Bickerdike Allen Partners
Architecture Acoustics Technology

FORMER PLYMOUTH AIRPORT SITE

AIRPORT RE-OPENING FEASIBILITY

NOISE ISSUES

Report to

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1.0 INTRODUCTION

Plymouth Airport closed two years ago and since then there has been a significant amount of residential development adjacent to its boundary, and some on a former part of the airport site. Despite this a local pressure group, Viable, has been campaigning to re-open the airport. A review has been undertaken from a noise perspective, to consider the feasibility of reopening the airport.

The review considers the planning situation in Section 2.0, the in principle noise impact of any reopened airport in Section 3.0, and the claims made on the Viable website in Section 4.0.

A glossary of acoustic and aviation terminology is included as Appendix 1.

2.0 PLANNING SITUATION

The planning situation is considered in three parts, National, Local and Site Specific, all of which will affect the potential operations to some degree.

2.1 National Policy

Aviation Policy Framework (March 2013)

The Aviation Policy Framework (APF) was published in March 2013 by the Department for Transport (DfT). The APF replaces the 2003 Future of Air Transport White Paper in conjunction with relevant policies and any decisions which Government may take in response to recommendations made by the Airports Commission, which is due to issue its final report and recommendations in 2015.

The APF defines the Government's objectives and policies on the impacts of aviation in the UK. On managing aviation's environmental impacts, and specifically noise, it states in paragraph 3.12 that the Government's overall objective on noise is to *"limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise"*.

It goes on in paragraph 3.13 to state that *"This is consistent with the Government's Noise Policy, as set out in the Noise Policy Statement for England (NPSE) which aims to avoid significant adverse impacts on health and quality of life."*

Some guidance is provided on the noise metric used to rate airborne noise in paragraph 3.15 where it states *"To provide historic continuity, the Government will continue to ensure that noise exposure maps are produced for the noise-designated airports on an annual basis providing results down to a level of 57 dB $L_{Aeq,16hour}$."*

This noise index is described in a footnote as *"The A-weighted average sound level over the 16 hour period of 07.00 -23.00. This is based on an average summer day when producing noise contour maps at the designated airports."*

In paragraph 3.17, the APF states that *"We will continue to treat the 57dB LAeq 16hour contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance. However, this does not mean that all people within this contour will experience significant adverse effects from aircraft noise. Nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise."*

The APF also discusses noise insulation and compensation. In paragraph 3.36 it states *"The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB LAeq,16h or more, assistance with the costs of moving."*

With regard to the Viable proposal paragraph 3.39 is relevant as it states *"Where airport operators are considering developments which result in an increase in noise, they should review their compensation schemes to ensure that they offer appropriate compensation to those potentially affected. As a minimum, the Government would expect airport operators to offer financial assistance towards acoustic insulation to residential properties which experience an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB LAeq,16h or more."*

National Planning Policy Framework (NPPF) (March 2012)

The National Planning Policy Framework (NPPF) published 27th March 2012, sets out the Government's planning policies for England and how these are expected to be applied. It is designed to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

The NPPF consolidates all policy statements, circulars and guidance documents into a single, simpler framework and replaces the planning guidance documents, such as PPG 24, Planning and Noise (1994), which is cancelled by the NPPF.

Government's current planning policy concerning noise is embodied in the National Planning Policy Framework (NPPF), and more specifically the Noise Policy Statement for England (NPSE). The aim of planning policies and decisions with respect to noise is addressed in paragraph 123 of the NPPF and is to:

"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

The above policy refers to "significant adverse impacts" and "other adverse impacts" which are not defined numerically although reference is made to further research being underway in this regard in The Noise Policy Statement for England. That research has not yet produced any numerical guidance for the different noise sources.

Noise Policy Statement for England (March 2010)

The Noise Policy Statement for England (NPSE) provides the framework for noise management decisions to be made that ensure noise levels do not place an unacceptable burden on society. The stated aims of the Noise Policy Statement for England are *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life*."

In respect of achieving the first aim above, the NPSE defines the Significant Observed Adverse Effect Level (SOAEL) as *"This is the level above which significant adverse effects on health and quality of life occur."* No objective guidance has been provided to enable policy makers, noise practitioners and decision makers to understand what this threshold level is. It is understood that research is currently underway to define this SOAEL. The document advises that in the absence of such guidance the lack of any objective guidance provides *"necessary policy flexibility"*.

The use and interpretation of the NPPF and the NPSE in assessing noise is in its infancy and the withdrawal of PPG 24, which contained clear numerical limits to assess the suitability of sites for new residential development, would have left a vacuum if the (APF) has not delineated numerical values for aircraft noise.

The Department for Communities and Local Government are working on additional guidance to assist in the interpretation of the NPSE and currently publish their draft planning practice guidance at http://planningguidance.planningportal.gov.uk/blog/guidance/. This covers a range of categories including Noise. Whereas this guidance has no formal status at present, it

does provide a useful insight into how the Government expect the NPSE to be used when assessing a planning matter.

It provides guidance on how to recognise when noise could be a concern and introduces the three following boundary levels in a table copied below as Table 1.

- Significant observed adverse effect level (SOAEL): This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- Lowest observed adverse effect level (LOAEL): this is the level of noise exposure above which adverse effects on health and quality of life can be detected.
- No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Of relevance, the guidance advises that above the significant observed adverse effect level boundary, the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.

At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring.

As illustrated in Table 1 the perception that noise is noticeable and intrusive is not related to a significant observed adverse effect. As mentioned above, Defra / DCLG have not yet defined the LOAEL and SOAEL for aviation noise. In absence of such numerical criteria we suggest that the DfT 57 dB $L_{Aeq,16h}$ criterion is clearly quieter than the SOAEL and greater than the LOAEL.

Perception	Examples of Outcome	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level (LOAEL)	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level (SOAEL)	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakenings; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Table 1: Noise Exposure Hierarchy

2.2 Local Policy

The local planning situation has been reviewed by Montagu Evans LLP. They have advised that there is no planning allocation that protects the airport and as such it is vacant previously developed land, and that the current statutory development plan simply comprises the adopted Core Strategy. They highlight that policy CS27 'Supporting Infrastructure Proposals' seeks to facilitate the necessary expansion of the airport in order to secure its long term viability but find that it has been established that Policy CS 27 no longer serves any useful

planning purpose. They therefore conclude that the former Plymouth Airport Site has no site specific policies and that development proposals therefore fall to be determined against more generic Core Strategy policies and the National Planning Policy Framework (NPPF).

2.3 Site Specific Restrictions

The current restrictions that will apply to a reopened Plymouth Airport will comprise the requirements of the airport operating lease and planning conditions resulting from the development of the former airport site land. There is also the potential for further restrictions in the future as a result of planning conditions on the development sought. Given the experience of recent airport planning applications, further restrictions seem highly likely.

2.3.1 Existing

The former airport had a lease containing operating requirements which we understand would also apply to a reopened airport. These include not allowing the landing or taking off or aircraft between the hours of 2230 and 0630 (local time) or allowing aircraft engine running during these hours with the exception of within the area designated as the engine testing bay when they may occur between 0530 and 0630. There are also restrictions on training activity, both outside the 0900 to 2000 period and at weekends.

In addition to these restrictions on when operations can occur there are requirements for flight paths to be followed, suitable noise abatement procedures, and limits on the aircraft types than can operate and how many movements can occur per annum.

Further restrictions are placed on the remaining part of the former airport site from the development which is now taking place on adjacent land that was formerly part of the airport site. This development includes housing and other noise sensitive uses. This adjacent development is covered by planning application No: 08/01968/0UT, the permission for which introduces conditions both on the new development and also on the remaining former airport site.

Of those that relate to the former airport site condition No.20 requires *full details of the Engine Testing Bay acoustic attenuation measures including the provision of an entrance gate shall be submitted to and approved*. In the UK dedicated engine testing facilities are relatively rare, with many airports using an open location as distant from noise sensitive properties as practical. One of the reasons for this is the cost of dedicated facilities which is significant, and even more so when an entrance gate, as required here is to be included.

Even with the dedicated facility required further restrictions on the number of engine tests that can occur are given in condition No.22. This includes *not more than 15 engine tests shall*

occur from 6.00am to 7.00am in any calendar month of which not more than three shall occur from 6.00am to 6.30am and then only in exceptional circumstances and not more than 120 in any calendar year. This condition could be obstructive to an early morning service, say operating five days a week before 7am to provide a connection to London and onward destinations.

To assist in monitoring the activity condition No.50 requires continuous noise monitoring at location(s) on the site boundary. A number of UK airports have noise monitoring systems installed which do measure continuously although the locations are generally some distance from the airport under arrival and departure routes. The requirement here diverges from this and as the number of locations to monitor at is undefined the cost implications are also uncertain.

The related condition No.61 sets noise level limits which apply *on all boundaries of the operational airport land following the installation of the Engine Test Bay, Noise Bund and associated noise mitigation works*. The limits apply to *any event or combination of events which is considered to be ground running engine testing, taxiing, hover taxiing of helicopters and running aircraft on the apron*. The range of limits given relates to different times of the day and also considers both long term averages over 12 month periods and short term averages over 1 hour and 15 minute periods.

These noise boundary conditions are extremely onerous and, are unworkable for a commercial airport. This stems primarily from condition No61 which sets a boundary noise level limit and ties it to noise from many sources. We know of no airport in the UK where such controls are applied and, given the day-to-day variability in noise conditions that will occur for a whole variety of reasons at an airport, a short term fixed boundary noise limit is not plausible. This is without taking into account that the engine test bay would be located next to or very close to the operational boundary.

2.3.2 Potential

Whether planning permission would need to be sought for the reopening of the airport site is questionable, but it would certainly be required for Viable Phases 2 and 3 where extensions to the runway are proposed which also require extensions to the airport site. The need to go through the planning process, even on the basis that the applications are approved and not legally challenged, will involve significant time and cost. It is also likely given the experience at other airports that extensive conditions would be applied covering a range of factors including noise.

Conditions could for example tighten the current movement limits and restrictions on the potential aircraft types. They could also require off site noise monitoring, radar track monitoring, and regular reporting of information such as noise contours. All of this would require time and incur significant costs to the operator.

Requirements on any successful applications would also be in addition to those that arise from the requirements of the Environmental Noise Directive (2002/49/EC) which are transposed into the Environmental Noise (England) Regulations 2006. Under these the operator would be required to every 5 years conduct noise modelling, produce a Noise Action Plan (likely to involve a public consultation). This is because a reopened airport would be within the City of Plymouth which is an agglomeration under the directive as it has a population over 100,000.

3.0 FUTURE NOISE SITUATION

The Viable proposal is to reopen and develop the airport in three phases, Phase 1 being recertification, Phase 2 a short runway extension, and Phase 3 a full runway extension. For each phase an assessment of the future noise has been undertaken which considers both the overall daytime noise and the noise from individual movements.

The daytime noise has been assessed by producing noise exposure maps (noise contours) of the A-weighted average sound level over the 16 hour period of 07.00 -23.00 based on an average summer day as discussed in the APF, see Section 2.1. These have been produced at a range of values including 57 dB $L_{Aeq,16h}$, taken as the approximate onset of significant community annoyance, 63 dB $L_{Aeq,16h}$, taken as the level where mitigation should be provided and also as representing moderate levels of annoyance, and 69 dB $L_{Aeq,16h}$, taken as the level which should be avoided and also as representing high levels of annoyance. Noise contours have also been produced at the lower value of 54 dB $L_{Aeq,16h}$, as a sensitivity analysis.

The above criteria specifically relate to fixed wing commercial activity which during the proposed Phase 3 is the dominant source of aviation noise. During the earlier phases general aviation and helicopter activity are significant contributors to the aviation noise. Whilst no reference is made in the APF to the fact that noise from smaller aerodromes used for business and general aviation (GA) purposes might give rise to a greater level of annoyance than noise of the same magnitude from commercial operations. In the past, a “penalty” of 5 dB has sometimes been applied to account for this possibility in the assessment of noise impacts from operations at general aviation airfields. It is therefore possible that the above criteria may underplay the impact of the proposed operations during the earlier phases.

It is presumed that a reopened Plymouth Airport will operate for similar hours to previously, which is from 06:30am to 22:30pm. This means that there will be some activity in the early morning, before 07.00am, which is classed as in the night-time planning period. To assess the noise from night-time movements Sound Exposure Level (SEL) footprints has been prepared for a number of aircraft types. Such footprints are used to indicate areas at risk of sleep disturbance.

Both the noise contours and the SEL footprints have been produced using the latest version of the Federal Aviation Administration Integrated Noise Model (INM) software, version 7.0d. Given the limited information available at this stage on future activity a number of assumptions have been made such as that 30% of the activity occurs in the 92 day summer period, which reflects the commonly found increase in activity when weather conditions are better, and that the initial departure and final arrival routes are straight.

The model does not include local terrain information. Whilst this has the potential to alter some of the predicted noise levels close to the former airport site the effect is generally small and is not justified given the information currently available on the potential development.

The model has been used with a database of the population and dwellings by postcode in 2013, provided by CACI Ltd, to assess what is contained within the contours and footprints. This database includes the recent development on the Plymouth Airport Approach Site in Glenfield Road but not the current development on the southern end of the former cross runway, 504k by Cavanna Homes.

3.1 Viable Phase 1 – Airborne Noise Daytime

The Viable Phase 1 proposal for the former Plymouth Airport site is for it to be *re-established initially as an unlicensed aerodrome to facilitate access for FOST, SAR helicopters, the region's Air Ambulances and general aviation. Following this unlicensed nursery stage the airport will be re-licensed as a Category 2 airport and a new based airline will be established to provide key business routes such as London (Stansted) and Manchester using 19-48 seat aircraft.*

BAP have been provided with information from Fjori Ltd on the theoretical level of aircraft activity that could occur during Phase 1. This is summarised in Table 2 and has been combined with information on the Viable website on the potential aircraft types to allow noise modelling.

Aircraft Category	Annual Movements
Non Air Transport Movements	
General Aviation (Single)	7,226
General Aviation (Twin)	1,858
Small Turboprop	1,239
Air Transport Movements	
Air Taxi	777
Helicopters	
Emergency Services	3,650
FOST	2,190

Table 2: Annual Aircraft Movements - Viable Phase 1

Using the annual movements by aircraft type summer noise contours have been prepared and are shown in Figure 1 from 54 dB to 66 dB $L_{Aeq,16h}$ in 3 dB steps. The areas, and the population and number of dwellings that are contained within the 54 dB, 57 dB, 63 dB and 69 dB contours specifically used in impact assessment are given in Table 3.

Daytime Noise Contour Details – Viable Phase 1			
Value ($L_{Aeq,16h}$)	Area (km^2)	Population Contained[(1)]	Dwellings Contained[(2)]
54 dB	1.4	1,900	850
57 dB	0.7	700	300
63 dB	0.2	<100	<50
69 dB	0.1	0	0

[(1)] Rounded to the nearest 100

[(2)] Rounded to the nearest 50

Table 3: Summer Noise Contour Details - Viable Phase 1

There are no residential properties in the noise contour representing high levels of annoyance, 69 dB $L_{Aeq,16h}$ but some are found in the noise contour representing moderate levels of annoyance, 63 dB $L_{Aeq,16h}$. These number around 10 and are in Blue Haze Close and Elmwood Crescent which are to the north of the centre of the runway near the former airport site perimeter.

The 57 dB $L_{Aeq,16h}$ contour extends from Clittaford Road in Southway to the roundabout on the B3432 where Plymbridge Road meets Novorossisk Road. There are around 300 residential

properties within the contour generally located to the northwest of the former airport site and under the potential flight path should it reopen.

The sensitivity contour, 54 dB $L_{Aeq,16h}$, extends from Coombe Bottom to Bickleigh Vale. It contains around 850 residential properties mainly in Southway to the northwest of the former airport site.

3.2 Viable Phase 2 - Airborne Noise Daytime

The Viable Phase 2 proposal for the former Plymouth Airport site is to introduce services to additional UK and near European destinations with 48-72 seat aircraft once an initial short runway extension is complete at the southeast end of the runway.

BAP have been provided with information from Fjori Ltd on the theoretical level of aircraft activity that could occur during Phase 2. This is summarised in Table 4 and has been combined with information on the Viable website on the potential aircraft types to allow noise modelling.

Aircraft Category	Annual Movements
Non Air Transport Movements	
General Aviation (Single)	7,809
General Aviation (Twin)	2,008
Small Turboprop	1,339
Air Transport Movements	
Air Taxi	602
Medium Turboprop	4,820
Large Turboprop	3,185
Helicopters	
Emergency Services	3,650
FOST	2,190

Table 4: Annual Aircraft Movements - Viable Phase 2

The resulting noise contours are shown in Figure 2 from 54 dB to 66 dB $L_{Aeq,16h}$ in 3 dB steps. The areas, and the population and number of dwellings that are contained within the 54 dB, 57 dB, 63 dB and 69 dB contours specifically used in impact assessment are given in Table 5.

Daytime Noise Contour Details – Viable Phase 2			
Value ($L_{Aeq,16h}$)	Area (km^2)	Population Contained[(1)]	Dwellings Contained[(2)]
54 dB	2.2	3,300	1,250
57 dB	1.1	1,000	450
63 dB	0.3	<100	<50
69 dB	0.1	0	0

[(1)] Rounded to the nearest 100

[(2)] Rounded to the nearest 50

Table 5: Summer Noise Contour Details - Viable Phase 2

There are no residential properties in the noise contour representing high levels of annoyance, 69 dB $L_{Aeq,16h}$ but there some are found in the noise contour representing moderate levels of annoyance, 63 dB $L_{Aeq,16h}$. These number around 30 and are mainly in Blue Haze Close, Elmwood Close which are to the north of the centre of the runway near the former airport site perimeter, and in Colston Close which is across the A386 Tavistock Road from the northwestern end of the runway.

The 57 dB $L_{Aeq,16h}$ contour extends from the Langley Plantation in Southway to Bickleigh Vale. There are around 450 residential properties within the contour generally located to the northwest of the former airport site in Southway where they are under the potential flight path should it the airport reopen.

The sensitivity contour, 54 dB $L_{Aeq,16h}$, extends from Yappers Wood to Boringdon Park Wood. It contains around 1,250 residential properties mainly in Southway to the northwest of the former airport site.

3.3 Viable Phase 3 - Airborne Noise Daytime

The Viable Phase 3 proposal for the former Plymouth Airport site is a full 279m runway extension at the southeast end of the runway to allow further destinations to be added using 72-125 seat aircraft and around one million passengers per year to be served.

BAP have been provided with information from Fjori Ltd on the theoretical level of aircraft activity that could occur during Phase 3. This is summarised in Table 6 and has been combined with information on the Viable website on the potential aircraft types to allow noise modelling.

Aircraft Category	Annual Movements
Non Air Transport Movements	
General Aviation (Single)	6,694
General Aviation (Twin)	1,785
Small Turboprop	2,677
Air Transport Movements	
Air Taxi	1,000
Large Turboprop	2,571
Regional Jet	10,714
Helicopters	
Emergency Services	3,650
FOST	2,190

Table 6: Annual Aircraft Movements - Viable Phase 3

The resulting noise contours are shown in Figure 3 from 54 dB to 69 dB $L_{Aeq,16h}$ in 3 dB steps. The areas, and the population and number of dwellings that are contained within the 54 dB, 57 dB, 63 dB and 69 dB contours specifically used in impact assessment are given in Table 7.

Daytime Noise Contour Details – Viable Phase 3			
Value ($L_{Aeq,16h}$)	Area (km^2)	Population Contained[(1)]	Dwellings Contained[(2)]
54 dB	6.7	9,000	3,850
57 dB	3.4	5,800	2,350
63 dB	0.9	1,000	450
69 dB	0.3	100	50

[(1)] Rounded to the nearest 100

[(2)] Rounded to the nearest 50

Table 7: Summer Noise Contour Details - Viable Phase 3

There are around 50 residential properties in the noise contour representing high levels of annoyance, 69 dB $L_{Aeq,16h}$. These are mainly in Colston Close which is in places only 200m from the northwest end of the runway.

There are around 450 residential properties in the noise contour representing moderate levels of annoyance, 63 dB $L_{Aeq,16h}$ which extends from Southway Drive in Southway to south east of the roundabout on the B3432 where Plymbridge Road meets Novorossisk Road. These are

mainly located to the northwest of the former airport site in Southway where they are under the potential flight path should the airport reopen.

The 57 dB $L_{Aeq,16h}$ contour extends from the Trehills Plantation on Roborough Road to the southern edge of Boringdon Park Wood. There are around 2,350 residential properties within the contour generally located to the northwest of the former airport site in Southway.

The sensitivity contour, 54 dB $L_{Aeq,16h}$, extends to some distance outside Plymouth and approaches the river Tavy to the northwest and the northern edge of Plympton to the southeast. It contains around 3,850 residential properties mainly in Southway to the northwest of the former airport site.

3.4 Viable Phases 1 to 3 – Airborne Noise Night-time

When it previously operated Plymouth Airport opened at 06.30am and if it re-opened this is expected to be repeated. This is to allow early morning departures to destinations such as London so onward connections can then be made.

When assessing airspace changes the CAA guidance given in CAP 725 is to produce Sound Exposure Level (SEL) footprints at 80 and 90 dB(A) where the change affects activity at night. Footprints at 90 dB(A) are also used to assess the risk of sleep disturbance, as for the populations within them there will be a very slight risk of sleep disturbance. They have also been used by the UK Government when determining Night Flying Restrictions at Heathrow, Gatwick and Stansted.

For a representative aircraft from each phase of the development outlined by Viable, SEL footprints have been prepared separately for departing aircraft in both directions from the runway. Those for the Phase 1 aircraft, the Beech 1900D are shown in Figures 4 and 5, those for the Phase 2 aircraft, the Bombardier Q400 (Dash 8-Q400), are shown in Figures 6 and 7. For Phase 3 footprints have been prepared for the Embraer 195 aircraft, as this is very similar to the Embraer 190 which Viable list. These are shown in Figures 8 and 9.

Comparing the footprints finds that they increase in size with each successive phase. This is not unexpected as with each phase the size of the aircraft increases, and for Phase 3 the propulsion also changes from a propeller to a jet. Details of the 90 dB(A) SEL footprints including the populations they are estimated to contain are given in Table 8.

90 dB(A) SEL Footprint Details			
Movement	**Area (km^2)**	**Population Contained[(1)]**	**Dwellings Contained[(2)]**
Phase 1 Rwy 13	0.2	0	0
Phase 1 Rwy 31	0.3	300	100
Phase 2 Rwy 13	0.5	100	50
Phase 2 Rwy 31	0.6	500	200
Phase 3 Rwy 13	4.8	4,600	1,800
Phase 3 Rwy 31	5.1	8,900	3,850

(1) Rounded to the nearest 100

(2) Rounded to the nearest 50

Table 8: 90 dB(A) SEL Footprint Details

Considering first the areas of the footprints; for each phase departures on runway 31, that is those to the northwest, are slightly larger. This is due to the runway not being completely flat, with the southeast end being lowest. Aircraft departing to the northwest therefore have to start at the lower end and accelerate up the slope leading to a larger footprint. Comparing across the phases the increase in areas shown on the figures is confirmed.

The populations and number of dwellings within the contours show the same pattern as the areas with increases with each successive phase, and in particular to Phase 3. The result is that early morning departures during Phase 3 could expose thousands of people to noise levels that are associated with a very slight risk of sleep disturbance.

3.5 Viable Phases 1 to 3 – Non-Airborne Noise

In addition to the airborne noise from the flights, which comprises noise from when an aircraft commences its take-off run until it has have slowed to taxiing speed after landing, there will also be noise from the development due to aircraft taxiing, using the aprons and also from engine testing.

Under the Viable proposals aircraft will be based at the airport and consequently maintenance work will also be conducted. Some of this maintenance engine testing will be required before the aircraft can be flown. As planned maintenance is often programmed to minimise disruption to flights, and so may occur at night, there is likely to be the need for early morning engine testing prior to 07.00 hours.

This occurred previously when the airport was operational and unfortunately was a prolonged issue for some of the local residents. This led to the involvement of the ombudsman who

found in their report no. 03/B/05263 five failings including *that the Council has failed to control engine testing by FOST BIL Plymouth Executive Aviation and BA in close proximity to homes*. As a consequence of these the Ombudsman recommended that the Council pay residents compensation for disturbance, time and trouble.

The engine testing at the time generally took place in a dedicated area to the east of the southern end of the former cross runway. This area benefited from screening by earth bunds on two sides but was open to properties in around 225m away in Tavistock Road from where complaints arose.

The proposed location for engine testing under the Viable proposals is to the north east of the previous location, to the south of the former airport terminal. This location is a similar distance from housing in Tavistock Road and more significantly is only around 80m from the housing development being constructed on the southern end of the former cross runway, 504k by Cavanna Homes. The site is also only around 70m from the College of St. Mark and St. John.

Without significant noise mitigation measures it therefore appears likely that an unacceptable situation would occur from the engine testing at this location. That is even without an allowance for aircraft types that are noisier than those that operated in the past, which as detailed in section 3.5 seems likely. As detailed in section 2.3.1 there is however a requirement for an Engine Testing Bay acoustic attenuation measures including the provision of an entrance gate.

From the past experience at Plymouth Airport and experience elsewhere we have found that a representative noise level for a large turboprop, such as the Dash 8, when conducting a high power ground run is 85 dB(A) at 152m from the aircraft. Correcting this to a location around 75m away, and then allowing for the performance of a dedicated engine test pen we predict an instantaneous level at the site boundary close to the housing development of 76 dB(A) during high power running. In practice during a ground run, which may take 30 minutes, only a small proportion is spent with the aircraft at high power. On the basis that the high power is for 5 minutes this gives a 15 minutes level of 71 dB $L_{Aeq,15min}$. This is in effect just equal to the boundary condition that would apply although it assumes no noise from any other sources, and no noisier aircraft are used. It therefore appears that a future airport operator would be hard pressed to meet the boundary noise level with the proposed engine testing location.

4.0 CLAIMS MADE BY VIABLE

On their website Viable make a number of claims under the heading *Plymouth Airport – 10 Myths Busted! (*http://www.viable.org.uk/plymouth-airport-10-myths-busted/). Myth no.7 is

given as *the airport has had houses built all around it now so it can't re-open* and there are a number of statements relating to it. Three of these are repeated below with comments.

The first relates to the relative location of the airport and states that *Plymouth's airport is like many other urban airports across the globe. Viable's plans are modeled on that of London City Airport which is in an even more constrained site than Plymouth. The houses built at the airport recently were built on the old cross-wind runway and are well clear of the remaining long runway.*

It is accepted that London City Airport (LCA) is also located in an urban area but looking at the areas immediately around the LCA runway and overflown during the initial and final phases of flight, it actually has significant unpopulated areas. For example there are very large docks to the north and south of the runway, and a further large dock to the west of the runway with the river Thames being relatively close to the east. Much of the dry land remains undeveloped and significant areas that have been developed are not residential, for example the Excel exhibition centre, and built with appropriate acoustic insulation. Consequently when the sizes of the populations immediately around the two airports are assessed on the basis of a defined rectangular area there is nearly double the population close to the Plymouth Airport site than at London City Airport.

This is on the basis of rectangles whose ends are offset 1 km from each end of the runway, and whose long sides parallel to the runway are offset from the runway centreline by 0.25 km, with population data for 2010 from CACI Ltd. The resulting populations are under 1,200 for London City Airport but over 2,100 for the Plymouth Airport site.

Another claim is that *an extended runway and newer aircraft will reduce aircraft noise emissions.*

Ignoring the fact that at present there are no aircraft noise emissions and so they cannot be reduced, this is not supported by the proposed development of the airport. Under Phases 2 and 3 the runway is successively extended to allow the operation of larger and larger aircraft. The extension from Phase 2 to Phase 3 also allows the introduction of passenger turbojet aircraft such as the Embraer 190.

In Sections 3.1 to 3.4 the consideration of the airport under each phase of development, Viable Phases 1 to 3, finds increases in the noise exposure with each development. Taking the number of people exposed to the level Government guidance classes as the onset of significant community annoyance this increases from around 700 under Phase 1, to around 1,000 under Phase 2, and to almost 6,000 under Phase 3.

The third claim is that *the houses were approved allowing for the proximity of a growing airport. The two runway extensions will allow more modern quieter aircraft to operate. Noise generation from engine testing and helicopter operations is also be mitigated in Viable's operations plan.*

As noted above under Phases 2 and 3 the runway is successively extended to allow the operation of larger and larger aircraft. The extension from Phase 2 to Phase 3 also allows the introduction of passenger turbojet aircraft such as the Embraer 190. These changes from turboprop to turbofan aircraft more than offset any noise benefit of introducing more modern aircraft.

Taking the situation of moving from Phase 2 to Phase 3 the change in aircraft is from large turboprop aircraft, such as the Bombardier Q400 (formerly Dash 8-Q400), to regional jet aircraft such as the Embraer 170 and 190. These types currently operate at London City Airport which has a noise monitoring system that records their movements. The results are used to categorise the aircraft and are reported annually in an Annual Noise Categorisation Report. The latest report is that for 2012 and has the mean annual departure noise levels in an Appendix A (http://www.londoncityairport.com/content/pdf/Appendix%2011.pdf). This shows that the Bombardier Q400 gave 89.3 PNdB whereas the Embraer 170 and 190 gave 93.0 and 94.2 PNdB respectively. The turbojet aircraft proposed for Phase 3 were therefore noisier by 4 to 5 dB.

A similar comparison can be made using information from another city airport, that in Belfast. This also has a permanent noise monitoring system which records the noise from the arriving and departing aircraft, although at locations more distant from the runway than those used at London City Airport. Belfast City Airport produces noise contours each year and the accompanying reports include details of the measured noise levels for the most common aircraft types.

The 2011 noise contouring report (http://www.planningni.gov.uk/index/tools/common-planning-bca-representations/annex_b__appendix_b_.pdf) contains this information in Table A2 of Appendix A. This gives the average noise levels for both the Bombardier Q400 and the Embraer 195, a very close relation of the Embraer 190. On arrival the Embraer aircraft is noisier by around 4 dB and on departure it is noisier by around 10 dB. This effect for departures is illustrated by comparing the SEL footprints for the aircraft, for example Figures 6 and 8.

5.0 DISCUSSION

As detailed in section 2.1 Government policy is to “limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise" and the Government “aims to avoid significant adverse impacts on health and quality of life”. It is against this backdrop that the plans by Viable to reopen and develop Plymouth Airport will need to be assessed.

From the assessment we have undertaken to date it seems clear that the proposed development of the site will lead to increasing noise exposure for the surrounding population, in particular under Phase 3 with the introduction of jet aircraft. These have been found elsewhere to be louder than the larger turboprops, contrary to the claims by Viable.

A Phase 3 operation would most likely lead to the need to offer re-location packages to many tens of homes and sound insulation improvement works to hundreds of homes.

Consequently we would expect, should permission for the development be given, that restrictions would be placed on airport operations. These would be in addition to those already in place which include noise boundary conditions that are extremely onerous and, are unworkable for a commercial airport. This is illustrated from an initial assessment of the potential noise from the proposed engine testing facility which finds that a future airport operator would be hard pressed to meet them.

6.0 SUMMARY

The proposed phased development involves two runway extensions which when both complete would allow larger aircraft, and in particular jet aircraft, to operate. Taking the situation of moving from Phase 2 to Phase 3 the change in aircraft is from large turboprop aircraft, such as the Bombardier Q400 (formerly Dash 8-Q400), to regional jet aircraft such as the Embraer 170 and 190. Taking account of the noise performance of these aircraft types at similarly sized UK airports, it is evident that such turbojet aircraft proposed for Phase 3 will be noisier by around 4 dB on arrival and up to twice as loud, by around 10 dB, on departure than the Q400.

Given this increase in noise from the individual aircraft it follows that consideration of the airport under each phase of development, Viable Phases 1 to 3, finds increases in the noise exposure with each development. Taking the number of people exposed to the level Government guidance classes as the onset of significant community annoyance this increases from around 700 under Phase 1, to around 1,000 under Phase 2, and to almost 6,000 under Phase 3.

With the airport fully developed, as Viable Phase 3, there are almost 6,000 people in almost 2,400 dwellings exposed to noise levels at or above the level Government guidance classes as the onset of significant community annoyance. Of these around 1,000 people in around 450 dwellings are exposed to a level of noise where the Government would expect airport operators to offer financial assistance towards acoustic insulation to residential properties. A primary school is also exposed to such a noise level. Government advice is to offer acoustic insulation to noise-sensitive buildings such as this school. The most exposed people, around 100 in around 40 dwellings, are predicted to be exposed to even higher levels of noise where the Government expects airport operators to offer households assistance with the costs of moving.

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for Bickerdike Allen Partners

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Partner

APPENDIX 1

GLOSSARY OF ACOUSTIC TERMINOLOGY

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

Statistical Term	Description
$L_{Aeq,T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.
L_{den}	$10\times\log\frac{1}{24}\left(12\times10^{\frac{L_{day}}{10}}+4\times10^{\frac{L_{evening}}{10}}+8\times10^{\frac{L_{night}}{10}}\right)$, where
L_{day}	is the A-weighted long-term average sound level for the daytime period (0700-1900).
$L_{evening}$	is the A-weighted long-term average sound level for the evening period (1900-2300).
L_{night}	is the A-weighted long-term average sound level for the night time period (2300-0700).
L_{AE}	Where the overall noise level over a given period is made up of individual noise events, the $L_{Aeq,T}$ can be predicted by measuring the noise of the individual noise events using the sound exposure level, L_{AE} (or SEL or L_{AX}). It is defined as the level which, if maintained constant for a period of one second, would deliver the same A-weighted sound energy as the actual noise event.
$L_{Amax,T}$	The maximum A-weighted sound pressure level. The value may be obtained with the sound level meter set to either F (fast) or S (slow) response and the setting should be stated with all such values.