



***Strategic Noise Mapping Report 2018
Submission to the EPA under the Environmental
Noise Regulations, 2006***

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Executive Summary

Under EU Directive 2002/49/EC relating to The Assessment and Management of Environmental Noise (known as the END), the relevant Noise Mapping Bodies (NMB's) are required to review and revise, if necessary, 'Strategic Noise Maps' every 5 years. Dún Laoghaire-Rathdown County Council is designated as a relevant NMB under the END.

Round 2 maps were produced in June 2012. A review has been carried out by Dún Laoghaire Rathdown County Council and a decision was made to revise the 2012 road source noise maps in order to produce new maps for 2017. It was agreed with the EPA, as in 2012, that major industrial sources would not be mapped. During the review phase it was found that major industrial plant did not have any strategic impact on the overall sound environment in the Dún Laoghaire Rathdown County Council area. Such plants produce sound emissions, at the boundary of their site, which were below the reporting threshold.

Irish Rail and Transport Infrastructure Ireland (TII) are required to produce noise maps for rail sources within the Dún Laoghaire Rathdown County Council on behalf of the Council.

Comparisons of the 'Noise Maps' and population exposure between the second round of mapping in 2012 and the current 2017 maps shows that there has been some changes in relation to the number of people exposed to noise categorised in the various decibel bands. In general the number of people categorised in each decibel band has decreased significantly since 2012. The possible reasons for this include:

- Revisions to the road network modelled;
- Significantly improved data relating to traffic flows and HGV content on roads within the County;
- Improved quality of digital terrain model (DTM) - 1m contours for Round 3, 10m contours for Round 2;
- Revised building height data
- Updated Census data (using Small Area Population Statistics (SAPS)); and
- Improved resolution of census data;

Approximately 63% of the population of Dún Laoghaire-Rathdown County Council are exposed to sound levels from traffic sources below an L_{den} (day, evening, night) level of 55dB(A). Approximately 72% of the population are being exposed to an L_{night} (night time) level below 50dB(A). Approximately 15% of the population are being exposed to undesirable night time sound levels of greater than 55dB(A) and approximately 3% are being exposed to an L_{den} sound levels above 70dB(A).

The full statistics on population exposure to sound from road sources for the Dún Laoghaire Rathdown County Council functional area are presented in Tables 11.1 to 11.5 on pages 31 and 32. The modelled sound levels are displayed as 'noise maps' Appendix C.

There is still a percentage of the population (15%) in the Dún Laoghaire Rathdown County Council area being exposed to undesirable night time sound levels. Consideration will be required to be given as to what action can be taken to reduce these numbers, during the revision of the Dublin Agglomeration Noise Action Plan.

Contents

1. Introduction	6
1.1 Background.....	6
1.2 Noise and Effects of Noise.....	7
1.3 Purpose and Scope of the END Directive	8
1.4 Purpose and Scope of the Regulations	9
1.5 Roles and Responsibilities of designated bodies	9
1.5.1 Noise Mapping Bodies	10
1.6 Key Phases in Noise Mapping.....	10
2. Overview of Strategic Noise Mapping Process	12
2.1 Project Review.....	12
2.2 Process Overview	12
3. Review of the Second Round of Noise Maps	14
3.1 Developments since the 2nd round of Noise Mapping in 2012.....	14
3.2 Review and Revision of Strategic Noise Maps prepared during Round 2.....	16
4. Define Areas to be mapped.....	16
4.1 Requirements of Directive	16
4.2 Requirements of Regulations.....	17
4.3 Approach to Definition of Mapping Extents	18
4.4 Maps and Statistics Describing Area to be mapped.....	18
4.5 Approach to Definition of Model Extents including buffer	19
5. Define Noise Calculation method.....	21
5.1 Requirements of Directive	21
5.2 Requirements of Regulations.....	21
5.3 Factors influencing selection of assessment method	21
6. Develop Dataset Specification and Requirements.....	22
6.1 Input Data Requirements.....	22
6.1.1 Conceptual Model	22
6.1.2 Input Data Requirements for CRTN – Road Source Noise Model	23
6.1.3 Physical Model.....	23
6.2 Data specification for noise mapping – Database Design.....	24
7. Produce Datasets	25
7.1 Identify Data Sources	25
7.1.1 Road Source Noise Model.....	25
7.1.2 Physical Model.....	27

8. Develop Noise Model Datasets.....	28
9. Noise Level Calculations.....	28
9.1 Documentation of noise mapping software system	28
9.1.1 Use of Calculation Settings/Efficiencies Settings	28
10. Noise Level Calculations.....	29
10.1 Post processing of noise level results.....	29
10.2 Area exposure assessment.....	29
10.3 Dwellings exposure assessment.....	29
10.4 Population exposure assessment.....	29
11. Results of Calculations	29
12. Summary and Conclusions.....	32

Appendix A: Glossary of acoustic and technical terms

Appendix B: Bibliography and references

Appendix C: Strategic noise maps

1. Introduction

1.1 Background

Under EU Directive 2002/49/EC relating to The Assessment and Management of Environmental Noise, (known as the END) which was transposed by SI number 140 of 2006, the relevant noise mapping bodies, are required to produce 'Maps' for noise emanating from Industry and Roads, including Major Roads, and for rail sources within the Dublin Agglomeration and for the noise coming from aircraft associated with Dublin Airport.

The aim of the Directive is:

"to define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise".

And to that end three stages are set out:

- Undertake strategic noise mapping to determine exposure to environmental noise;
- Ensure information on environmental noise and its effects is made available to the public; and
- Adopt action plans, based upon the noise-mapping results, with a view to preventing and reducing environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health and to preserving environmental noise quality where it is good.

The Directive defines noise mapping, strategic noise maps and action plans as follows:

- 'noise mapping' shall mean the presentation of data on an existing or predicted noise situation in terms of a noise indicator, indicating exceeding of any target value in force, the number of people affected in a certain area, or the number of dwellings exposed to certain values of a noise indicator in a certain area;
- 'strategic noise map' shall mean a map designed for the global assessment of noise exposure in a given area due to different noise sources or for overall predictions for such an area;

- 'action plans' shall mean plans designed to manage noise issues and effects, including noise reduction if necessary

The noise mapping bodies are required to review and revise, if necessary, 'Strategic Noise Maps' every 5 years. Noise Maps for the 2nd round of mapping were completed and produced for the Dublin Agglomeration in July 2012. This report outlines the procedures undertaken to produce the maps and the results of the 3rd Round of mapping.

As a designated noise mapping body within the Dublin Agglomeration, Dún Laoghaire-Rathdown County Council has a responsibility to develop noise maps for Roads, including Major Roads, in the Dún Laoghaire-Rathdown County Council administrative area. Irish Rail and Transport Infrastructure Ireland (TII) are required to produce noise maps for rail sources and light rail sources respectively within Dún Laoghaire-Rathdown County Council on behalf of the Council.

At the inception of the Round 3 mapping exercise, a review was carried out by Dún Laoghaire-Rathdown County Council and a decision was made to revise the 2012 road source noise maps in order to produce new maps for 2017. During the review phase it was found that major industrial plant did not have any strategic impact on the overall sound environment in the Dún Laoghaire-Rathdown County Council area and produce sound emissions, at the boundary of their site, which were below the reporting threshold. It was therefore agreed with the EPA, as in 2012, that IPPC licensed industrial sources industrial sources would not be mapped.

The production of strategic noise maps was undertaken through the use of computer software in which a model of the entire Dún Laoghaire-Rathdown County Council administrative area was developed. The software then calculated the sound levels at certain spacing's across the modelled area. These calculated sound levels were then colour coded to produce 'thematic noise maps'. No measurements of sound were involved in the process. The outputs were all related to calculations produced by the computer model. The 'END' emphasises that strategic maps are not to be used to address local noise nuisances such as neighbourhood or domestic noise nuisance.

1.2 Noise and Effects of Noise

Environmental noise, commonly called noise pollution, is among the most frequent sources of complaint regarding environmental issues in Europe, especially in densely populated urban areas and residential areas near highways, railways and airports,

(WHO, European office). Noise contributes greatly to diminishing people's quality of life. Unwanted sound (noise) of sufficient intensity and duration can cause temporary and/or permanent hearing loss. It can also interfere with speech communication, the transmission of other auditory signals, can disturb sleep and act as a general source of annoyance or disturbance and interfere with the performance of complicated tasks and the opportunity for privacy. In particular, exposure of people to daytime noise levels above 65 dB(A) can cause severe health problems. It is accepted that sound levels in cities range between 60-70 dB(A), with suburban levels between 50-60 dB(A). The World Health Organisation has set guideline levels for annoyance at 55 dB(A) representing daytime levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed.

1.3 Purpose and Scope of the END Directive

The over-arching aim of this Directive is to provide a common framework to avoid, prevent or reduce, on a prioritised basis, the harmful effects of exposure to environmental noise. It aims to do this by:-

- Monitoring environmental noise problems by requiring competent authorities in Member States to draw up "strategic noise maps" for major roads, railways, airports and agglomerations, using harmonised noise indicators L_{den} (day-evening-night equivalent level) and L_{night} (night equivalent level). These maps are to be used to assess the number of people annoyed and sleep-disturbed respectively throughout each member state in the European Union;
- Informing and consulting the public about noise exposure, its effects, and the measures to be considered to address noise problems;
- Addressing local noise issues by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain the environmental acoustic quality where it is good. The directive does not set any limit value, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities; and
- Developing a long-term EU strategy, which includes objectives to reduce the number of people affected by noise in the longer term, and provides a framework for developing existing Community policy on noise reduction from source.

The Directive is also aimed at providing a basis for developing EU wide measures to reduce noise emitted by the major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment. The Directive applies to environmental noise to which humans are exposed, in particular in built-up areas, in

public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise sensitive buildings and areas. It does not apply to noise that is caused by the exposed person himself/herself, noise from domestic activities, noise created by neighbours, noise at work places or noise inside means of transport or due to military activities in military areas. As these maps are Strategic Noise Maps they should not be used for the assessment of local noise nuisances.

1.4 Purpose and Scope of the Regulations

The purpose and scope of the Regulations are set out in statutory instrument S.I No. 140 of 2006, which transposes EU Directive 2002/49/EC relating to the assessment and management of environmental noise. It states that for the purposes of these Regulations, environmental noise means unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity.

The Regulations set out a two-stage process for addressing environmental noise. Firstly, noise must be assessed through the preparation of strategic noise maps for areas and infrastructure falling within defined criteria, e.g. large agglomerations, major roads, railways and airports. Secondly, based on the results of the mapping process, the Regulations require the preparation of noise action plans for each area concerned. The fundamental objective of action plans is the prevention and reduction of environmental noise.

The Regulations designate noise-mapping bodies and action planning authorities for the making of strategic noise maps and action plans. Primary responsibility for both noise mapping and action planning is assigned to local authorities. While a number of other bodies also have noise mapping functions, these bodies will carry out their functions on behalf of the local authorities concerned.

1.5 Roles and Responsibilities of designated bodies

The Regulations designate the Environmental Protection Agency as the National Authority for the purposes of the Regulations. The role of the Agency includes supervisory, advisory and coordination functions in relation to both noise mapping and action planning, as well as reporting requirements for the purpose of the Directive.

The Regulations designate noise-mapping bodies and action planning authorities for the making of strategic noise maps and action plans. Primary responsibility for both noise mapping and action planning is assigned to local authorities. While a number of

other bodies also have noise mapping functions, these bodies will carry out their functions on behalf of the local authorities concerned.

1.5.1 Noise Mapping Bodies

A strategic noise map is defined within the Environmental Noise Directive as a map designed for the global assessment of noise exposure in a given area due to different noise sources for overall predictions for such an area' (EU, 2002).

The roles of the Irish noise mapping bodies are set out in the Environmental Noise Regulations 2006. Table 1.1 outlines the organisations that have been designated as noise-mapping bodies under the regulations:

Table 1.1 Designated Noise Mapping Bodies

Source	Designated Noise Mapping Body (NMB)
For the agglomeration of Dublin	Dublin City Council and the County Councils of Dún Laoghaire/Rathdown, Fingal and South Dublin
For the agglomeration of Cork	Cork City Council and Cork County Council
For major railways -	Iarnród Éireann (Irish Rail) or the Transport Infrastructure Ireland, as appropriate;
For major roads	Transport Infrastructure Ireland, for national roads classified in accordance with Section 10 of the Roads Act 1993 (No.14 of 1993), and the relevant road authority, or authorities, for major roads not classified as national roads
For major airports	The relevant airport authority.

1.6 Key Phases in Noise Mapping

The Environmental Noise Directive sets out a process for managing environmental noise in a consistent manner across the EU and the Regulations set out the approach to meeting the requirements of the Directive in Ireland. Responsibility for undertaking the phases of work required under the Regulations is shared between the noise mapping bodies and the action planning authorities.

Noise Mapping and Noise Action Plans are required to be reviewed and revised every five years. The following timetable applies with regard to Noise Mapping for the 3rd Round:

- June 2017 - Strategic noise maps to be completed by NMBs for 3rd round agglomerations, major roads, major railways and major airports in respect of the 2016 calendar year;
- July 2017
 - Results of strategic noise maps are to be reporting to the EPA by NMBs;
 - Information on strategic noise maps to be made available to the public by NMBs;
- December 2017 - Strategic noise maps to be reported to the EC/EEA by the EPA for 3rd round agglomerations, major roads, major railways and major airports in respect of the 2016 calendar year – ENDRM DF4_8.

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2. Overview of Strategic Noise Mapping Process

2.1 Project Review

Dublin City Council acted as the lead co-ordinator in relation to developing the traffic source maps for the Agglomeration of Dublin for Round 1 in 2007 and Round 2 in 2012, with support and information from the other Local Authorities.

In 2017, Dún Laoghaire-Rathdown County Council developed its' own input data sets and Dublin City Council assisted the council in running the noise model. Responsibility for the preparation of the relevant noise maps lies with the Noise Mapping Bodies (NMB's) as outlined in Table 1.1. The preparation and implementation of the resulting noise action plans occurs at local level and is the responsibility of the Local Authorities.

The first co-ordination meeting for the local authorities in the Dublin Agglomeration was held in April 2017.

2.2 Process Overview

Figure 2.1 below sets out the different stages and inputs required for mapping of the Roads network.

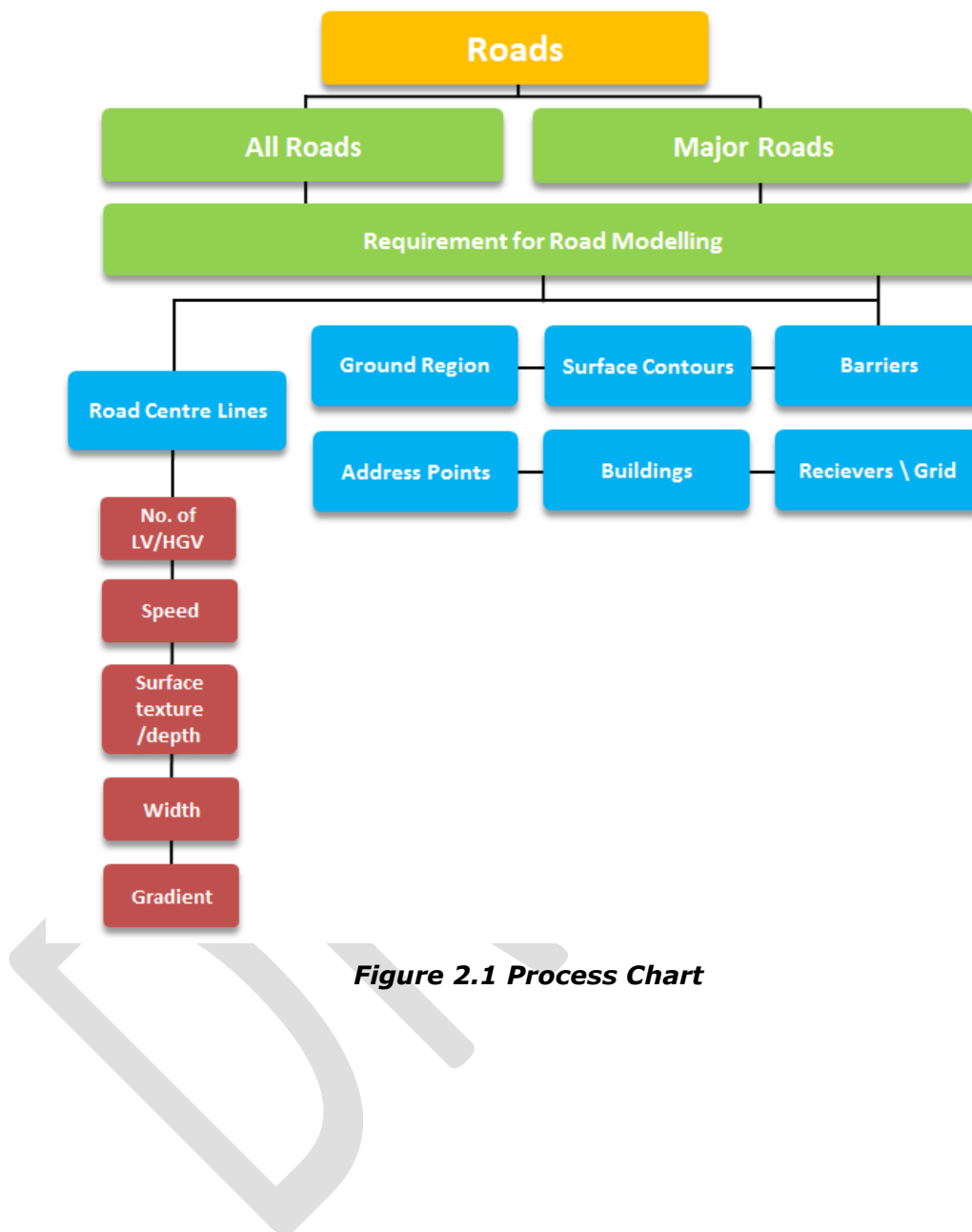


Figure 2.1 Process Chart

3. Review of the Second Round of Noise Maps

3.1 Developments since the 2nd round of Noise Mapping in 2012

Each noise mapping body (NMB) is required to review and, where necessary, revise strategic noise maps every 5 years or sooner where requested by the EPA or when a material change in environmental noise in the area concerned triggers a revision of the relevant noise action plan. Therefore, NMBs who undertook strategic noise mapping for the 2nd Round in 2012 had an obligation to undertake a review of the strategic noise maps and, where necessary, revise them.

A report was presented to the EPA in October 2016 reviewing changes between Round 2 and Round 3 in population, traffic volumes, significant infrastructure schemes, large developments and noise emissions from industrial sites. The following provides a summary of the findings:

Population Changes:

- Population increase - Based on the 2016 Census data, the population of the County now stands at 217,274, an increase of 5.3% or 11,013 people from 2011 with population increases occurring across the County. Figure 3.1 below outlines the locations of the population increase in the period 2011 to 2016.

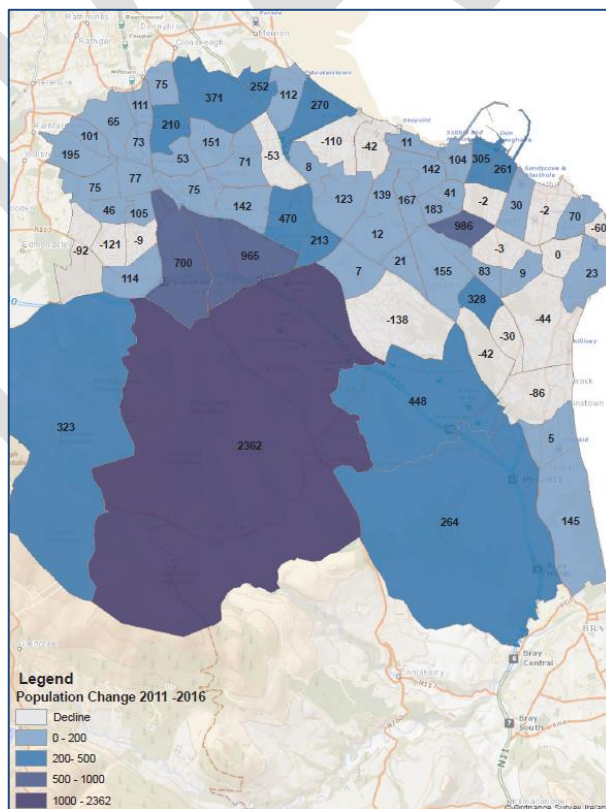


Figure 3.1 Population Increases 2011 to 2016

Traffic Volume & Road Infrastructure Changes:

- Traffic volumes – A review of traffic volumes was carried out on 30 main roads used in Round 2 using traffic count data from the SCATS traffic control system and this showed that traffic volumes increased by an average of 2%. A review of M50 and M11 traffic flows show increases in AADT's from 8% to 15% with no notable increases in population numbers along this corridor in the past 5 years.
- Significant infrastructure schemes – Since the last round of noise mapping, one new link road was completed in the last five years that forms a small part of the road network; the new road link in question is Burton Hall Link Road in Sandyford – 0.2km (local road).
- Improvements were also made to existing roads and junctions that included the provision of cycle tracks on Pottery Road and along Frascati Road/Temple Hill in Blackrock with the Leopardstown Roundabout upgrade to a traffic signalised junction.

From the above list we can see that there were no significant changes to the Major Road network over the past five years.

Large Residential Development Changes:

No major residential development has been completed in the past five years due to the economic downturn, although a number of mixed use developments commenced. These included the Honey Park development in Glenageary that has been part completed with population increases of almost 1,000 in the general area due to the high residential element to the development.

Noise emissions from industrial sites:

A review of industrial activity identified within the County for the Round 2 mapping was undertaken based on industries with Integrated Pollution Prevention and Control licences from the Environment Protection Agency and it was found that the noise emissions from these IPPC licenced sites fall below the reporting thresholds for strategic noise mapping.

3.2 Review and Revision of Strategic Noise Maps prepared during Round 2

Based on the information above in Section 3.1, revision of the strategic noise maps from Round 2 was not deemed necessary. However, a decision was made by Dún Laoghaire-Rathdown County Council to proceed with a revision of the strategic noise maps in order to take advantage of significant improvements in data available since Round 2 and advancements in the calculation methods. The improved data and calculation methods included:

- Roads network and traffic data for the majority of the County;
- Improved building height data;
- Improved terrain model data- 1m contours for Round 3, 10m contours for Round 2;
- Revised Census Data;
- Revised Calculation Methods - i.e. from calculated grid points (excluding buildings);
- Resolution of census data – Small Area Population Statistics (SAPS) for Round 3, Electoral Division (ED) for Round 2.

This was discussed with the EPA and it was also agreed maps for the whole of Dublin would be revised.

4. Define Areas to be mapped

4.1 Requirements of Directive

The Directive applies to environmental noise to which humans are exposed, in particular in built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise sensitive buildings and areas. The Directive defines an agglomeration as meaning *'part of a territory, delimited by the Member State, having a population in excess of 100,000 persons and a population density such that the Member State considers it to be an urbanised area'*.

Within agglomerations there is a requirement to assess the impact of all relevant roads. It is noted in WG-AEN GPG v2 that the END implies that all roads have to be taken into account and mapped within agglomerations.

There is also a requirement to assess the noise levels from “major roads” at any locations inside and outside any agglomerations. A “major road” is defined as a road with a total flow above 3,000,000 vehicle passages per year, approximately 8,220 vehicle passages per average 24 hours.

Note: The above definition of “major roads” has been clarified to consist of all roads classified as “National” roads or “Regional” roads with a total flow above 3,000,000 vehicle passages per year.

4.2 Requirements of Regulations

The Environmental Noise Regulations 2006 (S.I. No. 140 of 2006) designates all the local authorities within the Agglomeration of Dublin as individual noise mapping bodies, responsible for producing noise maps for roads, including major roads, all Industrial processes and non-major rail and airports within the agglomeration of Dublin.

The agglomeration of Dublin is defined as the county borough of Dublin, the administrative county of Dun Laoghaire Rathdown other than those areas excluded in the First Schedule to the Air Pollution Act 1987 (Marketing, Sale and Distribution of Fuels) Regulations 1998 (S.I. No. 118 of 1998), and the administrative counties of Fingal and South Dublin. The excluded areas of Dún Laoghaire Rathdown under the air Pollution Act 1987 (Marketing, Sale and Distribution of Fuels) Regulations 1998 are as follows:

1. The District Electoral Division of Tibbradden; and
2. That parts of the District Electoral division of Glencullen situated west of an imaginary line drawn as follows:- Commencing at the junction of Slate Cabin Lane and Woodside Road, thence in a south-easterly direction and proceeding along Woodside Road and Ballyedmonduff Road to the county boundary at Glencullen Bridge

The Environmental Noise Regulations prescribe two methods that can be used for the assessment of sound emissions from road sources. These are CRTN and the ‘Interim Method’ as described in the END. As with the previous two rounds it was decided to use CRTN, to ensure comparability of the outputs. The European common assessment method ‘CNOSSOS’ has been produced but it is not required to be used until 2018.

4.3 Approach to Definition of Mapping Extents

The Directive requires all agglomerations with a population of more than 100,000 inhabitants within their territories to be mapped. The Directive does not set out how an agglomeration is to be defined, rather that is left to the Member States to determine. The Regulations set out the following definitions for the agglomerations of Cork and Dublin:

- “agglomeration of Cork” means the restricted area of Cork as specified in the First Schedule to the Air Pollution Act 1987 (Marketing, Sale and Distribution of Fuels) Regulations 1998 (S.I. No. 118 of 1998); and
- “agglomeration of Dublin” means the county borough of Dublin, the administrative county of Dun Laoghaire Rathdown other than those areas excluded in the First Schedule to the Air Pollution Act 1987 (Marketing, Sale and Distribution of Fuels) Regulations 1998 (S.I. No. 118 of 1998), and the administrative counties of Fingal and South Dublin.

Note:

- The administrative county of Dun Laoghaire Rathdown was clarified to consist of the administrative area of Dun Laoghaire Rathdown other than those areas excluded in the First Schedule to the Air Pollution Act 1987 (Marketing, Sale and Distribution of Fuels) Regulations 1998 (S.I. No. 118 of 1998).
- These excluded areas are not included within the “agglomeration of Dublin” as defined in the Environmental Noise Regulations 2006.
- As part of Round 3, a decision was made to include the whole of Dún Laoghaire-Rathdown County Council. Subsequent discussion with the Department of Communications, Climate Action and Environment confirmed that the above definition of Dún Laoghaire-Rathdown County Council related to the Air Pollution Act 1987 and a decision was taken to include the entire county of Dún Laoghaire-Rathdown County Council in the definition of the Dublin agglomeration to be inserted into the Environmental Noise Regulations.

4.4 Maps and Statistics Describing Area to be mapped

The Dún Laoghaire-Rathdown County Council administrative area is located in the south east of Dublin. It is both urban and rural in nature and is bounded by the Irish Sea on the north and west with the Dublin Mountains located in the south of the County in the more rural part.

The area of the County is approximately 127km² and based on the 2016 Census data, the population of the County now stands at 217,274, an increase of 5.3% or 11,013 people from 2011 with population increases occurring across the County. The housing stock also rose during this period from 85,896 to 87,700. Figure 4.1 below outlines a map of the Dún Laoghaire-Rathdown County Council administrative area.



Figure 4.1: Dún Laoghaire-Rathdown County Council Administrative Area Map

Approximately 460 km of road was inputted into the models with 49% being designated as Major Roads i.e. carrying more than 8,220 vehicles per 24 hours. The area to be modelled was slightly larger than the area to be mapped as a two kilometre buffer outside the agglomeration boundary was included in the model in order to take into consideration the influence of traffic outside of the area to be mapped.

4.5 Approach to Definition of Model Extents including buffer

The EPA Guidelines for Strategic Noise Mapping state that the strategic noise mapping of agglomerations should provide an assessment of the noise levels from all relevant sources within the agglomeration, for all locations within the agglomeration.

For locations near to the boundaries of the agglomeration, there will most likely be noise sources outside the agglomeration which will have an influence on noise level assessment within the agglomeration. Some roads, railways, industrial sites and aircraft movements located outside the boundary of an agglomeration, may contribute significantly to noise levels within the agglomeration. Such sources must be included for consideration within the modelled area when noise mapping an agglomeration.

It is recommended that the buffer around the agglomerations should be 2 km wide, as this will ensure that all relevant noise sources are captured in all cases, and fits with the precautionary principle of environmental assessment.

A buffer region of 2km around the Dún Laoghaire-Rathdown County Council administrative area was therefore included in the model extents. This buffer region included areas in the neighbouring local authorities of Dublin City, South Dublin and Wicklow County Council is outlined in Figure 4.2 below.

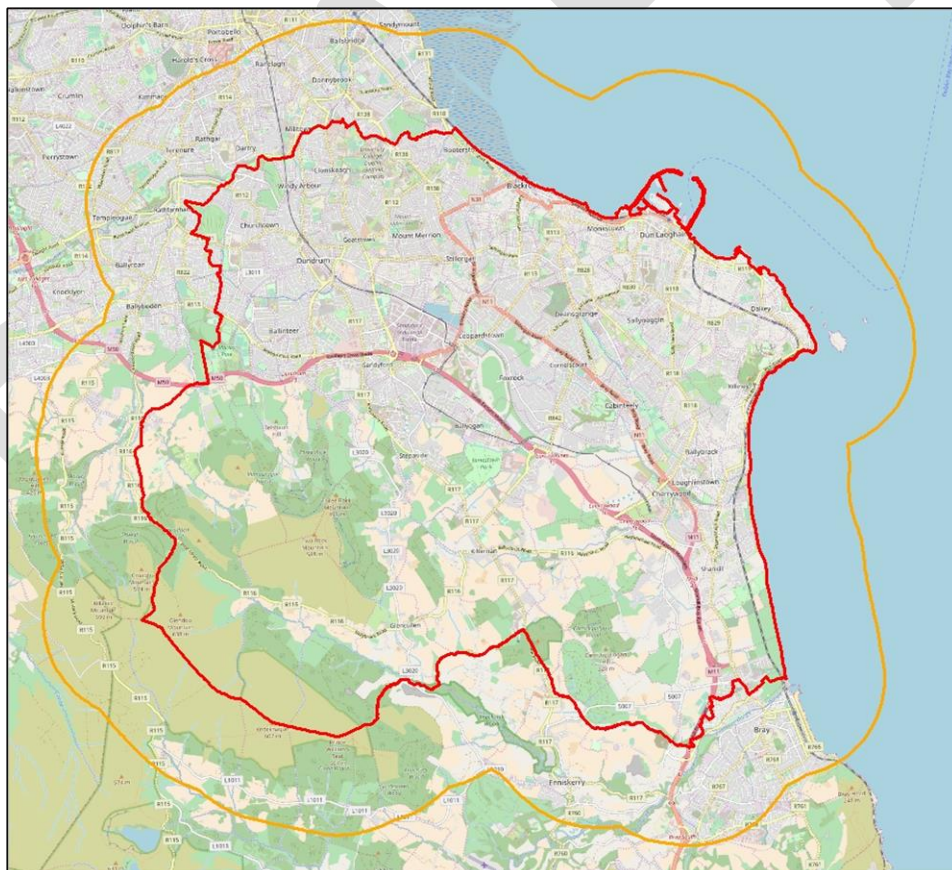


Figure 4.2: Dún Laoghaire-Rathdown County Council 2km buffer

5. Define Noise Calculation method

5.1 Requirements of Directive

The Environmental Noise Directive allows 'National Methods' to be used in the place of the prescribed 'Interim Method'. Although Calculation of Road Traffic Noise (CRTN) is not 'officially' a national method it is the most common method used in Ireland for the assessment of noise from road sources and is considered a 'de facto' national method. It was also used in the last two rounds of noise mapping.

5.2 Requirements of Regulations

The second schedule of the Regulations sets out the recommended interim computation methods which may be used for the assessment of noise. The methods are referred to as Interim methods as they are to be used until such time as a common method of assessment is adopted.

The Directive also provides for Member States to use either the EC Recommended Interim Methods or methods based upon those laid down in their own legislation. As it is common practise for environmental impact assessments to be undertaken in Ireland for roads and railways using the UK national calculation methods, the second schedule of the Regulations also sets out the UK methods CRTN and CRN. The Directive calls for the assessment to be undertaken using common noise indicators of L_{den} and L_{night} .

As with the previous rounds it was decided to use CRTN as no common assessment method for Europe has as yet been produced.

5.3 Factors influencing selection of assessment method

In the interest of consistency with the Round 1 and Round 2 Noise mapping, it was decided to use the adapted version of the UK CRTN methodology for the assessment of road traffic sound levels. This is one of the designated methods under the Environmental Noise Regulations.

Within this assessment procedure, Method 3 was used in the Dún Laoghaire-Rathdown County Council region, for conversion of 18Hr traffic volumes to L_{den} and L_{night} , as complete datasets in relation to hourly traffic volumes on the roads within the Dún Laoghaire-Rathdown County Council region were not available.

6. Develop Dataset Specification and Requirements

In general, the calculation of sound levels takes place in two stages within the 'noise Mapping' software:

1. The assessment of the level of sound emitted from a source, the "source noise emission; and
2. The assessment of the attenuation of the emitted sound en-route from the point of emission to the receptor, the "propagation attenuation".

After the assessment of sound levels across the area of the strategic noise mapping is performed, it is then necessary to undertake statistical analysis to determine the area, dwelling and population exposure data required to be reported to the EC. Following this concept, the input dataset required can be classified into:-

- Source input data which defines the position and characteristics of the noise sources;
- 3D model pathway input data which defines the environment within which propagation occurs;
- Population input data which defines the location of the population exposed to the long term environmental noise sources.

A specification is based upon the various features contained within a noise model, and based on the object definitions required by the noise calculation software. Outlined in the following paragraphs are the specifications used for the CRTN module of the Predictor \Lima software suite.

6.1 Input Data Requirements

6.1.1 Conceptual Model

The first stage is to establish a conceptual model which can be used to guide the development of subsequent stages in the development of a dataset for strategic noise-mapping. The data requirements of strategic noise mapping are expansive, and in order to make them more manageable it is useful to break the data requirements into the following categories:

- 3D model pathway input data:
 - data required for the common 3D pathway model;

- may be used by all models regardless of the source of the noise; and
- required for major source models, and agglomeration models;
- Road source input data;
- Population exposure input data:
 - required to analyse the noise exposure from the results of the strategic noise mapping;
- Noise model output data; and
- Contextual data – necessary to display noise mapping within context.

At this stage an initial conceptual model was proposed for road noise calculations. This was done to illustrate to extent of input dataset requirements, and to present an overview of the range and types of data required for noise modelling.

6.1.2 Input Data Requirements for CRTN – Road Source Noise Model

The information required for the source emission model for road traffic is specific to each method of assessment. The information is required for each road section for an assessment using the adapted UK CRTN method. The CRTN inputs are listed below for roads:

- Road centreline Geometry, along with data for:
 - Traffic volume and %HGVs;
 - Average vehicle speeds;
 - Direction of vehicle flow;
 - Road width – expressed in metres between carriageway edges;
 - Road surface type and texture depth;
 - Road gradient;
 - Road classification; Major or non-major road designation based on annual AADT traffic and a 3 million vehicle movement threshold;
 - Motorway or non-motorway.

6.1.3 Physical Model

The elements which make up the 3D model environment included:

- Digital ground model, consisting of:-
 - Equal height contour lines;
 - Buildings:- Polygon objects describing all building footprints within the model;
 - Ground cover: -Polygon objects defining areas of acoustically absorbent or reflective ground cover;

- Barriers: - Polyline objects defining barriers such as walls or fences considered to have potential noise attenuating effects.

The Directive requires information on the total number of dwellings exposed to noise from major roads. It also requires information on the estimated number of people living in dwellings that are exposed to noise for the various scenarios mapped. The type of information used was:-

- GeoDirectory 'Buildings' table; 'Address Point' Table.
- CSO census data – Population of each small area - Small Area Population Statistics (SAPS)

6.2 Data specification for noise mapping – Database Design

At the completion of the strategic noise mapping a series of noise level results sets along with statistical results from the area, dwelling and population exposure analysis are available. The noise calculation results are capable of being submitted to the EPA in the format required for forwarding onto the European Environment Agency.

7. Produce Datasets

The Environmental directive requires that data should not be more than 3 years old. All data sets used in the model were less than a year old. The following sections outline the key datasets identified and utilised as part of the modelling process.

7.1 Identify Data Sources

7.1.1 Road Source Noise Model

The information required for the source emission model for road traffic relates to the vehicles using the section of road, and their interaction with the road surface.

- **Road Centre Lines**

Road centrelines were taken from a shapefile for the Dún Laoghaire-Rathdown County Council road network as extracted from MapRoad Pavement Management System. The projection is in ITM and the geometry is derived from the OSI Prime 2 dataset for road centrelines.

- **Road Traffic Statistics**

At project inception it was identified that road traffic statistics (i.e. flows composition and speeds were not readily available for all roads through the Dún Laoghaire-Rathdown County Council administrative area. It was however identified that a valuable data-source in the form of vehicle counts from the loop detectors on the SCATS traffic signals system in operation throughout the county were available for the majority of roads. Data from the SCATS loop detectors was therefore used for the majority of roads throughout the county. The percentage of heavy goods (HGV) vehicles was estimated for those roads that did not have manual HGV counts. This estimation was based on comparing roads with similar profiles which had the information required.

- **TII TMU Data**

For National Routes in the Dún Laoghaire-Rathdown County Council administrative area traffic volume statistics were extracted from Transport Infrastructure Irelands Traffic Monitoring Unit Database, available at the following link: <https://www.nratrafficdata.ie/>

- Default Traffic

In a number of instances there were roads within the Dun Laoghaire Rathdown County Council Area where SCATS traffic signals, were not in place. It was therefore necessary to assign default flow values in such instances. The default flows were estimated based on roads of similar characteristics for which known values were available. This solution is in accordance with guidance on implementing the END in WG-AEN GPG v2.

- Road Gradients

Road gradients are required to be defined by CTRN as a percentage slope and are used to adjust emission levels to reflect the additional traction of a vehicle's engine during the climb. For the Round 2 mapping exercise it was identified that Dún Laoghaire-Rathdown County Council did not hold data relating specifically to road gradients. This data was also not available for the Round 3 mapping exercise and a decision was taken to use the "Gradient from geometry" option available with the Predictor modelling software. In using this option the gradient for each road polyline is determined automatically by Predictor based on the length of the polyline and the start and end height.

- Road Surface Type

Road surface type along with road texture depth is used by CTRN to model any noise emission enhancements generated by the interaction of a vehicle's tyres with certain road surfaces. Road surface type data was not readily available for all roads in the modelled area in for the Round 2 exercise and a decision was taken to model all road surfaces as bituminous surfaces. This assumption has been retained for the Round 3 exercise.

- Road Texture Depth

Road surface texture depth is required by CTRN and influences the various emissions enhancements generated within the various modelled road surfaces. Texture depth only influences these enhancements where traffic speeds are modelled as greater than or equal to 75 km/hr. Road surface texture depth was not readily available for all roads in the modelled area in for the Round 2 exercise and a decision was taken to model all road surface texture depths as 2mm. This assumption has been retained for the Round 3 exercise.

- Carriageway Width

The CRTN methodology sets the emission line at 3.5m inset from the nearside carriageway edge, which equates to the centreline in a standard 7.0m wide single carriageway two-way road. The road width data was taken from the Dún Laoghaire-Rathdown County Council Road Schedule which was available for the majority of the county.

7.1.2 Physical Model

The information required for the physical model comprised:

- **Contours**
Highly detailed OSI LiDAR data was available for use in the strategic noise mapping process. This data was simplified in order to reduce its size and model computation time. The simplification process involved:
 - Removing all contour lines less than 25.0m in length; and
 - Using the ESRI ArcGIS Simplify Line tool with the following options to simplify bend and remove topographical errors.

- **Barriers**
Identification of major barriers was carried out via field surveys and using Google Street View.

- **Ground Cover**
CORINE 2012 (Co-ORdinated INformation on the Environment) land cover data series was utilised. A Ground Absorption Factor was assigned to the various CORINE land descriptions.

- **Buildings**
GeoDirectory data products are developed by OSi and An Post to provide a single point location object for each building in Ireland. GeoDirectory is updated quarterly, for the purpose of the R3 strategic noise mapping it was recommended to use the Q1 2016 version following advice from CSO, who used this version when developing the SAPS data for Census 2016. This dataset was then filtered to remove building objects with an area of less than 25.0m² as a means of reducing the dataset. This approach is common with many other strategic mapping projects.

7.2 Identify gaps, anomalies and uncertainties

As there is no synchronisation of release dates between the availability of the different data sets, it was found that while there was information on new address points and buildings the actual representation of these buildings as polygons on a map were not

available in some areas where major residential developments had taken place. In some cases there was also limited information on the volume and type of traffic on some roads – mainly non-national or non-regional roads.

7.3 Field survey work to reduce data gaps

Where there were information gaps in relation to traffic volumes, default values were used depending on the profile of the road. Building height information was supplemented by using Google Street view to estimate building heights. Identification of major barriers was carried out via field surveys and using Google Street View.

8. Develop Noise Model Datasets

Noise model data sets were produced for the various elements of the model as outlined in Figure 1.1. There was limited manipulation of the data sets required as importing data from ESRI 'Shp' files is automated by the software model. All the GIS data was provided under licence by the OSI.

No direct use of procedures in the WG-AEN GPG v2 were used except for the use of profiling roads to assign traffic volumes. A visual inspection was carried out to ensure that all the layers in the model overlaid correctly with each other.

9. Noise Level Calculations

9.1 Documentation of noise mapping software system

The Predictor\Lima software suite was used in the processing of the noise maps. The most recent version – 11.20 was used. This conformed, as far as is known, to the CRTN computation procedures mentioned in paragraph 5.3.

9.1.1 Use of Calculation Settings/Efficiencies Settings

The default settings were used for computation, except for the setting of the fetching radius, which was set to 2000m. The grid spacing's were set to 10m spacing's. The models were subdivided automatically (tiled) into 1km² grids with 1km² buffers to improve calculation efficiency. For the area near the boundaries of each local authority, a buffer region of 2km was used. These smaller models were then recombined automatically on export into the GIS environment. Figure 9.1 below outlines the calculation settings used in the Predictor modelling software.

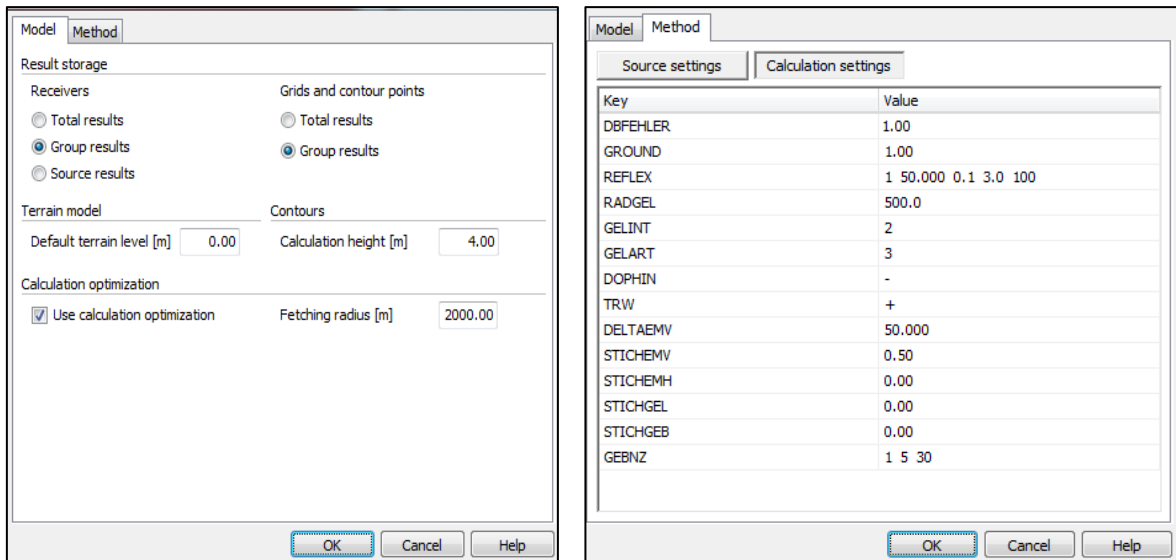


Figure 9.1 Predictor Calculation Settings

10. Noise Level Calculations

10.1 Post processing of noise level results

There was limited interpolation or manipulation of results required when producing the population exposure statistics. The inverse distance weighting method was used (IDW) when developing the sound contours from the grid results within the GIS environment. However the minimum interpolation allowable by the software was used.

10.2 Area exposure assessment

The area analysis was in line with the revised draft guidance provided by the EPA on Strategic Noise Mapping.

10.3 Dwellings exposure assessment

The dwelling exposure analysis was carried out in line with the revised draft guidance provided by the EPA on Strategic Noise Mapping.

10.4 Population exposure assessment

The dwelling exposure analysis was carried out in line with the revised draft guidance provided by the EPA on Strategic Noise Mapping.

11. Results of Calculations

Tables 11.1 to 11.5 outline out the population and dwelling exposures and area exposures to sound from traffic sources for both "All Roads" and "Major Roads" in the Dún Laoghaire-Rathdown County Council administrative Area. Figures 1- 4 are colour coded 'Noise Maps' indicating the various sound bands throughout the area.

For the purpose of the Noise Action Plan for the Agglomeration of Dublin, which is to be revised in 2018, targets are set out as to what sound emissions are desirable and undesirable. It indicates that a night time level greater than 55 decibels and a daytime level greater than 70 decibels is undesirable.

It identifies areas with desirable low sound levels as those areas with a with a night time level less than 50 decibels and/or a daytime level less than 55 decibels.

As can be seen from Table 10.1 approximately 63% of the population are exposed to sound levels from traffic sources below an L_{den} level of 55dB(A). Approximately 72% of the population are being exposed to night time levels below 50dB(A). Approximately 15% of the population are being exposed to undesirable night time sound levels of greater than 55dB(A) and approximately 3% are being exposed to an L_{den} sound levels above 70dB(A).

Rounding up or down to the nearest '100' of population in each decibel band, causes an over or under estimation of the total true population. However this 'rounding' is a requirement of the END and the 'error' is not considered significant.

Table 11.1 All Roads Population and Dwelling Exposure – L_{den}

24Hr L _{den} dB (A)	No. of People	%	No. of Dwellings	%
<55	137,600	63%	54,200	62%
55 to 59	33,300	15%	13,300	15%
60 to 64	22,500	10%	9,500	11%
65 to 69	19,200	9%	8,300	9%
70 to 74	4,300	2%	1,900	2%
75	1,100	1%	500	1%
Total	218,000	100%	87,700	100%

Table 11.2 All Roads Area Exposure – L_{den}

24Hr L _{den} dB (A)	Area in km ²
<55	83
55 to 59	19
60 to 64	12
65 to 69	7
70 to 74	4
75	2

Table 11.3 Major Roads Population and Dwelling Exposure – L_{den}

24Hr L _{den} dB (A)	No. of People	%	No. of Dwellings	%
<55	144,300	66%	57,100	65%
55 to 59	31,600	14%	12,600	14%
60 to 64	19,200	9%	8,100	9%
65 to 69	17,800	8%	7,700	9%
70 to 74	4,200	2%	1,900	2%
75	900	0%	300	0%
Total	218,000	100%	87,700	100%

Table 11.4 Major Roads Area Exposure – L_{den}

24Hr L _{den} dB (A)	Area in km ²
<55	87
55 to 59	18
60 to 64	11
65 to 69	6
70 to 74	3
75	2

Table 11.5 All Roads & Major Roads Population Exposure– L_{night}

L _{night} dB (A)	All Roads	%	Major Roads	%
	No. of People		No. of People	
<50	157,800	72%	163,100	75%
50 to 54	28,400	13%	25,300	12%
55 to 59	23,700	11%	21,700	10%
60 to 64	5,700	3%	5,600	3%
65 to 69	2,100	1%	2,000	1%
70	300	0%	300	0%
Total	218,000	100%	218,000	100%

12. Summary and Conclusions

The data on noise maps is required to be forwarded the EPA and subsequently to the European Commission. The Noise Maps' show colour coded areas in the Dún Laoghaire-Rathdown County Council administrative area based on sound levels, in 5 bands, incrementing in 5 decibels. The official night time band starts at 50 decibels and the Daytime band starts at 55 decibels. The EU Directive does not give an indication as to what level of sound is acceptable. This is left to each member state. At this point in time, Ireland does not have any statutory limit values, as is the case for air pollution.

For the purpose of the Noise Action Plan for the Agglomeration of Dublin, which is to be revised in 2018, targets are set out as to what sound emissions are desirable and undesirable. It indicates that a night time (L_{night}) level greater than 55 decibels and a day-evening-night (L_{den}) level greater than 70 decibels is undesirable. It identifies areas with desirable low sound levels as those area with a night time level less than 50 decibels and/or a daytime level less than 55 decibels.

There are two categories of sound sources to be mapped - 'All Roads' and 'Major Roads'. Dún Laoghaire-Rathdown County Council is a designated body for producing 'noise maps' for these sources. The production of maps for 'Rail' source sound emissions falls to 'Irish Rail' and the TII - being the designated noise mapping bodies for these sources. The Irish Rail maps have been revised along with the population exposure statistics which will be amended to take into account the change in population identified by the 2016 Census. No maps were produced for Industrial point sources as this category has been found to have no strategic impact on overall sound levels within the Dún Laoghaire-Rathdown County Council administrative area.

Full details of population exposure to sound from traffic sources are given in Table 11.1 to 11.5 and the maps included in Appendix C. These maps and statistics will guide the revision of the Dublin Agglomeration Noise Action Plan.

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Appendices

Appendix A: Glossary of acoustic and technical terms

Agglomeration: 'Agglomeration' shall mean part of a territory, delimited by the Member State, having a population in excess of 100,000 persons and a population density such that the Member State considers it to be an urbanised area.

Agglomeration of Dublin: 'Agglomeration of Dublin' means the county borough of Dublin, the administrative county of Dun Laoghaire/Rathdown other than those areas excluded in the First Schedule to the Air Pollution Act 1987 (Marketing, Sale and Distribution of Fuels) Regulations 1998 (S.I. No. 118 of 1998), and the administrative counties of Fingal and South Dublin;

Environmental Noise: Shall mean unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity such as integrated pollution prevention and control licensed industries. Noise is sometimes defined as unwanted sound.

Decibel dB(A) : A unit of measurement of sound.

L_{den}: (day-evening-night noise indicator) shall mean the noise indicator for overall annoyance. This comprises of adding the average value for the 12 hour daytime period with the average value of the 4 hour evening period plus a 5 decibel weighting or penalty, and the average value for the 8 hour night time period with a 10 decibel weighting or penalty. L_{den} is calculated as follows:

$$L_{den} = 10 * \log_{10} \left\{ \frac{1}{24} \left[12 * 10^{(L_{day})/10} + 4 * 10^{(L_{evening}+5)/10} + 8 * 10^{(L_{night}+10)/10} \right] \right\}$$

Daytime: Between the hours of 7am and 7pm

L_{day}: (day-noise indicator) shall mean the noise indicator for annoyance during the day period. This is the average value in decibels for the daytime period

Evening time: Between the hours of 7pm and 11pm

L_{evening}: (evening-noise indicator) shall mean the noise indicator for annoyance during the evening period. This is the average value in decibels for the evening time period.

Night time: Between the hours of 11pm and 7am

L_{night}: (night-time noise indicator) shall mean the noise indicator for sleep disturbance. This is the average value in decibels for the night-time period

'Major intensification': An Action(s) that are likely to lead to exceeding of any statutory sound limit, or national guide value or standard, or an action(s) that leads to an increase in sound levels above the undesirable sound levels' or likely to increase the pre-existing annual L_{den} by more than 5dB.

Noise Indicator: Method used to measure or quantify sound, in decibels, in order to equate it with what might be perceived as noise.

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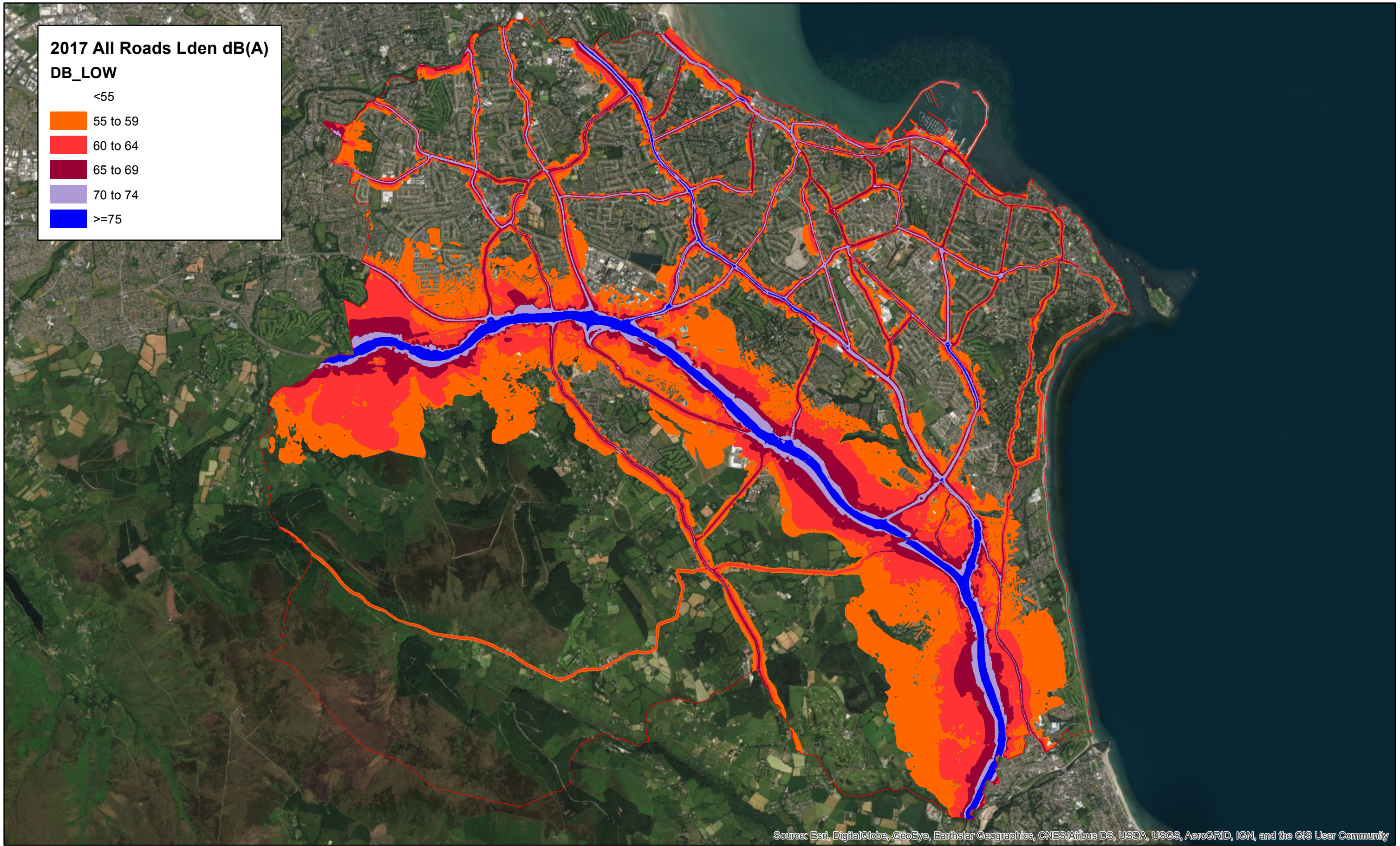
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Appendix C: Strategic noise map(s)

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

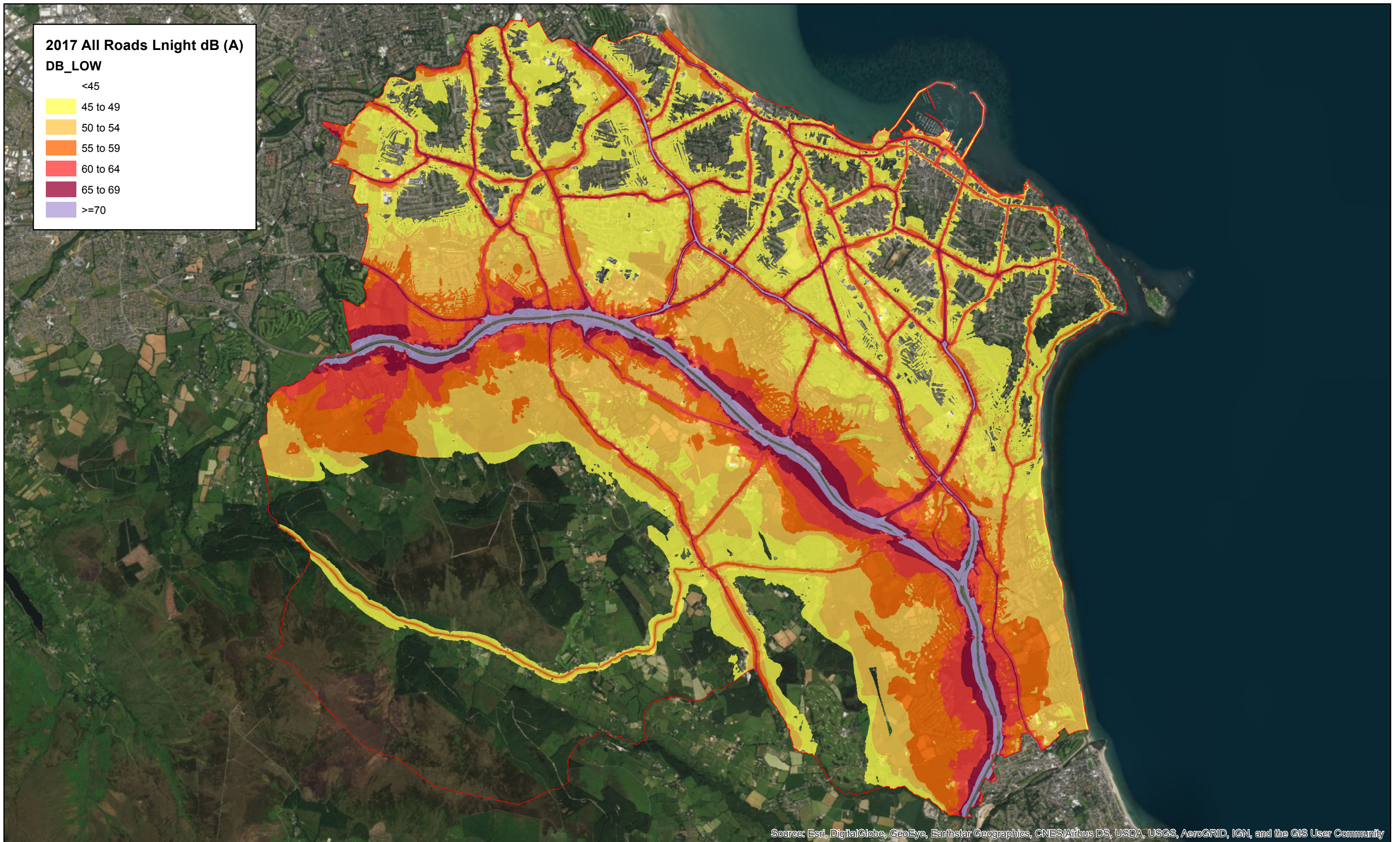
Project: Strategic Noise Mapping 2017. Produced by the Traffic & Road Safety Section Dun Laoghaire Rathdown County Council.

TRAFFIC SECTION
MUNICIPAL SERVICES
1 HARBOUR SQUARE
CROFTON ROAD
DUN LAOGHAIRE
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This strategic noise map presents a graphical representation of weighted predicted annual average road traffic sound levels in Dun Laoghaire Rathdown County Council. The map has been developed in accordance with S.I. No. 140/2006 (the Environmental Noise Regulations) and is a representation of the average environmental sound levels over one complete year. This map forms part of a national noise mapping strategy which can be primarily used as a strategic tool for large scale planning or policy matters and not suitable for local noise assessments.

TITLE:
Lden dB(A) Dun Laoghaire Rathdown Council – All Roads





2017 All Roads Lnight dB (A)

- DB_LOW**
- <45
 - 45 to 49
 - 50 to 54
 - 55 to 59
 - 60 to 64
 - 65 to 69
 - >=70

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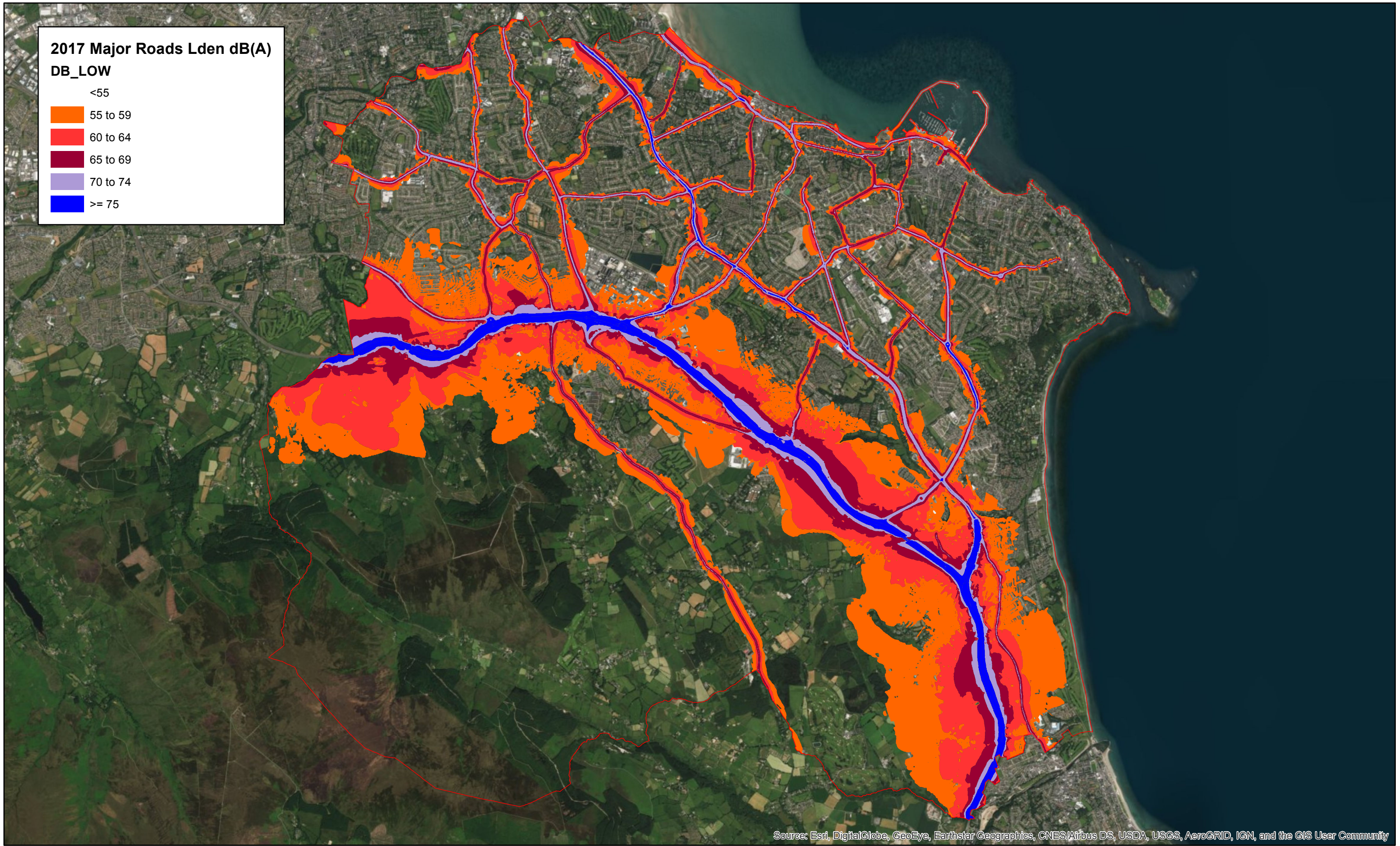
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TITLE:

Lnight dB(A) Dun Laoghaire Rathdown Council – All Roads





2017 Major Roads Lden dB(A)

DB_LOW

- <55
- 55 to 59
- 60 to 64
- 65 to 69
- 70 to 74
- >= 75

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

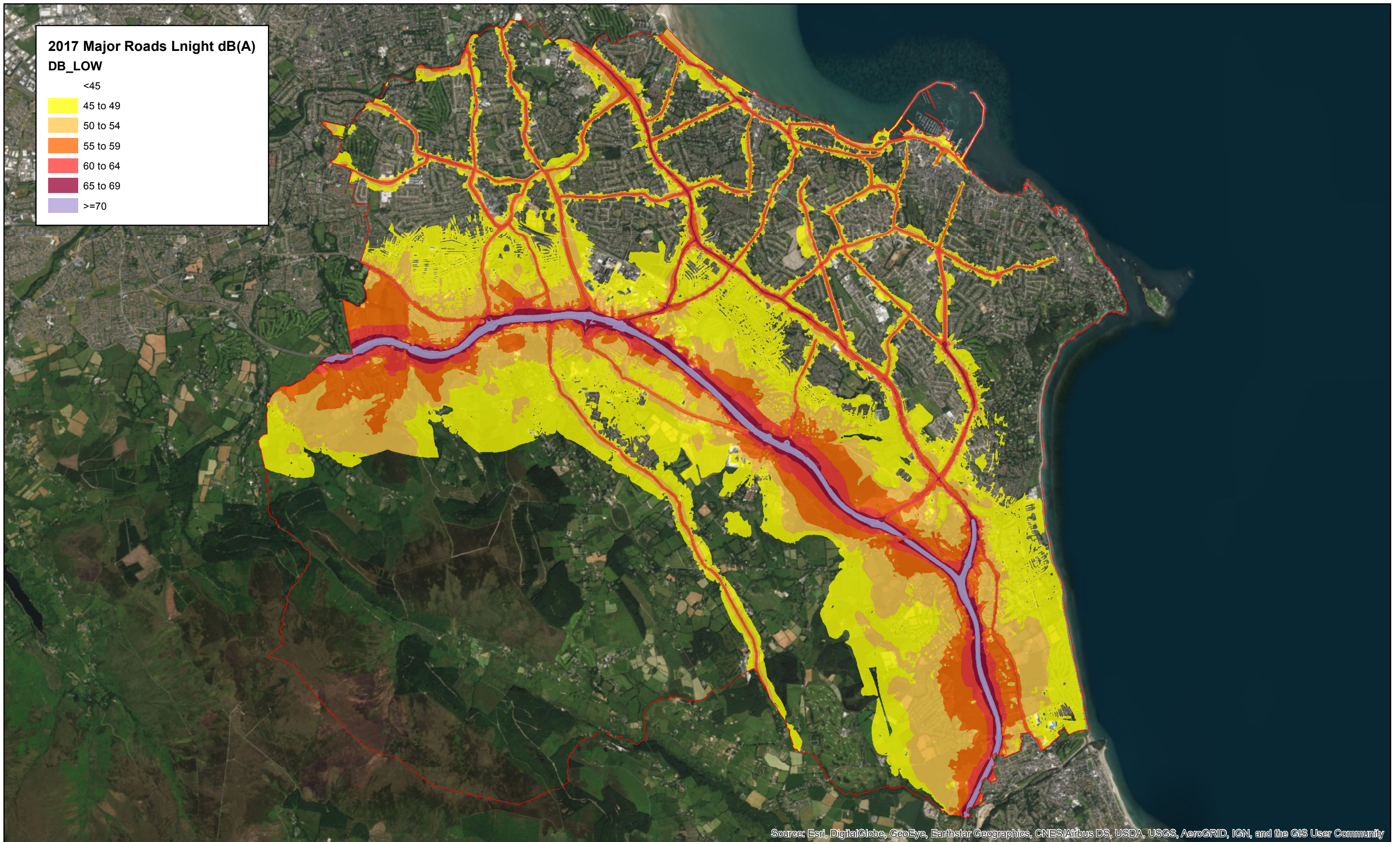
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TITLE:
Lden dB(A) Dun Laoghaire Rathdown Council – Major Roads





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Lnight dB(A) Dun Laoghaire Rathdown Council – Major Roads

