London Biggin Hill Airport RNAV (GNSS) Runway 21 Airspace Change Proposal ACP-2019-86 Stage 2 Design Options Development Document

ACP-2019-86

Document Details

Reference	Description
Document Title	London Biggin Hill Airport RNAV (GNSS) Runway 21 Airspace Change Proposal ACP-2019-86 Stage 2 Design Options Development Document
Issue	Original
Date	26th May 2021

Table of Contents

Table of Figures

Table of Tables

1 Design Options Development

1.1 Background

London Biggin Hill Airport (LBHA) is progressing through the Airspace Change Process as defined by the Civil Aviation Publication (CAP) 1616. This airspace change, if successful, is to introduce a RNAV(GNSS) arrival route in order to:

- Be compliant with EASA Regulatory requirements detailed within IR (EU) 20 18/10 48. This will also meet the requirements within the CAA Airspace Modernisation Strategy.
- Add a layer of resilience to the airport operation by providing a second instrument approach in the event that the current ILS procedure is unavailable.

As part of this redesign, LBHA must follow the guidance provided by the CAA and successfully complete the first 6 stages of CAP 1616. The first of these, Stage 1 (Define), was successfully completed earlier this year. Documentation relating to this stage can be accessed through the CAA Airspace Portal Airspace change portal (caa.co.uk)

This LBHA Airspace Change project is now at the Stage 2 (Develop & Assess).

1.2 Progress So Far

The Statement of Need submitted to the CAA to initiate this ACP stated:

LBHA is proposing to implement an RNAV(GNSS) Instrument Approach Procedure (IAP), with LNAV and LPV Minima to Runway 21. The IAP will be designed for aircraft in Speed Categories A, B, and C and will include an RNAV Missed Approach Procedure. The RNAV(GNSS) IAP will replicate/mimic the existing Runway 21 ILS/DME/VOR[1] procedure. The RNAV(GNSS) Procedure for Runway 21 will not only act as a back-up in the event of an ILS failure, but will also future proof the airfield and provide an alternative to procedures utilising the BIG VOR, which is due to be removed in the near future.

This is the formal explanation of why LBHA wishes to make changes within the airspace surrounding it.

Stage 1 of CAP 1616 requires that the airport and stakeholders, through a two-way process establish a set of Design Principles which will subsequently steer and guide the development of the route options. LBHA successfully completed Stage 1 and the finalized prioritised Design Principles that passed through the CAP 1616 Gateway 1 is shown in Table 1 below.

[1] ILS/DME/VOR Procedures are conventional procedure that utilise ground-based equipment to define the lateral and vertical guidance for the aircraft.

Priority	
1	SAFETY - New routes must be safe and must not erode current ANSP safety barriers
2	ENVIRONMENTAL CONCERNS - Arrival routes should, where possible, be designed to minimise the impact of noise below 7,000' and should avoid the overflight of populations not previously overflown
3	COMPLIANCE - Routes should, where possible, be designed to be PANS Ops compliant
4	NAVIGATION STANDARDS - New routes must be designed to use PBN
5	EFFICIENT ROUTES - Arrival routes should, where possible, be designed to minimise emissions and optimise operational efficiencies
6	REPLICATION - Procedure should, where possible mimic the existing procedure and/or the existing ILS positioning by ATC vectors

Table 1 Prioritised Design Principles

1.3 Stage 2 Engagement

The CAA guidance in CAP1616 states that a change sponsor must test the Comprehensive List of options with the same stakeholders engaged with in the development of the Design Principles to ensure "that they are satisfied that the design options are aligned with the design principles and that the change sponsor has properly understood and accounted for stakeholder concerns specifically related to the design options."

This was undertaken over a 4-week period starting on 9th April 2021 when an email with the required information was sent to all stakeholders previously contacted in Stage 1, together with the addition of Kent Hills AONB as recommended by the CAA at Gateway 1.

Within the email, a Zoom session[2] was offered as an opportunity to ask questions. The feedback window was open until 7th May 2021.

Most of the feedback received was positive and accepted that the options presented did represent a Comprehensive List. During the first Zoom session one attendee suggested an additional MAP option to route around RAF Kenley. This was accepted by LBHA and subsequently investigated. It is Option 12 in this document. To ensure stakeholders were aware of this additional option details

[2] Due to COVID 19 restrictions

were emailed out and the discussion at the following 2 Zoom session included this new option.

Engagement materials are available on the CAA Airspace Change Portal.

1.4 This Document

This document is required for Gateway 2 of CAP 1616 and explains how the change sponsor has developed options for the Comprehensive List.

1.5 Context CAP 1616

CAP 1616 is a seven-stage process published by the CAA, those seven stages are:

- Stage 1 – Define
- Stage 2 – Develop and Assess (current stage)
- Stage 3 – Consultation
- Stage 4 – Update and Submit
- Stage 5 – Decide
- Stage 6 – Implement
- Stage 7 – Post-Implementation Review

1.6 Context the LBHA operation

LBHA is supported by 1800 metres of tarmac which enables 2 runways (one in each direction), Runway 21 and Runway 03. Runway 21 is an instrument runway enhanced by an Instrument Landing System, and Runway 03 is currently a visual runway that will, in the near future, be supported by an RNAV (GNSS)[3] that is an Area Navigation (Global Navigation Satellite System) Approach.

Due to the prevailing southwest wind (about 70% of the time), and the fact that aircraft take off and land into wind, Runway 21 is the most used runway.

There are three types of approach typically flown as approaches to runway 21 at LBHA. These are:

- Radar vectors to the Instrument Landing System[4] (ILS) (this can include a visual circling approach to land on runway 03).
- Radar vectors to VOR/DME, at the time of writing, this procedure is expected to be withdrawn on 1 Dec 2022[5] and therefore the additional resilience provided by this procedure will be lost.
- Radar vectors to visual.

[3] An ACP conducted under CAP 725 awaiting CAA decision.
[4] The ILS is a radio navigation system which provides aircraft with both horizontal and vertical guidance just before landing. It relies on physical infrastructure on the ground at the airport and enables aircraft to land when weather conditions are poor.
[5] Information received from NATS the en-route air traffic service provider

Radar vectors are provided by NATS (Thames Radar) and are similar for each approach. These vectors create the current swathe shown below in Figure 1.

Due to the current airspace arrangements IFR aircraft (that is, aircraft operating under Instrument Flight Rules) inbound to LBHA when runway 21 is in use, route through OSVEV. The position of OSVEV can be seen in Figure 1. Additionally, it shows the position ALKIN, this reporting point is used when aircraft have to hold, and it is also the starting point for the VOR/DME procedure. Currently the only way to route from the network exit point (OSVEV) to ALKIN is with the use of radar vectors.

As this change will establish a new procedure, that procedure requires a new missed approach (MAP) element and a new radio communications failure (RCF) element. The MAP is followed when an aircraft is unable to land off an approach and has to re-join the arrival stream for another attempt, something that happens rarely, but is a normal safety procedure.

The RCF procedure is not explored further in this document because its use is extremely rare and subject to very specific requirements.

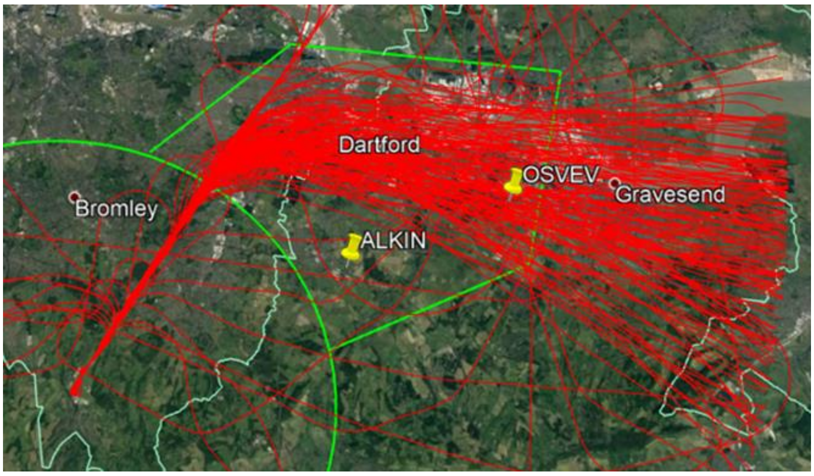

Figure 1 Current LBHA Radar Vectors

1.7 Context regarding the design of the options

As part of the UK's airspace modernisation strategy[6], and in line with the Statement of Need and Design Principles 3 and 4, all the options will be developed to be compliant with EASA regulatory requirements detailed within IR (EU) 20 18/10 48. This means the procedures are designed to be flown by the automatic systems that the majority of modern aircraft use for navigation. These designs will use waypoints. A waypoint in a procedure is defined positionally by its Latitude and Longitude; generally its position may not represent a physical feature on the ground and will be positioned so that the designed routes are technically flyable by the aircraft and can integrate with the national airways structure. The aircraft navigation systems will automatically direct the aircraft according to the routing designed into the procedure.

[6] CAA document CAP 1711

1.8 Next Steps

Within Stage 2 of CAP 1616, the Comprehensive List is be refined down, firstly to a Long List, then to a Short List.

A Design Principle Evaluation (DPE) is undertaken by the sponsor, this describes how the options respond to the design principles. The DPE document articulates the evaluation of each of the options against the design principles agreed during Stage 1 and is part of the document set submitted at Gateway 2. At the end of the DPE the options left form the Long List.

After the DPE the sponsor will then initiate an Initial Options Appraisal (IOA). Here the remaining options are tested against the criteria contained within CAP1616, Appendix E, Table E2 with the addition of qualitative assessments of noise and safety impacts, as required by a Level 1 change. The IOA document is also part of the document set submitted at Gateway 2. At the end of the IOA the options left form the Short List.

An additional requirement stated in CAP 2091, CAA Policy on Minimum Standards for Noise Modelling, requires the change sponsor to state at the Stage 2 Gateway what category of noise modelling will be undertaken for further stages of the CAP 1616 process. LBHA proposes to conduct noise modelling to comply with the requirements of Category D. Category D is considered appropriate as in summer 2019 there were around 2,100 people within the 51 dB $L_{Aeq,16h}$ daytime contour which is just above the mandated minimum threshold of 2,000 for Category D, but well below the recommended minimum threshold of 20,000 for Category C. At night there were around 20 people within the 45 dB $L_{Aeq,8h}$ contour which is well below the recommended minimum threshold of 1,600 for Category D.

2 Comprehensive List

2.1 Requirement

CAP 1616 requires LBHA to develop a Comprehensive List of options, but also accepts that there may be limited scope for multiple design options due to, for example, the physical constraints of adjacent airspace and/or procedures. Consequently, it is first necessary to set out the constraints that apply in this case.

2.2 Constraints and Criteria

It is important to state what this change is not about. It is not about increasing the numbers of aircraft that utilise LBHA and it is not about introducing new ground infrastructure at the airport.

In addition, this ACP is bound by the following constraints established in Stage 1:

- Designers are limited to the PANS-OPS design criteria.
- This change should not necessitate any change to any other air traffic procedure
- This change should not change any airspace configuration or classification.
- This change is limited to changes at 3000 feet and below, as procedures above are "owned" by NATS and are not part of this change.

To ensure that the options that were to be developed would be done so based on stakeholder feedback, the Design Principles which had previously been agreed by stakeholders at Stage 1, were established as the basis for the options development. For instance, Design Principle 2 led LBHA to explore different vertical profiles to minimise the noise footprint. Table 2 below shows how those agreed Design Principles were utilised as the criteria to explore and develop the options.

Priority	Design Principle	Criteria used during development
1	SAFETY - New routes must be safe and must not erode current ANSP safety barriers	The options should not necessitate ground-breaking safety work or require multiple knock-on changes.

Priority	Design Principle	Criteria used during development
2	ENVIRONMENTAL CONCERNS - Arrival routes should, where possible, be designed to minimise the impact of noise below 7,000' and should avoid the overflight of populations not previously overflown	The options should minimise the impact of noise and should avoid the overflight of populations not previously overflown.
3	COMPLIANCE - Routes should, where possible, be designed to be PANS Ops compliant	Designs should be PANS-OPS compliant; the parameters of the Instrument Flight Procedures (IFP) e.g. shape, accuracy, turn areas and obstacle clearances are predetermined (to a degree) in ICAO document PANS-OPS 8168 Aircraft Operations – Volume 2 Construction of Visual and Instrument Flight Procedures. This is the international standard for all IFPs.
4	NAVIGATION STANDARDS - New routes must be designed to use PBN	PBN standards used should be accessible to the largest number of operators.
5	EFFICIENT ROUTES - Arrival routes should, where possible, be designed to minimise emissions and optimise operational efficiencies	Options should have minimal track miles/fuel burn, and not cause operational complexity.
6	REPLICATION - Procedure should, where possible mimic the existing procedure and/or the existing ILS positioning by ATC vectors	Options should mimic the existing procedure and/or the existing radar vector swathe.

Table 2 Prioritised Design Principles and Development Criteria

2.3 Options Development

The paragraphs below explain how LBHA constructed the Comprehensive List as defined in CAP 1616. This process began by looking at options outside of the CAP 1616 process, then radical options looking at new ideas, and experience at other airports. Only after this did the option work look at the specific vertical and lateral variations that could be utilised in line with the design principles.

2.3.1 Options outside of CAP 1616

At first it was considered if this proposal could be achieved by change outside of the airspace change process. However, it would not be possible to meet the objectives of resilience and regulatory adherence any other way than through an ACP.

2.3.2 Radical ACP options

Next it was necessary to explore whether any possible radical airspace change options were appropriate. One of these possibilities was to look at multiple routes (feedback from Stage 1), offering managed dispersion. Another was the possibility of utilising the initial RNAV(GNSS) routing to enable interception of the ILS. Unfortunately, neither of these possibilities have been successfully introduced into UK airspace[7] and as such would require an enhanced level of safety work, would likely need airspace trials, and may need new ATC tools to even be feasible.

Further possibilities lay outside the constraints of this project as they would entail partial or wholesale change to the airspace in the area. These aspects are under consideration within a different airspace change; the Future Airspace Strategy Implementation South (FASI-S) airspace redesign work.[8]

Consideration was also given to the specification of the PANS-OPS design. A high-end specification (known as RNP-AR) would limit, considerably, the ability of certain aircraft types and crews to undertake such a procedure due to the requirement for specific CAA approval following specific training. Therefore, this would not meet the resilience criteria and has not been further investigated.

An assessment was made as to whether there were any radical options for the Missed Approach Procedure (MAP) even though as a rarely used routine procedure these would be limited. Due to the constraints of the project regarding airspace construct and not interfering with other procedures, it was apparent that no MAP option could change the current maximum altitude, or position of the hold.

2.3.3 Lateral only options

The Design Principles and additional feedback from Stage 1 suggested the desire to keep arrival aircraft within the current vectoring swathe, this aligns with the constraints of the extant air traffic arrangements and is progressed within the options development.

An option set was considered that would allow aircraft to arrive at LBHA from any direction, therefore, not utilising either OSVEV or ALKIN. Due to the constraints mentioned above and the desire for options to be within the current swathe, the

[7] 2014 Heathrow Trials identified issues regarding the management of managed dispersion
[8] Details can be found on the CAA Airspace Change Portal for each airport involved

only possible option was to focus on the area shown below circled in orange, as the diagram clearly shows some aircraft utilising this space today.

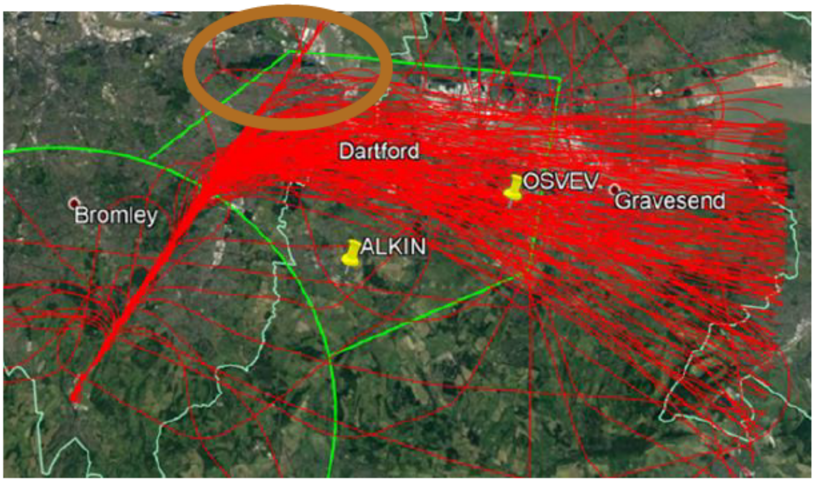

Figure 2 Current LBHA Radar Vectors with emphasis on northerly tracks

While it is possible that this option set may not "fit" into the extant air traffic arrangements, at this stage of high-level assessment we have included this in our Comprehensive List. Options that utilise this element are shown by the addition of a "T", e.g. Option 5AT. These options cannot be associated with designs that utilise ALKIN due to design constraints.

During this development stage it became apparent that some options could utilise an OSVEV to ALKIN direct link, instead of the current radar vector arrangement. Any of our options that utilise this link are shown by the addition of "D" e.g. Option 2AD. It was not possible to establish any other options for this link as by default it is a straight line between 2 points.

Another set of options looked at ignoring ALKIN and just using OSVEV. While it is possible that this option set may not "fit" into the extant air traffic arrangements as aircraft will leave OSVEV differently to today, at this stage of high-level assessment we have included these in our Comprehensive List.

As the design phase progressed option set 3 and 4 were discontinued but are included in this document for completeness; this is explained fully in Section 3.

The lateral options are numbered 1 to 7 for the inbound/arrival phase, with the addition of a D or a T where applicable.

When considering options for the MAP, the airspace construct and the IFP requirements have meant fewer options are possible. All options utilise ALKIN as the MAP hold (although the construct of the hold will change with the RNAV(GNSS) design requirements). The constraints of this project negate the construction of a hold anywhere else due to the knock-on effect to other procedures and airspace users. The MAP options are numbered 8 to 12.

2.3.4 Vertical only options

The Design Principles and additional feedback from Stage 1 suggest that due to environmental concerns aircraft should be kept higher for longer. This project is only concerned with aircraft from 3000 feet[9] due to the extant airspace structure, so this element was investigated as higher final approach gradients (approximately the last 10 nautical miles before touchdown). It was decided to progress these options as there is an evidence base to draw upon; procedures are operational at Heathrow Airport providing higher than the industry standard glideslopes for environmental benefit.

An important element to consider here is the impact that temperature has on the glideslope angle of an RNAV(GNSS) approach. It has a small effect on the altitude that an aircraft's altimeter says the aircraft is at compared to the height it actually is at, because the descent angle is based on the angle at the International Standard Atmosphere (ISA) temperature at mean sea level which is 15°C. Consequently, when the temperature is not exactly 15°C the RNAV (GNSS) approach angle will change ever so slightly; colder than 15°C produces a shallower approach angle and warmer than 15°C produces a steeper approach angle.

Consequently, if utilising a 3.5° RNAV(GNSS) it will be necessary to establish and publish the maximum temperature permissible to allow the approach to be flown, which is likely to make it unavailable during some of the summer as the actual Vertical Path Angle would then be non-compliant with the design criteria.

The vertical options considered are as follows:

Option A 3° Glideslope – the industry standard and the current approach angle for the VOR/DME and the ILS on Runway 21.

Option B 3.2° Glideslope – The Slightly Steeper RNAV trials at Heathrow and the associated ACP have shown that this approach can be flown successfully alongside a 3° ILS and that a small noise reduction is achievable.

Option C 3.5° Glideslope – the work undertaken by LBHA on the ACP for an RNAV approach to Runway 03 proves that the operators at LBHA can successfully operate with a glideslope at 3.5°. This glideslope for the RNAV approach on Runway 21 would necessitate an associated change to the ILS gradient to achieve a safe final approach environment. We acknowledge that this is contrary to the constraint of not changing any other procedure but feel that in this case it is acceptable to include this as the only change is a positive vertical one, it is a LBHA procedure and will have no impact on the positioning to the final approach. The prospect here is that all arrivals, when not flying visually, but flying the RNAV or the ILS would be slightly higher than today and therefore provide an increased noise benefit.

Radical option > 3.5° Glideslope – landing on the runway from angles greater than 3.5° is not operationally viable for many aircraft and some require modifications (an example is London City Airport). This option is contrary to the design regulations, PANS-OPS 8168 Vol 2; Part 3; Section 3; Chapter 4, Subsection 4.2.1.3 A procedure shall not have a promulgated Vertical Path Angle that is less than 2.5°. A procedure with a promulgated Vertical Path Angle that exceeds 3.5° is a non-standard procedure; therefore this option is discounted as non-compliant.

To help visualise these differences Figure 2 below shows the approximate heights above ground level for each glideslope angle at various ranges from the airport.

[9] Above mean sea level

LONDON BIGGIN HILL AIRPORT

BUSINESS | TRAVEL | COMMUNITY

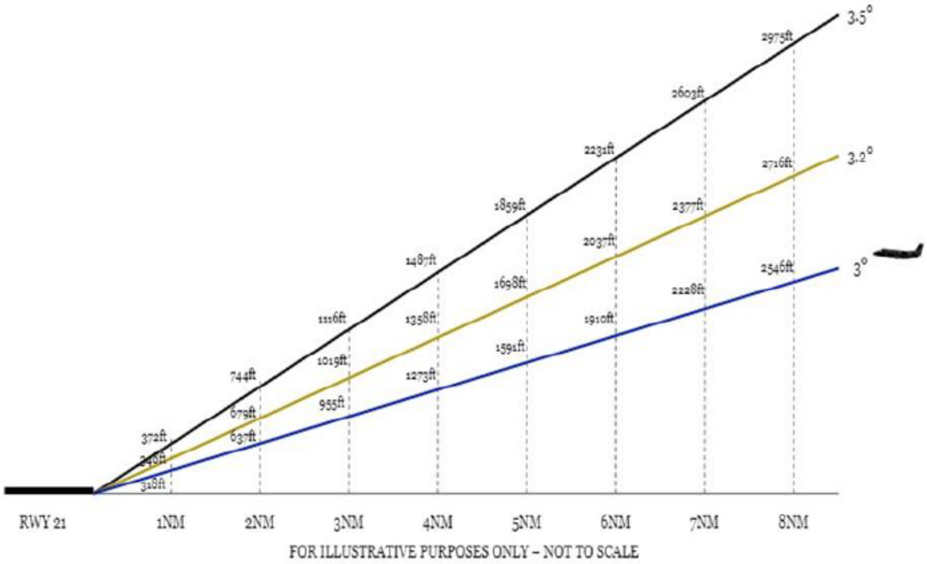

Figure 3 Glideslope options

Consequently the lateral options can now have an associated vertical option of A, B or C added. The Table below summarises the option variations.

Variation Code	Basic Description
A	Utilises a 3° final approach angle, which is currently industry standard.
B	Utilises a 3.2° final approach angle.
C	Utilises a 3.5° final approach angle.
T	Utilises a T-bar lateral approach philosophy where aircraft join from either the right- or left-hand side (making a T on the map) of the approach.
D	Utilises a direct routing between OSVEV and ALKIN.

Table 3 Variation Coding Explained

2.3.5 Number of Options

This work, together with stakeholder feedback, has resulted in 25 inbound options and 5 MAP options, details are shown in the following sections.

3 The Inbound Options

3.1 Options

The Comprehensive List contains all possible options, including radical options, this section and the following section give details of how specific routing options within the Comprehensive List were developed.

3.2 Option 1

Do Nothing. This will mean that when the VOR is removed from service there will be no IFR approach other than the ILS into LBHA on Runway 21, which would rely on radar vectors from NATS for positioning and have no functioning MAP. In addition, by not implementing a PBN approach LBHA will not be compliant with EASA Regulatory requirements detailed within IR (EU) 20 18/10 48.

3.3 Option 2A

Do Minimum. This option would be to replicate/mimic the current VOR/DME approach which starts from ALKIN. This assumes radar vectors from OSVEV to enable inbounds to exit the network using extant procedures, or radar vectors by NATS for inbounds from the MAP or the south as is the current practice for the VOR/DME approach. The glideslope is at 3.0°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors. The depiction shows aircraft arrival via the hold at ALKIN.

Figure 4 Option 2A

3.4 Option 2AD

This option would be to replicate/mimic the current VOR/DME approach which starts from ALKIN and utilise a new direct link from OSVEV to enable inbounds to exit the network. This assumes radar vectors or radar vectors by NATS for inbounds from the MAP or the south as is the current practice for the VOR/DME approach. The glideslope is at 3.0°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

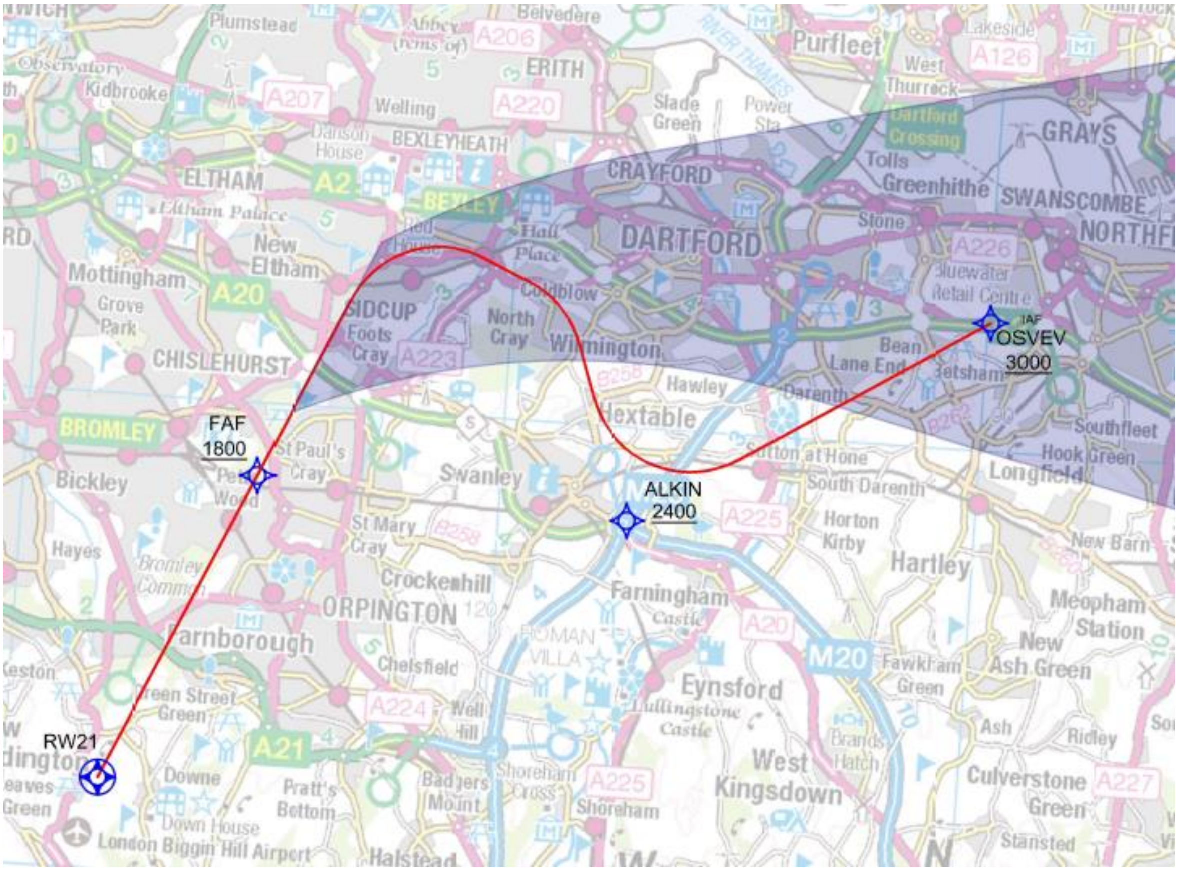

Figure 5 Option 2AD

3.5 Option 2B

This option would be to replicate/mimic the current VOR/DME approach which starts from ALKIN. This assumes radar vectors from OSVEV to enable inbounds to exit the network using extant procedures, or radar vectors by NATS for inbounds from the MAP or the south as is the current practice for the VOR/DME approach. The glideslope is at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors. The depiction shows aircraft arrival via the hold at ALKIN.

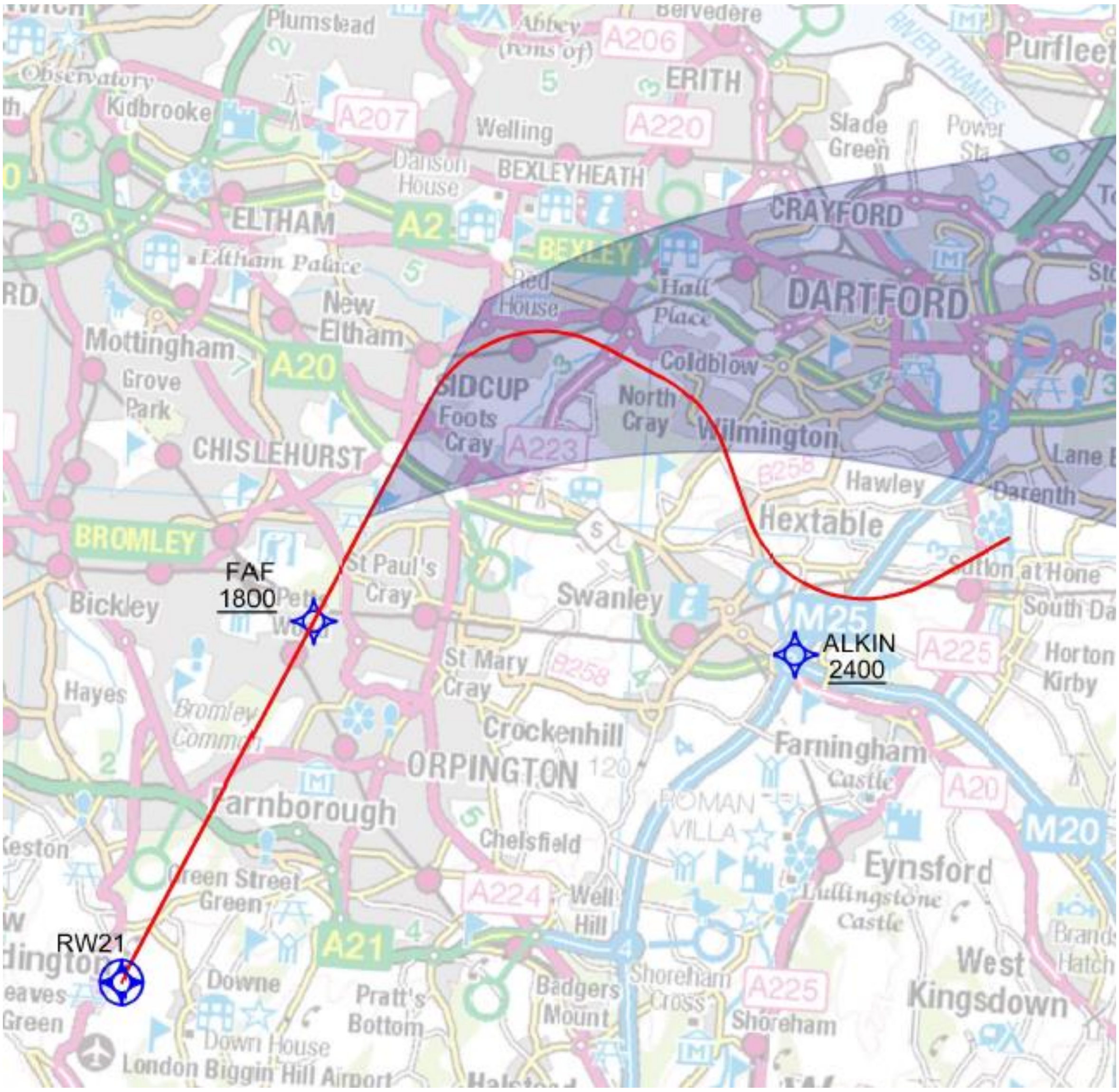

Figure 6 Option 2B

3.6 Option 2BD

This option would be to replicate/mimic the current VOR/DME approach which starts from ALKIN and utilise a new direct link from OSVEV to enable inbounds to exit the network. This assumes radar vectors or radar vectors by NATS for inbounds from the MAP or the south as is the current practice for the VOR/DME approach. The glideslope is at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

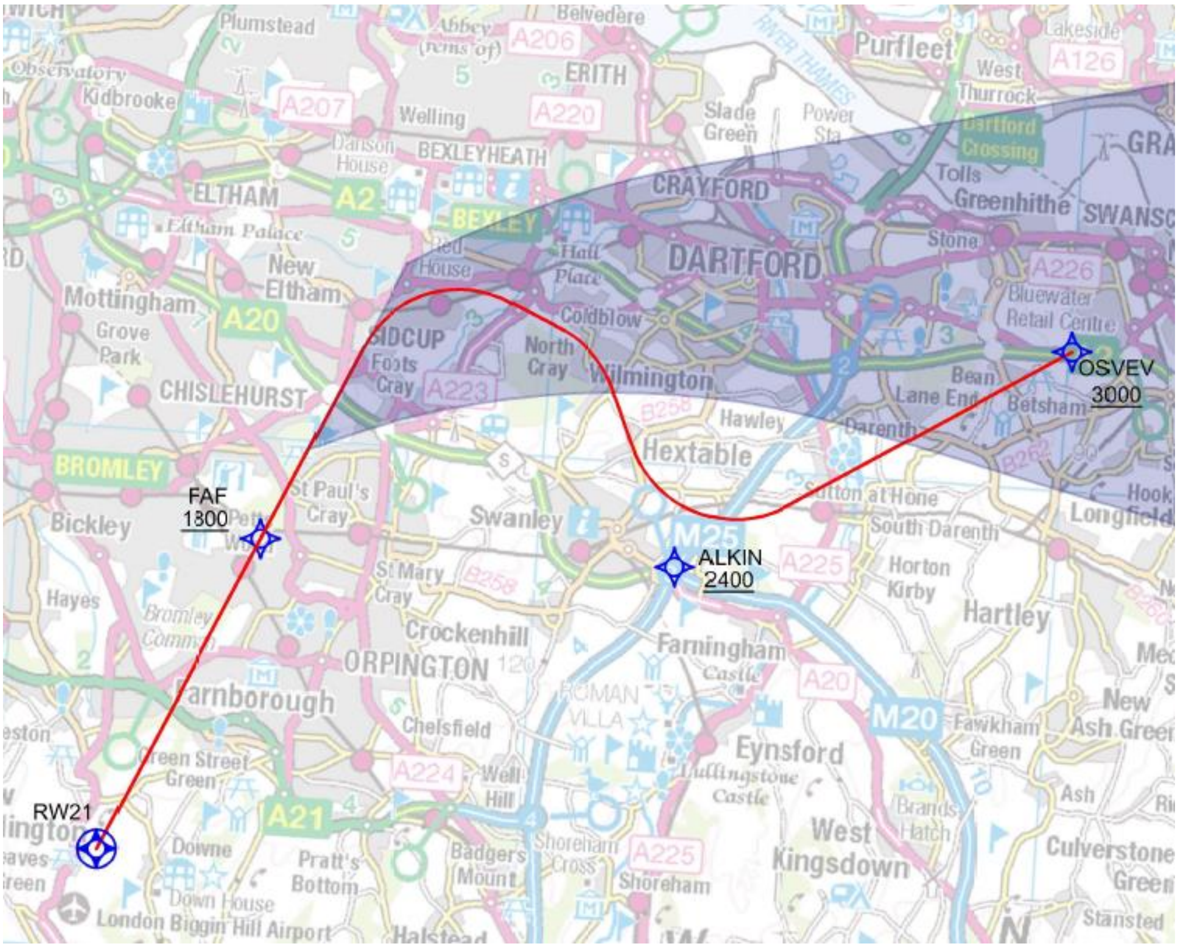

Figure 7 Option 2BD

3.7 Option 2C

This option would be to replicate/mimic the current VOR/DME approach which starts from ALKIN. This assumes radar vectors from OSVEV to enable inbounds to exit the network using extant procedures, or radar vectors by NATS for inbounds from the MAP or the south as is the current practice for the VOR/DME approach. The glideslope is at 3.5°.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors. The depiction shows aircraft arrival via the hold at ALKIN.

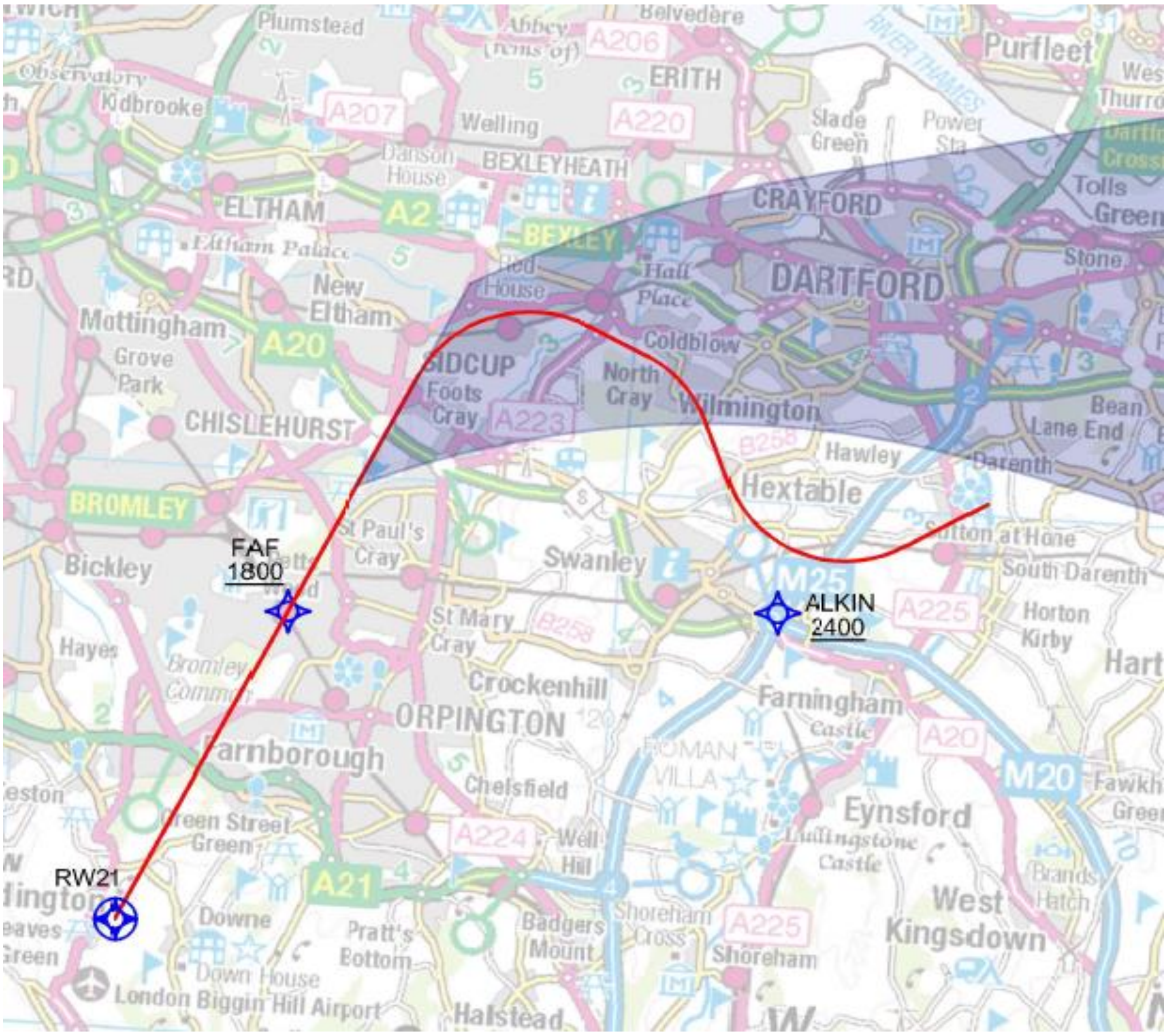

Figure 8 Option 2C

3.8 Option 2CD

This option would be to replicate/mimic the current VOR/DME approach which starts from ALKIN and utilise a new direct link from OSVEV to enable inbounds to exit the network. This assumes radar vectors by NATS for inbounds from the MAP or the south as is the current practice for the VOR/DME approach. The glideslope is at 3.5°.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

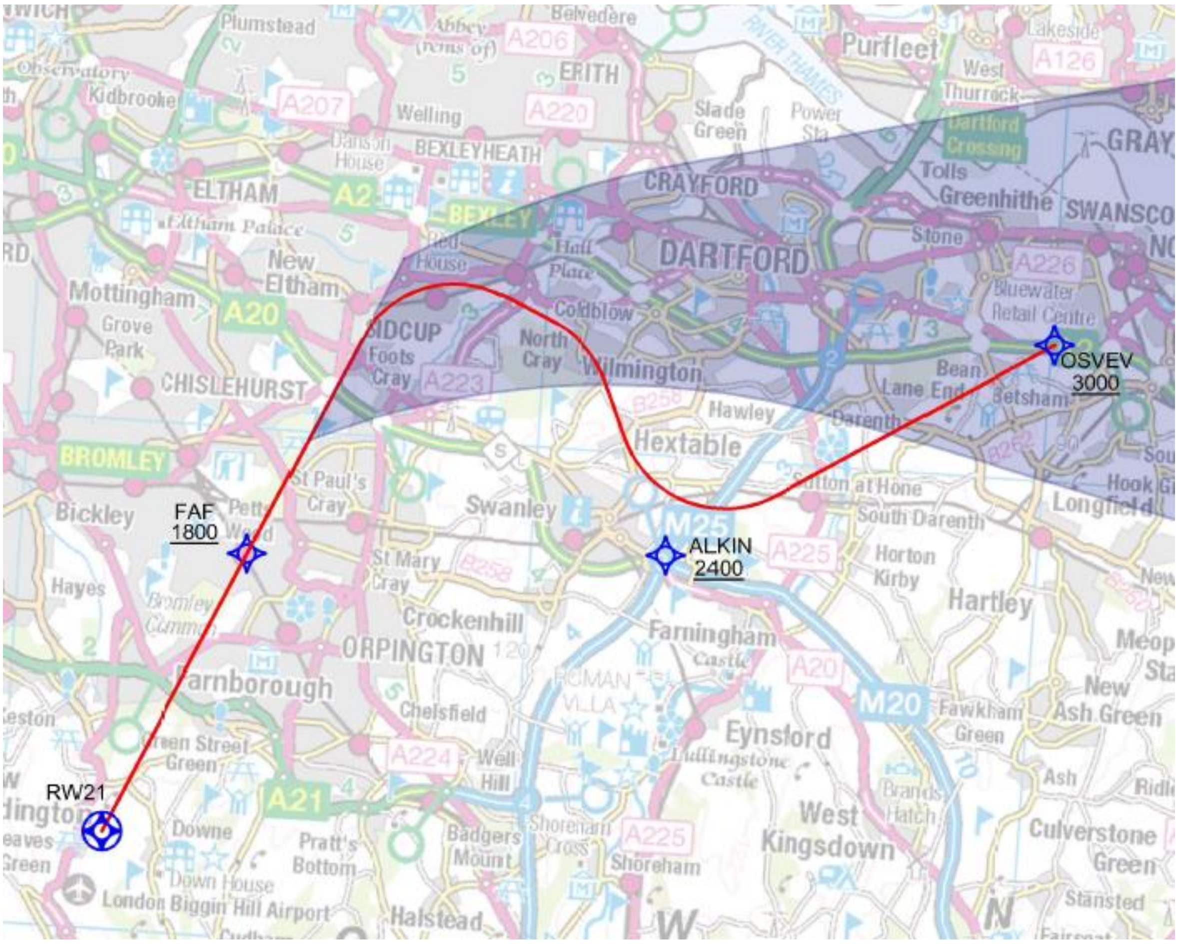

Figure 9 Option 2CD

3.9 Option 3A/B/C

Laterally left of current VOR plate, starting from ALKIN but remaining within current ILS vectoring swathe, final approach at 3°/3.2°/3.5°. This assumes radar vectors from OSVEV to enable inbounds to exit the network using extant procedures, or radar vectors by NATS for inbounds from the MAP as is the current practice for the VOR/DME approach.

Discontinued as it proved impossible to design within the constraints as it would result in a change to the positioning of aircraft as they prepared to land resulting in overflying new people, as shown by the red line in the Figure below.

3.10 Option 4A/B/C

Laterally right of current VOR plate, starting from ALKIN remaining within current ILS vectoring swathe final approach at 3°/3.2°/3.5°. This assumes radar vectors from OSVEV to enable inbounds to exit the network using extant procedures, or radar vectors by NATS for inbounds from the MAP as is the current practice for the VOR/DME approach.

Discontinued as it proved impossible to design within the constraints as it would result in a change to the positioning of aircraft as they prepared to land resulting in overflying new people, as shown by the green line in the Figure below.

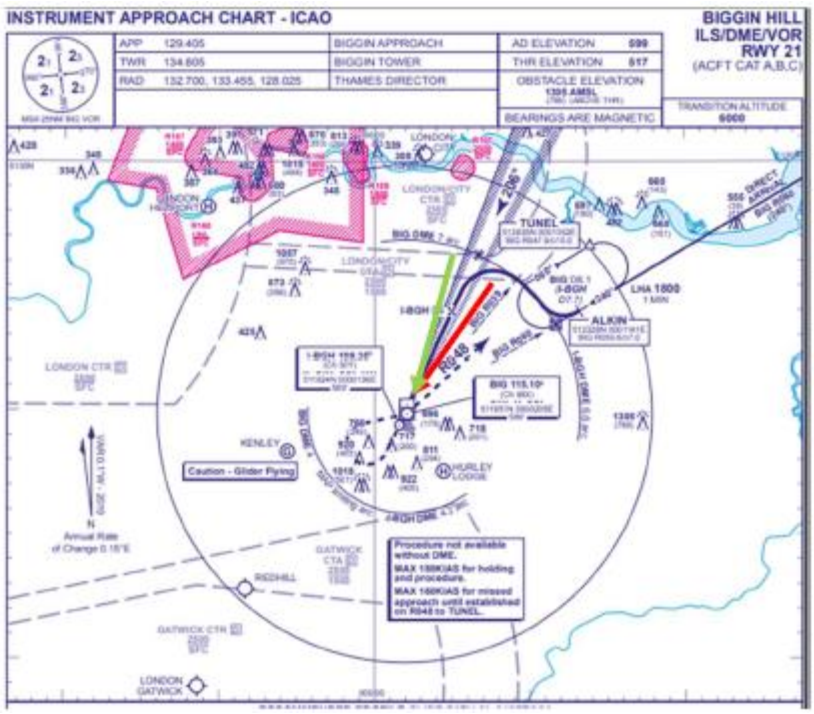

Figure 10 Option 3 and 4

3.11 Option 5A

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing through the centre of the current ILS vectoring swathe, final approach at 3°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

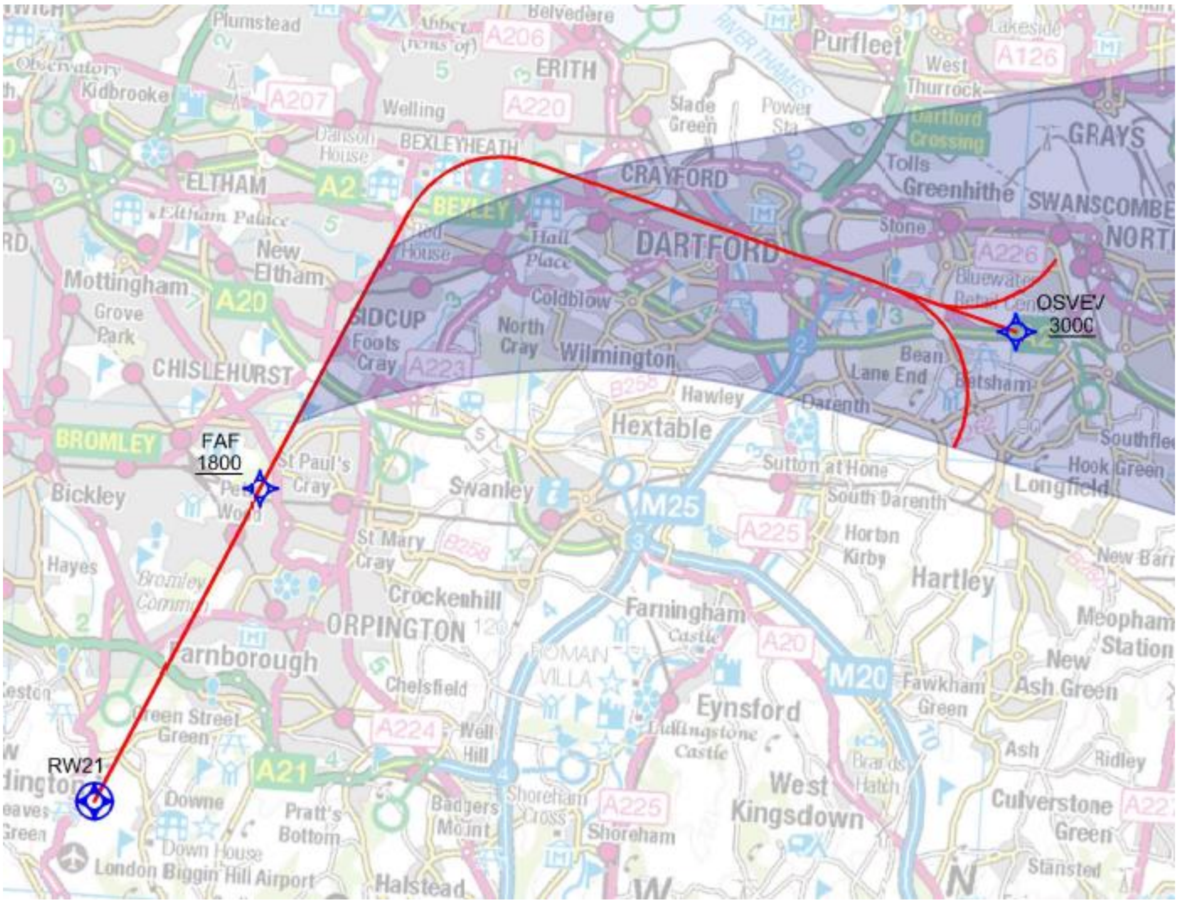

Figure 11 Option 5A

3.12 Option 5AT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing through the centre of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to understand the viability of the IAF North.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

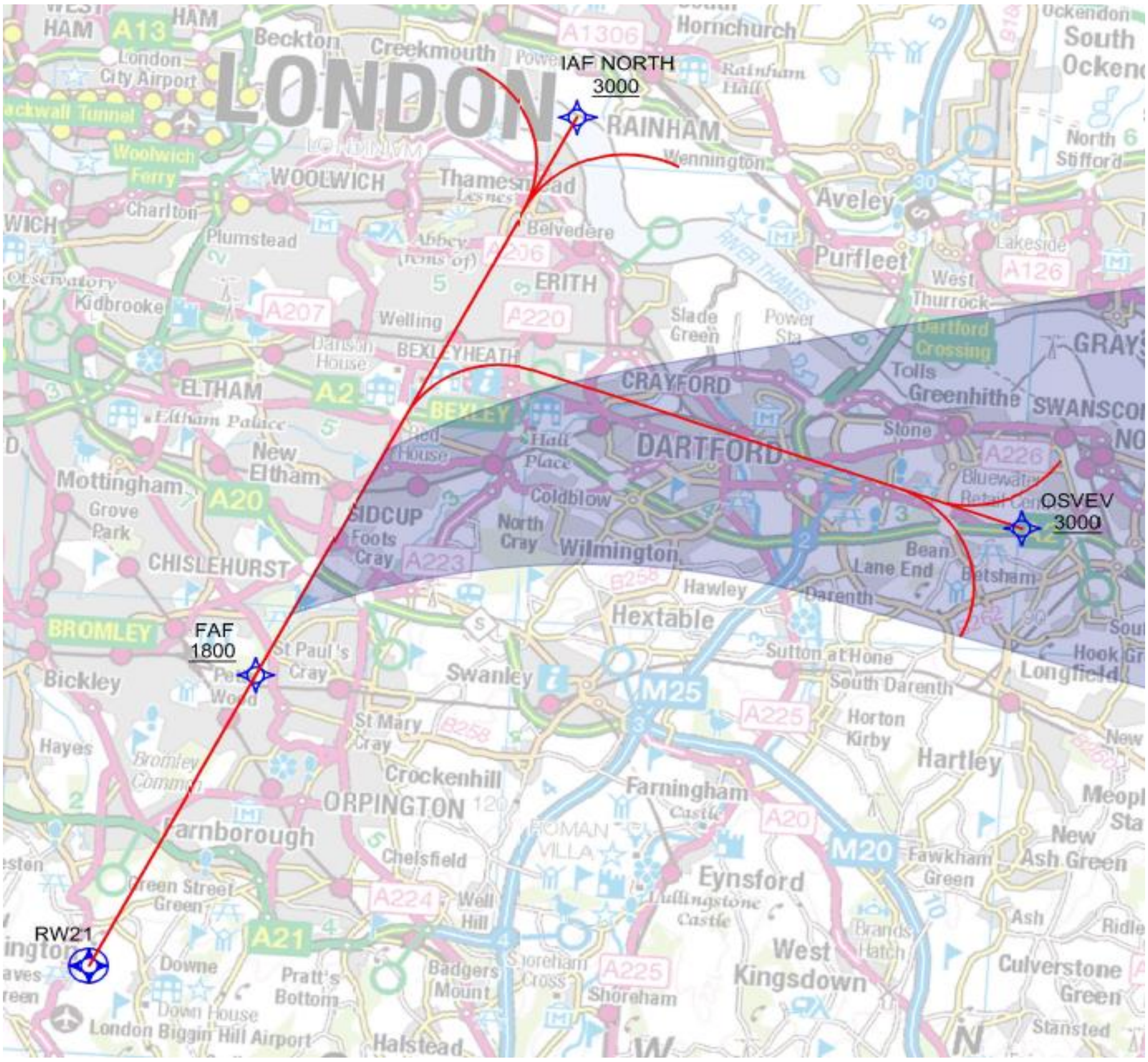

Figure 12 Option 5AT

LONDON BIGGIN HILL AIRPORT
BUSINESS | TRAVEL | COMMUNITY

3.13 Option 5B

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing through the centre of the current ILS vectoring swathe, final approach at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

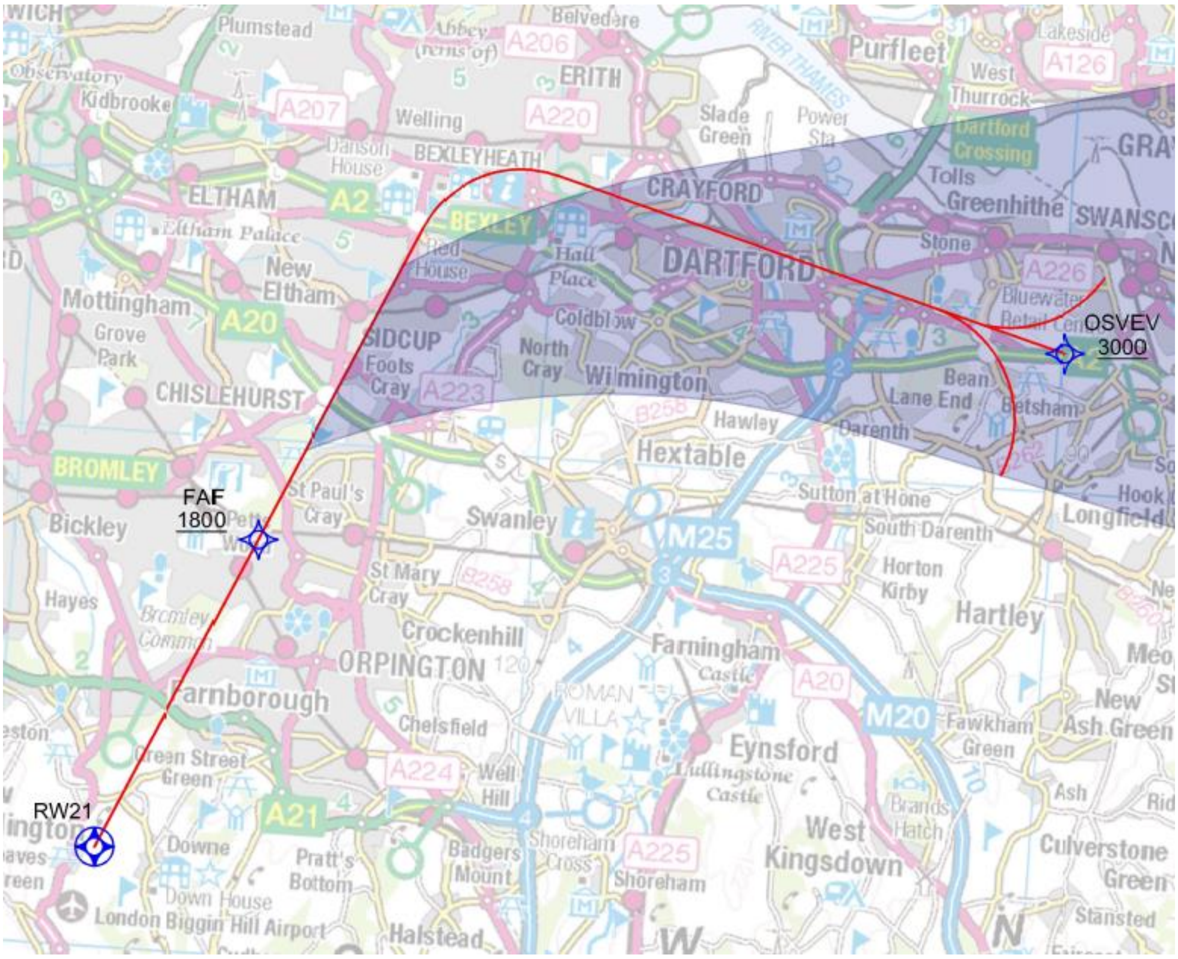

Figure 13 Option 5B

3.14 Option 5BT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing through the centre of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to understand the viability of the IAF North.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

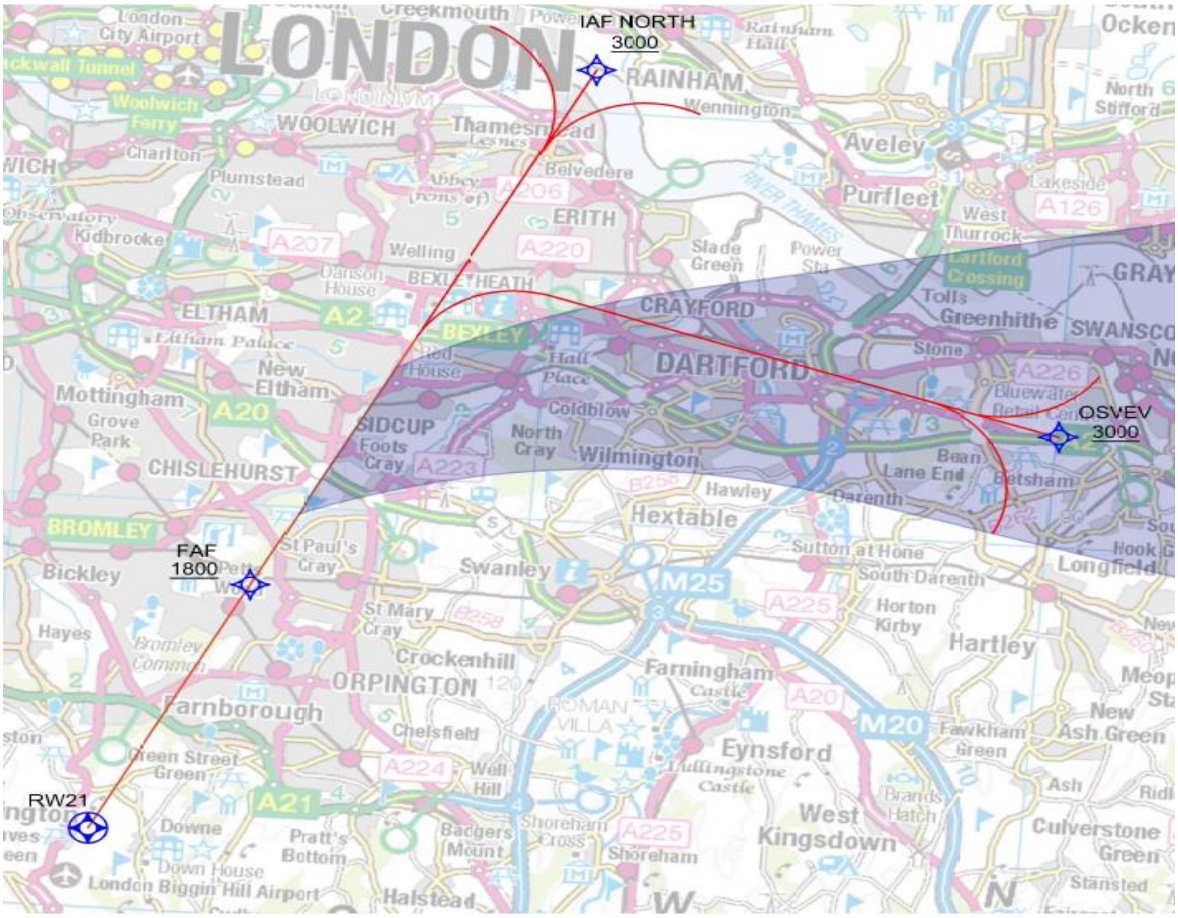

Figure 14 Option 5BT

3.15 Option 5C

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing through the centre of the current ILS vectoring swathe, final approach at 3.5°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

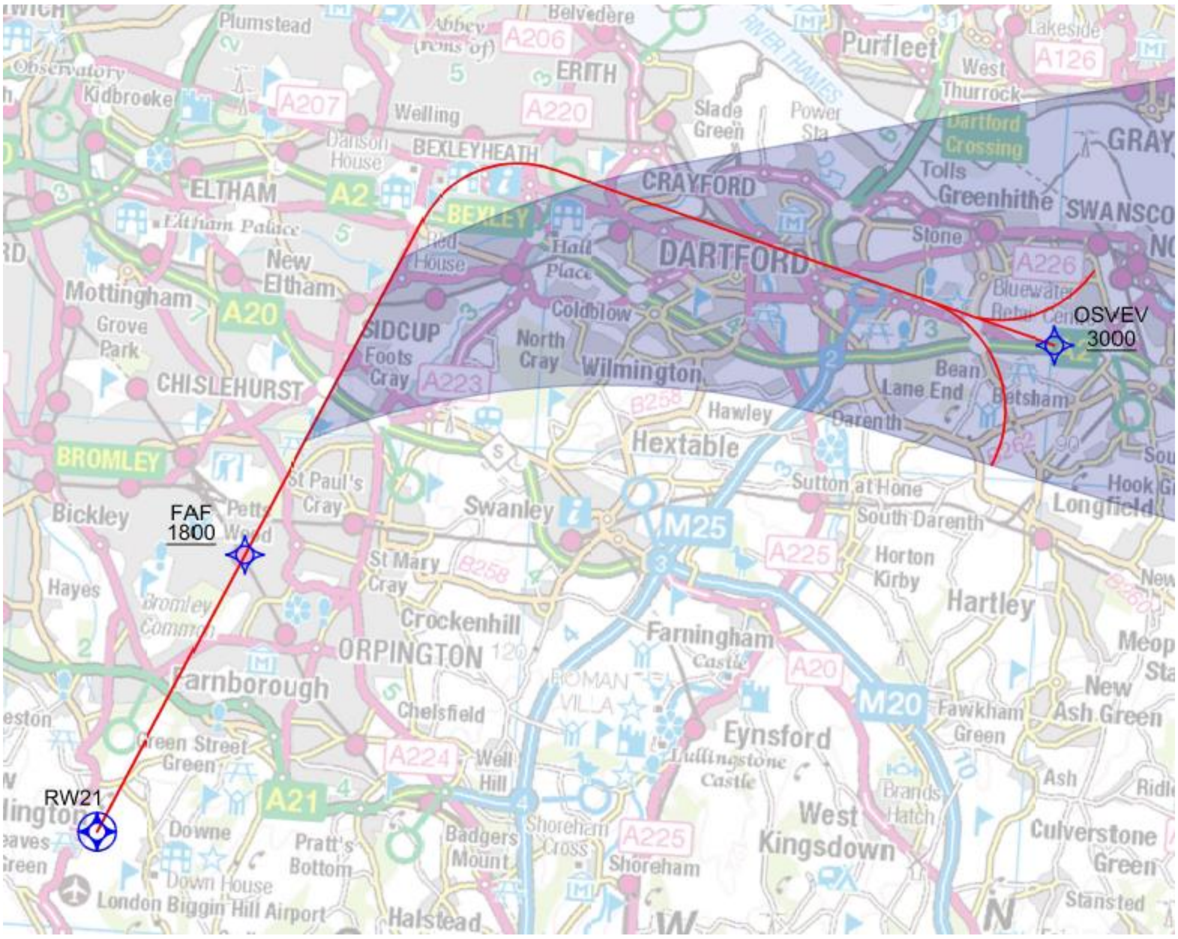

Figure 15 Option 5C

3.16 Option 5CT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing through the centre of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3.5°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

This option will require work to understand the viability of the IAF North.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

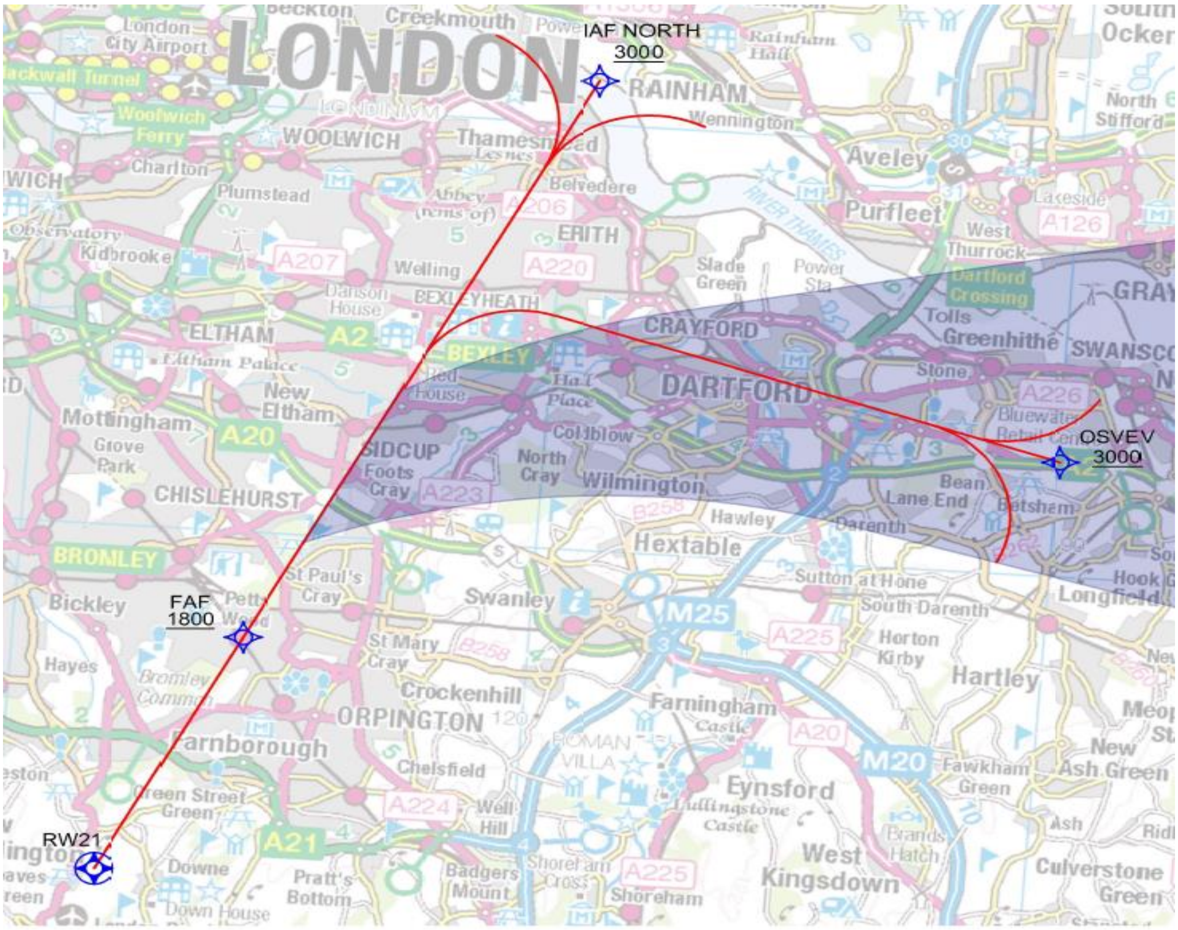

Figure 16 Option 5CT

3.17 Option 6A

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the left of the current ILS vectoring swathe, final approach at 3°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

Unable to route further left (which means this is the furthest south possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

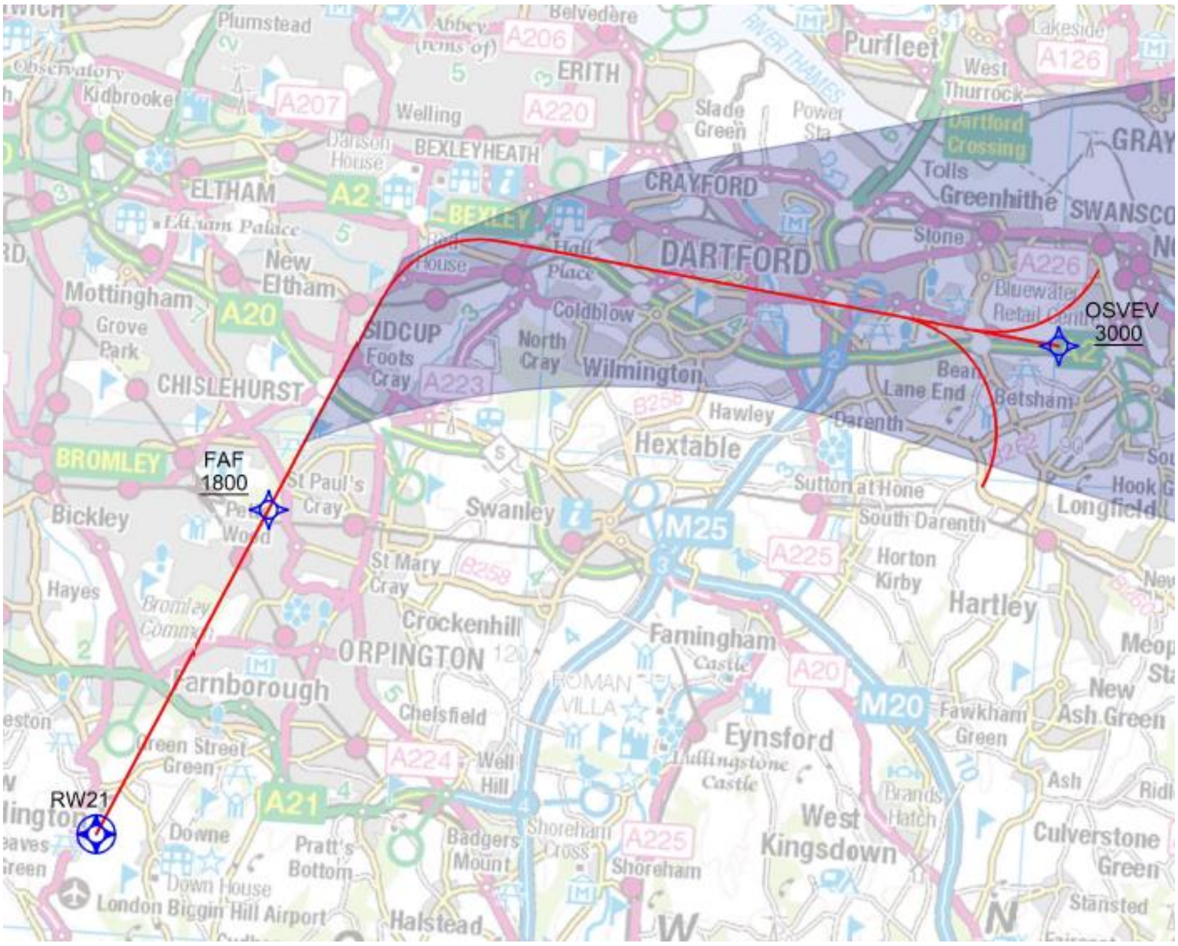

Figure 17 Option 6A

3.18 Option 6AT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the left of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to understand the viability of the IAF North.

Unable to route further left (which means this is the furthest south possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

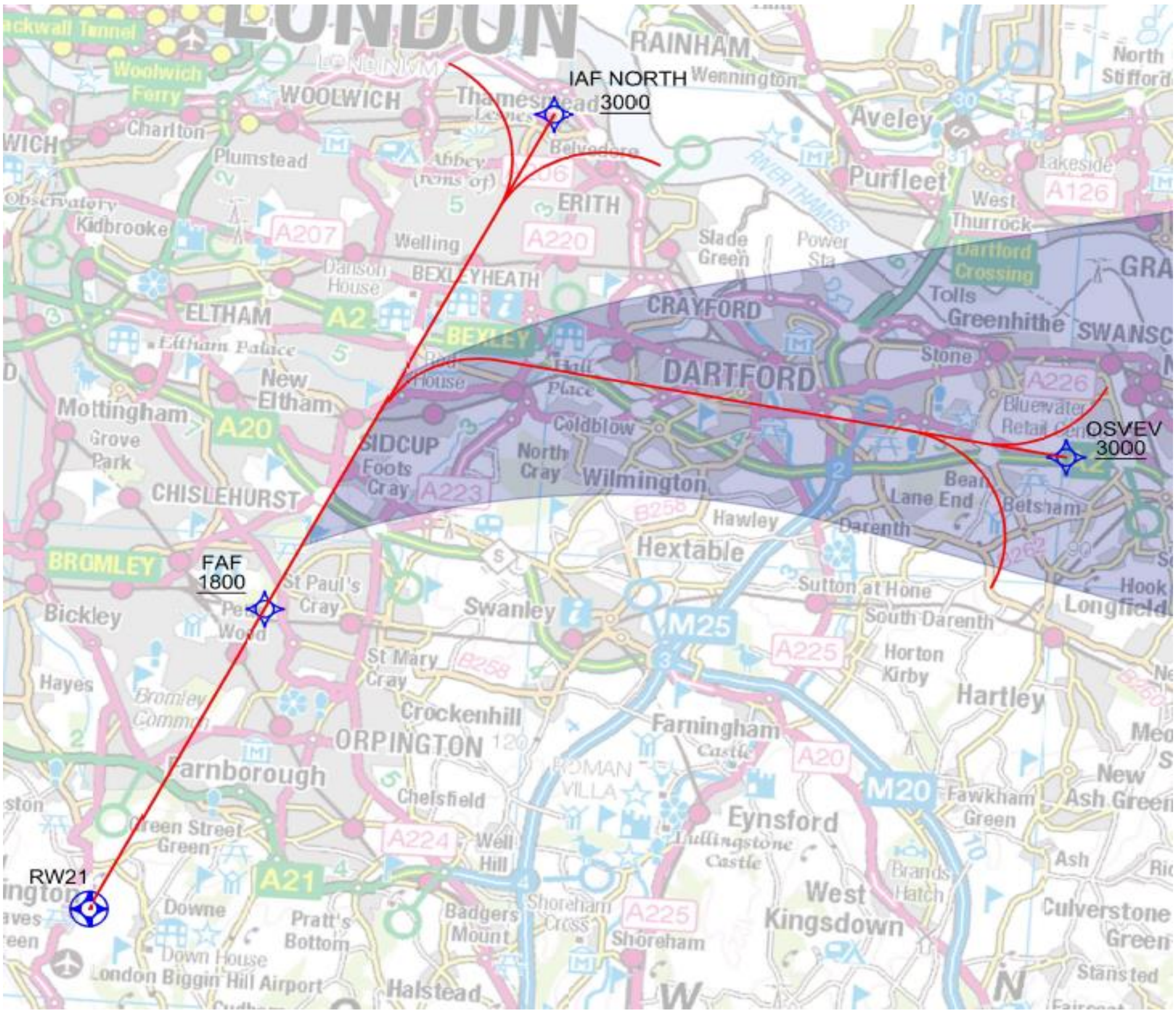

Figure 18 Option 6AT

3.19 Option 6B

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the left of the current ILS vectoring swathe, final approach at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

Unable to route further left (which means this is the furthest south possible) due to the design criteria. This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

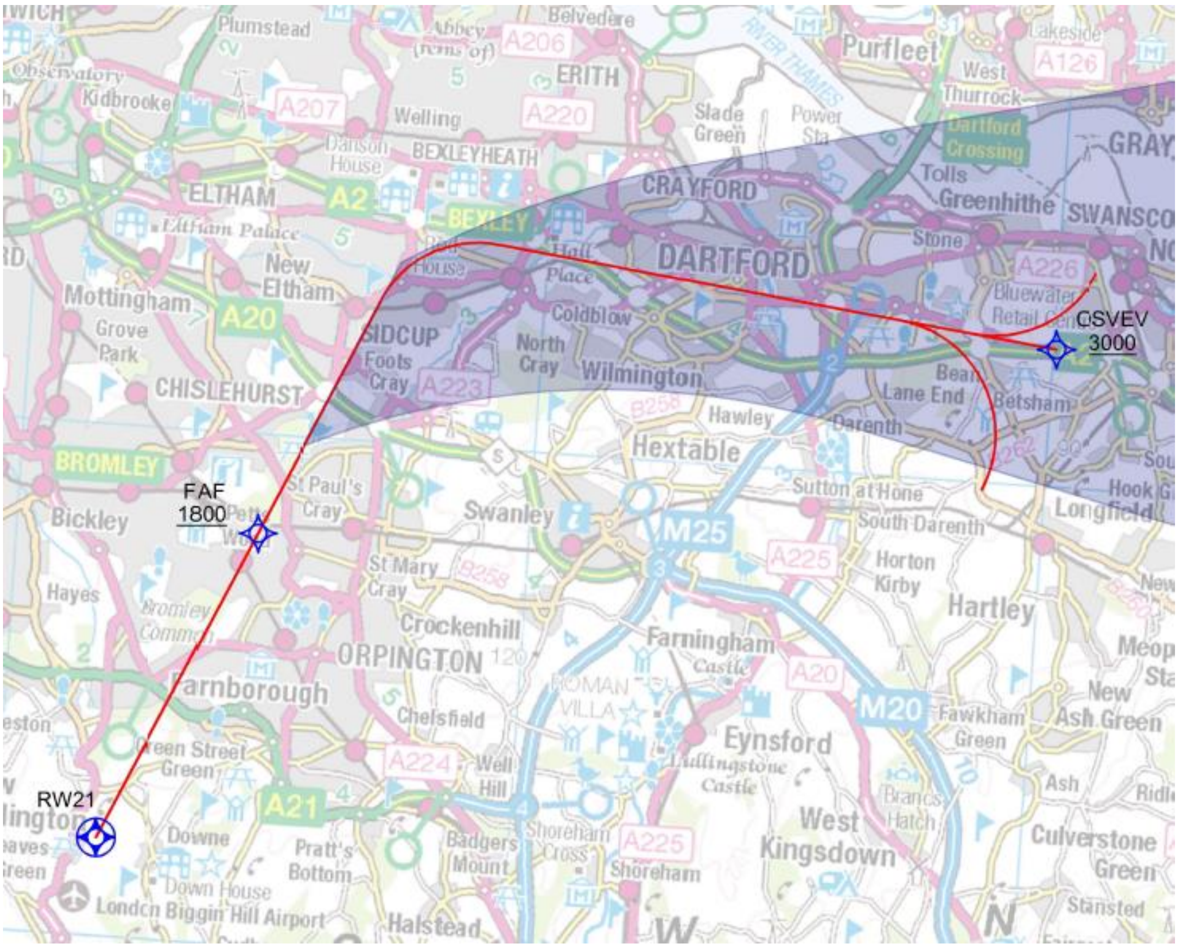

Figure 19 Option 6B

3.20 Option 6BT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network, routing down the left of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to understand the viability of the IAF North.

Unable to route further left (which means this is the furthest south possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

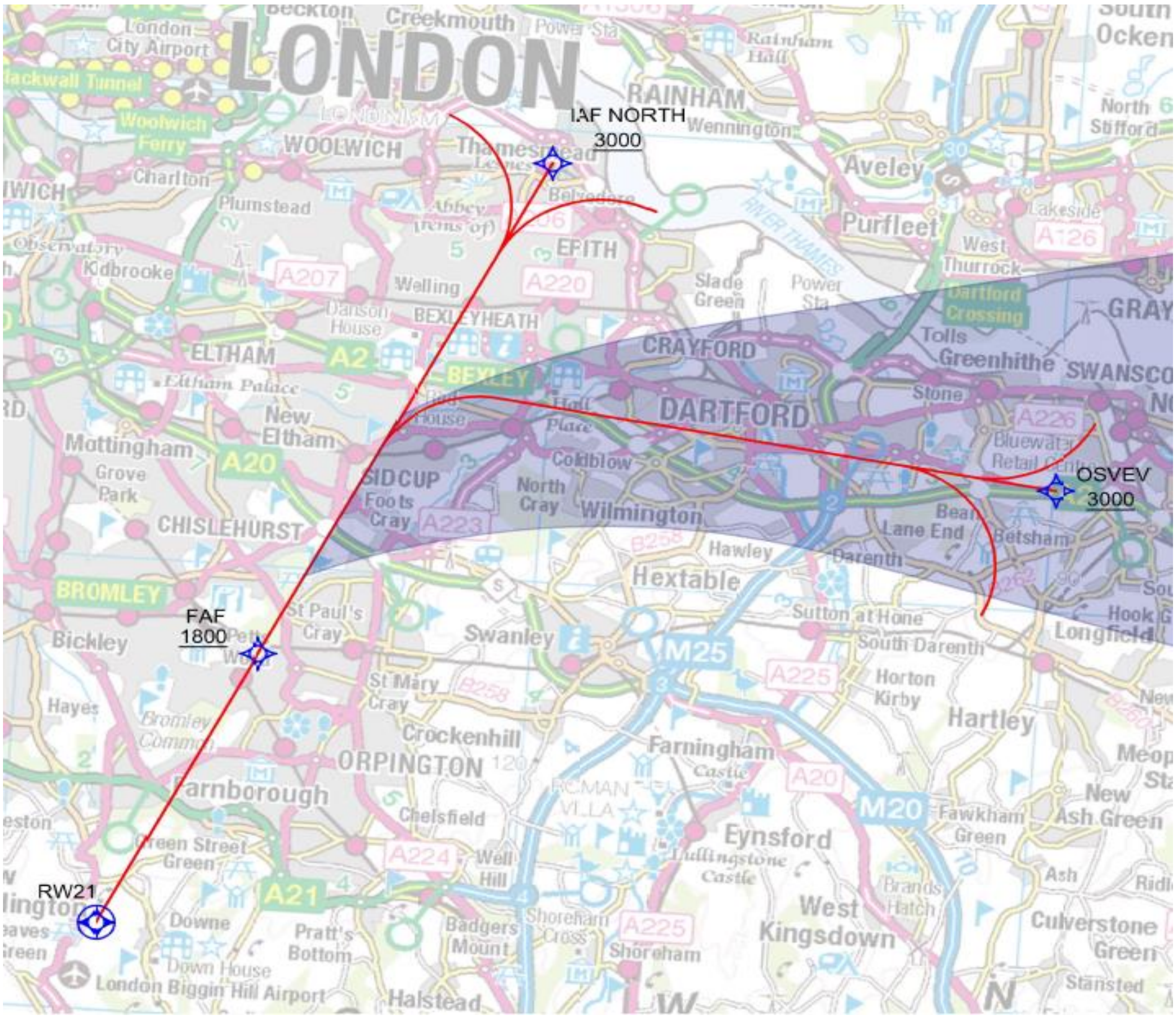

Figure 20 Option 6BT

3.21 Option 6C

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the left of the current ILS vectoring swathe, final approach at 3.5°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

Unable to route further left (which means this is the furthest south possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

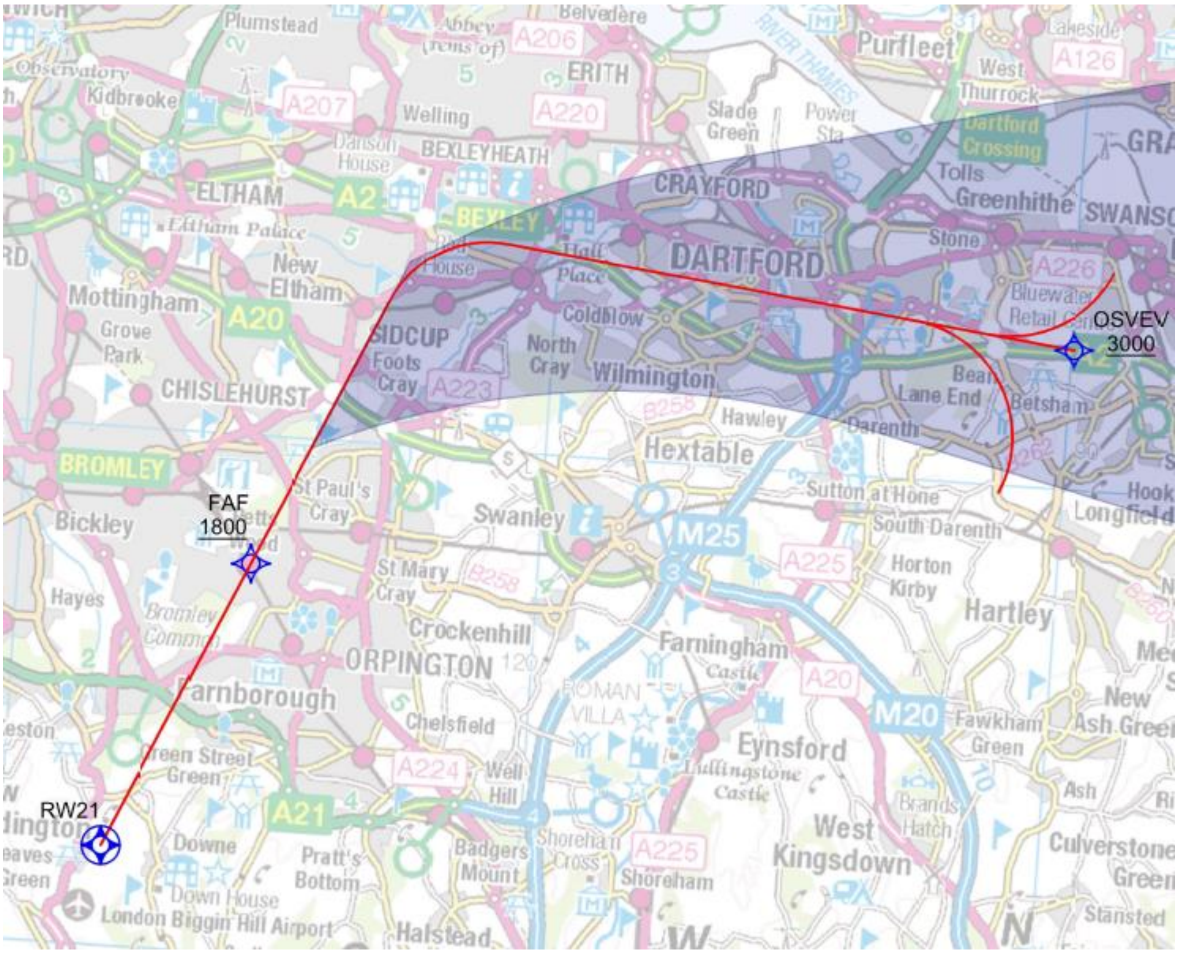

Figure 21 Option 6C

3.22 Option 6CT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the left of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3.5°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning. This option will require work to understand the viability of the IAF North. Unable to route further left (which means this is the furthest south possible) due to the design criteria. This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

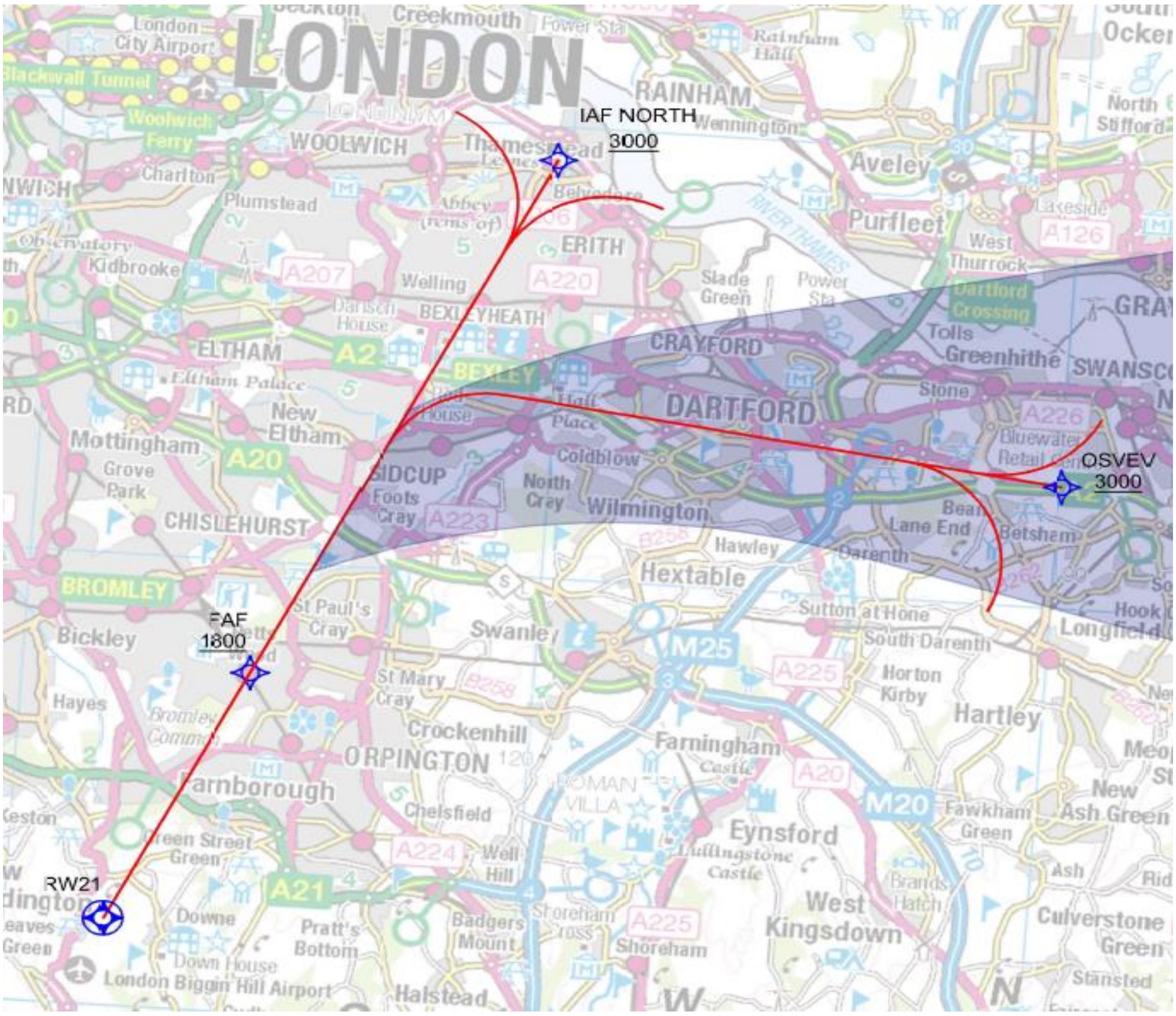

Figure 22 Option 6CT

3.23 Option 7A

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network, routing down the right of the current ILS vectoring swathe, final approach at 3°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

Unable to route further right (which means this is the furthest north possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

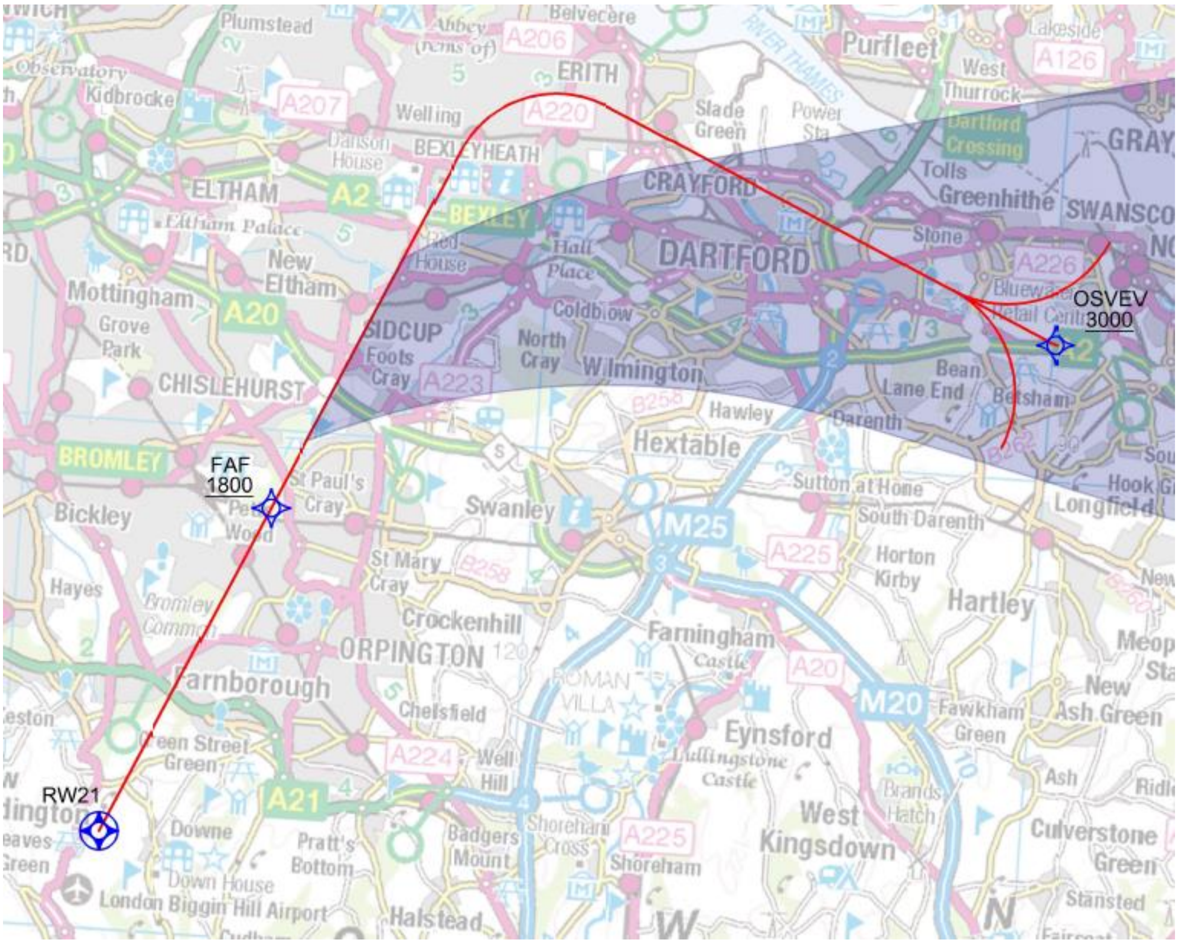

Figure 23 Option 7A

3.24 Option 7AT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the right of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3°. The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors. The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning. This option will require work to understand the viability of the IAF North. Unable to route further right (which means this is the furthest north possible) due to the design criteria. This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

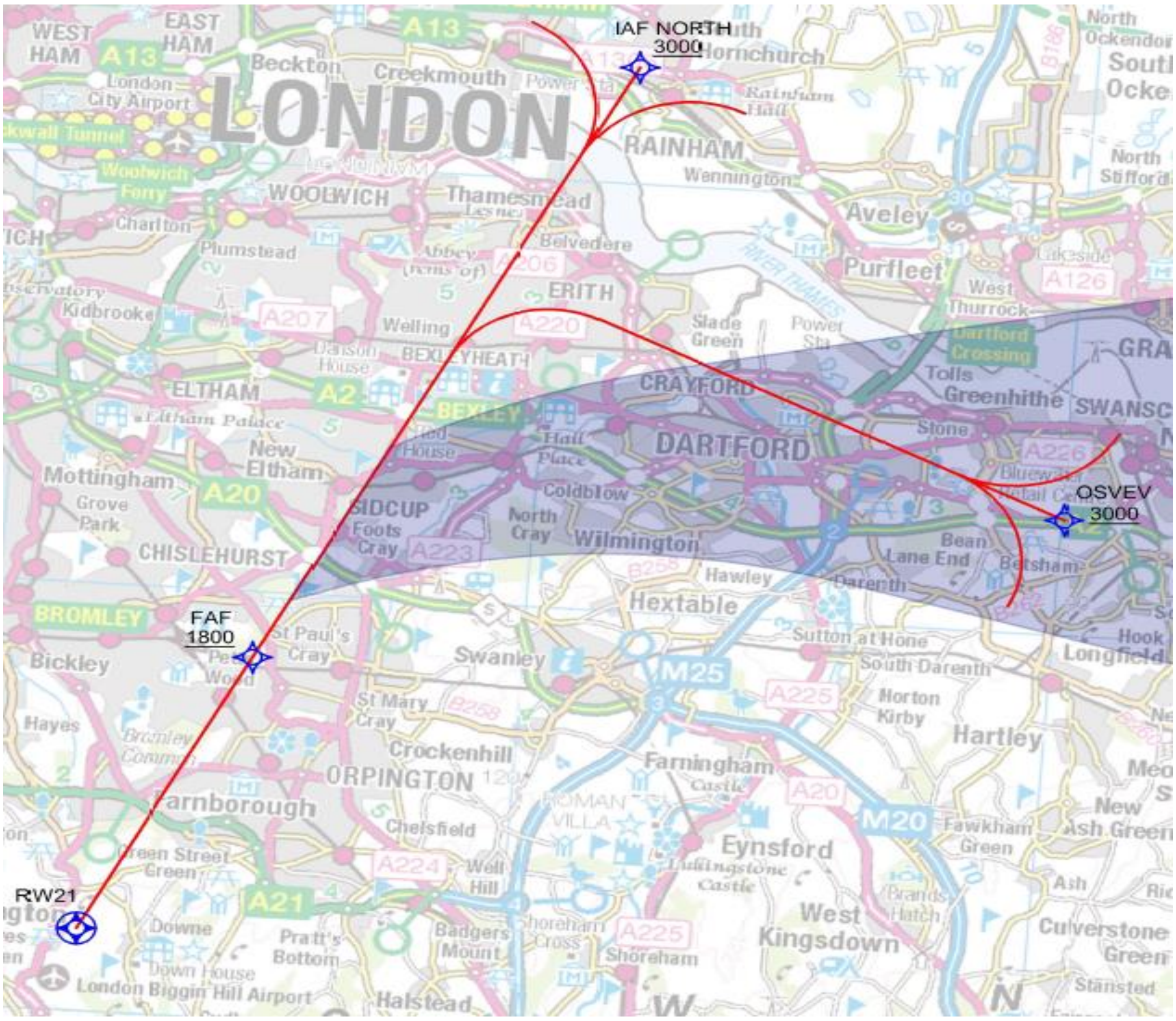

Figure 24 Option 7AT

3.25 Option 7B

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the right of the current ILS vectoring swathe, final approach at 3.2°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

Unable to route further right (which means this is the furthest north possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

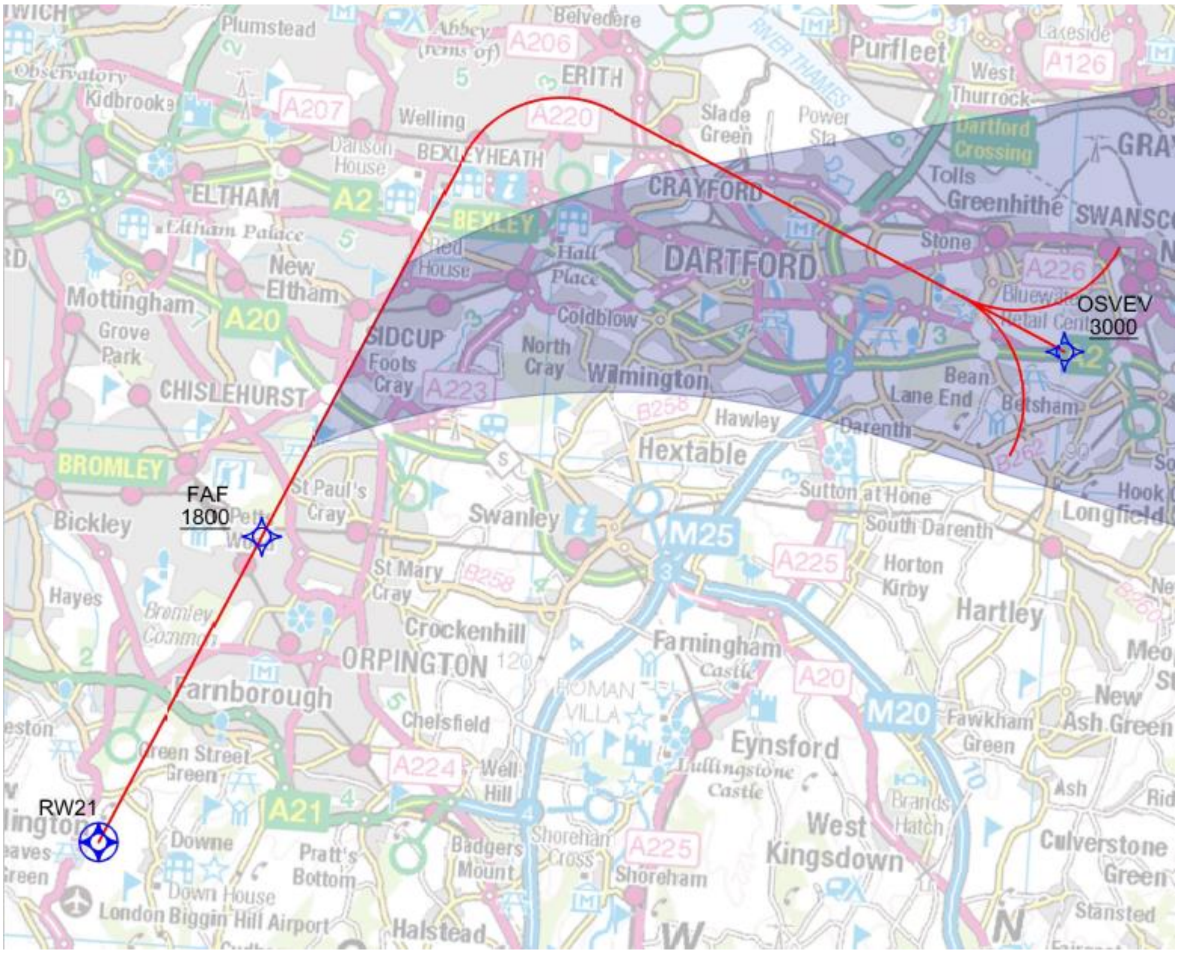

Figure 25 Option 7B

3.26 Option 7BT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the right of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3.2°. The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

This option will require work to understand the viability of the IAF North. Unable to route further right (which means this is the furthest north possible) due to the design criteria. This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

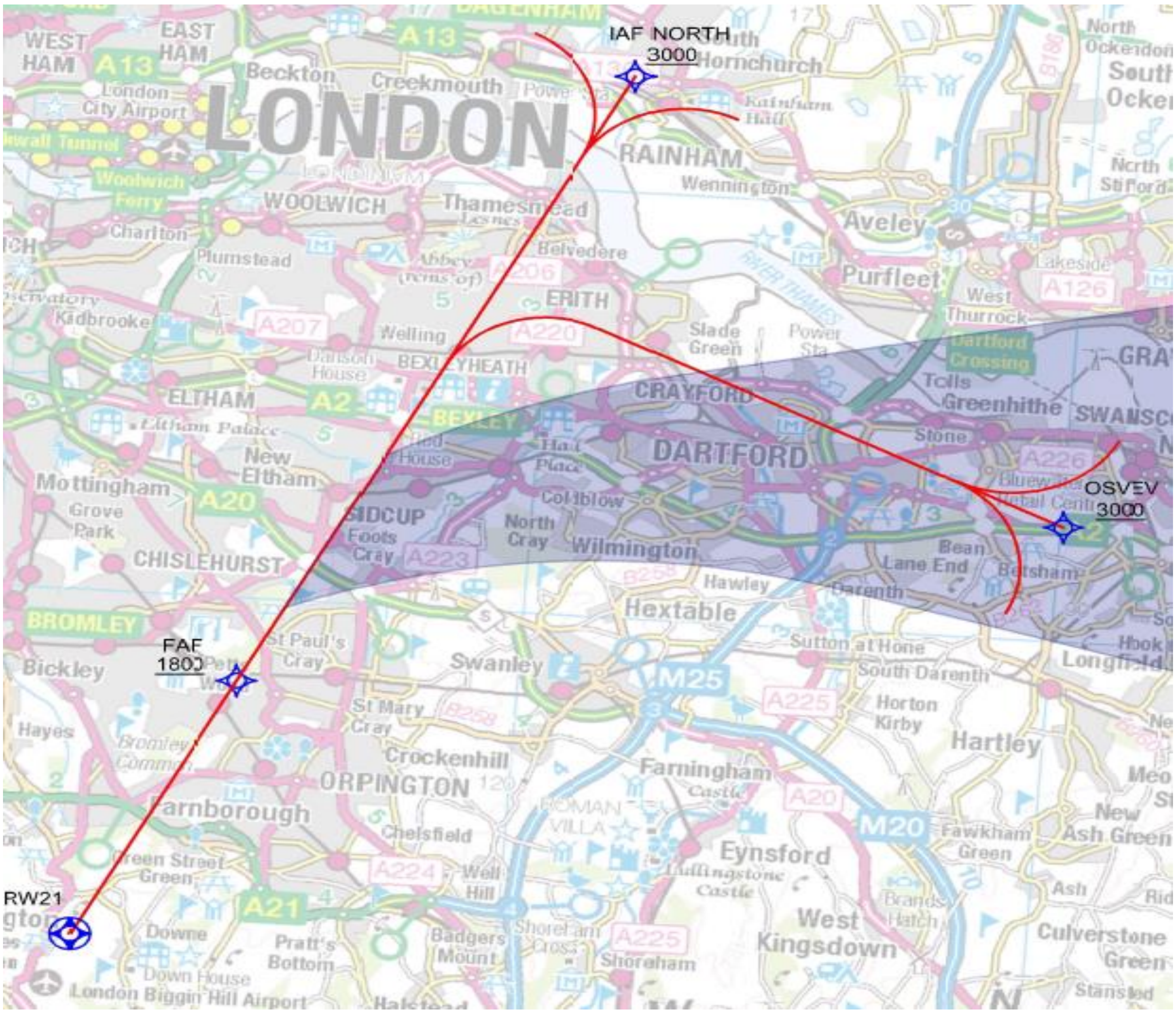

Figure 26 Option 7BT

3.27 Option 7C

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the right of the current ILS vectoring swathe, final approach at 3.5°.

The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors.

The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

Unable to route further right (which means this is the furthest north possible) due to the design criteria.

This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

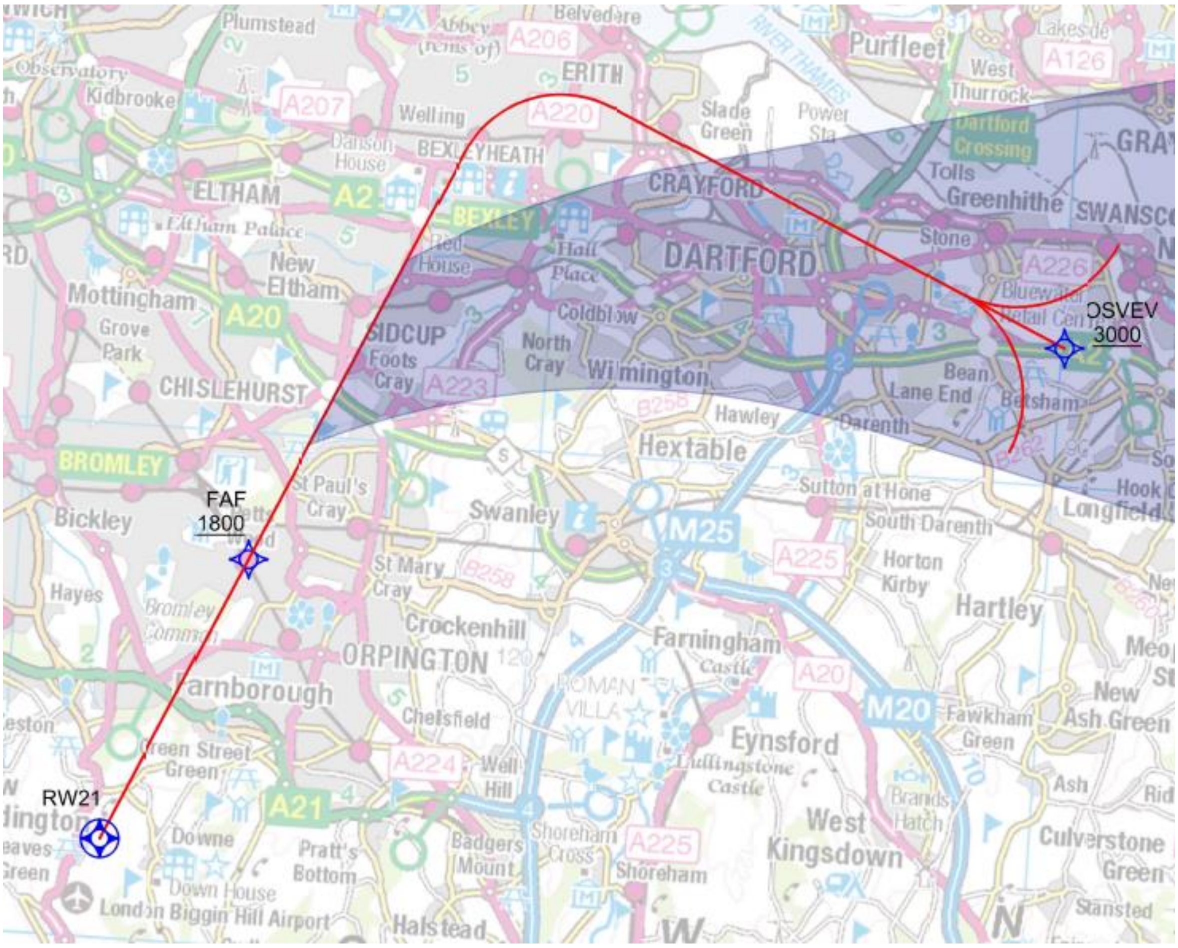

Figure 27 Option 7C

3.28 Option 7CT

From OSVEV and ignoring ALKIN, to enable inbounds to exit the network routing down the right of the current ILS vectoring swathe, with the addition of a new route positioned from the north/northeast. Final approach at 3.5°. The shaded area shows the position of the vast majority of the current arrivals of all types receiving radar vectors. The use of this option would require the ILS glideslope to also be increased, this would not change the lateral positioning.

This option will require work to understand the viability of the IAF North. Unable to route further right (which means this is the furthest north possible) due to the design criteria. This option will require work to assess whether extant or new procedures will be utilised to exit the network at OSVEV.

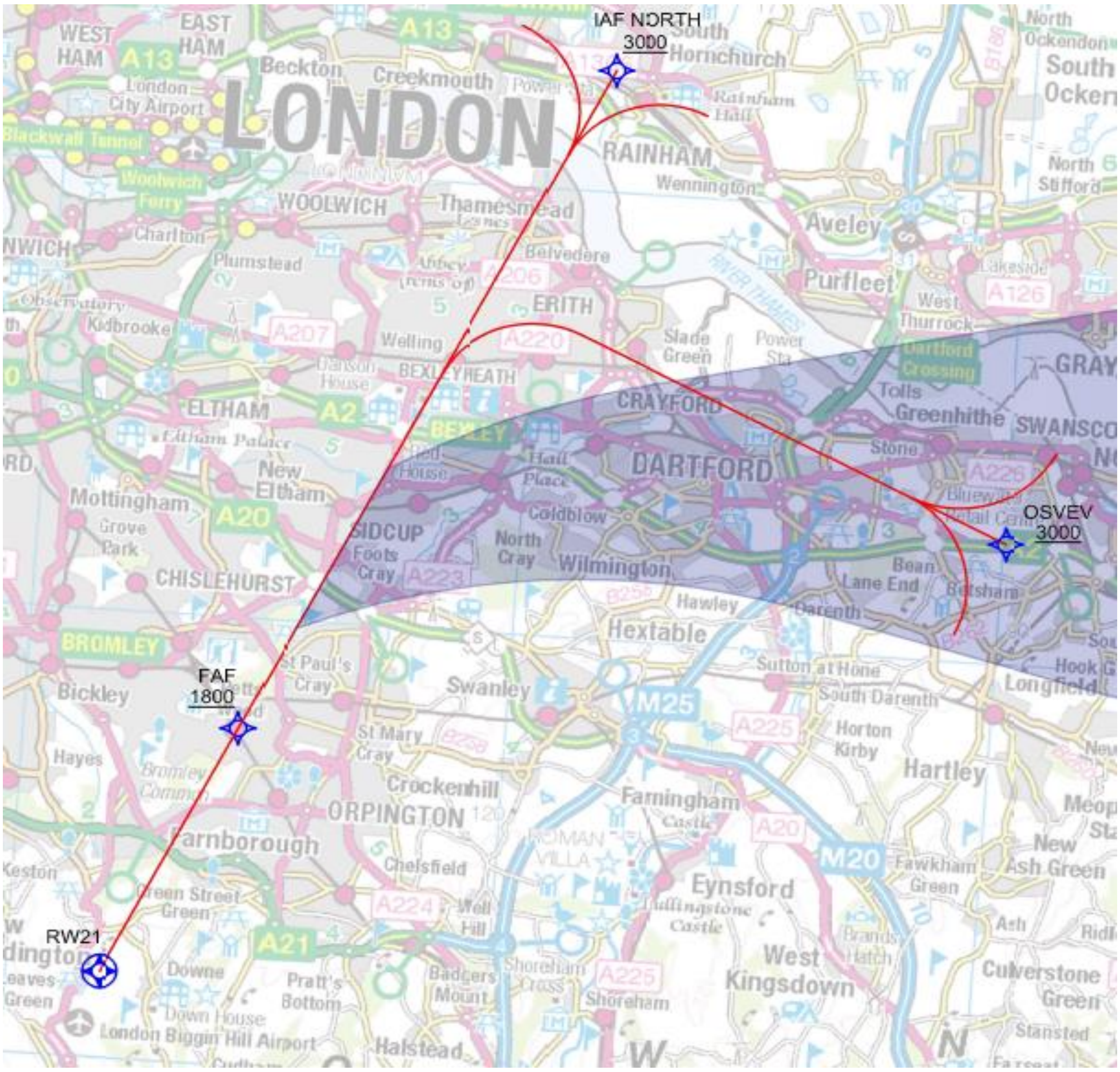

Figure 28 Option 7CT

4 The Missed Approach Options

4.1 Option 8 MAP Do Nothing

This is only possible with Option 1. The removal of the VOR will necessitate a different MAP.

4.2 Option 9 MAP Do Minimum

Mimic the current right turn MAP to ALKIN and then radar vectors from NATS. This will, however, result in different protection areas due to the design regulations, additionally the ALKIN hold will be laterally different from the conventional one, radar vectors from NATS after ALKIN will be required as is the case with the VOR/DME procedure.

This MAP would also become the ILS MAP.

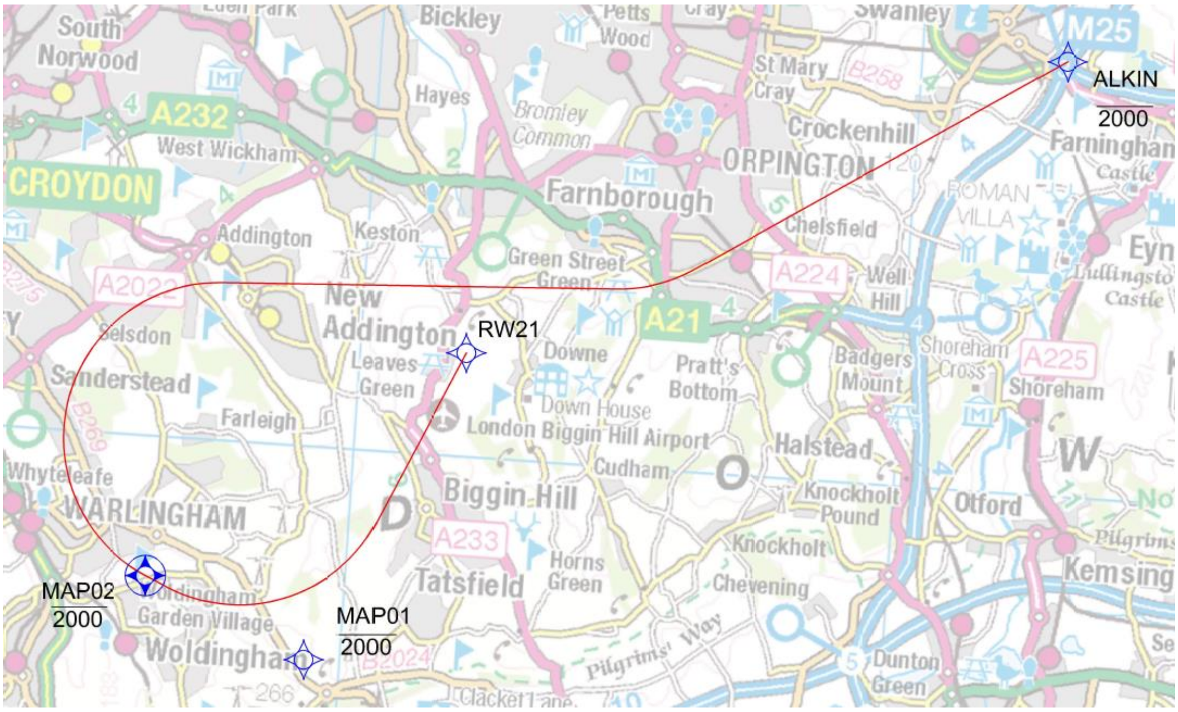

Figure 29 Option 9

4.3 Option 10

Most efficient left turn out back to ALKIN. This option will require work to assess interaction with the Gatwick zone.

This MAP would also become the ILS MAP.

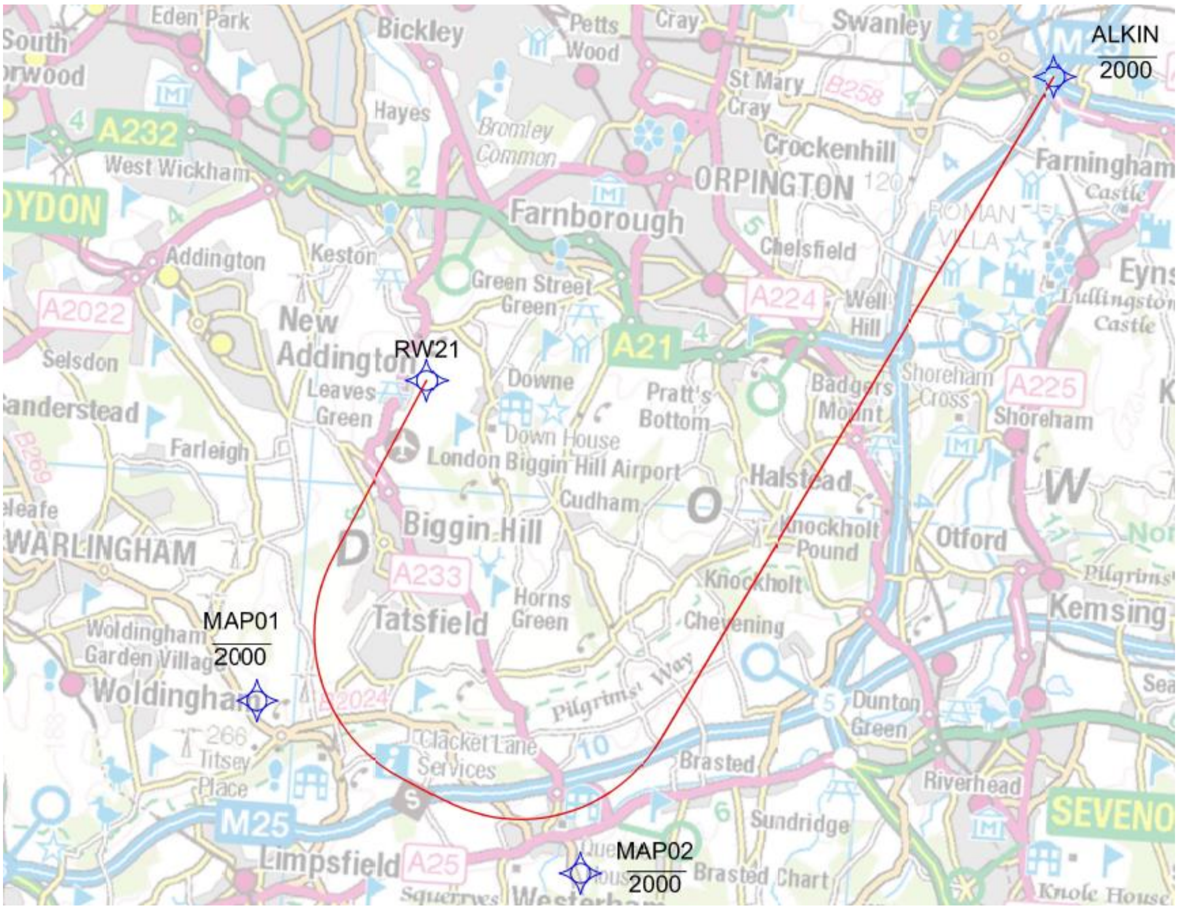

Figure 30 Option 10

4.4 Option 11

Most efficient right turn out back to ALKIN.

This option will require work to assess the first turns interaction with the Gatwick zone, and for the remainder of the right turn, the interaction with RAF Kenley.

This MAP would also become the ILS MAP.

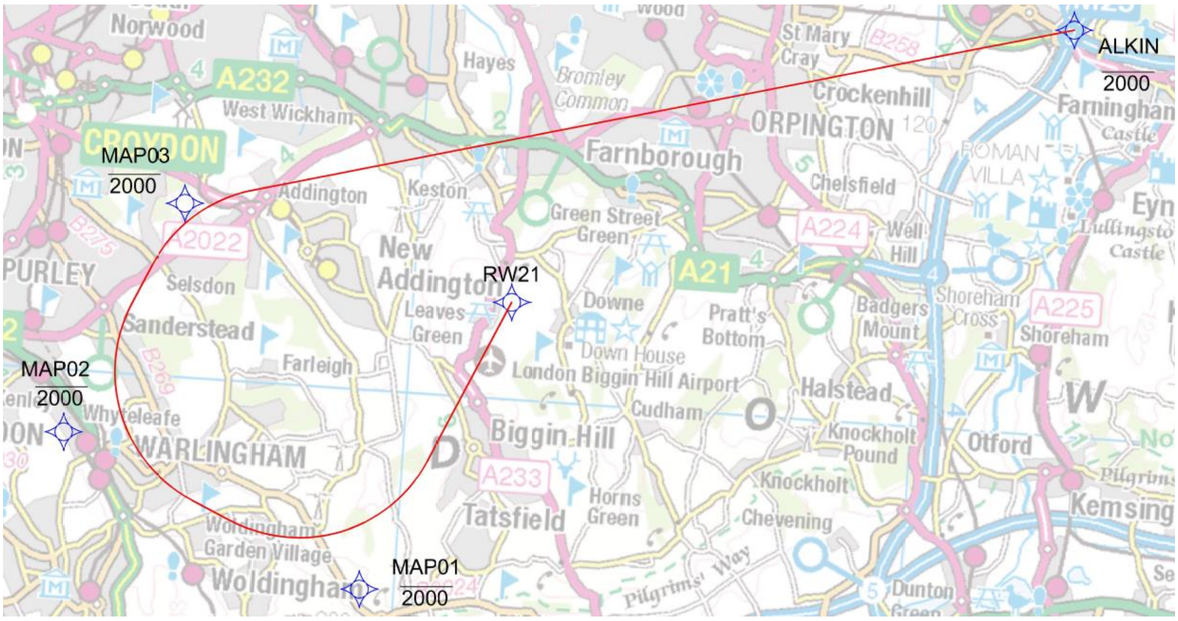

Figure 31 Option 11

4.5 Option 12

Developed from stakeholder feedback received during the engagement period, an option to avoid RAF Kenley similar, laterally, to the same procedure for Runway 03.

This MAP would also become the ILS MAP.

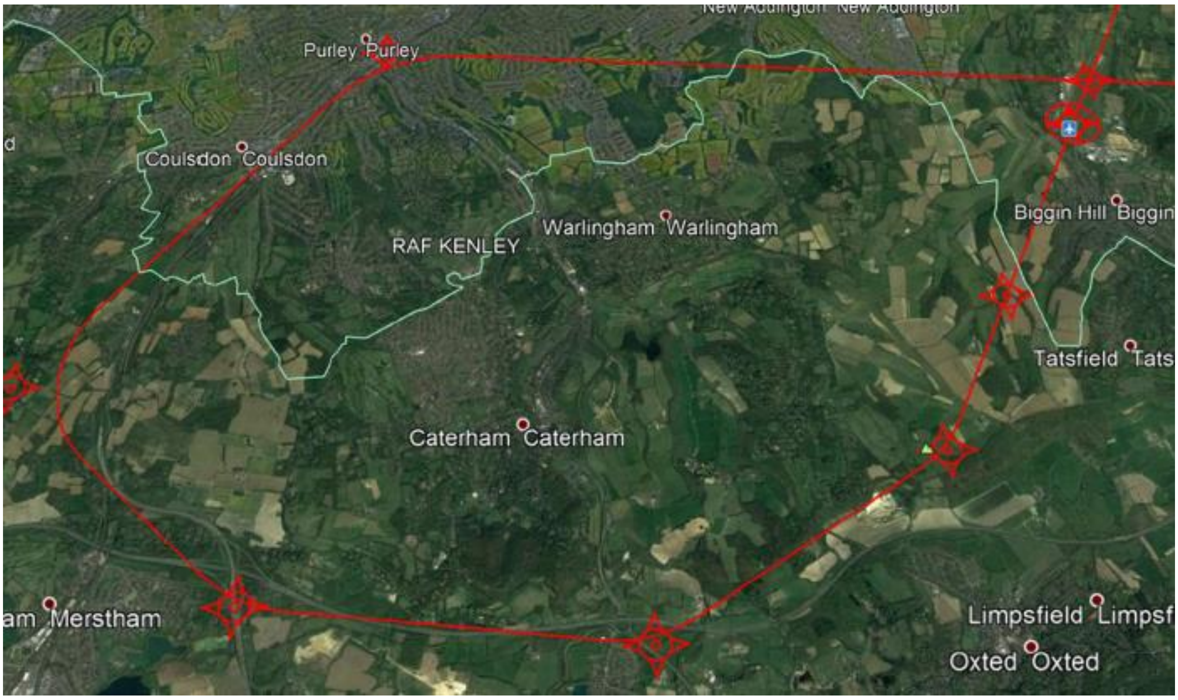

Figure 32 Option 12