London Biggin Hill Airport - Airspace Change Proposal

ACP-2019-86

Initial Options Appraisal

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Glossary of Terms

Acronym/Term	Definition
ACP	Airspace Change Proposal
Agl	Above Ground Level
AMS	Airspace Modernisation Strategy
Amsl	Above Mean Sea Level
ANSP	Air Navigation Service Provider
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
ATC	Air Traffic Control
CAA	Civil Aviation Authority (UK)
CAP	Civil Aviation Publication
CTA	Control Area
DME	Distance Measuring Equipment
DP	Design Principle
DPE	Design Principles Evaluation
EASA	European Aviation Safety Agency
EU	European Union
FAF	Final Approach Fix
GA	General Aviation
GNSS	Global Navigation Satellite System
HazID	Hazard Identification
IAP(s)	Instrument Approach Procedure(s)
IFR	Instrument Flight Rules
ILS	Instrument Landing System

Acronym/Term	Definition
IOA	Initial Options Appraisal
IR	Implementing Rule
LBHA	London Biggin Hill Airport
LPV	Localiser Performance with Vertical Guidance
MAP	Missed Approach Procedure
NERL	NATS Enroute Limited
NM	Nautical Mile
NO_2	Nitrogen Dioxide
NP(s)	National Park(s)
PANS-OPS	Procedures for Air Navigation Services – Operations
PBN	Performance Based Navigation
RNAV	Area Navigation
SoN	Statement of Need
VOR	VHF (Very High Frequency) Omni-Directional Range

1 Introduction

1.1 Introduction

London Biggin Hill Airport (LBHA) is progressing through the Airspace Change Process (ACP) as defined by the Civil Aviation Publication (CAP) 1616. This airspace change, if successful, is to introduce a Performance Based Navigation (PBN) (Global Navigation Satellite System [GNSS]) arrival route in order to:

- Be compliant with European Aviation Safety Agency (EASA) Regulatory requirements detailed within Implementing Rule (IR) (EU) 20 18/10 48. This will also meet the requirements within the Civil Aviation Authority (CAA) Airspace Modernisation Strategy (AMS).
- Add a layer of resilience to the airport operation by providing a second instrument approach in the event that the current Instrument Landing System (ILS) 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 Change Portal (caa.co.uk).

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

This ACP will only impact a small number of stakeholders as the majority of aircraft will continue to operate as they do today. Specifically, this ACP is being undertaken to change a rarely used inbound procedure utilised by approximately only 2 aircraft a month, and a Missed Approach Procedure (MAP) that is only used about 30 times a year.

The current operating environment at LBHA utilises a ground beacon, known as a VHF Omni-directional Range (VOR) in combination with Distance Measuring Equipment (DME), located on the airfield at LBHA. Furthermore, there are two waypoints referred to in this document, which are shown in Figure 1 below.

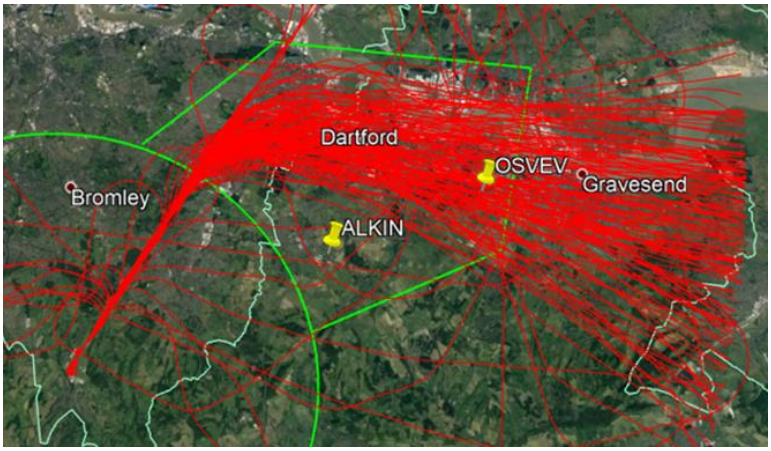

Figure 1 Typical radar vectors for arrivals to Runway 21 (featuring OSVEV and ALKIN)

As part of the drive to facilitate airspace modernisation, the VOR is currently scheduled for removal, as of 1st December 2022, making some of the existing procedures at LBHA unviable. If this were to occur without any mitigating action it would lead to a likely increase in tactical control that would result inefficient utilisation of airspace, additional fuel burn, increased levels of aircraft noise and emissions. This ACP attempts to address this issue, by establishing PBN approaches that utilise GNSS technology as opposed to conventional ground-based beacons.

1.1.1 Document Purpose and Scope

The overall purpose of this document is to provide a narrative, explaining the steps, rationale, and outcomes of Step 2B, the Initial Options Appraisal (IOA). It must be highlighted that this document does not contain a detailed IOA analysis of each option. Full analysis can be found in the IOA Full Analysis Table, alongside this document on the CAA Airspace Change Portal, available via the link below.

https://airspacechange.caa.co.uk/PublicProposalArea?pID=207

This document includes the methodology, baseline definition and results summary of the detailed IOA analysis, along with supporting Appendices, and is structured as follows:

1. Introduction (this Section)
2. Initial Options Appraisal Methodology
3. Baseline Definition
4. Initial Options Appraisal Results
5. Qualitative Safety Assessment
6. Design Options Short List
7. Initial Options Appraisal Full Analysis Table Extract (shown in Appendix A1)

Please note, it is highly recommended that readers review this document either before or alongside the IOA Full Analysis Table (Appendix A1) to provide additional context, clarification, and rationale. In addition, it must be clarified that all altitudes referred to within this document are based on height Above Mean Sea Level (amsl) rather than Above Ground Level (agl).

1.2 CAP1616 Airspace Change Process

In designing and implementing airspace changes, change sponsors are subject to the process described in CAP 1616 [Ref 1]. This is a seven-stage process, published by the CAA, which also provides guidance to those seeking to change the way in which airspace is used and managed. The seven-stage process is visualised in Figure 2 below, highlighting the current stage (Stage 2) within the process.

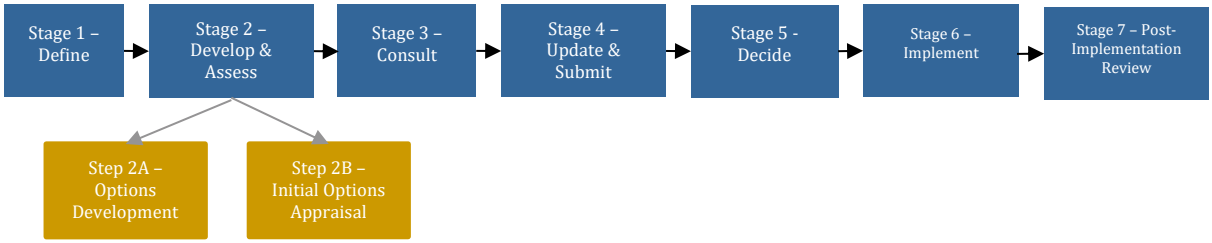

Figure 2 High-level CAP 1616 Process

1.2.1 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 prioritized Design Principles that passed through the CAP 1616 Gateway 1 is shown in Table 1 below.

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

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

Priority	
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

1.2.2 Previous Stage 2 Gateway

This ACP had a Gateway 2 date of 25th June 2021, and the original version of this document and the others associated with that Gateway 2 (all at Version 1) were assessed by the CAA. As part of the CAP 1616 process, the CAA provided feedback on the 3 documents as explained in their CAP1616 Stage 2 Gateway – CAA Response document, which is on the Airspace Change portal. As the ACP did not progress out of Stage 2 in June 2021 LBHA subsequently had to revise the documents for a new Gateway 2.

Consequently, this document, and the 2 other original documents have been updated to Version 2 to reflect that CAA feedback, and additional learning. All/any new information has had to be assessed for impact on the original documents, for example, Version 2 of this document contains scenarios that could be undertaken outside of the CAP 1616 process which were not originally available to LBHA. This new learning is detailed in Section 1.3 below.

Version 1 of these 3 documents is therefore no longer valid.

1.2.3 Step 2A – Options Development

Step 2A is explained fully within the Design Options Document and Design Principle Evaluation. For more details regarding Step 2A, readers should refer to these documents which are available on the CAA Airspace Change Portal.

The design options that progressed to Step 2B as future route possibilities are numbered 2A, 2AD and 9; these options are known as the Comprehensive List of Viable Options.

1.2.4 Step 2B – Initial Options Appraisal

At Step 2B of the process, the Comprehensive List of Viable Options is tested against the criteria contained within CAP 1616, Appendix E, Table E2 [Ref 1], with the addition of qualitative assessments of noise, tranquillity, biodiversity, and safety impacts, as required for a Level 1 airspace change.

The methodology used to carry out the IOA is described in Section 2 of this document. Furthermore, a summary of the IOA results can be found in Section 4. Please note, an extract of the more detailed analysis can be found as an Appendix (Appendix A1) to this document. The complete IOA Full Analysis Table can be found as a stand-alone document on the CAA Airspace Change Portal.

The main output of the IOA, is a Short List of options (including preferred options[s]) which can be found in Section 6 of this document.

1.3 Context – New Learning

1.3.1 Letter from NATS

LBHA recently received a letter from NATS (NERL) suggesting that it may be possible, within certain considerations, to prolong the life of the BIG VOR for a specified timescale. While this is not intended as a long-term solution it could facilitate the status quo until implementation of this ACP. Consequently, LBHA have now submitted a formal request to extend the life of the BIG VOR.

1.3.2 CAP 1781

The CAA recently published a document (CAP 1781) that offers a method of mitigation for continued use of a VOR/DME procedure when the radiating navigation facility (in this case the BIG VOR) is removed. If LBHA is assessed by the CAA as a candidate for CAP 1781 the use is specifically for a limited period only, on the condition that a permanent solution is also pursued. LBHA is currently researching a CAP 1781 solution in addition to this ACP and will engage with stakeholders as appropriate.

1.3.3 European Geostationary Navigation Overlay Service (EGNOS)

Due to changes under the Brexit agreement, EGNOS is not as fully available within the UK as it previously was, and some elements have been withdrawn. For this ACP, it means that the Localiser Performance with Vertical Guidance (LPV) element of the RNP approach will not be available, which adversely affects the resilience provided by such an approach. To maintain the necessary resilience LBHA has explored a PBN to ILS approach within this ACP.

2 Initial Options Appraisal Methodology

2.1 CAP 1616 Options Appraisal Requirements

The Options Appraisal process was carried out in accordance with the guidance in CAP 1616, and in conjunction with The Green Book [Ref 4] and the Department of Transport's WebTAG [Ref 5], which constitute best practice in options appraisal.

Options Appraisal is used as an iterative tool throughout the CAP 1616 [Ref 1] process to help refine the options from an initial Comprehensive List of Viable Options, down to a Short List (including preferred option[s]).

The appraisal process typically consists of the following elements:

- High-level objectives and assessment criteria.
- Baseline definition – usually today's operations.
- Comprehensive List of Viable options (including a do-nothing/minimum option[s]).
- Shortlist of options.
- Preferred or final option(s).

The Options Appraisal requirement of CAP 1616 [Ref 1] evolves through three iterations with the CAA reviewing at each phase as follows:

1. 'Initial' Options Appraisal at Step 2B with the CAA review at the Stage 2, as part of the Develop and Assess gateway.
2. 'Full' Options Appraisal at Step 3A with the CAA review at Step 3B and the subsequent Consult gateway.
3. 'Final' Options Appraisal at Step 4A, with the CAA review after the formal submission of the Airspace Change Proposal at the end of Stage 4.

Iteration 1, IOA, is the subject of this document and is submitted to the CAA as part of Stage 2.

The remainder of this section of the document focusses on the definition of the 'high-level objective and assessment criteria' and the assessment method.

2.2 High-level Objectives & Assessment Criteria

For an airspace change, the criteria against which appraisal options are assessed is defined within CAP 1616, Appendix E, Table E2 [Ref 1]. These criteria are described in Table 2 below. Additionally, Safety Assessment, Tranquillity and Biodiversity (as defined in CAP 1616, Appendix B [Ref 1]) have been added at the bottom. It is worth stressing that the IOA provides a qualitive assessment only, therefore no numerical, statistical or noise contour analysis has been conducted at this stage. This approach has been chosen because of the relatively small scale of the proposed change compared to other in progress ACPs, and it is therefore deemed proportionate. The

change sponsor will be conducting more detailed quantitative analysis in the Full/Final Options Appraisal as part of subsequent stages of the process.

Affected Group	Impact	Description
Communities	Noise impact on health and quality of life	Requires consideration of noise impact on communities including residents, schools, hospitals, parks, and other sensitive areas.
	Air Quality	Any change in air quality is to be considered[2].
Wider Society	Greenhouse Gas impact	Assessment of changes in greenhouse gas levels in accordance with WebTAG is required.
	Capacity and resilience	A qualitative assessment of the impact on overall UK airspace structure.
General Aviation	Access	A qualitative assessment of the effect of the proposal on the access to airspace for GA users.
General Aviation/commercial airlines	Economic impact from increased effective capacity	Forecast increase in air transport movements and estimated passenger numbers or cargo tonnage carried.
	Fuel burn	The change sponsor must assess fuel costs based on its assumptions of the fleets in operation.
Commercial airlines	Training costs	An assessment of the need for training associated with the proposal.
	Other costs	Where there are likely to be other costs imposed on commercial aviation, these should be described.
Airport/Air Navigation Service Provider	Infrastructure costs	Where a proposal requires a change in infrastructure, the associated costs should be assessed.
	Operational costs	Where a proposal would lead to a change in operational costs, these should be assessed.
	Deployment costs	Where a proposal would lead to a requirement for retraining and other deployment, the costs of these should be assessed.

[2] Air Quality assessments are only applicable below 1,000 feet and includes the consideration of Air Quality Management Areas (AQMAs).

Affected Group	Impact	Description
Safety Assessment	Safety Assessment	CAP 1616 requires a safety assessment of the proposal to be undertaken in accordance with CAP 760 (Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers) [Ref 6].
Wider Society	Tranquillity	The impact upon tranquillity need only be considered with specific reference to Areas of Outstanding Natural Beauty (AONB) and National Parks (NPs) unless other areas for consideration are identified through community engagement.
	Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Table 2 IOA Assessment Criteria

2.3 Method

2.3.1 Overview

The IOA was carried out by comparing all the options side by side against the CAP 1616 [Ref 1] criteria in tabular form. The Appraisal also included the results of a Qualitative Safety Assessment (as described in Section 5), and the noise impact for communities was supported by a qualitative noise assessment methodology (as described in Section 4.3.1). An extract of the full analysis of all the options is described in Appendix A1 and included as a separate document, which can be accessed via the CAA Airspace Change Portal.

Each option was compared against the 'Do Nothing baseline' which was established as the baseline for this ACP. This is explored further in Section 3 of this document.

2.3.2 Shortlisting

Once all the options had been assessed against the criteria, the list of options was refined to identify the Short List to be taken forward to Stage 3. The Short List is contained in Section 6, which also specifies the preferred options.

3 Baseline Definition

3.1 Baseline Overview

In accordance with CAP 1616 [Ref 1], a baseline is required for the IOA along with subsequent environmental assessments. CAP 1616, Appendix J [Ref 1] defines the baseline as:

"Scenario in analysis of different options where the impacts of the change not being implemented are analysed (also known as 'do nothing' or 'do minimum' option)" [Ref 1]

An established baseline will allow the change sponsor to conduct an assessment to understand the current impacts so that a comparison can be made with the impacts of the proposed options.

3.2 Baseline Rationale

As the change sponsor, LBHA has established a baseline scenario against which each proposed option will be compared. Since the previous iteration of this document (Issue 1) was published on the CAA Airspace Change Portal, a number of contextual factors have changed which has driven a re-assessment of the baseline.

Since the last iteration of this document, NATS Enroute Limited (NERL) have written to LBHA regarding the continued use of the VOR beyond the original timeline of December 2022. Given this, it is now possible for LBHA to continue operations using the VOR beyond December 2022; further commercial discussions are taking place. However, it must be stressed that the continued reliance on the VOR must be viewed as a temporary measure, unsustainable in the longer term.

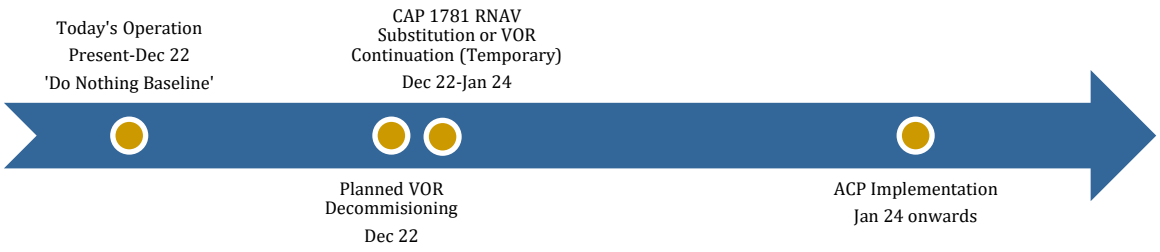

Figure 3 DVOR vs ACP Implementation Timeline

In addition, more detail is now available (since the last iteration of this document) regarding the use of an RNAV Substitution under CAP 1781 [Ref 7]. LBHA are currently undertaking activities in parallel to this ACP to apply for and implement the RNAV substitutions that would allow operations to continue following the removal of the VOR. Any temporary CAP 1781 solution could be implemented within the temporary 5-year limitation, which is based on the IFP 5-yearly review cycle. The precise timeframe for CAP 1781 implementation is as yet unknown.

LBHA has now considered the impacts of the scenarios mentioned above. These are depicted in Figure 4 below.

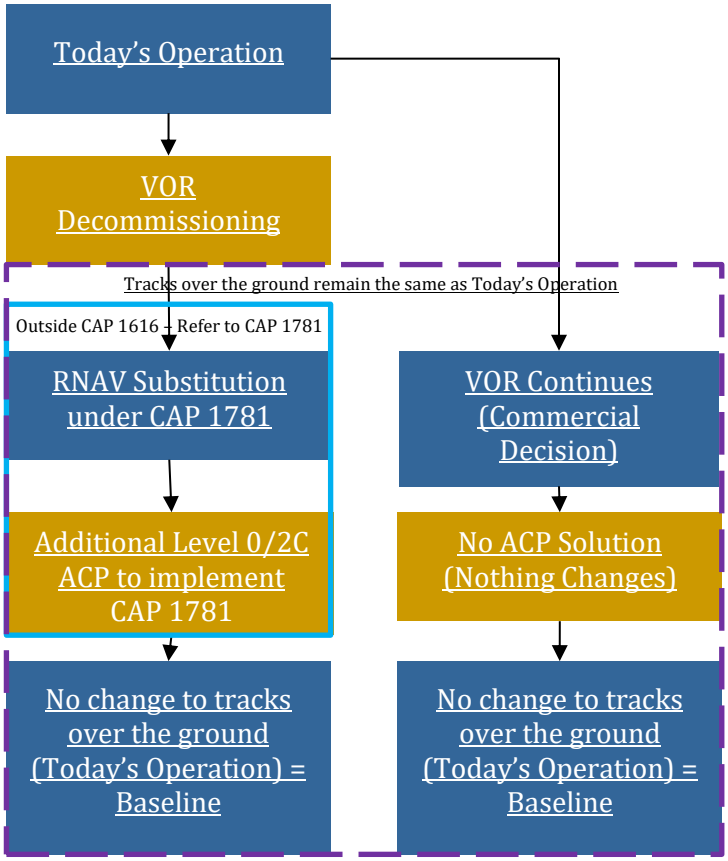

Figure 4 Baseline Rationale[3]

It is important to recognise that neither of the scenarios in Figure 4 are permanent solutions. The long-term solution is successful completion of this ACP.

However, due to the proposed timeline for this ACP, the temporary solutions described above are meaningful and relevant. This ACP has a planned implementation date of January 2024. This would mean that any short-term solution (as above) would be in effect from December 2022 until ACP implementation, in January 2024.

[3] The light blue box shown in Figure 4 indicates that this segment of the rationale lies outside the CAP 1616 process and is therefore not considered as part of this ACP. Furthermore, the purple dashed box indicates that these segments of the rationale will involve no change to tracks over the ground or final approach angle when compared to Today's Operation.

3.3 'Do Nothing Baseline' Summary

At the time of writing, there is a degree of uncertainty regarding the continuation of the VOR, meaning that an RNAV Substitution (under CAP 1781) may or may not be required (as described in Section 3.2 above). Despite this, the tracks over the ground will not change when compared to today's operation, regardless of which temporary solution is implemented. As a result, the change sponsor has elected to utilise a 'Do Nothing baseline' for comparison purposes as it provides an authentic scenario to benchmark against.

4 Initial Options Appraisal Results

4.1 Introduction

This section provides some additional clarification to assist the reader in understanding the rationale behind the IOA Results, which are presented in full, at the end of this section. The Results Summary, presented in Section 4.5 is a high-level extract of the Full Analysis Table, which is on the airspace change portal as a separate document. It is highly recommended that this section should be read before proceeding to read the Full Analysis Table (found in Appendix A1) to provide context and to understand the terminology used.

4.2 IOA Background

It is worth noting that in order to distinguish between option characteristics, each option has been assigned not only a number but a letter or combination of letters. Some options have been allocated numerous variation codes to specify the final approach angle and/or routing incorporated within said option. This coding system is explained in Table 3 below.

Variation Code	Basic Description
A	Utilises a 3° PBN final approach angle, which is currently industry standard.
B	Utilises a 3.2° PBN final approach angle.
D	Utilises a direct routing between OSVEV and ALKIN.

Table 3 Variation Coding Explained

Where the variation codes defined in Table 3 are combined, this means that that particular option utilises both those characteristics. For example, an option ending in "AD" would involve a 3° PBN final approach angle and include a direct routing from OSVEV to ALKIN.

4.3 IOA Considerations

The following sub-sections provide some context behind some of the items that were considered as part of the IOA.

4.3.1 Qualitative Noise Assessment Methodology

To support the assessment of the noise related criteria, LBHA carried out a qualitative assessment of the likely noise impacts of each option on people on the ground. Within the IOA, consideration has also been given to the overflight of AONBs, NPs and Biodiversity receptors, as described below.

Please note, at this stage no quantitative analysis has been carried out with regards to track mileage or noise contouring. As per the CAP 1616 process, full environmental assessments will be carried out in Stage 3 (Consult).

Additionally, the change sponsor has considered noise modelling requirements as specified in CAP 2091 (CAA Policy on Minimum Standards for Noise Modelling) [Ref 12]. Further details can be found in Section 1.9.3 of the Design Options Document, available via the CAA Airspace Change Portal.

With reference to the baseline, in accordance with CAP 1616, Appendix E, Paragraph E22 [Ref 1], by engaging with the local planning authorities, LBHA has established that there are no planned developments (E.g., Housing Developments) that affect this ACP and the associated baseline analysis.

4.3.2 Track Mileage

Please note, this sub-section is for information only. No quantitative comparison of track milage has been carried out as part of the IOA. Such analysis will be conducted in subsequent environmental assessment throughout the CAP 1616 process.

With regards to the 'D' variation options, it is worth clarifying a key factor, when comparing options. It must be stressed that any options with a 'D' variation code include a segment of the procedure that begins from OSVEV rather than ALKIN. This is applicable to Option 2AD. For example, Option 2A, which starts from ALKIN is 12.12 nautical miles (NM) long. Meanwhile, Option 2AD, which starts from OSVEV is 15.15 NM long. The additional 3.03 NM reflected in Option 2AD is the direct link between OSVEV and ALKIN.

The difference in starting point between Option 2A and Option 2AD should be noted when considering track mileage, greenhouse gas emissions and fuel burn. Having said that, aircraft operating utilising Option 2A, with no direct link between OSVEV and ALKIN would in fact likely follow a similar lateral path or be it through the use of radar vectors as opposed to a published procedure.

4.3.3 Tranquillity

As detailed in Table 2 (see Section 2.2), CAP 1616, Appendix B [Ref 1] requires change sponsors to consider the impact of the proposed change on levels of Tranquillity with specific reference to AONBs and NPs. Please note, there were no additional areas identified through community engagement.

The location of LBHA, means that it is close to the Kent Downs AONB and Surrey Hills AONB [Ref 8]. This is illustrated in Figure 5, which highlights the location of LBHA (shown in red) in relation to these areas.

Figure 5 LBHA Location relative to AONBs (Source: Natural England)

From Figure 5 above, it is clear to see that any aircraft inbound to LBHA, routing from the south or east would be required to overfly either the Kent Downs AONB or Surrey Hills AONB. However, it must be stressed that this occurs in the current operation as Thames Radar (provided by NATS) controllers use radar vectoring to position aircraft for LBHA.

The design options considered as part of this ACP originate from either ALKIN or OSVEV, both of which are outside either of the specified AONBs. Consequently, there will be no additional impact on either AONB as a direct result of this ACP. This is reflected in the IOA Full Analysis Table (as seen in Appendix A1).

Similarly, to the above analysis regrading AONBs, the change sponsor has considered the impact that the proposed airspace change may have on NPs. As illustrated in Figure 6 below, the closest NP boundary to LBHA is the South Downs NP. However, it can be seen from Figure 6 that LBHA (highlighted in the red circle) is approximately 23 NM from the northern boundary of the South Downs NP.

Figure 6 LBHA Location relative to NPs (Source: Natural England)

Additionally, all options associated with this ACP are to the north of LBHA (except for an element of the MAP), meaning that the airspace design options proposed as part of this ACP are even further away from the South Downs NP. Consequently, the change sponsor has concluded that there will be no impact on NPs. As a result, these have not been considered in the Full Analysis Table (see Appendix A1).

4.3.4 Biodiversity

As defined in Table 2 (see Section 2.2), CAP 1616 [Ref 1] requires change sponsors to consider the impact the proposed change may have on biodiversity within the vicinity of the change. CAP 1616, Appendix B, Paragraph B80 states "In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure" [Ref 1]. This statement is particularly true with regards to this ACP as it does not involve ground infrastructure. Nevertheless, the change sponsor has investigated "terrestrial, marine and other aquatic ecosystems" that may be impacted, as per CAP 1616, Appendix B, Paragraph B79 [Ref 1].

With regards to maritime and other aquatic ecosystems, none of the proposed options within this ACP pass over any major water courses such as major rivers, lakes, or reservoirs. Consequently, it is deemed that the impact of this ACP on water-based ecosystems is the same as the baseline scenario ('Do Nothing baseline'), of which there is currently no known adverse impact. This is reflected in the Full Analysis Table (as shown in Appendix A1).

In terms of terrestrial ecosystems, the change sponsor acknowledges that the proposed options will overfly Bird Conservation Targeting areas which is relevant to declining farmland birds such as Corn Bunting, Tree Sparrows, and Lapwings [Ref 9]. Additionally, an area to the west of LBHA is a designated Countryside Stewardship area for the Brown Hairstreak butterfly [Ref 9]. Furthermore, the Downe Bank Nature Reserve and Cuckoo Woods (directly to the east/north of LBHA respectively) are

designated as important areas for plant life such as wildflowers and fungi [Ref 9]. These areas are shown in Figure 7 below, with LBHA highlighted in red.

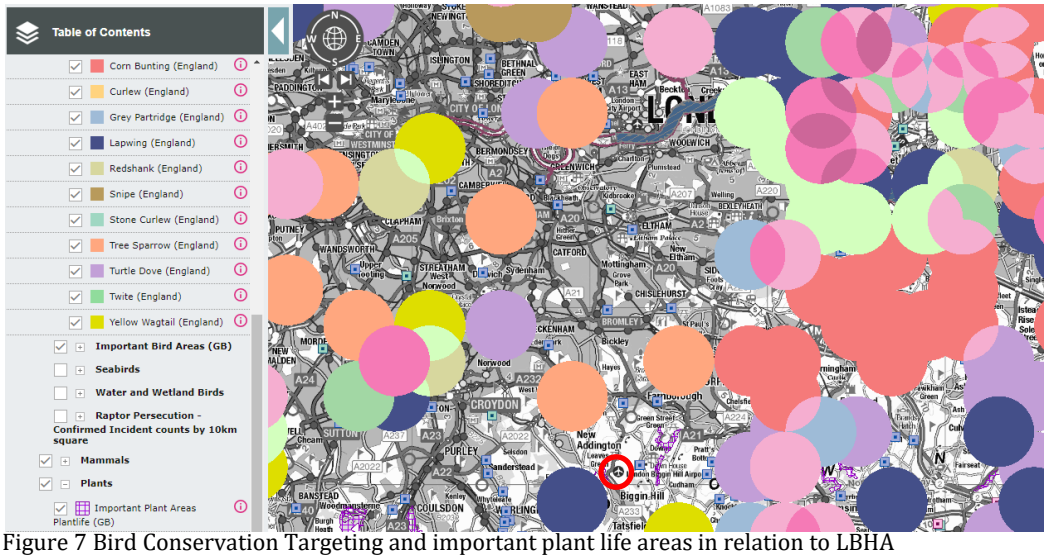

Figure 7 Bird Conservation Targeting and important plant life areas in relation to LBHA (Source: UK Government: DEFRA)

There is no anticipated impact on any of the areas shown in Figure 7 as a result of this ACP, simply because of the minimal changes made in terms of aircraft routing when compared to the IOA baseline ('Do Nothing baseline').

In addition, as specified in CAP 1616, Appendix B, Paragraph B80 [Ref 1], change sponsors are required to consider the impact of the change on any European Protected Species as defined in the Conservation of Habitats and Species Regulations 2010 [Ref 10]. Based on Figure 8 below, the change sponsor acknowledges that there are several European Protected Species within the area around LBHA (shown in the red circle). These include Bats, Great Crested Newts, and other mammals. Considering the limited changes in airspace design that form part of this ACP, the impact on these species is expected to be the same as the baseline scenario ('Do Nothing baseline'), of which there is no anticipated adverse impact.

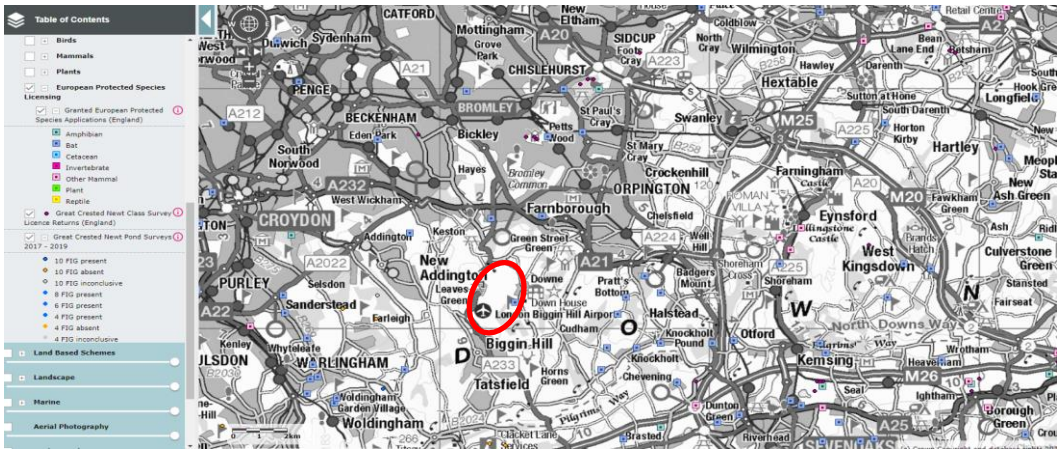

Figure 8 LBHA and European Protected Species (Source: UK Government: DEFRA)

4.3.5 Air Quality Management Areas

Like, AONBs and NPs, CAP 1616 [Ref 1] requires change sponsors to consider the impact of proposed changes on Air Quality Management Areas (AQMAs). AQMAs are areas within which local authorities are required to measure, review, and assess the impact of air quality on people's health and the environment [Ref 11]; most are associated with road traffic emissions.

With reference to LBHA, the most applicable AQMAs are Croydon, Bromley, Bexley, No.1 M25, No.2 M25 and Hooley. All of these areas require local authorities to measure the levels of Nitrogen Dioxide (NO_2) caused by road traffic. The locations of these AQMAs in relation to LBHA (highlighted in red) is illustrated in Figure 9 below.

Figure 9 LBHA Location relative to AQMAs (Source: UK Government: DEFRA)

The change sponsor acknowledges that the design options presented as part of this ACP do intersect the boundaries of the AQMAs mentioned above.

In terms of the approach options, all of the proposed options pass over the Bexley AQMA to the north of LBHA. However, it must be stressed that this already occurs in today's operation. Furthermore, aircraft flying over this area will be above 1,000 ft at the time. This is also true in relation to the MAP options, which intersect the Croydon, Hooley, No.1 M25 and No. 2 M25 AQMAs.

As aircraft will be above 1,000 ft at the time of intersection the impact (on all AQMAs) is deemed to be minimal based on CAP 1616, Appendix B, Paragraph B74 [Ref 1] which states:

"Due to the effects of mixing and dispersion, emissions from aircraft above 1,000 feet (amsl) are unlikely to have a significant impact on local air quality. Therefore the impact of airspace design on local air quality is generally negligible compared with other factors such as changes in the volume of air traffic, and local transport infrastructure feeding the airport. However, sponsors must still show explicit consideration of whether local air quality could be impacted when developing airspace change proposals." [Ref 1]

Based on CAP 1616, Appendix B, Paragraph B74 [Ref 1], above, it must be stressed that the implementation of this ACP will not have an impact on volumes of air traffic or local transport infrastructure feeding the airport. Furthermore, additional qualitive environmental assessments will be conducted in due course as required by Stage 3 of the CAP 1616 process.

4.4 Comprehensive List of Viable Options

Table 4 below provides a basic description of the comprehensive list of viable options that was established after the DPE. Please note that no discontinued or rejected options appear in Table 4 below.

Option No	Variation	Basic Description
2	A	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°.
	AD	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. It is assumed that radar vectors provided by NATS will be available from OSVEV if necessary/requested, as is the current practice, and that radar vectors for inbounds from the MAP will be available as is the current practice for the VOR/DME approach. The glideslope is at 3.0°.
9		Mimic the current right turn MAP to ALKIN (via the LBHA overhead) and then radar vectors from NATS or follow the procedural approach from ALKIN as is the case with the VOR/DME procedure. This will, however, result in different protection areas due to the design regulations, This MAP would also become the ILS MAP.

Table 4 Comprehensive List of Viable Options

A more detailed comprehensive list of viable options, including map overlays is published on the CAA airspace change portal as part of Step 2A.

4.5 Results Summary

This section provides a high-level summary of the IOA. An extract of the full analysis table is available in Appendix A1. The complete table can be found on the CAA airspace change portal.

Table 5 below outlines the colour coding scheme used in the subsequent table (Table 6) to distinguish between which options will be carried forward and which have not.

Colour Key	
Preferred Option	Meets objectives, insignificant impact, and is one of the Short-Listed options and is the most favourable.
Carry Forward	Meets objectives, insignificant impact, and is one of the Short-Listed options.
Not Carried Forward	Meets objectives or has an insignificant impact but is less attractive than other options.
Reject	Fails to meet one or more objectives or has a significant impact that cannot be effectively mitigated.
Previously Rejected	Included for completeness.

Table 5 Results Summary Colour Key

Table 6 (the Comprehensive List of Viable Options) below contains a high-level summary of the IOA results, broken down by option number and variation. For completeness, the options that have previously been rejected have also been included within Table 6. For details on the full analysis, please refer to the separate Appendix on the CAA airspace change portal, as detailed in Appendix A1 of this document. Please note, the same colour key is applicable to the Full Analysis Table (as shown in Appendix A1). A copy of Table 5 is included on the Full Analysis Table, when accessed as a sperate document via the CAA airspace change portal.

Option No	Variation	Status
1		Rejected at Options Development but included for comparative purposes only.
2	A	Carry Forward – Based on its performance in the IOA, Option 2A has been taken forward. This option provides a clear alternative to the preferred option but does not include a direct link from OSVEV to ALKIN.
	AD	Preferred IAP Option – Based on its performance in the IOA, Option 2AD has been selected as the Preferred option. This is because this option is more beneficial in terms of network connectivity when compared to Option 2A as it includes a link between OSVEV and ALKIN.
8		Rejected at Options Development but included for comparative purposes only.
9		Preferred MAP Option – As the only viable MAP option in the Comprehensive List of Viable Options, Option 9 has been selected as the MAP preferred option. As this is a replication of the existing MAP, the impact is expected to be minimal.

Table 6 IOA Results Summary

5 Qualitative Safety Assessment

5.1 CAP1616 Safety Assessment Requirements

A qualitative Safety Assessment is required for all options identified during Step 2A, and a detailed final safety assessment must be completed by the change sponsor prior to submission in Step 4B. LBHA is carrying out the safety assessment activities in accordance with CAP 760 [Ref 6], the separate guidance provided by the CAA for safety assessment.

LBHA is developing a full four-part Safety Case iteratively throughout the CAP 1616 [Ref 1] process which will be submitted to the CAA at Step 4B.

5.2 Safety Assessment Method

The Qualitative Safety Assessment uses the results of a formal Hazard Identification (HazID) workshop held on 21st April 2021 during which the hazards, causes and consequences relating to each of the longlist of options were identified.

A subsequent HazID workshop was held on 7th February 2022 which specifically focused on the 3.5 degree and PBN to ILS options.

5.3 Safety Assessment Results – Non-Technical Summary

The safety work to date implies that all the options in the Comprehensive List of Viable options will meet acceptable levels of flight safety and will provide a resilient procedure, while acknowledging that existing hazards (e.g., loss of surveillance, loss of GNSS signal in space) will remain. In addition, Option 2AD reduces the need for radar vectors for traffic leaving the network at OSVEV; this has a positive impact on safety.

In addition, Table 7 below describes the high-level safety assessments for the Comprehensive List of Viable Options. Please note that option variations have been grouped together to indicate how the same high-level hazards apply to each variant of the same option.

As radar vectoring considerations (e.g., loss of communications/ consideration of adjacent airports) will be the same as for current operations, this ACP does not introduce further safety considerations.

Option No	High-level Safety Assessment
2	There were no specific hazards identified for Option 2 other than the standard loss of communications with Thames Radar during the provision of radar vectors from OSVEV to ALKIN (where applicable). However, it was concluded that standard radio failure procedures were able to mitigate against this. With specific reference to the PBN to ILS section of this option, possible hazards were identified that may lead to increased pilot workload or result in an aircraft failing to establish on the ILS. Neither of these are anticipated to be a safety issue, as this operation is conducted elsewhere in Europe. Further safety work will be conducted through Stage 3 and 4 of the CAP 1616 process to further explore these hazards.
9	The hazards identified as part of this option were MAP conflicts with Kenley airfield (existing hazard) and a potential increase in pilot workload. Discussions at the HazID workshop did look at increasing the height of this MAP option, but it was concluded that this would cause conflict with London Gatwick traffic. Furthermore, no changes could be made to the lateral track, as this would make this option non-compliant with PAN-OPS. With specific reference to the ILS to PBN section of this option, possible hazards were identified that may lead to increased pilot workload or result in an aircraft failing to re-establish on the PBN procedure following a missed approach. Neither of these are anticipated to be a safety issue, as this operation is conducted elsewhere in Europe. Further safety work will be conducted through Stage 3 and 4 of the CAP 1616 process to further explore these hazards.

Table 7 High-level Safety Assessment

6 Design Options Short List

6.1 Shortlist of Options Taken Forward

Table 8 below presents the Short List of options carried forward to Stage 3 along with a summary of the Initial Appraisal Outcome for that option. The IOA has shown that the options brought through from the DPE are broadly similar in terms of noise and environmental impacts. However, Option 2AD provides better network connectivity, as it features a direct link between OSVEV and ALKIN.

Shortlist Option	Initial Appraisal Outcome
2A – Carry Forward	Based on its performance in the IOA, Option 2A has been taken forward. This option provides a clear alternative to the preferred option but does not include a direct link from OSVEV to ALKIN.
2AD – IAP Preferred Option	Based on its performance in the IOA, Option 2AD has been selected as the Preferred option. This is because this option is more beneficial in terms of network connectivity when compared to Option 2A as it includes a link between OSVEV and ALKIN.
9 – MAP Preferred Option	As the only viable MAP option in the Comprehensive List of Viable Options, Option 9 has been selected as the MAP preferred option. As this is a replication of the existing MAP, the impact is expected to be minimal.

Table 8 Shortlist of Options Taken Forward

References

Ref No	Source	Link
1	UK CAA	https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8127
2	European Union	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R1048
3	UK CAA	https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=8960
4	UK Government	https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent
5	UK Government – Department for Transport	https://www.gov.uk/guidance/transport-analysis-guidance-webtag
6	UK CAA	https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=2119
7	UK CAA	https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=10508
8	Natural England	https://naturalengland-defra.opendata.arcgis.com/maps/edit?content=Defra%3A%3Aareas-of-outstanding-natural-beauty-england
9	UK Government – Department for Environment, Food & Rural Affairs	https://magic.defra.gov.uk/MagicMap.aspx
10	UK Government	https://www.legislation.gov.uk/uksi/2010/490/schedule/2/made
11	UK Government – Department for Environment, Food & Rural Affairs	https://uk-air.defra.gov.uk/aqma/
12	UK CAA	https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=10124

Table 9 References

A1 Initial Options Appraisal Full Analysis Table Extract

Below is an extract of the IOA Full Analysis Table (

LBHA 21 PBN - INITIAL OPTIONS APPRAISAL - FULL ANALYSIS TABLE

Initial Options Appraisal Appendix A1 Version 2

Group	Impact	Level of Analysis	Option 1 - 'Do Nothing Baseline' - Today's Operation	Option 2A - VOR/DME Replication from ALKIN (3 Deg)	Option 2AD - VOR/DME Replication direct from OSVEV (3 Deg)
Communities	Noise impact on health and quality of life	Initial Options Appraisal: Qualitative	Today's operation entails aircraft receiving radar vectors to establish an approach on the ILS. The majority of aircraft inbound to LBHA receive radar vectors, with the main swathe of these being in the OSVEV area as shown in Section 1.7.1 within the Design Options Development document. Due to the continual use of radar vectoring associated with this option, the dispersion of traffic due to radar vectors (and therefore the dispersion of the noise impact) is varied.	Option 2A replicates as closely as possible, the existing VOR/DME approach, therefore there will be very little change to tracks flown (and they will still be in areas that are already overflown), meaning that the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario.	As this option replicates, as closely as possible, the existing VOR/DME approach, there should be very little change to tracks flow, meaning that the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. This option provides a direct link between OSVEV and ALKIN, reducing the need for radar vectors between these waypoints, which is unlikely to impact the noise footprint as this area is currently overflown.
Communities	Air Quality	Initial Options Appraisal: Qualitative	The majority of local areas overflown are impacted when the aircraft is above 1,000ft. It is acknowledged that parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. In addition, it is also acknowledged that today's operation involves the	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000ft. It is acknowledged that parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. This will have the same impact as todays operations. In addition, it is also acknowledged that this will involve the overflight of the	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000ft. However, it is acknowledged that parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. In addition, it is also acknowledged that this will involve the overflight of the Princess Royal University Hospital. Having said

Figure 10). The full analysis of the options is contained in the Initial Options Appraisal Full Analysis Table Version 2, that can be found in PDF format alongside this document on the CAA Airspace Change Portal.

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LBHA 21 PBN - INITIAL OPTIONS APPRAISAL - FULL ANALYSIS TABLE

Initial Options Appraisal Appendix A1 Version 2

Group	Impact	Level of Analysis	Option 1 - 'Do Nothing Baseline' - Today's Operation	Option 2A - VOR/DME Replication from ALKIN (3 Deg)	Option 2AD - VOR/DME Replication direct from OSVEV (3 Deg)
Communities	Noise impact on health and quality of life	Initial Options Appraisal: Qualitative	Today's operation entails aircraft receiving radar vectors to establish an approach on the ILS. The majority of aircraft inbound to LBHA receive radar vectors, with the main swathe of these being in the OSVEV area as shown in Section 1.7.1 within the Design Options Development document. Due to the continual use of radar vectoring associated with this option, the dispersion of traffic due to radar vectors (and therefore the dispersion of the noise impact) is varied.	Option 2A replicates as closely as possible, the existing VOR/DME approach, therefore there will be very little change to tracks flown (and they will still be in areas that are already overflown), meaning that the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario.	As this option replicates, as closely as possible, the existing VOR/DME approach, there should be very little change to tracks flow, meaning that the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. This option provides a direct link between OSVEV and ALKIN, reducing the need for radar vectors between these waypoints, which is unlikely to impact the noise footprint as this area is currently overflown.
Communities	Air Quality	Initial Options Appraisal: Qualitative	The majority of local areas overflown are impacted when the aircraft is above 1,000ft. It is acknowledged that parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. In addition, it is also acknowledged that today's operation involves the	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000ft. It is acknowledged that parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. This will have the same impact as todays operations. In addition, it is also acknowledged that this will involve the overflight of the	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000ft. However, it is acknowledged that parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. In addition, it is also acknowledged that this will involve the overflight of the Princess Royal University Hospital. Having said

Figure 10 IOA Full Analysis Table Extract