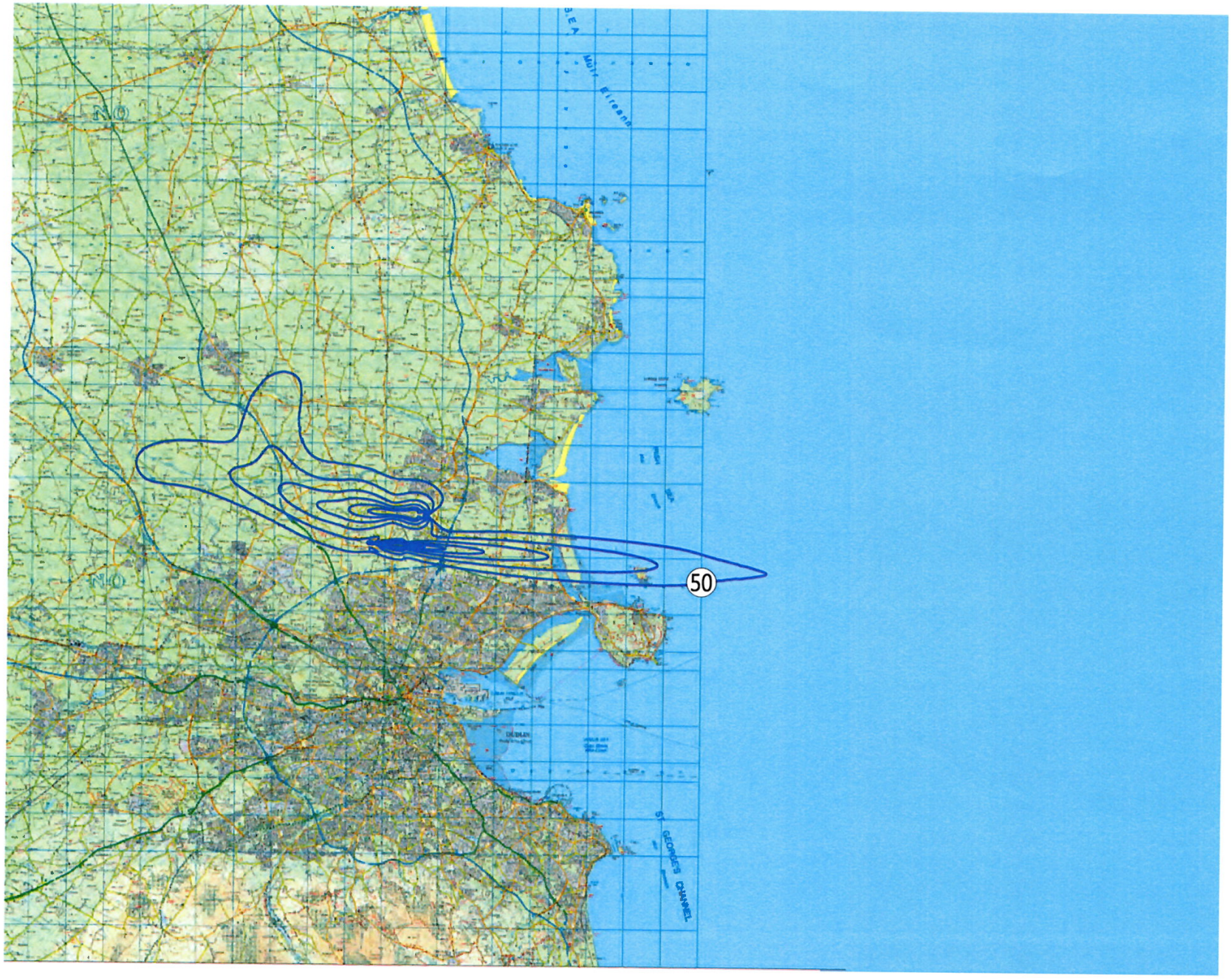
Westerly Segregated Mode
Arrivals South Runway
Departures North Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR004



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

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Dublin Airport
Local Area Plan

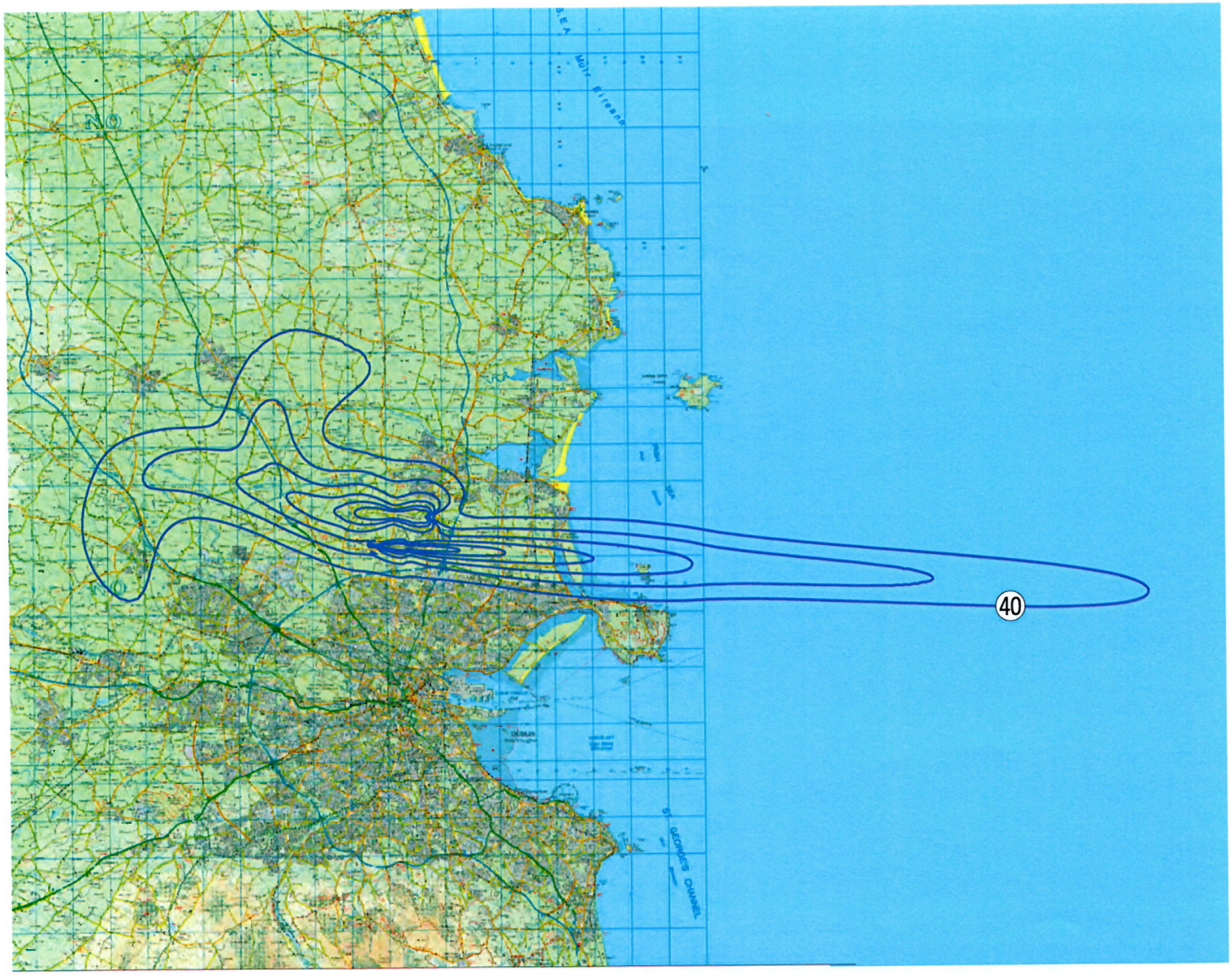
Westerly Segregated Mode
Arrivals South Runway
Departures North Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR005



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

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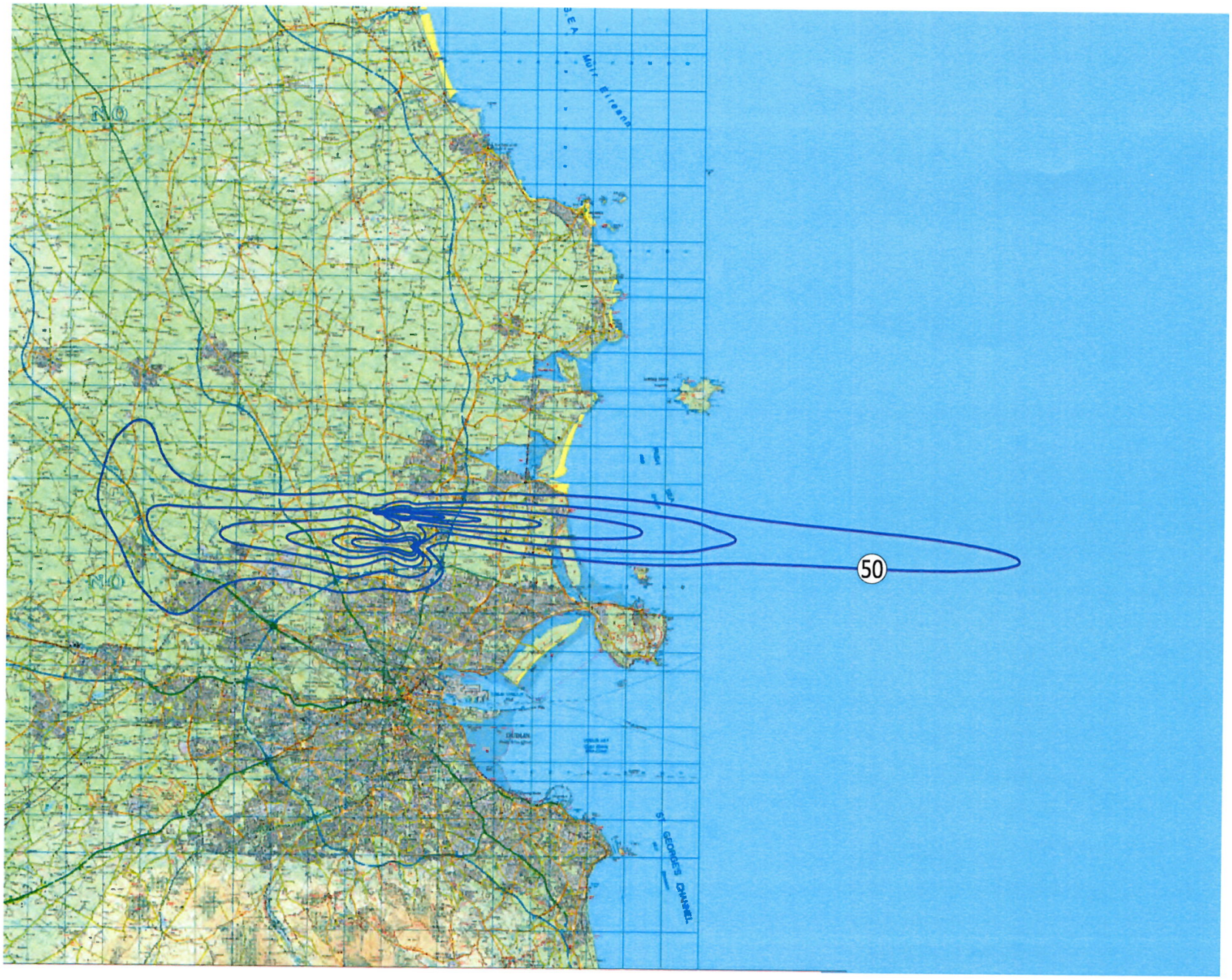
Westerly Segregated Mode
Arrivals South Runway
Departures North Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR006



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB L_{den} in 5 dB steps

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Dublin Airport
Local Area Plan

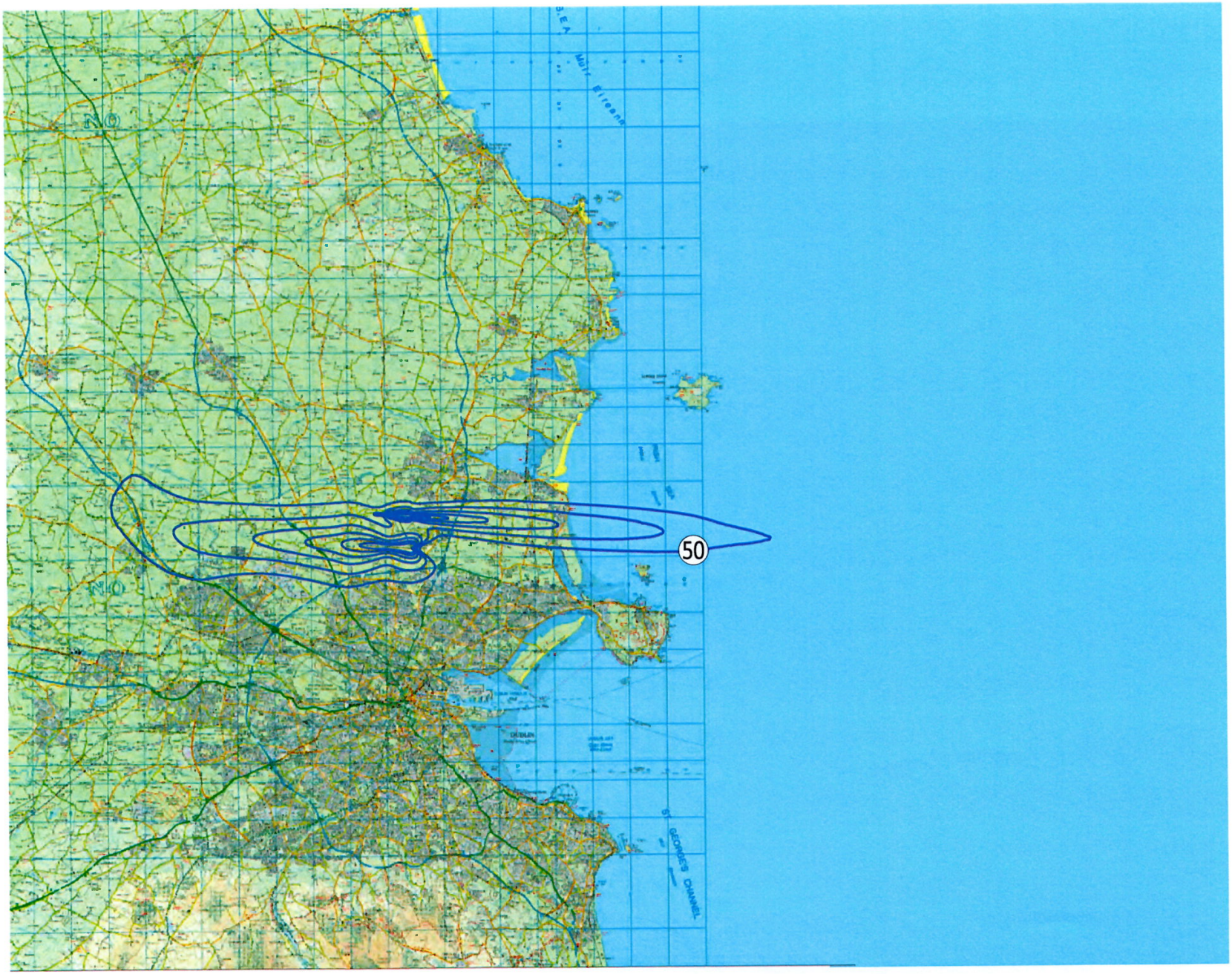
Westerly Segregated Mode
Arrivals North Runway
Departures South Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR007



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

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Local Area Plan

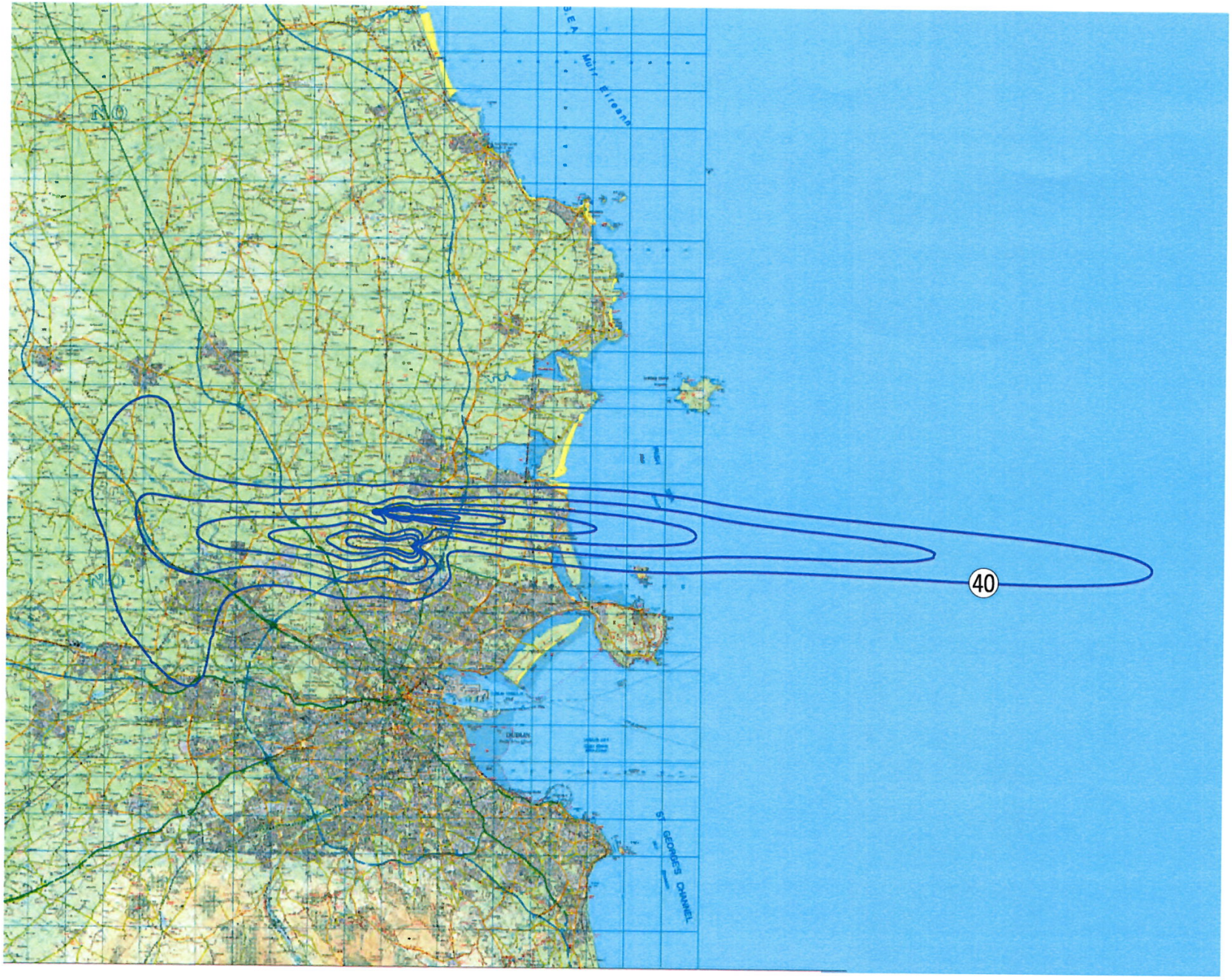
Westerly Segregated Mode
Arrivals North Runway
Departures South Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR008



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

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Dublin Airport
Local Area Plan

Westerly Segregated Mode
Arrivals North Runway
Departures South Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR009

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB L_{den} in 5 dB steps

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Easterly Segregated Mode
Arrivals South Runway
Departures North Runway

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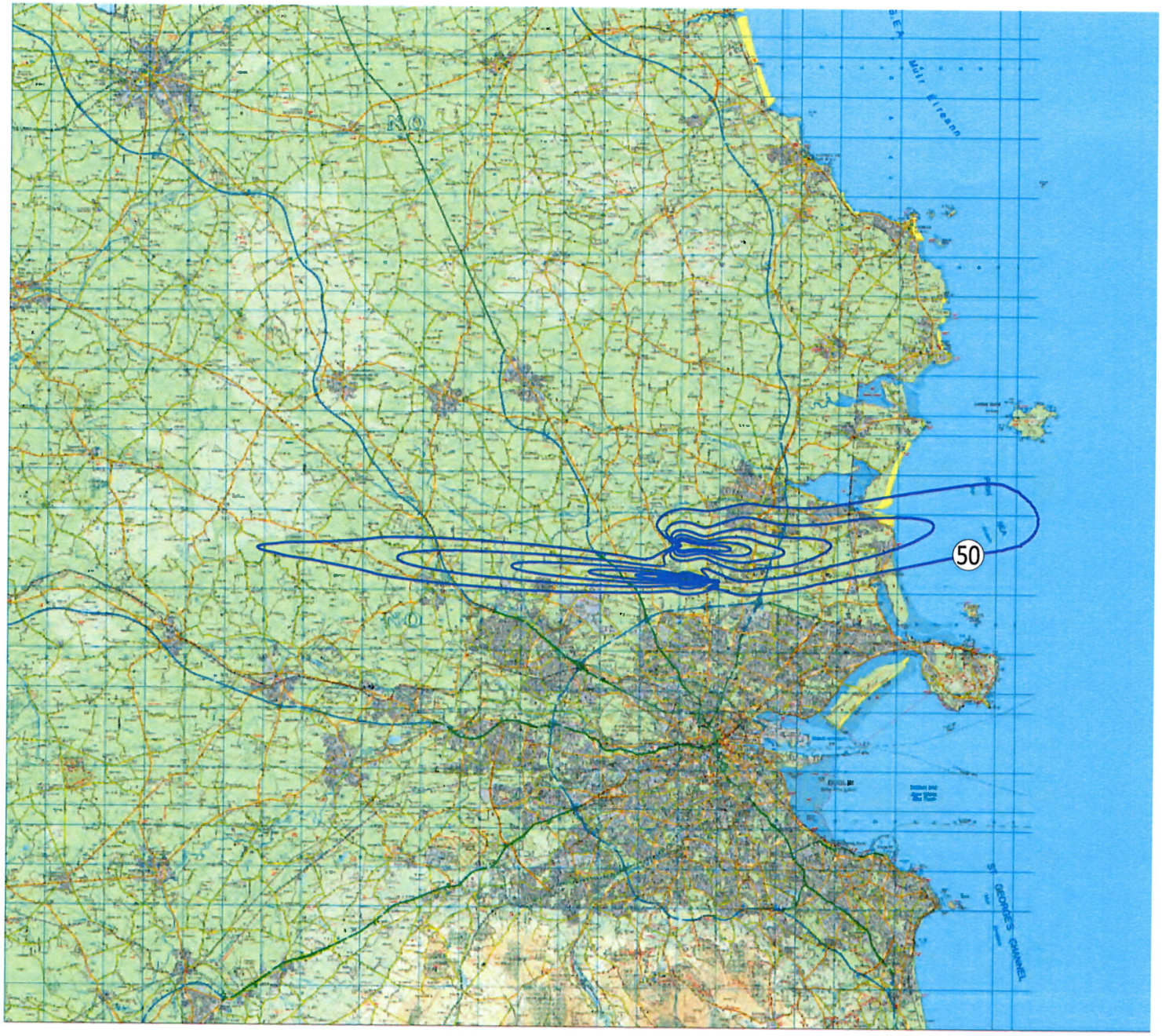
DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR010



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

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Easterly Segregated Mode
Arrivals South Runway
Departures North Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR011

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

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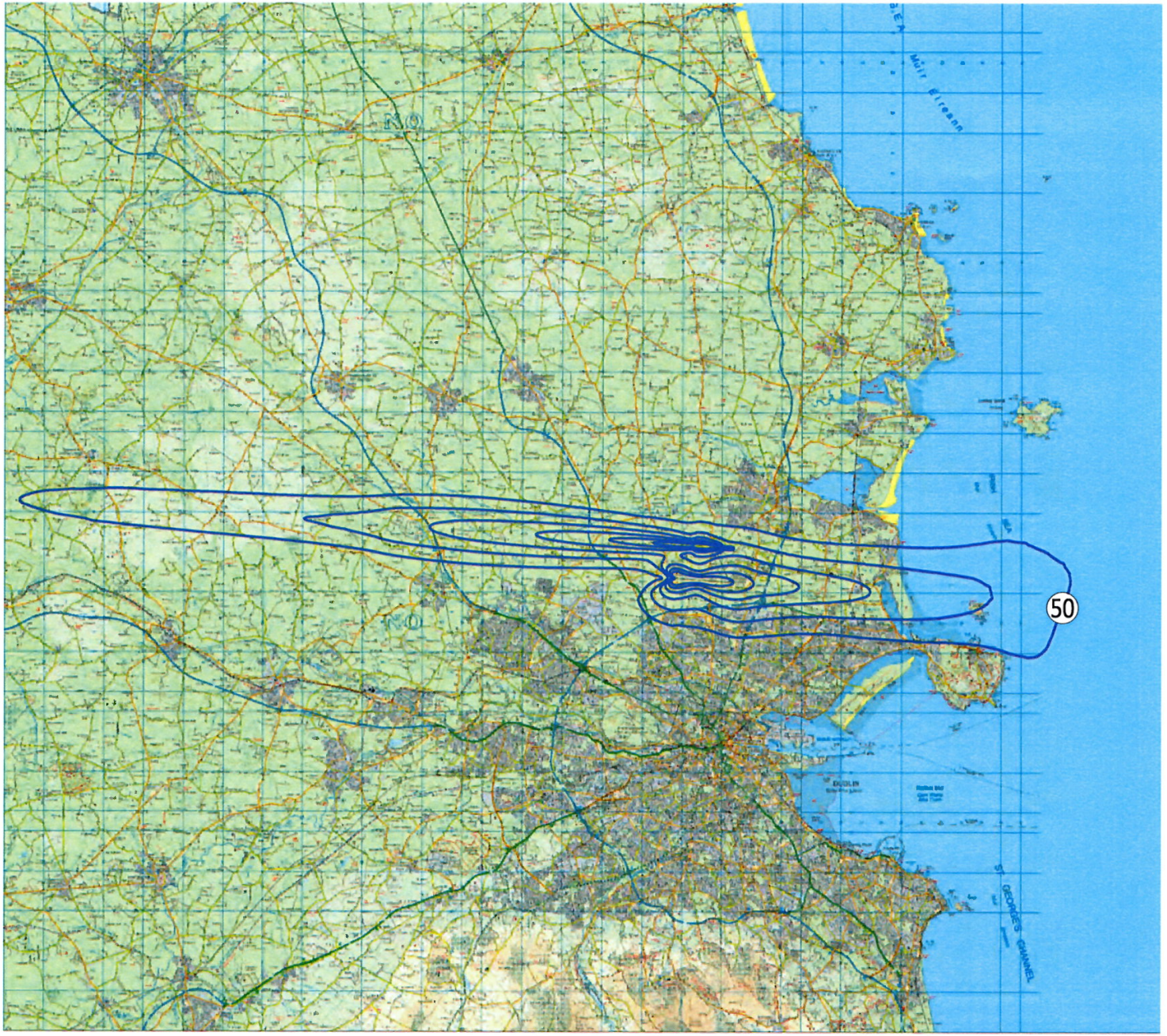
DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR012



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB L_{den} in 5 dB steps

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Dublin Airport
Local Area Plan

Easterly Segregated Mode
Arrivals North Runway
Departures South Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR013

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

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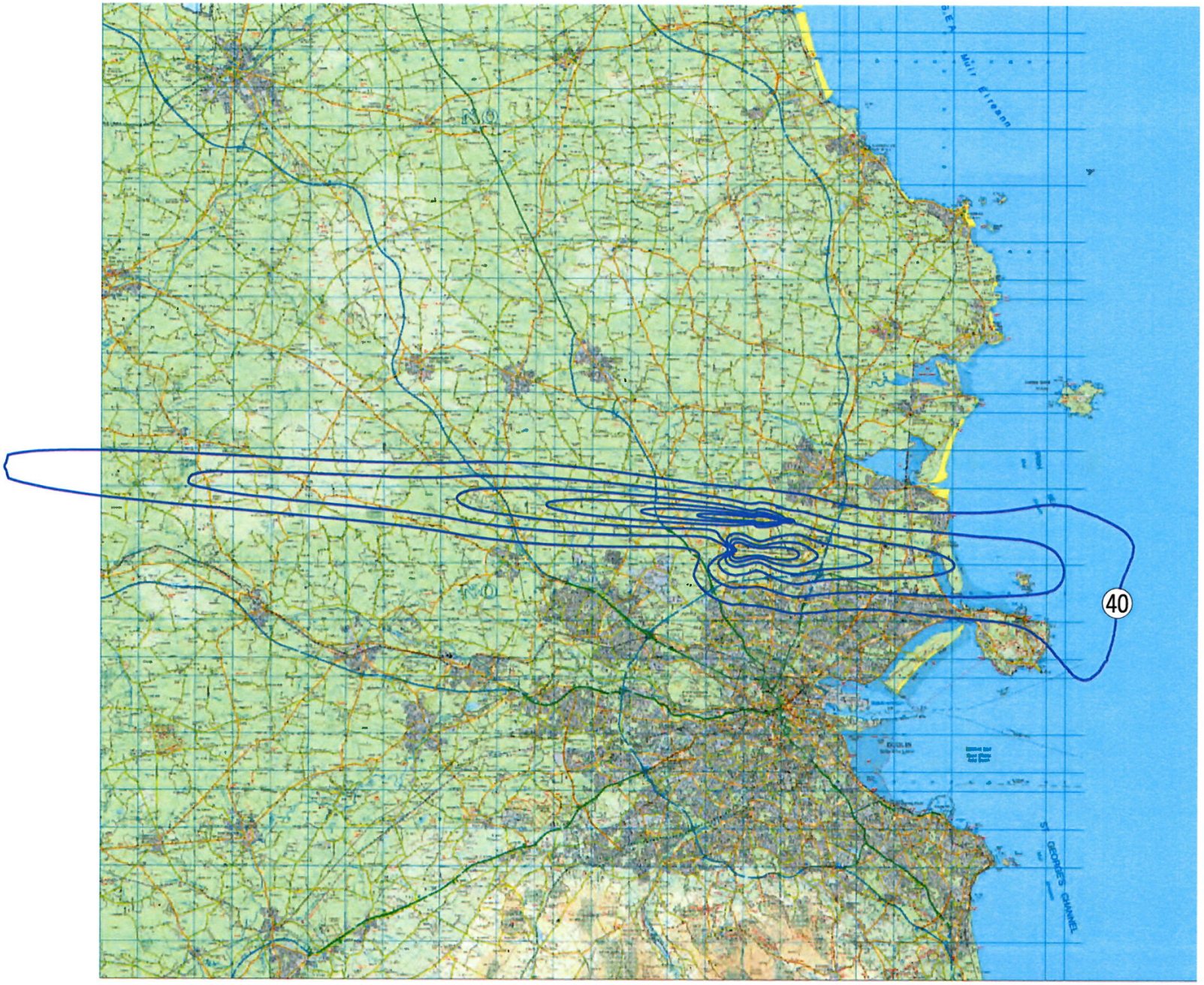
Easterly Segregated Mode
Arrivals North Runway
Departures South Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR014



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

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Easterly Segregated Mode
Arrivals North Runway
Departures South Runway

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR015

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB L_{den} in 5 dB steps

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

Westerly Mixed Mode

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR016

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

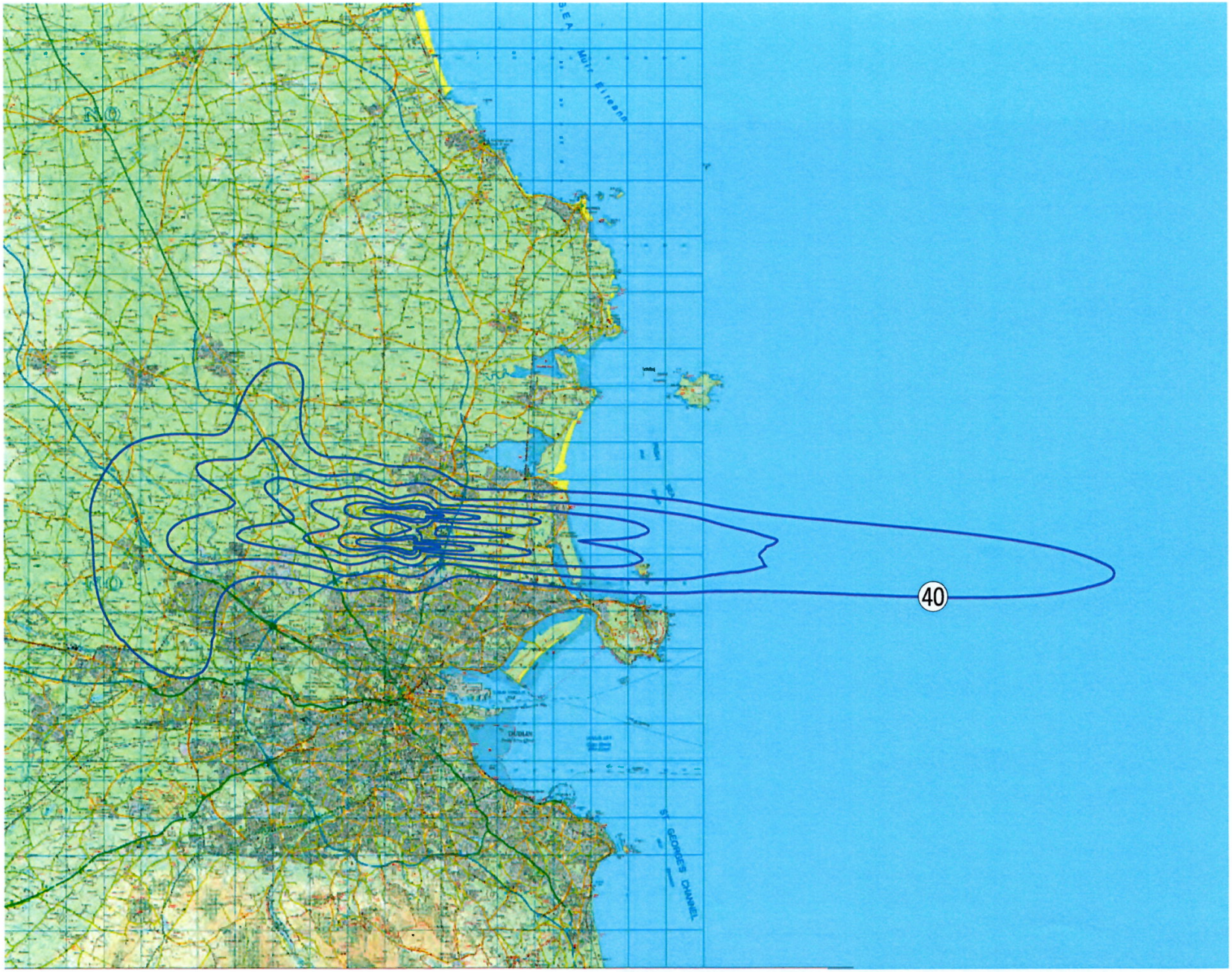
Westerly Mixed Mode

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR017



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

Rev	Date	Description	Initials

REVISIONS

Bickerdike Allen Partners
Architecture Acoustics Technology

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Dublin Airport
Local Area Plan

Westerly Mixed Mode

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DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR018

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB L_{den} in 5 dB steps

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Easterly Mixed Mode

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FIGURE No:

A11219/R01/DR019

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

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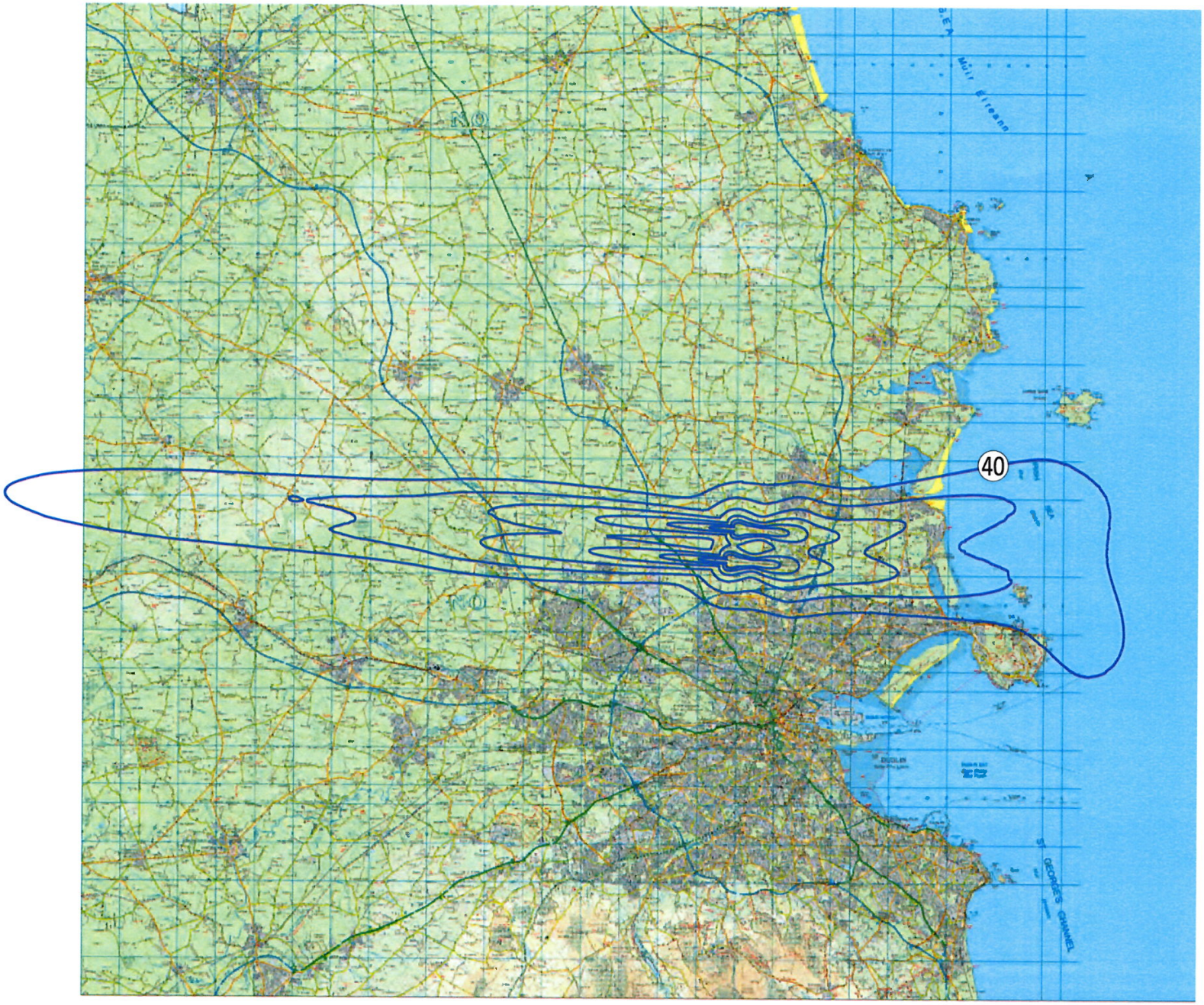
DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR020



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

Rev	Date	Description	Initials

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Easterly Mixed Mode

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR021

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

Daytime Westerly Operations
Current Runway Operating Restrictions

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR022

LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

50 to 75 dB $L_{Aeq,16h}$ in 5 dB steps

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

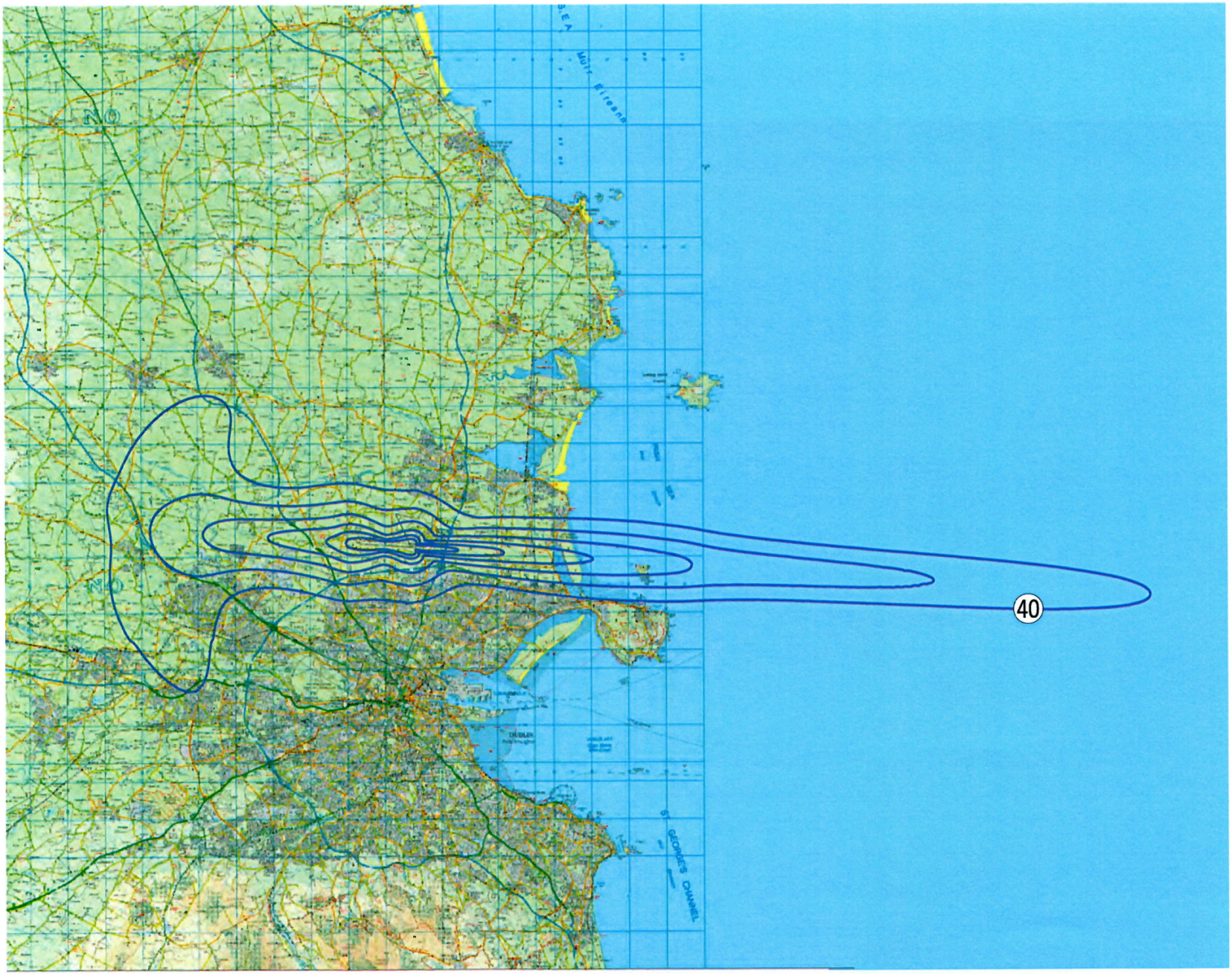
Daytime Easterly Operations
Current Runway Operating Restrictions

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR023



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

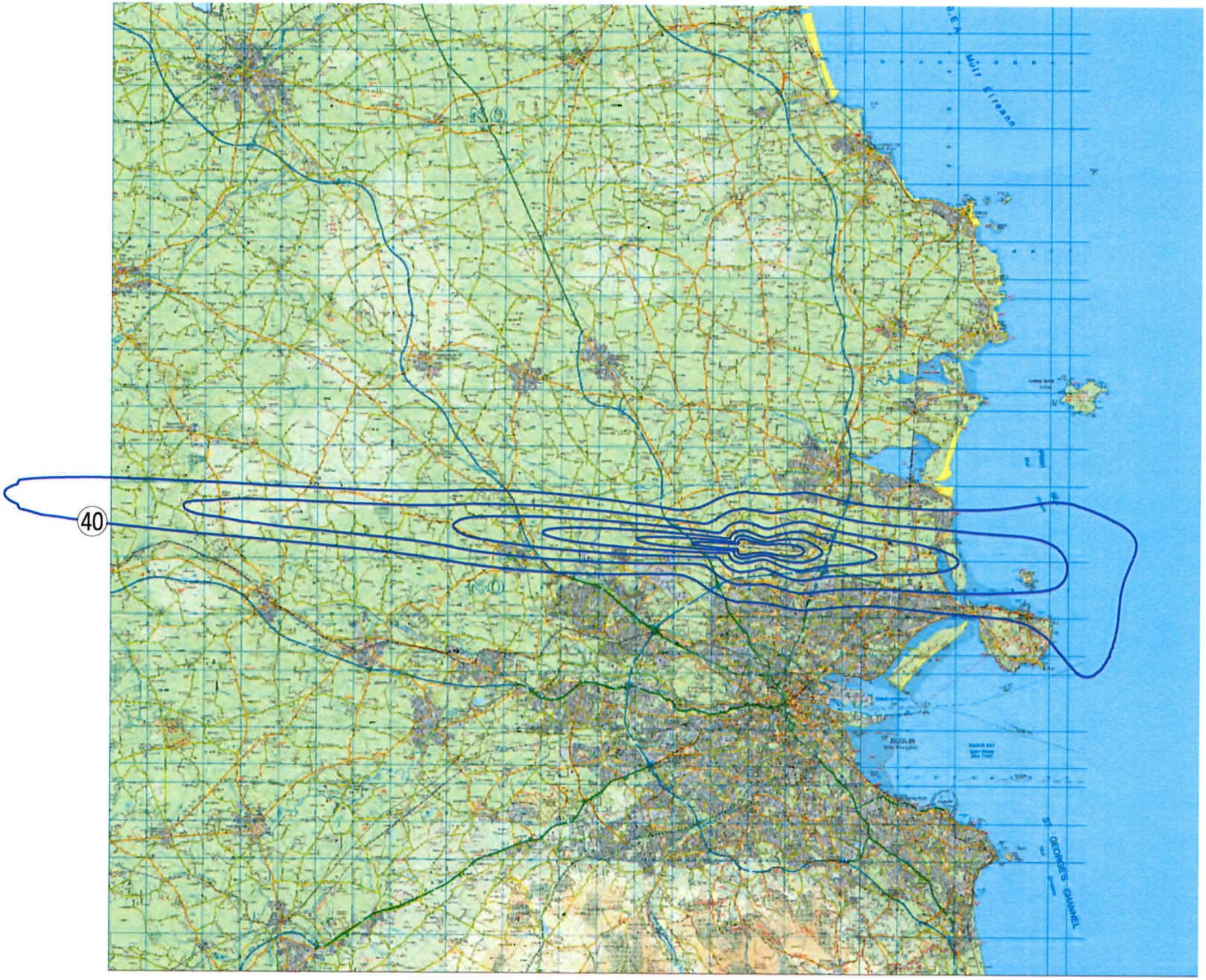
Night-Time Westerly Operations
Current Runway Operating Restrictions

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR024



LEGEND:

2037 Proposed Operations Average Annual Day Noise Contours,

40 to 65 dB L_{night} in 5 dB steps

Rev	Date	Description	Initials

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Dublin Airport
Local Area Plan

Night-Time Easterly Operations
Current Runway Operating Restrictions

DRAWN: MP CHECKED: DR

DATE: October 2018 SCALE: 1:300000@A4

FIGURE No:

A11219/R01/DR025

APPENDIX A

GLOSSARY OF ACOUSTIC AND AVIATION TERMINOLOGY

Sound

This is a physical vibration in the air, propagating away from a source, whether heard or not.

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in Watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} Watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules which transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-Weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental noise descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

$L_{Aeq,T}$ The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.

L_{den} The day-evening-night noised indicator in decibels (dB) defined by the following formula:

$$L_{den} = 10\lg\frac{1}{24}\left(12\times10^{\frac{L_{day}}{10}} + 4\times10^{\frac{L_{evening}}{10}} + 8\times10^{\frac{L_{night}}{10}}\right)$$

L_{day} The A-weighted long-term average sound level for the daytime period (07:00 to 19:00)

$L_{evening}$ The A-weighted long-term average sound for the daytime period (19:00 to 23:00)

L_{night} The A-weighted long-term average sound level for the night time period (23:00 to 07:00)

SEL The total noise energy produced from a single noise event, normalised to a 1-second duration. This is equal to L_{Aeq} + 10log(T).

Ambient noise

Usually expressed using $L_{Aeq,T}$ unit, commonly understood to include all sound sources present at any particular site, regardless of whether they are actually defined as noise.

Background noise

This is the steady noise attributable to less prominent and mostly distant sound sources above which identifiable specific noise sources intrude.

Sound transmission in the open air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB.

Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors affecting sound transmission in the open air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening and diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation, however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.

Aviation terms

Air Transport Movements

Air transport movements are landings or take-offs of aircraft engaged on the transport of passengers, cargo or mail on commercial terms. All scheduled movements, including those operated empty, loaded charter and air taxi movements are included.

NPR

Noise preferential route – departure flight ground tracks to be followed by aircraft to minimise noise disturbance on the surrounding population.

Dispersion

Due to the effect of the wind, aircraft speed, and pilot choice differing aircraft tracks about the nominal track are flown; this is known as dispersion around a nominal track.

Start of Roll

The position on a runway where aircraft commence their take-off runs.

Threshold

The beginning of that portion of the runway usable for landing.

Radar Vectoring

Aircraft are provided by Air Traffic Control (ATC) with various instructions which result in changes of heading, altitude and speed. The controller affects safe separation from other traffic by use of radar.

Nominal Tracks

Using recognised international design techniques, tracks across the ground can be delineated for departing and arriving aircraft. These tracks are nominal because they can be influenced by the wind, ATC instructions, the accuracy of navigational systems and the flight characteristics of individual aircraft. In UK it is usual to permit a 1500m swathe to be established about the nominal track for the purposes of assessing whether an aircraft has stayed on track.

AAL

Height of aircraft above aerodrome level.

Altitude

Height of aircraft above sea level.

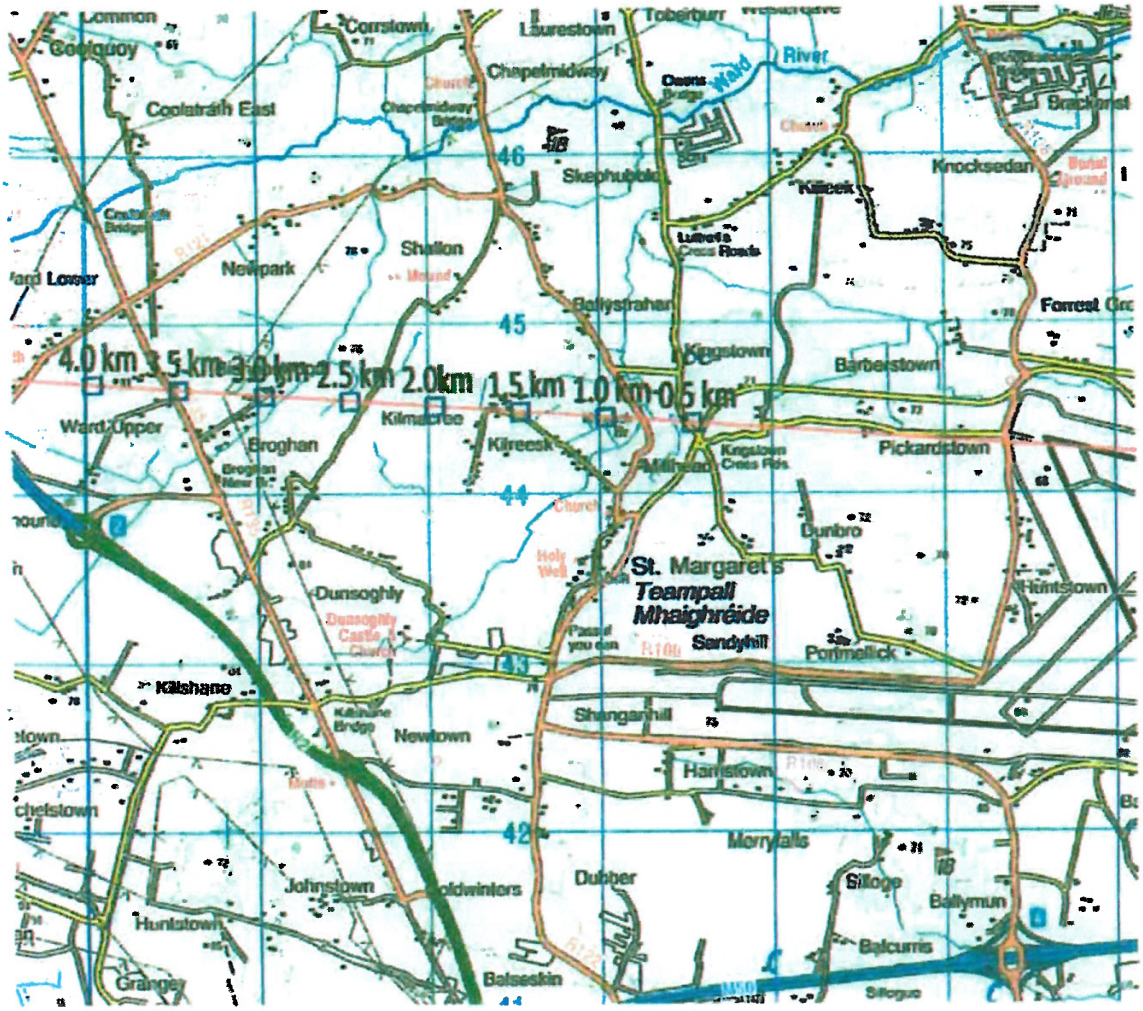
Night Period

The period from 23:00 to 07:00 hours.

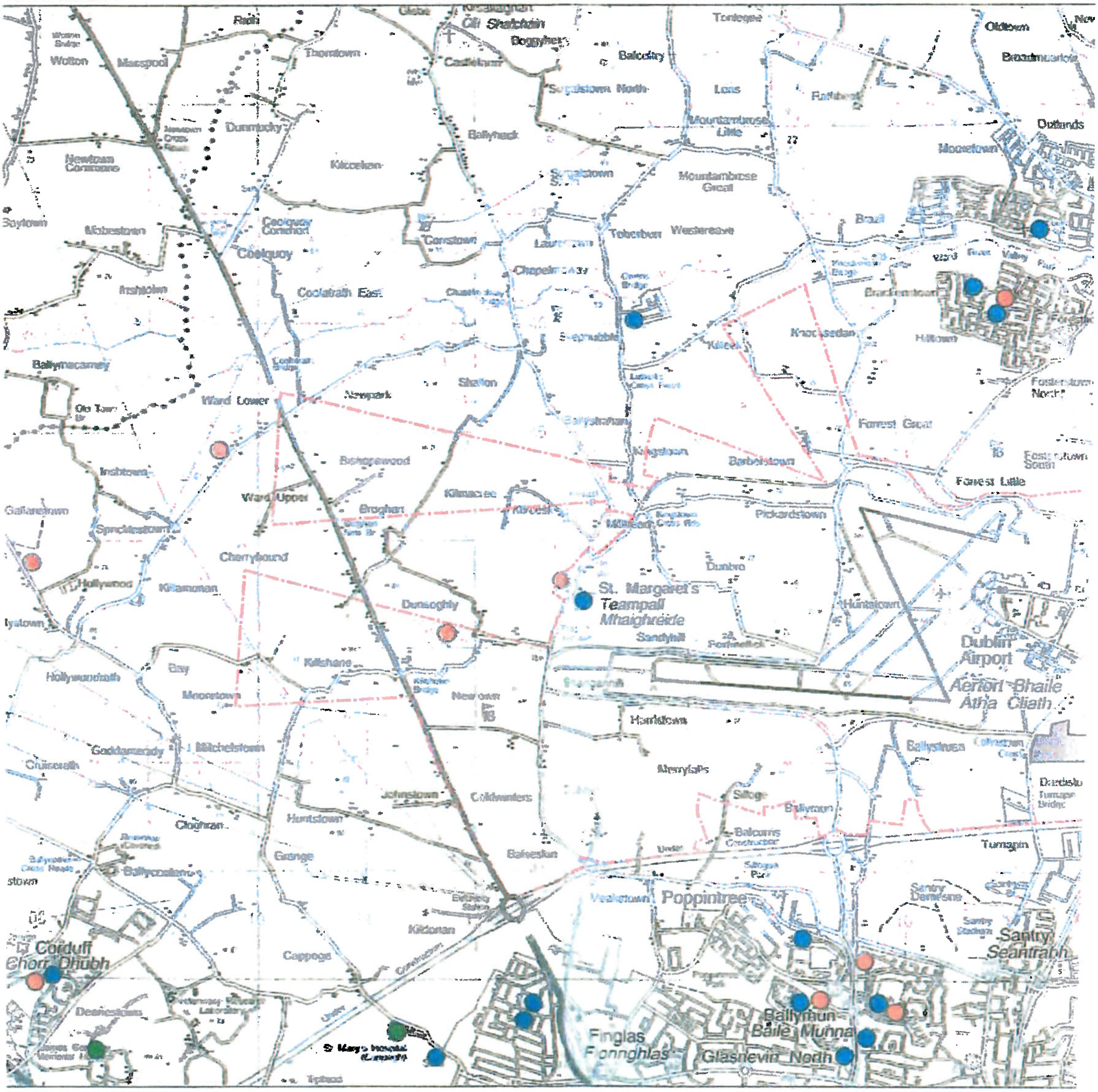
Noise Footprint

A noise contour which joins points on the ground which receive the same maximum noise level from the nearby airborne aircraft; often for night studies 90 dB(A) SEL is the level used.

2018 LONGITUDINAL STUDY


4.0 km
3.5 km
3.0 km
2.5 km
2.0km
1.5 km
1.0 km
0.5 km
Coolatrath East
Chapelmidway
Laurestown
Toberburr
River
Ward
Knocksedan
Skephubble
Killeek
Shallon
Newpark
Ballystrahan
Forrest
Kingstown
Barberstown
Ward Upper
Broghan
Kilmartree
Kilreesk
Millmeadow
Pickardstown
Dunbro
St. Margaret's
Teampall Mhaighréide
Dunsoghly
Dunsoghly Castle
Sandyhill
Portmellick
Kilshane
Newtown
Shangarhill
Harristown
Merrylalls
Johnstown
Goldwinters
Dubber
Silloge
Ballymun
Hunlstown
Balcurris
Grange
Balseskin
Bickerdike Allen Partners
Dublin Airport North Runway Project
Location of Assessment Points
A11219-N01-01

0.5 km - 1000 ft.



Wotton
Kilcoskan
Coolquoy
Coolatrath East
Ward Lower
Newpark
Shallon
Bishopswood
Ward Upper
Broghan
Kilmacree
Cherryhound
Kilamonan
Dunsoghly
Killshane
Moorestown
Newtown
Hollywoodrath
Goddamendy
Michelstown
Johnstown
Coldwinters
Huntstown
Cloghran
Grange
Kildonan
Cappoge
Barberstown
Pickardstown
Kingstown
Forest Great
Forest Little
Knocksedan
Brackenstown
Dunbro
St. Margaret's
Teampall Mhaighréide
Sandyhill
Harristown
Dublin Airport
Aerfort Bhaile Átha Cliath
Ballystruan
Poppintree
Ballymun
Baile Munna
Glasnevin North
Finglas
Santry
Seantrabh
Corduff
Deanestown
St Mary's Hospital
Tonlegee
Balcultry
Lusk
Mountambrose Great
Toberbunny
Westereave
Moortown
Outlands
Oldtown
Brazil
Forest Little
Turnapin

Bickerdike
Allen
Partners

DUBLIN AIRPORT

A11219-N01-DR

29 August 2018

'LONGITUDINAL ANALYSIS'– L_{Amax} AND SEL NOISE LEVELS

1.0 INTRODUCTION

Bickerdike Allen Partners LLP (BAP) have been retained by daa to predict the levels of airborne aircraft noise from individual movements close to the airport. That is from departing aircraft shortly after take-off and from arriving aircraft shortly before landing. This information has been provided in accordance with a request from the St. Margaret's Concerned Residents community group.

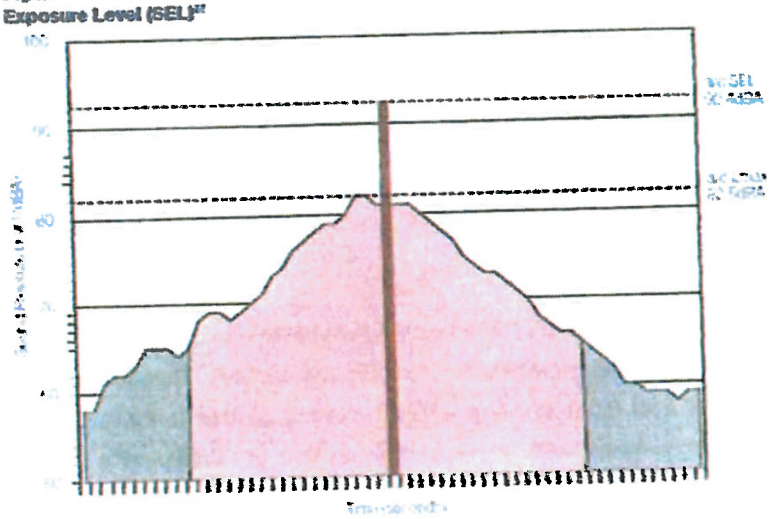
BAP have predicted the noise for six key aircraft types that either currently operate, have operated, or are forecast to operate in the future at Dublin Airport. The noise levels have been predicted for both arrivals and departures at eight points ranging from 0.5 to 4km, in 0.5 km steps, from the west end of the permitted North Runway along the extended runway centreline. The points are shown in the attached drawing A11219-N01-01. This note reports these predicted noise levels and details the methodology used in their calculation.

2.0 METHODOLOGY

Noise levels have been calculated using the Federal Aviation Administration (FAA) Integrated Noise Model (INM) version 7.0d. The same software was used for the noise mapping of Dublin Airport undertaken for the Environmental Protection Agency (EPA) in 2017.

Noise levels have been calculated in terms of both L_{Amax} and Sound Exposure Level (SEL). L_{Amax} is the maximum instantaneous sound pressure level of an aircraft movement. SEL is a measure of the total noise from an aircraft movement. The SEL noise level for an aircraft movement is the sum of all the noise energy for the event expressed as an average noise level for 1 second. This is shown in the figure below. By adding the SEL of all of the operations at the airport over either 16 hours or 8 hours for the daytime and night time periods respectively and then averaging you get the $L_{Aeq,T}$ average noise contours.

Figure 3.1: Aircraft time history, showing maximum level L_{max} and associated Sound Exposure Level (SEL)[2]



Source: CAA [2012]

The predictions assume the permitted North Runway is in operation. Arrivals have been modelled as using Runway 10L and departures have been modelled as using Runway 28R, both of these overfly the area to the north-west of the airport. Arrivals and departures have been modelled using straight routes, that is along the extended centreline of the North Runway.

Noise levels have been calculated for six key aircraft types:

- The Boeing 737-800 and the Airbus A320, which are the current most common aircraft types at Dublin Airport and in 2016 they performed around 37% and 23% of the total movements respectively;
- The Boeing 737 MAX8, which is forecast to be the most common type in the future, but doesn't yet operate in significant numbers;
- The Airbus A330-300, which is the current most common wide-body aircraft and in 2016 performed around 2% of the total movements;
- The Airbus A380, which is the largest aircraft forecast to operate at Dublin, but doesn't currently operate at Dublin;
- The Boeing 737-200, which is an older aircraft type that used to operate in large numbers, but no longer operates at Dublin. Noise levels have been provided for the Boeing 737-200 to illustrate how aircraft technology improves over time and that each generation of aircraft is quieter than the previous.

The INM noise modelling software includes a database of aircraft types and associated noise performance data. It is possible to refine this default data by a validation procedure to better predict aircraft noise around an airport based on actual noise monitoring data where this is available. At Dublin, the permanent noise monitoring and flight track keeping system provides this opportunity.

BAP have validated the default INM noise predictions for the most common aircraft at Dublin by comparing predicted noise levels with the noise levels measured at the airport's noise monitoring terminals (NMTs). Based on the validation exercise modifications have been made to the default INM noise predictions for the Boeing 737-800, the Airbus A320 and the Airbus A330-300. An aircraft type for the Boeing 737 MAX8 is not included in the INM, therefore the noise levels have been predicted for the Boeing 737-800 with an allowance made for the lower noise levels of the MAX8. This allowance has been based on the assumptions used by ECRD in their work for the Airports Commission in the UK[1].

Departures by the single aisle aircraft have been modelled as using intersection take-offs, whereas departures by the wide-body aircraft have been modelled as using the full runway length, as is expected to be case once the runway is operational.

[1] Baseline and Local Assessment Methodology Addendum, December 2014: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/389579/noise_methodology_addendum.pdf

3.0 RESULTS

The L_{Amax} and SEL noise levels rounded to the nearest decibel are given in Tables 2 and 3 below.

Operation	Aircraft Type	Noise Level, dB L_{Amax}							
		0.5 km	1.0 km	1.5 km	2.0 km	2.5 km	3.0 km	3.5 km	4.0 km
Departure	Airbus A320	86	83	78	78	77	77	76	76
	Airbus A330-300	91	90	89	88	87	83	82	81
	Airbus A380	89	88	87	86	85	84	83	83
	Boeing 737 Max8	87	84	81	79	78	77	77	76
	Boeing 737-800	90	87	83	81	80	80	79	79
	Boeing 737-200	*96*	*94*	*93*	*92*	*90*	*87*	*86*	*85*
Arrival	Airbus A320	94	90	87	85	83	81	80	79
	Airbus A330-300	97	93	90	87	86	84	83	82
	Airbus A380	95	91	89	87	85	83	82	81
	Boeing 737 Max8	94	90	87	85	83	81	80	79
	Boeing 737-800	94	90	87	85	83	81	80	79
	Boeing 737-200	94	90	88	86	84	82	81	80

Table 2: L_{Amax} Noise Levels at Assessment Locations

Operation	Aircraft Type	Noise Level, dB(A) SEL							
		0.5 km	1.0 km	1.5 km	2.0 km	2.5 km	3.0 km	3.5 km	4.0 km
Departure	*Airbus A320*	*94*	*92*	*89*	*88*	*87*	*87*	*86*	*86*
	Airbus A330-300	99	98	97	96	95	92	91	90
	Airbus A380	97	96	95	94	93	92	92	91
	Boeing 737 Max8	95	93	89	88	87	86	85	85
	Boeing 737-800	97	95	92	90	89	88	88	87
	Boeing 737-200	104	103	101	100	97	95	94	93
Arrival	Airbus A320	99	96	94	92	90	89	89	88
	Airbus A330-300	101	99	97	95	94	93	92	91
	Airbus A380	100	98	96	94	93	92	91	91
	Boeing 737 Max8	96	94	92	91	90	89	88	87
	Boeing 737-800	97	95	93	91	90	89	88	88
	Boeing 737-200	97	95	94	93	91	90	90	89

Table 3: SEL Noise Levels at Assessment Locations

4.0 SUMMARY

The noise levels for arrivals and departures by six key aircraft types have been predicted for operations on the permitted North Runway.

Duncan Rogers	David Charles	Peter Henson
for BickerdikeAllen Partners LLP	Associate	Partner

Supporting materials

6. If you wish, you can include supporting materials with your observation. Supporting materials include:

   - photographs,
   - plans,
   - surveys,
   - drawings,
   - digital videos or DVDs,
   - technical guidance, or
   - other supporting materials.

Fee

7. You **must** make sure that the correct fee is included with your observation. You can find out the correct fee to include in our Fees and Charges Guide on our website.

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Last updated: April 2019.