

Quantifying Noise Impact of Dublin Airport's North Runway Departure Routes: An EIA-Conformance Gap Analysis

Technical Annex

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This annex accompanies the report *Quantifying Noise Impact of Dublin Airport's North Runway Departure Routes: An EIA-Conformance Gap Analysis* (same Zenodo record and DOI: 10.5281/zenodo.19567671). It contains the full methodology derivations (centreline construction, corridor widening profile, turn geometry, cutoff), the ADS-B validation (four named reference flights on 25 March 2026 plus the wider 24-hour Cat C+D sample), the daa-published-NPR versus NRTG-constructed-corridor comparison, the affected-corridor noise-footprint justification, the design-choice-within-the-EIS-envelope analysis, and the worked best-case 8 NM population-avoidance example. The report is self-sufficient for citation of the population-exposure figures; this annex provides the supporting record for any reader requiring full methodological defence.

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1 Front matter

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Data availability: All analysis inputs and the QGIS project that produces every figure are deposited in the same Zenodo record as the report (DOI: 10.5281/zenodo.19567671). See [Report §6] for full reproducibility detail.

2 Introduction

2.1 A note on terminology (EIA, EIS, EIAR)

The EIA/EIS/EIAR terminology convention used throughout this annex is as set out in [Report §1.1]: “EIS” refers to the 2004/2005 Environmental Impact Statement for the North Runway and the straight-ahead departure routing assessed in it; “EIA-Conformance” in the title refers to conformance with the EIA (the statutory procedure and the 2004/2005 assessment produced under it).

2.2 Relationship to the report

This annex is the methodological and analytical record underlying the findings stated in the report. It presumes the reader has read the report; terminology is restated for self-containment but interpretation is not duplicated. The report’s findings (~30,186 residents, 8,761 buildings, newly affected by Routes Flown vs EIS-consistent alternatives; zero overlap, at the canonical 1.5 km half-width, between the Routes Flown overflowed corridor and the 28L Actual baseline; ~13,923 residents, 4,008 buildings, newly directly overflowed) are derived in §§3-5 of this annex.

Cross-references from the report take the form [Annex §N]; cross-references from this annex back to the report take the form [Report §N].

2.3 Scope

This annex does not present the population-exposure figures afresh; those are in [Report §3]. It does not repeat the discussion of statutory-framework implications or EIA consequences; those are in [Report §4]. It covers, in order: the full methodology, the affected-corridor noise-footprint justification, the design-choice-within-the-EIS-envelope analysis, what a population-avoidance design would produce, and the redistribution objection with worked best-case.

3 Defined terms

The canonical defined terms (“EIS Route”, “2016 Consulted Routes”, “Routes Flown”, “IFP/SID”, “NPR”) are set out in [Report §2.1]. This annex uses them throughout without restatement.

Mapping to the scenarios modelled in this annex. Section 3.5 defines four operational scenarios. Their relationship to the canonical terms:

- **“Routes Flown”** is the canonical term. Data-file layer names use the compound form 28R Routes Flown (e.g. 28R Routes Flown overflown, 28R Routes Flown affected, 28R Routes Flown newly overflown). The centreline geometry is constructed from the published waypoints (DW128 fly-by, DW129 fly-by, DW991 fly-over) and validated against ADS-B tracks captured on 25 March 2026.
- **“EIS Route”** is the straight-ahead departure assessed in the 2004/2005 EIS. This annex compares the Routes Flown against two NRTG-constructed EIS-consistent alternatives derived from the EIS Route: 28R Strict 5NM (a 5 NM straight segment before any turn, mirroring the legacy 28L SID convention) and 28R Designed (the same with a 1.5 NM extension past Dunboyne, by analogy with the 10R departure’s existing population-avoidance design; see §3.5). Neither is a defined term in the canonical table; both are EIS-consistent in the sense that they retain the straight-ahead initial departure that the EIS assessed.
- **“28L Actual”** refers to operations from the legacy south runway, used as the existing exposure baseline against which “newly overflown” and “newly affected” are measured.

4 Methodology detail

4.1 Route centreline construction

Centrelines were constructed for ten route variants: four EIS-consistent alternatives from 28R, three Routes Flown variants from 28R, and three from 28L (straight, northbound 5NM turn, southbound 5NM turn) that form the existing exposure baseline.

Waypoint coordinates were manually digitised from the SID coding tables in the IAA AIP AD 2 EIDW chart (AD 2.24-13) and held in `sid-study.gpkg` (Irish Transverse Mercator, EPSG:2157). As a cross-check the same tables were subsequently parsed programmatically from the AIP PDF; the three waypoints used in corridor construction (DW128, DW129, DW991) agree with the parsed coordinates to within 0.2 m. Runway centrelines were digitised as physical pavement ends; the published landing thresholds on the aerodrome chart (AD 2.24-1) are displaced inboard of the pavement and are not used here, since the relevant reference for departure modelling is the Departure End of Runway.

Turn radii derive from the ICAO 15-degree bank angle assumption for procedure design (PANS-OPS Doc 8168 Vol II, Part I, §2.3.3) at the relevant airspeed, per $R = V^2 / (g \cdot \tan \theta)$:

- $R = 6,292\text{m}$ (3.40 NM) at 250kt: EIS-consistent alternatives and the DW991 turn on the Routes Flown. 250kt is the standard below-FL100 airspeed limit.
- $R = 4,439\text{m}$ (2.40 NM) at 210kt: DW128 and DW129 fly-by turns on the Routes Flown, consistent with the 210kt speed limit published on that SID.

Waypoint types follow the published SID: - DW128 (fly-by): aircraft anticipates the turn; arc is tangent to both inbound and outbound legs, beginning before the waypoint - DW129 (fly-by): same treatment - DW991 (fly-over): aircraft overflies the waypoint, then initiates the turn; arc begins at the waypoint

At 210kt on the Routes Flown, the tangent lengths of the DW128 (2,402m) and DW129 (4,399m) fly-by arcs sum to 6,801m, almost exactly filling the 6,792m DW128-DW129 leg. Little to no straight segment exists between the two turns: the aircraft banks continuously from the DW128 anticipation point through DW129. This is confirmed against ADS-B tracks for all departures on 25 March 2026 (a representative 24-hour sample), including the reference flight BAW831 (A320neo to LHR) used in the single-event noise modelling at §4.

4.2 Corridor widening profile

The “overflown” corridor used throughout this annex has a steady-state half-width of 1,490m (≈ 1.5 km each side of the centreline). This value is anchored in the UK Department for Transport definition of the Noise Preferential Route track-keeping swathe at the three UK designated airports (Gatwick, Heathrow, Stansted): DfT Impact Assessment DfT00393 (2017), p.3, states: “in 1991 it was decided to add a 1.5km swathe to each side of the line to help with assessing track keeping performance. They were intended to provide communities with information and assurance on where overflight aircraft can be expected to be seen or heard.” daa has adopted approximately the same steady-state width at Dublin, though the corridor daa publishes diverges from a mathematically-clean construction around the published SID in ways discussed below.

The half-width is not constant near DER. It transitions from an initial half-width of 415m at DER, measured from the georeferenced daa-published corridor (`northrunwaynpr_modified` raster), to the steady-state 1,490m over the first 2.5km of downrange, and applies the steady-state width beyond that point. The transition is smoothed; the specific profile is documented in the reproducibility code and is immaterial to the population-exposure findings, since the near-DER region inside the initial-climb envelope is sparsely populated.

The corridor in this annex is a mathematically-clean construction around the published SID centreline. No compensation is applied for aerodynamic imprecision in the turn geometry at DER. The geometric comparison between the corridor used here and daa’s published boundary is shown below.

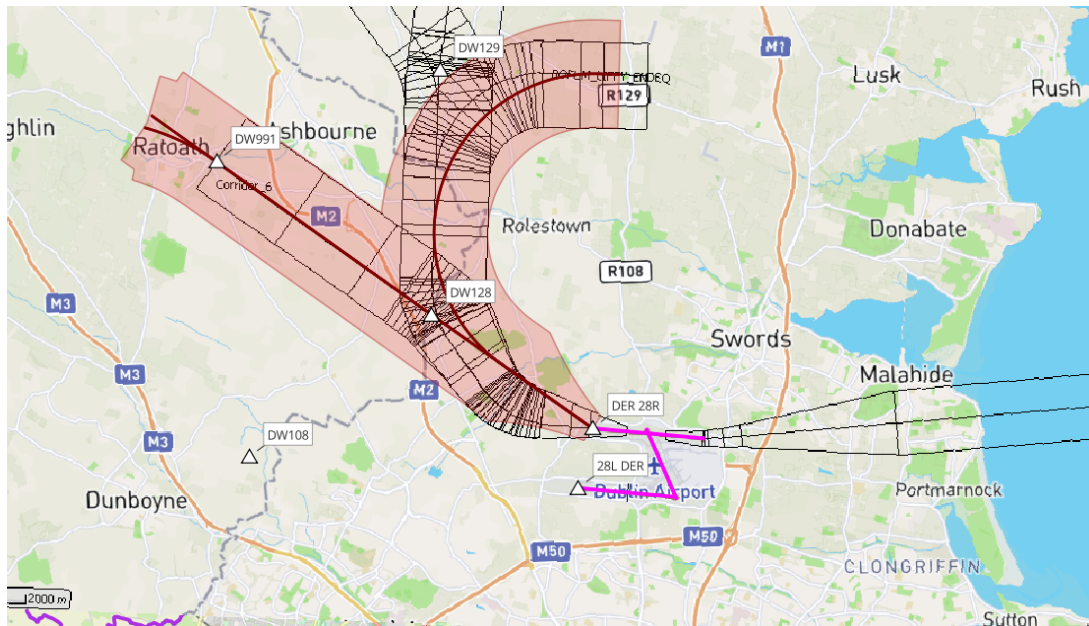


Figure 1: Direct overlay of daa's published "NPR" boundary (from the georeferenced northrunwaynpr_modified raster) and the NRTG SID-compliance corridor (the 28R Routes Flown overflow zone, constructed around the published SID centreline at the widening profile described above). The two corridors diverge: daa's is asymmetrically widened and offset to accommodate the aerodynamic tightness of the 30-degree DER turn, while the NRTG corridor tracks the published SID centreline directly.

daa's published corridor differs from the centreline-anchored construction. The 30-degree turn at DER on the Routes Flown is close to the edge of what can be executed precisely within commercial-aviation bank-angle and airspeed limits. daa's published "NPR" at Dublin is asymmetrically widened and offset relative to the published SID centreline. The geometric effect is that the corridor accommodates the aerodynamic difficulty of the 30-degree turn at DER. The practical consequence is that a subset of departures (those flown by FMSs that track the published SID most tightly) falls outside daa's own published track-keeping boundary and is recorded as non-compliant. A mathematically-clean corridor around the SID centreline, of the kind used in this annex, does not generate that finding.

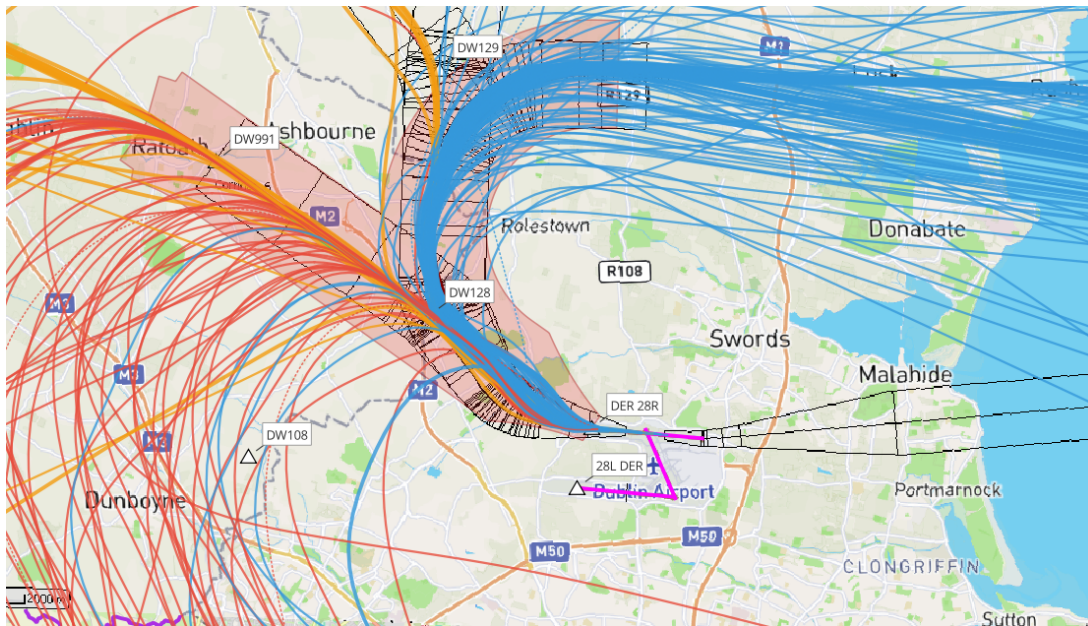


Figure 2: The same comparison as the previous figure, with 25 March 2026 ADS-B departure tracks overlaid. Tracks curve through the corridor in a dense band. Flights that fall outside daa’s boundary while remaining inside the NRTG corridor are visible as the “compliance” instances daa self-reports against its own drawn line; they are not track-keeping failures against the published SID.

The two corridors are not constructed by the same method. The report’s corridor is a mathematical construction around the published SID centreline. daa’s published corridor is asymmetrically widened and offset relative to that centreline. The report’s corridor is directly comparable to the UK DfT track-keeping metric used at Gatwick, Heathrow, and Stansted; daa’s is not. Much of the “non-compliance” that daa reports against its own boundary in the initial 2 km downrange is a consequence of how that boundary was drawn, not of where aircraft fly.

A second, wider corridor is used for the “affected” metric:

- **“Affected” corridor (3,000m each side at full width, $\approx 3\text{km}$):** The 3km half-width is an working choice, set at the approximate lateral extent of the 55 dBA single-event L_{max} contour of a departure overflight for the common Dublin departure fleet (B738, B38M, A320-family, A333) during initial climb, as produced by the NRTG single-event L_{max} noise model (see §4). The half-width is reported alongside the narrower 1.5 km overflown corridor so that a reader using a different threshold can recompute against the buildings/population tables.

The “affected” corridor uses the same transition approach scaled proportionally: an initial half-width of 835m at DER reaching the steady-state 3,000m at 2.5km downrange.

4.3 Cutoff

All routes are trimmed at 15km from DER, chosen to include the town of Ratoath as the furthest community under significant impact. An altitude-based cutoff (e.g. 6,000ft AAL) could be considered as future work: it would require reference departure profiles from comparable airports (e.g. LHR) to establish where aircraft typically reach that altitude when climbing straight ahead, wings level. Determination of a rationale for the cutoff altitude would be the first task in such follow-on study.

4.4 Turn geometry and ADS-B validation

Turn radii are conservative against interest for the EIS-consistent alternatives: at $R = 6,292\text{m}$ the corridor sweeps more gently and covers less ground than the actual aircraft would fly at a tighter radius. For the Routes Flown, the 210kt speed limit requires the tighter $R = 4,439\text{m}$, modelled accordingly. The EIS-consistent corridors are therefore plausibly larger than what would actually be flown, while the Routes Flown corridor matches the published operational constraints.

The modelled corridors were validated against real aircraft tracks captured via the FlightAware AeroAPI. Four reference flights on 25 March 2026 (EIN105 A333 to JFK, BAW831 A20N to LHR, RYS8564 B738 to AGP, RYR6875 B38M to BCN) cover the three Routes Flown variants from 28R (DW128 right fork, DW991 straight, DW991 left). All four fall within the modelled corridor, and the ADS-B positions of the fly-by and fly-over turns are consistent with the modelled waypoint treatments at 210kt and 250kt respectively.

As a wider cross-check, all Cat C+D departures on 25 March 2026 (a representative 24-hour sample) fall within the modelled Routes Flown corridor until vectored off by ATC. This is anecdotal confirmation that the modelled centreline matches the ground track of the published SID as flown, not a statistical validation. Cat A+B aircraft use different non-EIA-conforming SIDs; they are not counted in the building and population totals and are not part of this validation. See figures 13-14.

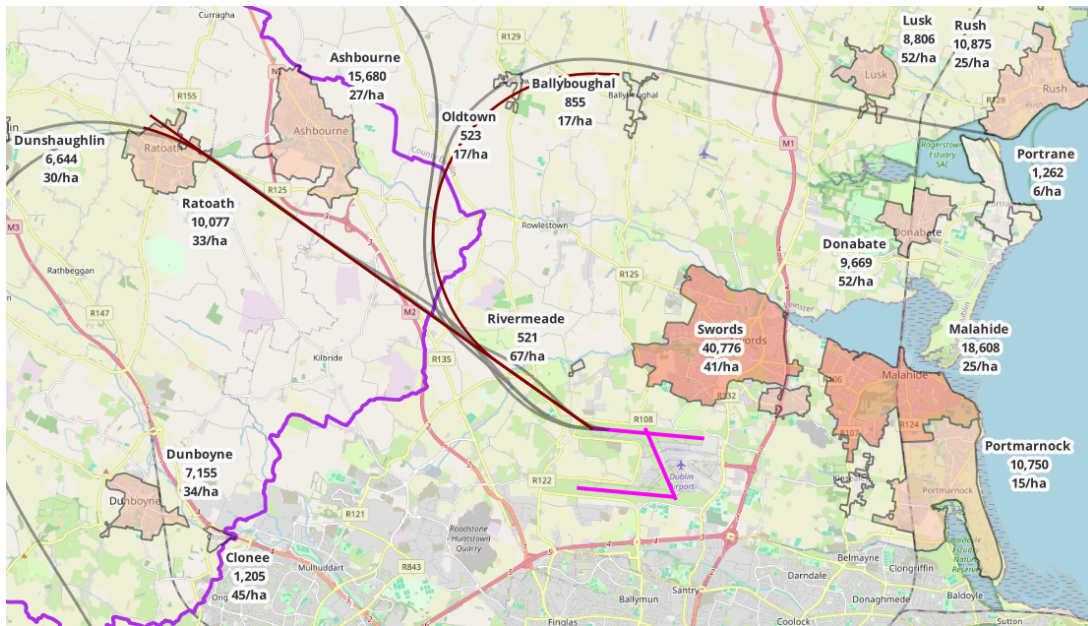


Figure 3: Four actual departure tracks (BAW831 A20N to LHR, EIN105 A333 to JFK, RYS8564 B738 to AGP, RYR6875 B38M to BCN) on 25 March 2026, overlaid on the modelled Routes Flown corridor. All four fall within the modelled corridor; the fly-by and fly-over turn geometry matches the ADS-B positions.

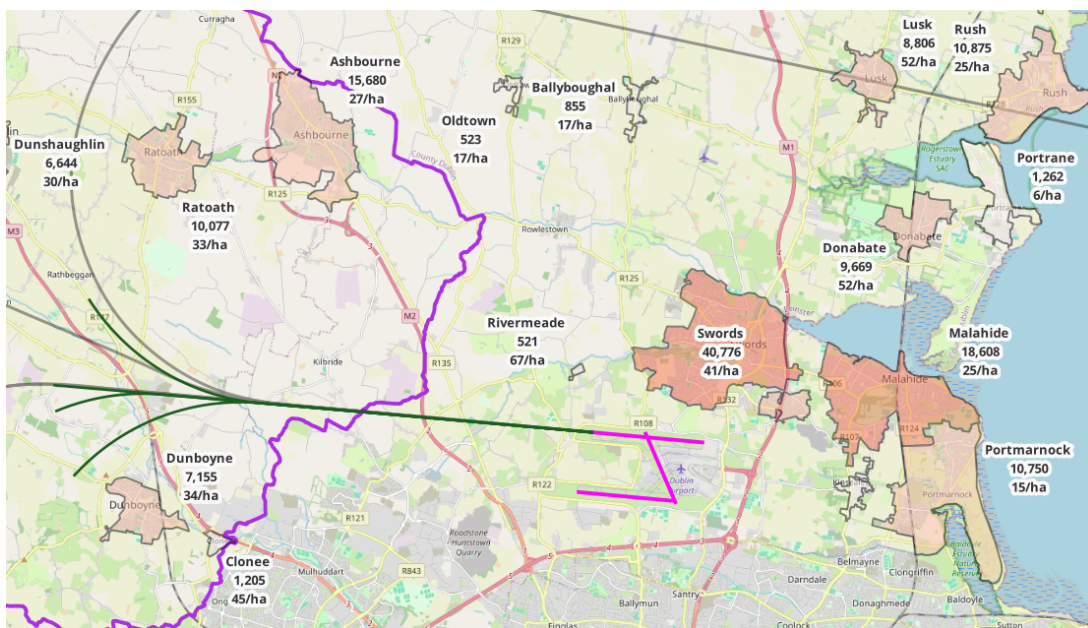


Figure 4: Modelled counterparts of the four reference flights under a Strict 5NM routing (straight on runway heading for 5NM, then a 15-degree bank at 250kt onto the outbound heading). These are our models of what EIS-consistent implementation would produce for the same aircraft and destinations; they are not ADS-B-verified (the Routes Flown flown by these aircraft did not follow this routing). Overlaid on the 28R Strict 5NM corridor for reference.

4.5 Selection zones per scenario

Four operational scenarios are constructed from the route centrelines:

28L Actual (south runway, baseline for existing exposure): straight-ahead, northbound 5NM turn, southbound 5NM turn. All 30 years of south runway operations fall within this envelope, taken as the existing baseline against which “newly exposed” is measured.

28R Strict 5NM (legacy convention): straight-ahead, northbound 5 NM turn, southbound 5 NM turn. The 5 NM figure is not an ICAO requirement; it is the convention adopted by the legacy 10R/28L SID, where the first waypoint (DW108, fly-over) sits 5 NM from DER. Placing DW108 1.5 NM further west would have placed the southbound turn point beyond Dunboyne; this was not done. Strict 5NM is modelled here as the alternative that takes the existing convention from the South Runway and applies it without modification to the North Runway. It is the result of replicating the legacy without intervention, not the result of a design exercise.

28R Designed (population-avoidance design): straight-ahead, northbound via ENDEQ (5 NM straight then gentle right turn, routed between Ratoath and Dunshaughlin), southbound 6.5 NM with a 1.5 NM extension past Dunboyne. The Designed alternative is constructed by examining the population distribution under the candidate corridor and adjusting the geometry to avoid the largest concentrations. Population-avoidance design of this kind is already in force at Dublin Airport: the 10R departure procedure requires aircraft to overfly the DW553 waypoint, 7 NM from DER, at or above 4,000 ft MSL, with a published 9.1% climb gradient. The combined altitude, distance and gradient constraints ensure traffic is high and east of Howth before any turn, keeping Dublin city clear of low-altitude overflight. The Designed variant applies the same kind of discipline to communities in north County Dublin and south County Meath. A further variant turning at 8 NM (e.g. via EBEZA) is not modelled here but is identified in §7 as a candidate for future analysis.

28R Routes Flown (as published and flown): DER 30° right fly-over to DW128, 57° right fly-by through DW128, 90° right fly-by through DW129 to ENDEQ direction; plus DER to DW128 to DW991 straight-through (fly-over), or with an 89° left turn at DW991.

For each scenario, the component corridors are merged into a single polygon per width (over-flown, affected) as the selection zone.

“Newly overflowed” and “newly affected” zones are the geometric difference of the scenario zone and the 28L Actual zone: the area inside the scenario zone and outside the 28L baseline zone.

4.6 Building counts

Residential building footprints were extracted from OpenStreetMap on 12 April 2026 for the bounding box (53.41, -6.55, 53.53, -6.25), using the Overpass API with the following tag filter:

```
way["building"="house"]
way["building"="apartments"]
way["building"="residential"]
way["building"="terrace"]
way["building"="semidetached_house"]
way["building"="bungalow"]
way["building"="detached"]
```

Within this bbox, 20,831 residential building polygons were returned. Tag distribution: house 20,263; apartments 215; residential 192; terrace 155; semidetached_house 6; bungalow 0; detached 0. The Irish convention in this area is to tag detached houses as house rather than the more specific detached.

Buildings are counted as one per polygon (one way). This understates dwelling counts for terraces (one way typically represents 4-10 dwellings) and for apartment blocks (one way represents all units in the block, often 20-100 dwellings). The building count is therefore a conservative proxy for dwelling count.

5 Affected-corridor justification

The 3 km half-width of the affected corridor is the approximate lateral extent of the 55 dBA single-event L_{Amax} contour for a departure overflight by the common Dublin fleet (B738, B38M, A320-family, A333) during initial climb. It is an working choice, not a regulatory threshold: 55 dBA is in the range commonly discussed in the environmental-noise literature as a level above which annoyance and sleep disturbance effects are reported, but no specific regulatory or WHO recommendation is invoked here. The geometric basis (single-event L_{Amax} reaching 55 dBA at approximately 3 km lateral distance for the departure fleet) is established by the NRTG single-event L_{Amax} noise model, a separate NRTG Zenodo deposit forthcoming (reserved DOI 10.5281/zenodo.19567722). That record, when live, will contain the model description, calibration, per-flight worked examples (BAW831, EIN105, RYS8564, RYR6875), and

the aggregate footprints. The model is appropriate for single-event L_{Amax} analysis and deliberately not for cumulative-dosage metrics (Leq, L_{den}, L_{night}), which require a fleet-wide operational-schedule model outside the scope of either deposit.

6 Design choice within the EIS-consistent envelope

The two EIS-consistent 28R alternatives modelled here (Strict 5NM, being the legacy convention from the 28L SID; and Designed, being Strict plus a 1.5 NM extension on the southbound routing to avoid direct overflight of Dunboyne) produce nearly identical “newly overflown” figures (330 buildings vs 333). On that metric, the 1.5 NM extension makes almost no difference.

It makes a substantial difference on total overflight:

Metric	Strict 5NM	Designed	Difference
Total buildings overflown	1,630	1,017	−613 (−38%)
Total population overflown	4,772	2,888	−1,884 (−39%)
Total buildings affected	6,192	5,257	−935 (−15%)
Total population affected	20,854	17,481	−3,373 (−16%)

The Designed extension pushes the southbound turn-initiation point 1.5 NM further west, past Dunboyne (population ~8,500, most of which sits along the runway heading line). The ~1,884 residents (613 buildings) that fall out of the Designed corridor relative to Strict are all inside the 28L baseline corridor: they continue to be overflown by 28L operations regardless of which 28R routing is in use. The “newly overflown” count is therefore unchanged (~330 buildings under either alternative), because no new population is added to overflight under either. What changes is which existing population is *additionally* overflown by 28R.

Under Strict 5NM, ~1,884 people in the Dunboyne area are within the 28R Strict corridor in addition to the 28L Actual corridor they have sat under for three decades. Under Designed, the same population is removed from the 28R corridor. Under the current split of operations (essentially all departures on 28R since 2022; see [Report §4.1]), the practical effect is that those 1,884 people go from being routinely overflown by current operations to being overflown only when 28L is in use as a fallback. That is a significant reduction in daily overflight count, event-based Leq, L_{night}, and cumulative exposure, and it costs 1.5 NM of additional straight flight to

deliver.

The “newly overflown” count of 333 (Designed) versus 330 (Strict) therefore understates the effect of the Designed extension: with 28L dormant, the relevant operational metric is not “is this community within any corridor in the model set” but “is this community within the corridor carrying current operational traffic.” On that metric, the Designed extension removes 1,884 people from the corridor that carries today’s departures. The “newly overflown” metric treats the two alternatives as equivalent because it measures the geometric novelty of the 28R corridor relative to the legacy 28L corridor, not the operational burden on affected populations.

This is the geometric mechanism by which population-avoidance design reduces operational noise burden. Both Strict 5NM and Designed are realisable at standard 15-degree bank and 250 knots and exceed the PANS-OPS minimum turn altitude (394 ft AGL) by a comfortable margin. The difference between them is 1.5 nautical miles of straight flight before turn initiation: an operational concession of 1.5 NM of additional track miles, identifiable by routine population-analysis applied to the candidate corridor. The effect is that 1,884 people go from being overflown by two runways to being overflown by one. The Designed scenario is what happens when the same practice in force on the 10R departure (§3.5) is extended to the populations under the 28R departure path.

The Routes Flown produce a different result: ~14,000 residents (4,008 buildings) that no EIS-consistent alternative would add to the overflown population.

7 What a population-avoidance design would produce

Section 5 quantifies the effect of a single design decision: the 1.5NM extension to avoid Dunboyne. The extension costs nothing; it is 1.5 NM of additional straight flight before turn initiation. It delivers a 38% reduction in total buildings overflown and a 39% reduction in population overflown, and it does so without adding any new exposed population elsewhere. It accomplishes this by keeping the corridor within the envelope of existing 28L exposure rather than creating new exposure.

This is procedure design when the designer has the relevant data (population distribution, existing noise exposure footprint, community boundaries) and consults it. The tools used in this annex (QGIS, OpenStreetMap, CSO Small Area data, FlightAware ADS-B, a published noise propagation model) are freely available. The analysis that identifies the 1.5NM extension opportunity is accessible to any engineer, planner, or procedure designer who chooses to perform

it. It requires no proprietary data, no specialist software, and no aviation expertise beyond the standard turn-radius calculation.

8 Redistribution objection

A predictable response is that affected communities are pushing noise onto someone else: that any alternative routing simply moves the problem from one community to another, and that the communities under the Routes Flown are no more deserving of protection than communities that would be affected under an alternative. This is the “NIMBY” framing.

The framing does not match the geographic distribution of population in the area. North County Dublin and south County Meath are not uniformly populated. Between the major settlements (Swords, Ashbourne, Ratoath, Dunshaughlin, Dunboyne) lie substantial areas of low-density agricultural land, characteristic Irish mixed farming with settlement densities under 10 dwellings per square kilometre. The alternatives modelled here (Strict 5NM, Designed) are not proposed as optimal routings; they are the routes that would result from (a) replicating the legacy 28L convention without modification, and (b) the simplest population-avoidance choice (extend by 1.5 NM to clear Dunboyne). The choice that population-avoidance design is possible at Dublin is not in question: it is in force on the 10R departure (§3.5). A properly conducted procedure design exercise for 28R, with the relevant population and land-use data, would not terminate at the geometry of either alternative modelled here. It would iterate further, routing the corridor over the identified low-density corridors between settlements and applying standard noise-abatement climb profiles (an 8 NM straight segment, level-off at 12,000 ft for UK-airspace handoff, thrust reduction, then routing between Ratoath and Dunshaughlin) to reduce ground-level exposure over any residual populated sections.

The alternatives modelled here represent the simplest design adjustments: do not make a 30-degree turn immediately at the departure end of the runway, do not pack two fly-by turns into a single 3.7 NM leg, extend the southbound straight segment by 1.5 NM to avoid a concentrated population. These choices do not redirect overflight to any presently-unaffected population. Strict 5NM avoids direct overflight of Dunboyne; it places the turn initiation over low-density farmland. Designed extends that further and still does not place new population under the corridor. Neither routing creates a new Dunboyne somewhere else.

The 12,000 ft level-off in the worked example is an existing ATC restriction associated with the airspace handoff into UK-controlled airspace, not an NRTG noise-abatement proposal; it pro-

duces a population-avoidance narrowing of the noise footprint as a side effect. The aircraft reaches LHR no later than under the Routes Flown routing. The worked example is a demonstration, not a recommendation: it combines standard procedure-design elements (sufficient straight segment, level-off, thrust reduction) to produce a corridor that does not land on concentrated population.

The argument is not that currently-overflowed communities should swap places with Dunboyne, or any other community. It is that a procedure design process that consults a population density map at all, and applies even the most basic noise-abatement practice, produces corridors that avoid the major settlements entirely. The Routes Flown do not do this and the analysis to identify such corridors uses freely available tools and standard professional methods.

9 Sensitivity analysis

The headline counts in [Report §3] use a single overflowed half-width (1.5 km) and a single affected half-width (3.0 km). This section sweeps both.

9.1 Scope

Three 28R scenarios (Routes Flown, Strict 5NM, Designed) across:

- Overflowed half-widths: 1.0, 1.5, 1.852, 2.0 km.
- Affected half-widths: 2.5, 3.0, 3.5 km.

Two overflowed values are named regulatory anchors: the 1.5 km UK DfT track-keeping swathe used at Gatwick, Heathrow and Stansted (DfT00393, 2017; canonical for this study); and the 1.852 km ICAO RNAV-1 Terminal Cross-Track Tolerance (XTT) of 1.00 NM, the 95%-containment half-width used in SID protection-area design (ICAO Doc 8168 Vol II, Part III §1 Ch 2 §2.2.2). RNAV-1 is the navigation specification that applies to SIDs. The 1.0 km and 2.0 km entries bracket the two anchors.

No comparable anchor applies to the affected corridor; the 2.5 to 3.5 km sweep bounds how much the headline moves around the working 3.0 km choice (see [Annex §4]).

The near-DER transition is held fixed at the canonical 415 m (overflowed) and 835 m (affected) initial half-widths reaching steady-state at 2.5 km downrange; only the steady-state value varies. The 28L Actual baseline is regenerated at the matching half-widths for every 28R run, keeping the “newly overflowed” and “newly affected” set-differences geometrically consistent. The driver

is deterministic and ships in the reproducibility bundle at `tools/gis/sensitivity.py`; full 48-row output at `sensitivity/results.csv`.

9.2 Results

Overflowed sweep at the canonical 3.0 km affected half-width:

Overflowed half-width	RF newly		Designed	RF / Strict
	overflowed pop	Strict 5NM		
1.0 km (below DfT)	10,847	930	936	11.7×
1.5 km (DfT, canonical)	13,966	999	1,010	14.0×
1.852 km (ICAO RNAV-1 XTT)	17,137	1,048	1,050	16.4×
2.0 km (above XTT)	19,000	1,061	1,060	17.9×

Affected sweep at the canonical 1.5 km overflowed half-width:

Affected half-width	RF newly affected pop	Strict 5NM	Designed
2.5 km	26,092	1,108	1,120
3.0 km (canonical)	30,186	1,164	1,202
3.5 km	31,499	1,215	1,298

9.3 Envelope and tier call

Overflowed corridor. Between the two regulator anchors (DfT 1.5 km, ICAO XTT 1.852 km), Routes Flown newly-overflowed rises from 13,966 to 17,137 (+22.7%). At 2.0 km it reaches 19,000 (+36.1%); at 1.0 km it falls to 10,847 (−22.3%).

Widening the corridor adds population; narrowing it removes population. The canonical 1.5 km is the narrower of the two anchors: a reader substituting the ICAO XTT arrives at a headline 22.7% higher, not lower. The choice is conservative against interest. Between anchors the movement sits in the “sensitive” tier (10-25%); extending to 2.0 km crosses into “material”

(>25%), but that upper bound has no regulatory basis and the move is in the conservative-against-interest direction.

Affected corridor. Routes Flown newly-affected moves from 26,092 (2.5 km) to 30,186 (3.0 km, canonical) to 31,499 (3.5 km): envelope –13.6% / +4.3%, “sensitive” tier. The upper half compresses because the corridor already intersects the built-up areas south and east of Ashbourne by 3.0 km. With no external anchor for the 3.0 km choice, the Report restates the headline alongside this envelope.

Scenario disparities are robust. Across the full 4×3 matrix, the Routes Flown / Strict 5NM ratio for newly-overflowed population stays between 11.7× and 17.9×. The order-of-magnitude disparity between the Routes Flown and any EIS-consistent alternative does not depend on corridor choice.

9.4 Summary

- The qualitative claim that Routes Flown newly-overflowed is an order of magnitude above any EIS-consistent alternative is insensitive to corridor choice.
- The point-estimate headlines (“13,923 newly overflowed”, “30,186 newly affected”) move 10-25% across defensible perturbations. The Report restates each alongside its range.
- The overflowed point estimate is conservative against interest under both external anchors (DfT, ICAO). The affected point estimate has no external anchor; its envelope is reported both ways.

10 Limitations

- **Building count undercounts dwellings:** terraces and apartment blocks are counted as single buildings. A more accurate dwelling count would require ancillary data (GeoDirectory, Eircode, or similar). The population estimate partly corrects for this at the Small Area level.
- **Small Area uniformity assumption:** population is allocated uniformly within each Small Area. This overestimates impact for zones that catch the edges of SAs where built-up density is lower.
- **OSM completeness:** OpenStreetMap building coverage is high in urban areas but variable in rural. Ashbourne, Ratoath, Dunshaughlin and Swords appear well mapped. Rural Meath may be under-represented.

- **15km cutoff:** routes beyond 15km from DER are not assessed. At 15km aircraft are typically at 5,000-6,000 ft AAL with continuing noise impact. A future version of this study will extend the analysis to an altitude-based cutoff.
- **Turn radius assumption:** single 15-degree bank used throughout. Real aircraft vary bank angle and speed through a turn. The assumption is standard for flight procedure design and is the design basis for ICAO PANS-OPS.
- **Conservative against interest:** methodology choices consistently favour the EIS-consistent alternatives being made to look as large as plausible (wider turn radius = wider corridor = more homes counted). This is deliberate: findings are defensible against critique that alternatives are unrealistically compact.
- **28L baseline is historical, not current:** the 28L Actual corridor reflects three decades of pre-2022 exposure, not current operations. Since 28R opened in August 2022, essentially all departures have been assigned to 28R. The “newly overflowed” figures isolate the marginal geometric novelty of the 28R corridor relative to the historic 28L footprint, not the operational burden the 28R corridor now carries as the primary exposure footprint of the airport. See [Report §4.1].
- **Methodology-specific:** full centreline-construction derivations, turn-geometry assumptions and corridor-comparison detail are in §§3.1-3.4 of this annex; population-exposure results and interpretation are in [Report §§3-4].

11 Reproducibility

The reproducibility and figure bundles are the same artefacts described in [Report §6]; they support both documents. OSM building query: see §3.6 of this annex. All GeoPackages are in EPSG:2157 (Irish Transverse Mercator); buildings in EPSG:4326 (WGS84); the QGIS project uses EPSG:3857 for OSM tile compatibility. Every figure PNG carries a companion .pgw world file for direct QGIS placement.

12 Use of this annex

The intended audiences, scope, and licence are as set out in [Report §7]. This annex is evidence, not advocacy; it provides the methodological record underlying the findings stated in the report, and is cited from the report where methodological defence is called for.

13 References

UK Department for Transport (2017). *Noise controls and noise preferential routes (NPRs) at designated airports: Impact Assessment*. Reference DfT00393, 20 October 2017. Available via gov.uk.

NRTG (2026). Communication to the Aarhus Convention Compliance Committee, Supplementary #2 (“Parliamentary Record”), 8 April 2026. Available at www.dublin-north-runway.com.

ICAO (2020). *Doc 8168: Procedures for Air Navigation Services: Aircraft Operations, Volume II (Construction of Visual and Instrument Flight Procedures)*, 7th Edition. International Civil Aviation Organization, Montreal.

Central Statistics Office (2023). *Census of Population 2022: Small Area Population Statistics*. Dublin: CSO. Available via tab.cso.ie CensusHub, table T2_4_SA.

OpenStreetMap contributors (2026). Building footprint data for Dublin Airport environs, extracted via Overpass API on 12 April 2026, bbox (53.41, -6.55, 53.53, -6.25). © OpenStreetMap contributors, data available under the Open Database License.

14 Appendix A: Figures

All figures are georeferenced PNGs with companion .pgw world files, distributed in EIDW-EIA-Conformance-Gap-Analysis-Figures-v1.0.zip in the Zenodo record. They can be loaded directly into any QGIS project to verify geographic placement.

14.1 EIS reference zones

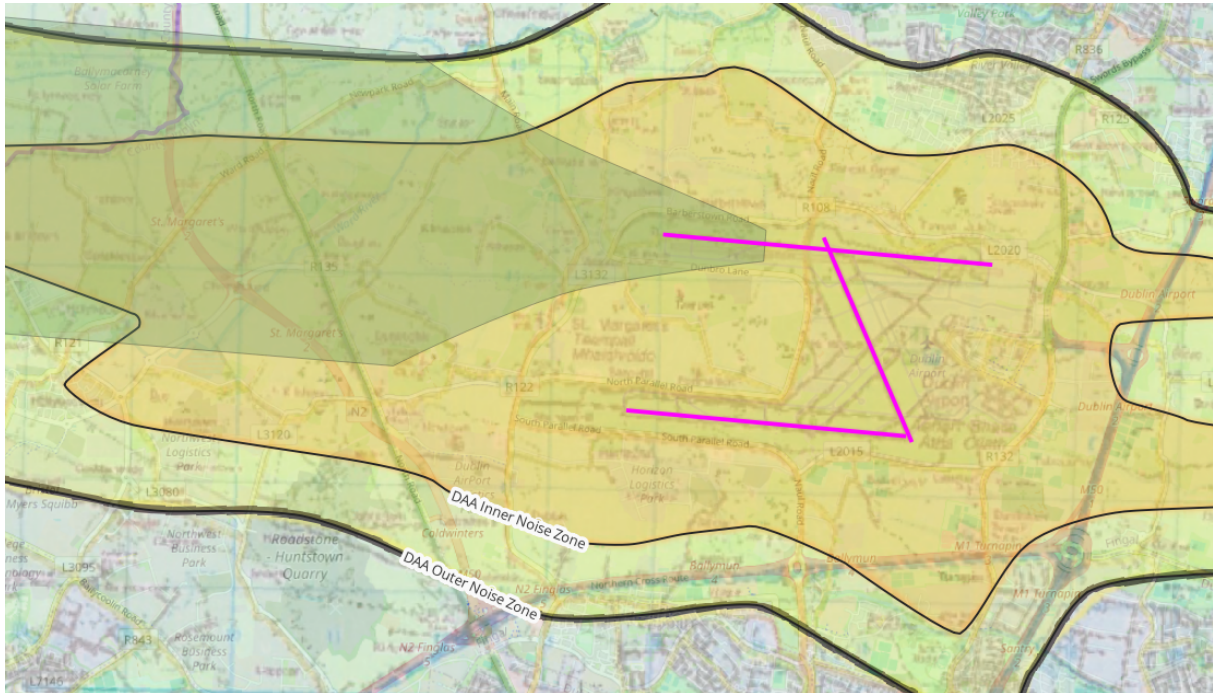


Figure 5: Original EIS noise zones (Inner and Outer), noise zones highlighted raster, and the EIS Route reference polygon. Shows how the statutory noise framework derived from the 2007 EIS assumed a straight-ahead departure.

14.2 Newly-exposed zones (EIS-consistent alternatives)

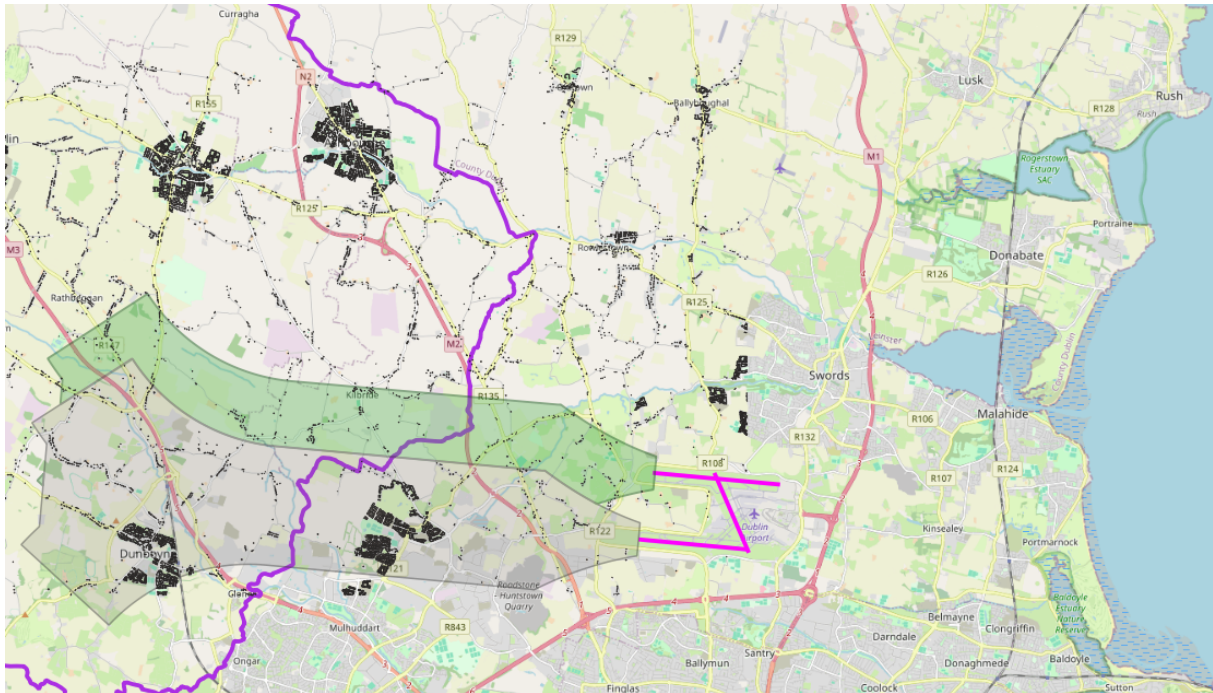


Figure 6: 28R Strict 5NM newly overflowed zone (green). The ground inside the Strict corridor but outside the 28L baseline: 998 residents (330 buildings).

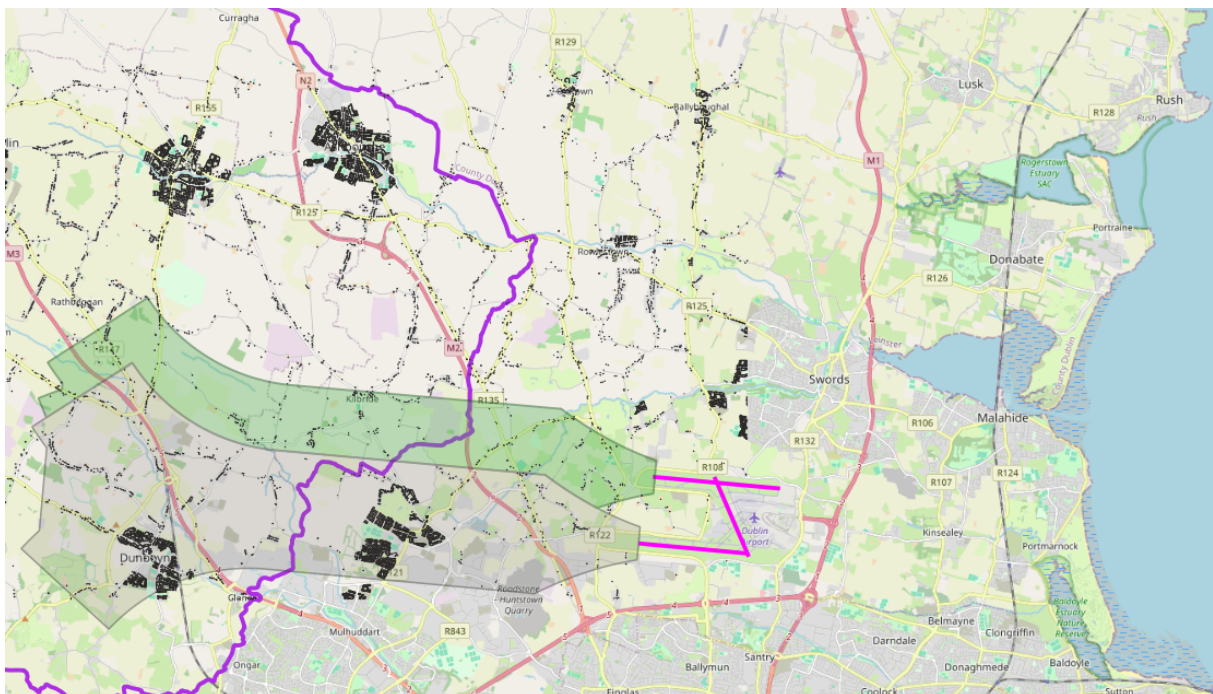


Figure 7: 28R Designed newly overflowed zone (green). 1,008 residents (333 buildings). Effectively identical to Strict in “newly” terms; see §5 for the total-overflight reduction the extension achieves.

14.3 Zoom-ins (§5, §6)

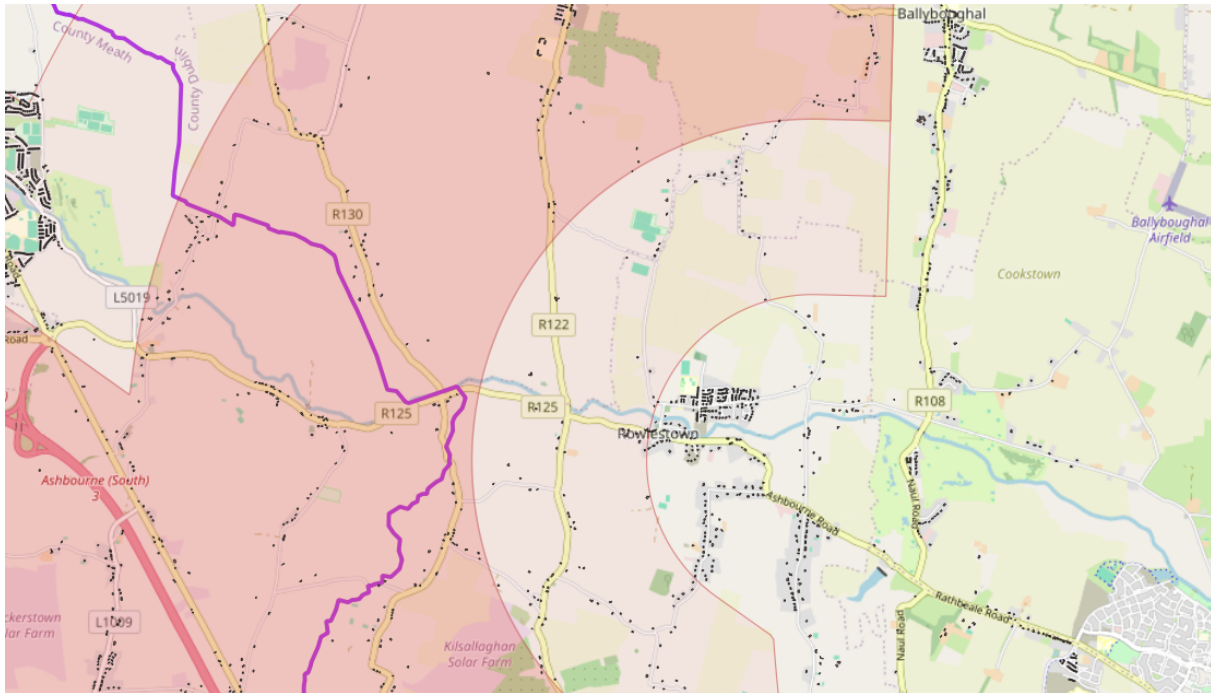


Figure 8: Ashbourne zoom. Apartment blocks and residential density within the 28R Routes Flown overflow and affected corridors. None of these structures fall within any EIS-consistent alternative.

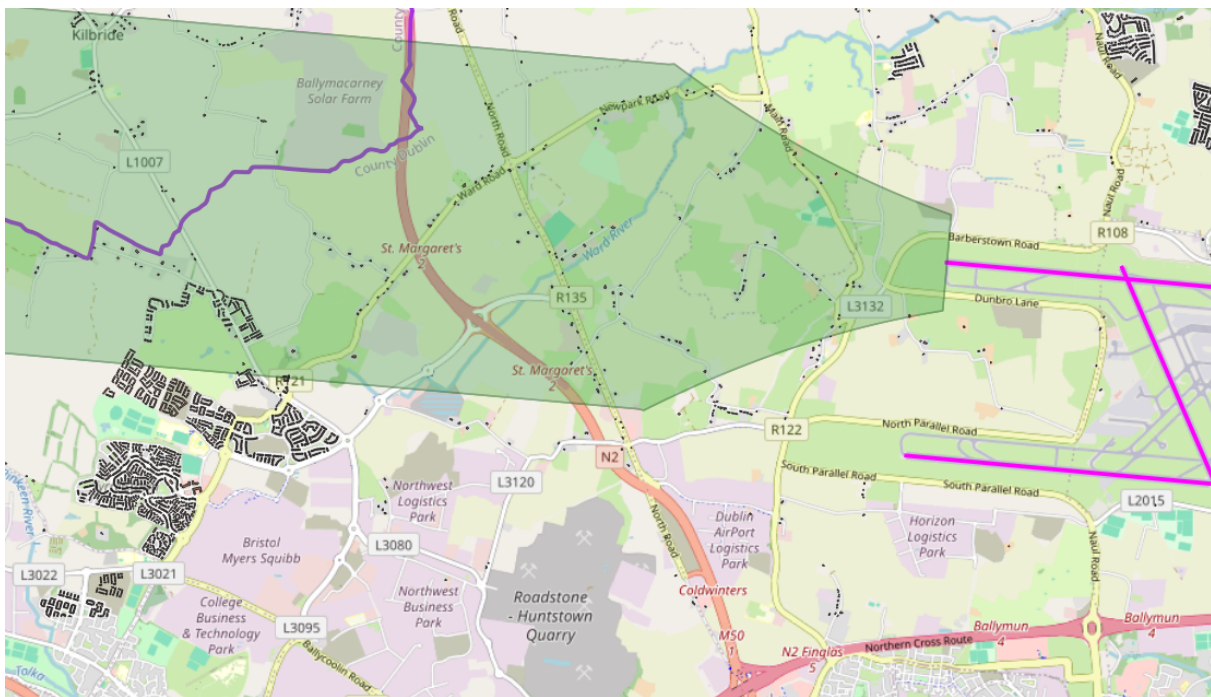


Figure 9: Dunboyne zoom. Strict 5NM overflow corridor (over Dunboyne) vs Designed overflow corridor (past Dunboyne). The 1.5NM extension separates the two.

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