# Phase two Engagement Materials

## CAP1616 Stage 2 Develop and Assess

April 2022

MAG Manchester Airport

# Manchester Airport Future Airspace

Thank you for taking part in our discussions about the future of airspace at Manchester Airport. As we develop our plans, the feedback we receive from stakeholders (the people and organisations who can affect, or be affected by, any changes to airspace), including the general public, will influence the decisions we make.

This document provides background information for the upcoming discussions, which build on those we held in November and December 2021. It also gives details of where you can obtain further information.

## Stage 2 – develop and assess

At the end of Stage 1 (Define), we produced design principles that we apply when considering options for changes to flight paths.

We are now in Stage 2 (Develop and Assess) of the airspace change process under the process contained in the CAA's CAP1616. Stage 2 focuses on developing route options that address the Statement of Need and align with the design principles. It consists of two steps.

- At Step 2A, comprehensive route options are developed, refined and assessed against the design principles.
- At Step 2B, the options that are most in line with the design principles are more closely assessed to understand their likely effects, both positive and negative.

Once we have completed the evaluation in Stage 2 (both Step 2A and Step 2B), we will send details of the work we have carried out to the Civil Aviation Authority (CAA) for approval. If we get their approval, we will proceed to Stage 3 (Consult) of the airspace change process where the refined options will be subject to full public consultation.

## Gathering views at Step 2A of Stage 2

Step 2A of Stage 2 is split into two phases of discussions with stakeholders and general public participants.

Phase one of the discussions took place between November and December 2021, when we explained the process our route designers had followed to identify the 'design envelopes' (broad areas where it would be possible to safely place departure and arrival routes that are in line with our statement of need and the design principles). We used the feedback from the phase one discussions to carry out further design work to identify changes to the route options. (If you were unable to attend the sessions in November and December, please let us know so we can give you details of the previous discussions.)

In our upcoming phase two discussion sessions, we will provide a recap of the design envelopes discussed in phase one, explain the changes we have made as a result of those discussions, and give you information about the route options we have developed within the design envelopes. We will explain why we have designed the options and how they fit with the design principles (shown on next page).

## Design Principles defined in Stage 1

**S Safety**

Our routes must be safe, and must comply with industry standards and regulations.

**P Policy**

Any change must accord with the Civil Aviation Authority's Airspace Modernisation Strategy. Any airspace change must also allow connection to the wider UK En-Route network and be aligned with the Future Airspace Strategy Implementation for the North programme and take into consideration the needs of other airports.

**C Capacity**

Our future airspace must enable best use of the capacity of our existing runways, in line with government policy.

**E Emissions**

We will minimise, and where possible reduce, emissions when we design routes. This may be achieved by selecting the most direct routes.

**N1 Noise**

Our route designs should seek to minimise, and where possible reduce, the number of people affected by noise from our flights.

**N2**

Where practical, noise effects should be shared. The use of dispersion and/or respite, especially at night, will be considered to achieve this.

**N3**

Where practical, our route designs should avoid, or limit effects upon, noise sensitive areas. These may include cultural or historic assets, tranquil or rural areas, sites of care or education.

**A Airspace**

Our route designs should minimise the impacts on other airspace users by limiting Controlled Airspace.

**T Technology**

Our route designs should be based on the latest aircraft navigational technology widely available.

## What to expect from the phase two discussions

The sessions will be held online using Microsoft Teams and are expected to last around 2½ and will include a 15-minute comfort break. You will be sent a link to the session, a glossary of terms that will be used, and a 'User guide to MS Teams'. The session you have been invited to is for people from the same representative group (for example, councillors or environmental health officers). The sessions will be recorded so all feedback can be analysed.

Each session will include a presentation from the Manchester Airport Future Airspace team, and you will be able to ask questions and offer comments throughout. Firstly, we will recap on what we shared during our phase one engagement, where we described the initial design process and the design envelopes created. Next, we will provide an overview of the feedback we received following those sessions and how it has informed our design. Then we will take you through the phase two design process and explain how it has led to the route options. We will then show you a sample design envelope with route options illustrated. In our phase one engagement an understanding of what respite meant was sought. So finally, we will take a closer look at design principle N2, which covers noise respite, and get your views on how this principle could be applied.

After the session, we will send you a pdf of the presentation that will include all the arrival and departures design envelopes on maps with lines that show the route options. We will also share a Q&A document and a recording of the presentation. That way you can study the design envelopes and route options in your own time and provide your

considered feedback on the methodology, route options and application of the design principles, including in relation to respite, through an online survey.

## What happens next

When we have gathered and considered all feedback from the phase two discussions, the route options will evaluated by our technical and environmental experts to see how well they meet the design principles. This will be presented in a Design Principles Evaluation and will complete the requirements of Step 2A. In Step 2B, the route options will be reviewed again by our technical experts and route designers, with the assessment presented in the Initial Options Appraisal.

We will then send final documents about the route options (including an Initial Options Appraisal Report, a Design Principles Evaluation, a Design Options Report, and a Stakeholder Engagement Report) to the Civil Aviation Authority (CAA) for their review.

## Further information

You can see our Statement of Need, which sets out why we want to modernise our airspace, and the agreed design principles, at www.manchesterairport.co.uk/futureairspace.

There is more information about the process for managing changes to airspace in the CAP1616 document, which sets out the detailed seven-stage process that we must follow.

You can see a video on Stage 2 at www.manchesterairport.co.uk/futureairspace.

You can find further information about Future Airspace Strategy:

- in the CAA Airspace Modernisation Strategy; and
- in the Airspace Change Organising Group (ACOG) report 'One Sky One Plan; Upgrading airspace, a critical national infrastructure programme for Britain'. This report sets out the significant benefits and opportunities on offer for the UK – from trade and efficiency to net zero and global competitiveness – and highlights the process involved in modernising the UK's skies.

## Contact us

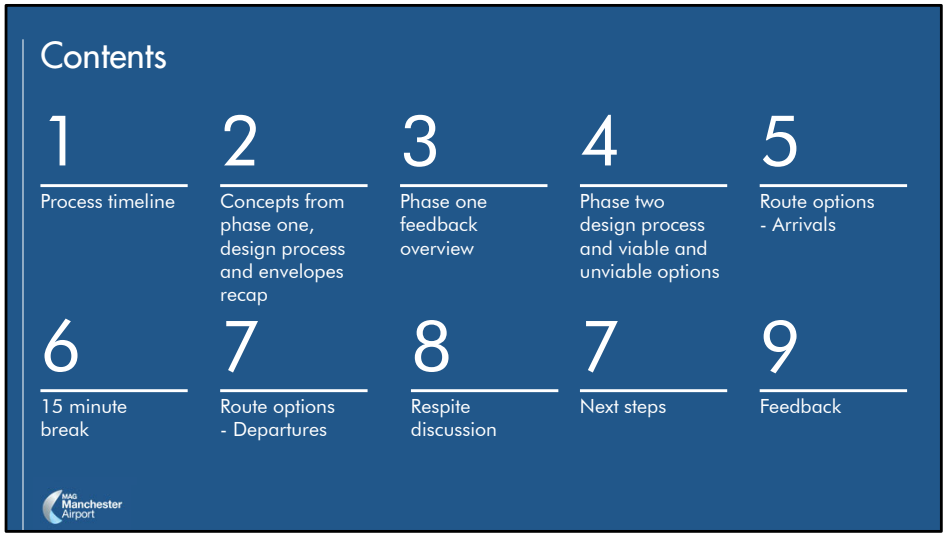
If you have questions or concerns, or if there is anything we can do to help you take part, please let us know by contacting futureairspace@manairport.co.uk.

# MANCHESTER AIRPORT FUTURE AIRSPACE

## Stage 2 – Develop and Assess
## Phase two engagement –Route options discussion

May and June 2022

MAG Manchester Airport




The purpose of this presentation session is to share with you the progression of our route options for arrivals and departures and explain the process we have followed.

- First, we will recap on what we shared at our last engagement sessions back in November and December of 2021, where we described the initial design process and the design envelopes we had created. Many of you attended these sessions and provided your insights so should be familiar with this work.
- Next, we will provide an overview of the inputs we received from those sessions and how they have informed our design.
- Then we will take you through the design process we have followed and explain how it has led to the route options. We will then show you sample design envelopes and the route options created within them.
- Finally, we would like to take a closer look at Design Principle Noise N2, which covers noise respite, and get your views on how this principle is best applied.

After today's session, we'll e-mail you a pdf of the presentation that will include all six arrival and 11 departure design envelopes on maps with lines that show the route options. That way you can study these options in your own time and provide your considered feedback by Thursday 16th June.

It is important that we receive your written feedback and insights, through the online survey. In particular we want to ensure that you are satisfied that the process we have followed to design the route options is consistent with the design principles we agreed at Stage 1. We're also interested to hear any observations you have about the route options we have designed. You might also want to share any other local factors we should be aware of or highlight if there are alternative route options that we could consider. We will also ask you for your thoughts on respite so that we can use these insights when we consult on options in Stage 3.

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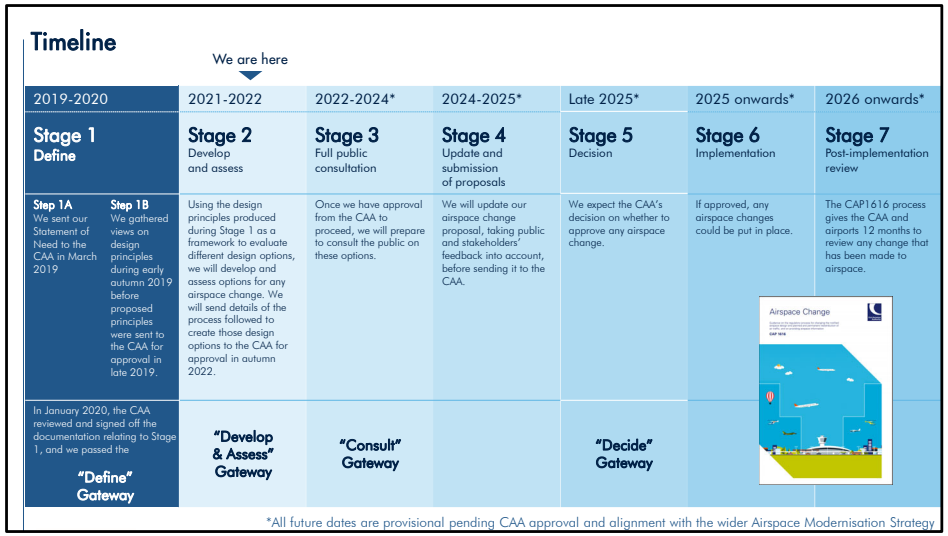
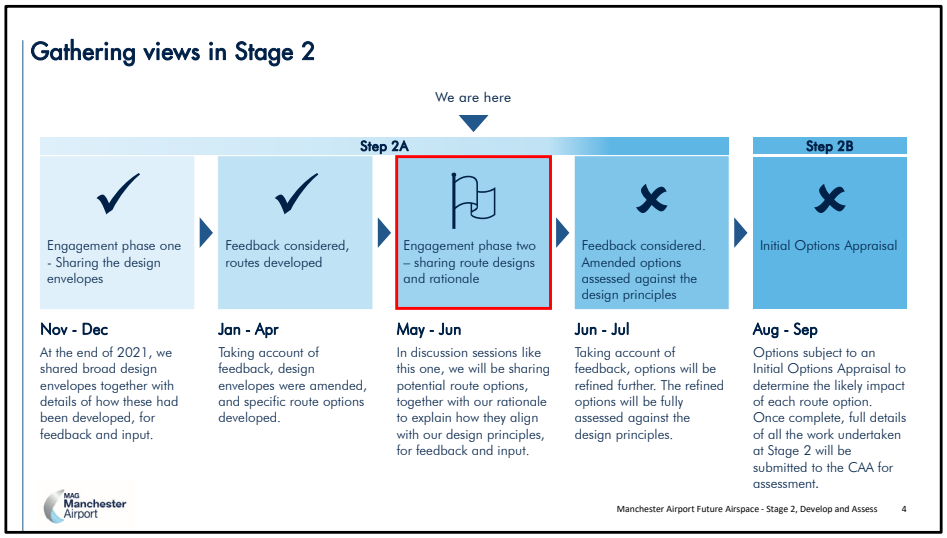



The Manchester Airport Future Airspace project is part of the Government's UK wide Airspace Modernisation Strategy. Changes of this nature are required to follow the Civil Aviation Authority's process for airspace change – which is called CAP1616.
As you can see there are four gateways where CAA approval is required to move forward.
In 2019 we submitted a 'Statement of Need' which set out our reasons for change and what we need to achieve from the change. We then engaged with stakeholders to develop proposed design principles. These are the high-level considerations that will guide the development of our route options which were submitted to the CAA for review. In January 2020, the CAA reviewed and signed off the documentation relating to Stage 1, and we passed the "Define Gateway". We will refer to the design principles throughout our discussion today as they are key to the development and evaluation of our route options. We are now at Stage 2 of the process named 'Develop and Assess'. This is where we begin to develop route options.
You can see on this slide how the process develops beyond Stage 2 and there are some indicative dates for each stage, however, these remain subject to change in line with the wider national Airspace Modernisation Strategy.




In this slide we have mapped the Stage 2 process. It shows what we have carried out so far, where we are now and what follows. In Stage 2, we are engaging on the early design work with a range of stakeholders that are representative of the communities and organisations which may be affected by airspace change. This is not a public consultation – public consultation will follow at Stage 3.

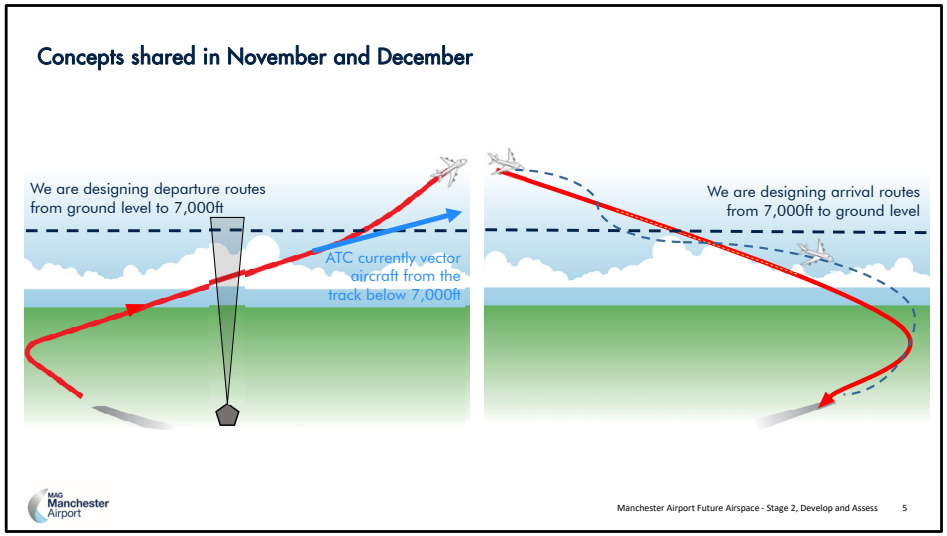
Many of you will have attended our discussion sessions in November and December where we shared the initial work completed by our route designers. In those sessions, we talked through the process our designers followed to identify the design envelopes. These envelopes are broad areas where it would be possible to design some route options. We then asked participants to provide input and feedback.

The feedback gathered in those sessions has been used to amend the envelopes and inform this next phase of the design process, which is to create a range of route options within each envelope. These options form the basis of what we will be sharing with you today.

The route options that we are presenting to you today will be refined and possibly added to based upon feedback from this and other sessions we are holding in May and June. Each option will then be evaluated in a 'Design Principles Evaluation' to determine whether each principle is either not met, partially met, or fully met. Once this evaluation is complete some options may be discounted as they fail to meet the design principles.

We will then move on to Step 2B which is where the options are subject to an 'Initial Options Appraisal' to understand the likely impacts, they would have – both positive and negative.

All the work completed at Stage 2 for both arrivals and departures will then be submitted to the CAA for assessment in the Autumn of 2022. Subject to CAA approval, Manchester Airport will then move on to Stage 3 of the airspace change process – when there will be a full public consultation on the shortlist of route options developed during Stage 2. The Stage 3 consultation strategy is subject to CAA approval and the timing of it will need to be aligned with the overall Airspace Modernisation Strategy at a national level.



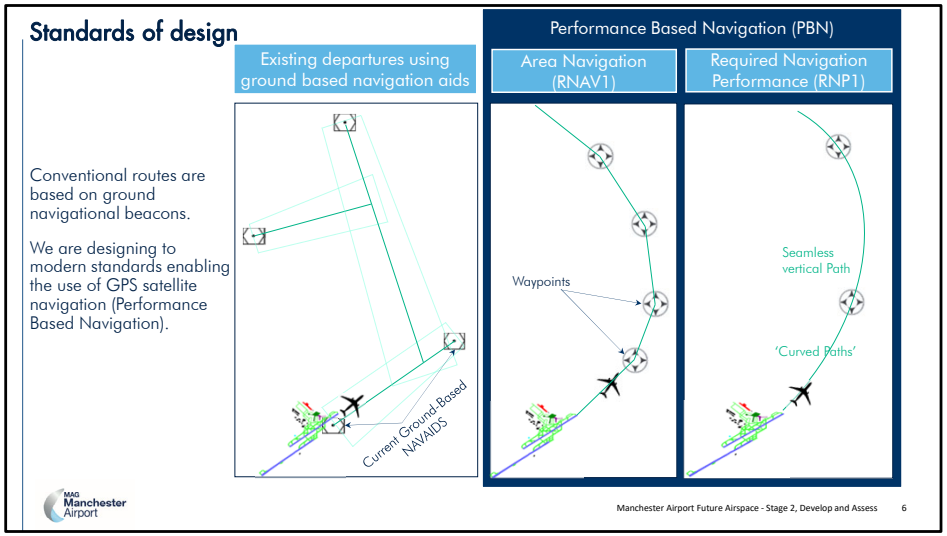

You may remember that our Future Airspace project is concerned with designing

- departure routes from the runway up to 7,000ft where they join the NATS upper airspace network
- and arrival routes from where an aircraft is received from the NATS upper airspace network, at 7,000ft down to the runway.

Currently, departing aircraft usually remain within a 3km corridor until they have reached a release altitude which varies between 3,000 and 5,000ft. Once aircraft have attained their release altitude, they can be sent by Air Traffic Control (ATC) in a direction more relevant to their onward routing. The current departure routes are laid out to 5,000ft, but in practice aircraft are more usually diverted before that height. In the future, aircraft will follow their departure route to 7,000ft and so they will be less dispersed than they are today.

You may recall that aircraft currently use ground-based navigational beacons to navigate. Many of these ground-based beacons are being taken out of service and so this form of navigation will not be possible for much longer. Feedback from earlier engagement showed stakeholders understood the switch-off of the beacons meant 'doing nothing' is not a realistic option and were generally supportive of the change required to switch to Performance Based Navigation. Further in the presentation we will show you our route options within two envelopes, providing an example to explain and illustrate the process we have been through.

Arriving aircraft are currently tactically controlled by Air Traffic Controllers who sequence aircraft into the best possible arrival order. This process naturally disperses the aircraft but makes it difficult to achieve an environmentally friendly Continuous Descent Approach or CDA. To align to the Design Principle Policy, doing nothing is not possible as this means aircraft will continue to require tactical intervention by ATC. The change to Performance Based Navigation means arrival routes seek to improve CDA performance. This may cause a greater concentration of aircraft but could reduce the overall number of people overflown and affected by noise.




One of the main objectives of the Airspace Modernisation Strategy is the use of Performance Based Navigation or PBN, dispensing with the need for ground-based navigational beacons. The technology also leads to a greater concentration of aircraft which offers the opportunity to reduce the overall number of people overflown and affected by noise. But can cause greater disturbance to those who are affected. This may be where we can usefully introduce options for respite our Design Principle Noise N2.

Our overall objective on noise is to limit and where possible reduce the number of people significantly affected by aircraft noise, as identified by the Design Principle Noise N1.

Two PBN technologies have been applied to our departure route designs, which are:

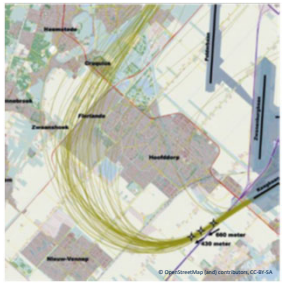
- Area Navigation (RNAV1) and
- The more advanced, Required Navigation Performance (RNP1).

For arrivals we are using the RNP Approach standard.

The key difference between RNAV1 and RNP1 is the requirement for on-board performance monitoring and alerting that is included in the more advanced RNP systems. We have carried out a 'Fleet Equipage Survey' to understand the capabilities of the aircraft used at Manchester Airport. The survey showed that by the anticipated date of implementation, all aircraft flying into Manchester Airport could use the RNAV1 and RNP Approach standard, and over 90% could utilise the more advanced RNP1.

By applying these standards, the use of modern technology can be realised, whilst still providing alternatives so all aircraft operating at Manchester Airport can be accommodated.

## Ground path of Precision Based Navigation (PBN)

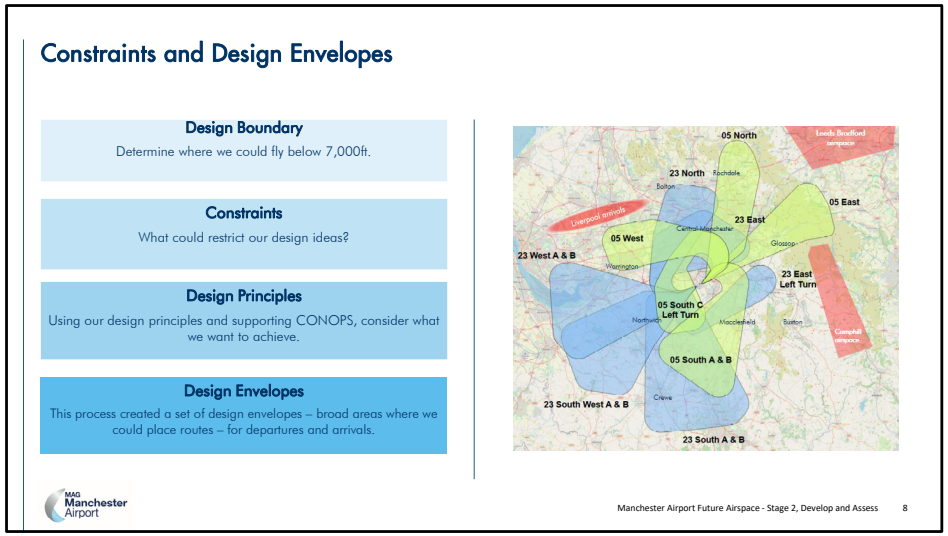


The green lines are aircraft tracks flown using conventional procedures and ATC vectoring.

The dark green lines are aircraft tracks flown using PBN.

Manchester Airport Future Airspace - Stage 2, Develop and Assess 7

This slide illustrates the contrast between departing aircraft using different navigational techniques. Those shown in light green have used ground based navigational procedures and are more dispersed than the dark green lines shown by the tracks of aircraft using PBN which are more concentrated.




On this slide we have summarised the process followed to establish the design envelopes that we presented in November and December.

- First, the rules and regulations to understand where aircraft could fly between 7,000ft and the ground were applied. Then basic geometry was used to create theoretical arrival and departure boundaries.
- The area around Manchester Airport was then analysed to identify constraints and considerations. Some of these are fixed and relate to things that are beyond our control, such as the location of neighbouring airports, whilst others may be open to change as they are determined by the way aircraft are directed by other airports and by the way NATS control aircraft in the upper airspace network.
- CONOPS is short for Concept of Operation and defines how the new system should work. So finally, the design principles and supporting CONOPS document were then applied.
- With all these inputs our designers were able to produce the design envelopes that we shared in November and December.

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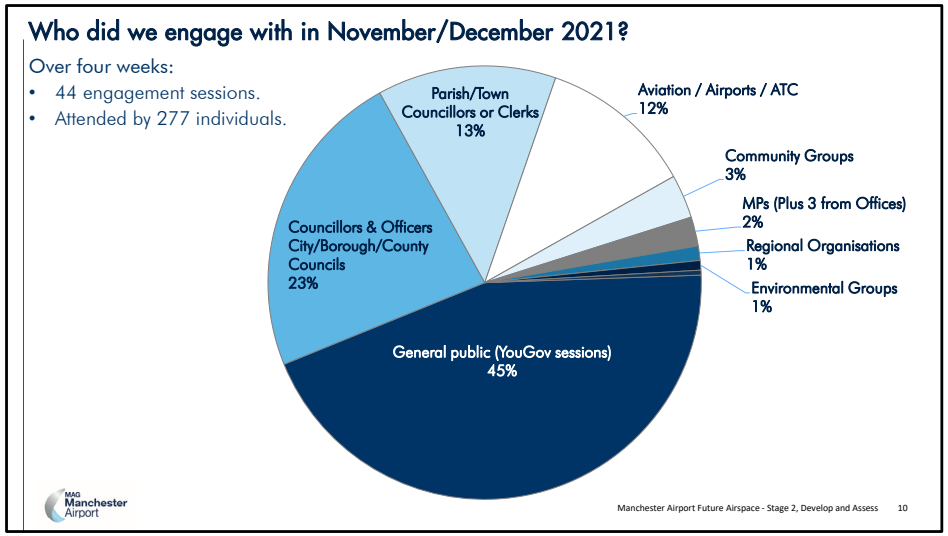
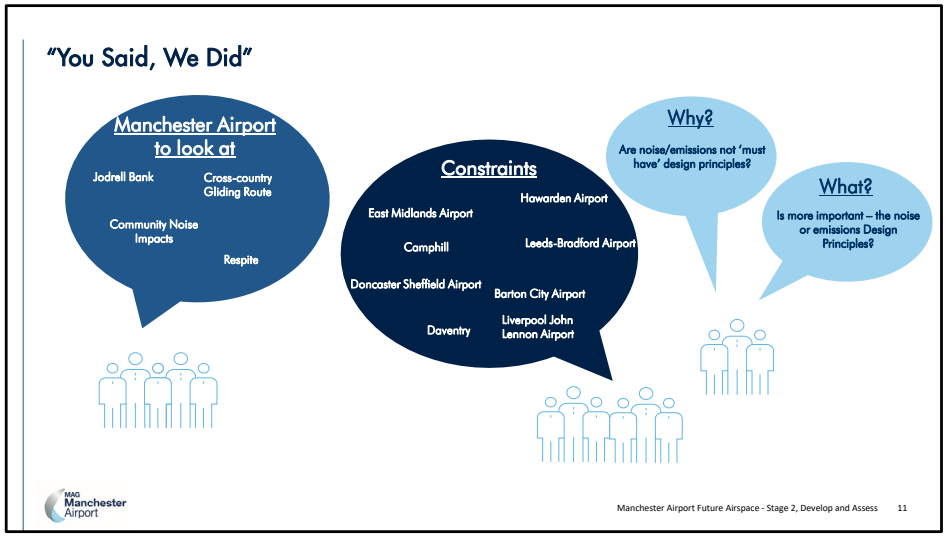
So that covers the background to today's session. In the next section, we will talk through the inputs stakeholders provided in November and December. We will summarise what stakeholders said and the actions we took in response. We will then outline how this feedback has influenced the route options we'll share with you later in this session.




In 2019 we defined an area, which includes 39 district, borough, and city council areas, as potentially affected by current and future operations. We completed our Stage 1 engagement with stakeholders in this area and subsequently passed through the 'Define' Gateway in January 2020.

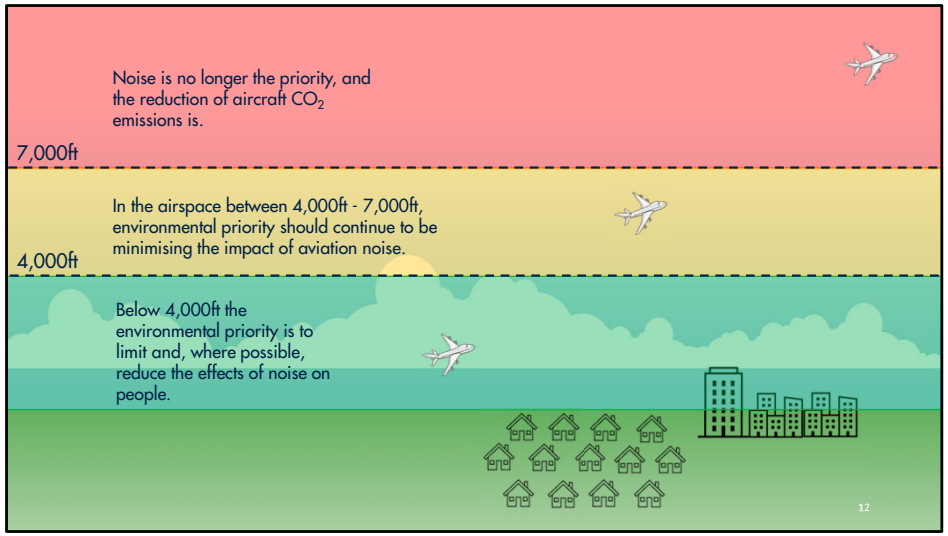
In September 2021 we again reached out to the representatives of the stakeholder categories defined in CAP1616 in the area and invited them to attend briefing sessions in November and December. In parallel, YouGov engaged with members of the general public in the vicinity of Manchester Airport. This has ensured that we continue to go 'above and beyond' the requirements of CAP1616 by engaging with members of the public in addition to the designated stakeholders.

In total we engaged with 277 individuals representing 89 groups representative of the communities and organisations affected by airspace change.

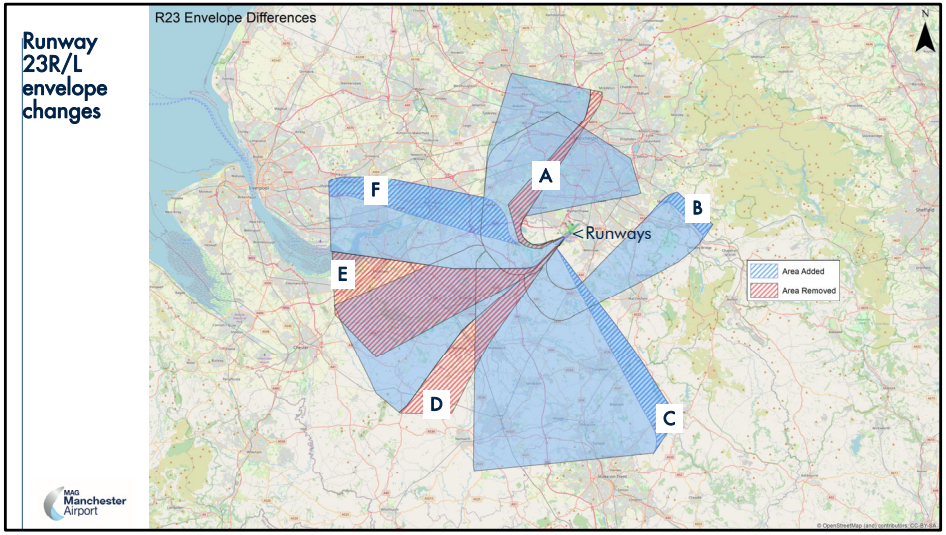



In our engagement sessions last year, we posed eight questions concerning the process that we had followed and the resultant envelopes. On this slide we have summarised the feedback into common areas.

- Respondents requested that we engage with Jodrell Bank directly
    - So, in January, members of the airspace team met with those representing Jodrell Bank and brought them up to date with our progress. Representatives from the observatory will be engaged in this and future phases of engagement.
- It was drawn to our attention that there are areas where our design envelopes could lead us to design route options which might not safely fit with operations to or from other airports.
    - In response to this we have continued to meet with other airports and are sharing our route options with them as part of this engagement process. We will continue to work together to understand how we can accommodate each other's needs for mutual and overall benefit.
- Stakeholders challenged whether the airspace blocks of Camphill, to the east, and Daventry, to the south-west, were fixed constraints.
    - In both cases we have raised the matter with NATS representatives who are controlling aircraft in the upper airspace network. They have accepted that any interactions in these areas would be by aircraft above 7,000ft and so would be their responsibility. We have also re-evaluated these areas to see if routing through these blocks would provide more options, but we found no benefit. There is no connectivity to the NATS upper airspace network through these areas, so aircraft would be required to fly longer routes to join the network elsewhere, causing greater fuel burn and so conflicting with our design principles. Routing in these areas would also require us to adopt more controlled airspace, which again, is not in line with our design principles.
- During the engagement we were made aware of a proposed cross-country route for light aircraft and gliders.
    - We have examined the airspace highlighted and determined that the route is primarily a concern for Leeds-Bradford Airport and the NATS Upper Airspace network because our routes will have climbed above 7,000ft by this point. We will maintain a 'watching brief' to see how this suggestion develops.
- Stakeholders wanted to know how noise 'respite', expressed in Design Principle Noise N2, could be delivered by the Future Airspace project.
    - As part of our discussion today – we are keen to explore this design principle with you. We will then be able to consider how best we can meet these objectives as we move forward into the next Stage.




- Finally, many stakeholders cited noise as the most important consideration but also stressed the importance of emissions. In some cases, stakeholders queried why the design principles Safety, Policy and Capacity were 'must haves' but noise and emissions were not. We were asked how these issues would be managed through the route design.
    - Government guidance is that the height of an aircraft should determine the priority given to managing noise or emissions:
        - ✓ Below 4,000ft the environmental priority is to limit and, where possible, reduce the effects of noise on people.
        - ✓ In the airspace at or above 4,000ft to below 7,000ft, the environmental priority should continue to be minimising the impact of aviation noise, unless the CAA is satisfied this would disproportionately increase CO2 emissions.
    - Above 7,000 feet, noise is no longer the priority, and the reduction of aircraft CO2 emissions is.
    - We agree that noise and emissions are going to be the primary impacts that many stakeholders and members of the public will have the greatest interest in. However, to be considered further in the process any route option must first meet each of the 'must have' design principles Safety, Policy and Capacity.
    - Noise impacts tend to be more subjective and require more detailed interpretation and a route may be good for noise but bad for emissions and vice versa. In addition to the Design Principles Evaluation and Initial Options Assessment produced at Stage 2, when we go to full public consultation on a short list of routes, in Stage 3, we will produce a data driven analysis of our shortlisted options.
- A report on our engagement will be sent to the CAA highlighting the changes made as a result of the insights provided by our stakeholders.




In this slide we will talk you through the design envelopes for Runway 23, that we showed you in November and December, and how these have changed as a result of the design process. I'll run through each in turn.

A is the 23 North Design Envelope and you can see that we have removed an area along the right-hand edge of the envelope. The international design rules document PANS OPS 8168 lays down the rules where you can and can't design including the point at which aircraft turn. When we applied the rules, it was clear that such a sharp turn radius was not possible, therefore a revision to the envelope was required. The updated envelope matches to the radius of the earliest turn possible to align with both Design Principles Safety and Policy.

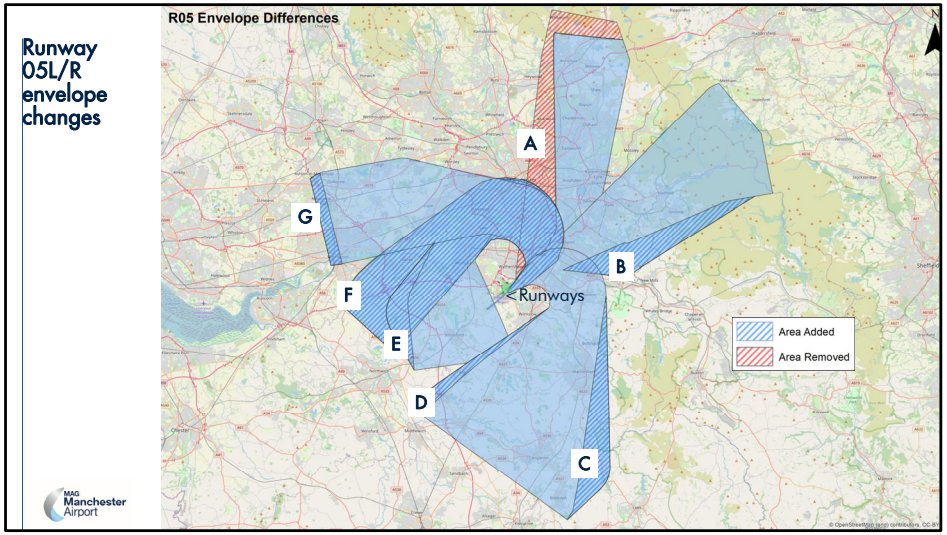
In B there is a small extension at the end of the East Left-turn Design Envelope at 7,000ft. This takes account of a route we designed to be as short as possible in line with the Design Principle Emissions. Because the route took such a tight turn it was heading east much sooner and for aircraft to have sufficient distance to achieve 7,000ft we have had to extend the envelope slightly east.

In C we have added an area to the east of the Southbound Design Envelope because we have designed route options that aim to avoid Congleton in line with the Design Principle Noise N1. These options are just to the east of the town, so we have expanded the envelope to accommodate these options.

In D we are looking at the South-west Design Envelope, and we have reduced the size of the envelope because of potential interaction between route options in this envelope and those in the southbound envelope. This aligns with the design principles Safety and Capacity.

In E, our initial design envelopes took into account existing routes that could be used to both the west and south-west which resulted in duplication. To make the use of the envelopes clearer we have removed the overlapping area to create distinct envelopes for south-west and west traffic.

Finally in F we have added an area to the north of the 23 West Design Envelope. This is in recognition of bilateral meetings with NATS which highlighted potential interaction with Liverpool traffic. This aligns with the design principles Safety, Policy and Capacity.




In this slide you can see the comparison between the design envelopes for Runway 05 and how these have changed.
Starting with A, the initial boundary of the 05 North Design Envelope was created to accommodate an early left turn. When reviewed, the position may have impacted the design principles Safety and Capacity by creating conflict with other routes. Therefore, we have removed an area to the west and northern edge of the envelope to reduce the risk and avoid potential interaction with routes in other envelopes, specifically the 05 West and South Left Turn.
In B, we have added an area to the lower edge of the 05 East Design Envelope. This change has been made to accommodate a route that is aligned to the Design Principle Capacity and helps to align all route options in this envelope with the NATS network traffic flow in line with the Design Principle Safety.
In C, we have added an area to the right of the 05 South Design Envelope. This is because we have created options that avoid direct overflight of Macclesfield in line with the Design Principle Noise N1. These route aircraft to the east of the town, so we have expanded the envelope to accommodate these accordingly.
D indicates where we have added a small area to the north of the 05 South Design Envelope to accommodate route options in that area. These options have been created to reduce the interaction with inbound aircraft to Runway 05L/R. This aligns with the design principles Safety and Capacity.
In E, we have extended the westerly edge of the 05 South Left Turn Design Envelope to provide more room for options that can align to the Design Principle Noise N1. These options route slightly further west to avoid communities before turning south, and this has resulted in this change.
In F, we have a new design envelope, which has been created in line with two design principles. Firstly, we are responding to the Design Principle Safety by seeking to provide an alternative envelope that removes potential conflicts with Liverpool traffic present inside the 05 West Design Envelope. Secondly, it enables the creation of a shorter route to the south-west in line with the Design Principle Emissions. At present, traffic routing to the south-west needs to route via the west envelope initially before turning south-west later. Routes within this envelope make that turn earlier and therefore reduce track miles, fuel burn and emissions.
Finally, in G the end of the 05 West Design Envelope has been slightly extended. This is to accommodate the shortest possible route to the west which turns as early as possible after departure. This reduces fuel burn in line with the Design Principle Emissions. Because the route took such a tight turn it was heading west much sooner and for aircraft to have sufficient distance to achieve 7,000ft we have had to extend the envelope slightly west.

# THE DESIGN PROCESS

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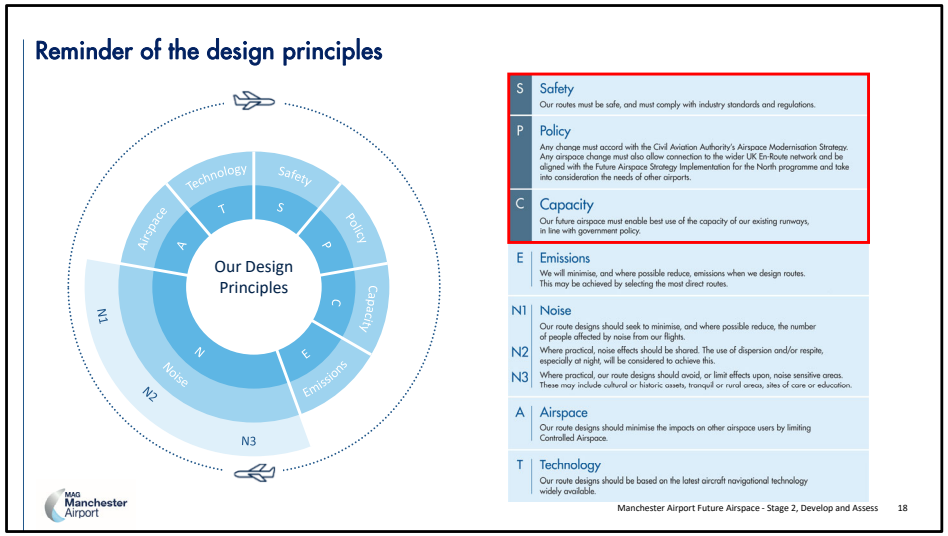



What you can see here are the nine design principles that were developed at Step 1B and have been agreed with the CAA. These are high level considerations that guide the development of the options as we progress through the airspace change project. These principles reflected discussions with stakeholders, and you'll see in our discussion today how they've guided our work.

Our task in this has been to use these design principles to create a set of route options within each of the design envelopes. If you recall, for departures these envelopes route from the runway up to 7,000ft and for arrivals it's the opposite, with envelopes going from 7,000ft down to the runway.

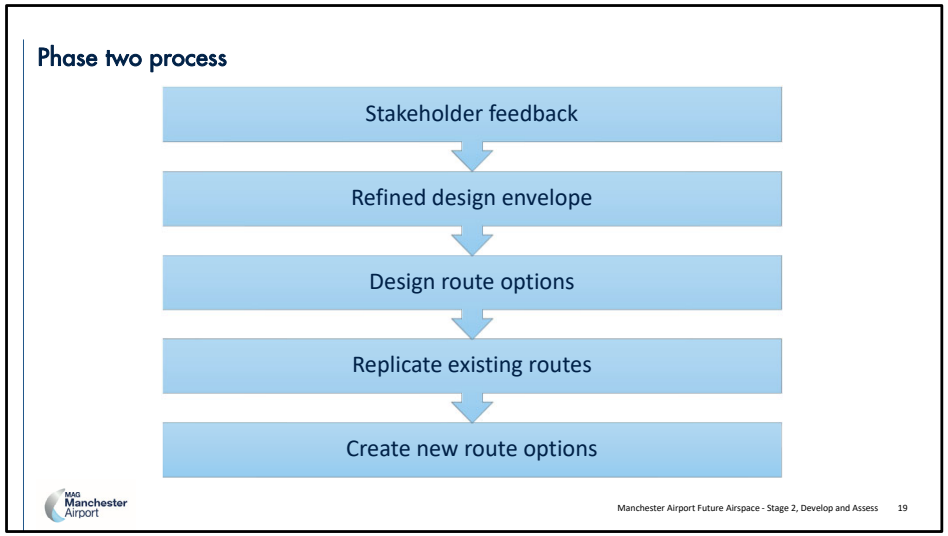
There are three design principles that are highlighted, which are Safety, Policy and Capacity, and these are important in informing our route options as they are those design principles which any design option "must" meet.

So, for example, in our earlier engagement sessions we outlined the rules and regulations that relate to safety and all our route options must meet these standards.

We've adopted a staged approach to identify a long list of options and then refine this down to focus on the options that are realistic, or viable, when viewed against these 'must have' design principles.

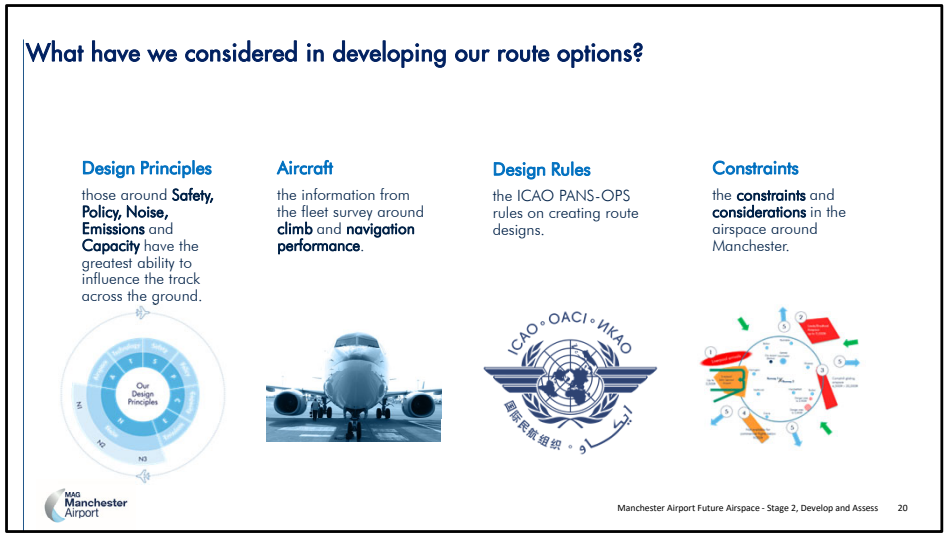
We'll talk cover a little more about this process later, but it's these viable options we're sharing with you today.

The next two slides give you some detail about how this process has been applied.

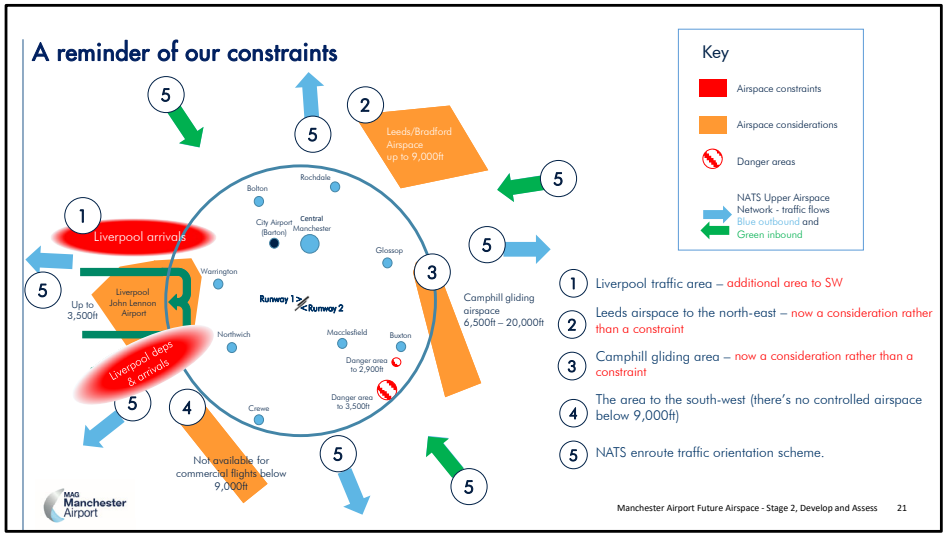



Beginning with the feedback we received from you last year we have refined the design envelopes. Then we've designed route options within these envelopes.

In each design envelope one of the route options replicates the existing route but has been designed using the new RNAV/ RNP technologies described earlier. We've done this as the existing routes won't work when the ground-based beacons, that we currently rely on, are switched off. It also allows us to show and compare the minimum, possible change.




So, what have we considered in developing our route options?
First and most important they address the Statement of Need and align with our design principles. All are important, but it's those that relate to safety, policy, noise, emissions, and capacity that have the greatest ability to influence where aircraft will route across the ground.
Secondly, we need to take into account aircraft performance and to do that we have information from the aircraft fleet survey. This provides information including how quickly aircraft can climb and the standard of PBN navigation equipment that they have on board which is important in creating designs that are flyable.
I talked previously about design rules, and these are contained in a document created by the International Civil Aviation Organisation called PANS OPS 8168. These rules are important because they give technical information such as how soon aircraft can turn after departure, and how tight these turns can be. You'll see these reflected in the designs we'll show you later. The aim of these rules is to ensure aircraft safety, which is a must have design principle, so in some cases this means we can't always create routes that completely avoid a built-up area or perhaps take the shortest route.
Lastly there are the constraints and considerations which we will cover on the next slide




You may well remember this diagram from the first stage of engagement. It looks at what's going on around us and identifies the constraints and considerations we have. A constraint is something that would be extremely challenging if not impossible to alleviate. A consideration is something that could be challenging but might be something that can be addressed in our designs.

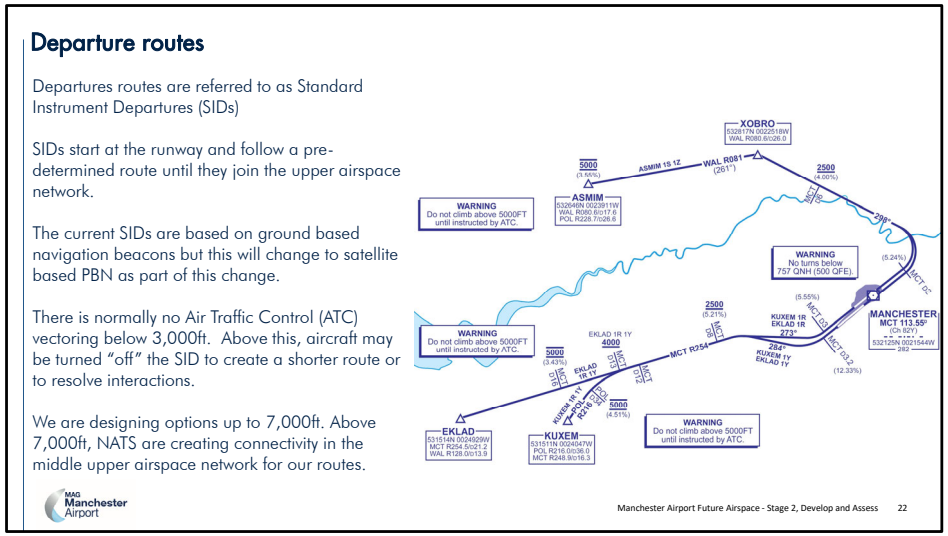
I won't talk through this diagram for too long as we covered this in detail before. However, I will take time to highlight three changes to this diagram since the first engagement.

First and most importantly is a new constraint that exists to the south of Liverpool and just to the west of Northwich. This is as an area where flights between Liverpool and Manchester may interact and was identified through discussions with Liverpool Airport. As we move into the next stage of the process, this is an area where we will need to focus efforts on creating a safe and efficient system. We've placed that on the map as a constraint because at this stage routing through this area would not be consistent with our design principles Safety and Policy.

Secondly, is a change to number 2 and the interaction with Leeds-Bradford Airport. Following discussions with NATS it has been agreed that this can be reduced to being a consideration rather than a fixed constraint. This is because the interaction between our respective routes is infrequent and would not take place below 7,000ft. Any interaction would therefore be within the airspace under the control of NATS. However, this lowering of status has not resulted in any envelope or route changes because the NATS network of routes as shown by arrow number 5 takes traffic to the south and west of this Leeds airspace.

Thirdly is the NATS network airspace to the south-east which you may recall is used for gliding activity and which sometimes extends to nearly 20,000ft. Conversations with NATS have reduced this to a consideration rather than a fixed constraint, and again this is because this airspace is under control of NATS and the interactions would not take place below 7,000ft. This change in status has not resulted in any change to departure design envelope or routes but this has been a consideration for our arrival options.

So, in summary, all these elements need to either be considered or act as a constraint to our design of options, and whilst only a few sit within our immediate vicinity, the height to which some extend, does influence our design.



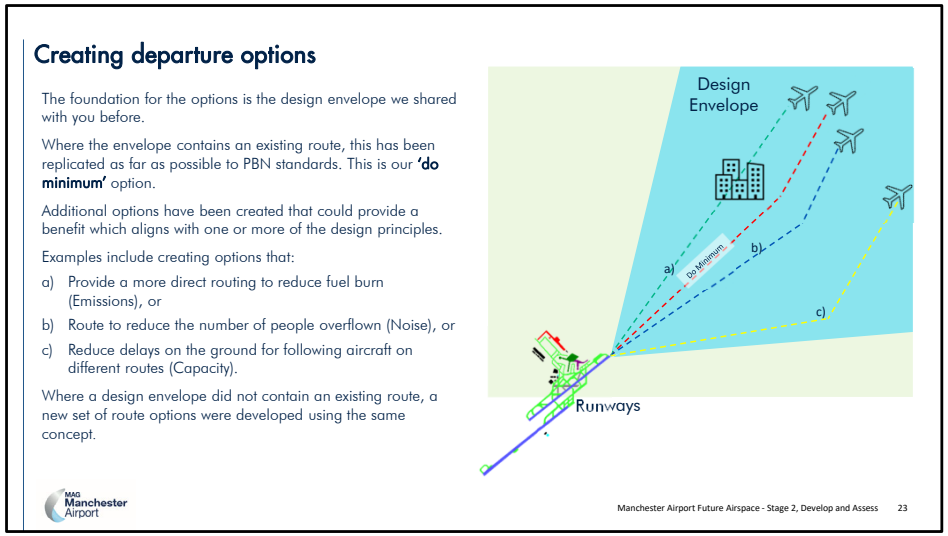

Next, we'll talk briefly about the departure routes and refresh some of the information we spoke about in the first stage of engagement.

As we said before, for safety reasons aircraft take-off and land, flying into the wind. In the UK the wind usually comes from a westerly direction so that results in Runway 23 being used more often than Runway 05.

Almost all aircraft flying out of Manchester follow one of the pre-determined departure routes called Standard Instrument Departures or SIDs. These are a series of navigation instructions which simplify the departure process by providing the pilot with several way points which they follow after departure. The diagram on this slide shows the current west and south-west routes from both the easterly and westerly runway directions as an example of the current SIDs.

After departure, aircraft will follow the course of the SID until at least 3,000ft but above this altitude it is not uncommon for Air Traffic Control to turn aircraft off the SID. This is the process known as vectoring that we described in the first stage of engagement and involves ATC turning aircraft to create a more direct route or to resolve interactions with other aircraft.

The new SID options we're creating extend to 7,000ft and above this NATS are creating an upper airspace network that will join up with our new routes. The expectation is that vectoring will tend to reduce, and aircraft will follow more defined routes with much less dispersal.




In our last engagement sessions, we showed you some departure design envelopes. We have designed route options within these areas and will talk you through them in this hypothetical example.

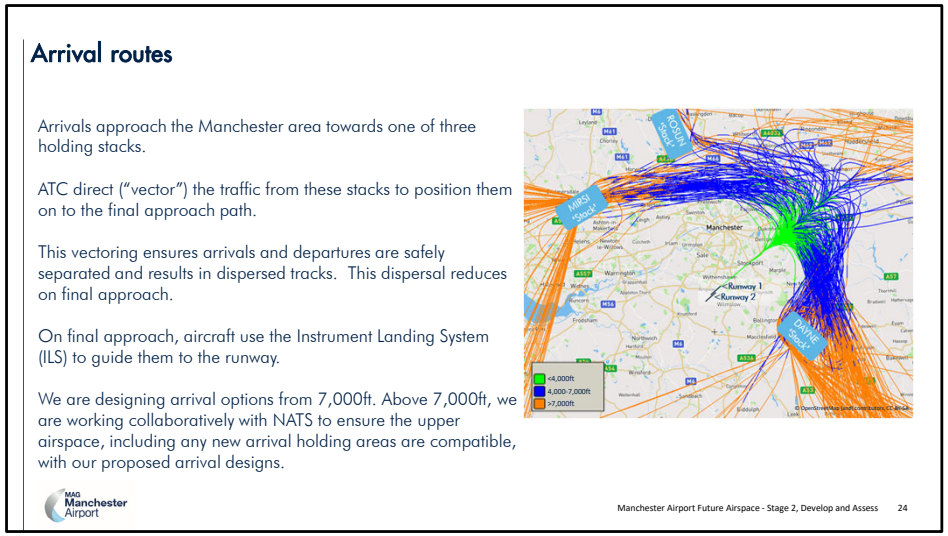
Where an envelope contains an existing route, we have replicated this to the new PBN standard as closely as possible within the design rules for PBN. This option is known as the 'do minimum' option and represents the least change possible within the PBN design rules. As mentioned previously, this is a requirement of the CAP1616 process. On the diagram you see here, the 'do minimum' option is the existing route and is shown by the dotted red line through the centre of the design envelope. Additional options were then created that could provide a benefit and which align to one or more of the design principles. On the diagram to the right, you can see some examples of how these route options have been built up.

So, route A, represented by the dotted green line, provides a more direct routing to 7,000ft. This means aircraft would burn less fuel on this route, and that's in line with the Design Principle Emissions.

Route B aims to reduce the number of people overflown, and therefore aligns to the Design Principle Noise N1.

Route C turns as soon as possible after departure, which has the potential to reduce delays on the ground for following aircraft. This is aligned to the Design Principle Capacity.

As we showed you before there are some design envelopes that are new and so these wouldn't have an existing route. In these envelopes we have designed the route options in exactly the same way as we have here, so all of the options are aligned to the design principles. The only difference is there is no replicated 'do minimum' route.




In our last engagement sessions, we talked to you about the arrivals to Manchester and the use of the three holding stacks. If the Airport is busy, there can be a build-up of aircraft instructed to hold in one of the stacks, where aircraft are separated vertically by 1,000ft in height. We have DAYNE to the south and MIRSI and ROSUN to the north, and you can see these on the diagram here.

Air Traffic Control use a process called vectoring to take aircraft from the stacks to position them on the final approach. This vectoring involves changes to course over the ground, height, and speed and ensures arrivals and departures are safely separated. This results in the dispersed tracks you can see here, but when aircraft are established on their final approach this dispersal reduces because they're using a system called the Instrument Landing System or ILS to guide them directly to the runway.

Our arrival route options are from 7,000ft to the runway and aim to use less vectoring although some will remain. This is because we need to ensure aircraft are safely separated and so we can maintain runway throughput so delays don't build up which would result in more emissions. Above 7,000ft, we are working collaboratively with NATS to ensure the upper airspace, including any new arrival holding areas, are compatible with our proposed arrival designs.

## Creating arrival options

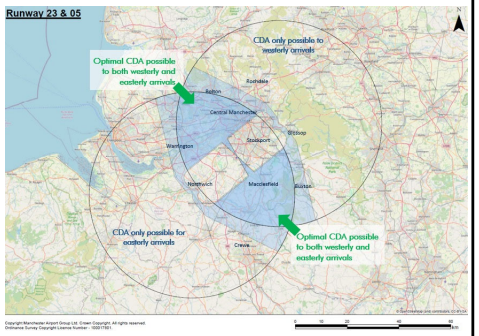
The foundation for the options is the arrivals design envelope we shared with you before.

This was developed to respond to the Policy requirement to provide a Continuous Descent Approach (CDA).

Like departures, our arrival options have been created to align with one or more of the design principles.

Examples include creating options that:

a) Route to reduce the impact of overflight (Noise N1 or N2) or
b) Reduce the interaction with departure options (Safety) or
c) Ensure routes remain within airspace boundaries (Airspace and Policy).



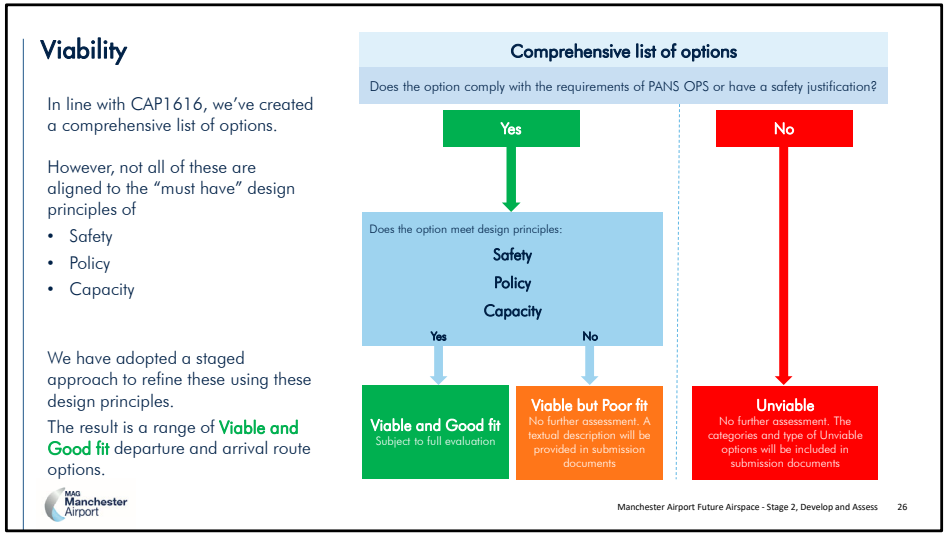

MAG Manchester Airport

Manchester Airport Future Airspace - Stage 2, Develop and Assess 25

For the arrivals options, we begin with the arrivals design envelope which you can see here on the right.

This was developed to respond to the Design Principle Policy and the requirement to provide a Continuous Descent Approach, or CDA, to both runway directions. You can see the blue shaded area within which this is possible, and we'll speak more about CDAs shortly.

Like the departures, our arrival options have been created to align with one or more of the design principles. So, for example we've created options that may route to reduce the impact of overflight in line with the Design Principle Noise. Other options help reduce the interaction with our departure routes in line with the Design Principle Safety, and other options route to remain within the airspace boundaries around Manchester which aligns with both the design principles Airspace and Policy.




As you'd expect, the process of options development has generated a lot of options, some of which respond to the design principles better than others.

What we've done is adopt a staged approach to identify a long list of options and then refine this down to focus on the options that are realistic, or viable. Initially we've based this on alignment with the three must have design principles of Safety, Policy and Capacity.

So, if we look at the diagram on the right, you'll see we have a comprehensive list of options, and the first filter is to make sure we align with the rules. We talked earlier about the rules for route option design being governed by the International Civil Aviation Organisation under the document PANS-OPS 8168 (Procedures for Air Navigation Services – Aircraft Operations). This provides a policy framework for aircraft operating safely and any options that are unable to meet this requirement are considered as Unviable.

There may also be some existing routes that are approved for operation today, but because the rules for PBN are slightly different, they don't fully align to PANS OPS. Because these are operating today these have an existing safety justification approved by the UK CAA and are considered viable. However, if they don't have this safety justification these are also considered unviable. Unviable scenarios will be outlined in our design options report but won't be developed in detail or analysed further.

We then consider the three design principles of Safety, Policy, and Capacity with which all options must comply. Safety considerations are already contained within PANS OPS but there are also other safety considerations such as avoiding interactions with other aircraft that need to be complied with. Policy covers PANS OPS but also UK CAA policy such as the Airspace Modernisation Strategy. Capacity considerations make sure we don't create options that have the potential to create delays by interacting with other routes. If an option can meet all three of these criteria, it'll be taken forward as Viable and Good fit. These are the options we're talking about today and will be in the material we'll send out to you.

However, if an option can't meet all three of these design principles it'll been classified as Viable but Poor fit, because although we can design it to the PANS OPS rules, it doesn't align with our must have design principles.

When we produce our full Design Principles Evaluation (DPE) report, at the end of this step, we'll describe both the Viable and Good fit options and the Viable but Poor fit options setting out which 'must have' design principles they cannot meet. The Viable and Good fit options will be subjected to the full Design Principle Evaluation.

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# ARRIVALS

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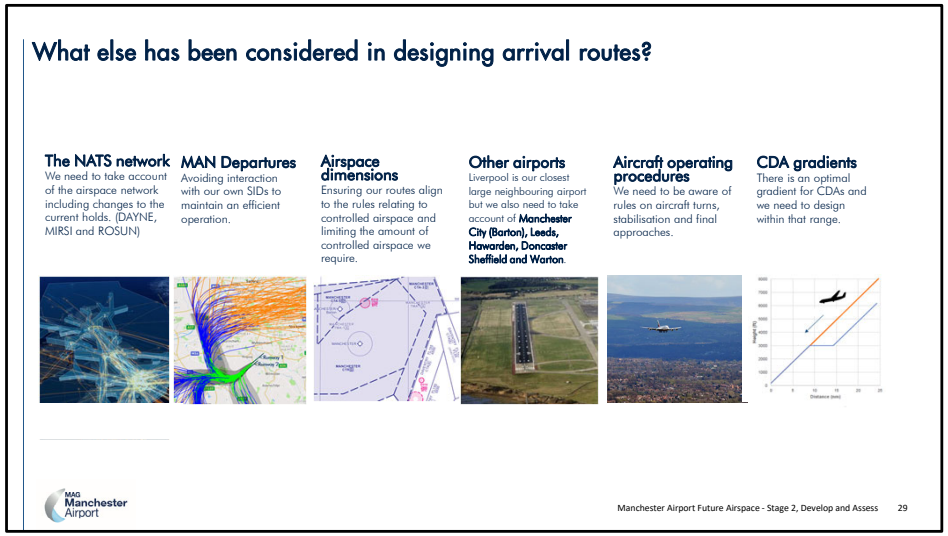



We talked earlier about what we've considered when developing our route options and the constraints that are around us. This slide is a reminder of some of those aspects and how they apply when designing our arrival options.

These are not in a priority order but together they are all important things to take account of.

So firstly, and in line with the Design Principle Airspace, we have the NATS upper airspace network, and we need to coordinate with them on where future arrival hold facilities will be so we can join our routes to their network. This aligns with the Design Principle Policy because creating an efficient network is part of the Government's Airspace Modernisation Strategy with which we must align.

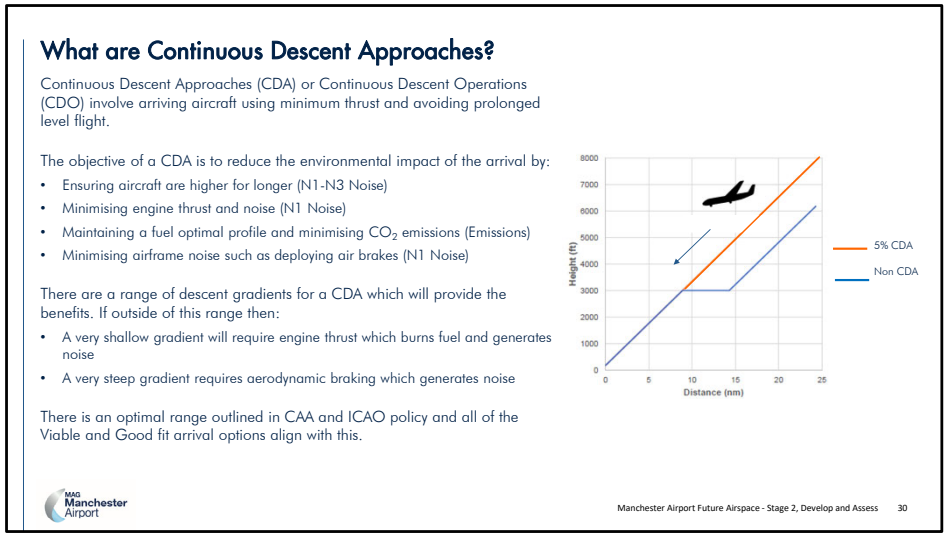
Next, we have a safety and capacity consideration, and the need to take account of our own departures and the departure design envelopes so they don't interact. Our future designs need to reduce interaction, and where possible we want to create a system that avoids aircraft having to level off on take-off or landing because of these interactions. This will help reduce both noise and emissions.

Next, we need to look at airspace dimensions, and in the constraints diagram we highlighted areas that we need to consider as we design our options. For arrivals it is the area to the east of Manchester that we need to be particularly aware of because of both the dimensions of the airspace and the high ground in that area.

Next is the policy requirement to consider the impacts on other airports and their airspace change proposals. You can see on the slide those airports we have engaged with.

Next is another safety consideration and the need to align to aircraft operating procedures. Here we're talking about how aircraft will fly the arrival routes, and how to make sure they can fly safely, and this has been informed by the aircraft fleet survey we've spoken about before.

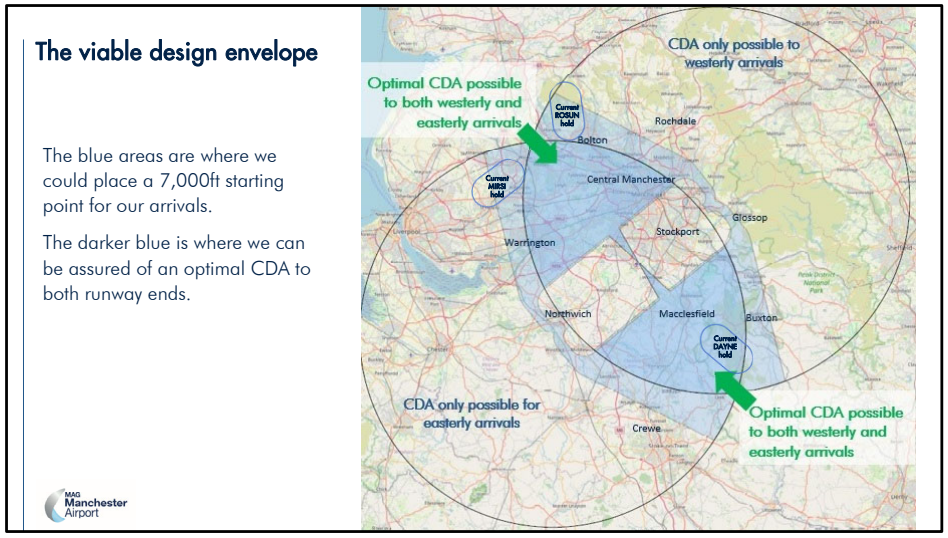
Lastly, we have a policy and emissions consideration, and we've spoken a lot about CDA. There is an optimal range of angles of descent for these to create the best noise and fuel benefits and, where possible, we want to design within that range.



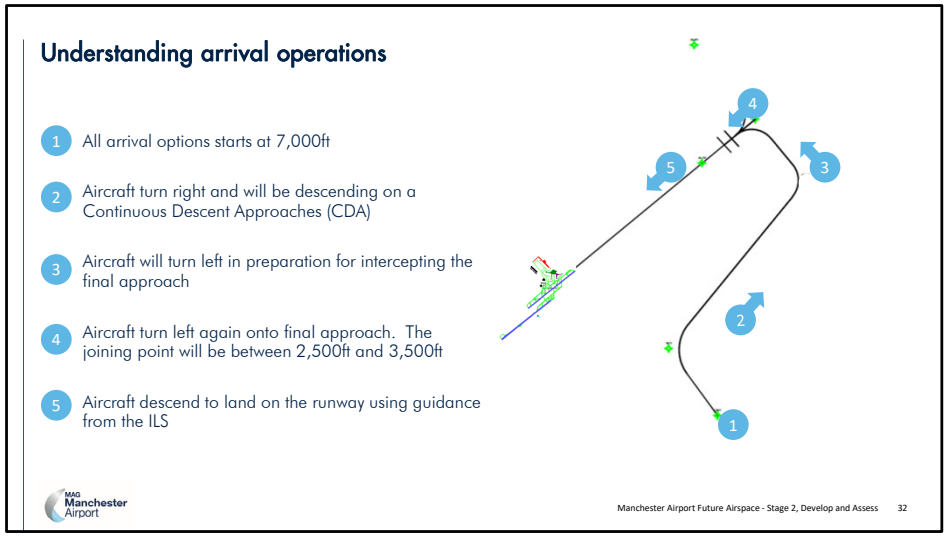

Continuous descent approaches or continuous descent operations (which are synonyms) have been in operation for a number of years and are a means of ensuring arriving aircraft use minimum thrust to reduce noise and emissions. They do this by avoiding prolonged periods of level flight, so in a way, they're a little like coasting gently down a hill rather than having to drive on the flat. You can see here the three main objectives of a CDA with regards to reducing the environmental impact of the arrival. All three of these can be linked directly to our design principles on environmental performance specifically Emissions and Noise. In addition, improving environmental performance is part of the Airspace Modernisation Strategy so CDAs also align to our Design Principle Policy, and this has driven design envelopes for arrivals.

Each aircraft operating into Manchester is different, because for every flight there are differences; for instance, in the weight of the aircraft, the fuel load and the number of passengers being carried. For this reason, there's not one fixed gradient for CDAs but a range.

The important thing is that we design arrivals options, so aircraft avoid periods of level flight and all of the Viable and Good fit options align with this optimal range.

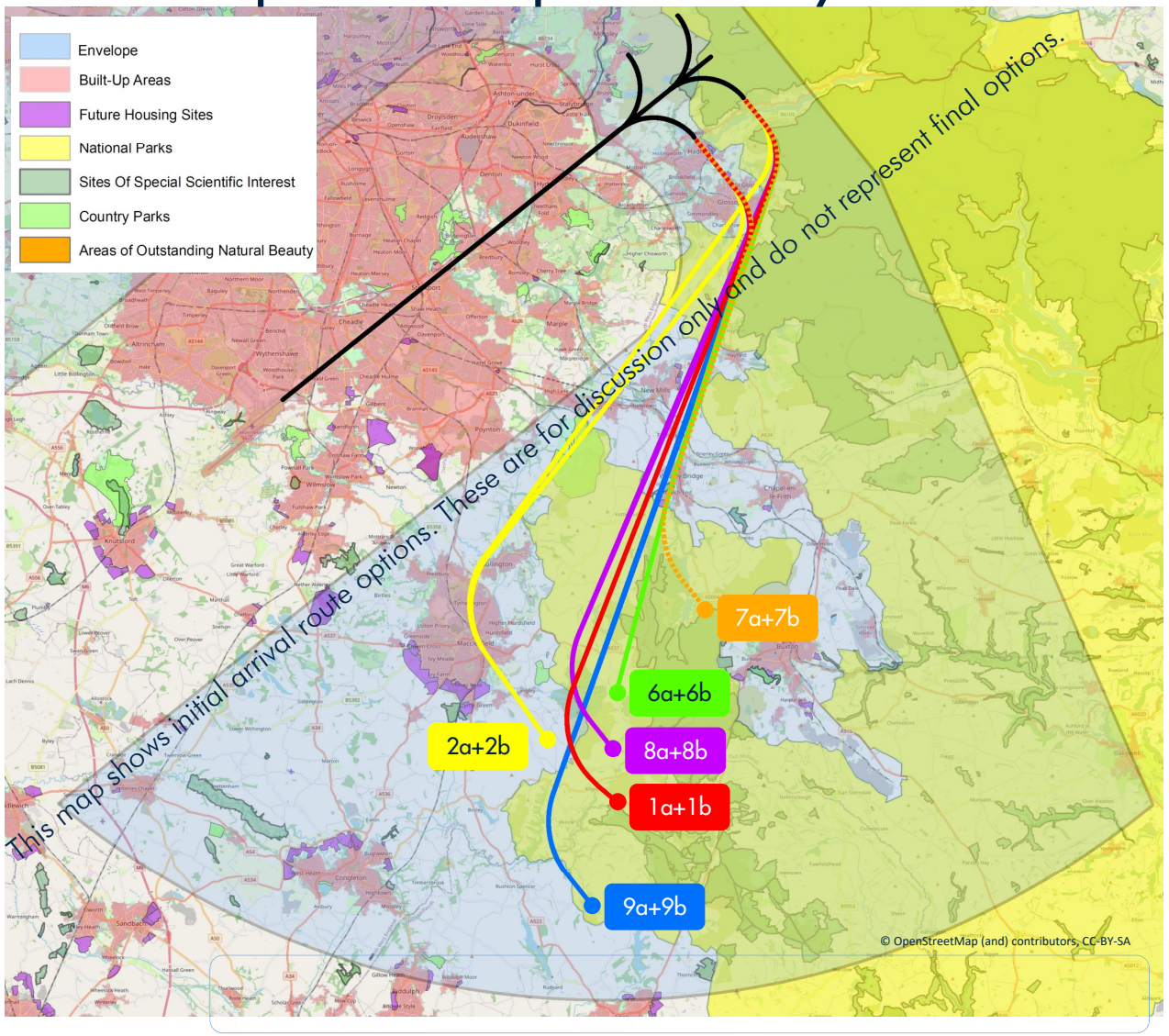



So, this is a very quick reminder of the viable design area for our arrivals which we spoke about a little while ago.
These two circles show the widest viable design area for the runways from the north-east or south-west. The darker blue areas, where the circles overlap, is an area where we could place our arrivals and get a CDA to both runway directions and we have marked optimal areas north and south.
We have designed the arrival options within the blue areas.




This next diagram is to help explain what the arrival options will look like.
As we said at the start, all our arrival options start at 7,000ft, and point 1 on the map marks that position for this option.
After passing this point aircraft start to descend and then turn right and, at point 2, they are descending on a continuous descent approach running nearly parallel to final approach.
At point 3 aircraft turn left and will still be descending as they prepare to join the final approach.
At point 4 aircraft turn left again onto the final approach. This point is flexible, and for Manchester is between 2,500ft and 3,500ft, that's around 8-12 miles from the runway. Between points 3 and 4 is the region where some ATC vectoring may still be required. This is for safety reasons to ensure the correct distance between aircraft and for capacity reasons to ensure the best use is made of the airspace.
Once they are joined on the final approach at point 5, the aircraft will descend to land on the runway using the guidance from the Instrument Landing System.

# Arrivals options example – Runway 23R South




This shows the Viable and Good fit design options from 7,000ft in the 23R South Design Envelope.

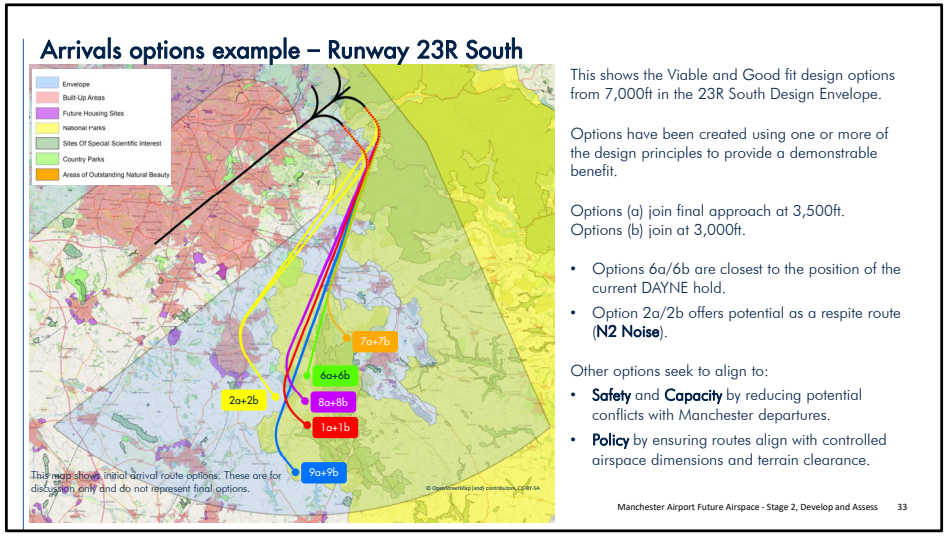
Options have been created using one or more of the design principles to provide a demonstrable benefit.

Options (a) join final approach at 3,500ft.
Options (b) join at 3,000ft.

- Options 6a/6b are closest to the position of the current DAYNE hold.
- Option 2a/2b offers potential as a respite route (N2 Noise).

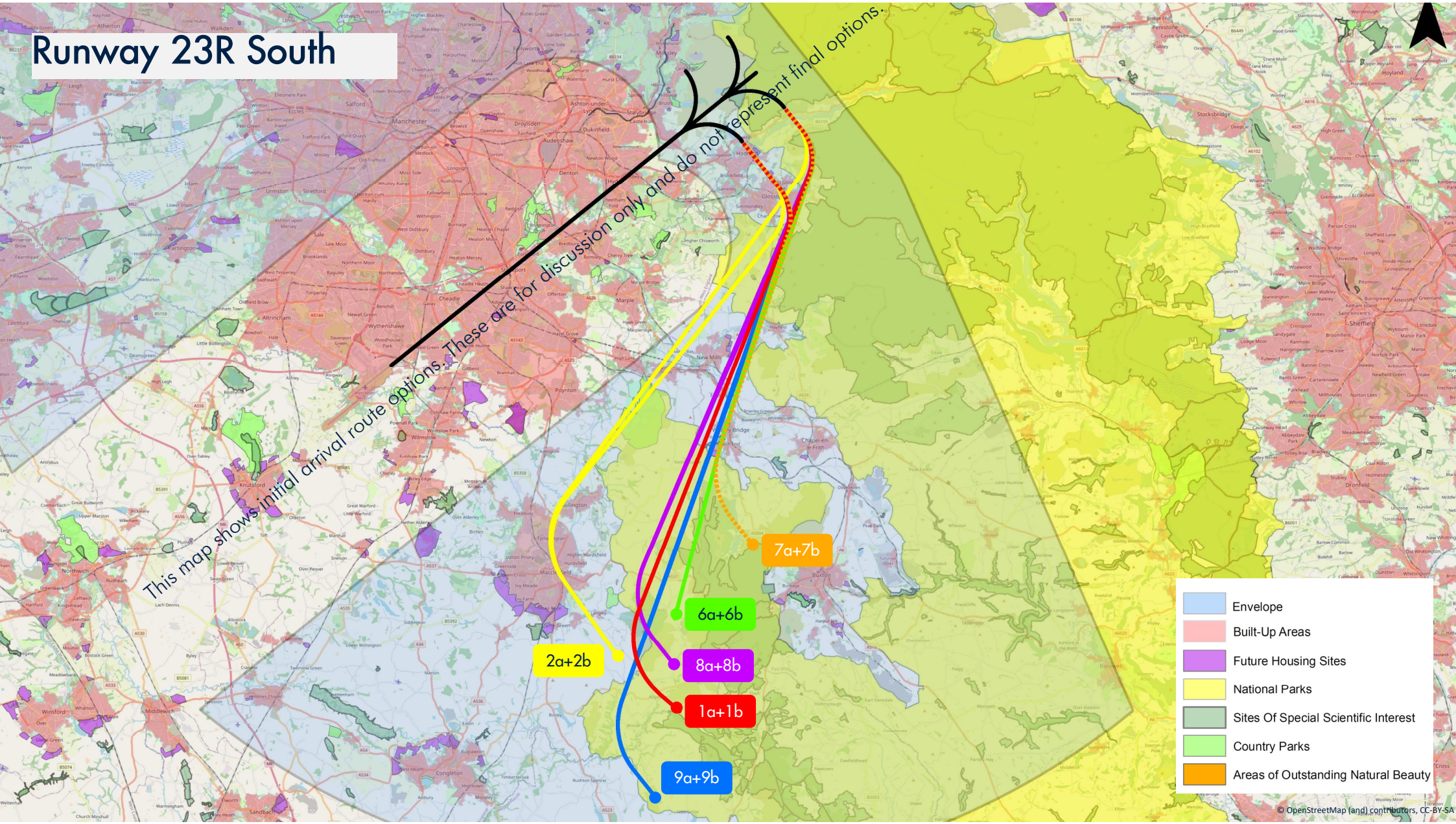
Other options seek to align to:

- **Safety** and **Capacity** by reducing potential conflicts with Manchester departures.
- **Policy** by ensuring routes align with controlled airspace dimensions and terrain clearance.




What we're showing here, are the arrival options for Runway 23R approaching Manchester from the south. These options are therefore all designed within the Runway 23 South Design Envelope.
The lines on the map represent the Viable and Good fit route options from 7,000ft, and have been created using one or more of the design principles.
As we have mentioned before, all the options can achieve a Continuous Descent Approach (CDA) from their starting points.
You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,500ft, about 12 miles from the runway, and the (b) options join at 3,000ft, around 10 miles from the runway. We have shown both these options so you can see the range of where aircraft would expect to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being directed by Air Traffic Control (ATC).
Of the options displayed here options 6a and 6b are the closest to the position of the current DAYNE hold, so these options most closely match current operations.
Option 2a and 2b have a slightly different track from the others and have been created as an alternative route for noise purposes in line with our Design Principle Noise N2.
All other options on the map have been created to align with the design principles Safety and Capacity by reducing potential conflicts with Manchester departures, particularly in the area just to the north of Macclesfield. By placing these routes in this position, they are deconflicted from departures envelopes which are slightly further north and west, whilst also applying the Design Principle Policy by remaining inside controlled airspace. The clustering is created by the routes remaining inside controlled airspace and the need to conform with the terrain clearance requirements created by the high ground of the Peak District to the east.
Route options 3, 4 and 5 are not shown because they have been assessed as Viable but Poor fit. This means these options did not align with one or more of the 'must have' design principles.
As described at the start, this is just one envelope and set of options for one of the runway directions. The remaining envelopes and colour coded routes, follow.

You can then review these in your own time and provide your comments back to us by Thursday 16th June.


Runway 23R South
This map shows initial arrival route options. These are for discussion only and do not represent final options.
2a+2b
6a+6b
7a+7b
8a+8b
1a+1b
9a+9b
Envelope
Built-Up Areas
Future Housing Sites
National Parks
Sites Of Special Scientific Interest
Country Parks
Areas of Outstanding Natural Beauty
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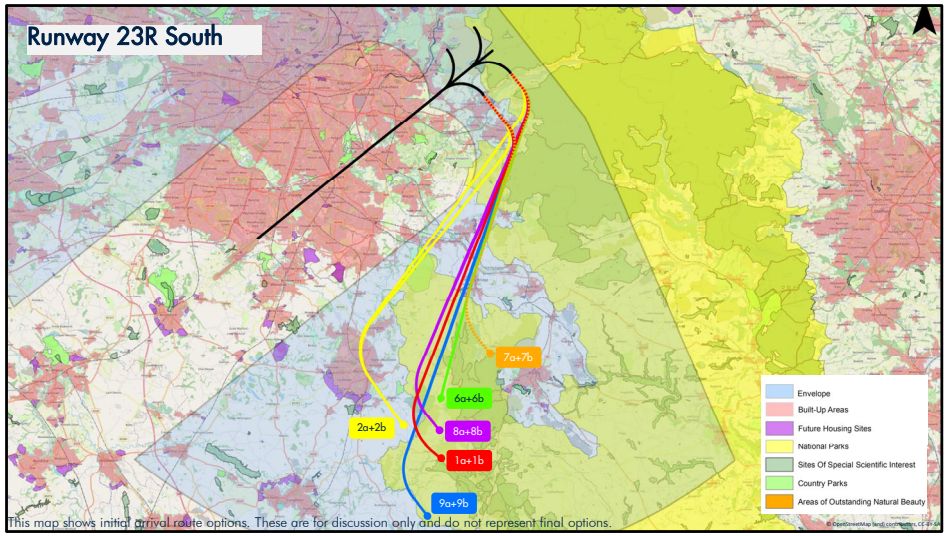



What we're showing here, are the arrival options for Runway 23R approaching Manchester from the south. These options are therefore all designed within the Runway 23 South Design Envelope.

You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,500ft, about 12 miles from the runway, and the (b) options join at 3,000ft, around 10 miles from the runway. We have shown both these options so you can see the range of where aircraft would expect to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being directed by Air Traffic Control (ATC).

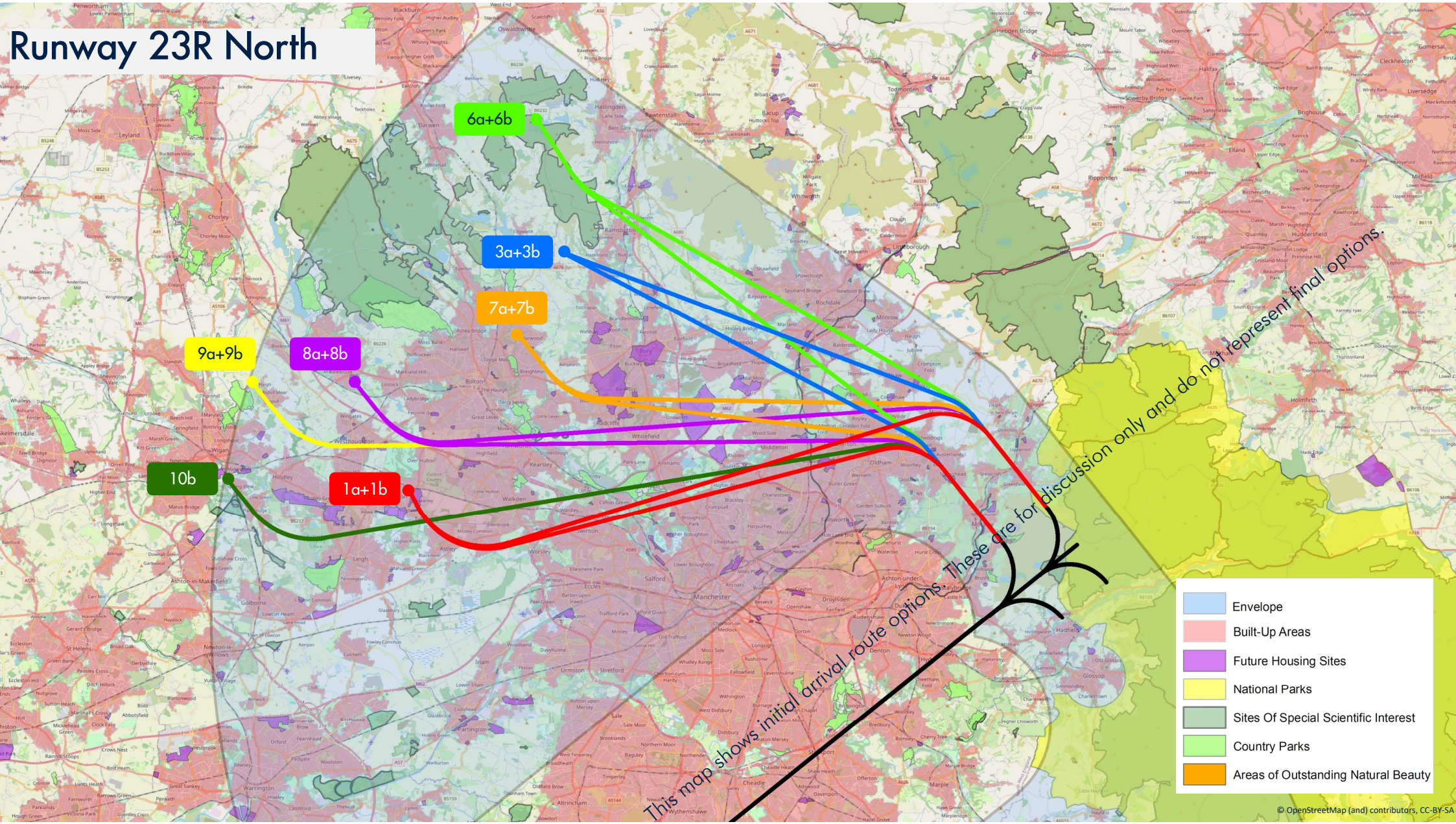
Of the options displayed here options 6a and 6b are the closest to the position of the current DAYNE hold, so these options most closely match current operations.

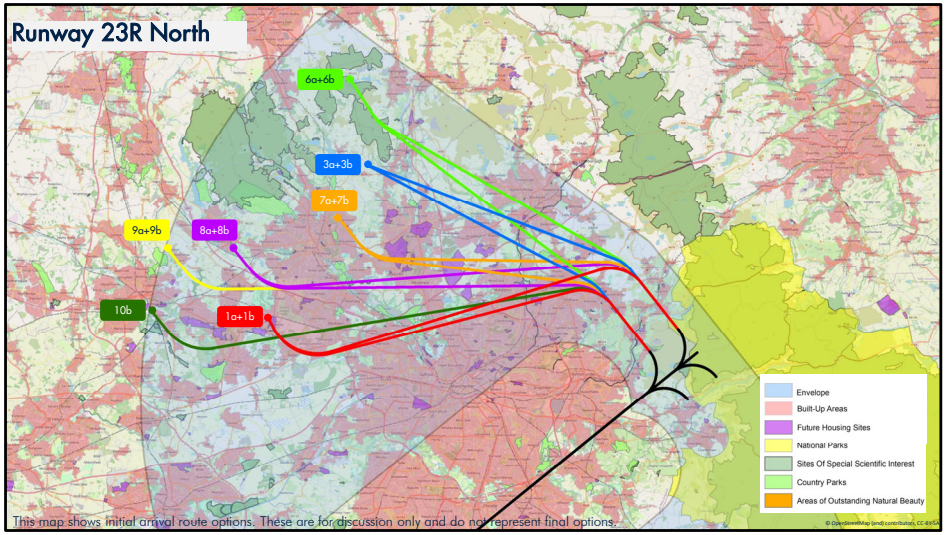
Option 2a and 2b have a slightly different track from the others and have been created as an alternative route for noise purposes in line with our design principles relating to noise.

All other options on the map have been created to align with the design principles Safety and Capacity by reducing potential conflicts with Manchester departures, particularly in the area just to the north of Macclesfield. By placing these routes in this position, they are deconflicted from departures envelopes which are slightly further north and west, whilst also applying the Design Principle Policy by remaining inside controlled airspace. The clustering is created by the routes to remaining inside controlled airspace and the need to conform with the terrain clearance requirements created by the high ground of the Peak District to the east.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 23R North






These are the arrival options for Runway 23R approaching Manchester from the north. These options are therefore all designed within the Runway 23 North Design Envelope.

The lines on the map represent the Viable and Good fit route options from 7,000ft and have been created using one or more of the design principles. As we have mentioned before, all the options can achieve a Continuous Descent Approach (CDA) from their starting points.

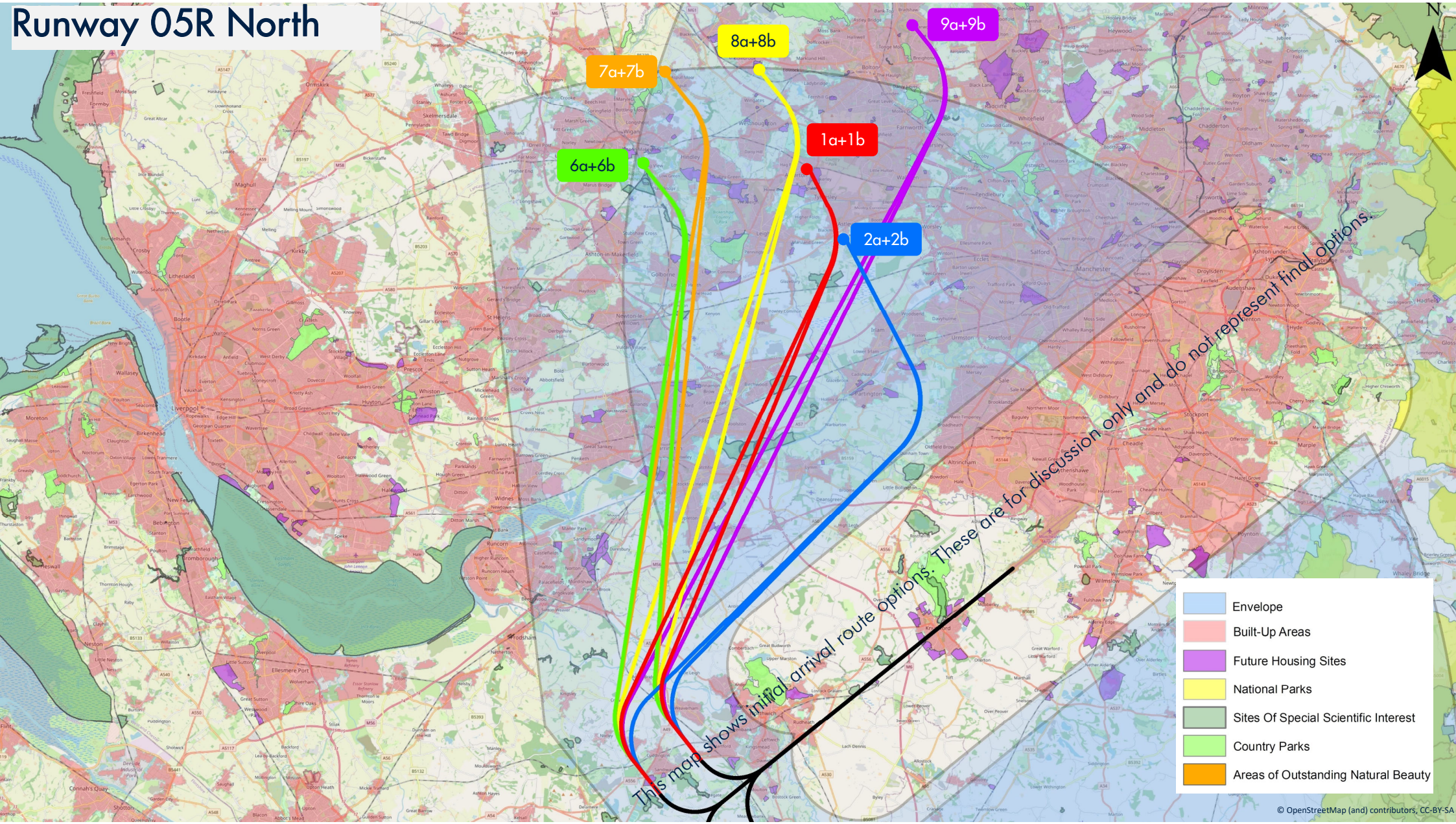
You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,500ft or about 12 miles from the runway, and the (b) options join at 3,000ft or around 10 miles from the runway. We have shown both these options so you can see a range of where aircraft would expect to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being vectored by Air Traffic Control.

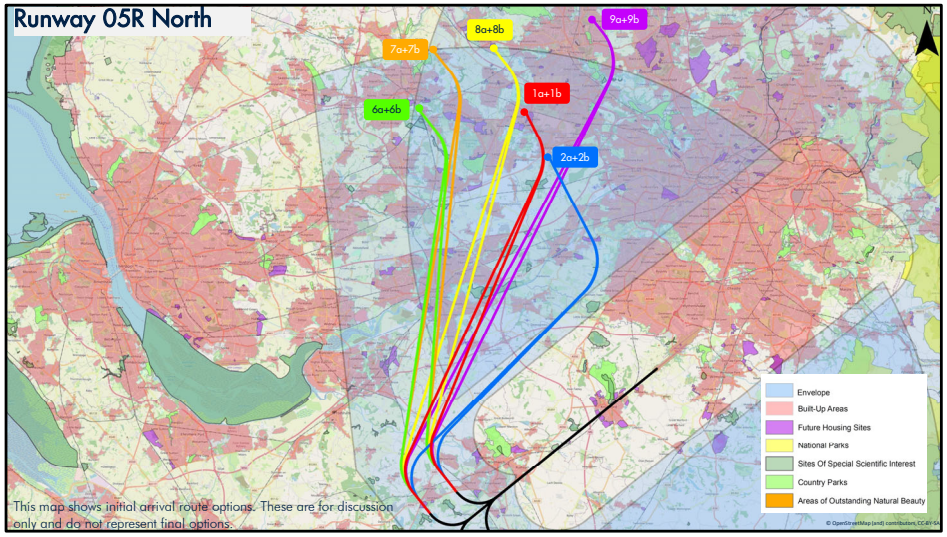
Of the options displayed here options 6a and 6b are the closest to the position of the current ROSUN hold, so these options most closely match current operations.

Option 3a and 3b have been created with less track miles than options 6a and 6b and align with the Design Principle Emissions.
All other options on the map have been created to align with the design principles Safety and Capacity by reducing potential conflicts with Manchester departures. They also align with the Design Principle Policy by remaining inside controlled airspace.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05R North






These are the arrival options for Runway 05R approaching Manchester from the north.

Option 9a and 9b sit outside the area which permits an optimised Continuous Descent Approach (CDA) to Runway 05 (see the overlap areas marked in slides 25 and 31) but are within the area where a CDA is possible. The starting point for 9a and 9b is the same starting point as the 23 North Design Envelope options 7a and 7b. Therefore, when considered together arrival options starting at this location are be optimised to our more common Runway 23 approaches (which account for 70-80% of operations).

The remaining lines on the map represent the Viable and Good fit route options from 7,000ft and have been created using one or more of the design principles.

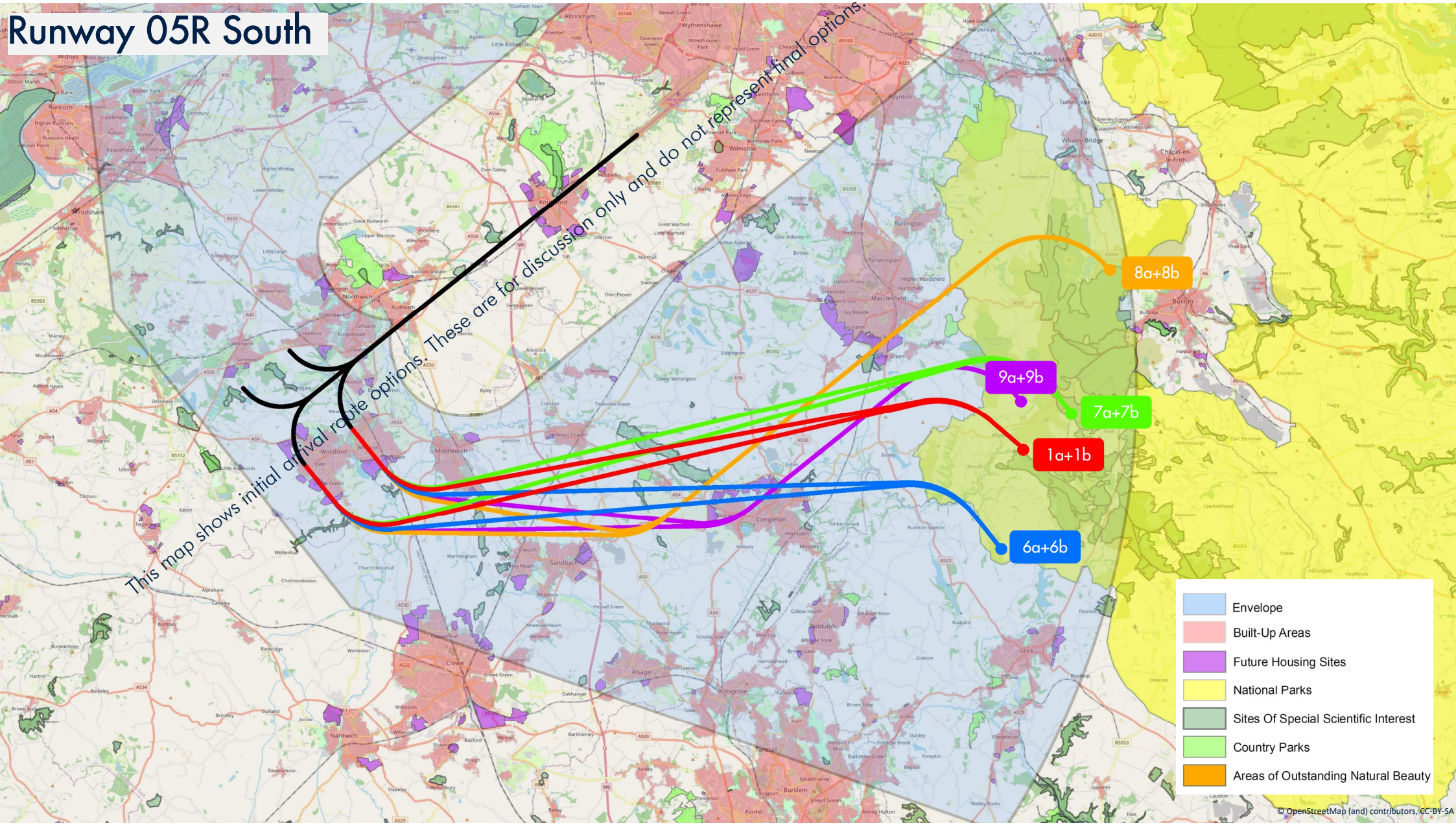
You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,000ft or about 10 miles from the runway, and the (b) options join at 2,500ft or around 8 miles from the runway. We have shown both these options so you can see a range of where aircraft would expect to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being directed by Air Traffic Control.

Of the options displayed here options 6a and 6b are the closest to the position of the current MIRSI hold and so these options most closely match current operations.

Option 2a and 2b have a slightly different track from the others and has been created as a possible relief route for noise purposes in line with Design Principle Noise N2.

*All other options on the map have been created to align with the Design Principles Safety and Capacity by reducing potential conflicts with Manchester departures. They also align with the Design Principle Policy by remaining inside controlled airspace.*

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*


Runway 05R South
This map shows initial arrival route options. These are for discussion only and do not represent final options.
8a+8b
9a+9b
7a+7b
1a+1b
6a+6b
Envelope
Built-Up Areas
Future Housing Sites
National Parks
Sites Of Special Scientific Interest
Country Parks
Areas of Outstanding Natural Beauty
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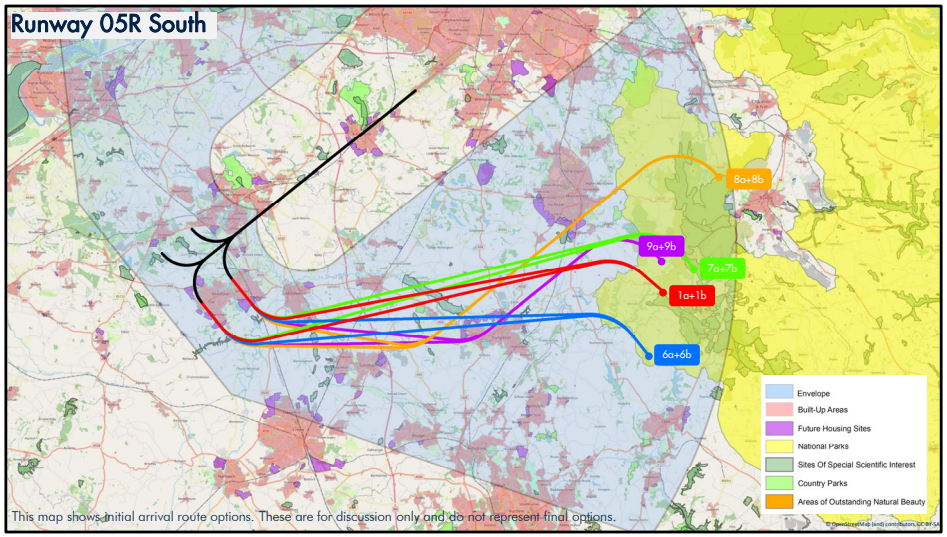



These are the arrival options for Runway 05R approaching Manchester from the south. These options are therefore all designed within the Runway 05 South Design Envelope.

The lines on the map represent the Viable and Good fit route options from 7,000ft and have been created using one or more of the design principles. As we have mentioned before, all the options can achieve a Continuous Descent Approach (CDA) from their starting points.

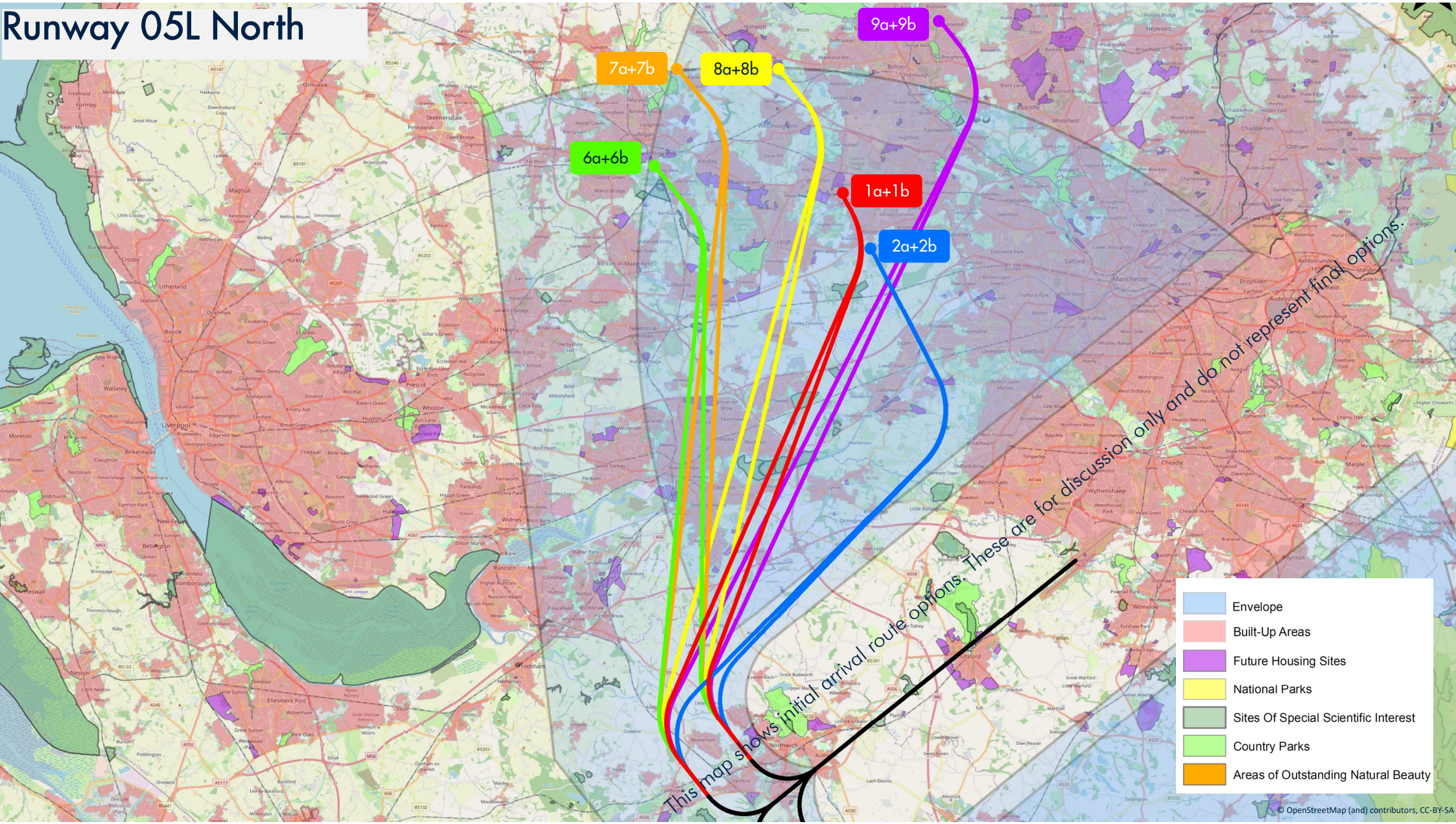
You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,000ft or about 10 miles from the runway, and the (b) options join at 2,500ft or around 8 miles from the runway. We have shown both these options so you can see a range of where aircraft would expect to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being vectored by Air Traffic Control.

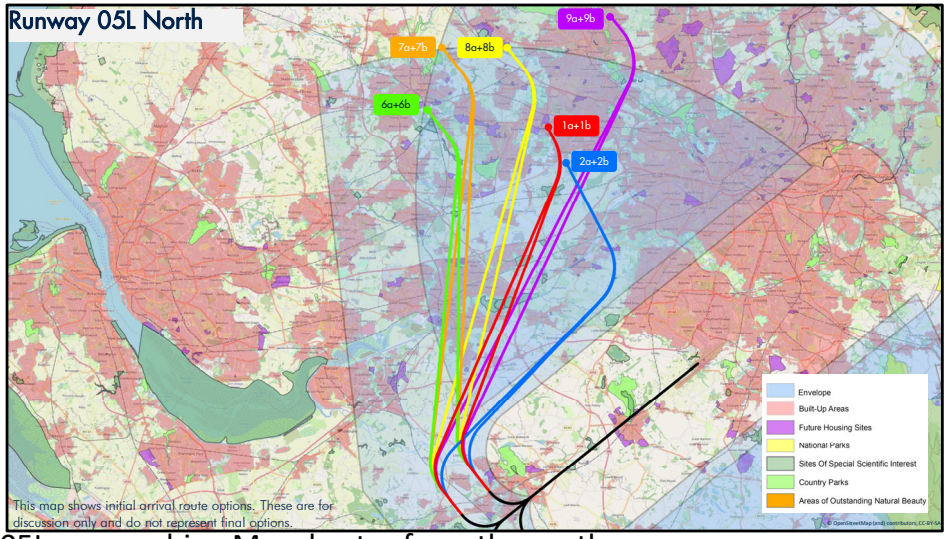
Of the options displayed here options 7a and 7b are the closest to the position of the current DAYNE hold, which we spoke about earlier, so these options most closely match current operations.

*Option 8a, 8b, 9a and 9b have a slightly different track from the others and have been created to reduce potential conflicts with Manchester departures by routing as close as possible to the edge of controlled airspace, aligning with our Design Principles Safety, Capacity and Policy.*
*All other options on the map have been created to align with the design principles Safety, Emissions and Capacity by reducing potential conflicts with Manchester departures, remaining within controlled airspace and attempting to reduce the track length compared to Options 8 and 9.*

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L North






These are the arrival options for Runway 05L approaching Manchester from the north.

Option 9a and 9b sit outside the area which permits an optimised Continuous Descent Approach (CDA) to Runway 05 (see the overlap areas marked in slides 25 and 31) but are within the area where a CDA is possible. The starting point for 9a and 9b is the same starting point as the 23 North Design Envelope options 7a and 7b. Therefore, when considered together arrival options starting at this location are be optimised to our more common Runway 23 approaches (which account for 70-80% of operations).

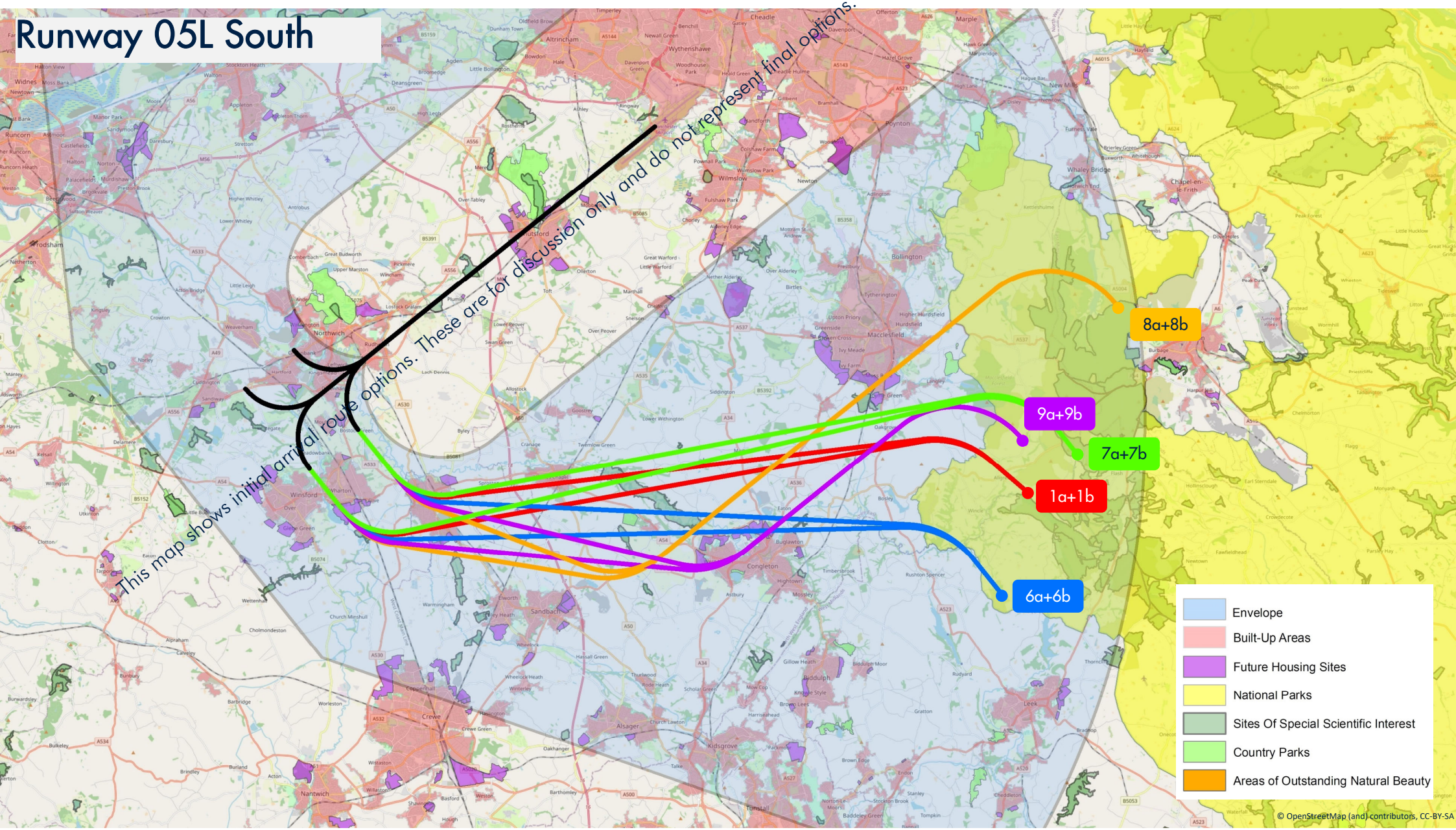
The remaining lines on the map represent the Viable and Good fit route options from 7,000ft and have been created using one or more of the design principles.

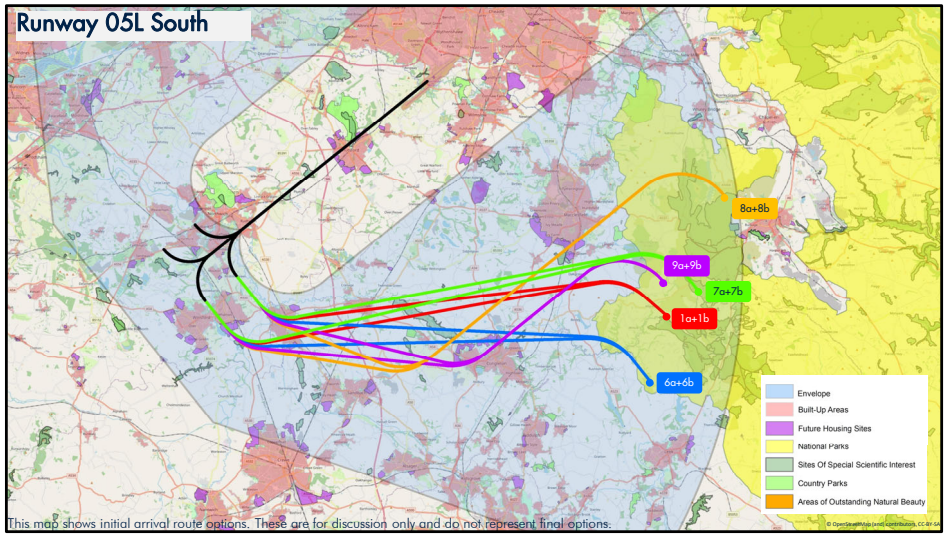
You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,000ft or about 10 miles from the runway, and the (b) options join at 2,500ft or around 8 miles from the runway. We have shown both these options so you can see a range of where aircraft would expected to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being vectored by Air Traffic Control.

Of the options displayed here options 6a and 6b are the closest to the position of the current MIRSI hold and so these options most closely match current operations.
Option 2a and 2b have a slightly different track from the others and has been created as a possible relief route for noise purposes in line with Design Principle Noise N2.
All other options on the map have been created to align with the Design Principles Safety and Capacity by reducing potential conflicts with Manchester departures. They also align with the Design Principle Policy by remaining inside controlled airspace.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L South






These are the arrival options for Runway 05L approaching Manchester from the south. These options are therefore all designed within the Runway 05 South Design Envelope.

The lines on the map represent the Viable and Good fit route options from 7,000ft and have been created using one or more of the design principles. As we have mentioned before, all the options can achieve a Continuous Descent Approach (CDA) from their starting points.

You will see that each option is marked as either (a) or (b). Those marked with an (a) join the final approach at 3,000ft or about 10 miles from the runway, and the(b) options join at 2,500ft or around 8 miles from the runway. We have shown both these options so you can see a range of where aircraft would expect to fly just before joining final approach, whether they are following the centreline of the procedure or whether they are being vectored by Air Traffic Control.

Of the options displayed here options 7a and 7b are the closest to the position of the current DAYNE hold which we spoke about earlier so this is likely so these options most closely match current operations.

Option 8a, 8b, 9a and 9b have a slightly different track from the others and have been created to reduce potential conflicts with Manchester departures by routing as close as possible to the edge of controlled airspace, aligning with our Design Principles Safety, Capacity and Policy.
All other options on the map have been created to align with the Design Principles Safety, Policy and Capacity by reducing potential conflicts with Manchester departures, remaining within controlled airspace and attempting to reduce the track length compared to Options 8and 9.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

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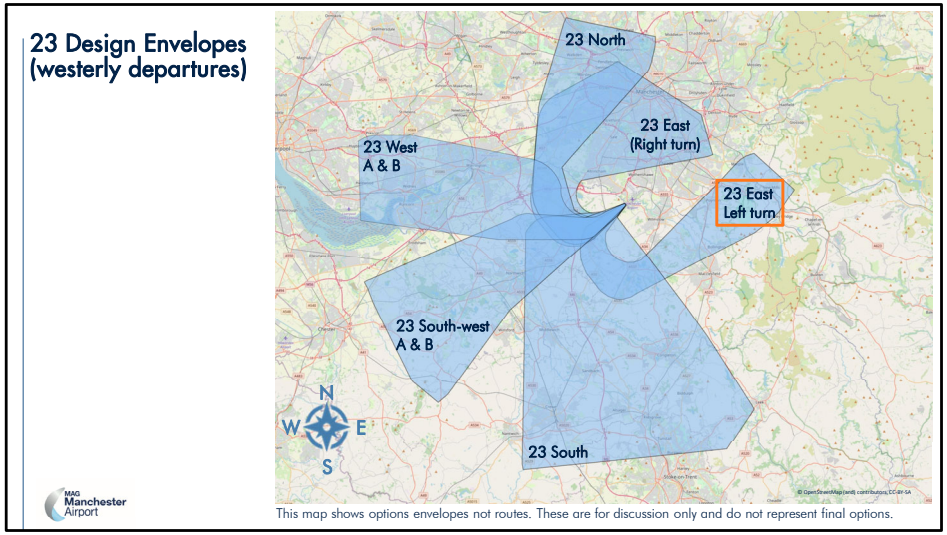
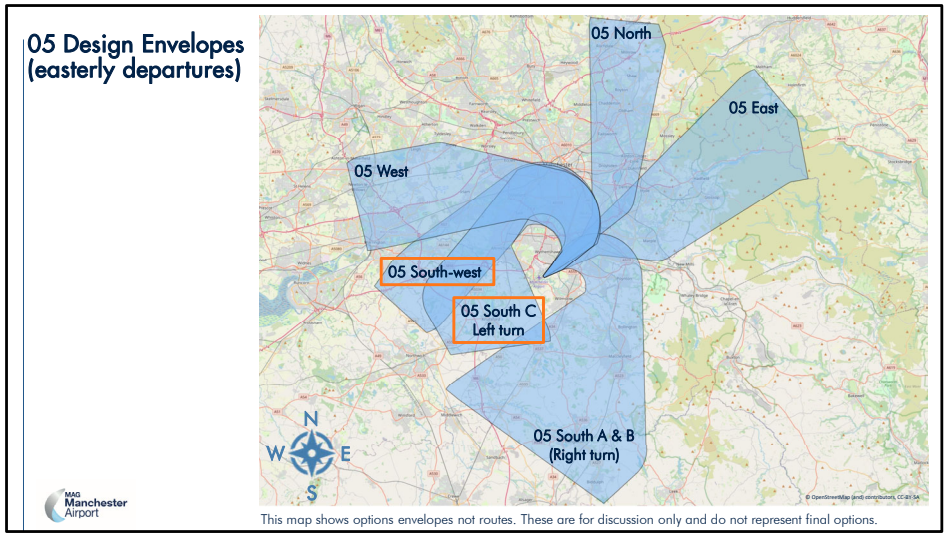
# DEPARTURES

MAG Manchester Airport



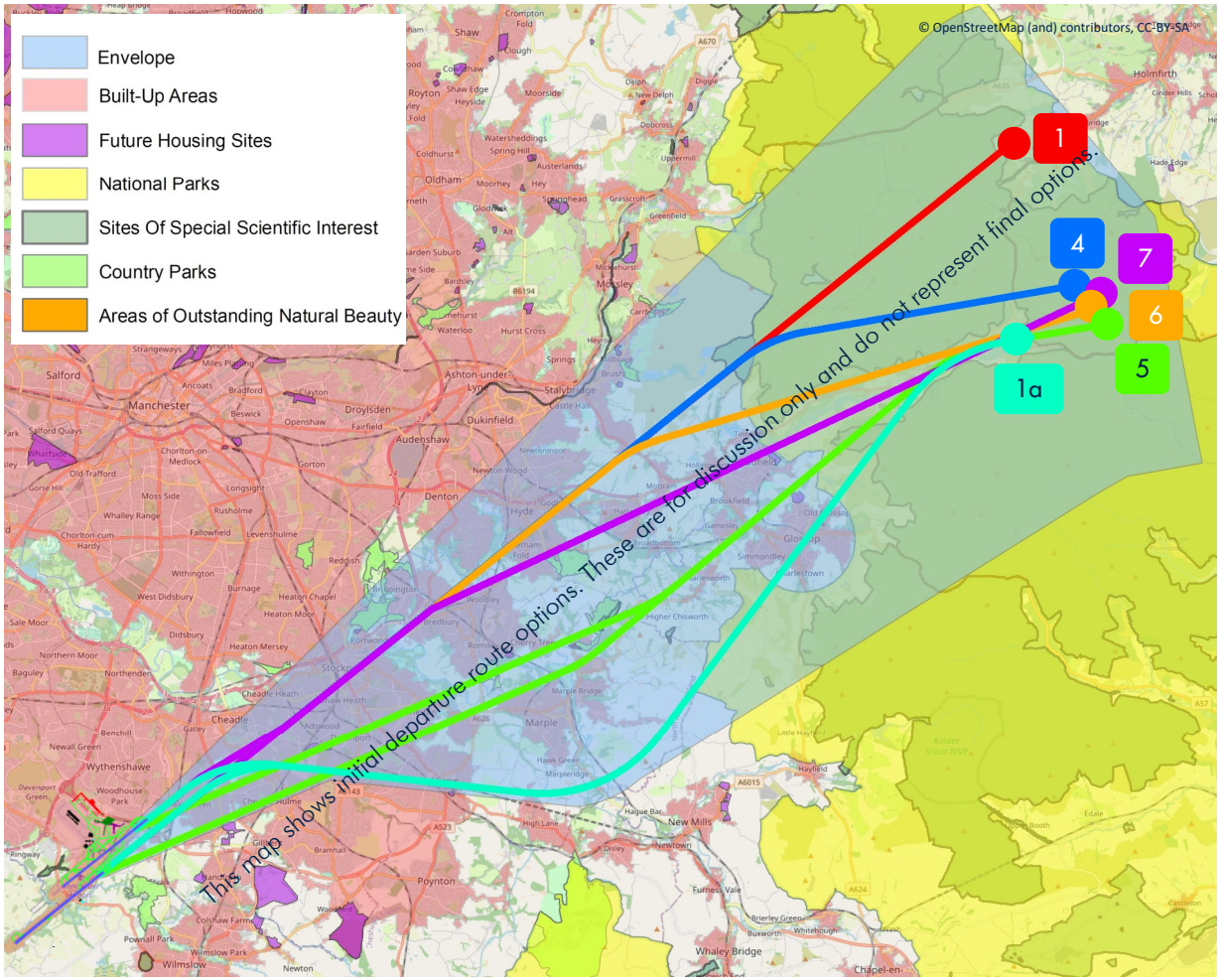

We will now take you through our departure route options. Remember, the design process under CAP1616, requires us to consider a comprehensive set of options- that address the Statement of Need and align with our Design Principles. When full public consultation takes place at Stage 3, we will be presenting a much shorter list of routes than you will see today. Using your feedback and by applying the CAP1616 process, during Stage 2 we will reduce the total number of options to those which offer the most benefits when measured against our design principles. That list of options will then be further reduced following assessment during the Initial Options Appraisal.

As a reminder, here are our departure envelopes for Runways 23 left and right. In the first engagement we explained that these were based on a combination of where we have existing departure routes, or where traffic is typically routed by ATC.
We created an envelope for eastbound traffic with a right turn and we also created a new envelope for routes heading to the east with a **Left turn** and that is highlighted here. So why have we done this? Firstly, our Design Principle Noise N2 requires us to look at ways to share noise, and this proposed design envelope offers an opportunity to deliver this. This is because an additional envelope may allow us to share noise and may provide an opportunity to create predictable noise respite. Secondly the CAP1616 process requires us to create a “Comprehensive list of options” where its viable for aircraft to fly. In this case, it is viable to design an envelope in this area, so this new envelope also aligns with the Design Principle Policy.




And these are our departure envelopes for Runways 05 left and right.
As with Runways 23 left and right these are largely based upon existing designed routes or aircraft tracks, but again we have created additional envelopes. So, as well as the existing southbound right turn from Runway 05 left and right we've also designed a left turn envelope to route traffic to the south which you can see highlighted as 05 **South C left turn**. Again, the rationale for this additional envelope is our desire to address Design Principle Noise N2. The envelope also responds to the high volume of flights in this direction, and this will allow us to look at ways to share noise and to align with the "must have" Design Principle Capacity.
As described earlier we've also designed a new envelope to the south-west in line with two design principles. Firstly, it responds to the Design Principle Safety by seeking to provide an alternative envelope that removes the conflictions with Liverpool traffic present inside the 05 West Design Envelope. Secondly, it enables the creation of a shorter route to the south-west in line with the Design Principle Emissions.
We will now show you a single envelope, with all the route options within it and explain how these options seek to address one or more of our design principles.

# Departures options example – Runway 05L/R East



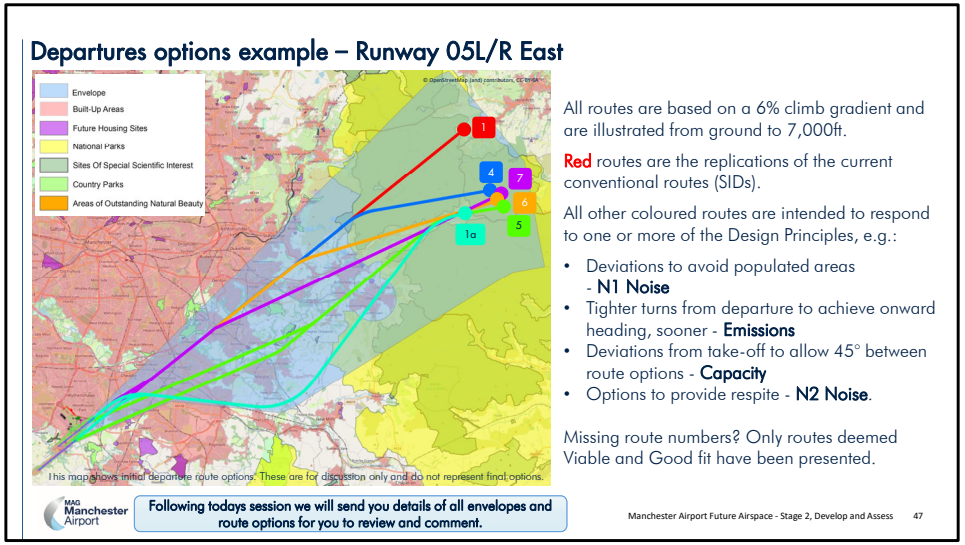

All routes are based on a 6% climb gradient and are illustrated from ground to 7,000ft.

Red routes are the replications of the current conventional routes (SIDs).

All other coloured routes are intended to respond to one or more of the Design Principles, e.g.:

- Deviations to avoid populated areas - N1 Noise
- Tighter turns from departure to achieve onward heading, sooner - Emissions
- Deviations from take-off to allow 45° between route options - Capacity
- Options to provide respite - N2 Noise.

Missing route numbers? Only routes deemed Viable and Good fit have been presented.




This is our Runway 05 East Design Envelope for departures heading to destinations such as Germany or Asia. As you can see there are multiple options within it, but remember we need your feedback to help us reduce these options to those which offer the most benefits when compared to our design principles. For completeness, we have included options from Runway 05L and Runway 05R, even though departures from Runway 05R are rare, representing just 0.05% of all 2019 departures.

The options we are sharing are all designed to climb at a constant 6% gradient: our fleet equipage survey suggests this is achievable by all aircraft currently using Manchester Airport. Each option connects with the NATS upper airspace network at 7,000ft.

We have colour coded and numbered the options within the envelopes for easy identification should you wish to make comments or send us feedback.

Route 1 in each design envelope is a replication of the Standard Instrument Departure and is always illustrated in red.

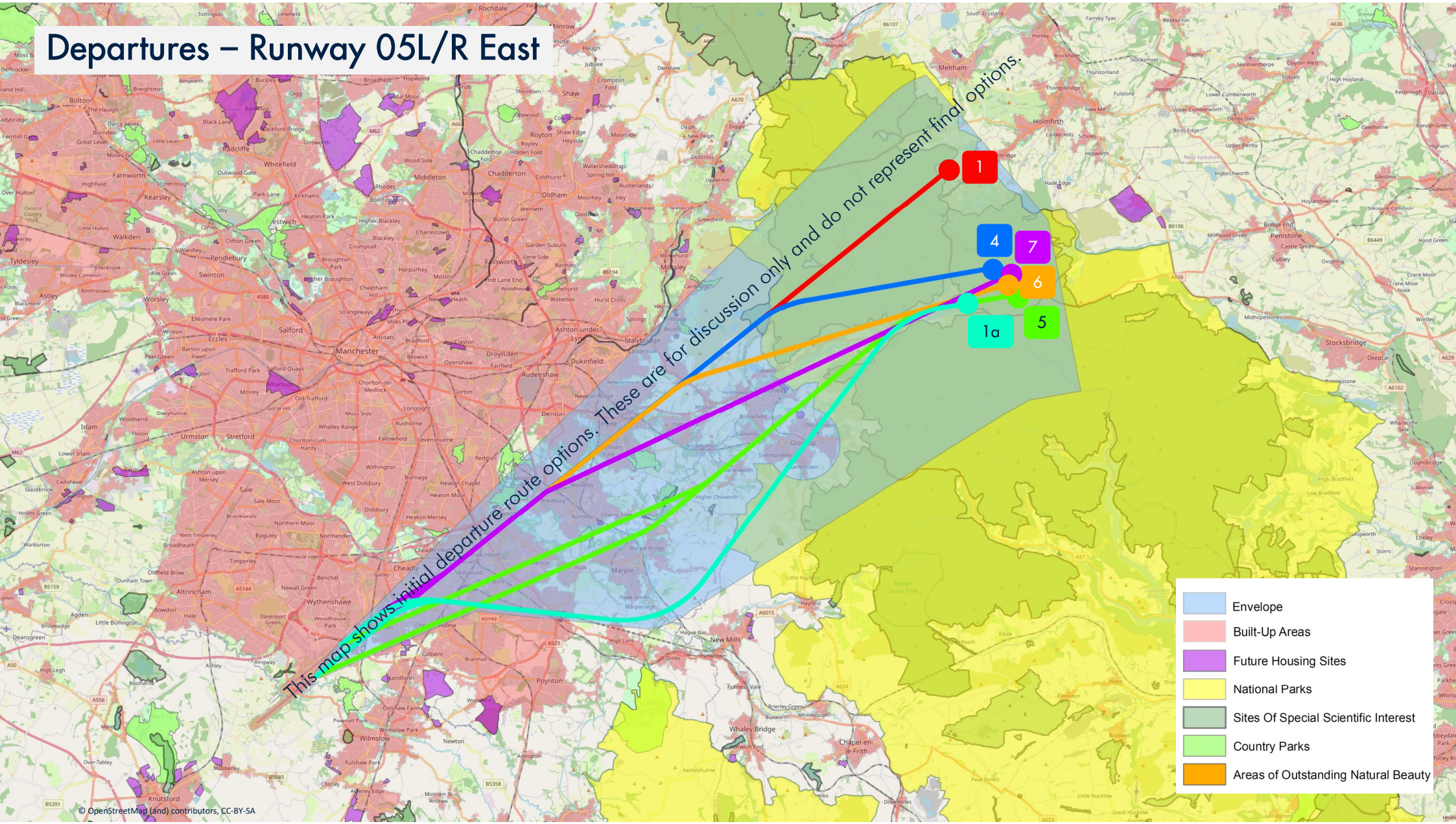
The other routes are intended to respond to one of more of the design principles. For example, those which track around built-up areas are intended to respond to the Design Principle Noise N1 such as options 4, 6 and 7. Those which make a tighter turn from departure, such as options 4, 5, 6 and 7, will achieve their onward heading sooner and are intended to respond to the Design Principle Emissions. A deviation from take-off can reduce the time interval between successive departures, intending to respond to the Design Principle Capacity shown here in option 1a.

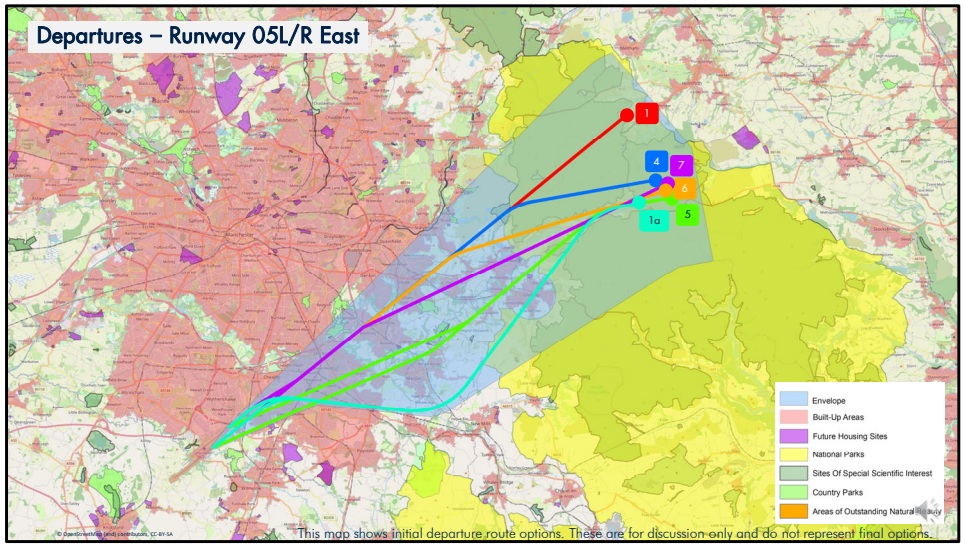
You may have noticed in the example shown, that there is no route option 2 or 3. These have not been included as we are only presenting you with Viable and Good fit options.

Please note, for departures, the routes suffixed with an ‘a’ or ‘b’ have no special meaning (as they did for arrivals), this is simply a result of the design development process.

We will now show two envelopes and describe how the options within them seek to address our design principles.

# Departures – Runway 05L/R East





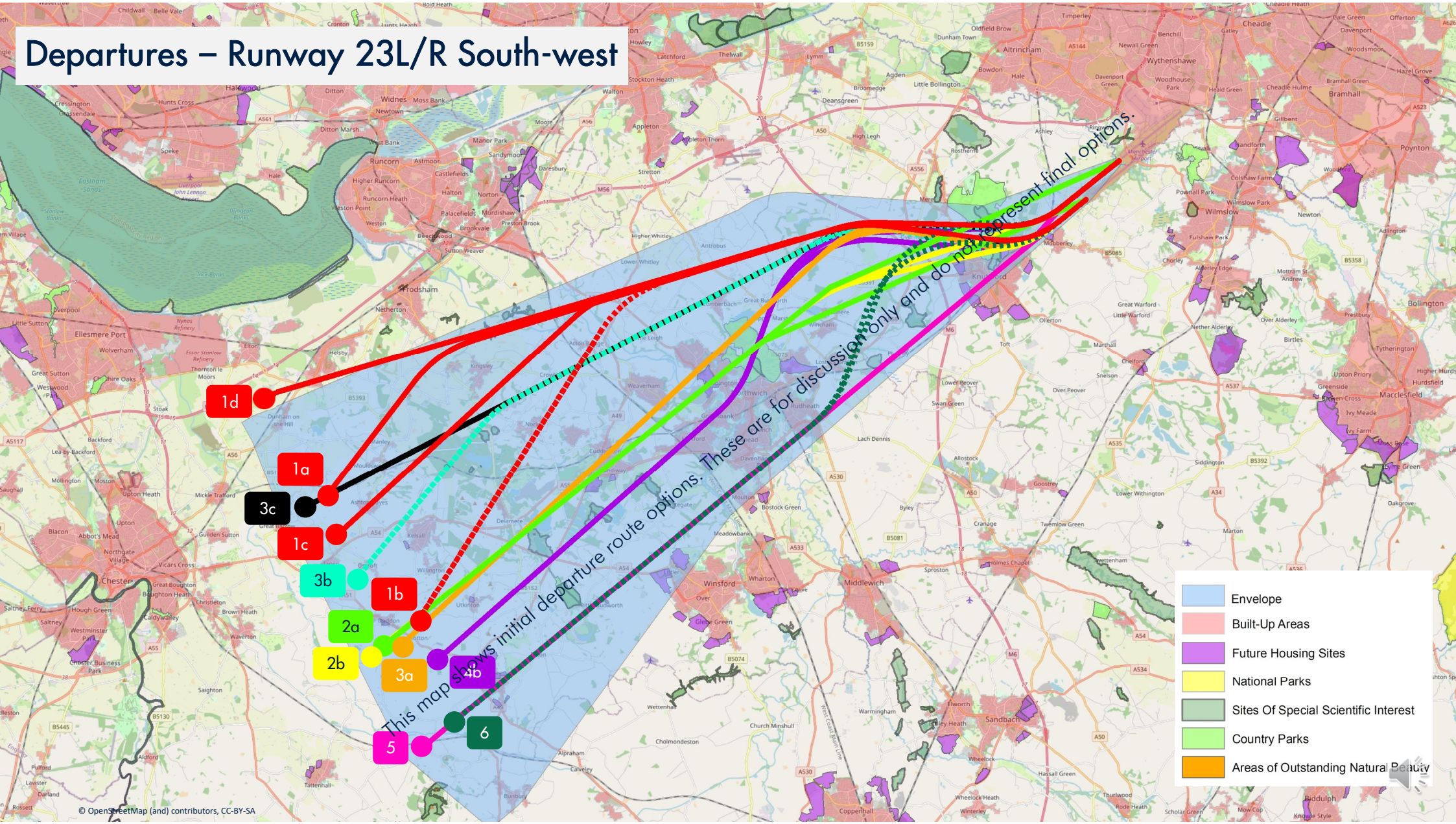

Route 1 in red, is a replication of the Standard Instrument Departure. Options 4, 6 and 7 follow the initial track of the current procedure but turn to the east slightly sooner. These are intended to respond to the Design Principle Emissions providing a more direct flightpath to connect with the upper airspace Network to the east.

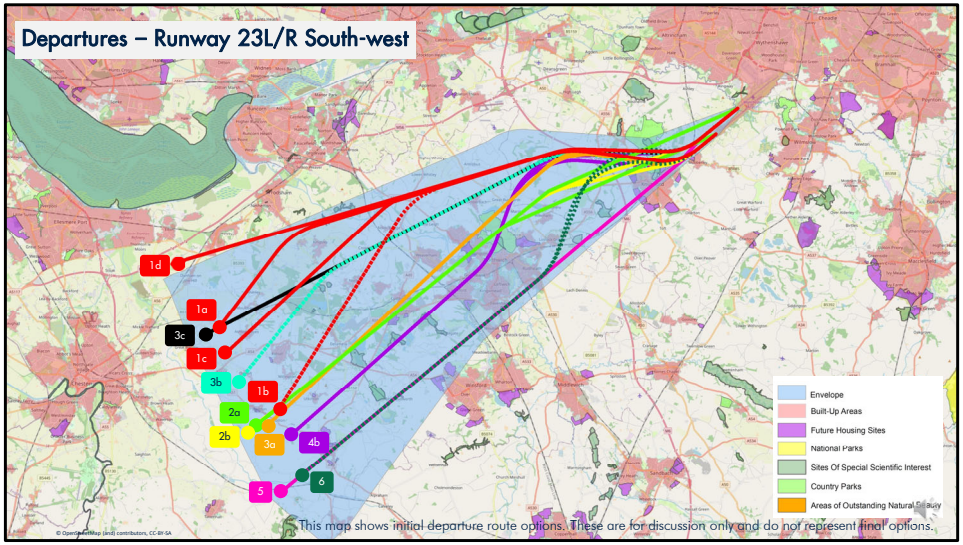
Option 5 deviates to the right after departure, avoiding various populated areas and therefore attempting to respond to our Design Principle Noise N1.

Option 1a, deviates south-east after departure. This is intended to diverge by 45 degrees or more from options in the 05 North Design Envelope. A deviation of 45 degrees is a minimum separation, within PANS OPS, which would enable us to achieve capacity benefits by reducing the time interval between successive departures to the north and the east.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Departures – Runway 23L/R South-west






This is our south-west envelope for Runways 23 left and right heading south-westbound from Manchester, to destinations such as Spain or Portugal.

In red, routes 1a, 1c and 1d are replications of our current procedures and represent the MONTY, KUXEM and EKLAD Standard Instrument Departures respectively. Option 1b follows the same initial track as route 1a but turns to the southwest sooner in an attempt to reduce the track mileage to the network connection point aligning with the Design Principle Emissions.

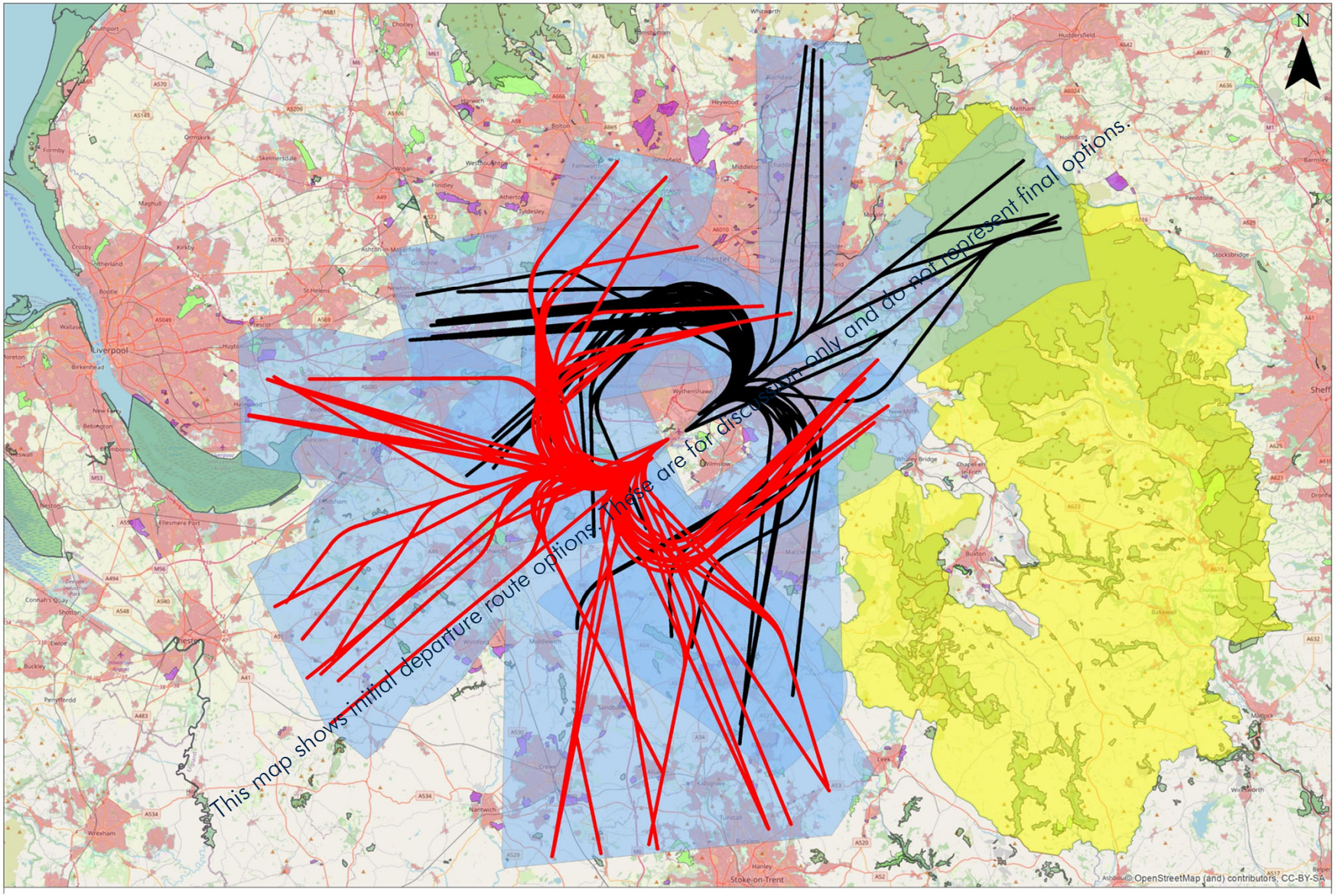
Option 5 is also intended to align with the Design Principle Emissions, climbing straight ahead from the runway, making no turns or deviations up to 7,000ft.

Option 2a diverts north of the runway centreline by 15 degrees after departure to try to avoid a large built-up area. Options 2b, 3a, 3b, 3c, 4b and 6 are also designed to avoid various built-up areas, attempting to reduce the noise impacts for some communities on the ground. These routes are intended to align with our Design Principle Noise N1.

It is impossible to design options which avoid all communities, but more detailed analysis will follow to determine which options provide the greatest benefits. In some cases, separate options in part may follow the same track over the ground. You can see an example of this with options 5 and 6. Option 5 climbs straight ahead after departing, whereas option 6 deviates around a populated area before it heads to the south-west, overflying the same track as option 5.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Map of all envelopes and design options




Route Options from Runways 05L/05R

Route Options from Runways 23R/23L

- Envelope
- Built-Up Areas
- Future Housing Sites
- National Parks
- Sites Of Special Scientific Interest
- Country Parks
- Areas of Outstanding Natural Beauty

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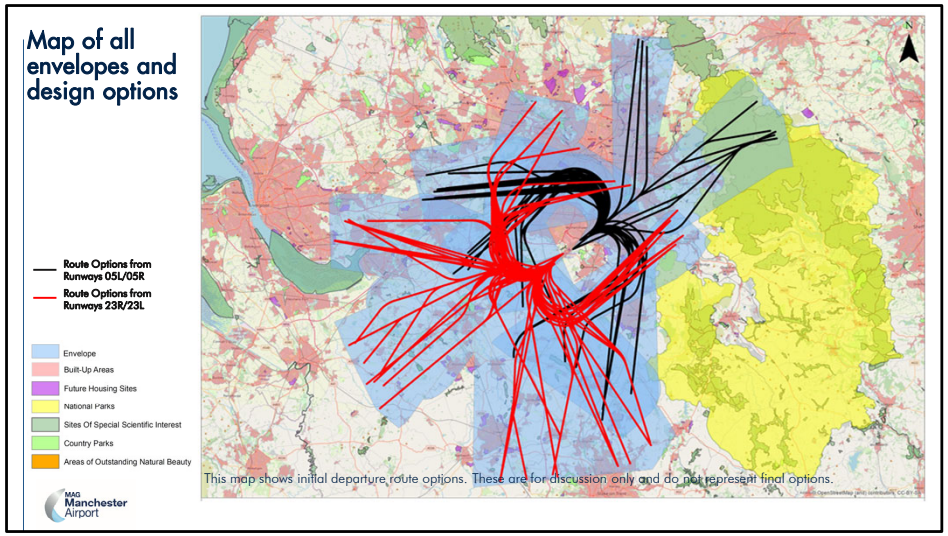
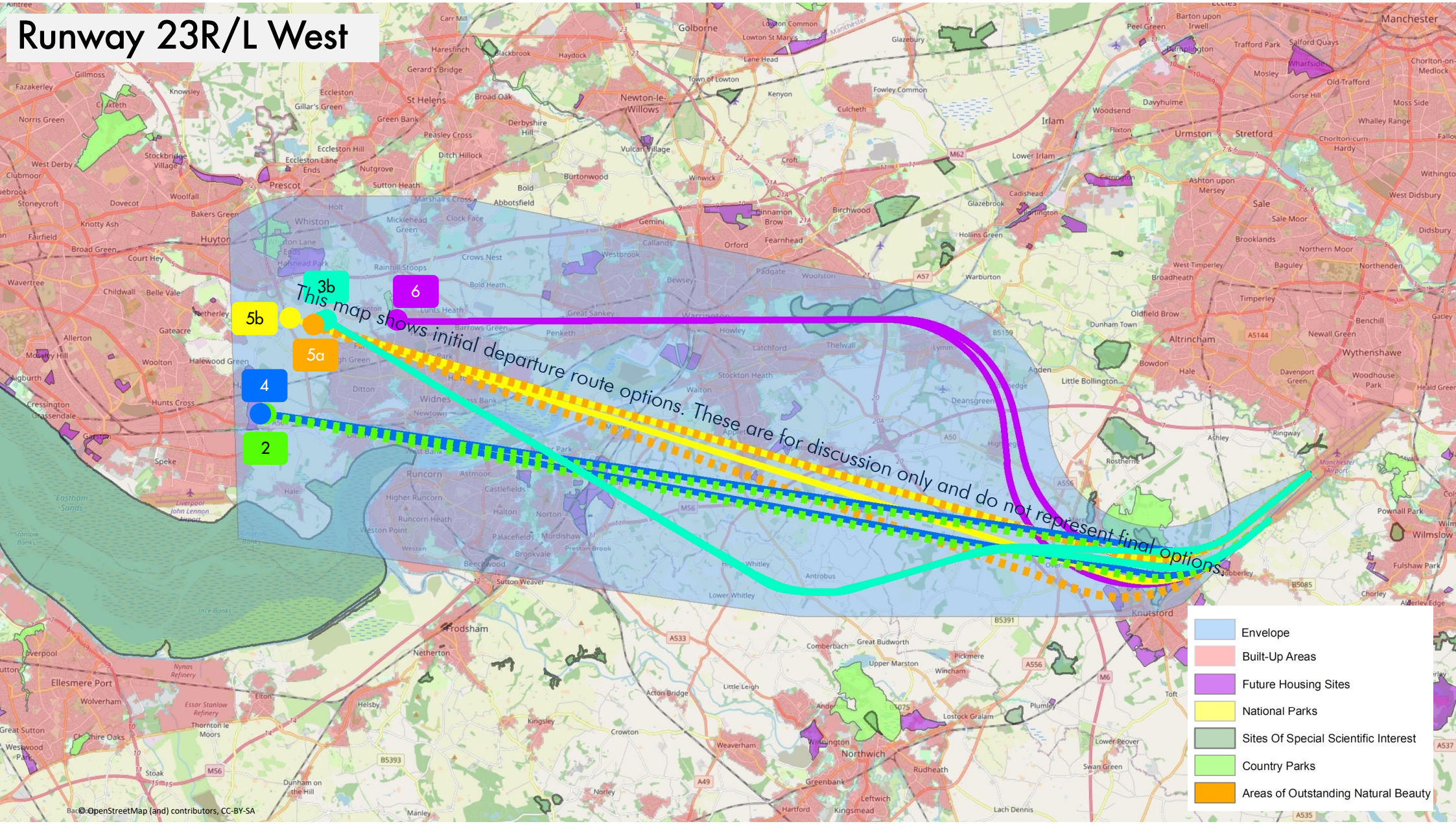


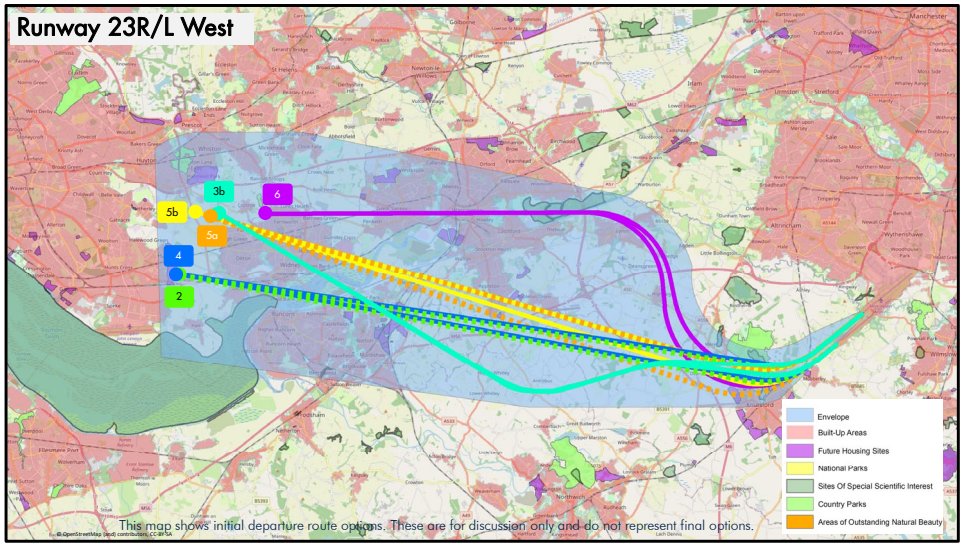

We have 11 departure envelopes in total, each containing multiple route options as illustrated here. Red routes are from Runways 23R/L and black routes from Runways 05L/R . There are 90 route options in total.

The remaining envelopes and colour coded routes, follow.

You can then review these in your own time and provide your comments back to us by Thursday 16th June.

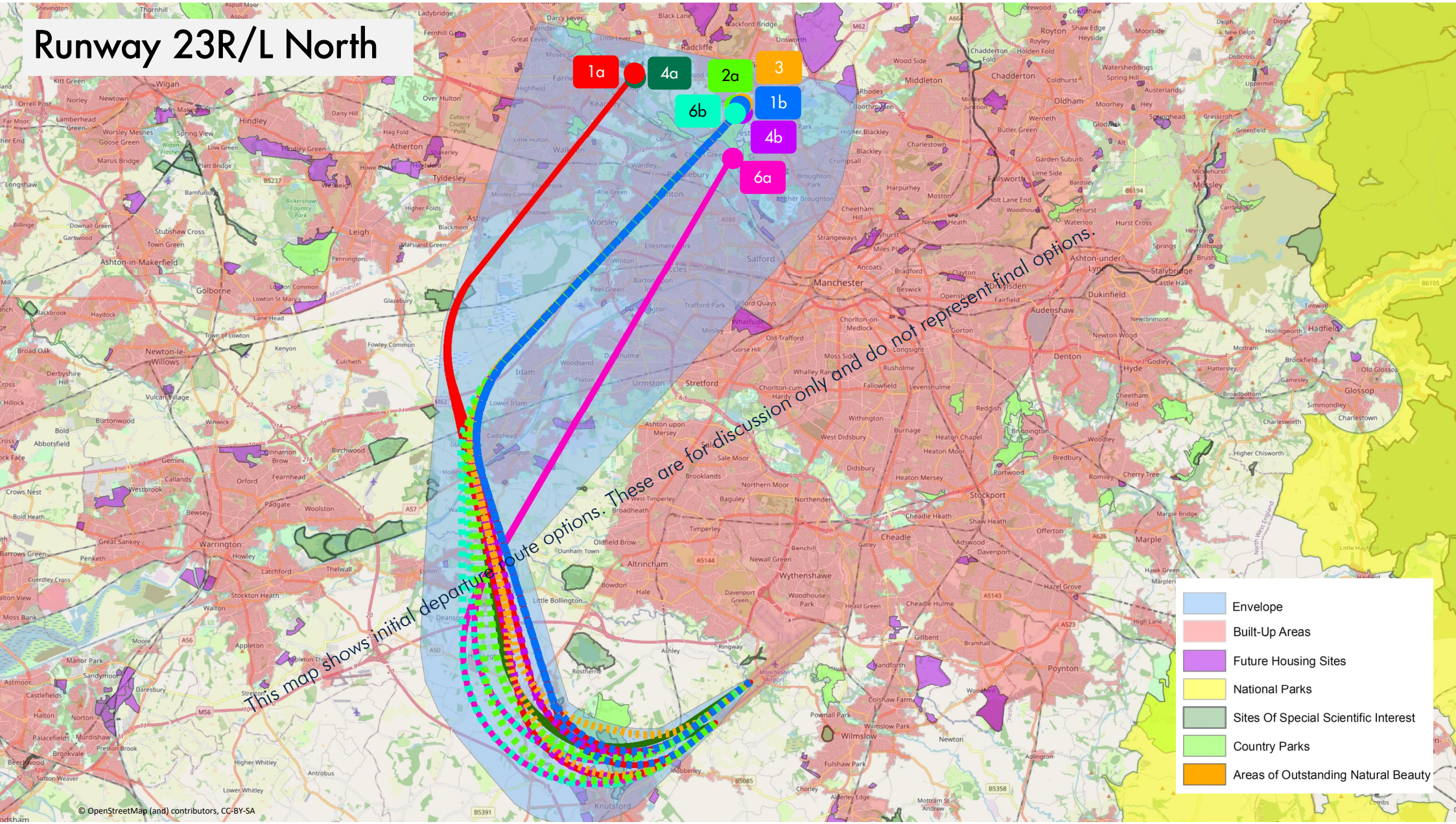
# Runway 23R/L West

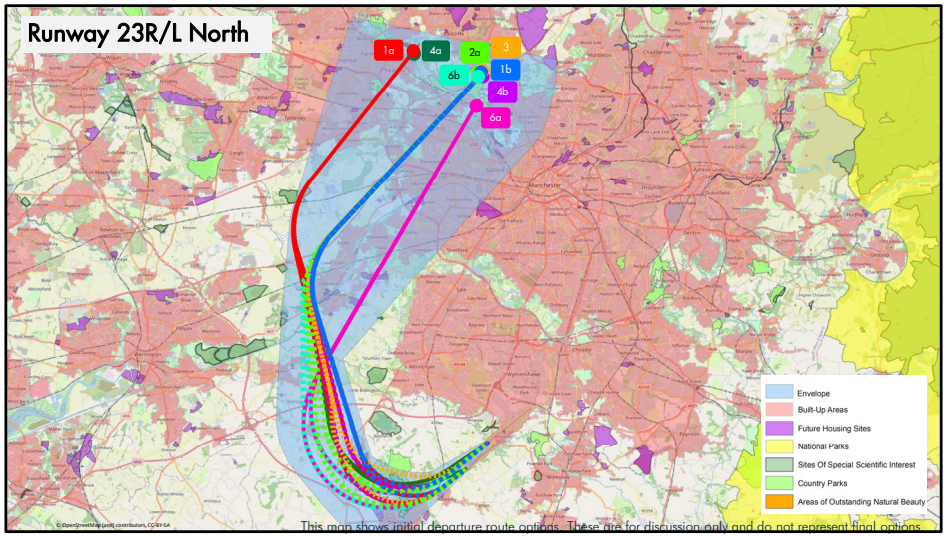





Here are route options departing from Runway 23L or 23R, heading westbound from Manchester, such as destination in Ireland and across the Atlantic. There are no red routes within this envelope because there are no current procedures which fly this way. Option 3b attempts to address the Design Principle Noise N1 by avoiding various built-up areas. Option 6 may be able to address our Design Principle Capacity, deviating by more than 45 degrees from options in the south-west envelope and the options 2,4, 5a and 5b attempt to align to the Design Principle Emissions by offering a more direct route to the west.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*


Runway 23R/L North
1a
4a
2a
3
6b
1b
4b
6a
This map shows initial departure route options. These are for discussion only and do not represent final options.
Envelope
Built-Up Areas
Future Housing Sites
National Parks
Sites Of Special Scientific Interest
Country Parks
Areas of Outstanding Natural Beauty
© OpenStreetMap (and) contributors, CC-BY-SA



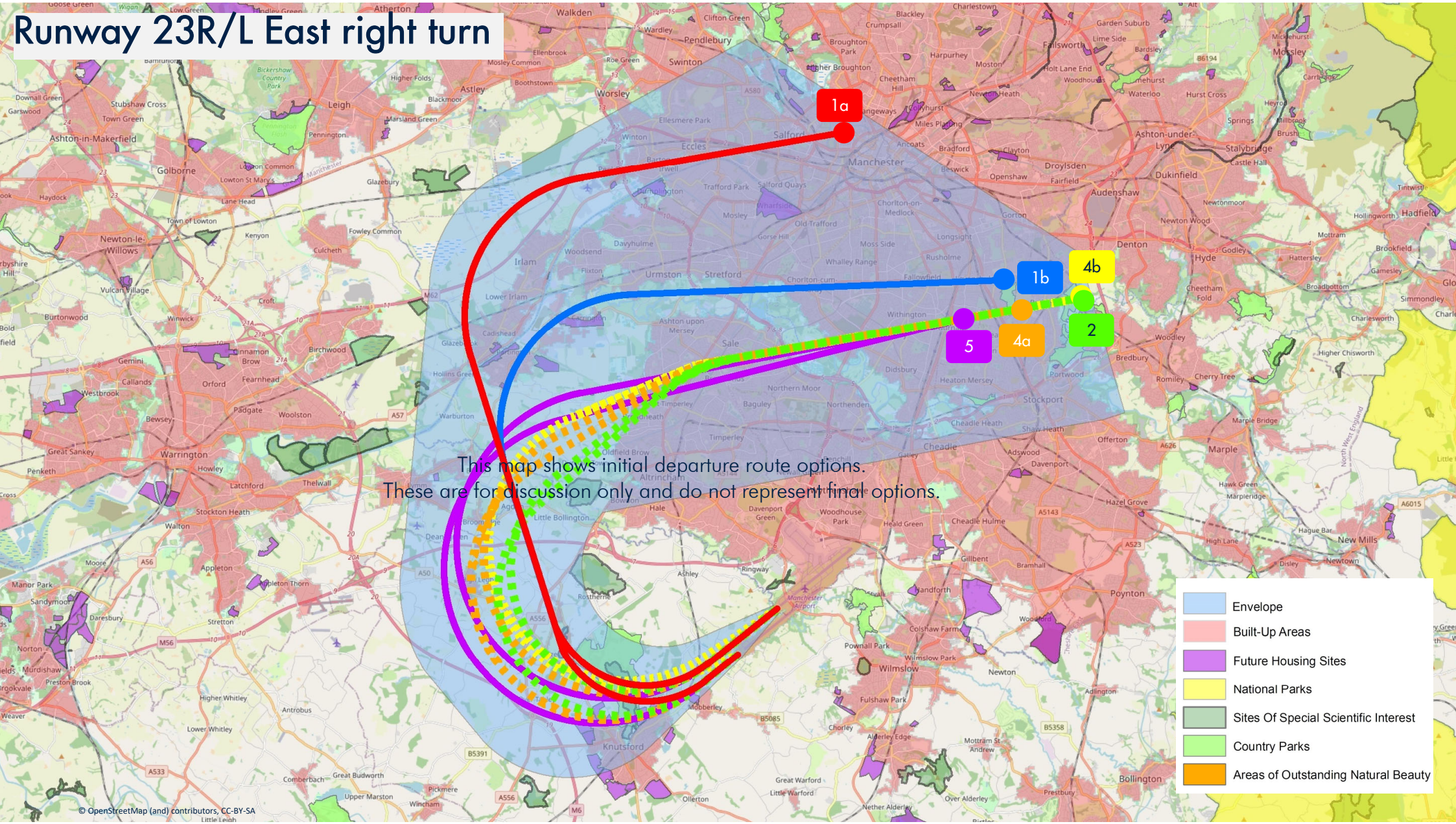

These are our options from Runway 23L or 23R for northbound traffic to for departures heading to destinations such as Scotland and Scandinavia. Option 1a is a replication of the existing Standard Instrument Departure (SID). Option 4a is also a replication of the SID but designed with an inbuilt speed restriction for aircraft of 190 knots (kts) in the initial turn, making the turn tighter and inside the replication. Our designers have replicated these routes by initiating the first turn after departure much closer to the airport than the most up to date rules and regulations would permit if these routes were implemented today. As we explained in slide 26 a safety justification permits this.

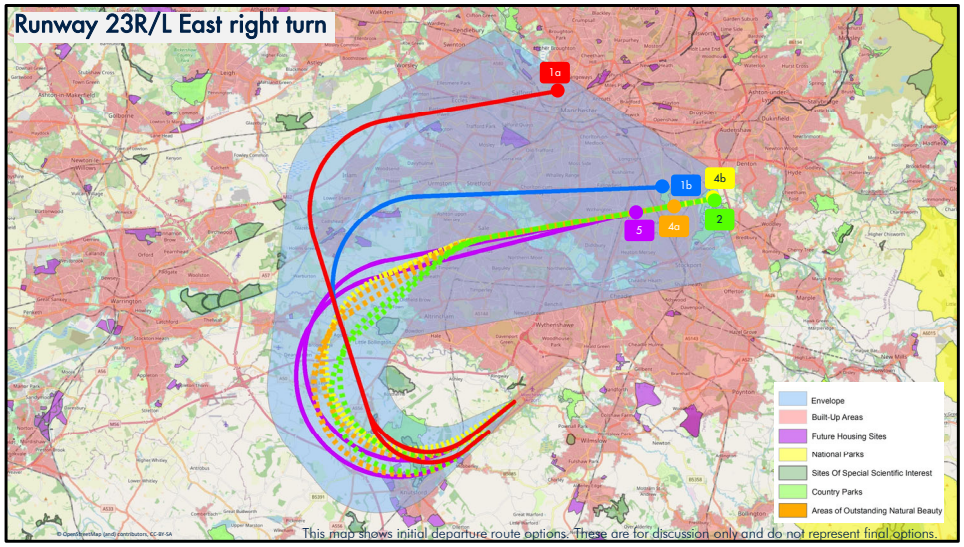
Option 4b makes its initial turn at a speed of 190kts which enables a tight turn radius. 2b makes an initial turn at 210kts and 6b turns at 220kts. The higher the speed for the initial turn, the wider the turn radius. These options conform to the PANS-OPS design rules and therefore respond to our Design Principle Policy. Option 3 initiates the first turn within 1 nautical mile (nm) of the runway to avoid a large population centre which seeks to align with our Design Principle Noise N1. Option 6a has no speed restriction and is designed to align to our Design Principle Emissions.

Option 7 is designed with a track adjustment after departure, of 5 degrees for Runway 23R and 15 degrees for Runway 23L. This is intended to avoid a large built-up area and attempts to align to our Design Principle N1 Noise.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 23R/L East right turn



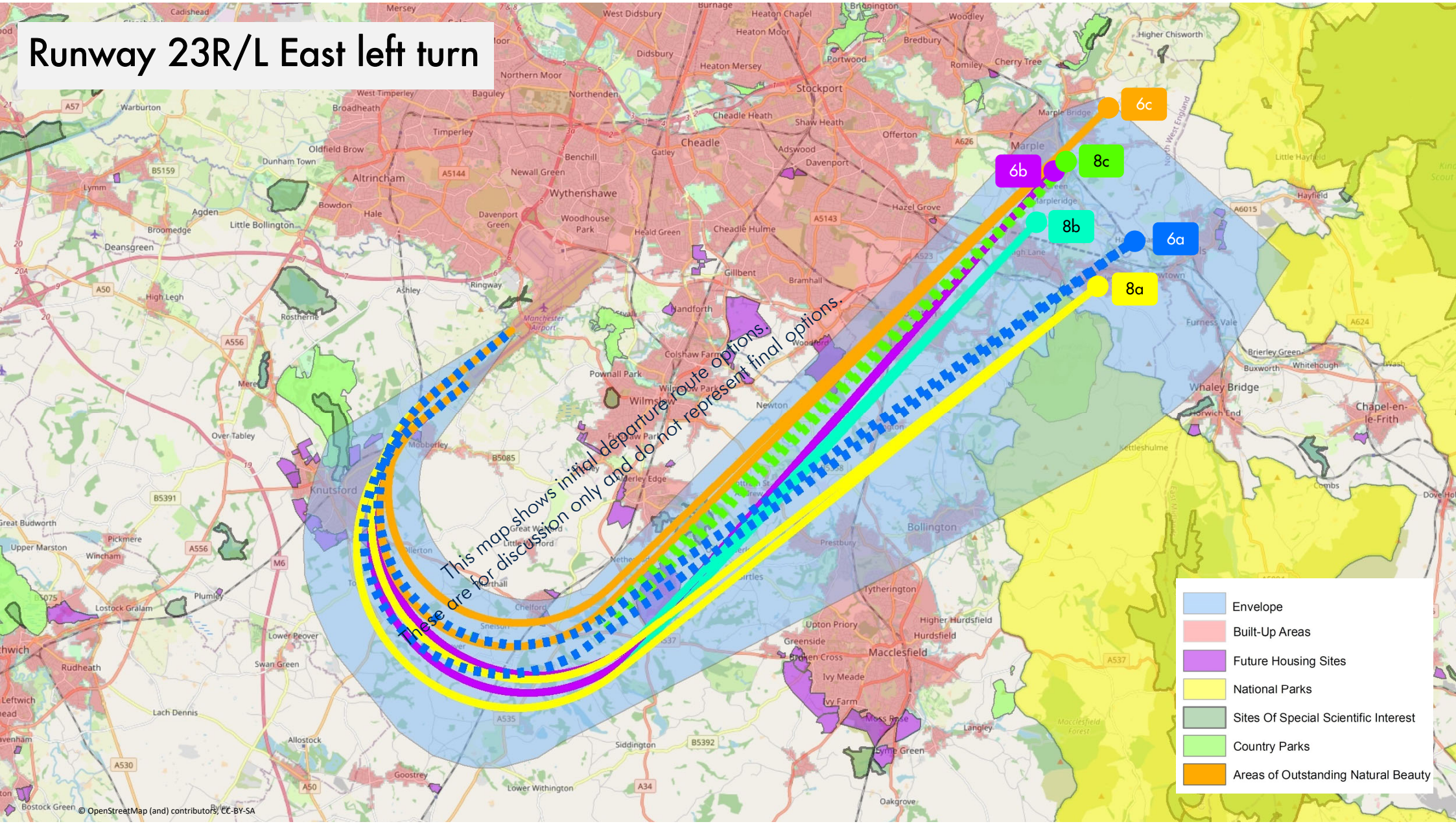


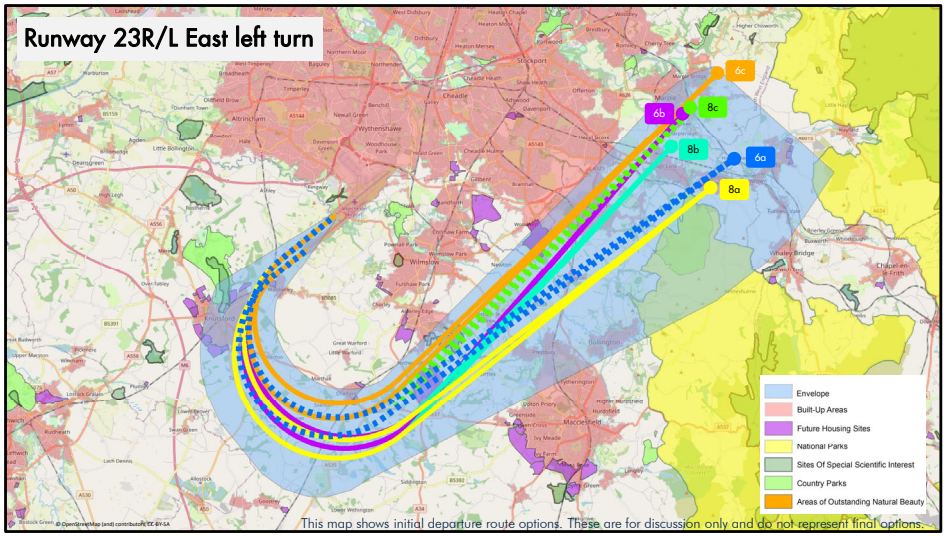

This slide shows route options which depart Runway 23L or 23R, they then make a right turn which eventually tracks towards the east for departures heading to destinations in Germany or Asia.

Option 1a is a replication of the existing Standard Instrument Departure (SID). Our designers have replicated this route by applying a speed restriction of 200 knots (kts) (ensuring a tighter turn) and initiating the first turn after departure much closer to the airport than the most up to date rules and regulations would permit if this SID was designed today. As we explained in slide 26 a safety justification permits this. Option 1b also initiates the first turn closer to the airport than current rules permit and is flown at 200kts. After departure, option 4b makes a track adjustment to the north, 5 degrees from runway 23R and 15 degrees from 23L, attempting to avoid a large built-up area and therefore aligning with or Design Principle Noise N1. Option 2 makes the initial turn at 190kts to enable a tighter turn radius, option 4a turns at 220kts which results in a wider turn radius. These options are intended to respond to our Design Principle Noise N1 by avoiding various communities on the ground. Option 5 is designed to attempt to address the Design Principle Emissions by taking the shortest route to our estimated network connection point.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 23R/L East left turn

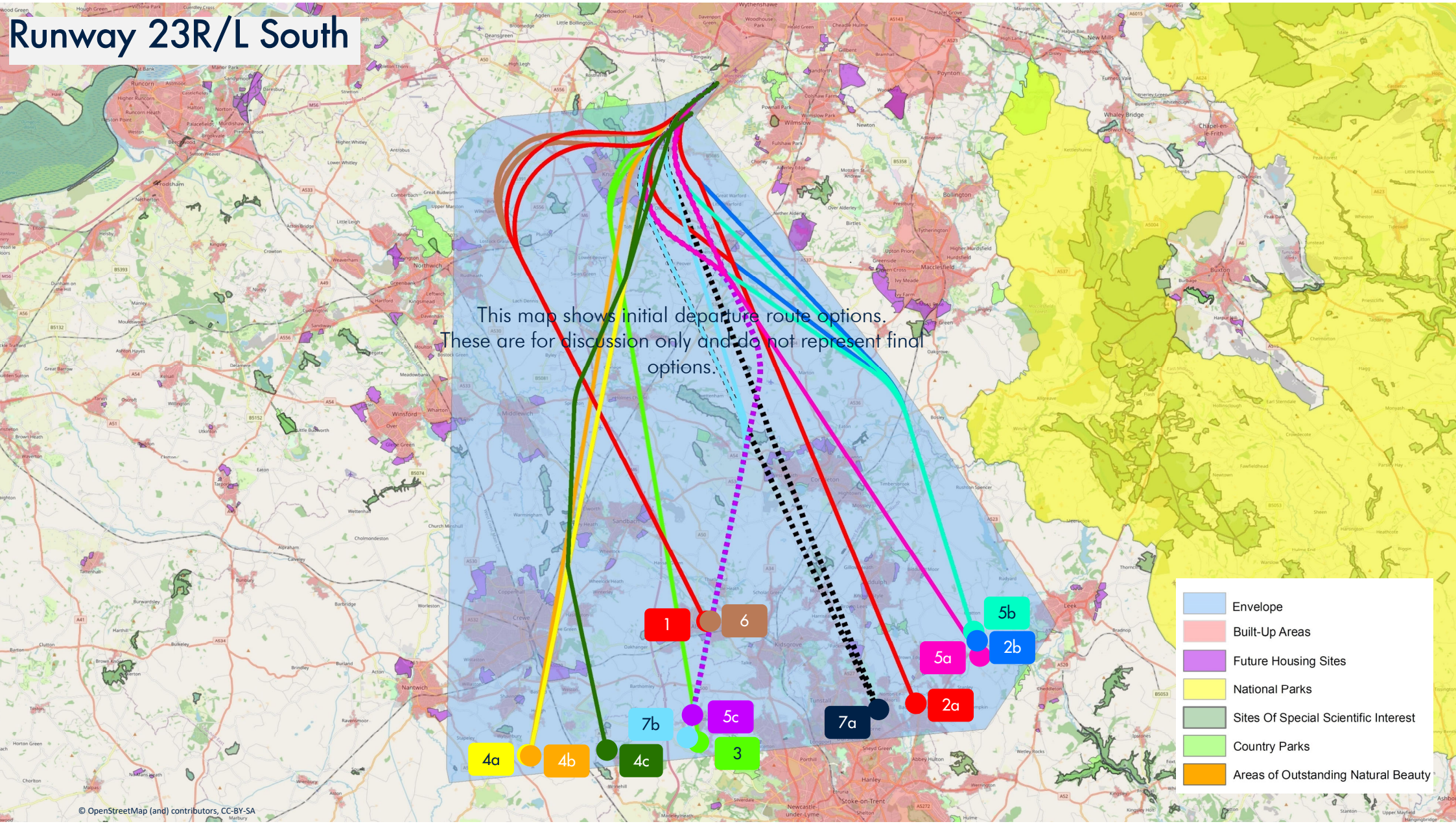


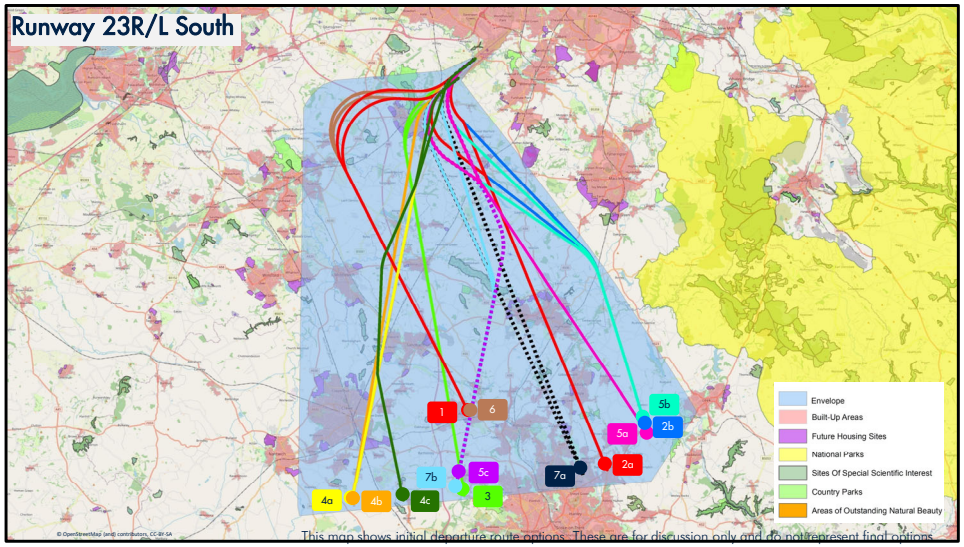



This envelope is also designed for traffic heading east from Manchester; however, as you can see the aircraft make a left turn after departure. There are no red routes within this envelope because this is an entirely new concept, aircraft do not normally operate in this way utilising today's route structure. The concept may offer an alternative to aircraft overflying the city centre as seen in the previous slide. Options 6c, 6b, 8c and 8b attempt to address the Design Principles Emissions by taking the shortest route to our estimated network connection point and aligns to Policy by complying with the PANS-OPS requirements. Options 6a and 8a align to our Design Principle Noise N1 by attempting to avoid various communities on the ground.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 23R/L South





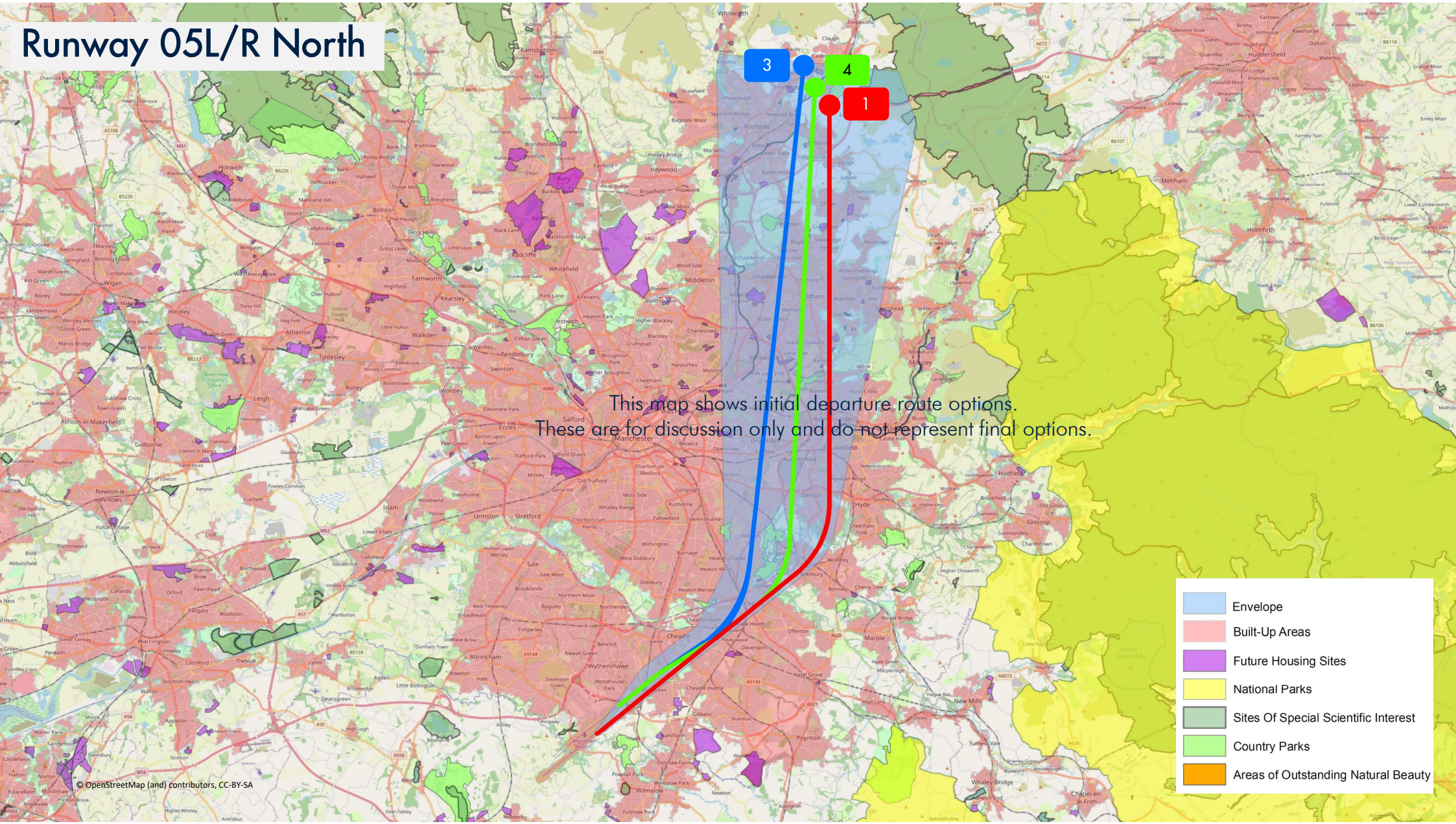

Here are our route options from Runway 23L or 23R heading southbound for departures heading to destinations such as France or Switzerland.

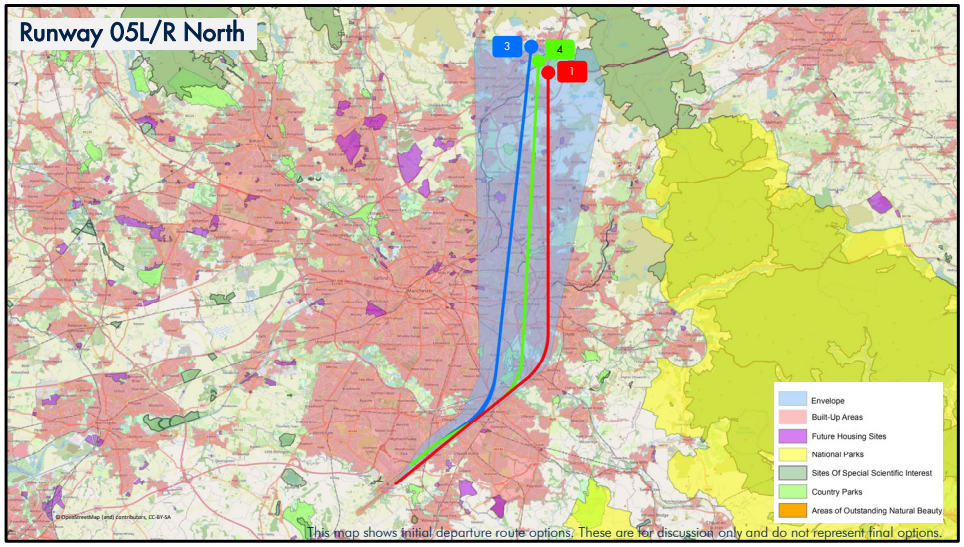
Routes 1 and 2a are the do minimum replications of our Standard Instrument Departures (SIDs) whilst option 6 uses the slightly higher RNP1 design standard to create an alternative version of a replicated departure with a speed restriction of 200 Knots (kts).

The options 2b and 5b are intended to offer the potential to provide capacity benefits in line with Design Principle Capacity. They turn away from the other departure tracks and terminate at the eastern edge of the envelope. Options 3 and 7a, attempt to address the Design Principle Emissions by taking the shortest route to our estimated network connection point and the orange routes 4a, 4b, 4c, 5a, 5c and 7b respond to our Design Principle Noise N1 by attempting to avoid various communities on the ground.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L/R North

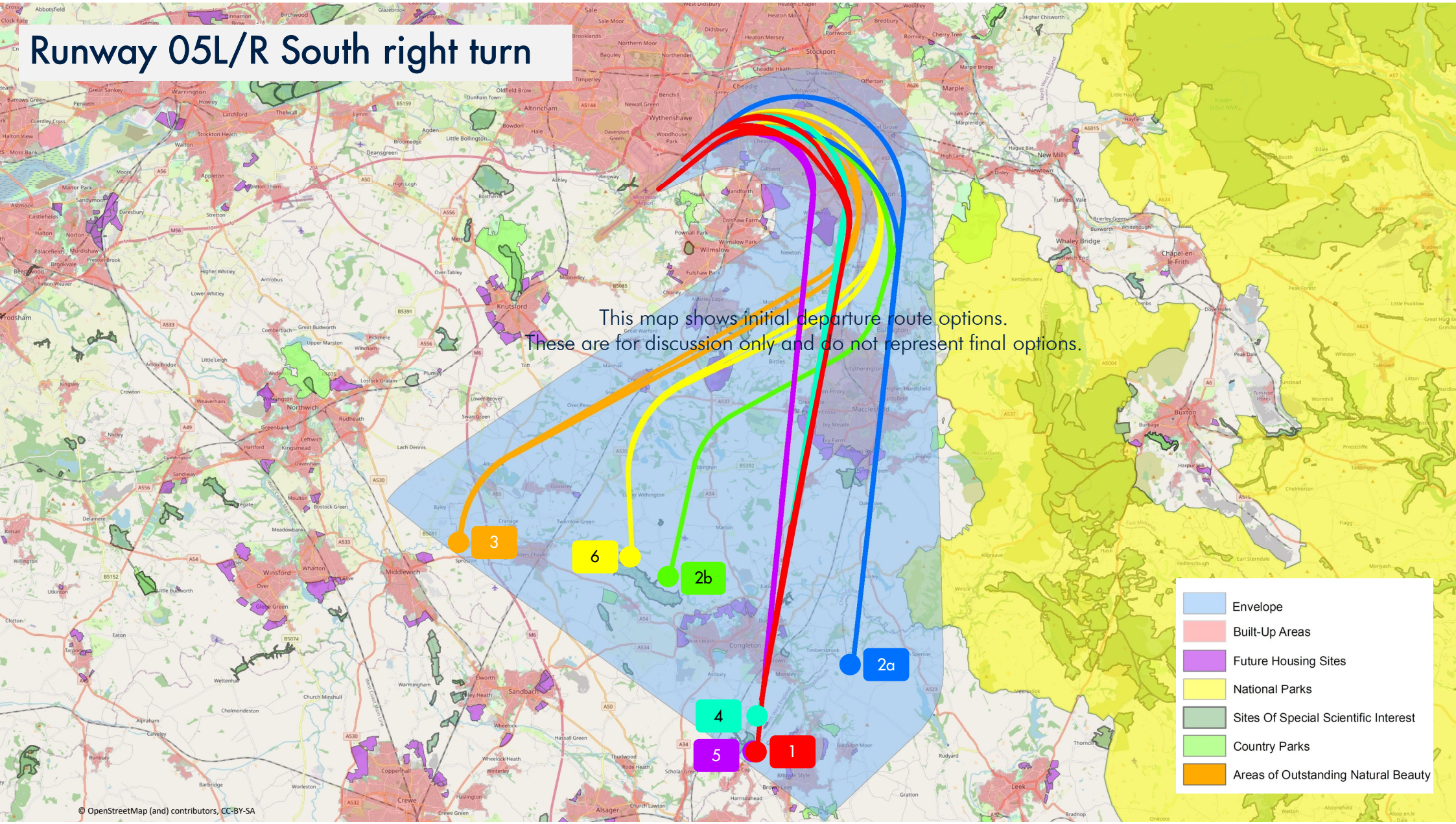


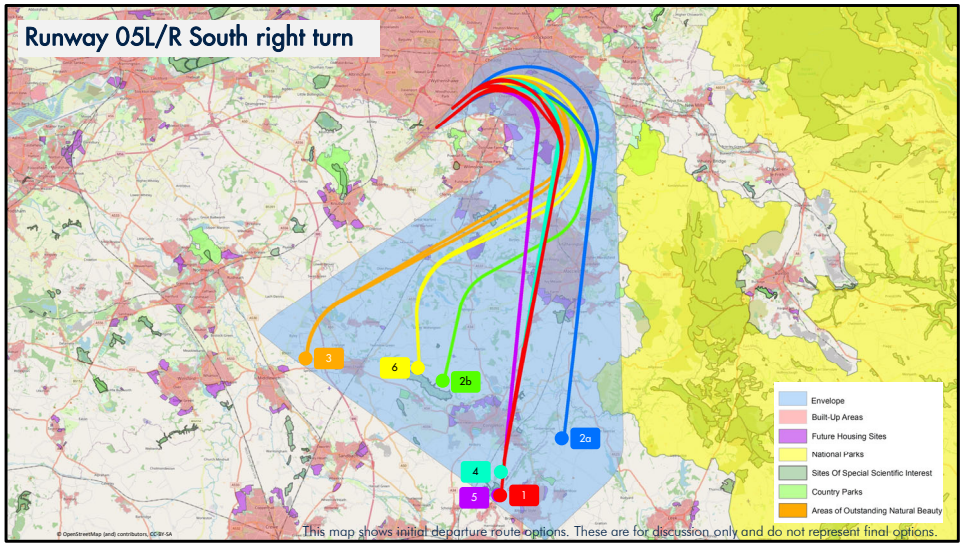



The next set of slides represent aircraft departing from Runways 05L or 05R. This slide shows the north envelope for departures heading to destinations such as Scotland and Scandinavia. Option 1 is a replication of the existing Standard Instrument Departure (SID). Option 3 is designed to align with the Design Principle Emissions by taking the shortest route to our estimated network connection point. Option 4 responds to our Design Principle Noise N1 by attempting to avoid various communities on the ground before connecting to the upper airspace network north of the Airport.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L/R South right turn



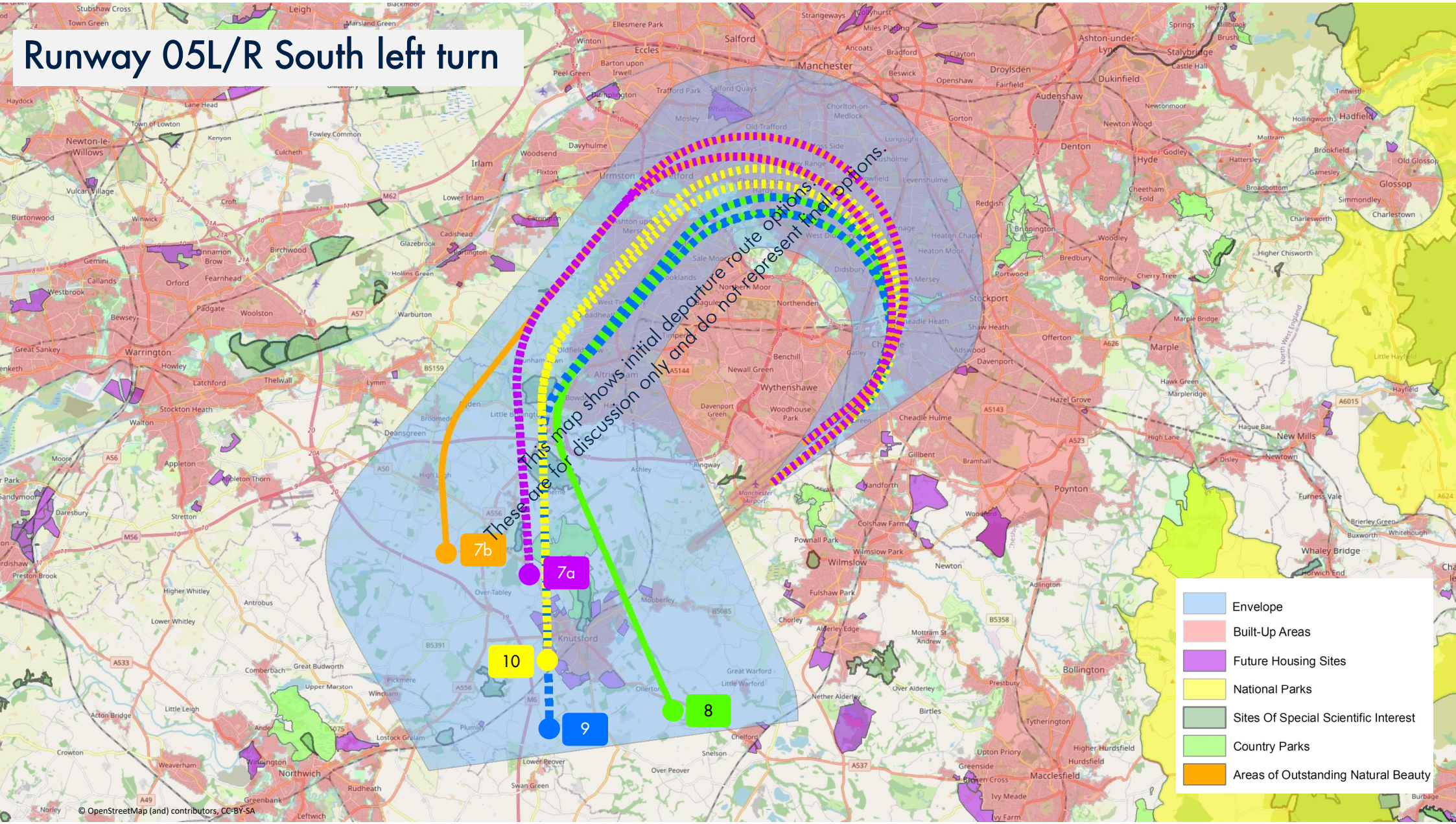


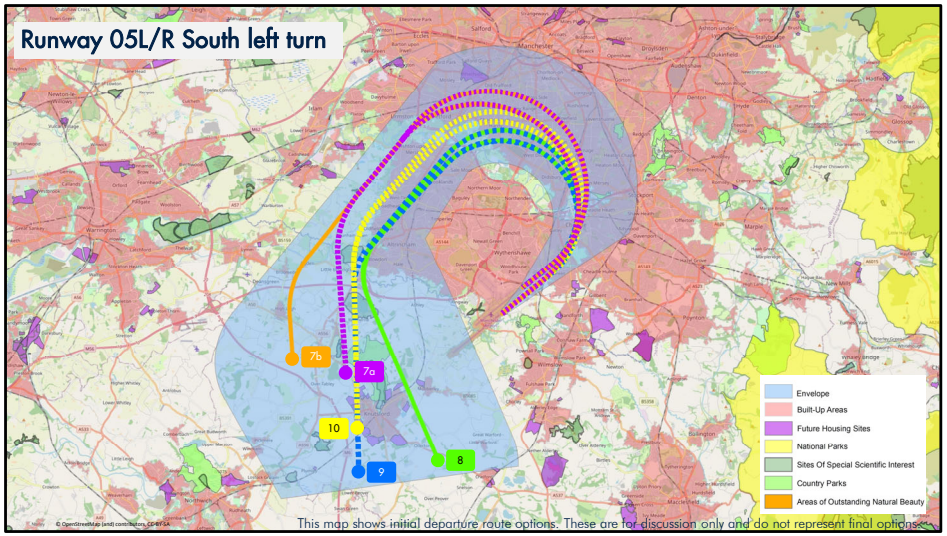

These are our southbound departure options from Runways 05L or 05R heading southbound for departures heading to destinations such as France or Switzerland. Route 1 is the replicated (do minimum) Standard Instrument Departure (SID). Option 4 uses the higher RNP1 design standard to create an alternative version of a replicated departure and Option 5 has been designed with a slightly lower speed limit for the initial turn which permits a slightly tighter turn radius.

Options 2a is designed to address the Design Principle Emissions by taking the shortest route to our estimated network connection point and the options 3, 6 and 2b align to our Design Principle Noise N1 by attempting to avoid various communities on the ground before connecting to the upper airspace network south of the Airport.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L/R South left turn

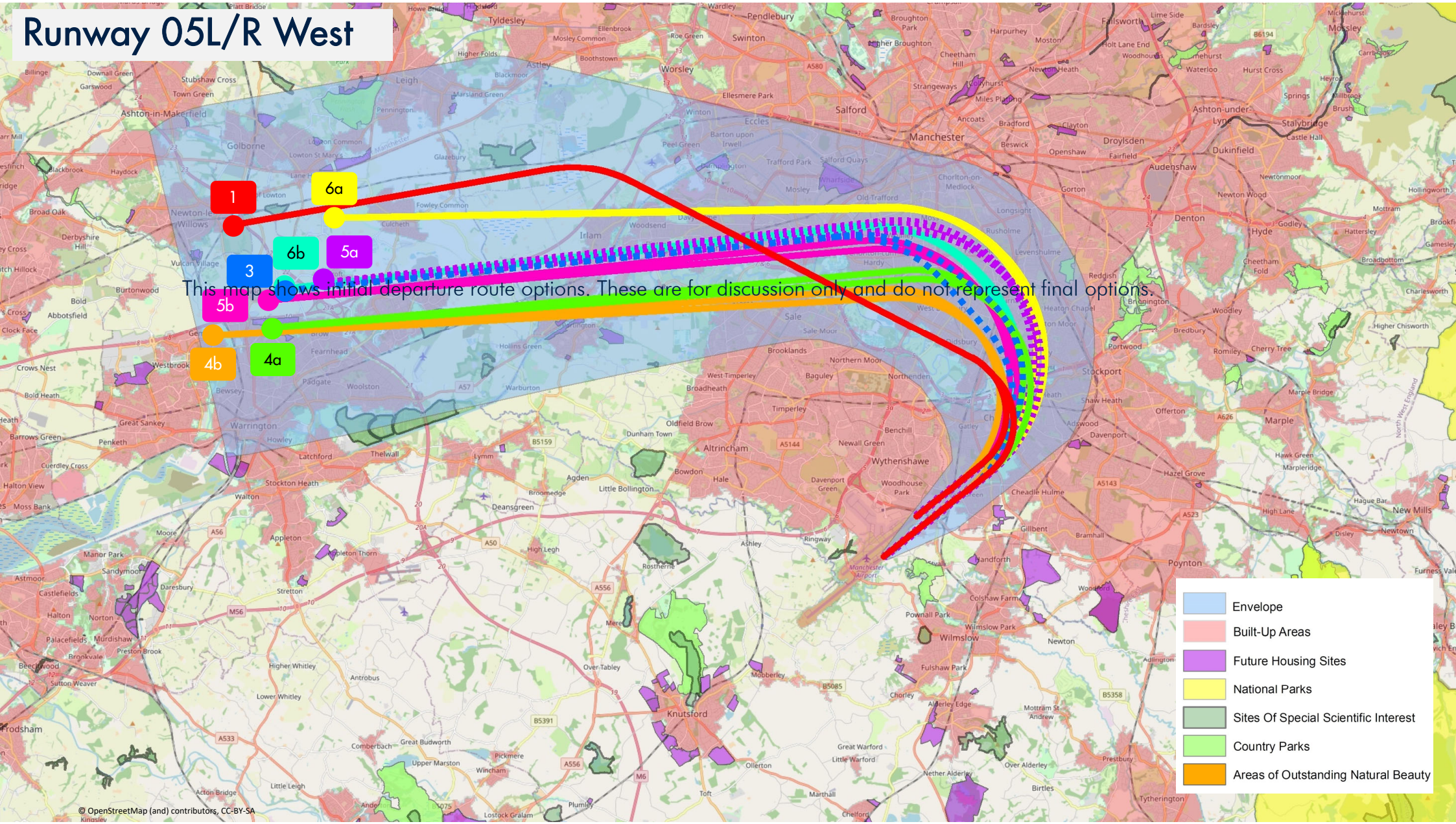


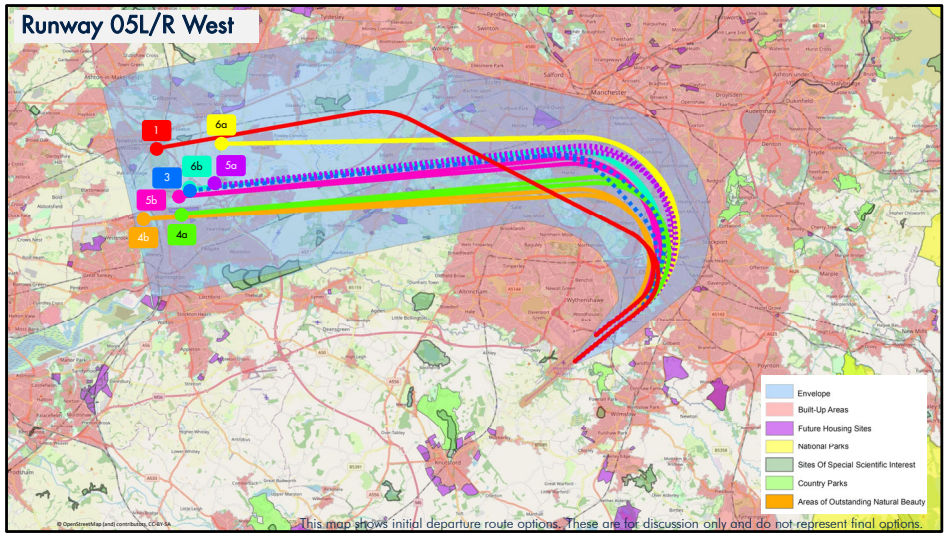



In this slide you can see southbound departures which initially turn left after departure. There are no red routes within this envelope as this is an entirely new concept which does not represent the way aircraft operate today. This envelope is designed to meet Design Principle Capacity by offering aircraft operators an alternative to a right turn from Runways 05L or 05R. This may have the potential to reduce delays on the ground by reducing the time interval between departures that wish to head southbound from Manchester. Options 8 and 9 are also designed to address the Design Principle E Emissions by taking the shortest route to our estimated network connection point. Options 7a, 7b and 10 are designed to align with our Design Principle N1 Noise by attempting to avoid various communities on the ground.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L/R West

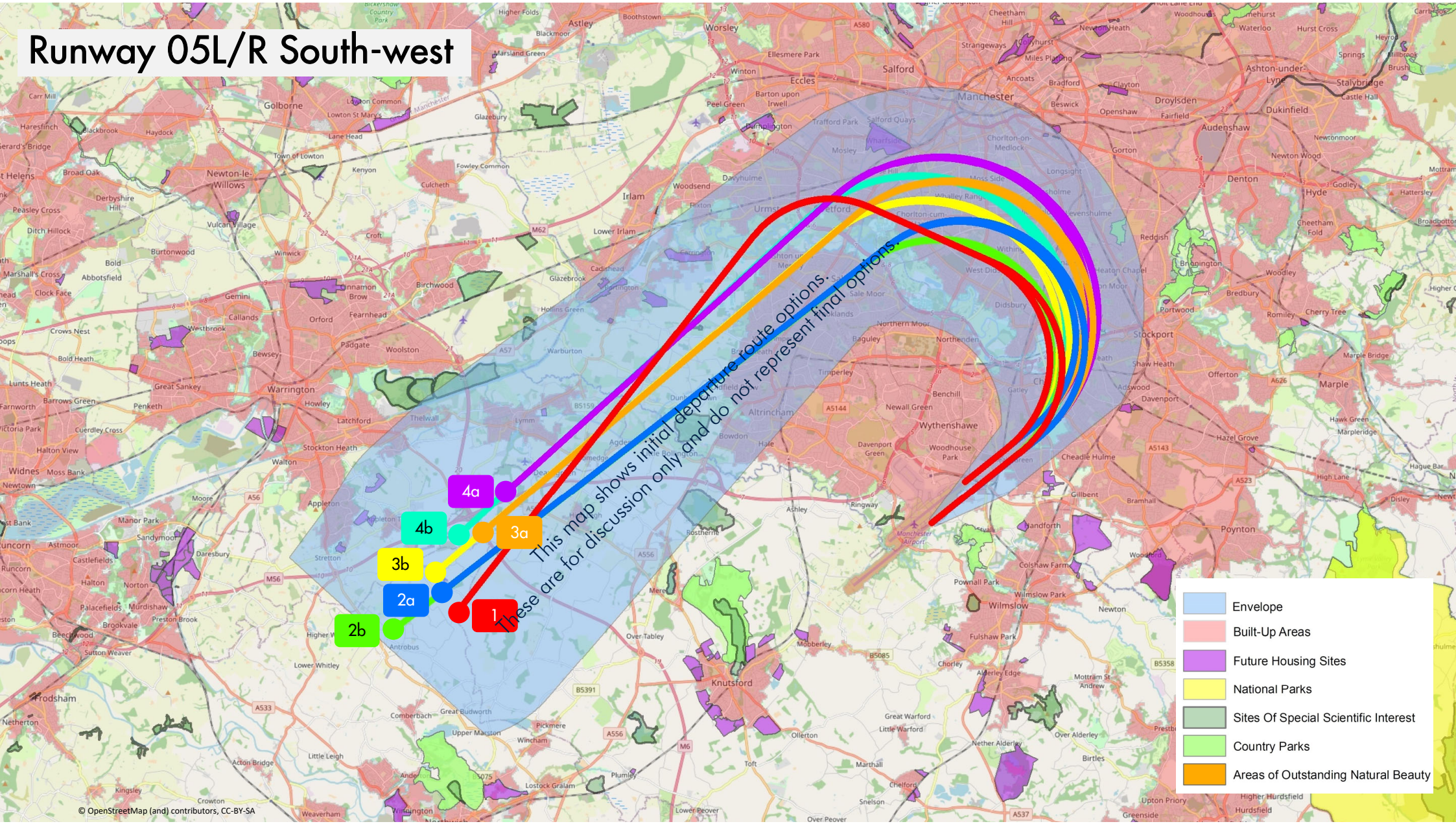


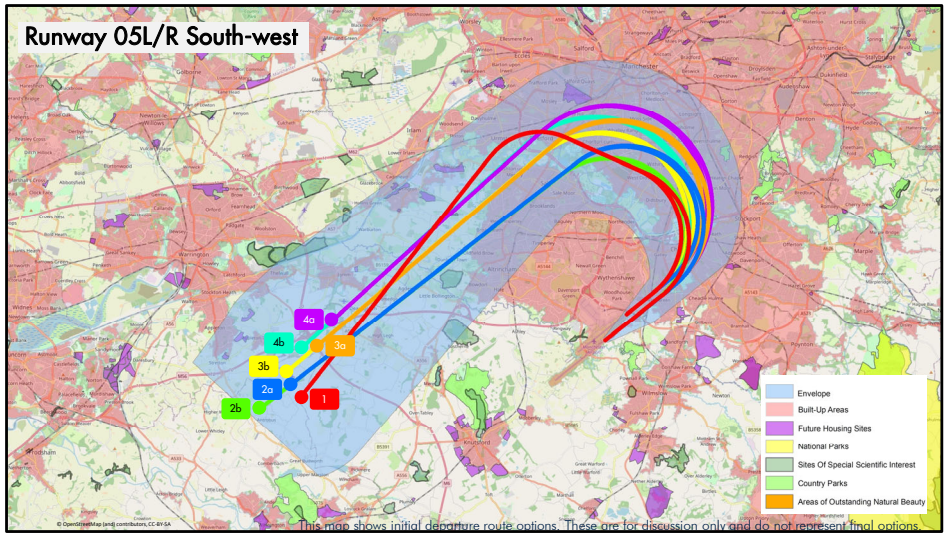



These are our westbound departure options from Runways 05L or 05R, heading westbound from Manchester, such as destinations in Ireland and across the Atlantic. Option 1 is a replication of the Standard Instrument Departure (SID). Our designers have replicated this route by applying a speed restriction of 185 knots ensuring a tight turn. As we explained in slide 26 a safety justification permits this. Options 4a, 4b and 6a are designed to address the Design Principle Emissions and the options 3, 5a, 5b, and 6b attempt to respond to our Design Principle Noise N1 by avoiding various communities on the ground.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

# Runway 05L/R South-west






These are our south-west departure options from Runway 05L or 05R, heading south-westbound from Manchester, such as destinations in Spain or Portugal. Option 1a follows the initial track of the existing westbound Standard Instrument Departure (SID). Our designers have created this route by applying a speed restriction of 185 knots (kts) ensuring a tight turn but initiating the first turn after departure. Option 2a is designed to address the Design Principle E Emissions by taking the shortest route to our estimated network connection point and the options 3a, 3b, 4a and 4b align to our Design Principle Noise N1 by attempting to avoid various communities on the ground before connecting to the upper airspace network south-west of the Airport. These routes also align with our Policy Design Principle by commencing the initial turn 1 nautical mile (nm) from the runway.

*Please note -on the map base we have colour coded different features and the design envelopes are shaded blue. Where there is an overlap, of two shaded areas, the colour is distorted from that shown in the key. For example, the yellow areas of the National Park appear green within the blue shaded design envelope.*

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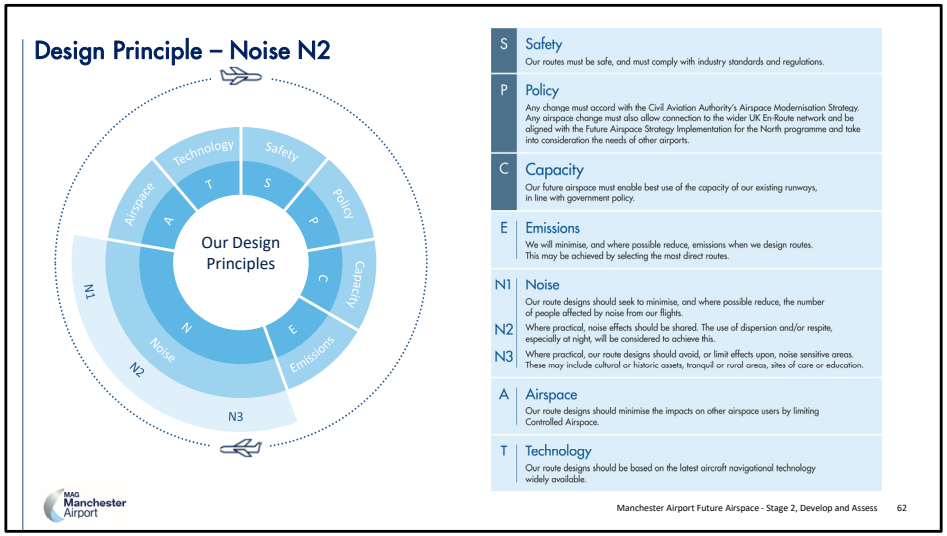
# APPLYING THE NOISE DESIGN PRINCIPLE

## Scenarios for feedback

MAG Manchester Airport




As a reminder the three principles are:

| | |
|---|---|
| N1 | Our route designs should seek to minimise, and where possible reduce, the number of people affected by noise from our flights. |
| N2 | Where practical, noise effects should be shared. The use of dispersion and/or respite, especially at night, will be considered to achieve this. |
| N3 | Where practical, our route designs should avoid, or limit effects upon, noise sensitive areas. These may include cultural or historic assets, tranquil or rural areas, sites of care or education. |

For Design Principle Noise N1, we have a looked at options that avoid major towns and settlements wherever possible. We have marked built up areas and known future housing sites on the map bases, on which we have then overlaid route options.

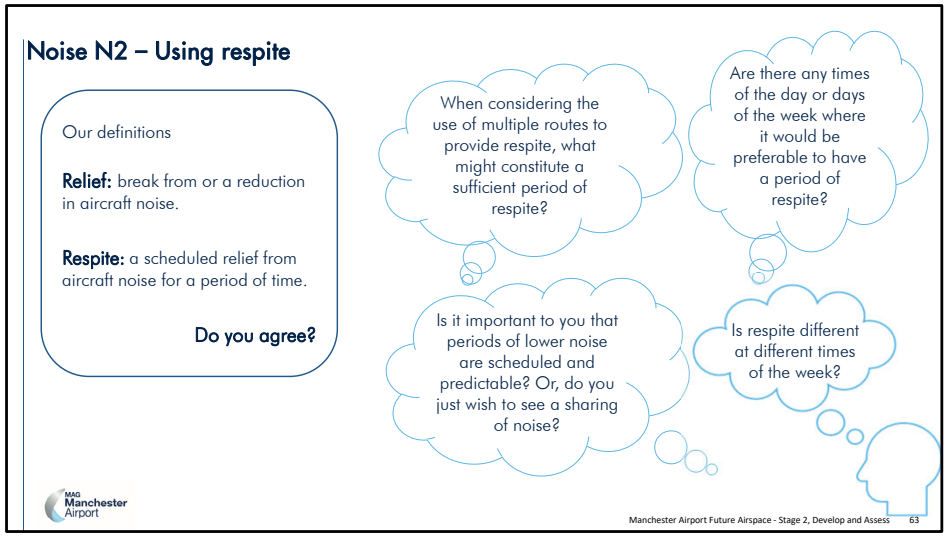
Design Principle Noise N2 relates to the provision of relief or respite, and in total there are 160 arrival and departure route options overflying various areas.

Design Principle Noise N3 relates to designs that avoid or limit effects on noise sensitive areas. To assist identification of issues for such areas we have marked National Parks, Areas of Outstanding Natural Beauty (AONB), Sites of Special Scientific Interest (SSSI), and country parks. Separately we have also mapped noise sensitive buildings such as centres of education, healthcare, and worship as well as historical assets. When we can carry out more detailed assessments of the merits of individual routes for Stage 3 these will be reflected.  We are also looking for your feedback, identifying any additional local factors that we should be aware of. Is there anything in your area we should consider?

In order to develop our options, we'd like to hear your point of view regarding respite.

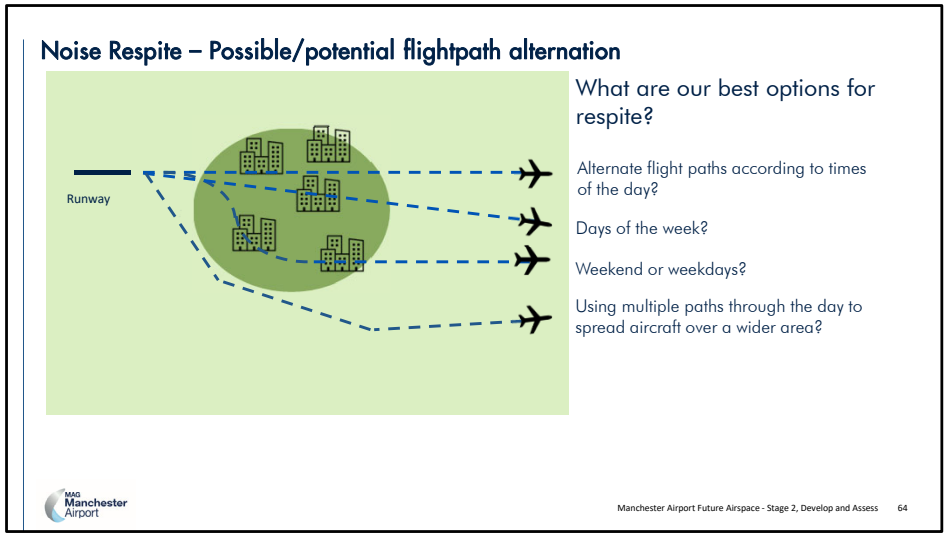
We would also like your feedback on several alternative concepts we're looking at to provide respite or relief.

Please note that these are only concepts at this stage and are there to help form ideas and aid discussions. Not all of these may be operationally viable in all cases, particularly when we seek to engage with the wider airspace network and seek to integrate our arrivals with our departures.




We are defining ‘relief’ as a break or a reduction in aircraft noise at any particular time. - This could be accidental or driven by the weather.

We are defining ‘respite’ as a planned or scheduled period of ‘relief’ for the community.



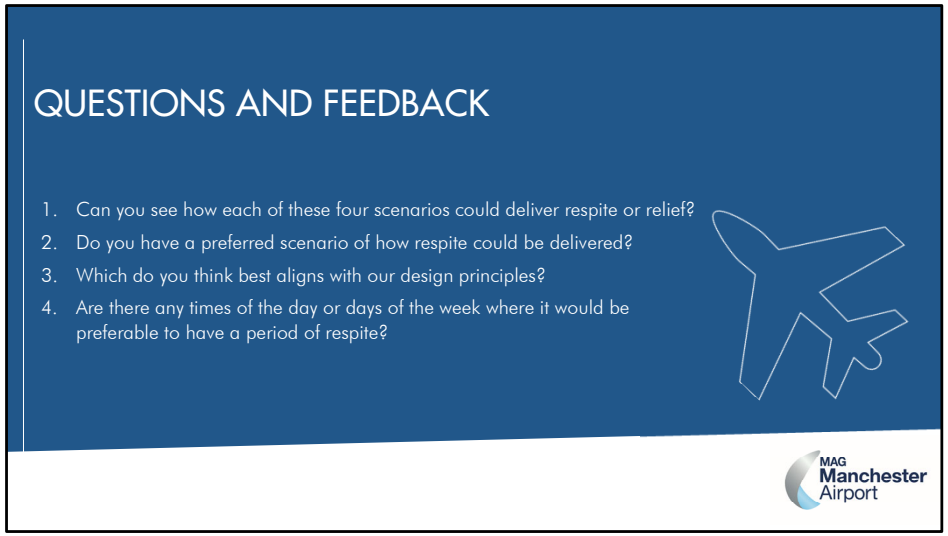

Respite can reduce the impact of noise in different ways, which could include:

- varying the routes used on different:
    - times of day - perhaps, mornings or afternoons are preferable for respite?
    - days of the week - perhaps you would wish to see fewer flights on a Tuesday or at one end of the week than the other?
    - or differentiating between weekdays and weekends. - does aircraft noise have a greater effect on a weekday than a weekend?

This creates predictable periods of no or reduced overflight.

Alternatively, designing multiple routes in a particular direction could be used to reduce the frequency and number of flights using each individual route by spreading them out.

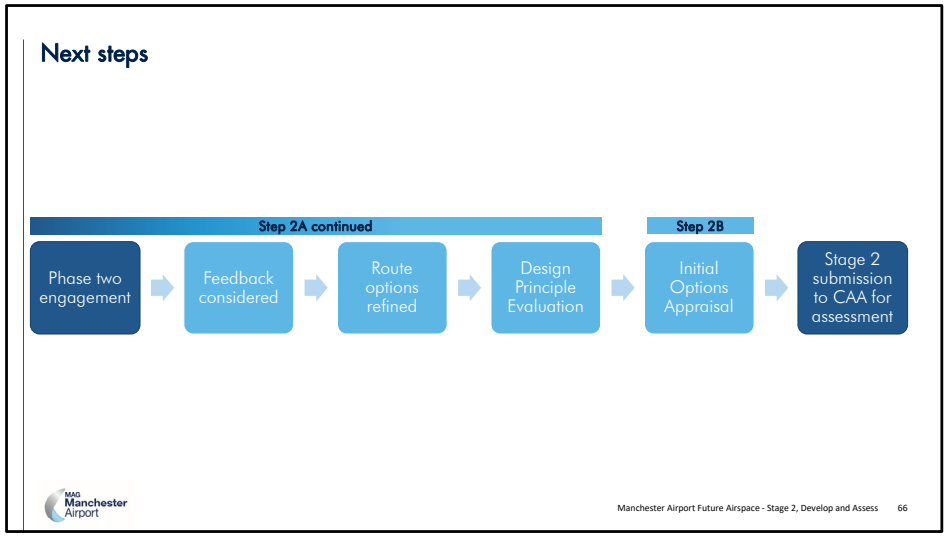
The extent to which these options can be used will become clearer as we progress through the process.




That concludes our slides on the different ways we could deliver noise respite.

We're very keen to hear what you think of these four options?

You will see on the screen four questions to guide your responses.




In terms of next steps, as we have previously mentioned, we'll be providing you with all the materials that we have covered today together with a feedback survey. We will need your feedback by 5pm on Thursday 16th June 2022.
Once we have collated all the feedback, we will review and consider your inputs and the route options will be refined further. The route options will then be evaluated against the design principles. The Design Principles Evaluation (DPE) then completes the work required for Step 2A.
After this, we start Step 2B of Stage 2 and the route options are subject to an Initial Options Appraisal to determine their likely impacts. Once complete, we'll submit details of all the work completed throughout Stage 2 for assessment by the CAA. Once approved these documents will appear on the CAA portal and we will send you a link.

# THANK YOU FOR YOUR TIME

Feedback deadline –5pm on Thursday 16th June 2022

futureairspace@manairport.co.uk

MAG Manchester Airport

# Manchester Airport Future Airspace

Glossary

April 2022

MAG Manchester Airport

# Glossary

| Term | Definition |
|---|---|
| Airspace Change Organisation Group (ACOG) | A newly established body set up by the Government and the CAA to co-ordinate airspace-change projects across airports and upper airspace. |
| Airspace Modernisation Strategy (AMS) | The CAA's strategy and plan for the use of UK airspace, including the modernisation of airspace. |
| Air Traffic Control (ATC) | Air traffic control make sure aircraft fly safely within airspace, often issuing commands to aircraft to climb, descend or turn. |
| Air traffic movement (ATM) | An air transport movement is a landing or take-off of an aircraft operating a scheduled or non-scheduled service |
| Above Mean Sea Level (AMSL) | When this is stated, the measure of altitude given is above mean sea level. Runway 1 is 256 ft and Runway 2 is 235 ft above mean sea level. |
| Civil Aviation Authority (CAA) | The industry's regulator. |
| CAP1616 | The CAA's guidance document which sets out the regulatory process which all airspace change proposals must follow. |
| Concept of Operations (CONOPS) | Document describing how we want our airspace system to work. Acts as a guide to our airspace designers. |
| Continuous Descent Approach (CDA) | Method by which arriving aircraft descend on a smooth continuous glide path, therefore staying higher above the ground for longer and reducing the level of arrival noise heard on the ground. |
| Design envelopes | Broad areas where it may be appropriate for us to place routes for arriving and departing aircraft. |
| Design Principles (DPs) | High level considerations that will guide the development of our route options. Manchester Airport has nine design principles |

| | |
|---|---|
| | that were developed through stakeholder engagement as part of Step 1B of the airspace change programme. |
| Design Principle Evaluation (DPE) | The Design Principle Evaluation involves taking all of the Viable and Good Fit options developed and qualitatively evaluating them against the Design our Principles. This helps to determine which options best meet the Design Principles and therefore proceed to the next stage of the airspace change process. |
| Future Airspace Strategy Implementation North (FASI-N) | Group accountable for delivering airspace changes (includes airports and NERL (NATS En Route)) in the north of Britain. |
| Holding stack | If an approach delay is expected instructions may be given to enter a holding pattern or 'Stack'. Aircraft in the holding pattern circle at different heights around a central point until the way is clear for them to be guided into sequence for landing. Aircraft in the stack are separated vertically by 1,000 feet. The lowest level of the stack is 6,000 feet. There are three Stacks in use at Manchester Airport, DAYNE, MIRSI, and ROSUN. |
| International Civil Aviation Organisation (ICAO) | A United Nations organisation responsible for international standards for civil aviation, including the rules for route design. |
| Instrument Landing System (ILS) | A precision runway approach aid based on two signals which provide vertical and horizontal guidance to aircraft on approach to land. |
| Initial Options Appraisal (IOA) | The document that is the first iteration of the three option appraisals required by CAP1616 - the design options appraised within the IOA are the outputs from the Design Principles Evaluation (DPE). |
| NATS | The UK's air traffic navigation service provider, formerly known as National Air Traffic Services. |
| NERL | NATS (En Route) Public Limited Company.<br>The sole provider of air traffic control services for aircraft flying 'en route' in UK airspace and the eastern part of the North Atlantic. |
| Preferred Noise Route (PNR) | Lines of tolerances widen from the runway ends out to 1½ Kilometres to each side of the Standard Instrument Departure route (see below). The area encompassed by these 1½ |

| | |
|---|---|
| | Kilometre tolerances is that commonly recognised as the Preferred Noise Route (PNR). |
| PAN-OPS 8168 – Procedures for Air Navigation Services | ICAO document which defines the rules for designing approach and departure procedures. |
| Performance Based Navigation (PBN) | Satellite based navigation system designed to improve track keeping accuracy for aircraft. |
| Rate of Climb | The rate at which to increase height by distance travelled. |
| Respite | Planned periods where overflight or noise impact are reduced or halted for the purpose of providing communities with periods of undisturbed time. |
| Standard Instrument Departure (SID) | In common with other large airports aircraft departing from Manchester are directed to fly Standard Instrument Departures (SIDs). A SID is a series of navigational instructions, laid out with a diagram and text that simplify the departure process by providing the pilot and/or the aircraft's computer system with several waypoints and a climb profile (the rate at which to increase height by distance travelled) they need to follow to make sure they accurately follow the SID and remain safe. |
| Statement of Need | A statement setting out the airspace issue or opportunity that a sponsor seeks to address and what it hopes to achieve. Change sponsors are required to submit this to the CAA at Step 1A of the airspace change programme. Manchester Airport submitted a Statement of Need in March 2019. |
| Vectoring | Navigational guidance given to aircraft by air traffic control in the form of specific directional headings. |