CITY AIRPORT DEVELOPMENT PROGRAMME (CADP)

CONSOLIDATED ENVIRONMENTAL STATEMENT ADDENDUM (CESA) NOVEMBER 2014

VOLUME I - PART A: RESPONSE TO LONDON BOROUGH OF NEWHAM'S REGULATION 22 REQUEST OF 20 AUGUST FOR FURTHER ENVIRONMENTAL INFORMATION

London City Airport
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CITY AIRPORT DEVELOPMENT PROGRAMME (CADP)

CONSOLIDATED ENVIRONMENTAL STATEMENT ADDENDUM

INCORPORATING ALL FURTHER INFORMATION PROVIDED TO THE LONDON BOROUGH OF NEWHAM SINCE THE SUBMISSION OF THE ENVIRONMENTAL STATEMENT OF JULY 2013

VOLUME I

PART A

November 2014

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1 INTRODUCTION AND APPROACH TO THE CONSOLIDATED ENVIRONMENTAL STATEMENT ADDENDUM

a) Introduction

1.1 On the 26th July 2013 London City Airport (the Airport) submitted proposals for the City Airport Development Programme (CADP) comprised in two planning applications:

- CADP1 ï A detailed application for new airfield infrastructure and extended passenger facilities at the Airport (LPA ref. 13/01228/FUL)
- CADP2 ï An outline application for a new hotel with up to 260 bedrooms (LPA ref. 13/01373/OUT)

1.2 The applications were accompanied by a number of documents, including an Environmental Statement (ES) and its Non-Technical Summary (NTS) which together reported the findings of the Environmental Impact Assessment (EIA) of the proposed CADP.

1.3 This document - the **Consolidated Environmental Statement Addendum ('CESA'),** gathers together in one place all further information and clarifications on the ES which have been provided to the London Borough of Newham (LBN) since July 2013. This includes the Airportõs response to three successive ôRegulation 22õ requests from LBN, as set out in its letters of 21st January, 23rd May and 20th August 2014, described herein.

1.4 This volume of the CESA (Part A, Volume I) provides the Airportõs response to the most recent of these requests, whilst Part D (Volume III) reproduces all relevant extracts of the first ES Addendum (March 2014) and of the second ES Addendum (May 2014) which contained the ôfurther informationõ requested in LBNõs earlier letters.

1.5 Much of the information contained in this CESA has no consequence or bearing on the findings of the original ES. Instead, it simply acts to clarify, validate and elaborate upon particular matters contained within the ES and/or to provide further project details that have been requested by LBN in the intervening period. Indeed, the vast majority of the ES text remains valid on account of the fact that the main findings of the EIA, including the identification of all ôlikely significant environmental effectsõ of the CADP proposals, are not materially altered by the further environmental information or other matters of clarification which have been provided by the Airport.

1.6 However, certain changes to the CADP proposals, in particular the improvements to the construction programme together with supplemental noise and cumulative impact assessment work requested by LBN, can be regarded as ômaterialõ additions to the original ES. Accordingly, the original ES has now been amended to account for this further information and other minor changes. The ES is reproduced in full within the **Consolidated Environmental Statement (November 2014)** (CES) which has been submitted to LBN at the same time as the CESA. The amendments contained in the CES are denoted by new text (in red font) and by the replacement of three key chapters (as light green pages), namely: Chapter 6: Development Programme, Demolition and Construction, Chapter 8: Noise and Vibration, and Chapter 18: Cumulative effects. The CES is summarised in a revised version of the Non-Technical Summary ("NTS of Consolidated Environmental Statement", November 2014) which has also been submitted to LBN.

1.7 In summary, the CES provides a complete account of all 'likely significant environmental effects' of the proposed CADP, as required by the EIA Regulations 2011, together with proposed mitigation measures to avoid, reduce or offset potential adverse effects and to ensure that the beneficial effects of the development are realised; it incorporates some of the additional information and clarification provided to LBN since July 2013 but only where this has consequences for the content of the original ES. The CESA, on the other hand, provides <u>all</u> of the responses given by the Airport to the requests made by LBN for additional information or clarification.

1.8 In order to gain a full understanding of the likely significant environmental effects arising from the construction and operation of the CADP, as well as proposed mitigation, the reader should refer to the following:

1. The CESA;
2. The CES (Volume I) and its accompanying technical appendices (Volumes II, III and IV); and
3. The Updated NTS of the Consolidated Environmental Statement.

1.9 Where appropriate, references are given in the CESA which enables the reader to cross refer to specific chapters, sections or paragraphs of the CES, where a particular issue may be explained or described in more detail.

b) <u>Consolidated ES Addendum (CESA), November 2014 –Explanation of Parts</u>

1.10 Due to the nature and range of material it contains, the CESA is divided up into 4 separate Parts (A to D) which are presented in 3 separate Volumes (I, II and III), as described below.

CESA Volume I – Part A: Response to London Borough of Newham's Regulation 22 request of 20th August for Further Environmental Information

1.11 **Part A** sets out the Airport's response to the specific matters raised by the London Borough of Newham (LBN) in its letter dated 20th August 2014 (presented at Appendix 1.1). This further information has been requested by the Council in accordance with Regulation 22 ("Further information and evidence respecting environmental statements") of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011.

1.12 Part A is structured into sections 2 - 8 in order to provide the commensurate information requested in LBN's letter in a logical order. Section 2 describes the Improved Construction Programme prepared for the CADP, whilst Sections 3 to 7 provide the statutory 'further information' to the ES. The specific wording of each item of the Council's letter is reproduced in a text box, with the appropriate response set out directly below each question/ item.

1.13 Section 8 at the end of Part A provides an overarching Summary and Conclusion which comments on the implications of the further information to the findings of the July 2013 ES.

1.14 The content of the individual sections of Part A is described in more detail at the end of this Introduction to the CESA.

CESA Volume II – Parts B and C: Supplemental Information Regarding 120,000 EIA Sensitivity Test and Proposed Noise Controls

1.15 **Part B** presents the results of an EIA Sensitivity Test which assesses a plausible aircraft fleet mix that would achieve 120,000 actual aircraft movements (120,000 noise factored) by 2023, consistent with the limits that were consented by LBN in 2009 (ref 07/01510/VAR). This is compared to the 111,000 actual aircraft movements (120,000 noise factored) forecast by 2023, which comprises the principal and ‘most likely’ forecast assessed in July 2013 ES (referred to herein as the “2023 Principal Case”).

1.16 The 120,000 Actual Aircraft Movements (2023) Sensitivity Test (herein referred to as the “120,000 EIA Sensitivity Test”) finds that the ‘likely significant environmental effects’ of this movement cap being reached are acceptable and not materially worse than those presented in the ES. Accordingly, it acts to demonstrate that there is no need to impose new planning conditions or controls which would reduce actual aircraft movements below the previously approved 120,000 movement cap.

1.17 **Part C** describes the proposed future system of aircraft noise control at the Airport, as required by the Aircraft Categorisation Review (ACR) contained in the Section 106 Agreement accompanying the 2009 Permission. Its purpose is to incentivise the use of quieter aircraft at the Airport and it has been brought forward now in order to provide certainty about future planning controls. This part of the CESA explains why it is an appropriate control and that it would be more effective and equitable than the existing Noise Factored Movement (NFM) system in operation today.

CESA Volume III - Part D): Relevant Extracts of the March 2014 ES Addendum (ESA) and May 2014 Second ES Addendum (ESSA)

1.18 In addition to providing the ‘new’ further information referred to above, for the sake of completeness, Part D of the CESA contains relevant extracts from the two previous addendums - the Environmental Statement Addendum (ESA) submitted to LBN in March 2014, and the Environmental Statement Second Addendum (ESSA) submitted in May 2014; these are presented in Parts D.1 and D.2 respectively, comprising Volume III of the CESA.

1.19 The ESA and ESSA have been reviewed in order to identify where information contained in these two earlier documents (both EIA ‘further information’ and other ‘matters of clarification’) remains valid, taking into account the new information provided in Part A of the CESA. Therefore, this information has been categorised as ‘superseded’ (e.g. information related to the construction programme); ‘updated’ as denoted by track-changes to the text (e.g. the re-ordering of appendices and appropriate cross references to the CES); or, ‘unaltered’ and therefore reproduced without amendment. An audit trail of these changes is summarised in Table D.1.1 and Table D.2.1 presented at the beginning of these sections.

1.20 Part D (Volume III) therefore replaces the ESA and ESSA and all relevant additional environmental information prepared since the July 2013 ES is now contained within the CESA. In addition, some of this information (where material to the EIA process and ES findings) is also now incorporated into the Consolidated Environmental Statement (November 2014), as described above.

c) **<u>Further Description of the CESA Part A - Sections 2 to 7</u>**

Part A: Section 2 - Improved Construction Programme

1.21 Section 2 provides an account of improvements to the proposed CADP construction programme and certain construction activities, in order to further reduce the environmental impacts of these works to local residents and other receptors. In particular, following a detailed feasibility study by the Airport and its consultants (informed by ongoing discussions with LBN, construction contractors and other parties), options to substantially reduce the extent and duration of night time and weekend working have been identified ï these Out of Operational Hours (OOOH) works have been reduced as far as practicable, taking into account the overriding engineering, operational and safety considerations which apply to the Airport.

1.22 The changes are illustrated on the *Improved Construction Programme - August 2014* (Appendix 2.1) and are described in the text of this section of the CESA. These further improvements were made following feedback from LBN (in June 2014) that it remained concerned about the potential noise impact of the CADP construction works on local residents, particularly at night. Consequently, the programme now includes a headline reduction from 70% to 30% of night time piling to support the proposed deck over King George V (KGV) Dock; a corresponding reduction in the total duration of night time piling works of over 10 months; a significant reduction in other sources of night time noise disturbance to local residents during these essential construction activities; and, the removal of all night works from areas south of KGV Dock proximate to local residents south of the Airport. Additionally, a new 3m high temporary construction noise barrier (as shown in Appendix 4.2) will be installed along the southern perimeter of the Airport in order to shield residents from noise and other impacts from the works.

1.23 Whilst the extent and duration of such OOOH construction is substantially reduced when compared to the original construction programme (i.e. compared to that presented in the July 2013 ES Chapter 6, subsequently revised by Section 2 of the ESSA (Version 2)) certain construction activities, such as work on the airfield, must still take place when the runway and apron areas are not operational. The nature of these activities and an explanation of why they must take place in the OOOH periods is given in Section 3 of this CESA, in response to Item 1 of LBNôs Regulation 22 letter.

1.24 In light of the shift of night-time to predominantly day-time working, amended HGV vehicle movements (two-way trips per month) have also been calculated and are also presented in Section 2.

1.25 Section 2 of the CESA thereby provides the context for the revised noise and other assessments prepared in response to LBNôs Regulation 22 letter. As such, whilst not explicitly requested by LBN, this section provides the essential background construction details on which the subsequent assessments and/or further information are based.

Part A: Section 3 - Alternative to Construction Method

1.26 Section 3 of the CESA addresses Items 1 and 3 within LBNôs Regulation 22 letter.

1.27 The first part of Item 1 requests that further justification is given in regard to the elements of the programme that occur outside of the operational hours.

1.28 Item 1 (i) to (iv) then asks the Airport to assess the impacts of four potential scenarios, namely: temporary closure of the Airport for an extended period in order to allow unimpeded construction of the CADP; partial temporary closure of the Airport during the weekend period; shorter operational hours to allow construction to take place in the morning or evening period; and "any other scenarios". Subsequently, LBN requested that consideration be given to a number of further variant scenarios, including the implications of 24 hour working on the length of the weekend closures required for the duration of the night-time piling works, an additional scenario involving closure of the Airport for 7 hours during the day to allow additional construction work to be carried out, again for the duration of the night-time piling works, and a possible closure of the Airport during August and at Christmas.

1.29 The first three of these scenarios are addressed by analysing the commercial and other impacts of the following additional variables, and the additional scenarios incorporated:

A: Temporary Closure
Temporary closure for the full period of Out of Operational Hours (OOOH) construction works
Temporary closure during the limited period of piling
Each of the above assessed separately on the basis of day time working only or 24 hour working
B: Weekend Closure
Weekend closure for full period of period of OOOH construction works
Weekend closure to allow piling to be completed more quickly, with and without 24 hour working.
C: Restricted Opening Hours
Restricted opening hours to 07.00 to 20.00 for the duration of construction (allows additional 2.5 hours construction)
Restricted opening hours to 08.00 to 18.30 for the duration of construction (allows additional 5 hours construction)
Restricted opening hours to 07.00 to 12.00 and 14.00 to 20.00 for duration of construction (allows additional 4.5 hours of construction)
Closure of the Airport for 7 hours during the day (10.00 to 17.00 or 09.30 to 16.30) to allow additional construction work for the duration of the night time piling works only.
D: Closure during August and at Christmas
Closure of the Airport during these periods to contain the night-time piling works (although this is not considered feasible in terms of the required construction works and without risk to the programme overall)
An alternative of closure of the Airport for August and a number of subsequent weekends to allow the night-time piling works to be completed (in lieu of the above)

1.30 The analysis demonstrates that all of these suggested scenarios would have significant socio-economic impacts (i.e. loss of airlines business, loss of revenue to the local economy, and loss of local jobs). Furthermore, in the context of the *Improved Construction Programme* (with considerably reduced OOOH working, night-time noise and associated impacts, as described herein) such restrictions are neither necessary nor proportionate to the socio-economic harm that temporary closure or reduced operational hours at the Airport would cause.

1.31 In response to the fourth category 1(iv) ‘Any other scenarios’, Section 3 of the CESA considers a range of alternative construction methods (e.g. infilling KGV Dock) which have been examined and dismissed by the Airport on the combined grounds of engineering feasibility, impact on programme, safety, cost, breach of planning policy and/or environmental impact. Following the consideration of these more radical alternatives, this section of the CESA then provides a review of alternative piling techniques and associated activities that have the greatest potential to generate noise. The piling techniques have been ranked in relation to practicality, programme, financial, operational and safety factors.

1.32 Following this review, the three short-listed piling options (Vibro Piling, Rotary Bored Piling and Giken Piling) have been assessed by the Airportǿs noise consultants Bickerdike Allen Partners (BAP) in order to investigate the potential noise impacts of the three options. This assessment is based on the principle of Best Practical Means (BPM) and responds to Item 3 of LBNǿs letter which requests an evaluation of the noise benefits/ disbenefits of different piling methods taking into account their noise characteristics and the effect on programme, as agreed at a meeting with LBN on 23rd July 2014.

1.33 As requested in Item 3 of LBNǿs letter, consideration of the duration of the works has included a 15 dB weighting for night-time work to enable comparison of the piling options. The full Noise BPM assessment is provided in Appendix 3.2 and is summarised at the end of Section 3 of the CESA.

1.34 Considering all factors, the review of the piling options within Section 3 supports the selection of ǮVibro-Pilingǯ for the CADP.

Part A: Section 4 - Construction Noise and Mitigation

1.35 In response to Item 2 of LBNǿs letter, BAP has reassessed the resultant day and night time construction noise levels as Ǯabsoluteǯ levels in accordance with the required methodology (British Standard BS5228) and have also calculated the Ǯworst caseǯ 15 minute reference period for night time noise to retain consistency with the original ES.

1.36 Item 4 of LBNǿs letter requested further information in relation to effectiveness of proposed mitigation measures, including construction noise barriers. Therefore, noise reduction from the new Temporary Construction Noise Barrier has been modelled by BAP and the results are presented in Appendix 4.5. The location, appearance and outline acoustic specification for this barrier are provided at Appendix 4.2. It is expected that the final details of this barrier will be secured by condition and the potential wording of such condition is set out within Appendix 4.2.

1.37 In response to Item 5 of LBNǿs letter, this section of the CESA also provides an evaluation of the practicality of a range of additional, more localised noise mitigation measures (such as screens around piling rigs) and identifies those which, subject to feasibility testing, will be employed by the appointed Contractor.

1.38 Various monitoring, management and mitigation measures to be implemented by the Airport and its Contractor throughout the CADP works are described within the ǮFramework Construction Noise and Vibration Management and Mitigation Strategyǯ (CNVMMS). An amended version of this document is presented at Appendix 4.4, as requested by LBN at Item 6 of its letter. The CNVMMS describes how the contractor will be bound by a rigorous specification relating to the control of noise and vibration of all demolition and construction works associated with the CADP. This will include contractual obligations to ensure that they use plant in compliance with relevant standards and put in place BPM to comply with stringent noise and vibration limits at the boundary of the site.

Part A: Section 5 - Implications of the London Airspace Management Project (LAMP)

1.39 Item 7 of LBN's letter is addressed within Section 5 of the CESA and relates to an assessment of the recent advancements in London Airspace Management Plan (LAMP) with respect to London City Airport and its immediate airspace. The assessment considers the proposed changes to airspace and how this may influence aircraft noise ('air noise') together with emissions from aircraft in flight and any consequent effects on air quality. This concludes that there will be no material differences in these effects from those assessed in the ES and its subsequent addendums.

Part A: Section 6: Cumulative Effects

1.40 In response to Item 8 of LBN's letter, information has been added to the Cumulative Effects Assessment in order to account for the proposed mixed-use Silvertown Quays development (Ref- 14/01605/OUT) and the Fox & Connaught proposed hotel (Ref- 14/00986/FUL).

1.41 This section provides a consolidated account of the cumulative effects assessment presented in Chapter 18 of the July 2013 CADP ES, as well as the ES technical chapters dealing with noise, air quality, transport and traffic – especially in regard to 'in-combination' construction effects. It therefore considers all major development schemes in proximity to the Airport which have recently been submitted to LBN and/or granted planning consent since July 2013. These include the ABP Royal Albert North scheme (Ref- 14/00618/OUT) which was previously addressed as part of the May 2014 ESSA and has since obtained a 'resolution to grant' planning permission from LBN.

1.42 The sub-section titled Cumulative Noise Effects provides a comprehensive account of the number of residential properties and the estimated population which would fall into the 'With CADP' air noise contours should these developments proceed and be built-out in the future. This assessment finds that the additional development changes do not materially affect the number of dwellings and population that will be affected by the CADP. Therefore, this change has no impact on the air noise conclusions of the ES which still remain valid.

1.43 Notwithstanding, for the sake of completeness, Chapter 8: Noise & Vibration and Chapter 18: Cumulative Effects have been revised to take account of these additional cumulative schemes (in addition to the other 'further information') and replacement chapters are provided in the Consolidated Environmental Statement (November 2014).

Part A: Section 7 - Alternatives Sites for the Hotel

1.44 As requested by Item 9 of LBN's letter, consideration is given to alternative sites for the Hotel development which is the subject of the CADP2 application. This provides a supplement to the main alternatives to the CADP1 proposals which were considered in ES Chapter 4: Alternatives and Design Evolution, as required by the EIA Regulations. This assessment demonstrates that there are no suitable alternatives for this bespoke purpose-built Hotel to serve the Airport.

2 OVERVIEW OF THE IMPROVED CONSTRUCTION PROGRAMME

a) <u>Introduction</u>

2.1 The following Section is intended to outline the improvements that are being proposed to the CADP construction programme in order to reduce the impact and duration of Outï of-Operational Hours (OOOH) construction works, in particular the night time works. This Section has been prepared in collaboration with the Project Engineers (TPS).

2.2 This Section of the CESA should be read in conjunction with the following documents as referred to throughout:

CESA Appendix 2.1, including:

- *Improved Construction Programme - August 2014*
- *Description of Revised OOOH Construction Activities - August 2014*
- *Annotated Piling Zones-Working Hours Split - September 2014*
- *OOOH Programme - August 2014*

The Consolidated Environmental Statement (November 2014) (CES), including:

- *Replacement ES Chapter 6: Development Programme, Demolition and Construction*
- *Replacement ES Chapter 8: Noise and Vibration.*

2.3 As listed above, Chapter 6: Development Programme, Demolition and Construction has been replaced in the Consolidated Environmental Statement (CES, November 2014) to reflect the improvements to the likely construction sequence and working hours. It therefore supersedes both the July 2013 chapter and the previous version presented within the March 2014 ESA. It should be noted however, that the majority of this chapter remains valid and up to date and thus, only the text which is rendered obsolete or is altered by the revised construction details has been amended.

2.4 Similarly, ES Chapter 8: Noise & Vibration is replaced in full in the CES due to the *Improved Construction Programme* and to account for the various supplementary noise assessments presented in Part A and D of the CESA.

2.5 These revised chapters are provided in full in the main body of the CES (Volume I) and also in ótracked changedô format in the accompanying appendices (Volume II). This enables the reader to review these chapters afresh as well as to identify where text from the original versions has been altered.

b) <u>Summary of Construction Programme Improvements</u>

2.6 With the aim of reducing the impact and duration of night time construction works, a further technical review and examination of proposed working methods has been carried out to identify potential improvements in the construction programme, including consideration of alternative techniques/methodology, the application of intensive and alternative plant, and additional mitigation.

2.7 The *Improved Construction Programme* and *Out–of-Operational Hours (OOOH) programme* now separates out specific OOOH activities, providing a finer grain of detail (as described below and in Appendix 2.1). This has enabled the sequencing of such activities to be improved to better align working, significantly reduce the overall duration of night time working, and to avoid or minimise as far as possible the associated night time noise impacts. This is particularly the case for piling and deck works which have the potential to be the noisier construction activities.

2.8 Where feasible, the use of multiple plant has also been incorporated into the construction methodology (e.g. using two piling barges for the entirety of the CADP night time construction programme) so as to maximise the use of daytime piling and reduce the duration of any night time works.

2.9 Further, the construction programme now includes a significant number of additional activities occurring during the weekday operational hours (06:30 to 22:00 hours) in lieu of OOOH night time working, as previously presented in the in the ES Addendum (March 2014). The improvements achieve:

- A reduction in the amount of night time piling from 70% to 30%;
- A reduction in the duration of night time works by 21 months throughout the overall CADP construction period;
- A reduction in the number of night time construction activities and frequency of others;
- A significant reduction in the duration of night time piling of approximately 10 months (45 weeks) - reducing from 77 weeks to 32 weeks;
- A reduction in the overall duration of noisier night time deck works of over 6 months (29 weeks);
- A reduction in the number of deck work activities occurring at night, including a reduction in frequency of a number of those remaining activities at night;
- All construction activities previously occurring at night south of KGV Dock moved to daytime hours, including the construction of the hotel, car parks and forecourt works; and
- Provision of an additional temporary construction noise barrier south of KGV Dock to reduce construction noise impacts in the communities south of the Airport, including North Woolwich.

2.10 The improvements have been identified following detailed contractor input and the preparation of a construction methodology (for piling) that enables a temporary relaxation of the Transitional Surfaces (TS) of the Airport during operational hours. As explained below, the Transitional Surfaces can accommodate minor infringements such as the temporary erection of cranes and other tall plant once the Airport is satisfied with the ósafety caseô which is submitted to the Civil Aviation Authority (CAA).

c) Risk Assessment for the Airport's Transitional Surfaces

2.11 Obstacle Limitation Surfaces (OLS), of which the Transitional Surface (TS) is a component part, are a complex arrangement of protected areas surrounding an airport, beginning at the ends and sides of the runway strip and projecting out to a radius of 13km.

2.12 The safeguarding of these surfaces, or areas, is the responsibility of the Airport. 'Safeguarding' in this context refers to the control of obstacles, both temporary and permanent, that penetrate the surfaces. The primary purpose of safeguarding is for the protection of aircraft in flight.

2.13 In assessing the risk to aircraft in flight, the obstacles that penetrate these surfaces can be divided into two categories - permanent and temporary. Obstacles that are classified as temporary have a lower risk value. In addition, obstacles that are temporary and transient (moving) fall into the lowest risk category of a safeguarding assessment, and in some areas can be ignored as they constitute a negligible risk.

2.14 In assessing the construction methodology for the proposed future development of the CADP, the safeguarding experts at the Airport have undertaken an objective risk based assessment. This approach is considered to be an appropriate method for assessment of infringements of the OLS and is recommended by the Civil Aviation Authority (CAA). This risk assessment has been brought forward to an earlier stage of the project than would normally be the case in order to undertake further analysis of night time working requirements, as requested by LBN. Ordinarily, such risk assessment would be undertaken once a contractor is appointed.

2.15 The use of this risk-based approach has identified the opportunity for more of the construction activities, including piling and deck works, in KGV Dock (together with all construction activities in the landside areas to the south of the Dock) to be undertaken during the Airport's operational hours.

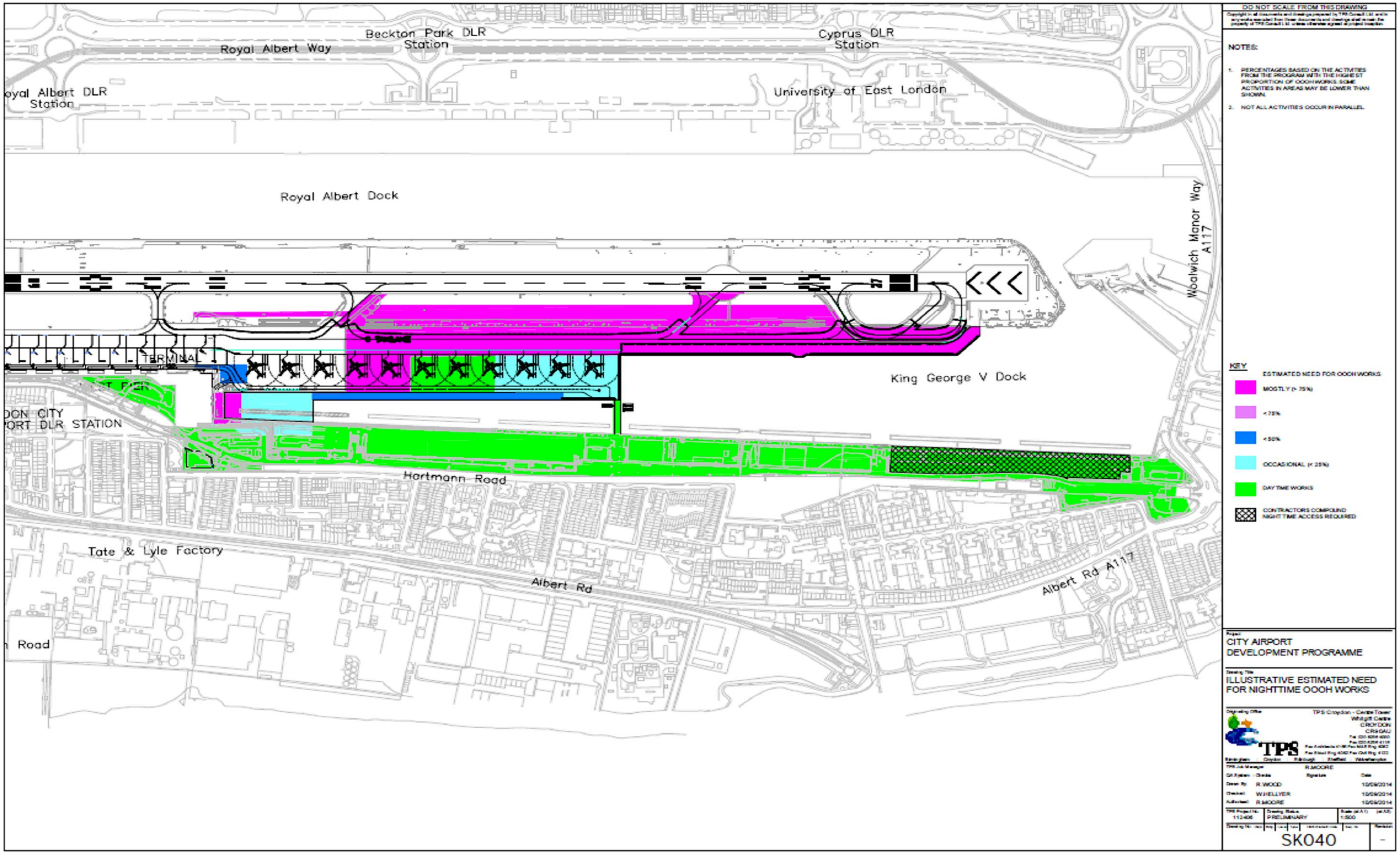
2.16 The Airport's consultant Eddowes Aviation Safety Limited has undertaken a bespoke risk assessment that demonstrates that the proposed works, involving some temporary penetrations of the OLS, will meet an appropriate target level of safety. In summary, the Airport is satisfied from this provisional assessment that the proposed temporary penetrations of the Transitional Surface (TS), associated with the use of cranes and other taller items of construction plant on a temporary basis, are safe and will be acceptable to the CAA. The safety case for the current construction methodology has been informed by previous relaxations of the TS and OLS at the Airport and has taken into account preliminary feedback from airlines. The bespoke risk assessment is included at Appendix 2.2: CADP Safeguarding Assessment (November 2014).

2.17 As set out in Section 3 of the CESA, there remain particular safety and operational circumstances of working which means that some construction activities must inevitably take place whilst the runway, apron and terminal are not in active use, particularly those activities that are closer to, or within, the airfields. However, as noted above, these have been significantly reduced. The *Improved Construction Programme* takes account of these constraints.

2.18 As illustrated in Figure 2.1 below, this colour-coded plan shows the spatial extent of OOOH works and demonstrates the extent to which such works have been reduced to avoid or lessen associated impacts on residents proximate to the Airport.

2.19 The green shading illustrates ódaytime onlyô works, which stretch across the landside areas to the south of KGV Dock, closest to the communities south of the Airport including North Woolwich. The areas of ñmostlyò OOOH (> 75%) are shown in dark pink. These essential OOOH works are largely contained to the airfield and adjoining areas in KGV Dock (i.e. some distance from residents to the south). The exceptions are works to the terminal building associated with the Eastern Terminal Extension and Out Bound Baggage (OBB) facility. The other areas of ópartialô OOOH works (<50%) in bright blue, and óoccasionalô OOOH works (<25%) shown in light blue, occur within KGV Dock, as described in Section 3. Some of the óoccasionalô works would only occur during certain nights and only if absolutely necessary. Finally, the hatched area denotes the dedicated Contractors Compound to which night time access will be required by construction vehicles during particular phases of work.

Figure 2.1- Estimated Need for OOOH Works



d) <u>Detailed Description of Key Improvements to the Construction Programme</u>

2.20 The *Improved Construction Programme* is intended to provide an indicative representation of likely sequencing of the works for the CADP. It has been drawn up by the project engineers (TPS) to inform the likely sequence without being overly conservative or optimistic. However, this programme will be developed further when a preferred contractor is selected and the design and construction methodology are fixed.

2.21 In particular, the latest programme has been developed to give greater clarity on when night time construction is likely to be necessary and demonstrates that such construction activities will be in discrete packages. Moreover, as described below, the form and intensity of the construction varies over the programme, with significant periods of respite in between.

2.22 The likely programme now contains references to Operational Hours (OH) and Out of Operational Hours (OOOH) in some of the programme activity titles. The activities that this finer grained approach has been applied to are:

- The piling works;
- The work on the pile heads and beams; and
- The deck planks services and topping.

2.23 Further details on the specific programme improvements are contained in Appendix 2.1. The main indicative phases of the CADP construction are divided into the "Interim Works" (Year 1 to the beginning of Year 3) and the "Completed Works" (Year 3 to Year 7) as described in the CES Chapter 6. It is important to note that the overall duration of the construction programme remains unaltered, although work has generally shifted from the night to day-time when the Airport is operational and the ambient noise environment is predominantly influenced by aircraft taking off and landing, and manoeuvring on the ground.

2.24 The improved programme allows for construction to occur 6 nights a week (Monday to Saturday) therefore providing a period of respite every Sunday night. Also, as illustrated in the '*Book of Construction Noise Maps*' (Appendix 4.1) there will be extended periods of time when no noisy construction activities will take place at night. Furthermore, based on the indicative programme, there is now likely to be a period of almost 2 years respite between the Interim and Completed Works when OOOH piling and deck works will not take place.

2.25 The reduction in the duration of piling, deck works and other OOOH activities is illustrated in bar chart form at Appendix 2.1 (*OOOH Programme - August 2014*). This demonstrates a significant change to the OOOH Programme presented in the ES Addendum (ESA, March 2014) in that a large number of activities previously identified as taking place during these periods will now occur during the Airport's operational hours and the frequency of many of those remaining OOOH activities has reduced.

2.26 The programme of night time works previously presented in the ESA (March 2014) has been shortened significantly - by 21 months overall. Within this period, the number of deck work activities taking place at night has been greatly reduced, with the frequency of a number of those remaining activities also reducing.

2.27 Importantly, all construction activities previously occurring at night south of KGV Dock have been moved to daytime hours, including the hotel, car parks and forecourt works. This avoids any construction activities occurring at night in the areas most proximate to the residential communities to the south of the airport, including North Woolwich.

2.28 The following sub-sections provide a more detailed account of the changes to the timing and durations of particular activities presented on *the Improved Construction Programme*.

Piling

2.29 The proportion of piling undertaken during Out of Operational Hours has been reduced significantly from 70% to 30%. This represents a reduction in the number of piles that need to be installed during OOOH periods by around 59%. The improved balance in piling is shown on the *Annotated Piling Zones-Working Hours Split* at Appendix 2.1. This was previously provided in the ESA (March 2014) and divides the piling works into 7 zones (1A, 1B, 2A, 2B, 2C, 3A and 3B) which correspond to the piling sub-phases shown on the *Improved Construction Programme*.

2.30 Within each piling zone, the figure also illustrates where pile casings are likely to be installed in KGV Dock during normal weekday hours (shown in pink) and those areas where, for safety and operational reasons, piling is likely to take place OOOH, as shown in yellow.

2.31 The overall period of OOOH piling has reduced by approximately 10 months (45 weeks) as follows:

- The previous duration of “Interim Works” (OOOH piling) was 47 weeks for sections 2A, 2B and 3A. The previous duration of “Completed Works” (OOOH piling) was 30 weeks for sections 2C and 3B. Therefore, this derived a combined duration of 77 weeks overall[1].
- The “Interim Works” OOOH piling has been reduced to 19 weeks (in two periods of 12 and 7 weeks) with the “Completed Works” OOOH piling reduced to 13 weeks. Therefore, the total duration of OOOH piling has been significantly shortened, to 32 weeks overall.
- Notably, based on the improved indicative programme the two principal phases of piling are now likely to be almost 2 years apart on the programme, thereby providing an extended period of respite i.e. once the two periods of OOOH piling for the “Interim Works” have been completed and before the final 13 weeks of piling on the “Completed Works” commences.

2.32 In summary, a significant reduction in OOOH piling has been achieved through: the allocation of activities into specific Operational Hours (OH) and OOOH periods; temporary relaxations of the Transitional Surfaces; and, the utilisation of two piling barges in the “Completed Works” (one was previously proposed), thereby enabling increased piling during Operational Hours.

Deck Works

2.33 The overall period of OOOH deck works has reduced by 29 weeks as follows:

[1] It is noted that the ESSA stated OOOH piling works totalling 74 weeks. Following detailed contractor input the likely duration under the previous programme would actually have totalled 77 weeks.

- The duration of ñInterim Worksò OOOH deck works was previously 53 weeks (sections 2A, 2B and 3A). The duration of ñCompleted Worksò OOOH deck was previously 59 weeks (sections 2C and 3B). Together, these deck works totalled 112 weeks throughout the construction of CADP overall.
- The duration of the ñInterim Worksò OOOH deck works period is now 37 weeks and the duration of the ñCompleted Worksò OOOH deck works is now 46 weeks; thereby, totalling 83 weeks overall throughout the construction of CADP.

2.34 The reduction in OOOH working during in the Completed Works has in part been achieved through the use of two, as opposed to one, marine piling rigs throughout critical periods of the construction process. This has given knock-on benefits to the activity termed ñBreak Away Existing Dock Edgeò that runs in parallel and needs to be performed progressively in conjunction with the piling and deck works. The duration of this activity has therefore reduced from 52 weeks to 23 weeks.

2.35 It should be noted that the OOOH deck works have been broken down into more detail for the Interim Works than for the Completed Works. This can be seen under the sub-headings ñStand, Deck and Noise Barrierò of the *Improved Construction Programme* (Appendix 2.1).

2.36 As outlined earlier within this Section (under sub-heading ôcõ) and later within Section 3 (under sub heading ôbõ), the reduction in OOOH deck works will be achieved through the temporary relaxation of the Transitional Surfaces (TS) of the Airport during operational hours, as well as operational engagement, where acceptable, to agree concrete delivery through the live airfield. As the OOOH elements of the deck works for the Completed Works will be undertaken within close proximity to the airfield, the precise operational constraints for this second phase will need to be evaluated in conjunction with the Contractorðs detailed method statement for these works, once this Contractor is appointed.

Detail of All OOOH Improvements

2.37 The detailed technical review of construction methodology has identified that the construction activities set out in Table 2.1 below can be carried out during the operational hours of the Airport. These activities were previously identified as OOOH works in the ESA (March 2014). As stated at the beginning of this Section, improvements to the construction programme include the transference of construction activities occurring south of KGV Dock to the daytime, including the construction of the hotel, car parks and forecourt works.

2.38 Table 2.1 identifies the construction activities that have shifted entirely from OOOH to Operational Hours (OH), comparing the *Indicative Detailed Construction Programme* (Rev 5, February 2014), which was previously contained in Appendix 3.1 of the ESA, with the *Improved Construction Programme - August 2014* which is presented in Appendix 2.1 of this CESA.

2.39 The ôLine Numbersö in the first two columns of both Table 2.1 and 2.2 correspond with the numbering sequence given in the first column of the respective versions of the construction programme. As such, by comparing the two programmes, the reader can identify where the order and duration of specific construction activities has changed.

RPS

Table 2.1: Construction Activities shifted from OOOH to Operational Hours

Indicative Construction Programme presented within the March 2014 ESA (Line Number)	Improved Construction Programme-August 2014 (Line Number)	Description of activities moved entirely to operational hours
START / MOBILISATION		
4	4	Contractor Compound
INTERIM WORKS		
Stands, Deck & Noise Barrier		
15	17 & 18	Deck - Section 2A Deck Planks, Services
18	25 & 26	Deck - Section 2B Deck Planks, Services
21	32 & 33	Deck - Section 3A Deck Planks, Services
23	36	Noise Barrier / Edge Barriers
24	37	Services / Lighting / Markings / Equip For New Stands
Taxiway		
27	40	Edge Barriers to New Taxiway (progressive)
Western Terminal Extension Phase 1		
50	63	Frame
COMPLETED WORKS		
Stands, Building Footprint & Noise Barrier		
Eastern Stands / Taxiway Extension		
63	76	Enabling Works - Remove Quayside Covered Walkways
64	77	Enabling Works - Relocate Car Rental Offices
68	82	Deck - Section 2C Piles
69	83	Deck - Section 2C Pile Heads & Beams
58	71	Above Ground Structure
75	90	Noise / Edge Barriers to New Deck
Eastern Terminal Extension - Main Building		
84	99	Prepare For Frame
Eastern Terminal Extension – Piers		
91	106	Prepare For Frame
98	113	Complete and Handover Remaining Piers
Western Terminal Extension Phase 2		
105	120	Demolition
106	121	Foundations
107	122	Structure
Forecourt Road, etc.		
113	128	Strip Out & Demolish City Aviation House
114	129	Civil Engineering works
Dockside Upgrade + Surface Car Park		
119	134	Civil Engineering Works
Hotel		
123	138	Frame
124	139	Envelope

2.40 It is recognised that the construction programme, whilst indicative, is still quite detailed and may be difficult for the non-engineer/ layperson to follow. Therefore, the reduction in OOOH working for particular activities on the *Improved Construction Programme* can perhaps be more readily appreciated by comparing the current ó*Out of Operational Hours (OOOH) Programme*ô (dated August 2014) with the previous ESA version (February 2014). Both of these programmes are provided at Appendix 2.1 and, for the sake of clarity, the original February 2014 version is now watermarked as being ñsupersededò.

2.41 Looking at the occurrence of the red bars on the two versions of the programme, signifying activities that are mostly (>75%) OOOH, and also the white/ empty bars signifying activities that will only take place during operational hours (i.e. 0% OOOH), it is clearly seen that the substantial majority of construction activities have now been removed from the more sensitive OOOH periods.

2.42 Table 3.1, Section 3 of the CESA identifies those construction activities that remain OOOH. The accompanying text identifies the few activities that must continue to take place during OOOH periods and explains why this is necessary.

2.43 Table 2.2 below identifies those OOOH activities that have been reviewed and a reduction in frequency identified. Again, this underlines how the Airport and its advisors have sought to limit construction works taking place during the night-time, as far as is reasonably practical and safe to do so.

Table 2.2: OOOH activities with reduced frequency

Indicative Construction Programme presented within the March 2014 ESA (Line Number)	Improved Construction Programme- August 2014 (Line Number)	Description	Previous %	Proposed %
20	30 & 31	Deck ï Section 3A Pile Heads & Beams	<50%	0% & <25%
31	44	Foundations and Preparation	>75%	<50%
32	45	Building & Link Bridge Frame	>75%	<25%
37	50	Demolition & Reinstatement	<50%	<25%
76	91	Services / Lighting / Markings / Equip for New Stands	>75%	<25%
92	107	Frame Construction	>75%	<50%
93	108	Building Envelope	>75%	<50%
97	112	Dismantle Existing Eastern Pier & Make Good	>75%	Weekend Daytime

2.44 A further description of each OOOH construction activity (as identified in Tables 2.1 & 2.2 above) is provided at Appendix 2.1.

2.45 In summary, the amendments to the OOOH working as presented in the Improved Construction Programme have resulted in the following overall reductions in the duration of OOOH works:

- The need for OOOH night working during the ñInterim Worksò period has reduced by 3.5 months;
- The need for OOOH night working during the ñCompleted Worksò period has reduced by 17.5 months; and,
- In both phases, the number and intensity of many construction activities has also reduced considerably.

2.46 The principal programme differences which derive the above numbers is summarised in Table 2.3 below.

Table 2.3: Overall Reduction in OOOH activities

Stage	Previous / Reduced	Likely Start of OOOH work	Likely Finish of OOOH work	Duration
Interim Works	Previous OOOH working	Contractor compound	Coaching Facility building envelope.	18.5 months
	Reduced OOOH working	Deck Section 2A and OOOH Piling.	Coaching Facility building envelope.	15 months (3.5 month reduction)
Completed Works	Previous OOOH working	Relocation of car rental offices.	Western Terminal Extension (WTE) Phase 2 structure.	39.5 months
	Reduced OOOH working	Deck Section 3B and OOOH piling	Eastern Terminal Extension Pier building envelope. Demolition and reinstatement of the Coaching Station is now a standalone activity for 3 months at the end of 2020	22 months (17.5 month reduction)

e) <u>HGV Movements</u>

2.47 In light of the changes to the construction programme, the construction vehicle (Heavy Goods Vehicles) movements associated with the *Improved Construction Programme* have been re-considered by the Airportõs Transport Consultants, Vectos.

2.48 This has highlighted an increase in the ôYear 4õ to the middle of ôYear 7õ peak movements. The peak number of total HGV vehicle movements is anticipated to be in the order of 773 two-way trips per month during the Completed Works (Phase 2) of the construction programme. This compares to 626 two-way trips per month reported previously on the ES Chapter 11: Traffic and Transportation and in the separate Transport Assessment (TA). Chapter 11 has therefore been amended to account for this change and is re-presented in the Consolidated Environmental Statement (November 2014).

2.49 The increase is primarily due to the revised assumptions on the form of the Hotel construction, which is now anticipated to be constructed with a concrete frame (with no OOOH works). As a result of changing the construction approach to a concrete frame method, this will necessitate some additional construction movements for cement deliveries etc.

2.50 This small increase is considered to have a negligible impact on local roads including Woolwich Manor Way and would not give rise to new or materially different effects compared to the programme considered under the ES Chapter 11 and the TA. Furthermore, only a small proportion of the daily construction traffic will occur at peak times.

2.51 There are no changes to the peak number of HGV vehicle movements within the Interim Works of the construction programme.

3 ALTERNATIVES TO CONSTRUCTION METHOD (LBN ITEMS 1 AND 3)

a) Introduction

3.1 The following section responds directly to Items 1 and 3 of LBNôs Regulation 22 request for further information, as reproduced below. This request was presented under the heading of óConstruction Noiseô However, it would appear to have a broader purpose as it refers more generally to a number of alternative construction methods and programming scenarios. These may alter the duration and extent of noise impacts, but would also have technical, economic, environmental and other implications if pursued by the Airport. As such, a more in depth consideration of these scenarios is provided here, whilst noise impacts are also further addressed in Section 4: Construction Noise and Mitigation.

3.2 In relation to Item 3 of LBNôs letter, three short-listed piling options (Vibro Piling, Rotary Bored Piling and Giken Piling) have been assessed by the Airportôs noise consultants Bickerdike Allen Partners (BAP) in order to investigate the potential noise impacts of the three options. This assessment is based on the principle of Best Practical Means (BPM). In accordance with Item 3 of LBNôs letter, consideration of the duration of the works has included a 15 dB weighting for night-time work to enable comparison of options (e.g. shorter duration noisier works vs. quieter works for a longer duration).

b) Regulation 22 – 'further information'

> ***LBN Reg 22 Request:***
>
> ***Chapter 8 - Noise and Vibration***
>
> *Construction Noise*
>
> *1. Set out further justification as to why elements of the construction programme needs to occur outside operational hours of the Airport, and during the most noise sensitive periods for the local area. It is considered that alternatives to this construction method should be tested and presented. Accordingly, set out what impacts to the Airport there would be under the following scenarios for the duration of the out of hours construction period;*
>
> *i) Temporary closure of the Airport.*
>
> *ii) Partial temporary closure, for example at weekends.*
>
> *iii) Temporary alterations to morning and evening flights.*
>
> *iv) Any other scenarios.*
>
> *It would be expected that the response would consider and set out the commercial impacts (including viability of the business), flight scheduling and any other operational constraints.*

Response:
Introduction – Item 1

3.3 Item 1 above, first asks for further justification as to why elements of the construction programme need to occur outside operational hours of the Airport (abbreviated in this CESA as OOOH works) which represent ñthe most noise sensitive periods for the local areaò As explained in Section 2(c), there remain particular safety and operational circumstances of working which means that some construction activities must inevitably take place whilst the runway, apron and terminal are not in active use, but these have been significantly reduced. The *Improved Construction Programme* takes account of the constraints, optimises the programme to further prioritise daytime working, and allows for temporary relaxations of the Transitional Surfaces to permit the use of cranes and other taller items of construction plant during the Airportõs operational hours.

3.4 The reasons why certain essential works still need to take place in the OOOH period can be summarised by the following five key considerations. These reasons are linked to the specific OOOH programme activities listed in Table 3.1 below.

i. Obstacle Limitation Surfaces including the Transitional Surfaces

3.5 As described earlier in Section 2, the Obstacle Limitation Surfaces (OLS) and associated Transitional Surfaces (TS) pose certain limitations on the height of construction equipment during operational hours. This has been reviewed by the Airport, by means of a risk assessment, to determine temporary relaxations that can be applied to increase the extent of daytime working, as described in Section 2(c) (see also Appendix 2.2).

3.6 Where there is a requirement for plant heights that go beyond those considered to be safe under the temporary relaxations, work will still be required during the night time and weekend closures periods. For example, taller plant that is required to construct the deck structure, particularly the piles close to the runway, necessitates some OOOH works. In general, the closer the works are to the runway and operational airfield, the less scope there is for taller/ permanent plant as the risk profile increases.

ii. Access for concrete through the live airfield and option for alternative delivery by barge.

3.7 The design for the deck has utilised precast elements as much as possible to maximise the ability for daytime working. However, there is still a requirement to construct a smooth running surface which also provides increased structural strength. This surface is referred to as the ñin-situ concrete toppingò which comprises surface concrete in a ñstiff mixò with a low water content to enable the surface to be laid to the required tolerances and to provide the required durability.

3.8 The concrete for the in-situ topping needs to be delivered close to the point of placement and then pumped a short distance to the final point of placement. This requires concrete delivery through the live airfield and, at some points, through the runway strip.

3.9 A review has been undertaken to see if concrete delivery can be undertaken during operational hours which has identified that some areas can be performed during the daytime. This operational hours delivery is dependent on achieving a safe construction vehicle route though the live airfield, adequate space for construction equipment in the airfield or completed deck, and plant heights that do not affect aircraft operations. While this review has given savings in the extent of OOOH working, it has not been possible to eliminate it completely, especially for the sections of deck where access through the Runway Strip or taxiway network is required. However, it is expected that the extent of OOOH will only be occasional for the majority of this activity.

3.10 A review has also been undertaken to see if concrete delivery can be undertaken by barge to the edge of the proposed deck adjoining the airfield, instead of by lorry through the live airfield, as described below.

3.11 In order to deliver concrete to the airfield by barge, the mixed concrete would first have to be transported by road from the batching plant to the CADP construction compound at the eastern end of KGV Dock. After this, it would need to be transferred onto a barge at the edge of the Dock and the barge would then be moved to the work area, whereupon the concrete would be placed into a hopper and fed into the concrete pump.

3.12 Concrete workability decreases as a function of time from when it was batched and needs to maintain a reasonable level of workability to allow it to be pumped and placed - this is typically within 90-120 minutes of batching.

3.13 The double handling of concrete, from lorry to barge, would entail at least an additional 30 minutes above that of the direct road route through the airfield. This delay is likely to reduce the workability of the concrete to the level that cannot be guaranteed to be suitable, and this could in turn result in spoiled batches with consequential wastage and programme delays.

3.14 The second constraint to barging concrete is that a steady supply of concrete is required to lay the ins-situ topping smoothly. The concrete topping is poured in bays of approximately 400m^2 which, at a thickness of 150mm, requires 60m^3 of concrete. Each concrete wagon can carry around 6m^3, which means 10 concrete wagons are required for each concrete pour. As there is a limit to the number of barges that can be operated in the Dock safely, it is unlikely that the same volume of concrete could be delivered via barge to achieve a continuous pour. Furthermore, this method of transport would increase the risk of spillage and pollution of the Dock.

3.15 A third constraint to barging is that the piles, precast beams and precast planks need to be installed in advance of the in-situ topping concrete placement. The topping can only be installed when rebar has been placed and fixed on the precast units. This process will restrict barge access to the point of concrete placement. Not only will this impede delivery to the point of placement, it will also require concrete pumping. This concrete pump would operate at a height which, in many cases, would need to be performed in OOOH periods.

3.16 In view of the above, this option can be discounted on the basis of practicality and risk.

iii. Works in Runway Strip

3.17 Works within the Runway Strip are restricted by Airport operations and need to be performed OOOH. This particularly applies to the following activities: Break Away Existing Dock Edge; Stormwater Drainage & Culvert; Services / Lighting / Markings; and New Pavement Construction. The noisier elements of such works will predominantly be carried out during the weekend daytime.

iv. Works in/ against the Live Airfield

3.18 Works within and against the live airfield need to be performed during OOOH periods where the proposed works would pose an undue safety risk or operational constraint on the Airport. The potential for works during the Airportôs operational hours has been reviewed to see where improvements in the extent of daytime working can be made, although this does not remove the need for OOOH working altogether. The latter applies to construction within the airfield such as the new Coaching Facility. It also applies to construction directly against the airfield where plant and working areas will need to be set up within the live airfield, such as the Eastern Terminal Extension Pier frame and envelope.

v. Works in/over the Live OBB Facility

3.19 The Out Bound Baggage (OBB) facility at London City Airport is in continuous operation during Airport operational hours. This is a staffed facility and, due to safety and operational constraints, construction work within and over this facility will need to be performed OOOH.

3.20 The main safety constraint around working over the OBB area is that the steel frame members and heavy pieces of the building envelope for the Eastern Terminal Extension would need to be lifted over the baggage area to be installed. These will be large heavy loads and therefore cannot be lifted over the heads of operational staff (in accordance with Health & Safety legislation). Whilst a protection deck will be installed in the OBB area, this will only afford protection against light loads and will not be able to serve as a crash deck for heavier loads such as steel members. Additionally, installation of this protection deck will need to be completed outside of operational hours as there will be nothing between the erection and lifting process for this deck and the operational staff below.

3.21 The baggage operation at the Airport is of vital importance to its operation and it is constrained in terms of location. Moreover, it requires expensive pieces of X-Ray and baggage sorting equipment which are integrally linked to functions within the Terminal and therefore cannot be temporarily relocated for the duration of the construction works.

Summary of remaining OOOH works:

3.22 Taking account of the above factors, Table 3.1 below summarised the remaining essential OOOH works and the approximate percentage of each activity which will need to occur during the periods when the Airport is closed. These activities are cross-referenced to the line number in the *Improved Construction Programme* (abbreviated as ICP in Table 3.1) which is provided at Appendix 2.1. The estimated frequency of OOOH works is also illustrated within the improved OOOH Programme, Appendix 2.1.

Table 3.1: OOOH activities remaining in the proposed CADP works

ICP Line No.	Name	Estimated frequency of OOOH works	Reason for OOOH works
INTERIM WORKS			
Stands, Deck & Noise Barrier			
13	Deck - Section 2A - Piles Installed OOOH	>75%	Transitional Surface
16	Deck - Section 2A - Pile Heads & Beams OOOH	<25%	Transitional Surface
19	Deck - Section 2A - Topping	>75%	Access for concrete

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ICP Line No.	Name	Estimated frequency of OOOH works	Reason for OOOH works
	OOOH		through live airfield
21	Deck - Section 2B - Piles Installed OOOH	>75%	Transitional Surface
24	Deck - Section 2B - Pile Heads & Beams OOOH	<25%	Transitional Surface
27	Deck - Section 2B - Topping OOOH	>75%	Access for concrete through Live Airfield
28	Deck - Section 3A - Piles Installed OOOH	>75%	Transitional Surface
31	Deck - Section 3A - Pile Heads & Beams OOOH	<25%	Transitional Surface
34	Deck - Section 3A - Topping OOOH	>75%	Access for concrete through live airfield
35	Break Away Existing Dock Edge For New (Progressive)	weekend	Works in Runway Strip
Taxiway			
41	Stormwater Drainage & Culvert Stage 1	>75%	Works in Runway Strip
42	Services / Lighting / Markings, etc to New Taxiway	<25%	Works in Runway Strip
43	New Runway Link	>75%	Works in Runway Strip
Coaching Facility			
44	Foundations and Preparation	<50%	Works in Live Airfield
45	Building & Link Bridge Frame	<25%	Works in Live Airfield
46	Building Envelope	<25%	Works in Live Airfield
50	Demolition & Reinstatement	<25%	Works in Live Airfield
OBB Stage 1A			
51	Erect Protection Deck inside Existing OBB	>75%	Works in Live Facility
52	Edge Beams / Foundations for New OBB Structure	<50%	Works in Live Facility
53	Remove Existing OBB Tent	>75%	Works over Live Facility
54	Erect New OBB Tented Structure	<50%	Works over Live Facility
	Western Energy Centre		
COMPLETED WORKS Stands, Building Footprint & Noise Barrier Eastern Stands / Taxiway Extension			
84	Deck - Section 2C Deck Planks, Services & Topping	<25%	Access for concrete through Live Airfield
85	Deck - Section 3B Piles - Installed OOOH (2 Rigs)	>75%	Transitional Surface
87	Deck - Section 3B Pile Heads & Beams	<25%	Transitional Surface
88	Deck - Section 3B Deck Planks, Services & Topping	>75%	Access for concrete through Live Airfield
89	Break Away Existing Dock	Weekend	Works in Runway Strip

ICP Line No.	Name	Estimated frequency of OOOH works	Reason for OOOH works
	Edge For New (progressive)		
91	Services / Lighting / Markings / Equip for New Stands	<25%	Works in Runway Strip
93	Airside Drainage & Culvert Works Stage 2	>75%	Works in Runway Strip
	Eastern Terminal Extension - Main Building		
94	Preparation - Erect Protection Deck Inside OBB	>75%	Works in Live Facility
95	- Dismantle OBB Tent	>75%	Works in Live Facility
100	Frame Construction	<25%	Works over Live OBB Facility
101	Building Envelope	<25%	Works over Live OBB Facility
	Eastern Terminal Extension – Piers		
107	Frame Construction	<50%	Works in and against Live Airfield
108	Building Envelope	<50%	Works in and against Live Airfield
112	Dismantle Existing Eastern Pier & Make Good	Weekend	Works in Live Airfield

LBN Items 1 (i) to (iii)

3.23 The following text provides a summary of the assessment of the scenarios listed at 1 (i) to (iii) of LBN's Regulation 22 letter of 20th August 2014. The assessment has been completed on behalf of the Airport by York Aviation, with input from TPS (CADP Project Engineers). As requested by LBN, the assessment considers and sets out the commercial impacts (including viability of the business), impacts on flight scheduling, and any other operational constraints under the above scenarios.

3.24 In all cases, the implications have been considered alternatively for the complete duration of the proposed OOOH construction works as well as for the duration of night time piling works only. This approach was agreed with LBN Officers and their technical advisors at a meeting on 3rd September 2014.

3.25 The durations of closure/ alterations under each scenario have been derived using the *Improved Construction Programme* (Appendix 2.1) as the base case for the assessment and then estimating the resulting reduction in construction duration/OOOH works if the Airport was closed or operating hours restricted under the various scenarios. It should be noted that the *Improved Construction Programme* has achieved a significant reduction in the amount and duration of OOOH working and night time piling as summarised above and in Section 2 of the CESA. However, as noted above and set out in Table 3.1, some elements of the construction are still required to take place at night.

3.26 The full report on the various scenarios, titled 'Operational Impact of Construction Related Airport Closures or Restricted Opening Hours', is presented at Appendix 3.1 and the main impacts and conclusions are summarised below. A detailed technical note prepared by TPS which sets out the assumptions for any reductions in construction durations/OOOH works forms Appendix A to the report (within CESA Appendix 3.1).

3.27 The full report provides a detailed qualitative and quantitative assessment of both the commercial and wider implications under each scenario. The Summary conclusions of this assessment are extrapolated below for ease of reference and tabulated in Table 3.2 at the end of the section.

Summary of Impacts of Airport Closure Options

3.28 At the outset, it is important to note that the impact of any closure of London City Airport, however temporary, will have wider ramifications for airline scheduling and the effective use of airport capacity in the UK and Europe. If airlines are required to re-schedule, they will have to do so within the constraints of available capacity and it cannot be assumed that this will be possible. Hence, the implications for airlines and passengers may be substantial and these are over and above the directly measurable local implications.

3.29 Whilst the complete closure of the Airport for several months or weeks respectively, for either the extended duration of Out of Operational Hours (OOOH) construction or piling only, may deliver modest reductions in the total duration of night-time construction works, the socio-economic impacts would be extremely severe, placing all of the employment generated by the Airport, amounting to 1,900 direct FTE jobs and 570 indirect/induced FTE jobs in 2012, at risk. Alongside the loss of jobs, there would be a loss of the contribution which the Airport makes to the GVA of the local area, amounting to almost £110 million in 2012, as well as a broader loss to the UK economy of a further £640 million of wider impacts on passengers and business.

3.30 Millions of passenger journeys would also be lost or heavily disrupted as it is highly unlikely that the airlines could realistically relocate operations, in whole or in part, to other London airports. The impacts on the Airport and, more importantly, its users would be very significant such that the ongoing viability of airline operations at the Airport could be put at risk, with a high probability that some or all of the airlines would not recommence operations following the closure. This would place the viability of the Airport and associated employment in jeopardy.

3.31 Weekend closures would also have significant impacts on the airlines and passengers using the Airport, resulting in the loss of between 435,000 and 664,000 passengers, if weekend closures were imposed for the full duration of the planned OOOH construction works. Weekend closures would also result in substantially reduced employment of up to 260 annual FTE jobs during each of the construction phases and up to £27 million of lost GVA in the local area over the two construction phases. Furthermore, to the extent that airline operations were no longer economically viable, this could result in deeper and longer lasting reductions in employment. Even shorter duration weekend closures would give rise to a substantial risk that airlines could find that operations from the Airport were no longer economically viable if restrictions on the utilisation of aircraft resulted in unacceptable losses.

3.32 Significantly, notwithstanding any impact of weekend closures on the Airport, the reductions in OOOH construction duration would be modest at best (reducing OOOH working from 37 to 36 months overall or a reduction of 2 weeks OOOH piling in both phases) and the closures would further reduce the already restricted (6 day) utilisation which based airlines could make of their London City aircraft. Some further reductions to night time piling of between 4-6 weeks may be achievable in both phases if it was assumed that 24 hour continuous working window would be allowed throughout the whole weekend for the duration of piling. This would mean that the local community would not benefit from any noise respite period whatsoever during the week or over the weekend, from either aircraft or construction noise. Notwithstanding this, the socio-economic impacts, when coupled with the other potential impacts on both the Airport and airlines, would be significant in the case of weekend closures and would be disproportionate to the relatively modest reductions in the overall OOOH construction programme.

3.33 To the extent that the impacts might be mitigated by allowing a shorter period of operations on Saturdays and Sundays, there would be no material gain in construction production rates or a shortening of the OOOH works overall when limitations such as mobilisation, demobilisation, piling production rates and other construction related factors are considered.

3.34 Significantly, notwithstanding any impact of weekend closures on the Airport, the reductions in OOOH construction duration under such a scenario would be modest at best. In particular, the impacts of any scenario including restrictions on operating hours must also be considered in the context of the negligible reduction in the duration of OOOH works/piling and the significant impact of any curtailment of activity during these peak hours including the severe implications for the whole aircraft schedule, particularly for based carriers, that could also result in some non-based airlines dropping London City from their schedules altogether. The impacts arising from either weekend closures or restricted operating hours are considered completely disproportionate to any minimal reductions in OOOH programme.

3.35 In terms of adjustments to the Airportõs operational hours, only two of the scenarios (curtailing flights by an additional 5 hours to between 08.00hrs and 18.30hrs or by 7 hours between 10.00 and 17.00 or 09.30 and 16.30) would deliver any notable reduction in OOOH construction duration - 4 weeks and 3-4 weeks respectively in the duration of night time piling works in each construction phase, although the impact on the overall construction programme would be negligible.

3.36 Curtailing flights for lesser periods at the beginning/end of the day or during the early afternoon is unlikely to have any effect on reducing the duration of noisier construction activities, such as piling, as it would not provide sufficient time for a second pile to be completed within the night time window. This needs to be set against the significant impact which further curtailing flight times would have, particularly during the important peak hours each day, on the airlines and their ability to use their aircraft assets efficiently and productively and to maximise passenger throughput. Any curtailment of activity during these peak hours would have severe implications for the whole aircraft schedule, particularly for based carriers, but could also result in some non-based airlines dropping London City from their schedules altogether.

3.37 The peak period represents the optimum travel period for business passengers. Therefore, the implications of a further 5 hour curtailment of the operational day for the whole duration of OOOH construction works would be very severe, with a minimum loss of passengers carried through the Airport of 1.4 million during the Interim Works and 2.8 million during the Full Works. Associated, job losses would be 870 FTEs and 1,150 FTEs respectively, with a potential local GVA loss of over £100 million over the two construction phases. Even for the duration of the night-time piling works, the reduction of passengers at each phase from a 5 hour curtailment or 7 hour midday closure would exceed 300,000, with a loss of 220 to 350 FTE jobs in total, and £11 to £17 million in local GVA at each phase. The effect on the airlinesôutilisation of aircraft would be substantial and is likely to have long term implications on the viability of fleet replacement and expansion at

London City. The socio-economic impacts and impacts on both airlines and passengers would be significant and would be completely disproportionate to the relatively modest reductions in the overall OOOH construction programme.

3.38 LBN also requested consideration to be given to closure of the Airport for the duration of the night-time piling works during August and at Christmas. However, TPS consider this not to be practical in terms of the required sequencing of construction activities and the requirement to carry out these specific works at a fixed point on the construction programme. Furthermore, 24 hour piling work during the Christmas period would likely impact the local community during a holiday period.

3.39 The report at Appendix 3.1 nonetheless illustrates the implications of such a scenario (if it were feasible) and shows it to be similar to that for a full temporary closure for the duration of the night-time piling works, albeit there are fewer passengers using the Airport over the Christmas period and there are less business passengers in August. TPS has therefore considered whether there would be scope to extend the August closure to provide a viable construction window comprising the whole of August and additional weekend closures to complete piling works as a feasible alternative, with similar characteristics in terms of reducing the impact on business passengers. The implications of such a scenario are also illustrated. Again, the impacts are very similar to those assessed for a full temporary closure for the duration of the night-time piling works. The TPS technical note is presented at Appendix A to York Aviation's report (CESA Appendix 3.1)

3.40 In short, the impacts of any full closure or restricted operations scenarios in order to avoid or further reduce OOOH construction works would be severe. Table 3.2 sets out in more detail the potential impacts under each scenario.

Table 3.2- Summary of Impacts

	Effect on OOOH Construction Duration	Impacts
Scenarios 1 & 2. Temporary Airport Closure for in lieu of planned Duration of OOOH[2] Works – Day working or 24 hour working: *Closure of the Airport for between 10 and 12 months during the construction of Interim Works and between 13 and 16 months during the construction of Full Works dependent on whether 24 hour or day*	• Reduction in total OOOH construction programme by between 9 months (24%) with day working and 14 months (38%) with 24 hour working.	• A conservative estimate of the annualised reduction in the number of direct, indirect and induced full time equivalent (FTE) jobs sustained by the Airport of between 2,340 and 2,450 during the Interim Works construction period and 2,630 FTE jobs during the Full Works construction, with an associated loss of gross value added (GVA) in the local area of between £111 million and £117 million during the Interim Works and £136 million during the Full Works; • Loss of all of the Airport's business for the duration, amounting to 3.5 million to 4.2 million fewer

[2] Out of operational hours.

	Effect on OOOH Construction Duration	Impacts
time only working is assumed respectively.		passengers being able to use the Airport during Interim Works construction and 5.3 million to 6.5 million fewer during Full Works construction; • Journey time penalties to passengers of between £94 million and £113 million during Interim Works construction and between £142 million and £175 million during Full Works construction; • A direct loss to the overall Airport revenues of between £94 million and £113 million at Interim Works and between £142 and £175 million at Full Works construction; • Significant operational impacts on the airlines; • Significant long term risk of airlines relocating elsewhere and employment being lost permanently, including the risk that the loss of skilled staff would prevent the Airport from reopening.
Scenarios 1 & 2. Temporary Airport Closure for Duration of Night Time Piling Works – Day working or 24 hr working: *Closure of the Airport for between 8 and 16 weeks during the Interim Works construction and between 5 and 10 weeks during the Full Works construction, dependent on whether 24 hour or day time only working is assumed respectively.*	• Reduction total duration of piling by 6 weeks (19%) to 26 weeks with day working. • Duration of total night time piling works reduced by 19 weeks (60%) to 13 weeks overall if 24 hour working.	• A conservative estimate of the annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 420 and 750 during the Interim Work construction period and between 280 and 420 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £20 and £40 million during Interim Works construction and between £1 million and £29 million during the Full Works construction; • 647,000 to 1.3 million fewer passengers being able to use the Airport during the Interim Works construction and 470,000 to 940,000 fewer during Full Works construction; • Journey time penalties to passengers of between £21 million and £41 million during Interim Works construction and between

	Effect on OOOH Construction Duration	Impacts
		£15 million and £30 million during Full Works construction; • A direct loss to the overall Airport revenues of between £15 million and £31 million at Interim Works construction and between £11 and £22 million at the Full Works construction but taking into account the effect of the closures on the airlines and the high probability that some or all of them might not return to the Airport following the closure, the overall financial impacts could be significantly greater; • Substantial long term risk of airlines relocating elsewhere and employment being lost permanently.
Scenario 3. Weekend Closure for Duration of Works: *Weekend closures of the Airport for periods of 15 and 21 months during both the Interim and Full Works construction respectively in the event of closure for the full duration of the OOOH construction works, and 17 and 11 weeks respectively if closure was just for the period of the night time piling works.*	• Reduction in total OOOH construction programme by 1 month (3%) to 36 months. • Duration of total night piling works reduced by 4 weeks (12%) to 28 weeks.	• An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 60 and 260 during the Interim Works construction period and between 50 and 260 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £3 and £13 million during Interim Works construction and between £2 million and £14 million during the Full Works construction; • 83,000 to 435,000 fewer passengers being able to use the Airport during Interim Works construction and 66,000 to 664,000 fewer during Full Works construction; • Journey time penalties to passengers of between £3 million and £14 million during Interim Works construction and between £2 million and £21 million during Full Works construction; • A direct loss to the overall Airport revenues of between £2 million and £10 million during the Interim Works construction and between

	Effect on OOOH Construction Duration	Impacts
		£2 and £16 million during the Full Works construction; • Weekend closures would not achieve any material reduction in overall OOOH construction (3% reduction). • Substantial loss of utilisation for the airlines with operational/fleet scheduling difficulties for airlines and/or the cost of splitting operations; • Significant reduction in choice of flights for passengers, particularly at the beginning and end of the working week; • Substantial long term risk of airlines relocating.
Scenario 4. Restricted Opening Hours: *Restrictions on operating hours for a period of 15 months during the Interim Works construction and between 21 and 22 months during the Full Works construction if the restrictions are for the full duration of the OOOH construction works, and between 15 and 19 weeks during the Interim Works construction and 9 and 13 weeks during the Full Works construction if the restriction is for the duration of night time piling.*	• Improvements to overall duration of works and night-time piling only where the Airport closes in the early mornings and during evenings (5 hour daily restriction, before 0800 and after 1830) ï 1 month improvement to overall duration to 36 months (3%) and 7 weeks (22%) improvement to night time piling duration to 25 weeks, or where closure of the Airport for 7 hours in the middle of the day is contemplated.	• An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of up to 870 during the Interim Works construction period and up to 1,150 FTE jobs during the Full Works construction, with an associated loss of GVA in the local area of up to £41 million during the Interim Works construction and up to £60 million during the Full Works construction; • Up to 1.4 million fewer passengers being able to use the Airport during the Interim Works construction and up to 2.9 million during the Full Works construction; • Journey time penalties to passengers of up to £46 million during the Interim Works construction and up to £92 million during the Full Works construction; • A direct loss to the Airport revenues of between up to £34 million during the Interim Works construction and up to £69 million during the Full Works construction; • Fundamental operational/fleet scheduling difficulties for airlines and loss of aircraft utilisation; • Significant reduction in choice of

	Effect on OOOH Construction Duration	Impacts
		flights for passengers; • Early morning and evening closure would not achieve a material reduction in overall OOOH construction (3%). • Substantial risk of the airlines relocating and not returning to the Airport.
Scenario 5. Closure in August and at Christmas: • *Closure for a 4 week period in August and a 2 week period at Christmas, during periods of lower business passenger demand, to allow 24 hour night-time piling works if it was feasible to manage the works within these time frames and at these times of year. In the alternative closure for the whole of August at each phase followed by closure for 5 weekends to complete the piling work at*	• It is not considered feasible or practical to contain OOOH construction or night-time piling works to these specific periods. Assuming 24 hour piling works, periods of 8 and 5 weeks closure respectively would be required to complete the OOOH piling (as assessed in scenario 2)	• An estimate of the annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 240 and 270 during the Interim Work construction period and between 250 and 320 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £11 and £13 million during Interim Works construction and between £13 and £17 million during the Full Works construction; • 368,000 to 422,000 fewer passengers being able to use the Airport during the Interim Works construction and 416,000 to 533,000 fewer during Full Works construction; • Journey time penalties to passengers of between £7 and £8 million during Interim Works construction and between £8 and £11 million during Full Works construction; • A direct loss to the overall Airport revenues of between £9 and £10 million at Interim Works construction and between £10 and £13 million at the Full Works construction but taking into account the effect of the closures on the airlines and the probability that some or all of them might not return to the Airport following the closure, the overall financial impacts could be significantly greater; • Substantial long term risk of airlines relocating elsewhere and

	Effect on OOOH Construction Duration	Impacts
Phase 1 and 1 weekend at Phase 2, with 24 hour working in each case.		employment being lost permanently.

3.41 The implications of periods of closure during the OOOH works have the potential to seriously undermine the Airport's business model, which in a competitive market may not fully recover. There is a high risk of this occurring with any extended period of closure or restriction but the risks remain with even shorter periods of closure or restricted operations. The extent to which benefits would be gained from relatively short reductions in construction periods have to be weighed against the potential risks to the Airport's business model overall.

3.42 Overall, it is considered that any closure or restriction of operations for the full duration of the OOOH works is likely to have long term implications for London City Airport in terms of it achieving its growth potential as outlined for CADP. This would have substantial implications for the employment and economic activity supported by the Airport in the local area and in the contribution which the Airport makes to the wider economy of London. All of the employment at the Airport could be put at risk with a period of full closure, whilst shorter duration closures will have longer lasting impacts on the economic activity which the Airport supports.

3.43 As detailed in the TPS note presented at Appendix A to York Aviation's report (CESA Appendix 3.1) and summarised in Table 3.2 above, the extended closure scenarios could, at face value, achieve a notable reduction in OOOH works - either to the total *OOOH construction programme*, or, piling works alone. However, this needs to be balanced against the severe (Substantial Adverse) socio-economic impacts of closing the Airport summarised above. The assessment demonstrates that the impacts on the Airport and, more importantly, its users would be very significant such that the ongoing viability of airline operations at the Airport could be put at risk, with a high probability that some or all of the airlines may not recommence operations following the closure, so placing the future viability of the Airport and associated employment in jeopardy.

3.44 Airlines are likely to substantially and permanently downscale their operations and may relocate to serve other markets completely. It is unlikely that operations at London City would recover immediately and there will be long term implications for the business and its ability to deliver economic growth for East London. There will be wider implications for passengers and the business community in the City of London and Canary Wharf. The implications will be substantially greater than the direct and quantifiable implications of the closure itself which are set out above. This applies whether a full closure is contemplated or simply a restriction of weekend or weekday operating hours, although clearly the magnitude of the impacts is significantly greater with a full closure than with smaller scale restrictions to operations. That said, the impacts of smaller scale operational restrictions remain significant.

3.45 The impact of a shorter length of full closure, for the duration of the night time piling works, would be less but would still generate a notable risk of long term damage to the Airport's business.

There remains a high risk that some or all of the airline operations would not return to the Airport following a period of closure.

3.46 Even shorter length restrictions to the operating hours or on weekends could have an impact on airline finances as their already curtailed aircraft utilisation would be further impacted. This could damage their willingness or ability to grow at London City and could result in deferral of plans to introduce new quieter aircraft.

3.47 In conclusion, any shortening of the operational hours of the Airport would have a serious adverse effect on the airlinesôutilisation of aircraft and this is likely to have long term implications on the viability of fleet replacement and expansion at London City. The socio-economic impacts and impacts on both airlines and passengers would be significant and would be completely disproportionate to the relatively modest reductions in OOOH programme.

3.48 As also summarised in Table 3.2, both weekend closures and/or temporary alterations to operating hours would not necessarily result in a material reduction in construction programme when limitations such as mobilisation, demobilisation, piling production rates and other construction related factors are considered.

3.49 A key consideration in determining the impacts of restricted operating hours on OOOH construction works is the effective piling production rate, which is considered likely to be one pile per night, as was achieved during the previous construction project at the Airport (Operational Improvements Project (OIP) in 2007). This includes for the mobilisation, casing installation, boring and concreting of the supporting piles for the proposed deck. Therefore, for each week night, the duration of the OOOH window remains constant in order to undertake this sequence of activities required for installing one pile and then removing the piling rig and other plant before the Airport re-opens. A relatively small increase in construction hours (achieved by a reduction in Airport flying times) will not give sufficient time to perform the works to a whole second pile. It is not practical to construct part of a pile within a nightshift and complete on the following shift, as a bored pile is likely to collapse if it is not concreted on the same working shift. This was a material consideration in assessing the reduction that could be achieved to the construction programme with different periods of operating restrictions.

3.50 Notwithstanding any impact of weekend closures on the Airport, the reductions in OOOH construction duration under such a scenario would be modest at best. In particular, the impacts of any scenario including restrictions on operating hours must also be considered in the context of the negligible reduction in the duration of OOOH works/piling and the significant impact of any curtailment of activity during these peak hours including the severe implications for the whole aircraft schedule, particularly for based carriers, that could also result in some non-based airlines dropping London City from their schedules altogether. The impacts arising from either weekend closures or restricted operating hours are considered to be completely disproportionate to any minimal reductions in the OOOH programme.

3.51 Overall, the impacts of any full closure or restricted operations scenarios in order to avoid or further reduce OOOH construction works would be severe and would be deemed as constituting a **Substantial Adverse effect**, as defined in the CADP ES Chapter 3: EIA Methodology (paragraphs 3.56 ï 3.64) (as amended by the CES, November 2014) .

LBN Items 1 (iv) - Any other scenarios

Consideration of Radical Alternatives to the CADP Construction Method

3.52 Prior to the development and finalisation of the *Improved Construction Programme* (Appendix 2.1) an analysis of other, more fundamental changes to the construction approach were evaluated in by the project engineers (TPS) and other members of the CADP project team. This considered the environmental, operational, programme and financial impacts of such alternative construction options. Consideration was given to the following construction scenarios in the context of reducing the duration of night time works and other potential benefits and disbenefits:

1. Damming and draining KGV Dock entirely;
2. Partially draining the KGV, Victoria and Royal Albert Docks (to different levels of up to -5m depth).
3. Placing Caissons (watertight retaining structures) in the Dock to create a base for the new Apron deck; and
4. Filling the Dock entirely with earth/ aggregate instead of piling.

3.53 None of these radical alternatives are considered to be acceptable or practical for the reasons given below.

Damming and draining KGV Dock entirely

3.54 This would have the advantage of providing an unimpeded, õland basedô working compound offering space for various construction activities to progress in tandem. Piling works could occur in a bottom-up manner using a conventional range of non-marine construction plant. The void created by draining the Dock may also enable other construction activities (e.g. concrete placement and component assembly) to take place in a contained space below the Airportõs Transitional Surface and, initially at least, out of sight of residents and the public, with limited noise break-out and other potential impacts. This option may therefore accommodate some periods of 24 hour working in order to speed up the construction. However, the final capping of the piles/columns and laying of the deck structure at surface level would be constrained in a similar way as for the existing proposed construction methodology.

3.55 As KGV Dock is hydraulically connected to the Royal Albert and Royal Victoria Docks, via its open link to the east of the airfield, it would be necessary to create a coffer dam at the eastern extent of the working area to separate it from the rest of KGV Dock. This structure would typically be an earth filled double walled & cellular coffer dam using sheet piles which would need to be driven into the Dock bed and sealed before the water is drained. The sheet piles and earth fill would then need to be removed at the completion of the works to allow the water to flow back. Both of these activities would require some construction when the Airport is closed (i.e. in OOOH periods) because the associated installation plant would breach the Transitional Surface to an unacceptable level, especially in the area to the north of the Dock and closest to the airfield.

3.56 Once the void is established, all plant and materials would need to be lowered into it from the Dock edge, as the depth of void (approximately 11m), would most likely prohibit temporary access ramps to be constructed. Furthermore, as the piling and deck works progressed there would be an increasingly limited working space available meaning that the final sections of the apron stands would need to be constructed from barges and jack-up rigs.

3.57 This alternative has many technical and environmental disadvantages which make it an unviable proposition. First, the soft upper sediments of the Dock bed would need to be dredged and/or stabilised with concrete ballast in order provide a suitable working base on which piling rigs and other plant could be sited. These enabling works and the draining of the Dock itself would take many months and add to the overall programme complexity. There would also be various environmental and safety risks associated with this process. For instance, the dock sediments are thought to be contaminated (due to the long industrial history of the Docks) and such material would need to be removed or remediated to avoid hazardous exposure to the workforce and wider environment. If left in-situ, there is also a risk that the exposed sediments could give off odours and hazardous gases as they dry out.

3.58 The installation and subsequent removal of the sheet piles forming the coffer dam structure risks the potential for undesirable noise and vibration impacts in at least two (albeit relatively short) phases of the CADP works, particularly if this piling needed to take place during OOOH periods/ at night when residents are most susceptible to such disturbance. It is expected that the sheet piles would be driven with a vibro hammer unless a reaction based system (such as Giken ï see below) were found to be appropriate.

3.59 Therefore, the construction and later deconstruction of the temporary coffer dam would be a costly, resource and energy intensive process which derives waste, noise and other environmental impacts. These additional impacts are avoided by the preferred construction methodology which requires no such temporary works.

3.60 With regard to engineering and safety risks, the draining of the Dock might create stability issues for the exposed Dock walls as these structures are currently hydraulically supported by the weight of the water column. The Dock walls could be propped up by temporary supports, or the entire perimeter of the void enclosed by a cofferdam, but again this would add to the overall programme, costs and engineering uncertainty of the works.

3.61 Working in a confined below-ground space has inherent risks to the safety of construction personnel, particularly as there may be no immediate means of escape in the event of an accident. The removal of the water also creates significant safety risks as the deck structure would be constructed at height over the Dock bed. Moreover, there would be increased risks for the operational airfield with the significant drop in height that would be created.

3.62 With regard to ecology, an extensive area of dock wall habit, comprising an algal tuft supporting a rich diversity of invertebrates (as described in CES Chapter 13: Ecology & Biodiversity) would be permanently damaged if the Dock were to be drained. This would also temporarily remove an important resource for fish feeding, breeding and sheltering in the Dock. However, impacts on fish and mobile species would not necessarily be permanent as these could be netted and re-located to other parts of the Royal Docks whilst the works take place.

3.63 In terms of overall programme, it is estimated that a period of 3 to 6 months would be required at the start and end of the project to accommodate this radical alternative. This period would significantly increase if work was required to the Dock wall to improve its stability.

3.64 In conclusion, the potential advantages of fully draining the Dock (e.g. shielding of noise in the initial stages of work) are far outweighed by the technical, environmental, safety and programme risks associated with this option.

Partially draining the Dock

3.65 The option of partially draining the KGV Dock to create additional ‘headroom’ for the piling below the Airport’s Transitional Surface has been considered. This has the potential to reduce the amount of OOOH works which are needed; although only marginally less than for the *Improved Construction Programme* (as described in Section 2) now that a ‘safety case’ for the temporary relaxation of the Transitional Surfaces has been established by the Airport.

3.66 Under this option the Dock water level would be lowered by between 0.9m and 5.0m, with correspondingly greater opportunities of including cranes and other taller plant below the Transitional Surface. This may also enable piles to be partially constructed (i.e. above the lowered water line) during the day and/or throughout a 24 hour period. In theory, the enclosure of these works below the Dock walls could provide effective attenuation of noise and therefore residents to the south would be shielded from any significant impacts during the initial piling works. However, the completion of the pile columns and caps and the laying of the deck structure above would occur under similar constraints as for all options.

3.67 Unlike the full draining option described above, there would be no impoundment of the working area with a coffer dam (or similar) because this would prevent access by the barges and jack-up rigs required for the construction. As such, the whole of KGV and RAD Docks would have to be drained to the same water level.

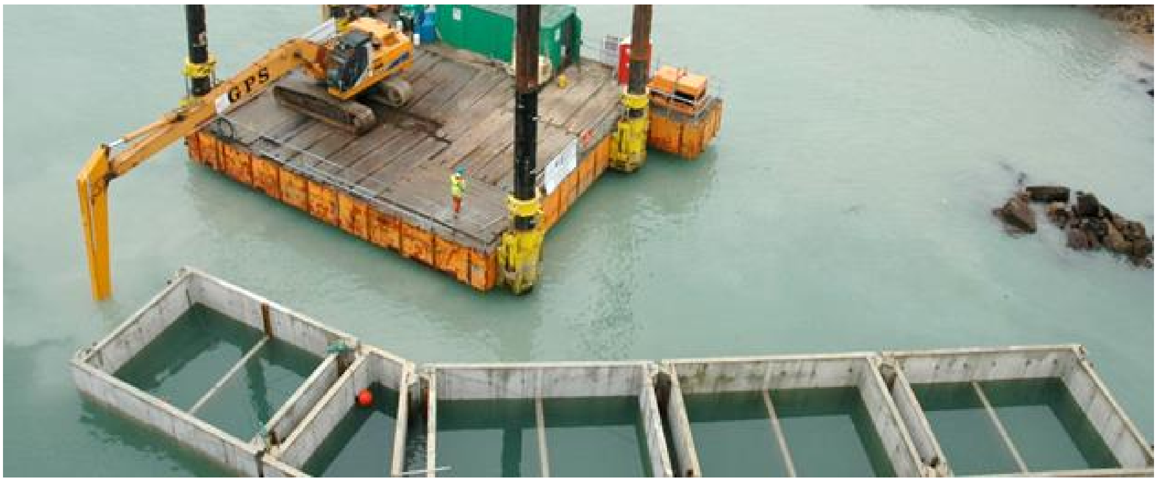
3.68 As reported in CES Chapter 12: Water Resources & Flood Risk (paragraph 12.36), the water level of the Docks ranges from a maximum of 4.24 m ODN (7.59 CD) to a minimum of 3.44 m ODN (6.79 CD). Therefore, there is controlled variation in depth of 0.8 m and water levels are maintained within this range by pumping from the River Thames. This is the responsibility of RoDMA who have a statutory role for maintaining the navigation, recreation, water quality and other functions and characteristics of the Docks. As such, any proposal to drain the Docks below the regular minimum water level would need to be agreed with RoDMA. It can be expected that they would be unlikely to consider this acceptable (even on a temporary basis) as this would conflict with the above objectives. In particular, significantly lowering the water by 5.0m could have an adverse impact on the Regatta (watersports) Centre at the western end of RAD and may prohibit access to the Docks by large vessels for the duration of the works.

3.69 Lowering of the water level by more than 1.0m could also impact upon the submerged Dock wall habitat (as described above) and this impact would be even more pronounced as it would affect the whole of the KGV and RAD Docks, where similar habitat exists. Draining of the Docks by much more than this amount could also lead to changes to the stability of the highly stratified water column which exists in the Docks (as described in CES Chapter 12 and Chapter 13). In particular, removing a significant volume of water from the Docks (say 4 or 5m) may cause a mixing of the colder, saline and deoxygenated water which occurs at depth with the warmer fresh water nearer the surface, particularly during warm summer months. Potential consequences of this mixing are the mobilisation of nutrients and contaminants from the Dock bed leading to pollution incidents, algal blooms and incidents of dead fish.

3.70 In conclusion, the potential advantages of partially draining the Dock are again far outweighed by the technical, environmental and other risks associated with of this option.

Placing Caissons in the Dock

3.71 One alternative to piling is to use caissons - watertight retaining structures used, for example, to establish the foundations of a bridge pier and for the construction of a concrete dam (see image below). These are constructed such that the water can be pumped out, keeping the working environment dry. Once floated into position, a caisson is sunk by self-weight, concrete or water ballast placed on top, or by hydraulic jacks. The leading edge (or steel cutting shoe) of the caisson is sloped out at a sharp angle to aid sinking in a vertical manner. Alternatively, the dock bed is prepared to receive a casing with a flat base.



3.72 To install a caisson in place, it is brought down through the surface sediments until a suitable foundation base is encountered. Once in place, the caisson must be ballasted or anchored to prevent it moving until it can be filled with concrete or other suitable material to provide the permanent structure. In the case of the CADP, it would be necessary to dredge out the soft Dock bed sediments in order to obtain a suitable foundation base for these caissons to be installed. This dredging process would be both technically difficult and could lead to the mobilisation of contaminants in the water column with associated risks of pollution incidents and ecological impacts, as described for the Dock draining options (above).

3.73 Whilst potentially quieter, the process of installing caissons (in lieu of piles) would be a logistically complex process which would significantly extend the construction programme overall. Furthermore, a substantial volume of concrete (or other suitable material) would be required to construct and fill the caisson - this structure being required to fill around 50% of the dock void. This estimate is based upon avoiding the flotation of a caisson and would result in the need for materials at a volume of around 380,000 m3 (half of 75, 628 m2 plan area x 10m dock depth). As such, this is an inherently less sustainable option and could lead to greater construction traffic impacts, cost and time.

3.74 In conclusion, the potential advantages of using caissons (i.e. reduced noise) are far outweighed by the negative sustainability and cost implications, the effect on programme, and significant environmental risks associated with this alternative.

Infilling the Dock with earth/ aggregate.

3.75 The last alternative construction method would be to infill the Dock. This would first require the installation of a permanent coffer dam/ sheet piles to enclose the working area for the construction of the CADP apron and parallel taxilane, after which the void would be drained and infilled with compacted earth, rock of other materials to establish the base of the new concrete deck over. An alternative to this would be to consider marine placement of the fill, although the impact would be similar.

3.76 This total infilling of the Dock would have many of the same impacts and technical problems as presented for the other alternatives examined above. Moreover, it would require the import of very substantial volumes on fill material (with traffic, dust, noise, sustainability and other associated effects) and would render this part of the Dock permanently óreclaimedô, contrary to policies in the London Plan.

3.77 There are very few tangible advantages presented by this option, except perhaps the opportunity for reduced night-time working and slightly lower noise over the equivalent period of piling. However, the extended programme and other environmental impacts of these works are likely to nullify such potential benefits. For these reasons, this final óradicalô alternative has been dismissed.

3.78 Having assessed and concluded the above main alternatives, the assessment now focuses on the alternative piling techniques and plant which could be employed in the construction of the new apron stands and parallel taxiway.

Assessment of Piling Options

3.79 An appraisal of the suitability of the proposed piling technique for the CADP (i.e. Vibro-piling) has been undertaken by comparing the advantages and disadvantages of other piling types and alternative construction plant. This exercise has been undertaken to further consider ñany other scenariosò to the proposed construction method in accordance with LBNÓs request 1(v). Accordingly, it considers a wide range of alternative techniques to identify and evaluate those which could be practicable and, ultimately, lead to an improvement in terms of the night time programme and noisy works. To inform this study, extensive discussions (and initial technical assessments) have taken place with consultants, contractors and suppliers who work in the relevant industry. This process has included input from the following companies:

- Carillion
- Bachy Soletanche
- Bauer Technologies
- Bauer Equipment
- Giken
- Dawson Construction Equipment and Dawson Contract Piling
- Balfour Beatty Ground Engineering

- Martello Piling
- MENK
- Atkins
- Royal Haskoning

3.80 These discussions have identified various construction techniques which would evidently be far less practicable from a construction perspective. However, for completeness, all the methods are described below and ranked by TPS in terms of Practicality and, where applicable for Programme, Financial and Safety considerations. On this basis, three options were shortlisted and these options were then subject to a detailed analysis of their noise characteristics by the Airportõs noise consultants (Bickerdike Allen Partners (BAP)) taking into consideration the duration of the works with a 15 dB weighting for night-time work to enable comparison of options, as requested in Item 3 of LBNõs letter. For the sake of brevity, this further noise analysis is summarised at the end of this section and presented in full in Appendix 3.2: Best Practical Means Noise Assessment. Further noise mitigation options associated with the piling and related plant are described in Section 4 of the CESA.

3.81 In terms of Practicably, the ranking of 1 to 5 is based on the following descriptions:

1. Proven to be practicable
2. Thought to be practicable with evidence of construction in a similar environment - There may be issues to overcome to enable construction.
3. Thought to be practicable without evidence of construction in a similar environment - There may be issues to overcome to enable construction.
4. Unlikely to be practicable ï There are significant issues to overcome to enable construction.
5. Not practicable ï There are major issues to overcome to enable construction.

3.82 Any item receiving a Practicality rating of 4 or 5 was discontinued from any further ranking.

3.83 A description of each option is presented below and the rankings under the above headings is summarised in Table 3.3.

Vibrodriver Casing & Rotary Bore

3.84 This is the preferred methodology for the CADP which is described within Chapter 6 of the Environmental Statement (represented in the CES). It is also the methodology used by Carillion to construct the stands 21 to 24 (the Eastern Apron Extension) and for the Runway Hold over KGV Dock, together constituting the Operational Improvements Programme (OIP) which was completed in 2007. As such, this is a proven and safe technique that is deliverable within the unique characteristics at the Airport.

3.85 This method therefore constitutes the benchmark (or ôbase caseö) against which the other alternative methods have been assessed.

3.86 As described in CES Chapter 6, the Rotary Bore for the pile is required to create a structural concrete column to support the deck within the ground beneath the Dock. The casing is required as formwork for the column; to reduce the risk of contamination from the Dock entering the groundwater; and, to provide containment to enable the boring operation.

3.87 This method can be installed from a ‘spud leg’ barge. A spud leg barge has legs that drop into the dock bed to reduce movement of the barge during construction, although the full weight of the barge is still supported by flotation. It can also be constructed from a ‘jack-up’ barge. A jack-up barge also has legs like the spud leg barge but the legs are used to take the weight of the barge to reduce the reliance on flotation. These barges tend to be more stable as they do not rely on flotation, although they can take a significant amount of time to reposition and are considerably more expensive. These are the primary reasons why this type of barge was not used on the previous OIP project at the Airport.

3.88 In summary, the Vibrodriver Casing & Rotary Bore methodology is proven to be practicable and deliverable. It was therefore initially selected for the CADP due to its low impact (to Programme, Financial and Safety considerations), as set out in Table 3.3 at the end of this Section.

Rotary Casing & Rotary Bore

3.89 This technique uses a similar approach to the Vibrodriver Casing & Rotary Bore, although it employs an alternative method to install the casings. Whilst this would be a minor change to the piling methodology, it does have some significant implications on the plant that would otherwise be used in the base case. In this method, the casing would be installed by the pile rig instead of a separate vibrodriver. To achieve this, the casing is placed into the Dock and the pile rig needs to reach over the top of the casing to engage it. The operation to reach over the casing before it is fully driven requires a taller piling rig. Once engaged, the rig uses a rotating motion and downward pressure to drive the casing, which is potentially quieter than vibro-piling the casings. This rotating motion is likely to require a jack-up barge to provide increased stability, as the twisting motion needs to be resisted by the barge.

3.90 These changes to equipment would have an impact on the proposed works, as follows:

- The increased height of the piling rig (estimated at 26 metres above Dock water level) poses a risk that more of the piling works would need to be performed at night, as it is likely to infringe the Airport’s Transitional Surfaces to unacceptable greater degree. Consequently, this would increase the frequency of OOOH working.
- A jack-up barge would be likely to be necessary to provide increased stability due to the additional loads transferred onto the barge. This would have a significant impact on the programme as the jack-up barge would take 1.5 hours longer to reposition for each subsequent pile. If a larger floating barge were to be used to try to overcome this problem, a similar programme risk would be experienced because the methodology is less proven and there is chance that the required tolerances could not be achieved, with an associated impact on the extent of corrective works required.
- The same piece of equipment is required for both the casing installation and the pile auger. This means that the two operations cannot be performed simultaneously on two pile locations and, as such, there could be a further impact/ delay to the construction programme.

3.91 With regard to programme implications, there would be some significant challenges to overcome including the following considerations:

- This approach requires a jack-up barge which takes 2-3 hours to mobilise. The spud-leg barge would take approx 1 hour to mobilise (based on advice from Bauer). Therefore, there would be approximately a 1.5 hour increase in the piling activity per day.
- Piling is currently programmed to occur within a 5.5 hour window, which would increase to around 7 hours with this method.
- Based solely on the extension of time, the increase in programme would be approximately 27% when compared to the vibrodriver. However, this does not account for the risk that the viability of the weeknight working window could be compromised for a period by this extended duration. Therefore, the programme extension could be significantly greater.

3.92 In summary, this methodology was concluded to be broadly ópracticableô although there are significant programme issues. It was therefore considered further as part of the óBest Practicable Means Noise Assessmentô presented at Appendix 3.2.

Giken piling

3.93 Giken piling is reaction piling based system which means that these piles are installed through pushing forces. These pushing forces need to be counteracted on the system, which is typically achieved through attachment to adjacent piles or other significant structures. This method has been successfully applied by Giken in the practice of sheet piling, whereby the piling progresses in a linear fashion and there are previously installed piles on which to attach the plant to enable the pushing loads to be counteracted. Giken Piling (with a tubular piler) was used by Crossrail at Canary Wharf (at the North Dock of West India Quay), in order to construct the station box. The linear nature of the piling enables the adjacent piles to be used as the pushing force. However, the required piling at London City Airport is very different to this method as the piles are spaced at 10m centres.

3.94 An alternative to the 10m pile spacing has been considered but the spacing needs to be maximised to reduce the number of piles that need to be installed. A smaller pile grid would require a significantly larger number of piles with an associated increase in OOOH working. The 10m spacing proposed is also the practical limit of the precast beams and planks. A larger span would result in significant increases in precast weights which would be difficult to place.

3.95 Giken were contacted to see if their technology could be adapted to the specific situation at the Airport. They suggested that a system called the ñGyropress Methodò may be a practical option. This method does not solely rely on pressure to install the casing; it also uses a twisting motion. In principle, the forces for the installation are likely to be similar to the Rotary Casing installation, although this system may be able to provide a greater pushing force. According to Giken, this would need a jack-up barge to provide the counteracting loads. Also, the Gyropress module typically sits on adjacent piles and therefore a bespoke attachment would need to be provided to connect the Gyropress module to the barge.

3.96 While the Giken system is branded as ñEnvironmentally Silent Piling Technologiesò it still requires a piling module, power pack, and cranage. This is similar equipment to other piling techniques and will produce some noise during operation. The noise data provided by Giken (contained at

Appendix 3.2) is limited and relates to a smaller pile diameter than proposed for the CADP. This noise data may therefore underestimate what might be expected on the CADP project.

3.97 Furthermore, this system only addresses the requirement for the casing installation, which constitutes a relatively short duration activity for some of the other proposed methods described herein. The casing would still need to be bored to provide the structural concrete column inside the casing and, as such, this would be a similar method to the ‘Rotary Casing & Rotary Bore’ option described above.

3.98 Whilst Giken considers that a solution could be achieved in terms of applying this piling method to the CADP, there remain various overriding programme and installation constraints that indicate that this is unlikely. In addition, there is currently there is no evidence of a similar installation and there would be several technical issues to overcome to enable this. Moreover, the programme impact is expected to be high due to the combination of the following:

- The installation requires a jack-up barge which will take longer to mobilise;
- The equipment is different to that typically used for sheet piling and Giken have stated that the specific “Gyropress” module required is not currently available in the UK, therefore this is an uncertainty;
- The equipment is only available from a single supplier and the method relies on a specific model which may be committed to other projects at the time of construction.

3.99 The overall programme implications are likely to be similar to the Rotary Casing & Rotary Bore option above, with a minimum increase of approximately 27% installation time due to increased periods of mobilisation and repositioning. However, this could be much more as there may be a significant impact on the works that can be scheduled in the night time window.

3.100 The financial impact would also be high as the construction relies on a single piece of equipment and requires a jack-up barge. There are significant engineering and deliverability issues to overcome and the solution only addresses the casing installation which is a shorter element of the work when using other construction techniques.

3.101 However, as this methodology is theoretically ‘practicable’, it has also been considered as part of the Best Practicable Means Noise Assessment presented at Appendix 3.2.

Dawson Push - Pull Sheet Box

3.102 Dawson construction plant has developed a system for reaction piling which uses a different approach to Giken, but may have similarly quieter properties. The Dawson approach is to form a box of traditional sheet piles and then to use a hydraulic ram attached to each individual sheet. The rams can then push one sheet down while using the others as the reaction force.

3.103 The individual sheets need to be able to move relative to each other to achieve the construction and the system uses sheet pile sections to create the box. Unlike other casing methods, this box is not circular and so is likely to cause issues when boring within it, as it will not be a close fit to the pile bore.

3.104 There are also concerns with water ingress between the joints in the sheet piles which will pose an environmental risk of contamination entering the groundwater.

3.105 For these reasons, it is highly unlikely that this method would be either environmentally or technically acceptable for use in the CADP construction. The assessment of this option was therefore discontinued on the basis of having limited practicability, scoring 4 on the scale of practicality.

Driven Piling

3.106 Driven piling uses a heavy falling weight to drive piles into the ground. This method creates a large amount of noise due to the impact of the falling weight impacting with the pile.

3.107 Due to the excessive noise generated by this piling method, it is not well suited to construction in a built up area, particularly at night. Further consideration of this option was therefore discounted, as it scored 5 ('Not Practical') on the scale of Practicality.

Soil Displacement Screw Pile

3.108 Soil displacement screw piles use a technique where the ground is displaced to the side of the pile as the screw is driven into the ground. This requires the ground around the pile to be compacted to create the void for the pile concrete. This method has the benefit that the soil is not excavated to ground level. However, as the ground has to accommodate the displacement to create the void, it is not suited to dense materials like the Thanet Sands that exist under KGV Dock. It is also much better suited to smaller diameter piles where the required displacement is lower. Finally, this method would also require a casing to be installed by another method.

3.109 For these reasons, the method is not suited to the CADP construction and it was allocated a score of 5 of the Practicality scale. Further consideration of this option has therefore not been given, including any implications on the programme.

Continuous Flight Auger (CFA)

3.110 CFA piles are formed by drilling to the required depth using a hollow stem continuous flight auger. After reaching the designed depth, a high slump concrete is then pumped through the hollow stem. While the concrete is being pumped, the auger is withdrawn at a controlled rate, removing the soil and forming a shaft of fluid concrete extending to ground level.

3.111 The CFA process is not thought to be at all practicable for the CADP for the following reasons:

- The spoil handling in a marine environment is difficult, as the spoil tends to mound around the pile as the auger is withdrawn. The spoil is also likely to fall into the dock water which poses a risk to the aquatic ecology of the Dock;
- The method only withdraws the auger when the pile operation is complete and there is no method to quickly drop the mast. This is a significant consideration in the temporary relaxations of the Transitional Surfaces and poses unacceptable safety risks. As such, such piling would increase the amount of OOOH/ night time working;
- The rigs typically have concrete delivery pipes protruding above the normal height of the rig to achieve the concrete delivery down the hollow stem. This increases the height of the rig and the associated impact on the extent of night time working; and,
- A casing would still need to be installed.

3.112 For the above reasons, the method is not suited to the CADP construction and it was allocated a score of 4 of the Practicality scale. Further consideration of this option has therefore not been given, including any implications on the programme.

Summary

3.113 The following table summarises the piling options that have been assessed; considering their practicality and cost and whether each could offer potential improvements to the construction programme, including reducing the duration of OOOH works. Safety considerations were also looked at but did not provide a clear differentiation between the options.

3.114 Based on this ranking, the use of Vibrodriver Casing & Rotary Bore piling, representing the preferred methodology for the CADP (i.e. the base case), clearly performs better than all other options considered.

Table 3.3 - Summary of Methodology and Ranking

Methodology	Practicality Ranking	Programme Ranking	Financial Ranking	Safety Ranking	Noise Ranking	Overall Ranking
Vibrodriver Casing & Rotary Bore	1.	1.	1.	1.	2	1
Rotary Casing & Rotary Bore	2.	2.	2.	1.	3	2
Giken piling	3.	3.	3.	1.	1	3
Dawson Push-Pull sheet box	4.	N/A	N/A	N/A	N/A	N/A
Driven Piling	5.	N/A	N/A	N/A	N/A	N/A
Soil Displacement screw pile	5.	N/A	N/A	N/A	N/A	N/A
Continuous Flight Auger (CFA)	4.	N/A	N/A	N/A	N/A	N/A

3.115 As mentioned above, a detailed assessment of the noise characteristics of the 3 ópracticableô piling options (Vibrodriver Casing & Rotary Bore; Rotary Casing & Rotary Bore; and Giken piling) has also been completed by BAP and is contained in Appendix 3.2. A summary of the outcome of this assessment is provided below, which also addresses Item 3 of LBNós letter:

> *3. Additional assessment of noise levels taking into consideration the duration of the works with a 15 dB weighting for night-time work may also be provided to enable comparison of options (such as shorter duration noisier works compared with quieter works for a longer duration).*

Response:

3.116 As described in Paragraph 1.32 (Section 1 of the CESA), it was confirmed with LBN at a meeting on 23rd July 2014 that the above requirement relates to the assessment of viable piling options. A summary of this assessment is included below.

Summary of Noise Assessment for the 3 'short-listed' Piling Types

3.117 The three piling options short-listed following the technical feasibility assessment described above, were: Vibrodriver Casing & Rotary Bore; Rotary Casing & Rotary Bore; and Giken piling.

3.118 Consideration has been given to these three piling methods and the noise exposure likely to result from each has been assessed for a reference point located at a distance of 10 metres from the specified piling operation. The full assessment within Appendix 3.2 is based on the principle of Best Practical Means (BPM). This allows a comparison to be made between different piling operations based on their likely durations over the programme period, taking into account the daytime, evening and night-time periods over which they are expected to operate. A noise weighting has been included in the calculation to account for the greater disturbance that arises when works are undertaken during the weekend, evenings (5dB) or night-time (15 dB), as requested in Item 3 of LBNõs letter).

3.119 The results of this assessment show little difference between two of the piling methods ï ôVibrodriver Casing & Rotary Boreö and ôRotary Casing & Rotary Boreö, with the options being ranked 2nd and 3rd in noise terms.

3.120 For the third piling method, Giken tubular piling, a significantly lower noise dose has been identified, although the quality of noise data available is limited and this finding relates to a smaller pile diameter than proposed for the CADP. This noise data may therefore underestimate what might be expected on the CADP project. Any potential noise benefit is considered to be significantly outweighed by the programme risks and other engineering and deliverability disadvantages of this novel method, as described above and ranked within Table 3.3.

4 CONSTRUCTION NOISE AND MITIGATION (LBN ITEMS 2, 4, 5 & 6)

a) <u>Introduction</u>

4.1 The following section responds directly to LBN¢s Regulation 22 request for further information under Items 2, 4, 5 and 6 of the letter. The responses have been prepared by the Airport¢s Noise Consultants - Bickerdike Allen Partners (BAP).

b) <u>Regulation 22-'further information'</u>

LBN Reg 22 Request: *2) Confirm the works to be carried out during each phase of the shorter duration of night time operations, and demonstrate the resultant day and night time construction noise levels as absolute levels in accordance with BS5228 methodology. The reference period for night time should be 15 minutes to retain consistency with the original ES.*
4) Demonstrate the effectiveness of the barrier with respect to the revised proposed methods.

Response:

4.2 This section draws together and expands upon the essential elements of the construction noise assessment undertaken since the July 2013 ES. The assessment takes account of the various improvements to the construction programme and planned Out of Operational Hours (OOOH) works, as set out in the previous sections of this CESA.

4.3 For the sake of completeness, the section of ES Chapter 8: Noise and Vibration dealing with construction noise has also been altered to reflect this. This replacement chapter is provided in Part D (Volume III) of the CESA

4.4 The principal noise effects and improvements arising from the reduction in the duration of OOOH construction activities, both for weekend and night-time periods, are assessed and reported below. The effects of increasing construction activities during the operational day as a consequence of shifting many construction activities out of the night-time are also considered.

4.5 The approach taken in this assessment has been to achieve an acceptable noise environment through the provision of on-site and off-site mitigation, as necessary to avoid any significant adverse effects while ensuring that Best Practicable Means (BPM) are deployed at all times for all construction activities relating to the CADP.

On and off-site Noise Mitigation

4.6 The off-site mitigation provision is described in detail in Appendix 4.4 of this CESA and includes, for those properties that are eligible, an offer of the Sound Insulation System (SIS) First or Second Tier Works available under the Airport¢s current Section 106 Agreement dated July 2009, or, in accordance with an alternative procedure and timescales as agreed between the Airport and LBN.

4.7 Most dwellings potentially affected by construction noise will have already been treated under earlier sound insulation schemes. These properties will either have secondary glazing or double glazing to reduce noise levels. These properties will also have sound attenuated ventilation units to provide fresh air without the need to open windows. These are known as ôFirst Tierôworks. Dwellings predicted to be exposed to night time noise levels of 50 dB L_{Aeq} will be re-offered these First Tier works.

4.8 A higher standard of insulation will be available in the ôSecond Tierôscheme. Even if dwellings already have double glazed windows they will be offered secondary glazing or a contribution towards high acoustic performance double glazing. This will provide a higher sound insulation performance. Sound attenuated ventilation units will be available if not already installed. The trigger levels relating to eligibility for such Second Tier works, subject to time of exposure, are those presented below in Table 4.1.

Table 4.1 - Limits at the façade of any residential property (No Treatment under SIS)

Period		Hours	Construction Noise Limit, dB LAeq,T	Time Period, T
Daytime	Monday ï Friday	08.00 ï 18.00	75	10 h
		18.00 ï 23.00	55	1 h
	Saturday	08.00 - 13.00	75	5 h
	Saturday	13.00 ï 23.00	55	1 h
	Sunday	08.00 ï 23.00	55	1 h
Night-time	Any day	23.00 ï 08.00	55	15 min

4.9 The assessment reported below provides a description of the additional on-site noise, mitigation measures that will be provided to minimise the impacts of construction noise, both day and night, throughout the duration of the CADP construction. Further mitigation options are set out below (see *Summary of Noise Mitigation*).

Progression of Construction Noise Assessment since July 2013 ES

4.10 In light of the various construction noise assessments undertaken as part of the Environmental Impact Assessment (EIA) process, as reported in the Environmental Statement (ES) and its two subsequent addendums (the March 2014 ESA and May 2014 ESSA), it is relevant to set out the key differences between each stage of assessment and to explain how this current assessment builds upon those undertaken to date.

4.11 In the July 2013 ES, the construction noise assessment was undertaken in a conventional manner by including a consideration of the worst affected receptors around the development site and predicting the construction noise levels for a variety of different phases of the CADP construction programme. The predictions were made over a typical one hour period, as is the normal convention.

4.12 LBN, while not disputing the conventional nature of this approach, sought further information (in its letter of 21st January 2014) on the evening and night-time construction noise levels, citing the duration of construction and the significant amount of works to be undertaken outside normal hours.

4.13 In response to this request, the ESA (March 2014) provided Construction Noise Prediction Contour Maps (re-presented at CESA Appendix F.1.2, Volume III) for each three month period throughout the duration of construction based upon the previous construction programme titled "*Indicative Detailed Construction Programme, Revision 5*". These maps indicated how noise during OOOH periods would be distributed throughout the construction site within the Airport over the duration of the build.

4.14 The noise maps in the ESA were produced for each 3 month period of the programme from the start of 2015 (Year 1) to the end of 2021 (Year 7). Each map presented the typical construction processes that might occur over a one hour period. British Standard BS5228:2014 recommends the use of a one hour assessment period at night and many large infrastructure developments have also adopted this night time assessment period, including CrossRail, Jubilee Line Extension and the A13 works.

4.15 The noise assessment in the ESA therefore provided a far more detailed account than that presented in the July 2013 ES of how noise levels might vary around the site over a typical OOOH night or weekend day for different phases of the works.

4.16 In the ESSA (May 2014), a further refinement of this assessment was undertaken and presented as a series of 'worst case' sensitivity tests. In its Regulation 22 letter of 23rd May, LBN requested that consideration be given to a shorter timeframe, i.e. 15 minutes, than that used in the ES and ESA which depicted the noise levels that would arise typically over a night or OOOH weekend period. The reason for this was to ensure that the short term noisier activities were identified sufficiently to assess impacts at night.

4.17 LBN also requested that a 'cumulative assessment' be undertaken to account for the noise arising from the transportation of materials into and out of the site along the proposed haul road. The sensitivity tests presented in the ESSA therefore included the cumulative noise effects of construction activities and the haul road, concentrating on the piling and deck works that were identified as the key night time noise producing activities.

Current assessment of construction noise

4.18 This section reports on the latest assessment which draws together all of the above and re-produces a 'Book of Noise Maps' at Appendix 4.1, as an update to the noise maps produced as part of the ESA and ESSA. These maps indicate, in 3 month slices of time throughout the construction of the CADP, the noise levels expected at a typical bedroom receptor during OOOH periods identified in the *Improved Construction Programme*. They are based on a 15 minute assessment period as requested at Item 2 of LBN's letter of 20th August and include noise effects from the haul road that extends along Hartmann Road East in order to be consistent with the noise assessment presented in the ESSA. The assessment also considers all construction activities throughout the CADP construction, as opposed to focussing only on noisier works such as the piling and deck works, as was the case in the ESSA.

4.19 Due to the significant improvements in the proposed *Improved Construction Programme* and resultant *OOOH Programme* (see Appendix 2.1) substantially less construction activity is now proposed at night.

4.20 The Book of Noise Maps presented at Appendix 4.1 supersedes those previously issued in the ESA and ESSA. In summary, the assumptions used to generate the new Book of Noise Maps presented are:

- A 15 minute reference period of activity for OOOH working, (in contrast to the one hour period used in ESA and ESSA with 15 minute sensitivity testing);
- The inclusion of a haul road within the noise assessment model;
- A timeline taking account of all key noise-producing construction activities throughout the duration of the *Improved Construction Programme*; and,
- Additional mitigation measures including the Temporary Construction Noise Barrier along the southern edge of the Airport long term car park, as well as local mitigation around noisy items of plant. These are in addition to other temporary noise barriers at the construction compound and along Hartmann Road.

4.21 The analysis within this Section provides a 'worst case' assessment of those receptors that may be impacted by noise during OOOH construction activities throughout the CADP build. It is considered a 'worst case' assessment because predictions relate to a shorter than standard assessment period (15 minutes as opposed to 1 hour) as well as assuming that many construction activities, that may occur occasionally and at different intervals, are all happening at the same time during a 15 minute period.

4.22 The Book of Noise Maps presented in Appendix 4.1 uses a night-time criterion that relates to a more stringent 15 minute period, as requested at Item 2 of the LBN letter dated 20th August 2014. This is also consistent with the reference period stipulated by LBN for night time construction limits during the OIP construction works at the Airport completed in 2007 (namely 55 dB $L_{Aeq,15min}$). Accordingly, the noise maps have been prepared for a 15 minute period to represent a 'worst case' account of night time construction noise during occasional short-term periods.

4.23 In any one hour period, a noisy activity such as using a vibratory piling technique to install steel pile cases might occur for 10% of the time. When considered over a 15 minute period however, the level of activity could rise to say to 40%, and hence give rise to a greater noise exposure when assessed over this shorter time period. Accordingly, it is considered that a 15 minute period represents a more demanding (noisier) case than assessed previously in the ES.

4.24 The assessment in this CESA considers all construction activities over the six year CADP construction period. It does this both for receptors at the conventional assessment height of 4 metres (first floor level), which is appropriate for most of those receptors closest to the works (i.e. within North Woolwich to the south of the Airport) but also for all other receptors such as those in blocks of flats with more than two storeys.

4.25 A further addition to this analysis is the inclusion of the proposed Temporary Construction Noise Barrier on the Airport site, which would be additional to other noise mitigation barriers proposed for the Hartmann Road (East) and around the construction compound.

4.26 This barrier is to be erected as a means of protecting those receptors, south of the Airport and closest to the works, from the effects of construction noise during both operational hours and

OOOH. The noise barrier will be located south of KGV Dock and will be 3 metres in height. Its extent will vary according to the phasing of construction, with part of the barrier installed for both phases of construction as the works move eastwards across the site. The location, design and acoustic specification of the Temporary Construction Noise Barrier are provided in Appendix 4.2. This also includes the suggested wording of a planning condition to secure its installation.

4.27 An assessment of the effectiveness of mitigating construction noise barriers was undertaken based on heights of up to 4 metres. The assessment found that a 3m high barrier would offer a useful noise reduction for properties closest to the works at 1st floor level. However, increasing the barrier to 4m would not reduce the small number of properties exposed to noise levels in excess of 55 dB LAeq,15min. This is because these properties are located at high level, predominately the upper floors of Dunedin House. As a result, any increase in barrier height would provide a negligible improvement for these flats which overlook the CADP construction site.

4.28 In regard to the 50-55 dB LAeq,15min band, the assessment found that a 4m barrier would only reduce the number of properties in this band by a very small margin. As demonstrated below the potential worst case for receptors close to the temporary construction noise barrier (i.e. close to Newland Street) is likely to occur within the period shown on Contour 6 in the Book of Noise Maps in Appendix 4.1. During this period combined deck, piling and drainage works is predicted to expose 213 dwellings to noise levels of between 50 and 55 dB LAeq,15min. Following detailed assessment a 4m barrier was shown to have little advantage over a 3m barrier, only reducing the number of properties exposed to 50 and 55 dB LAeq,15min by up to 10. A 3m barrier is therefore proposed as this is deemed to be the most appropriate mitigation response and it will also ensure that any potential visual impacts arising from any higher barrier on local residents south of the Airport would be avoided.

Results of current Noise Assessment

4.29 The Book of Noise Maps (Appendix 4.1) shows for comparative purposes that, with the mitigation measures proposed, a noise level of 55 dB LAeq,15 min is not exceeded at any receptor at a first floor receiver height in the residential areas to the south of the Airport. It indicates how, for a series of receptors to the south of the Airport, the construction noise levels are expected to vary over the six year programme; firstly, based on the noise maps presented in the ESA, and secondly based on the current book given in Appendix 4.1.

4.30 The graphs contained in Appendix 4.3 compare the noise levels for each receptor under each scenario. However, in making any direct comparison, the following key points need to be borne in mind, insofar as the noise maps at Appendix 4.1 are:-

- Based on a 15 minute assessment period, whereas those presented in ESA used a one hour reference period. This has the effect of overstating the noise in comparison to those presented in the ESA;
- Include a haul road, whereas those presented in the ESA do not;
- Include a temporary noise barrier and some local mitigation, whereas those presented in the ESA do not;

- Include two piling rigs during the ‘Completed Works’, whereas those in the ESA include only one piling rig during this phase[3]; and

- Do not take account for the shorter duration of OOOH works within a given 3 month period under the Improved Construction Programme - it simply represents a snapshot in time.

4.31 Whilst it is difficult to demonstrate a ‘like for like’ comparison given the differences in assumptions behind each of the two sets of maps, in general terms the graphs in Appendix 4.3 indicate the notable improvement in OOOH noise levels at receptors to the south of the CADP construction works, as compared to those presented in the ESA, throughout most of the six year CADP *Improved Construction Programme*.

4.32 In contrast to the ESA, the Book of Noise Maps at Appendix 4.1 demonstrate that for all residential areas the noise levels at first floor level do not exceed 55 dB $L_{Aeq,15min}$. In practice, where a slight increase in noise is predicted in the Book of Noise Maps over those presented in the ESA, for example as a result of using two piling rigs as opposed to one, this difference would be broadly offset by adjusting for the factors listed in the first two bullet points above.

4.33 Some receptors that are situated on the upper levels in blocks of flats with a clear line of sight to the CADP construction site will, on occasion, be exposed to construction activities that produce noise levels slightly higher than 55 dB $L_{Aeq,15min}$.

4.34 Table 4.2 below identifies for each 3 month slice of time within the CADP construction, based on the activities described on the associated noise map, the number of receptors that may be exposed to 55 dB and above, in the range of 50 dB to just under 55 dB; and less than 50 dB $L_{Aeq,15min}$. Given the ‘worst case’ nature of this assessment, that is, using a 15 minute averaging time, the receptors identified as experiencing a given noise level will only experience this at times during a night when the specified activity or works are taking place and not necessarily for extended periods of time.

4.35 The *OOOH Programme* at Appendix 2.1 identifies when the reduced number of OOOH works are programmed to take place during each 3 month period. The *Improved Construction Programme* and resultant *OOOH Programme* indicate both the number of weeks when the works will take place and also the extent to which that activity takes place over the specified duration. For example, it may specify that works will take place over a six week period (in any given 3 month slice) and those works would only occur for less than 25% of the time. Therefore, the noise level calculated here will only occur at times during a period of less than 25% of six weeks, in the specified 3 month slice. It is relevant to bear this in mind when reviewing the noise maps and further information presented below.

4.36 The number of receptors is based on the CadnaA acoustic model of the Airport and surrounding area. This model includes a number of key receptor positions used for many years at the Airport. This includes a small number of non-residential receptors such as ‘Royal Docks Business Park’, ‘North Side of Royal Albert Dock’, and ‘Building 1000’. Many of these non-residential receptors

[3] The earlier series of maps has been modified where appropriate to include piling and deck works for Phase 3C which were erroneously omitted in the original ESA book of maps.

are on the north side of The Royal Albert Dock and are exposed to higher levels of construction noise.

Table 4.2 – Number of Receptors Exposed to Construction Noise

Contour and 3 Monthly Construction Timeslice	Description	<45	≥45 - <50	≥50 - <55	Location of dwellings/ receptors	≥55	Location of dwellings/ receptors
1 ï 2015/01/01	No night works	0	0	0	n/a	0	n/a
2 ï 2015/04/01	No night works	0	0	0	n/a	0	n/a
3 ï 2015/07/01	No night works	0	0	0	n/a	0	n/a
4 ï 2015/10/01	Deck - Section 2A Piles Installed OOOH Deck -Section 2B Piles Installed OOOH	1651	413	127	Dunedin House, Winifred and Newland Street Flats, Westland House and Queensland House [All upper levels]	0	n/a
5 ï 2016/01/01	Deck - Section 2A Pile Heads and Beams Installed OOOH Deck - Section 2B Pile Heads and Beams Installed OOOH Erect protection deck inside existing OBB	2007	180	4	Claremont Close Flats [upper levels]	0	n/a
6 ï 2016/04/01	Deck - Section 2A - Topping OOOH Deck - Section 2B - Topping OOOH Deck - Section 3A - Piles installed OOOH Stormwater Drainage & Culvert Stage 1	1504	470	213	Dunedin House, Westland House, Newland Street Flats, Queensland House [All upper levels]	4	Non-residential receptors on edge of Royal Albert Dock
7 ï 2016/07/01	Stormwater Drainage & Culvert Stage 1 Services / Lighting / Markings, etc. to New Taxiway New runway link	1546	470	168	Dunedin House, Westland House, Newland Street Flats, Queensland House, Winifred Street [All upper levels],	7	Non-residential receptors on edge of Royal Albert Dock, Building 1000
8 ï 2016/10/01	Deck - Section 3A - Topping OOOH Services / Lighting / Markings, etc. to New Taxiway Building and Link Bridge Frame	1672	366	153	Claremont Close Flats, Dunedin House, Westland House, Newland Street Flats, Queensland House, Winifred Street [All upper levels],	0	n/a
9 ï 2017/01/01	No night works	0	0	0	n/a	0	n/a
10 ï 2017/04/01	No night works	0	0	0	n/a	0	n/a
11 ï 2017/07/01	No night works	0	0	0	n/a	0	n/a

Contour and 3 Monthly Construction Timeslice	Description	<45	≥45 - <50	≥50 - <55	Location of dwellings/ receptors	≥55	Location of dwellings/ receptors
12 ï 2017/10/01	No night works	0	0	0	n/a	0	n/a
13 ï 2018/01/01	No night works	0	0	0	n/a	0	n/a
14 ï 2018/04/01	Deck - Section 3B Piles - Installed OOOH (2 Rigs)	1530	337	314	Claremont Close Flats, Westland House, Queensland House, Felixstowe Court Flats Dunedin House, Woodman Street Flats [upper levels]	10	Non-residential receptors on edge of Royal Albert Dock Claremont Close Flats [Upper Levels]
15 ï 2018/07/01	Deck - Section 3B Pile Heads and Beams Deck - Section 3B Deck Planks, Services & Topping Airside drainage & culvert works Stage 2	1658	334	198	Claremont Close Flats, Westland House, Queensland House, Felixstowe Court Flats [upper levels]	1	Non-residential receptors on edge of Royal Albert Dock
16 ï 2018/10/01	Deck - Section 2C Deck Planks, Services & Topping Services / Lighting / Markings / Equip for new stands Airside drainage & culvert works Stage 2 Frame construction	1538	456	196	Dunedin House, Claremont Close Flats, Westland House, Queensland House, Newland Street Flats [upper levels]	1	Non-residential receptors on edge of Royal Albert Dock
17 ï 2019/01/01	Deck - Section 2C Deck Planks, Services & Topping Services / Lighting / Markings / Equip for new stands Airside drainage & culvert works Stage 2 Frame construction - building Building envelope - building Frame construction ï piers	1462	509	200	Dunedin House, Claremont Close Flats, Westland House, Queensland House, Newland Street Flats [upper levels]	20	Non-residential receptors on edge of Royal Albert Dock, Dunedin House [upper levels]
18 ï 2019/04/01	Services / Lighting / Markings / Equip for new stands Building envelope - building Frame construction -	1579	413	175	Dunedin House, Claremont Close Flats, Westland House, Queensland	24	Non-residential receptors on edge of Royal Albert Dock Dunedin

RPS

Contour and 3 Monthly Construction Timeslice	Description	<45	≥45 - <50	≥50 - <55	Location of dwellings/ receptors	≥55	Location of dwellings/ receptors
	piers Building envelope - piers				House, Newland Street Flats [upper levels]		House [upper levels]
19 ï 2019/07/01	Building envelope ï piers	2039	145	7	Winifred Street Flats [Upper levels]	0	n/a
20 ï 2019/10/01	No night works	0	0	0	n/a	0	n/a
21 ï 2020/01/01	No night works	0	0	0	n/a	0	n/a
22 ï 2020/04/01	No night works	0	0	0	n/a	0	n/a
23 ï 2020/07/01	No night works	0	0	0	n/a	0	n/a
24 ï 2020/10/01	Demolition and reinstatement ï coaching facility	2109	73	5	Claremont Close Flats	4	Non-residential receptors on edge of Royal Albert Dock
25 ï 2021/01/01	No night works		0	0	n/a	0	n/a
26 ï 2021/04/01	No night works		0	0	n/a	0	n/a
27 ï 2021/07/01	No night works		0	0	n/a	0	n/a
28 ï 2021/10/01	No night works		0	0	n/a	0	n/a

Summary

4.37 The above predictions provide an objective snapshot as to the predicted noise levels for various representative OOOH periods during the CADP build as proposed in the *Improved Construction Programme* at Appendix 2.1. The re-assessment of night construction noise has found that, for the majority of the construction period, only a small number of receptors to the south of the airport may exceed noise levels in excess of 55 dB $L_{Aeq,15min}$. These are generally high level (2nd floor and above) receptors of properties closest to the works. A more significant number are exposed to levels between 50 and 55 dB L_{Aeq}. These receptors are predominately the Westland, Queensland and Dunedin House flats which overlook the Airport. These have already been treated under the Airportôs earlier Sound Insulation Schemes and only a very small minority of the occupants of these flats (12 out of 233) refused access to install the insulation measures. This means that, in practice, the vast majority of these properties will already be protected as a result of treatment under the Airportôs (First Tier) Sound Insulation Scheme (SIS). Moreover, the Airport has already committed to offering those properties that previously refused the Airportôs offer, exposed to night time construction noise levels in excess of 50 dB LAeq, a further opportunity to accept the works ahead of carrying out noisy night time works.

4.38 The assessment within Table 4.2 (above) covers the residential receptors to the south of the Airport which are the key concern. To the north east of the Airport, the guideline noise level of 55 dB L_{Aeq}, 15min is marginally exceeded at the University of East London (UEL) buildings for some works, as was the case previously and shown on the noise maps presented in the ESA. At worst, noise levels are predicted to reach up to 57 dB at this location. Due to the close proximity of this site to the Airport, the University was required by planning condition to be constructed with adequate mitigation against aircraft noise. As such, these modern halls of residence have been constructed to effectively mitigate aircraft noise. The residual construction noise effect is therefore not considered significant for these receptors.

Assessment of Construction Noise with Proposed Further Mitigation and Effect of Reduced OOOH Working

4.39 As discussed below and set out at Appendix 4.4: Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS), the Airport will extend the First Tier SIS to any properties likely to be exposed to greater than 50 dB $_{LAeq,15min}$ during the night-time period, and offer enhanced Second Tier sound insulation measures to any properties likely to be exposed to greater than 55 dB $_{LAeq,15min}$. Daytime limits are also proposed which, if exceeded, will trigger further sound insulation measures for eligible dwellings. However, none of the daytime limits are expected to be triggered based on the noise assessment.

4.40 In assessing the overall effect of OOOH and night time construction noise, many variables need to be considered. These are project-specific and include the number of receptors affected, the duration, and the character of the construction noise. These all need to be considered to determine if there is a significant overall effect.

4.41 The construction noise predictions demonstrate that the number of receptors affected will be small. All of these receptors will have been offered treatment under the Airport's previous sound insulation schemes. Most have already accepted this treatment. The *Improved Construction Programme* also brings substantial improvements in the duration and character of construction noise during the sensitive night time periods. This is due to significant reductions in a number of OOOH construction activities, as set out in detail in Sections 2 and 3 of this CESA. The improvements are further summarised below, specifically in relation to the change in the construction noise environment during the sensitive night time period.

Summary of Reduced OOOH Working

4.42 <u>Piling works</u> – The "Interim Works" piling period has now reduced from 47 weeks down to 19 weeks. Similarly the "Completed Works" piling phase has reduced from 30 weeks to 13 weeks. These are significant reductions of the duration of night time piling works. The *Improved Construction Programme* now limits night time piling to a small band of activity furthest from the nearby residential areas, with the two principal phases of piling being separated by a respite period of 2 years.

4.43 <u>Piling works methodology</u> – The assumptions for night time piling noise have been based on the methodology previously adopted for the OIP works. This method uses a combination of vibro-driving, to insert the pile casings, and augering. This results in significantly less noise and vibration than traditional driven piling methods.

4.44 Piling methods are discussed further in Section 3: Alternatives to Construction Method (LBN Item 1(iv)). While certain alternative piling methods (e.g. Giken Hydropress) can produce less noise than the vibro-driving method assumed here, the adoption of a marginally quieter method could prolong the piling operation; the net result being that the overall disturbance to the community, not only that caused by noise, would extend over a longer timeframe. An assessment of the possible effects of prolonging the piling operations at night (using a 15dB weighting at night as requested by LBN), as a result of using a slightly quieter piling technique, has been undertaken and is reported in Appendix 3.2. When a contractor is appointed, a re-assessment will be made of available piling methods.

4.45 Deck works, overall ï The ñInterim Worksò has reduced from 53 weeks to 37 weeks. A similar case applies for the ñCompleted Worksò with the total reduced from 59 to 46 weeks.

4.46 Deck works, pile heads and beams ï During these periods, night time construction activity is now only expected for occasional use (<25%) due to the constraints of the Transitional Surface. For these occasional night time periods, the activities likely to generate noise will be modest, for example cranes and floodlights to move large beams close to the runway.

4.47 Deck works, topping ï A more substantial duration of night works (9-13 weeks per deck area) is expected for the deck topping. This is due to the need for access through the airfield. The noise sources for these activities will comprise concrete delivery, pumps, poker vibrators, along with floodlights. Noise levels are expected to be within recommended guidelines without the need for additional noise mitigation at source. Mitigation measures for all construction activities will be reviewed in detail to upon appointment of the Contractor to ensure Best Practicable Means (BPM) are adopted.

4.48 Stormwater drainage and culvert works (Stage 1 & 2) ï will still require a more substantial overall construction time at night (24 and 31 weeks for Stage 1 and 2). This is due to the works being carried out on the runway strip. The character of many of the construction noise sources will be relatively low and continuous such as floodlights and excavation with occasional concrete works. There will however, be periods when higher noise activities involving breaking equipment will be used. The construction noise predictions have demonstrated that these can be controlled to within acceptable levels through the use of temporary acoustic screening close to the noise sources. As with all construction activities, the details of the exact plant will be assessed when a Contractor is appointed and BPM will be adopted.

4.49 Taxiway and Runway Link ï These activities are constrained due to the need to work in an operational airfield environment and this is expected to include around 67 weeks of OOOH works, although not on a continual basis. Due to the distance to the nearest residential receptors, night noise levels will generally be below the required noise criterion. However, certain elements of noisier breaking activities are likely to need local screening to be controlled to acceptable levels. This includes local 1.5 to 2.0 metre acoustic screens around concrete breaking activities to minimise noise emissions to the local community.

4.50 Coaching Facility ï These works are constrained to night works and OOOH works due to the need to work close to an operational airfield. This location will benefit from substantial noise screening provided by the existing buildings/pier. The duration of these works is also low, involving a total of 29 weeks, with night/OOOH works required for around 50% of the foundation work, with occasional (<25%) for building envelope, link and reinstatement works.

4.51 OBB works ï These works are comparable to the Coaching Facility works. This area benefits from noise screening from existing buildings and the works will be limited in duration (13 weeks).

4.52 Eastern Terminal Extension Main Building ï The new *Improved Construction Programme* has eliminated almost all night/OOOH works. Those construction activities that require night or OOOH works will be limited to elements of the frame construction and building envelope to avoid works over the live OBB facility. The noise sources will again comprise floodlights/craneage plant with relatively low noise levels.

4.53 Forecourt/ Civil Engineering Work/ Aviation House/Hotel/ Western Energy Centre ï These works, while relatively short in duration, are close to nearby residential properties. Due to the close proximity there is the potential for construction noise to affect these nearby properties if these works were carried out in the sensitive night/OOOH period. Accordingly, these have now moved into daytime operational or weekend hours.

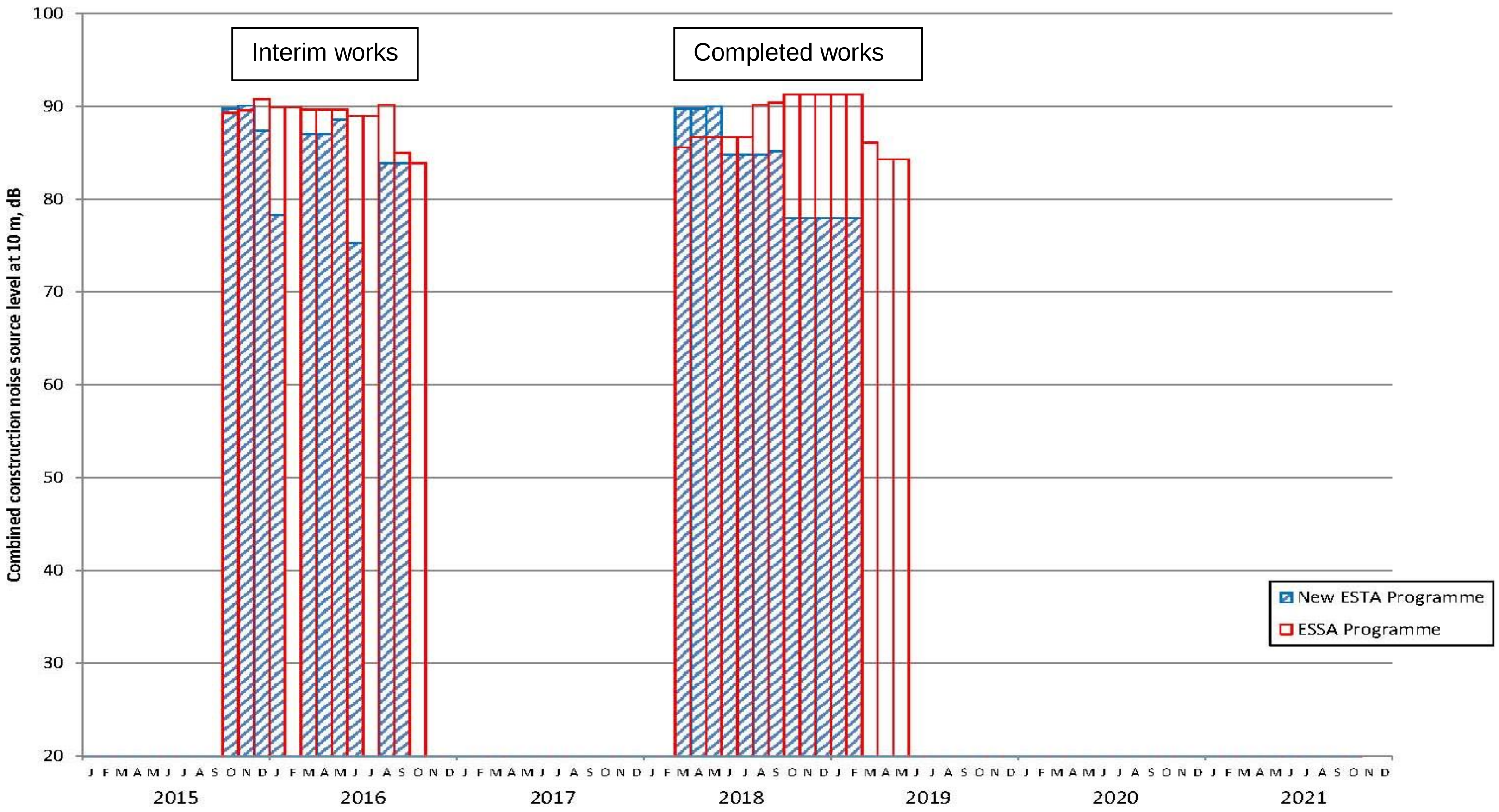
Duration of Exposure to Noise during OOOH Periods

4.54 To demonstrate the significant improvement in duration of noisy night time works in the *Improved Construction Programme* (Appendix 2.1) in comparison to the programme presented in the ESSA, an exercise has been undertaken to compare, for each month, the overall noise produced at night during the OOOH piling, pile heads, beams, and deck works.

4.55 A noise exposure level has been derived for each month of the programme from a consideration of the construction plant and activities that will be taking place. The noise exposure level relates to the noise produced at a distance of 10 metres for each item of plant, weighted to account for how often it would be used during the period. It takes no account of any additional noise mitigation measures (as summarised above), such as the Temporary Construction Noise Barrier or local screening, which would be expected to further reduce noise impacts.

4.56 The graph below shows a comparison of the results of this exercise for the earlier ESSA programme and for the *Improved Construction Programme*.

Figure 4.1: Plant Noise Output at 10 metres during Piling and Deck Works – Comparison of Indicative Construction Programme (ESSA, May 2014) and the Improved Construction Programme (CESA)



4.57 The graph shows that in the early couple of months for the Interim Works (Phase 1), the magnitude of noise during piling is much the same at night under both programme scenarios. This reflects the plant noise output at 10 metres. In practice however, the noise level received at most receptors will be less under the *Improved Construction Programme* because of the noise reduction provided by the temporary construction noise barrier.

4.58 Months 3, 4 and 5 in the middle of 2015 (Year 1) show the benefits arising from the reduction in night-time piling and deck works, as compared to the ESSA programme. This pattern continues and illustrates how, during the Interim Works, there will be occasional month-long periods of respite from piling and deck works noise at night.

4.59 For the Completed Works (Phase 2), the early months show a slightly greater plant noise output as a result of the use of two rigs as compared to one. Again, the additional noise under the *Improved Construction Programme* takes no account of any benefits in noise reduction achieved from the Temporary Construction Noise Barrier. Instead, the indicative improvements that would arise from this noise barrier are presented in Appendix 4.5. This shows that the noise reductions from the barrier more than counter the noise increases due to the operation of duplicate piling rigs, for receptors to the south of the works at the eastern end. In some areas, such as to the western end of the temporary noise barrier, the reductions in noise are modest as a result of the barrier. This is due in part to the existence of the DLR structures that already offer some noise reduction. Despite these modest reductions, they are beneficial in that they ensure that no ground or 1st floor receptors are exposed to construction noise levels during the OOOH works in excess of 55 dB $L_{Aeq,15min}$.

4.60 The benefits of the significant reduction in night time OOOH activities and the shortening of the programme for the Completed Works (Phase 2) (ie. resulting from the use of two piling rigs) are evident in the later period of 2018 (Year 4) where the plant noise levels reduce and disappear for the last few months under the *Improved Construction Programme.*

4.61 The above assessment provides an objective measure to demonstrate the benefits of the *Improved Construction Programme.*

Daytime Construction Noise

4.62 The Improved Construction Programme shows that some activities previously proposed for the night-time will now take place during the operational day. The construction noise assessment undertaken and presented in the ES found negligible noise impacts for daytime operational hours works. This finding was based on the following criteria.

Table 4.3 – Daytime Construction Noise Criteria

Period	Noise level	Classification
Daytime	Ó85 dB $L_{Aeq,\ 10/5h}$	Significant substantial - adverse
Monday to Friday 08.00 - 18.00	Ó75 dB $L_{Aeq,\ 10/5h}$	Significant Moderate(1)ï adverse
Saturday - 08.00 ï 13.00	Ó65 dB $L_{Aeq,\ 10/5h}$	Minor ï adverse
	<65 dB $L_{Aeq,\ 10/5h}$	Negligible ï adverse

4.63 The split of construction activities under the *Improved Construction Programme* will increase the amount of daytime construction works for some activities, such as piling and deck works, compared to the previous programme. However, these increases will be small and will not alter the finding that daytime construction noise levels will be ***negligible***.

4.64 This conclusion was originally presented in Table 8.53 and 8.54 of the ES which presented the predicted daytime construction noise levels at the peak period of construction activity at various óworst caseô nearby receptors around the site. These tables are replicated below:

Table 4.4 - Construction – Peak Construction Year (Year 4) construction noise predictions (LAeq,T) (July 2013 ES Tables 8.57 & 8.58)

Construction activity	Noise sensitive receptor										
	A	B	C	D	E	F	G	H	I	J	K
Site prep and compound	35	36	38	41	39	43	41	63	50	42	57
Breaking out dock walls	49	50	53	60	53	61	52	60	58	50	55
Auger Piling	43	44	47	54	47	55	46	53	51	44	48
Concrete deck ï precast beam and plank	40	41	43	51	43	52	43	50	48	40	45
Deck drainage and services	49	50	53	60	53	61	52	60	58	50	55
Concrete deck ï in-situ topping	43	44	47	54	47	55	46	54	52	44	49
Pavement works	49	50	53	60	53	61	52	60	58	50	55
Buildings - site prep-excavation	46	48	56	54	42	53	41	48	45	37	41
Buildings ï piling	49	52	60	58	45	56	44	51	48	40	45
Buildings ï sub and superstructure	48	51	59	57	44	55	43	50	47	39	44
Buildings ï envelope and fit-out	47	50	58	56	43	54	42	49	46	38	43
Landside infrastructure concrete and general works	59	61	69	67	55	66	54	61	58	50	55

Table 4.5 - Construction – Peak Construction Year (Year 4) construction noise predictions comparison with daytime criteria

Construction activity	Noise sensitive receptor										
	A	B	C	D	E	F	G	H	I	J	K
Site prep and compound	Negligible (A-K)										
Breaking out dock walls	Negligible (A-K)										
Auger Piling	Negligible (A-K)										
Concrete deck ï precast beam and plank	Negligible (A-K)										
Deck drainage and services	Negligible (A-K)										
Concrete deck ï in-situ topping	Negligible (A-K)										
Pavement works	Negligible (A-K)										
Buildings - site prep-excavation	Negligible (A-K)										
Buildings ï piling	Negligible (A-K)										
Buildings ï sub and superstructure	Negligible (A-K)										
Buildings ï envelope and fit-out	Negligible (A-K)										
Landside infrastructure concrete and general works	Negligible (A-B)		Minor (C-D)		Negligible (E)	Minor (F)	Negligible (G-K)				

4.65 These predictions take no account of the Temporary Construction Noise Barrier that is to be installed to the south of the site or local mitigation provided under Best Practicable Means (BPM).

Once these measures are installed, they will provide protection to southern receptors from not only OOOH works but also those undertaken during the operational day. Appendix 4.5 shows the general noise reductions expected from the Temporary Construction Noise Barrier at these óworst caseô nearby receptors which, for the closest receptors to the south of the Airport, will more than offset any slight increase in daytime noise resulting from a shift of activities from night-time to daytime.

4.66 Although the general noise reductions from deploying the Temporary Construction Noise Barrier appear modest at first floor height (4 metres), they assist in reducing the number of residential receptors exposed to levels in excess of 55 dB. The barrier also assists in mitigating and reducing construction noise effects throughout the construction programme for receptors that would be adversely affected, but not significantly affected, during the day and/or night.

4.67 To demonstrate the above for daytime, two contours are presented in Appendix 4.6 - *Daytime Construction Noise Contours* that show predicted construction noise levels for daytime activities. For consistency, in the noise model, these are predicted using the same 15 minute assessment period used for the night period and also include the temporary noise barrier. The noise levels may be slightly lower than shown here when assessed using the longer weekend/evening 1 hour assessment period and therefore may be treated as a óworst caseô. One figure presents noise predictions for combined piling (2A), deck works (2A) and deck services works (2B) works. It can be seen that predicted noise levels at 1st floor level are no higher than 55 dB(A). The other figure presents noise predictions for combined building works on the Eastern Terminal Extension and Pier along with Services works on the stands. Again, noise levels at 1st floor level are no higher than 55 dB(A).

Summary of Noise Mitigation

4.68 In addition to the improvements in construction programme, the mitigation measures offered to date, including those set out in this CESA, need to be considered in aggregate when assessing the overall effect of construction noise. These various mitigation measures are listed below:

- Framework Construction Noise and Vibration Management and Mitigation Strategy (CVNMMS) formalising noise control procedures, as presented in Appendix 4.4.
- Noise limits outlined within the CNVMMS being set by a planning condition;
- Re-assessment of noise levels when the Contractor is appointed using BPM to identify any further improvements available. This will include more details of the proposed construction plant and methodology, in addition to identifying any further appropriate noise reduction measures that may be available;
- Regular noise monitoring, as set out in the CNVMMS;
- Respite from night time construction during Sunday nights;
- Those properties who are exposed to construction noise levels at night in the range 50 dB to 55 dB $L_{Aeq,15min}$ (for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months) and who previously refused works under the Sound Insulation Scheme will be re-offered treatment under the Airportôs First Tier Works Scheme;

- Second Tier Works (secondary or contribution towards high acoustic performance thermal double glazing) will be made available to properties predicted to exceed 55 dB LAeq regularly (for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months) (see CNVMMS at Appendix 4.4);
- Temporary noise barriers close to Woodman Street, the Contractorôs Compound and Hartmann Road;
- Local noise screening around some plant; and
- Provision of a new temporary noise barrier south of the KGV Dock as specified in Appendix 4.2.

Summary and Conclusion

4.69 This section of the CESA has sought to demonstrate, in terms of absolute levels, the resultant daytime construction noise levels (in tabular form and with noise map examples) and night-time construction noise levels (as a book of OOOH noise maps and night-time piling and deck works duration graphs). Appendix 4.5 demonstrates the effectiveness of the Temporary Construction Noise Barrier.

4.70 The revised technical assessment presented in this CESA changes the overall noise impact on account of the reduced construction noise activities during OOOH works, including many activities which have been moved to daytime hours. Further extensive mitigation is proposed (as summarised above), including the detailed CNVMMS and physical measures such as noise barriers.

4.71 The more detailed assessment provides more context on the number of receptors likely to be affected by construction noise. On the basis of this assessment, it is considered that the overall residual noise effects of the CADP construction would be a ***minor adverse*** impact in relation to OOOH works (night time and weekends).

4.72 The CNVMMS, as well as appropriate planning conditions, will ensure the proposed mitigation measures are implemented to safeguard the amenity of the surrounding community.

4.73 The recent review and improvements to the construction programme have eliminated many night time activities and substantially reduced most others in terms of duration and/or intensity.

4.74 Based on the *Improved Construction Programme*, this assessment has reviewed in further detail the number of receptors and the extent to which they are likely to be affected by construction noise over the key noise-producing periods, including during OOOH works (night time and weekends). In addition, it has taken account of the extensive noise mitigation measures that are being offered as part of CADP and as set out in the ES, ESA and ESSA to safeguard the amenity of the surrounding community. The residual construction noise effects will give rise to a negligible impact during daytime operational hours and minor adverse impact during Out of Operational Hours. With the offered mitigation, the residual construction noise effects will give rise to a ***negligible*** impact during daytime operational hours and ***minor adverse*** impact during Out of Operational Hours.

LBN Reg 22 Request:

5) Describe other mitigation methods that have been considered and reasons for not employing them at this stage, or identifying those that may be considered in future when the contractor is known.

Response:

4.75 The proposed principal means of mitigating construction noise have already been presented and their effectiveness discussed in the above response. This section therefore considers the options for other mitigation measures which may, subject to feasibility, be employed by the appointed Contractors. These additional mitigation measures have not been accounted for in the previous noise assessment as they cannot be considered to be ócommittedô measures at this time because this will depend on the techniques and plant etc. used by the Contractors .

4.76 Those measures which are unlikely to be suitable for the CADP works are also described and the reasons for this are explained, as requested by LBN.

4.77 This assessment has been completed by TPS who have applied the same scoring system as used in the assessment of different piling options (i.e. 1 = Practical to 5 = Not Practical), as set out in Section 3. This comparison of potential mitigation options therefore considers the practicality of employing such measures and, where practical, considers potential implications to the CADP construction programme, financial and safety considerations. The scoring of the options is summarised in the table at the end of this sub-section.

Review of Additional Mitigation Options

Reduce Noise of Kelly Bar Cleaning

4.78 Systems are available to reduce the noise related to cleaning the Kelly Bar. The Kelly Bar is part of the piling rig and it is necessary to remove soils and materials from it. The specific cleaning methods will vary between different piling plant manufacturers.

4.79 This is a proven technique that can be used to mitigate the noise impact of the construction and therefore it is recommended to be used in the construction process, at times when the benefit is noticeable (i.e. it may not be required in the day time).

4.80 There may be minor impacts on the production rates, although these should not be significant.

Shrouding the piling equipment – Vibrodriver

4.81 Shrouds are available for piling to reduce noise impacts. These shrouds have been developed for driven piling due to the higher levels of noise that this method generates. An example of this is the MENK noise reduction skirt. The application of similar systems used for lower noise vibrodriver plant, have not been identified by TPS.

4.82 A shroud for the vibrodriver was considered for the previous OIP project at London City Airport and was not found to be practical in that instance. However, the appointed Contractor for the CADP works would be expected to further evaluate this option.

Shrouding the piling equipment – Piling Rig

4.83 Creating a shroud around the piling rig has been discussed with piling contractors. This practice would require a noise barrier to be created around the entire piling rig. This physical screen would pose two significant safety risks to the operatives on the barge; first, it increases the risk of a person being caught between the moving rig and the screen and, secondly, it restricts movement space on the barge which will constrain the construction operation. While the barges are a significant size, there is a lot of equipment onboard and free movement of the piling rig and the crane are required for the construction.

4.84 These over-riding concerns are likely to render this option unviable for the CADP works.

Reduced Noise at Casing Gates

4.85 In discussions with piling contractors, the issue of metal on metal ‶clanging" was raised as a potential noise risk. This may be particularly evident if there is metal on metal contact during the vibrodriver operation. To minimise the risk, the gates which guide the casing could be lined with a different material to minimise the risk of such noises. This may be wood or another non metallic material.

4.86 While this technique is not well documented, it is a low risk from a programme, cost and safety perspective. Therefore, the appointed Contractor will be expected to apply this.

Machine Silencing

4.87 Machine silencing is the method of creating muffles and baffles on the piling rig to minimise the noise emitted or to deflect the noise to less sensitive areas.

4.88 This has been discussed with piling contractors and the solution and effectiveness of the silencing is likely to vary for different equipment suppliers. As the equipment supplier is not known at this stage, the specific proposals cannot be assessed. However, the Contractor would be expected to select the most appropriate equipment for the works and will be required to set out options for machine silencing in his Construction Method Statement.

Summary

4.89 The following table summarises TPS' provisional assessment scoring of these 'additional mitigation options' that could be employed by the appointed Contractor and will be reconsidered when the detailed construction methods are further developed.

Table 4.9- Summary of Methodology and Ranking

Methodology	Practicality Ranking	Programme Ranking	Financial Ranking	Safety Ranking
Reduce noise of Kelly Bar cleaning	1.	1.	1.	1.
Shrouding of the piling equipment – Vibrodriver	4.	N/A	N/A	N/A
Shrouding the piling equipment – Piling Rig	4.	N/A	N/A	3.

Methodology	Practicality Ranking	Programme Ranking	Financial Ranking	Safety Ranking
Reduced noise at casing gates	3.	1.	1.	1.
Machine Selection/Silencing	3.	1.	2.	1.

LBN Reg 22 Request:

6) Update the Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS) where necessary to retain consistency with the revised assessment.

Response:

4.90 The Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS) is contained in Appendix 4.4. Excluding minor amendments to the introduction of this document, it remains unchanged from the version issued with the ESSA (May 2014).

4.91 The changes to the OOOH programme and the introduction of additional noise mitigation measures, such as the inclusion of the temporary construction noise barrier to the south of the Airport car park and beyond, bring about reductions in construction noise and vibration impacts, particularly during the OOOH periods. However, the provisions of this strategy document remain unchanged from that proposed in the ESSA, even though there have been significant reductions in the amount of night-time construction activities with associated reduced noise impacts.

5 LONDON AIRSPACE MANAGEMENT PROJECT (LAMP) (LBN ITEM 7)

a) <u>Introduction</u>

5.1 The following Section addresses Item 7 of LBN's letter in relation to an assessment of London Airspace Management Programme (LAMP) proposed changes to airspace. It has been compiled by Bickerdike Allen Partners (BAP) and Air Quality Consultants (AQC).

> ***LBN Reg 22 Request:***
>
> ***Chapters 8 and 9 (Noise and Vibration and Air Quality)***
>
> *7) An assessment needs to be undertaken of the likely impact of London Airspace Management Programme (LAMP) proposed changes to airspace.*

Noise and Vibration Response (by BAP):

5.2 Phase 1a of LAMP represents the first stage of the Future Airspace Strategy to modernise the airspace over the South East of England by 2020 and was the subject of a public consultation completed in January this year (2014). Further elements of LAMP Phase 1a will involve modernisation of London City Airport flight departure and arrival procedures below 4000ft.

5.3 In preparation for the implementation of Phase 1a of LAMP, expected in December 2015, the Airport is seeking to ensure that its associated 10 standard instrument departure routes (SIDs) and 2 standard arrival routes (STARs) below 4000 ft are RNAV (ARea NAVigation) compliant. This will ensure that LCY are prepared for any changes arising from LAMP and that those aircraft equipped with the appropriate navigational aids are able to fly the RNAV compliant routes.

5.4 LAMP complies with a European wide process to modernise airspace which will be a legal requirement for the UK and other European states by 2020. The CAA is planning to mandate that all operators will have to be RNAV 1 approved by November 2017, and airports in the London area must replace conventional procedures by November 2019. The Airport commenced consultation on these RNAV route proposals below 4000 ft on 4th September 2014.

5.5 The key feature of an RNAV compliant route is that it enables an aircraft with the appropriate guidance system to use modern GPS based navigational aids, rather than ground based beacons, to follow a defined route. This provides the potential for aircraft to fly as closely as ±1 nm to the SID and STAR centrelines.

5.6 The assessment presented below explores the noise implications that arise as a result of aircraft following RNAV compliant routes into and out of London City Airport within the context of the

CADP proposals. In this regard, the area of interest is restricted to the zones around London City Airport where the noise from airborne aircraft is envisaged to have a significant effect[4].

5.7 London City Airport, working in conjunction with NATS, are designing the RNAV compliant routes to replicate as far as possible the routes where aircraft fly today. The CAA defines RNAV replication of conventional departure routes[5] as follows:

> **"The design of an RNAV or RNP (Required Navigation Performance) route that follows the path over the ground of the nominal track of the existing conventional route as closely as possible. Note: it is the path over the ground of the designed conventional route and not the nominal centreline of the associated NPR or the current traffic concentration."**

5.8 Therefore, the CAA's emphasis for replication is on reproducing the design of the conventional route. London City Airport has sought to do this for departures by designing routes to match closely the current trajectories flown by the majority of flights whilst following the path over the ground of the nominal track of the existing conventional route as closely as possible.

5.9 For arrivals there is currently no formal route to replicate. Therefore, it has been agreed with the CAA a 'replication' is an RNAV defined route that matches the current concentration of flights seen in today's airspace.

5.10 This assessment has considered the proposed RNAV routes that essentially follow as closely as possible where aircraft fly today. The centrelines of the routes have been derived using statistical data gathered from the Airport's noise monitoring and flight track keeping (NTK) system as well as information on proposed routes provided by London City Airport.

5.11 With regard to noise, the area of interest lies close to the Airport and the opportunity for aircraft to spread out or disperse as they fly along the departure and arrival routes is limited. To explore this effect, two different "dispersion" scenarios have been considered. The first scenario relates to the standard dispersion model used in the ES contours that assumes aircraft spread out as now on departure. It is not known at this stage what changes in dispersion in this zone close to the Airport will arise in the future once the RNAV compliant routes are fully utilised. Therefore, to investigate a reduced dispersion case for comparison with now, the second scenario assumes no dispersion along departure routes (no dispersion is already assumed along arrival routes approaching the Airport). This is a "lower bound" scenario in terms of dispersion and will not occur in practice since some dispersion will occur even with RNAV. It does however allow a comparison between two scenarios to be made; one assuming that aircraft spread out on departure (disperse) much as today and one assuming all aircraft depart along exactly the same path. This enables a comparison of the noise effects to be made.

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[4] The Aviation Policy Framework treats the 57 dB LAeq,16h contour as the average level of daytime aircraft noise marking the approximate onset of significant community annoyance.

[5] Guidance on PBN SID Replication for Conventional SID Replacement, Directorate of Airspace Policy, Civil Aviation Authority, 19 August 2013

Actual Track Calculation

5.12 The actual tracks have been produced for each individual departure route using the NTK system in place at the Airport. This system is able to produce a ómean trackô for tracks flown over a period of time. The time period used for the calculation of the mean tracks was the last quarter of 2013, i.e. October to December. This period has been chosen to reflect as closely as possible where aircraft fly today, utilising radar track data from the Airportõs upgraded NTK system which was installed in September last year.

5.13 These routes have been compared with the RNAV tracks proposed by LAMP as part of the proposed changes to airspace, and a good correlation was found between the mean tracks and the proposed routes. This is to be expected as the LAMP proposed routes are intended to replicate the current situation as closely as possible. Figure A9575/N17/01 (Appendix 5.1) shows the actual departure tracks compared with the Airportõs SIDs used in the noise contours presented in the July 2013 Environmental Statement.

5.14 In addition, data from the Airportõs NTK system and flight information system has been used to determine the split of individual aircraft types along individual SIDs. This provides a more accurate assessment of where aircraft actually fly as compared to the methodology deployed in the ESSA for comparing contours produced in the ES against those based on actual tracks flown. The contours based on actual tracks were derived solely from the two most commonly used actual routes; one from Runway 09 and the other from Runway 27. This latest assessment is therefore a refinement of the ESSA assessment.

Contour Production

5.15 Other than the departure tracks, the contours have been prepared in the same way as those in the July 2013 Environmental Statement; that is, using latest INM software (version 7.0d), which has been used with validated aircraft types based on measured results. The following three average mode summer LAeq,16h noise contours have been produced, in order to show the effect of using the actual routes, with and without dispersion:

- 2012 Actual
- 2023 Without Development
- 2023 With Development

5.16 Aircraft movement data detailing the tracks used by the major aircraft types operating at the Airport in the summer of 2012 has been provided by the Airport. This data covers over 80% of the aircraft movements. For those aircraft where data is available, the actual percentage split between tracks has been used for that aircraft. For aircraft where data is not available, the average overall percentage split between tracks has been used.

5.17 For the future contours, the overall percentage split in 2012 has been applied to all aircraft types.

Dispersion

5.18 To account for the fact that aircraft do not all follow the route centreline exactly, it is normally necessary to apply some assumptions about how aircraft spread out or disperse following a departure from an airport. The dispersion assumptions in the contouring work presented in the

July 2013 ES were set out in Appendix 8.2 and are repeated below. These have been used here to present the ñupper boundò scenario of the maximum dispersion likely to arise under LAMP and once the RNAV compliant routes are adopted at the Airport.

5.19 A further set of noise contours has been prepared assuming the ñlower boundò scenario and assumes all aircraft follow the route centrelines exactly.

Noise Contour Results

5.20 The resulting noise contours are presented in CESA Appendix 5.2 (LAeq,16h airborne aircraft noise contours-Comparison showing revised track effect- Figures A9575/N17/02 to A9457/N07/04) for 2012, 2023 óWithout Developmentô and 2023 óWith Developmentô respectively. Each contour figure presents three sets of contours, one set based on the Airport SIDs and two sets based on actual tracks, one with and one without dispersion. The contours are presented at values from 54 to 72 dB LAeq,16h in 3 dB steps. The areas relating to the 57 dB, 63 dB and 69 dB noise contour are given in Table 5.1 below. The dwelling and population counts, not including permitted development, are given in Tables 5.2 and 5.3, and the corresponding counts including permitted development are given in Tables 5.4 and 5.5.

Table 5.1: Contour Areas

Scenario			Contour Area (km^2)		
			57 dB $L_{Aeq,16h}$	63 dB $L_{Aeq,16h}$	69 dB $L_{Aeq,16h}$
Current (2012)	SIDs (ES)		6.3	1.6	0.5
	Actual Tracks	Dispersed	6.3	1.6	0.5
		Not Dispersed	6.3	1.6	0.5
2023 Without Dev	SIDs (ES)		7.8	2.0	0.6
	Actual Tracks	Dispersed	7.7	2.0	0.6
		Not Dispersed	7.8	2.0	0.6
2023 With Dev	SIDs (ES)		9.1	2.4	0.7
	Actual Tracks	Dispersed	8.8	2.3	0.7
		Not Dispersed	8.9	2.4	0.7

Table 5.2: Dwelling Counts (not including permitted developments)

Scenario			Dwellings Within Contour[1]		
			57 dB $L_{Aeq,16h}$	63 dB $L_{Aeq,16h}$	69 dB $L_{Aeq,16h}$
Current (2012)	SIDs (ES)		8,300	400	0
	Actual Tracks	Dispersed	8,600	400	0
		Not Dispersed	8,700	400	0
2023 Without Dev	SIDs (ES)		12,400	900	0
	Actual Tracks	Dispersed	11,700	900	0
		Not Dispersed	11,800	900	0
2023 With Dev	SIDs (ES)		15,100	1,300	0
	Actual Tracks	Dispersed	13,600	1,200	0
		Not Dispersed	14,100	1,200	0

[1] Dwelling counts rounded to nearest 50

Table 5.3: Population Contours (not including permitted developments)

Scenario			Population Within Contour[1]		
			57 dB $L_{Aeq,16h}$	63 dB $L_{Aeq,16h}$	69 dB $L_{Aeq,16h}$
Current (2012)	SIDs (ES)		17,900	1,000	0
	Actual Tracks	Dispersed	18,600	1,000	0
		Not Dispersed	18,800	1,000	0
2023 Without Dev	SIDs (ES)		27,800	2,100	0
	Actual Tracks	Dispersed	26,000	2,000	0
		Not Dispersed	26,300	2,000	0
2023 With Dev	SIDs (ES)		34,100	2,900	0
	Actual Tracks	Dispersed	30,500	2,800	0
		Not Dispersed	31,700	2,800	0

[1] Population counts rounded to nearest 100

Table 5.4: Dwelling Contours (including permitted developments)

Scenario			Dwellings Within Contour[1]		
			57 dB $L_{Aeq,16h}$	63 dB $L_{Aeq,16h}$	69 dB $L_{Aeq,16h}$
Current (2012)	SIDs (ES)		8,300	400	0
	Actual Tracks	Dispersed	8,600	400	0
		Not Dispersed	8,700	400	0
2023 Without Dev	SIDs (ES)		26,400	5,500	0
	Actual Tracks	Dispersed	25,900	5,300	0
		Not Dispersed	26,100	5,300	0
2023 With Dev	SIDs (ES)		30,600	6,700	0
	Actual Tracks	Dispersed	29,100	6,600	0
		Not Dispersed	29,600	6,600	0
[1] Dwelling counts rounded to nearest 50					

Table 5.5: Population Counts (including permitted developments)

Scenario			Population Within Contour[1]		
			57 dB $L_{Aeq,16h}$	63 dB $L_{Aeq,16h}$	69 dB $L_{Aeq,16h}$
Current (2012)	SIDs (ES)		17,900	1,000	0
	Actual Tracks	Dispersed	18,600	1,000	0
		Not Dispersed	18,800	1,000	0
2023 Without Dev	SIDs (ES)		65,600	14,500	0
	Actual Tracks	Dispersed	64,300	14,100	0
		Not Dispersed	64,800	14,100	0
2023 With Dev	SIDs (ES)		76,000	17,500	0
	Actual Tracks	Dispersed	72,300	17,400	0
		Not Dispersed	73,600	17,400	0
[1] Population counts rounded to nearest 100					

Noise Contour Comparison

5.21 Tables 5.1 to 5.5 above show that the area, dwelling counts and population counts for the 57dB, 63dB and 69 dB noise contours are similar whether based on the Airport's SIDs or on the mean departure routes actually flown by the aircraft for a given year scenario.

5.22 As shown in Table 5.1, for 2012 there is no difference in the area within the contours whether aircraft follow the SIDs or whether they fly along the actual tracks under either of the dispersion scenarios. In 2023, the contours using the actual routes are slightly smaller, with those using dispersed routes marginally smaller than those produced with no dispersion.

5.23 In terms of dwelling and population counts, the counts within the 57 dB $L_{Aeq,16h}$ contours determined from the actual tracks are generally slightly higher than those determined using the SIDs in 2012, but lower in 2023. The counts within the 63 dB $L_{Aeq,16h}$ contours determined from the actual tracks are the same or slightly lower than those produced using the Airportꞌs SIDs. As with the areas, the contours produced using dispersed routes result in marginally higher counts than those produced with no dispersion. These marginal differences result in the main from a slight change in the contour shape which removes or brings in postcodes that include either a group of single dwellings or, in some cases, blocks of flats, based on an assessment of CACI postcode data.

5.24 To conclude, this assessment indicates that there is no material difference between the areas of the key noise contours and the dwelling and population counts contained within them; whether calculated from the Airportꞌs published SIDs (as used in the ES) or the mean actual departure tracks as determined from the Airportꞌs noise monitoring and flight track keeping system and in line with those proposed under LAMP. As a result, the conclusions concerning air noise in the noise chapter (Chapter 8) of the ES (as supplemented by the ESA and ESSA) remain unchanged as a result of this analysis.

Air Quality Response (by AQC):

5.25 The proposed changes under LAMP will not affect the number of arrivals or departures, or the use of Runways 09 and 27, and are designed to affect aircraft routing at altitude (i.e. between 1000 and 4000 feet).

5.26 By convention, pollutant emissions from aircraft are calculated within the Landing and Takeoff (LTO) cycle, which includes all aircraft operations during arrival and departure, up to a ceiling height of 3000 feet. In reality, however, emissions from aircraft at altitudes of more than a few hundred feet will have an imperceptible impact on ground-level pollutant concentrations. The proposed RNAV replications will therefore not affect ground-level pollution concentrations, and there are no local air quality implications for the CADP proposals.

5.27 The proposed RNAV replications will potentially allow aircraft to plan smoother descent patterns on arrival which will result in a small reduction in fuel burn, and corresponding pollutant and CO2 emissions. Thus, the total pollutant emissions calculated within the LTO cycle for future years may be lower than stated within Chapter 9 of the ES, but any benefit is expected to be small.

5.28 As a result, the conclusions concerning air quality remain unchanged from those presented in the ES as a result of this analysis.

6 CUMULATIVE EFFECTS (LBN ITEM 8)

a) Introduction

6.1 Item 8 of LBN's letter dated 20th August 2014, reproduced below, includes the request for further consideration to be given to the cumulative ('in combination') effects of the CADP with the most recent development proposals in proximity to the Airport, namely: the Silvertown Quays planning application for a mixed use scheme (LBN Ref: 14/01605/OUT) and the Fox & Connaught hotel application (Ref: 14/00986/FUL).

6.2 At the request of LBN, this section gives a detailed account of the cumulative effects of the CADP with several major developments within close proximity to the Airport, in view of the specific characteristics of these proposed developments. Unlike the ES, which only accounted for committed and approved developments, this assessment also considers 'live planning applications'. Moreover, the analysis in this section is generally more detailed than that reported in the ES. However, for the sake of completeness, the Consolidated Environmental Statement (November 2014) also provides a refreshed version of ES Chapter 18: Cumulative Effects, including a summary of this further assessment.

b) Regulation 22-'further information'

LBN Request:

Chapter 18 (Cumulative Impacts)

The ES does not take into account the following live planning applications received since your response to the 2nd Reg 22 (1) letter we issued on the 23rd May 2014. These are listed below;

a) Silvertown Quays: (Ref: 14/01605/OUT) – Outline planning application with all matters reserved except for Access for the redevelopment of the site for mixed use purposes, including the alteration, partial demolition and conversion of the Millennium Mills and the construction of buildings across the site to include Brand buildings (Sui Generis), Residential (Use Class C3), Office (Use Class B1), Retail (Use Classes A1-A5), Leisure (Use Class D2), Education (Use Class D1), Hotels (Use Class C1), other Non-Residential floor space such as community use (Use Class D1), provision of public open space, works of repair and restoration of the Dock walls, infilling and excavation of parts of the Dock area, the placing of structures in, on, or over the Dock area, utilities, construction of estate roads and the creation of new accesses to the public highway, works of landscaping and making good, creation of surface and sub-surface car parking areas.

b) Fox and Connaught Hotel: (Ref:14/00986/FUL) - Proposed 84 bedroom hotel and associated landscaping.

Both these applications may be determined at the Council's Strategic Development Committee on the 21st October 2014 and, in the event that the Council resolves to grant planning permission, they will become committed schemes for EIA purposes. As such, a decision on these applications may occur before any decision is made on CADP1 and CADP2. In view of the specific characteristics of the proposed developments, being significant major *developments within close proximity to London City Airport, we require the cumulative and interrelated impacts arising between these two developments and the CADP1/2 proposals should be considered as part of the ES. The impacts should not be assessed solely in relation to Chapter 18 but should be considered where appropriate as part of the assessment of the other relevant chapter topics, particularly in relation to Chapter 8 (noise and vibration).*

c) <u>Cumulative Effects</u>

6.3 In accordance with the EIA Regulations 2011 and associated guidance, the July 2013 ES took into account all known schemes in the area which were approved, subject to planning permission or otherwise designated for development at that time. The list of 'cumulative schemes' was determined in consultation with LBN, as described in ES Chapter 3: EIA Methodology, and by the application of the screening criteria described in ES Chapter 18: Cumulative Effects (Paragraphs 18.19 -18.20 and Table 18.2).

6.4 The ES considered two forms of cumulative effects:

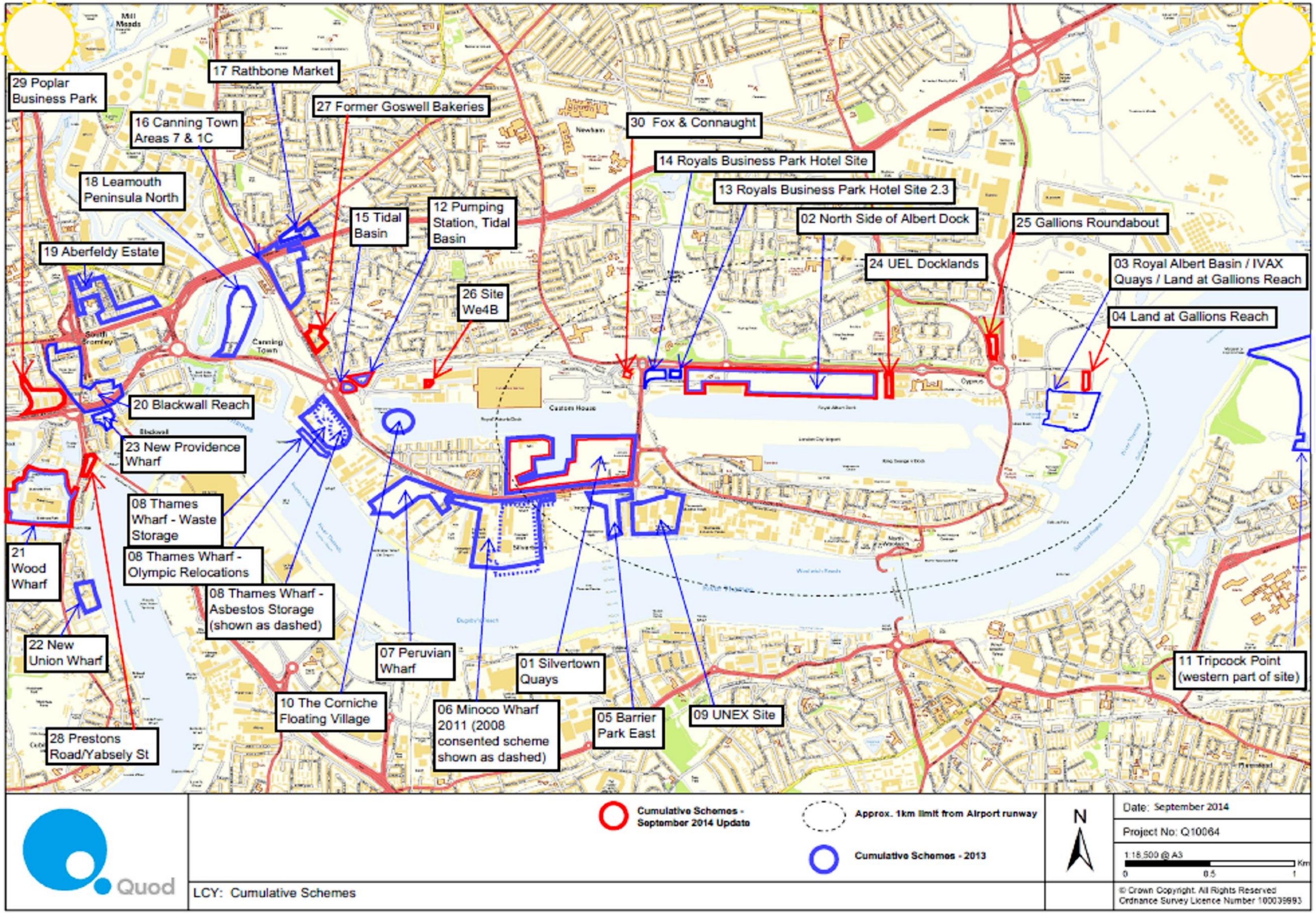
- Type 1 - The combined effects of individual residual impacts of the proposed development on a particular sensitive receptor, for example, the consequence of increased traffic flows on air quality and noise, and the effects of increased employment on travel patterns. These are sometimes known as 'interactive effects'; and
- Type 2 - The combined effects from several developments in the area which individually might be insignificant, but when considered together, could result in a significant cumulative effect.

6.5 As no material changes to the CADP1 and CADP2 proposals have been made since the applications were submitted to LBN in July 2013, the further information in this ES Third Addendum (and previous ES Addendums) does not materially alter the findings of the ES with regard to Type 1 effects. Therefore, it is not necessary to reconsider such interactive effects.

Screening and Selection of Type 2 Cumulative Schemes

6.6 The schedule of cumulative schemes (forming ES Table 18.2) and the figure showing the location of these schemes in relation to the CADP (ES Figure 18.1) have been updated by the Airport's planning advisors Quod. As illustrated by Figure 6.1 below, the schemes illustrated in blue were considered in the original July 2013 ES, whilst the schemes with a red boundary are recent applications or variations that are now considered as part of this update. The schedule of cumulative schemes is included within Appendix 6.1, superseding ES Table 18.2. Both the tables and figures are now also updated by the replacement Chapter 18: Cumulative Effects, contained in the Consolidated Environmental Statement (November 2014) (CES).

Figure 6.1- Map of Cumulative Schemes



6.7 RPS has used these materials to determine which newly consented developments (from July 2013 to August 2014) warrant consideration in the cumulative effects assessment.

6.8 This exercise has been undertaken for the sake of completeness, notwithstanding the fact that LBN has only asked for specific schemes to be considered (ñ*significant major developments within close proximity to London City Airport*ö) namely: the ABP scheme to the north of the Royal Albert Dock (ref. 14/00618/OUT) as requested in the Councilõs Regulation 22 letter of 23rd May 2014; and, the Silvertown Quays and Fox & Connaught schemes as requested in the Councilõs most recent letter of 20th August 2014.

6.9 The selection process for these cumulative schemes was first informed by the air noise contours prepared by BAP to identify those proposed developments which would fall within 57dB $L_{Aeq, 16hr}$ óWith Developmentô air noise contour for 2023 (ES Figure 8.11); and secondly, the supplementary screening criteria used in the original ES (paragraph 18.19), namely:

- Developments that are within 1km of the boundary of the Airport boundary;
- Comprise more than 10,000 sqm of development and/ or 100 or more residential units and/ or are of a particularly sensitive nature (e.g. new schools or hospitals);
- Expected to be built-out at the same time as the CADP and with a defined phasing and construction programme;
- Developments which are considered likely to result in significant environmental effects of some nature, often signified by being subject to EIA; and,
- Developments that have planning permission or a óresolution to grantô planning permission.

6.10 Including the two recent schemes referred to above, a total of nine additional developments have been identified since the completion of the July 2013 ES which may have the potential to generate cumulative effects in combination with the CADP, as shown in Table 6.1 below.

Table 6.1 - Schemes Included in the Cumulative Effects Update

Scheme/ (Identifier number on plan)	Application Reference/ Date Approved (if known)	Summary Description	Approximate Distance from the Airport/in 57dB contour?
Silvertown Quays (01)	14/01605/OUT (Pending)	Outline planning application with all matters reserved except for Access for the redevelopment of the site for mixed use purposes, including the alteration, partial demolition and conversion of the Millennium Mills and the construction of buildings across the site to include Brand buildings (Sui Generis), Residential (Use Class C3), Office (Use Class B1), Retail (Use Classes A1-A5), Leisure (Use Class D2), Education (Use Class D1), Hotels (Use Class C1), other Non-Residential floor space such as community use (Use Class D1), provision of public open space, works of repair and restoration of the Dock walls, infilling and excavation of parts of the Dock area, the placing of structures in, on, or over the Dock	50m (to western site boundary) Yes

Scheme/ (Identifier number on plan)	Application Reference/ Date Approved (if known)	Summary Description	Approximate Distance from the Airport/in 57dB contour?
		area, utilities, construction of estate roads and the creation of new accesses to the public highway, works of landscaping and making good, creation of surface and sub-surface car parking areas.	
ABP Royal Albert Docks (02)	14/00618/OUT Resolution to grant 23/07/2014	Hybrid planning application for up to 437,185 sqm (GEA) of floorspace with part submitted in outline and part submitted in detail, where: The Outline Component comprises a business-led mixed use development for up to 374,067 sqm (GEA) of floorspace (excluding basement) for business; retail, financial and professional services, food and drink uses, community and cultural, and assembly and leisure uses; residential; car parking and energy centre; new servicing routes, highways and landscaping, public realm improvements, public open space, access, and associated development. The Detailed Component of the application seeks approval for 63,118 sqm (GEA) of floorspace comprising business, serviced apartments, retail, financial and professional services, food and drink uses, community and cultural, and assembly and leisure uses, temporary car park and energy centre (including temporary access road and associated works), access and connectivity improvements, landscaping and public realm improvements, open space and associated development, and the change of use of two existing Grade II listed buildings.	250m north Yes
Land at Gallions Reach, Atlantis Avenue, E16 2QJ (04)	12/01576/FUL	Development of site to provide 89 residential units arranged in 3 blocks of 12, 5 and 8 storeys in height, 35 associated car parking, amenity space and cycle parking to be provided.	Approx. 700m east/ north-east of the Airport. Yes
26-34 Tidal Basin Road, E16 1AD (16)	13/01873/FUL Approved Note: Supersedes previously approved development Ref. 09/02013/FUL	Redevelopment of the site to provide two residential buildings (Class C3 use) of 24 and 23 storey's respectively, comprising 360 residential units and 455sqm of flexible Class A, B1 or D1 floorspace, landscaped open space with associated basement car parking, servicing, storage, plant and works incidental to the development.	Approx 2.5km west of the Airport. Yes
Site We4B, Western Gateway, Canning Town, London E16 1AD (27)	09/01288/FUL Planning Permission Granted November 2013	Erection of new hotel (Use Class C1) of 223 bedrooms with associated restaurant, lobby and meeting rooms upon existing podium. Change of use of basement area to ancillary C1 use for sprinkler tanks, CHP plant, and five on site car spaces.	Approx 2.2 km west of the Airport. Yes
Former Goswell Bakeries & vacant warehouses,	13/01461/FUL	Mixed use development including 336 residential flats, commercial uses, car parking and public realm including	Approx 2.5km west of the Airport

Scheme/ (Identifier number on plan)	Application Reference/ Date Approved (if known)	Summary Description	Approximate Distance from the Airport/in 57dB contour?
Caxtob Street North, E16 (28)		pedestrian of Hoy Street.	No ï just outside 57dB contour.
Car Park At South East Junction Of Prestons Road And Yabsley Street, Prestons Road, London (29)	PA/12/02107 Planning Permission Granted 20/06/13	The erection of two buildings of 7 & 26 storeys comprising 190 residential units (78 x 1 bed; 58 x 2 bed; 50 x 3 bed; 2 x 4 bed; 2 x 5 beds), 134sq.m of gym space at upper ground level, 42 car parking spaces and 244 cycling spaces at basement level, communal open space and associated works.	Approx 4.5 km west of the Airport Yes
Poplar Business Park, 10 Prestons Road, London, E14 9RL (30)	PA/11/03375 Planning Permission Granted 23/09/13	Demolition of existing buildings and redevelopment of the site to provide a mixed use scheme of between 3 and 22 storeys comprising 8,104 sq metres business accommodation (Use Class B1), 392 residential units (Use Class C3), associated parking and landscaping	Approx 5 km west of the Airport Yes (just)
Fox & Connaught, Lynx Way, London, E16 1JR (31)	14/00986/FUL (Pending)	Proposed 84 bedroom hotel and associated landscaping	350m to north west Yes

i. Silvertown Quays

6.11 An outline planning application by the Silvertown Partnership was submitted to LBN in July 2014 comprising the mixed-use redevelopment of a 27 hectare plot of land surrounding the Pontoon Dock in the Royal Docks, to the west of the Airport. This development scheme is generically known as ôSilvertown Quaysô

6.12 The scheme also includes a 3.4 hectare ôDock Bridgeôsite which encompasses part of the Royal Victoria Dock and the existing bridge between the ExCeL and Britannia Village. Further details of the Dock Bridge will be provided in a future detailed planning application.

6.13 The main Silvertown Quays development comprises a mixed-use scheme that would provide a range of residential units, retail, offices and work space, open space, leisure space, ôBrand buildingsô to exhibit showcase corporate, educational and other brand uses and community facilities including a primary school. The proposed development includes partial infilling of Pontoon Dock by material excavated across the site for basements. Parts of the Millennium Mills would be demolished and rebuilt and the Grade II Listed Silo D Building would be retained.

6.14 The components of the development are defined by a series of Parameter Plans and a Development Specification & Framework (DSF).

6.15 RPS has reviewed the supporting Environmental Statement and associated documents prepared by Ove Arup & Partner Limited (Arup, July 2014) in order to identify whether any significant environmental effects identified in that document would have any additive, subtractive or synergistic cumulative effects in combination with the CADP.

6.16 For the purposes of the EIA, maximum and minimum parameters of the development have been assessed by Arup, complemented by an ŏIllustrative Masterplanô Assumptions regarding the Zone-specific minimum and maximum housing unit sizes and numbers have also been made. In total, the development will deliver a maximum of 3,033 units and a minimum of 2,369 (as shown in Table 2.2 of the Silvertown Quays ES).

6.17 A detailed appraisal of the individual topic-based ES chapters (Nos. 3 to 17) has been undertaken. The ES does not include a specific chapter on cumulative impacts; instead, the cumulative assessment has been addressed within the technical chapters.

6.18 Chapter 1: Introduction of the Silvertown Quays ES includes Figure 1.2 and Table 1.2 which identify the schemes that have been considered within the cumulative assessment. Although specific reference to the CADP is not used, the correct planning reference is listed under ŏLondon City Airportô Accordingly, the Silvertown Quays ES and the conclusions reached therein are founded on a full understanding of how the Airport will develop over time, both with and without the CADP, including the realisation of the 120,000 annual movement limit under the existing 2009 planning permission (Ref. 07/01510/VAR).

6.19 Chapter 2: the Site and Proposed Development (notably paragraph 2.1.26 and 2.1.27) explicitly acknowledges the Airport as a constraint to development in respect of compliance with the safeguarded Obstacle Limitation Surfaces (OLS) and the Public Safety Zone (PSZ). These constraints have helped define the layout and maximum heights of the proposed buildings. Furthermore, the pedestrian and cycle bridge (i.e. the Dock Bridge) would be constructed within defined parameters for width, height and outline construction details, observing these constraints.

6.20 Chapter 14: Transport (paragraph 14.5.3) of the Silvertown Quays ES states:

> **"The committed schemes are those with planning permission, while the cumulative schemes are those that are either subject to a live planning application, or those that are expected to come forward. The schemes included are as follows and have been agreed by LBN for the purposes of traffic modelling:**
>
> - **26-34 Tidal Basin Road;**
> - **We8, The Pumping Station Site, Tidal Basin Road;**
> - **<u>London City Airport;</u>**
> - **26-34 Tidal Basin Road;**
> - **Barrier Point East;**
> - **Royal (Minoco) Wharf; and**
> - **Royal Albert Basin / Great Eastern Quays".**

6.21 The predicted traffic flows for CADP have therefore been included within the Transport Assessment and ES supporting the Silvertown Quays application and thereby assessed and accounted for in the ŏbase caseôfor the air quality, noise and other assessments.

Silvertown Quays - Construction Programme Overview

6.22 The main Silvertown Quays development has been divided into seven distinct ŏDevelopment Zonesôas shown on Parameter Plan 08 in Appendix 2.1 of the ES. The implementation of each of the Development Zones would be staged to ensure the demolition, refurbishment and construction activities required for the redevelopment are delivered in a ňtimely, proper and orderly sequence to minimise disruptionò

6.23 Section 2.3 of Chapter 2 states that construction of the proposed development is estimated to take place over an eleven year period between 2015 and 2026. An outline of the proposed demolition and construction works is provided within the Construction Method Statement (CMS) provided in ES Appendix 2.6.

6.24 The proposed development would begin in Development Zone 1 (DZ 1) to the west of the SQ site (i.e. away from the Airport). Therefore, cumulative impacts such as construction noise would be much less likely to transpire during these initial stages of construction (mid 2015 to mid 2019).

6.25 The ES states that any subsequent phasing would be dependent on market conditions. Therefore, the Applicant does not commit to a timed development programme or the order in which subsequent zones will be constructed. However, the CMS details the following construction phases and overall programme for the proposed development:

- Enabling Works from February 2015 to August 2015;
- New Dock Bridge (referred to in the CMS as ‘Link Bridge’) from April 2015 to June 2016;
- Millennium Mills (‘Phase 0’) works from April 2015 to July 2021;
- Phase 1 from July 2015 to September 2019;
- Dock Infill Works from March 2016 to December 2017;
- Phase 2 from January 2018 to June 2021;
- Phase 2A from January 2018 to April 2019;
- Phase 2B from July 2019 to March 2023;
- Phase 3 from December 2019 to January 2025; and
- Phase 4 from June 2022 to January 2026.

6.26 In regards to cumulative construction effects, it can be concluded that many of the above phases of work will occur at different times and/or be spatially distant from the ongoing CADP works.

6.27 The CMS demonstrates how the scheme could be built within the overall programme and highlights a range of mitigation measures to avoid or reduce the environmental impacts from the construction works. However, detailed Construction Method Statements for individual plots and buildings “would be expected to come forward during reserved matters application stages”.

6.28 The overarching CMS accounts for, *inter alia*, the following considerations (Para 2.3.2):

- **<u>London City Airport operations</u>;**
- **Traffic management;**
- **Waste management; and,**
- **Workforce issues.**

6.29 Accordingly, the CMS for Silvertown Quays contains many of the same mitigation measures as presented in the outline draft of the Construction Environmental Management Plan (CEMP) for the CADP (CADP ES Appendix 6.1)

6.30 The Silvertown Quays ñIndicative Construction Programmeò estimates that peak construction activity would occur during 2019 when the Phase 1 and Phase 2 works overlap. At this time around 25 buildings would be at various stages of construction and there would be an estimated 1,500 construction workers on the site.

6.31 Phase 3 (2020-24) comprises the construction of around 12 buildings in the centre of the site. This would include commercial office space, the remainder of the Brand buildings and the leisure building in Development Zone 3. As illustrated on the *Improved Construction Programme* ï August 2014 (CESA Appendix 2.1) the main construction works for the CADP will be complete by 2020. Therefore, the chance of significant cumulative effects occurring between the two sites by this time is minimal. Furthermore, the final phase of the Silvertown Quays scheme (Phase 4 - from 2022-2044), which lies to the immediate west of the Airport adjoining the Connaught Bridge Roundabout, will be built-out after the CADP construction is completed.

Other Construction Impacts on the Operational Airport

6.32 Construction activities on the Silvertown Quays site have the potential to affect operations at the Airport. In particular, large items of construction plant such as cranes and scaffolding can interfere with radar and radio frequencies used by the Airport. Therefore, the Applicant has committed to liaise closely with the Airport with respect to locations and types of construction plant, particularly in cases where it could impinge on the defined physical safeguarded areas so that flight operations can continue unimpeded throughout the construction phase.

6.33 Initial consultation has been undertaken with the Airport to discuss the implications of constructing the taller elements of the development which lie just beneath the Airport Obstacle Limitation Surfaces (OLS). It has been agreed that the upper levels of buildings could be constructed using saddle jib tower cranes (or similar) as long as appropriate methodologies and risk assessments are provided to the Airport and agreed beforehand.

6.34 All operations will comply with the restrictions implied within the CAAõs Advice Note 4 ï ôCranes and Other Construction Concernsö and other advice provided by the Airport Operators Association (AOA) by the General Aviation Awareness Council.

6.35 The appointed contractor for the Silvertown Quays development will also consult with NATS to agree all aspects of the construction methodology that could affect flight operations and safety.

Overview of Potential Cumulative Effects from Construction

6.36 As noted in ES Chapter 1: Introduction, the EIA conducted by Arup incorporates committed developments within the construction and operational assessment. Cumulative impacts during the construction phases are presented in each individual chapter (3-16) and are generally reported as either ônegligibleö or ôminorö impacts. These impacts closely mirror those stated in the CADP ES in both Chapter 18: Cumulative Effects and the relevant technical chapters (7-16).

6.37 Paragraph 3.9.1 in the Silvertown Quays ES concludes:

> **"No cumulative or interactive effects are anticipated during construction of the proposed development, since the mitigation measures applied to the proposed development are anticipated to minimise or eliminate any potential significant effects."**

6.38 Several potential environmental impacts are by their nature highly localised and will be contained within the respective site boundaries (e.g. impacts on archaeology, flood risk, contamination, micro-climate etc.). Therefore, the potential for such impacts to interact between the two developments and thereby derive 'cumulative effects' is negligible, particularly considering the spatial separation of the sites by Connaught Road. As such, no further consideration needs to be given such topics.

6.39 However, for more mobile impacts including traffic, noise and dust, there is some potential for cumulative effects due to the proximity of shared sensitive receptors. These potential impacts are considered below.

Socio-economic Effects

6.40 For some topics, for example construction work employment, the combined effects of the CADP and Silvertown Quays developments result in beneficial effects. For example, paragraph 11.8.1 of Chapter 11 of the Silvertown Quays ES states:

> **"The proposed development together with the cumulative schemes would be expected to generate employment opportunities during their demolition and construction stage..... However, it is expected that the cumulative schemes and the proposed development would have a beneficial effect with respect to construction related employment."**

6.41 The Airport concurs with this assessment and will willingly work with the developer to ensure that opportunities for sharing resources and promoting employment during the construction phase are optimised, where practicable to do so.

Aquatic Ecological Effects

6.42 Chapter 6: Aquatic Ecology, describes the likely significant effects of the proposed Silverton Quays development with respect to aquatic ecological habitats on and in the vicinity of the site, particularly on the Victoria and Pontoon Dock system. Construction activities that have the potential to affect or influence the aquatic habitat are identified in ES Paragraph 6.2.2 as follows:

- **Noise and vibration from heavy plant, machinery and any piling activities;**
- **mobilisation of fine particulate sediment materials into the water column through "in dock" works such as piling, dredging or infilling of dock sections;**
- **mobilisation of historically contaminated dock sediments through "in dock" works such as dredging or infilling of dock sections; and**
- **accidental loss of containment incidents, spills and leaks (e.g. fuel oils, lubricants and hydraulic fluids).**

6.43 Construction of the proposed development includes the partial infilling and remodelling of Pontoon Dock. It is proposed in the CMS that preliminary dredging of Pontoon Dock will be required using a plough, backactor, grab or other appropriate dredging plant. The works also include: the construction of a cut off wall to separate Pontoon Dock from Victoria Dock; the stabilisation of existing dock walls; and, the construction of ten supporting piers within Victoria dock for a footbridge. These activities all have the potential to re-suspend and mobilise fine particulate sediment that occurs throughout the bed of the dock. Before mitigation, such effects have the potential to create ósignificant adverse effectsô on the invertebrates of the peripheral rocky dock-bed habitats; óadverseô effects on the dock wall invertebrate communities (Paragraph 6.8.3); and, ósignificant temporary negative impactô on fish (Paragraph 6.8.8).

6.44 To minimise the above effects, the ES authors recommend a range of mitigation measures. These include the installation of ósilt curtainsô around the area of dredging and construction of the division (cut off) wall; vibro-piling (similar to that proposed for the CADP) and/or other non-impact methods; fish rescue from Pontoon Dock and transference into Victoria Dock; and, the implementation of measures to prevent any spilled materials from entering the dock waters via runoff, drainage systems or other routes.

6.45 Following implementation of the proposed mitigation measures, it is concluded that the construction works in Pontoon Dock will not have a significant impact to any aquatic ecological receptors (paragraphs 6.11.1 to 6.11.6).

6.46 Whilst the CADP works in KGV Dock are not as extensive in nature (i.e. not requiring dredging or infilling works), the ES concluded that there would be a minor adverse effect on aquatic invertebrates and fish fauna due to the direct loss of sections of the Dock wall (CADP ES Paragraph 13.227). To compensate for this loss of habitat, replacement substrate in the form of artificial fish refugia (suspended wire mesh sheeting) has been proposed. Taking account of this mitigation, it is concluded that there will a ñnegligible permanent adverse impactò which is deemed ñnot significantò (CADP ES Table 13.9).

6.47 As neither construction project will have significant impacts on aquatic ecology following mitigation, cumulative impacts can also be expected to be negligible and not significant. This assessment is supported by the authors of this chapter of the Silvertown Quays ES, who conclude at Paragraph 6.10.1:

> **"Other developments adjacent or close to the site area that may, cumulatively with the proposed development, impact the aquatic habitats and species have been considered. It is probable that any cumulative impacts would not have a significant impact on any aquatic habitats or species".**

Terrestrial Ecological Effects

6.48 Whilst the site itself has no statutory designations, surveys have confirmed that bats, breeding birds (including protected species), invertebrates (e.g. bees and moths listed on Biodiversity Action Plans), and rare flowers are present on the Silvertown Quays site.

6.49 The ES concludes that, without mitigation, some significant adverse effects on terrestrial ecology could result from the disturbance and harm to species and habitats due to pollution, noise, lighting, vibration and the movement of people and vehicles on-site during construction and operation of the development. However, significant beneficial effects are expected to be provided by habitat creation and diversification through embedded ecological measures in the scheme design. This would include planting, green and brown roofs, and other ecological features, particularly around the dockbridge and shallow dock areas.

6.50 The ES chapter on Terrestrial Ecology states that mitigation measures would be outlined in an óEcological Management Planô for construction, and within an overarching óCode of Construction Practiceô which would be agreed with LBN prior to the start of construction.

6.51 The ES confirms that none of the cumulative developments considered (i.e. including the CADP) are relevant to the ecological resources on the Silvertown Quays site. Paragraph 7.8.35 explains that such sites:

> **"are unlikely to be utilised to a significant degree by any of the ecological resources on site. Therefore it is unlikely that there will be any significant additive effects from cumulative developments".**

Cultural Heritage

6.52 The notable structures in terms of cultural heritage on the Silvertown Quays site are Silo D, which is a Grade II Listed Building, and the Millennium Mills complex which has been locally listed by LBN. The former Pontoon Dock is also considered to be a built heritage asset although not designated or locally listed.

6.53 In the absence of mitigation there is the potential for significant adverse effects during construction. The potential remains of a hydraulic lift (within Pontoon Dock) and the former Iron Works (to the south of Pontoon Dock) could be affected by the excavation and construction works within Pontoon Dock.

6.54 The building fabric of Millennium Mills would also be affected by proposed demolition and refurbishment works. It has therefore been recommended that a programme of archaeological works and building recording of those elements to be rebuilt is incorporated into the Code of Construction Practice to mitigate these effects. Following the implementation of such measures, overall residual effects are expected to be 'insignificant'. Moreover, the retention of the Grade II listed "Silo D" building within the new scheme would bring about beneficial effects by enhancing its setting.

6.55 As the Silvertown Quays and CADP sites are spatially distinct (being separated by Connaught Road), there is no potential for cumulative impacts on buried archaeology, as no archaeological resource or feature has been identified which might straddle both sites.

6.56 With regard to built heritage, the Silvertown Quays ES concludes that there will be no significant effects on the setting of historic fabric of Royal Victoria Dock due to "*the change of general character resulting from proposed development*". It therefore follows that there will be no cumulative effect on KGV Dock either.

6.57 ES paragraph 4.1.10, states:

> **"No significant permanent direct cumulative or interactive effects are anticipated as the receptors identified in the baseline section are either, in the case of industrial remains, confined to the proposed development or, in the case of prehistoric peat deposits, sufficiently extensive as to reduce the likely magnitude of effect to insignificance".**

Construction Traffic

6.58 The Silvertown Quays Construction Method Statement (CMS) states that the workforce for this project will be encouraged as much as possible to use public transport, as the project is served by the DLR, by railway, and by the local bus network. It is accepted that this is not a viable solution for all the project workforce, and that there will be a demand for parking on site.

6.59 Site working hours for the Silvertown Quays development will cause a peak traffic inflow onto site between 7.15am and 8.00am, and outflow will naturally be staggered between 4.30pm and 6.30pm. The CMS says that the contractor or contractors will consult with the local police and local authority to agree strategies to minimize possible excessive traffic delays.

6.60 During the peak of construction of the Silvertown Quays development, forecast to be during 2019, there is estimated to be up to 418 construction vehicle trips per day (paragraph 14.8.7). This would be the equivalent of approximately 20 arrivals and 20 departures per hour, assuming a managed 10-hour arrival schedule. During the peak construction phase of development, these construction vehicles would access the site via the Connaught Bridge roundabout access.

6.61 The baseline assessment shows there to be 40 HGV trips during the AM peak hour. An additional 40 two-way trips per hour on Connaught Bridge therefore represent a significant increase on this road. The authors therefore conclude that, as a relatively local route which provides access to industrial buildings only, the effect on Connaught Road will be of ‘minor adverse significance’ during the peak construction period. To address this impact, a Construction Traffic Management Plan (CTMP) will put in place measures to minimise the disruption caused by an increase in HGV movements and construction vehicles on the highway (paragraph 14.10.1)

6.62 By comparison, the CADP work during this period of time will generate a maximum of 773 two-way monthly peak movements. On the assumption of a 30-day working month, this equates to 220 two-way trips per day, equivalent to 26 two-way HGV vehicle movements and 194 two-way staff movements. It is important to understand that these 220 trips are spread across the course of a day and only a small proportion of the daily construction traffic will occur at peak times. Moreover, alternative construction traffic routes will be used for the CADP, including Woolwich Manor Way to the east. This eastern construction route will be used for the majority of HGV movements (i.e. instead of Connaught Road) but will have only a negligible effect on traffic levels on Woolwich Manor Way. The use of barges to transport material will further reduce peak construction vehicle movements.

6.63 In conclusion, even with the combined traffic flows of the two developments during this period, there is unlikely to be any worse than a ‘minor’ significant cumulative impact on Connaught Road or other local roads,

Air Quality

6.64 Dust generating activities during the demolition and construction phase have the potential to impact cumulatively on nearby sensitive receptors. Therefore, appropriate mitigation for dust emitting activities has been suggested for the Silvertown Quays development. Similar to the CADP, these include site specific mitigation measures for ‘high risk’ sites according to the Institute of Air Quality Management (IAQM) guidance. Such mitigation measures will greatly reduce or eliminate dust related impacts at source.

6.65 Accounting for mitigation, it is considered that the risk of significant dust generation and deposition beyond the Silvertown Quays site boundary will be ‘negligible’. Consequently, significant cumulative dust effects with the CADP construction works are highly unlikely.

RPS

Noise

6.66 Chapter 10 of the Silvertown Quays ES identifies noise sensitive locations surrounding the proposed development, concentrating primarily on residential locations to the west and south of the site including the consented Royal (Minoco) Wharf and Barrier Park East sites. It also identifies the proposed hotel at the Airport (CADP2) as a potentially sensitive receptor to noise.

6.67 In general terms, the spatial sequence of construction activity on the Silvertown Quays mirror those of the CADP, with works progressing from west to east. This means that receptors are unlikely affected by construction noise (from piling etc.) from both sites at the same time and in the same location.

6.68 In accordance with British Standard BS 5228-1:2009+A1:2014, the ES noise consultants (Arup) have applied the óABCômethod of assessment to establish the threshold of potential significant effect of noise at residential receptors. Under this approach, the adverse impact threshold is determined at a dwelling using the existing ambient noise level, rounded to the nearest 5dB. This is then used to determine the assessment category: A, B or C, which then defines the adverse noise impact threshold,

6.69 Predicted construction noise during the peak year of construction for Silvertown Quays (2019), is generally not significant and below the ABC thresholds at all locations. However, two of the nine monitoring locations (P2 and P6) are predicted to exceed the ABC threshold during the demolition of Block A. Paragraph 10.8.20 states:

> **“This scenario is intended to show the worst-case construction noise levels when construction work is closest to each receiver position during the initial phases of the work. It should be noted that these noise level estimates represent the noisiest activities expected during construction for a limited period (at least a month).”**

6.70 It is noted that hoardings and other acoustic shields would be used to help mitigate such óworst caseôimpacts.

6.71 It can be assumed that noise impacts from the Silvertown Quays works will not be made worse due to the construction of the CADP, as the monitoring locations (P2 and P6) are located towards the western-most part of the site, these being the furthest from the Airport site.

6.72 Furthermore, the proposed CADP noise impacts beyond the site boundary are likely to be less than 55 dB LAeq (both during the day and night ((See CESA Section 4), and therefore not significant. Site specific mitigation together with the proposed general principles of construction site noise management for the Silvertown Quays (as set out in the project CMS) and for the CADP (set out in the Framework Construction Noise and Vibration Mitigation Management Strategy (CNVMMS) Appendix 4.4), will ensure that closest noise sensitive receptors will not be subjected to significantly elevated noise levels during construction.

6.73 It is noted that the development of Silvertown Quays will actually serve to attenuate noise effects, by providing screening between the noise sources and potential sensitive receivers. This would include construction of buildings adjacent to the main vehicular access entrance at the Mill Road roundabout in order to shield the adjacent Britannia Village properties during subsequent stages of construction, as well as works to and within Pontoon Dock or any construction works further east of the proposed development.

6.74 Traffic noise associated with the peak construction year (2019) at Silvertown Quays and additional traffic on the surrounding roads would result in noise changes of less than 1 dB(A), as reported in Chapter 10: Noise of the Silvertown Quays ES (paragraph 10.8.34). As stated above, this assessment was informed by the traffic model which takes account of the proposed development traffic in addition to the traffic from all cumulative developments in the study area including the CADP.

Silvertown Quays Cumulative Effects during Operation

6.75 Generally, cumulative impacts stated within the individual Chapters of 3-16 of the Silvertown Quays ES are either ‘negligible’ or in some cases ‘beneficial’, such as for concluded in the Socio-Economic assessment. A summary of the main operational effects, and their potential to give rise to cumulative effects with the operational CADP is provided below.

Socio-economic Effects

6.76 With regard to cumulative socio-economic effects, Chapter 11 of the Silvertown Quays ES concludes the following (paragraph 11.8.12):

> **“Overall these schemes, along with the proposed development, would deliver new housing, generate employment meeting local and regional government targets set for the area which together would have a beneficial effect in terms of socio-economics.”**

Aquatic Ecological Effects

6.77 Chapter 6: Aquatic Ecology, describes the likely significant effects of the completed scheme on aquatic ecology. Potential effects are identified at ES Paragraph 6.2.2 as follows:

- **loss and/or modification of aquatic habitat arising from the construction of supporting piers and/or any modification;**
- **encroachment of the dock frontage;**
- **surface water runoff into dock water bodies;**
- **shading caused by dockside constructions, pontoons and any additional floating structures.**
- **light pollution from quayside development; and**
- **elevated noise and visual disturbance from quayside development usage.**

6.78 The ES authors identify that the remodelling of Pontoon Dock will inevitably have a ‘significant adverse impact’ in the short to medium term at a local level (Paragraph 6.9.30 – 6.9.31). However, a range of habitat enhancement measures are proposed as part of the development in order to increase the capacity of the redeveloped dock to support viable populations of animals and plants, including invertebrates, fish, insects and emergent plants (as set out in paragraphs 6.9.31 to 6.9.48). Such measures include the repair, modification and replacement of the existing dock walls to enhance the ecological value of these structures and artificial fish spawning sites. These are complementary measures to the artificial fish refugia proposed under the CADP and could lead to a long term positive impact on ecology of the Royal Docks as a whole.

Terrestrial Ecological Effects

6.79 Ecological and landscape elements have been embedded into the design of the Silvertown Quays to "*protect, maintain and where possible enhance biodiversity on site*". However, due to the close proximity of the Airport all habitat creation measures will need to comply with the safeguarding requirements of the Airport and the CAA in order to reduce the risk of bird strike. Therefore, no significant cumulative effects are envisaged.

Transport Effects

6.80 The Transport Assessment (TA) and corresponding chapter of the ES (Chapter 14: Transport) supporting the Silvertown Quays planning application jointly present an assessment of the direct and indirect effects of the completed development on the demand for all transport modes including highway, public transport, walking, cycling, car parking and servicing. The forecasts are based on the maximum floorspace for each land use type, which is likely to overstate the realistic maximum travel demand by around 20%.

6.81 Trips generated by the nearby committed developments have been included in the public transport and highway assessments undertaken. It is understood that Arup used the most up-to-date traffic flows provided by Vectos (LCY and ABP's transport consultants) which include the predicted traffic flows from the CADP and other committed schemes. Therefore, the effects of the committed developments have been assessed cumulatively in the 'base case' traffic model. ES Paragraph 14.9.7 confirms this:

> **"Trips generated by the nearby committed developments have been included in the public transport and highway assessments undertaken. Therefore the effects of the committed developments have been assessed cumulatively.**

6.82 During operation of the completed Silvertown Quays development there would be an increase in the number of trips travelling to and from the site on each mode of transport. It is concluded that the effect on the highway network would be 'negligible' and the parking proposals are considered to be adequate to alleviate any increase in on-street parking demand.

6.83 The ES states that the increase of North Woolwich Road to two lanes in each direction ("*which is being considered by the authorities*") would also mitigate the effects of the proposed and cumulative developments on the highway network, leading to a residual 'negligible' effect.

6.84 The Docklands Light Railway (DLR) is expected to experience a modest increase in passenger numbers. However, the proposed DLR service operating at Pontoon Dock is considered to have sufficient capacity to accommodate the travel demand associated with the site. Therefore, mitigation measures for the DLR are not considered necessary.

6.85 Buses are expected to experience various effects from increased demand as a result of the proposed development, other cumulative schemes and Crossrail. The ES states that "*work is therefore on-going with Transport for London to provide an appropriate improvement package to mitigate effects so that the potential effect on bus capacity is negligible*".

6.86 Pedestrian and cycle routes have been included in the scheme to improve sustainable travel initiatives. Furthermore, the increase in car parking and initiatives set out in the Applicant's Travel Plan would encourage bus and cycle use, thereby leading to minor beneficial effects.

6.87 In view of the above, it can be deduced that there will be no significant adverse cumulative effects on any mode of transport due to the combination of the CADP with the Silvertown Quays development once these schemes have been built out. With respect to traffic generation on the highway network, the initial conclusions of the TA and ES supporting the CADP application remain valid; namely (paragraph 18.48):

> **"The junction capacity assessment predicts traffic flows at junctions within the study area under future built out development scenarios. The assessment concluded that there is sufficient capacity at the junctions assessed to adequately deal with the Airport and future developments. It is considered that the traffic impact assessment is robust and the impact of the development traffic on the local highway network in the context of future cumulative development in the area is acceptable."**

Air Quality

6.88 Arup has undertaken an assessment of operational air quality effects of the Silvertown Quays development in relation to two key vehicle-generated air pollutants, namely nitrogen dioxide (NO2) and fine particles (PM10). Atmospheric dispersion modelling was used to predict air pollutant concentrations at sensitive receptors such as houses, schools and medical facilities with and without the proposed development in place.

6.89 This assessment was applied to both the interim opening year (2019) and when fully built out (2026). LBN's designated Air Quality Management Area includes the North Woolwich Road to the south and east of the Silvertown Quays site. However, air quality is expected to improve as a result of continuing emission controls on vehicles and other initiatives and consequently pollutants concentrations will be lower by the year of opening of the scheme (2019).

6.90 The traffic generated by all committed developments in the study area (including the CADP) has been has been factored into the traffic scenarios assessed in the air quality model (ES paragraph 3.9.2). As such, any cumulative or interactive effects associated with traffic generated by the combination of the Silvertown Quays scheme, the operational CADP and other future developments have been accounted for in the main air quality modelling results.

6.91 The results show that NO2 and PM10 concentrations during the operation of the proposed development are forecast to remain below their respective air quality standards at all receptors in the two future assessment years (2019 and 2026) Therefore, impacts are likely to be negligible (paragraph 3.11.2). As no significant air quality effects have been identified from the operation of the proposed development, no mitigation measures are proposed.

6.92 This conclusion closely mirrors the CADP ES, with Paragraph 18.40 stating:

> **"The Silvertown Quays site is currently partly encompassed by LBN's AQMA (Connaught Bridge and North Woolwich Road). The combined air quality effects on the AQMA from increased concentrations of NOx from the increase in traffic flows on the local road network are considered to be negligible or minor adverse (at worst)."**

6.93 The above assessment was based on the previously consented scheme at Silvertown Quays (Ref- 12/01234/FUL). However, the effects arising from traffic emissions from the operation of the new scheme are not anticipated to be significantly greater, as the development trip rates for the C1, D1 and D2 land-use classes are within their respective benchmarks.

Noise

6.94 In order to assess the likely impact of the proposed Silvertown Quays development, noise and vibration levels have been assessed for an interim year of 2023 when part and development will be built out and for 2026 for the completed development in operation. The existing noise climate was determined by site survey in February 2014. The main noise sources were recorded as being “*traffic from surrounding roads and aircraft approaching or departing London City Airport to the east of the site, which dominate the noise climate for short periods*”.

6.95 Future noise levels on the Silvertown Quays site have been considered taking into account the worst-case contribution from aircraft noise and to allow for expected future increases in noise impact from aircraft movements, This is based on the CADP ES noise contours submitted as part of the 2013 planning application, for the year 2023 (paragraphs 10.4.5. 10.8.6 and 10.8.10).

6.96 A detailed ‘Site Suitability Assessment’ is provided in the Silvertown Quays ES (paragraphs 10.8.8 to 10.8.14) to account for the projected ‘with CADP’ air noise contours and how these dictate the need for acoustic treatment of the proposed buildings within each noise contour- ranging from 63 to 69dB $L_{Aeq,16h}$ across the site (noting that only a very small area in the north-east corner of the site falls into the 69dB air noise contour and that the illustrative masterplan drawings within the DAS (Fletcher Priest Architects, July 2014) indicates that no buildings are proposed here).

6.97 This assessment concludes that the building envelopes throughout the development will need to have a high acoustic performance to reduce external noise levels by between 32 and 40 dB(A) within the masterplan area, with the higher acoustic performance requirements being applicable to the development zones closest to the Airport. In particular, the proposed school which is proposed in Phase 4 (2022 – 2026) and appears to be located in Development Zone 6 in the northeast corner of the site, is indicatively sited “on the 66 dB $L_{Aeq,16hr}$ noise contour” (i.e. the 2023 With CADP contour). The ES authors thereby acknowledge that substantial noise mitigation measures will need to be implemented to achieve an acceptable noise environment for this school (paragraph 10.8.13). Such mitigation will be defined at the detailed planning stage in accordance with Building Bulletin 93 and the draft “Acoustic Design for Schools” 2014 document.

6.98 Traffic noise changes associated with opening year operational traffic flows and additional traffic on surrounding roads would result in noise changes of less than 2 dB(A) (paragraph 10.8.35). This includes traffic resulting from other developments proposed in the locality (i.e. including the CADP). Night-time traffic flows are estimated to increase by less than 5%. Operational road traffic noise effects would therefore not be significant.

6.99 For the development in operation, noise attenuation measures would be delivered through the detailed design of buildings. It is considered that the operation of the development would, following the implementation of proposed mitigation measures, be of ‘negligible’ significance with respect to noise and vibration. Consequently, all impacts associated with the proposed development have been rated as “not significant” with incorporation of the relevant mitigation measures (paragraph 10.11.1).

6.100 It can be concluded from the above analysis that the ES for the proposed Silvertown Quays development has taken a careful and proper account of the existing and future "worst case" noise environment associated with the CADP. Notwithstanding, the proposed uses of the site are deemed suitable as long as adequate mitigation measures are incorporated at the detailed design stage.

6.101 No significant cumulative noise effects from the operation of the development with the CADP have been identified and therefore no other additional mitigation measures are considered necessary.

Summary and Conclusion

6.102 In summary, the Silvertown Quays ES considers cumulative schemes within each technical chapter of the ES prepared by Arup. It is evident that the CADP has been built into the traffic model, noise assessment and other 'base case' assumptions used in the EIA. In all cases the ES concludes that there will no significant adverse cumulative impacts and that individual impacts will generally be of no greater magnitude than those arsing from the developments in isolation (i.e. there would be no additive effects).

6.103 The CADP ES (July 2013) considered the 2007 consented Silvertown Quays scheme (planning ref.14/01605/OUT), which was assessed in the various technical chapters of the ES and within Chapter 18: Cumulative Effects. This earlier scheme proposed approximately 2,000 more residential units than the current planning application (i.e. 5000 compared to a maximum of 3,033 units now) which means that the number of residential units within the 57dB air noise contour will reduce, as described in Section 6 (g) of this CESA.

6.104 Whilst the new Silvertown Quays scheme proposes a range of additional commercial uses, it can be concluded that the cumulative impacts previously assessed would not be made worse. Moreover, as stated within CADP ES Table 18.3, all cumulative impacts are likely to be of 'negligible' magnitude, with the exception of Air Quality where the impact is considered to be 'negligible to minor adverse' at worse. It is therefore considered that the conclusion of the July 2013 ES remains valid.

ii. Fox & Connaught Hotel

6.105 The Fox & Connaught hotel is a new proposal since the CADP ES and its subsequent Addenda (ESA, March 2014 and ESSA, May 2014) were completed. Therefore, the cumulative effects of this smaller development have been considered, as requested by LBN

6.106 The planning application (Ref: 14/00986/FUL) for the Fox and Connaught scheme was submitted to LBN by Darren Law Architecture on 8th May 2014. This proposes an 84 bedroom hotel, 33 parking spaces and associated landscaping on a site to the west side of Connaught Bridge. The proposed development is located on an unused brownfield site within the curtilage of The Fox public house, a Grade II Listed Building.

6.107 The proposal was not deemed to be EIA development due to its relatively modest scale (i.e. falling outside of the indicative screening thresholds for EIA). However, a series of individual technical assessments were undertaken and submitted in support of the planning application. These include: a Daylight and Sunlight Assessment; Flood Risk Assessment; Heritage Statement and, a Transport Statement.

6.108 RPS has reviewed these reports and considers that there will be no cumulative effects with the CADP scheme on account of the fact that the identified effects of this hotel scheme are insignificant and generally do not extend beyond the site boundary or its immediate locality. Construction effects will also be negligible in the context of the many larger developments proposed for the Royal Docks area and the distance of the site from the Airport (approximately 350m to the northwest).

6.109 The Planning Statement supporting the application acknowledges that the site falls within the 57dB air noise contour of the Airport, as stated in Paragraph 3.11:

> **"It is considered this matter can be dealt with by a suitable Planning Condition as it is clear that buildings within the Zone are acceptable in principle. A noise assessment will be prepared if the application is successful."**

6.110 In conclusion, due to the size and nature of the development, there is little reason to suggest that any cumulative construction or operational impacts would occur in combination with the CADP. However, in response to LBN's request, the hotel has been included in the updated air noise cumulative assessment presented in section (d) below.

iii. ABP Royal Albert Docks Scheme

Introduction

6.111 The cumulative effects update included in the CADP ES Second Addendum (ESSA, May 2014) considered the potential cumulative effects of the ABP Royal Albert Dock in some detail, at the request of LBN. For the sake of completeness, this earlier assessment is re-presented below with minor amendments to account for the further information contained in this CESA (e.g. with regard to the reduction OOOH working hours).

6.112 At a meeting with the Council on 21st March 2014 the Airport was also requested to consider two variants of the ABP scheme – the first being the planning application scheme which derives a population of c. 1300, and the second with a population of c. 1,600 people assuming the Council's preferred tenure of 35% affordable housing and 39% family units (3 bedroom). This sensitivity test only applies to the assessment of air noise impacts as set out in the updated air noise effects section below.

6.113 RPS has reviewed the ES prepared by URS Infrastructure & Environment UK on behalf of the ABP (Royal Albert Dock - Environmental Statement Volume I; Hybrid Planning Application, Spring 2014), in order to identify whether any significant environmental effects identified in that document would have any additive, subtractive or synergistic cumulative effects in combination with the CADP. This has included a detailed appraisal of both the individual topic-based ES chapters (Nos. 5 to 16) as well as URS's consideration of cumulative effects (Chapter 18: Cumulative Effects).

6.114 The Airport was consulted at an early stage in the preparation of this planning application and on aspects which determined the scope and datasets used in the EIA. This dialogue has assisted URS/ ABP in their appreciation of how the existing and future environment around the Airport (particularly air quality, noise and road traffic) would influence the Royal Albert Dock site. Accordingly, the ABP ES and the conclusions reached therein are founded on a full understanding of how the Airport will develop over time, both with and without the CADP, including the realisation of the 120,000 annual movement limit under the existing 2009 planning permission (Ref. 07/01510/VAR).

6.115 The involvement of the Airport's transport consultants (Vectos) in the ABP project has also ensured that the traffic model for the proposed scheme builds-in the projected base flows resultant upon the construction and operation of the CADP. This ensures that the assessment of the corresponding environmental effects, such as traffic-borne air quality emissions and noise, take account of the base flows with the CADP built out.

6.116 It is noted that, following the submission of the ES, two Regulation 22 requests for further information were issued to the Applicant by LBN. LBN's first request on the 22nd May 2014, identified that no Flood Risk Assessment (FRA) had been submitted with the application. This FRA was subsequently submitted to LBN on the 28th May 2014.

6.117 A second Regulation 22 request was sent to the Applicant on 13 June 2014 requiring the submission of further information in support of Chapters 6 (Waste and Recycling), 9 (Air Quality), and 15 (Wind Microclimate). This further information, along with other matters of clarification was submitted by URS to LBN on 4 July 2014. None of this information was considered to have changed the overall conclusions of the ES. Having reviewed this further information, RPS has concluded that this has no bearing on the cumulative effects assessments (presented below).

6.118 In addition to the ES, the ABP planning application also included a separate Aviation Safeguarding Assessment (Avia Solutions Group, March 2014) which acknowledges the constraints placed on the development by the existence and future growth of the Airport, including the Obstacle Limitation Surfaces (OLS), bird strike management and noise. The ES also refers to this at paragraph 3.18, concluding:

> **"Minimising the attractiveness of the Site to birds will also require further consideration during more detailed design of individual buildings, as well as factors such as lighting, microclimate and magnetic environment to ensure that these do not impede on the operations of the airport".**

6.119 In relation the consideration of navigational aids and bird hazard, two planning conditions have been suggested by the Airport for the ABP proposal, as detailed within LBN's Strategic Development Committee report (23rd July 2014). In considering the navigational aid equipment, the Airport requested that the following condition should be imposed:

> **"Prior to the commencement of each phase of development a technical safeguarding assessment shall be undertaken and shall be undertaken and shall be submitted to and approved in writing by the local planning authority in consultation with London City Airport. The technical safeguarding assessment must demonstrate that construction of the relevant phase will not adversely affect the ability to install and operate effectively a "Category 2" Instrument Landing System as well as future satellite based positioning equipment aids at London City Airport and will not adversely affect the operation of the current "Category 1" Instrument Landing System DME, NDB and all radio based aircraft communication systems in use at the Airport."**
>
> **Reason: To protect the current and future safety and efficiency of aircraft operations at London City Airport.**

6.120 In regard to bird hazard, the Airport also suggested the following revised condition to make the position clearer:

> **"Prior to the commencement of any phase of development an assessment of risk of bird strike hazard to aircraft operating at London City Airport due to that phase shall be undertaken and shall be submitted to and approved in writing by the local planning authority in consultation with London City Airport. The assessment must demonstrate that the development does not increase the overall risk of bird strike hazard to such aircraft taking into account all bird activity within a 13 kilometre radius of the Airport.**
>
> **Reason: To protect the safety of aircraft operations at London City Airport."**

Overview of ABP ES and Cumulative Effects

6.121 It is apparent that the ABP ES is comprehensive in its coverage and addresses all of the applicable issues and topics contained the CADP ES. It also proposes compatible mitigation measures (e.g. a Construction Environmental Management Plan) to avoid, reduce or offset significant environmental effects in accordance with the requirements of the EIA Regulations. The ABP Chapter 18: Residual Effects Assessment and Conclusions (paragraph 18.42) states:

> **"In relation to noise and vibration, local air quality, cultural heritage (buried heritage assets), ecology, traffic and transportation, and energy and water use, the ES identifies a number of best practice mitigation measures to eliminate, reduce or mitigate adverse demolition and construction effects. All the mitigation measures presented within this [ES] will be further reviewed throughout the detailed demolition and construction logistics planning and throughout preparation of the CEMP. Best practicable means of preventing, reducing and minimising environmental effects through this phase of the Proposed Development will be adopted and all measures, controls and management plans will be reviewed and agreed in consultation with LBN and local residents".**

6.122 It then goes on to conclude (paragraph 18.44):

> **"During the completed and operational phase of the Proposed Development significant adverse effects are limited and relate to the following:**
>
> - **Overshadowing effects to surrounding amenity areas during the winter (negligible to moderate adverse)."**

6.123 As the new Terminal, Passenger Pier, Hotel and other structures proposed by the CADP applications are to the south of the ABP site and, in any case, too far away and not of sufficient height to overshadow the ABP development, it can be concluded that there will be no worsening of this singular 'significant adverse effect'. In recognition of this, the topic of 'Daylight, Sunlight and Microclimatic Effects' was scoped out of the CADP EIA in agreement with LBN through its scoping opinion of October 2012 (see CADP ES Chapter 3, Table 3.4: Scoped Out Issues).

6.124 Paragraph 18.43 of the ABP ES provides a summary of the positive effects of the ABP scheme (in isolation):

"Once completed, the Proposed Development will result in the following significant beneficial effects:

- **Townscape and visual impacts, specifically effects on views, townscape character areas and townscape setting of heritage assets (permanent, minor to moderate beneficial).**
- **Socio-economics, specifically in relation to creation of jobs and increase in spending (major beneficial) and contribution to housing targets (moderate beneficial);**
- **Water resources, drainage and flood risk, specifically in relation to improvement to flood risk (moderate beneficial); and**
- **Wind, specifically wind conditions within Phase 1A (negligible to moderate beneficial)"**

6.125 With the exception of wind conditions (which are not relevant for the reasons stated above) the CADP will provide many of the same beneficial environmental and socio-economic effects and of a similar scale of significance, as detailed in the July 2013 ES Chapter 19: Summary of Mitigation and Residual Effects. It can therefore be concluded that the aggregation of these effects from the ABP and CADP schemes will provide further net benefits to the Royal Docks area and the wider community.

Relevant Conclusions of ABP/ URS's Cumulative Effects Assessment

6.126 URSô assessment of Type 2 cumulative effects is set out their ES Chapter 17: Cumulative Effects Assessment. Table 17.4 of that chapter provides a list of cumulative schemes which were considered by URS and ABPó other technical consultants, as well as indicating which topics were ó scoped-inô and which were ó scoped-outô of the assessment. The table includes the expansion of the Airport under its existing 2009 planning permission (item 16) as well as with CADP1 (17) and with CADP2 (18). With the exception of microclimate, all relevant EIA topics are covered in the assessment.

6.127 The chapter contains discrete sub-sections on ñLCY Ground Noiseò and ñLCY Air Noiseò which conclude the following:

"In the planning application [CADP1], the change in ground noise due to the proposed infrastructure changes was predicted as being 0.4dB at the RAD site. A change in noise level of this magnitude is not considered to have a meaningful effect on glazing requirements for proposed buildings. Consequently, it can be concluded that ground noise as a result of improvements to LCY infrastructure will not affect glazing recommendation for buildings in the Proposed Development" (paragraph 10.2 (sic)), and

"Specific requirements for glazing and mechanical ventilation systems should be designed to achieve suitable internal noise levels. However, it has been demonstrated that glazing specifications can be installed to meet the BS 8233 'good' criteria for the façade areas with the highest noise levels" (paragraph 17.76), and

"Overall, it is considered that through the use of appropriate design measures such as glazing specifications and façade insulation design, ambient noise affecting the proposed residential areas will be controlled such that the Site is suitable

for the proposed use, should the London City Airport proposals be approved and built out". (paragraph 17.77)

6.128 Other cumulative effects are presented on a topic-by-topic basis but dealt with more generically, with the CADP scheme considered together with the other cumulative schemes which were identified by URS.

ABP Royal Albert Docks Cumulative Effects from Construction

6.129 During the demolition and construction phase, cumulative effects are generally concluded to be ónegligibleô or óminor adverseô which is consistent with the levels of effect for the ABP scheme in isolation (i.e. there is no worsening of effects). URS conclude that there could be up to ómoderate adverseô effects from the generation of construction waste (paragraph 17.48), noise (para. 17.66) and groundwater/ contamination (17.83). There are also concluded to be some positive cumulative effects during this stage, including ómoderate beneficialô socio-economics/ employment effects (paragraph 17.55). No ómajorô adverse cumulative effects are identified.

6.130 These conclusions closely mirror those presented in the CADP ES, in both Chapter 18: Cumulative Effects and the component technical chapters 7-16. However, as stated above, the URS assessment is not solely related to the combined impacts of the ABP scheme plus the CADP. As such, the noise and other construction impacts should be considered taking account of the proximity of shared receptors, the coincidence of the respective construction programmes and the likely effectiveness of the mitigation measures which, for the CADP, are those set out in the Consolidated ES Chapter 6: Development Programme & Construction (November 2014), supplemented by further details in Section 2 of this CESA.

6.131 Chapter 5 of the ABP ES: Demolition and Construction, sets out a range of construction mitigation measures which appear comprehensive and compatible with the Airportøs own construction environmental management proposals and commitments. ABP are clearly aware of the need to minimise impacts on the Airport itself. For instance, paragraph 5.70 states:

> **"The receptors considered to be most sensitive to cumulative effects during the construction phase is LCY……etc",**

6.132 ABP ES Figure 5.1 (Hybrid Planning Application Indicative Construction Phasing Programme) provides detail on the phasing of the development and identifies different peaks of activity during the 13.5 year construction programme (2014 to 2028). Paragraph 5.23 states the following:

> **"Owing to the long construction period (approximately 13.5 years) and the various phases of construction on the Site, three sequences and "timeslices" across the programme of works have been defined to inform the EIA. Each timeslice represents points in time when multiple works (and in the majority of cases, occupation) are likely to occur across the Site. The ES, where relevant to the assessment of demolition and construction related effects, has assessed the potential effects occurring at each of the three representative timeslices as follows:**
>
> - **Sequence 1: 3rd quarter of 2017 when infrastructure and utilities works, and Phases 1A and 1B (together accounting for approximately one third of the overall Site) are under construction and potential for occupation of some of the earlier buildings in Phase 1A;**

- **Sequence 2: Mid 2020 when Phases 1A, 1B, 2 and 3 are all under construction, with some occupation likely in the earlier buildings of Phases 1A, 1B and 2; and**
- **3rd Quarter of 2023 when Phases 1A, 1B and 2 are completely finished (assumed to be occupied), and phases 3 and 4 are under construction”.**

6.133 As shown on the corresponding CADP *Improved Construction Programme* (Appendix 2.1), there will inevitably be some overlap in construction activities identified in the construction programme. However, there are several factors that act to reduce or mitigate for the likelihood of significant cumulative impacts occurring, namely:

6.134 The ABP construction areas will be shielded/ enclosed by suitable hoarding and other measures will be taken to reduce noise at source because of the proximity of nearby sensitive receptors, including residents to the north and east and the LBN Council offices which sit in the centre of the development site. Therefore, significant noise impacts from these works are highly unlikely to be experienced at locations further away, including residential properties at the south side of KGV Dock. Moreover, the temporary construction noise barrier along the southern boundary of KGV Dock will provide some additional protection from noise and visual impacts from the ABP development as well as from the CADP construction.

6.135 The ôBook of Noise Mapsô contained in Appendix 4.1 of this CESA, reveal that the north side of the Royal Albert Dock will not be exposed to significant noise levels from the CADP works;

6.136 ABP anticipate that the core working hours for both the demolition and construction phases would be 08:00 ï 18:00 hours weekdays; 08:00 ï 13:00 hours Saturday; with no working normally undertaken on Sundays or Bank Holidays (para 5.3); whereas some elements of the CADP construction works will still take place Outside of Operational Hours (OOOH) i.e. after 18:00 and before 08:00 on weekdays and at weekends from 13:00 Saturday to 12:00 on Sunday, for the reasons explained in Section 3 of this CESA.

6.137 The construction ôpeaksô for the CADP works do not coincide with the ABP construction ôtimeslicesô as described above; and

6.138 By time the first residential blocks in the ABP scheme are occupied (assumed to be after 2020) all major construction works for the CADP will have been completed.

6.139 In light of the above factors, it is considered that the cumulative construction impacts from the CADP and ABP schemes will be no worse than ***minor adverse***.

ABP Royal Albert Docks - Cumulative Effects from Operation

6.140 The ABP ES concludes that cumulative effects during the operational phase of the scheme (assessed as the final completion date of 2028) will be largely ôbeneficialô or ônegligibleô

6.141 With regard to air quality, paragraph 17.62 states:

> **“The traffic data provided includes the influence of local committed and cumulative developments (including that of the London City Airport Expansion), therefore the cumulative air quality effects have been considered in the assessment and these are considered to be of negligible significance”.**

6.142 With regard to noise, paragraph 17.70 states:

> **"An assessment has been done of the potential effects of the proposed extension of the London City Airport on the future occupants of the Proposed Development (which may result in increases in noise due to air and ground noise), and the mitigation measures that will need to be incorporated into the Proposed Development to ensure the required noise levels are met, resulting in a negligible effect".**

6.143 The ABP ES states that there will be a ‘minor adverse’ effect on built heritage (para 7.96) but this appears to relate to the scheme’s own impact on the Ham Creek and to potential geo-archaeological and palaeo-environmental deposits at the site. As the ABP and CADP sites are spatially distinct (being separated by the Royal Albert Dock) there is no potential for cumulative impacts on buried archaeology, especially on account of the fact that because no contiguous archaeological feature has been recorded in the area.

6.144 There will be a ‘negligible’ to ‘minor adverse’ impact on terrestrial ecology at the ABP site from the construction (due to local habitat types and the potential presence of invertebrates) but no impact on the dock waters or ecology. Furthermore, paragraph 17.91 concludes:

> **"The cumulative effect of other schemes in conjunction with the Proposed Development is considered to be up to minor beneficial impact to the ecological receptors identified on-site at local level".**

6.145 The above conclusions are broadly consistent with those presented in the CADP ES, in Chapter 18: Cumulative Effects and the component technical chapters 7-16.

6.146 In summary, as set out previously in the ESSA (May 2014), no changes to CADP cumulative assessment conclusions have been identified after considering the information contained in the ABP ES and its subsequent Addendums.

iv. Additional consented schemes

6.147 Six other consented schemes, that were submitted for planning approval after the 2013 ES, were considered in the updated cumulative effects assessment contained in the May 2014 ESSA. These schemes are listed in Table 6.1 above and shown on Figure 6.1.

6.148 These 6 remaining schemes (collectively termed the ‘other schemes’) have also been included in the cumulative air noise effects (Section ‘g’ below) and, where applicable, in other assessment topics. However, as shown above, 5 of these other schemes (Nos. 16, 27, 28, 29 and 30) are a considerable distance away from the Airport and are physically and visually disconnected from it. Therefore, with the exception of air noise from overflying aircraft, there is a negligible risk of cumulative effects occurring.

6.149 The Land at Gallions Reach, Atlantis Avenue (No. 4 in Table 6.1) is a consented but as yet un-built development by One Housing Group on a site approximately 300m from the eastern end of the runway. This is a relatively small scale scheme (comprising 89 residential units), especially when viewed in the context of the adjoining Royal Albert Basin / IVAX Quays / Great Eastern Quays masterplan (refernce12/01881/OUT), which lies to the south and is therefore closer to the Airport.

6.150 The Planning Statement for the Atlantis Avenue development (NLP, 8th August 2012) indicates that, whilst no ES was prepared in support of the planning application, a number of technical assessments were completed, including:

- Flood Risk Assessment by Conisbee;
- Microclimate Assessment by RWDI Consulting Engineers;
- Odour Assessment by Entran Ltd;
- Daylight and Sunlight Impact Assessment by XCo2 Energy;
- Energy Statement by XCo2 Energy;
- Sustainability Statement by XCo2 Energy;
- Noise Assessment by Sandy Brown Associates LLP; and
- Ecological Survey by Ecology Solutions.

6.151 A review of the documents reveals that the design has taken full account of the proximity of the Airport (including noise levels) and that no significant environmental effects would arise which could accentuate or worsen the impact of the CADP scheme.

d) Cumulative Air Noise Effects

6.152 Chapter 8 of the CADP ES included an assessment of aircraft noise ('air noise') exposure to both existing dwellings and 'permitted but not yet built' residential developments sites.

6.153 The ES air noise assessment has been updated to include the revised dwelling numbers for Silvertown Quays and the proposed 84 hotel bedrooms in the Fox & Connaught development (recognising that hotel customers are not permanent residents).

6.154 The proposed residential units in the APB Business Park (assuming the 'worst case' occupancy of 1600 occupants (based on a scheme with a higher percentage of family housing.) have been included in this revised assessment, as described in the previous ESSA. Furthermore, the 'other' permitted developments consented since July 2013 (described above) have also been included.

6.155 For the purposes of comparison, the dwelling and population counts have been determined based on the Airport's Standard Instrument Departure (SID's) routes used in the July 2013 Environmental Statement, as opposed to the actual mean departure routes discussed in the Second ES Addendum (re-presented in Part D of this CESA).

Assessment

6.156 Table 6.2 below sets out the additional residential developments that have been included in this analysis based on the criteria described earlier (paragraph 6.9). The predicted air noise level, in terms of dB LAeq,16h is given for each, based on average mode operations at the Airport.

Table 6.2 - Air Noise Levels at Land Proposed for Regeneration and Development (dB LAeq,16h)

Development Scheme Locations	Curr.	2017	2019		2021		2023	
	(2012)		With dev.	W/o dev.	With dev.	W/o dev.	With dev.	W/o dev.
Silvertown Quays* (01)	66	68	68	67	68	67	68	67
ABP Royal Albert Docks (02)	59	61	62	61	62	61	62	61
26-34 Tidal Basin Road, E16 1AD (16)	63	61	61	60	61	61	61	61
Former Goswell Bakeries & vacant warehouses, Caxtob Street North, E16 (28)	56	57	57	57	57	57	57	57
Car Park At South East Junction Of Prestons Road And Yabsley Street, Prestons Road, London (29)	56	57	57	57	57	57	57	57
Poplar Business Park, 10 Prestons Road, London, E14 9RL (30)	56	57	58	57	58	57	58	57
Fox & Connaught Hotel, Lynx Way, London, E16 1JR (31)	60	62	63	62	63	62	63	62

* Predicted air noise levels at the Silvertown Quays site are unaltered from those presented for the ‘Silvertown A’ site in Table 8.18 of the July 2013 ES.

6.157 The above sites are additional to or modified versions of, those considered and presented in Table 8.27 of the CADP ES.

6.158 The planning permission for one development previously considered, the ‘Unex Site’, has lapsed. Consequently, this has been removed from the dwelling and population counts within noise contours, as presented in Tables 6.3 and 6.4 below.

6.159 The 89 residential units provided for in the Atlantis House development (described above) are not included as additional properties in the analysis as these were accounted for as part of the Great Eastern Quays outline scheme which was previously assessed in the 2013 ES. Finally, Site We4B Western Gateway relates to a hotel application and therefore this has also been excluded from the dwelling and population counts.

6.160 It is of relevance to consider the above sites using the previous Planning Policy Guidance for noise (PPG 24), accepting that this has now been withdrawn and replaced by the National Planning Policy Framework (NPPF). This is because PPG24 is still used in practice to inform Local Authorities on the suitability of a site for residential development, as the equivalent technical guidance is not provided in the NPPF.

6.161 Reviewing the future noise exposure of the above development sites, without CADP, finds that all but one fall into Noise Exposure Category B (NEC B). For sites that lie in NEC B, PPG 24 states that conditions should be imposed to ensure an adequate level of protection against noise. Silvertown Quays falls into Category C. PPG24 states that where it is considered that permission should be given, conditions should be imposed to ensure a commensurate level of protection against noise.

6.162 Considering the future noise exposure in 2023, with the CADP, all of these sites remain within the same Noise Exposure Category. This indicates that the CADP has no material impact on the planning status or suitability of these sites for residential development.

6.163 The number of dwellings and population, including permitted but not yet built residential developments, are set out below.

Table 6.3- Approximate number of dwellings in contours (including permitted but not yet built residential developments), LAeq,16h average mode, summer day

Scenario	Current	2017	2019		2021		2023	
Contour, $L_{Aeq,16h}$	(2012)		With dev.	Without dev.	With dev.	Without dev.	With dev.	Without dev.
57 dB	8,300	25,300	26,500	22,300	27,500	23,600	27,500	23,000
63 dB	400	4,400	4,500	3,500	4,700	3,900	4,800	3,800
69 dB	0	0	0	0	0	0	0	0

Note: Counts include up to 3,000 dwellings for the Silvertown Quays development as the latest application for this site anticipates delivering between circa 2,300 and 3,000 residential units.

Table 6.4- Approximate population in contours (including permitted but not yet built residential developments), LAeq,16h average mode, summer day

Scenario	Current	2017	2019		2021		2023	
Contour, $L_{Aeq,16h}$	(2012)		With dev.	Without dev.	With dev.	Without dev.	With dev.	Without dev.
57 dB	17,900	61,200	64,300	53,800	66,800	57,200	66,900	55,700
63 dB	1,000	11,400	11,600	9,100	12,200	10,100	12,300	10,000
69 dB	0	0	0	0	0	0	0	0

Note: Counts include population for 3,000 dwellings for the Silvertown Quays development as the latest application for this site anticipates delivering between circa 2,300 and 3,000 residential units.

6.164 Comparing the above dwelling and population counts with those presented in Tables 8.16 and 8.17 of the July 2013 ES shows only minor changes. Within the 57 dB contour, a small decrease in the number of dwellings arises. For example, in 2023 without the CADP development, the number of dwellings inside the 57 dB contour now decreases to 23,000 from 26,400. With the CADP in place in 2023, the number now decreases to 27,500 from 30,600 in the CADP ES, a reduction of 3,100 dwellings.

6.165 In summary, additional development changes that have arisen since the completion of the CADP ES in July 2013 do not materially affect the number of dwellings and population that will be affected by the CADP. Therefore, this change has no impact on the air noise conclusions of the CADP ES which still remain valid.

e) Summary

6.166 As requested in LBN's letter of 20th August, consideration has been given to the cumulative ('in combination') effects of the CADP with the most recent development proposals in proximity to the Airport, namely: the Silvertown Quays planning application for a mixed use scheme (LBN ref: 14/01605/OUT) and the Fox & Connaught hotel application (ref: 14/00986/FUL). For the sake of completeness, relevant extracts of the earlier cumulative effects update (as presented in the May 2014 ESSA) have also been re-presented in order to provide a consolidated account of cumulative effects of other major developments granted planning consent since the July 2013; in particular, the ABP Royal Docks scheme to the north of the Airport (LBN ref. 14/00618/OUT).

6.167 This updated cumulative effects assessment acts to supplement and update the CADP ES but should be read in conjunction with the July 2013 ES Chapter 18: Cumulative Effects, together with various relevant technical chapters including: Chapter 8: Noise & Vibration; Chapter 9: Air Quality; Chapter 11: Surface Transport & Access; Chapter 13: Ecology and Biodiversity; and, Chapter 14: Cultural Heritage.

6.168 As summarised in Table 6.5 below, this assessment demonstrates that none of these additional developments in proximity to the Airport will give rise to any materially different or otherwise significant cumulative effects to those as described in Chapter 18 and Chapters 7-16.

Table 6.5 Summary of Cumulative Impacts

Potential Impact Areas	Cumulative Impact Identified in CADP ES (July 2013)	Cumulative Impact accounting for additional developments granted consent or submitted after July 2013.
Socio Economics	Moderate Beneficial (except for potential adverse effect of enlarged PSZ)	Moderate Beneficial
Noise	Negligible to Minor Adverse	Negligible
Air Quality	Negligible to Minor Adverse	Negligible to Minor Adverse
Townscape and Visual	Negligible to Minor Beneficial	Negligible to Minor Beneficial
Traffic and Transportation	Negligible	Negligible
Water Resources and Flood Risk	Negligible	Negligible
Ecology and Biodiversity	Negligible	Negligible
Cultural Heritage	Negligible	Negligible
Waste	Negligible to Minor Adverse	Negligible to Minor Adverse
Ground Contamination	Negligible	Negligible

6.169 It is acknowledged that the construction works have the greatest potential to result in cumulative impacts, particularly in view of the relative proximity of the ABP and Silvertown Quays sites to the Airport and the extended duration of both construction programmes. However, for the reasons set out in this section of the CESA, such effects are likely to be no worse than ‘minor adverse’, including cumulative noise effects.

6.170 It is evident from the Environmental Statements supporting both of these major mixed-use regeneration schemes that they have been designed in full knowledge of the CADP proposals. Accordingly, the applicants have proposed appropriate designs and other mitigation measures to ensure that acceptable environmental conditions are achieved and maintained throughout the construction works and during the subsequent occupation and operation of the developments.

6.171 Consistent with prevailing environmental legislation and planning policy requirements, it is likely that the Fox & Connaught scheme and the ‘other’ developments identified Table 6.1 will adopt suitable mitigation measures to avoid any adverse effects from their construction and operation; for example, by the implementation of a Construction Method Statement (CMS), Construction

Logistics Plan (CLP) and/or Construction Environmental Management Plan (CEMP) to control traffic, noise, dust and other potential environmental effects of those works.

6.172 In conclusion, there would be no significant adverse cumulative impacts as a result of the proposed CADP in combination with the developments considered above or those assessed previously in the July 2013 CADP ES.

7 ALTERNATIVE SITES FOR THE HOTEL (CADP 2) (LBN ITEM 9)

a) Introduction

7.1 The following Section responds to LBN's Regulation 22 request for further information in relation to CADP 2 (the proposed Hotel) and has been prepared by RPS and Quod.

b) Regulation 22-'further information'

LBN Reg 22 Request: ***Chapter 4 (Alternatives and Design Evolution)*** *9) The ES does not set out consideration of alternative sites for CADP 2 – the hotel development. These need to be assessed.*

7.2 Chapter 4: Alternatives and Design Evolution of the ES is provided in accordance with the requirements of Schedule 4, Part 1 (S.2) of the Town and Country planning (Environmental Impact Assessment) Regulations 2011, which specifies that an ES should contain:

> **"An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for the choice made, taking into account the environmental effects"**

7.3 The ES Chapter describes the main alternatives considered throughout the development of the proposed CADP, along with the reasons for the final proposed infrastructure, terminal layout and other arrangements. The choice and siting of the Hotel (CADP2) was not considered to be a 'main alternative' in the context of the EIA Regulations and would, if considered in isolation, be unlikely to constitute 'EIA development'. However, in response to LBN's request, consideration has now been given to this matter, as set out below.

7.4 The on-airport hotel provision is designed to complement the overall CADP proposals, whilst supporting the needs of visitors and the general public. The Design and Access Statement (DAS) submitted in support of the proposals (Pascall & Watson, July 2013) confirms, at Page 83, that existing hotels within the Royal Docks are not located within close proximity to the Airport, being situated towards the ExCel centre, and provide a product less suited to the Airport's typical business customer profile. The proposed Hotel represents a significant opportunity to provide complementary uses at the Airport that would bring interest and activity to this part of the Docks.

7.5 The location and design of the Hotel has been influenced by the spatial requirements of the Airport site and surroundings, in addition to the needs and requirements of both the Hotel itself and the wider CADP proposals. It represents an important component of a comprehensive strategy to deliver the CADP.

7.6 Taking into account the spatial requirements of the existing Airport facilities and the CADP proposals, there is insufficient space to locate a hotel of the required size to the west of the existing terminal. It is, therefore, proposed to locate a Hotel to the east of the existing terminal and facilities. As confirmed within the DAS (Page 83), it is important to consider the future CADP context in this regard. Immediately to the east of the Airport terminal would be the redeveloped passenger Forecourt that primarily facilitates the need to swiftly transfer passengers and visiting public, both to and from public and private transport.

7.7 Existing airfield constraints are a key driver for the location and design of the Hotel with, for example, height constraints being prescribed by the ósafeguarding surfacesô surrounding the Airport which place limits on development (DAS, Page 83).

7.8 A key factor in delivering a successful hotel development to serve London City Airport is to locate it close to key components within the surroundings, including the Airport Terminal, DLR station, passenger drop-off, car parking and taxi/bus services. The Hotel will also require a floor plate large enough so that it can provide the necessary space for the building itself, associated access, servicing arrangements and landscaping requirements. As the Hotel will be within walking distance of the Terminal, passengers will not be required to take a taxi or other mode of transport to reach it, with an associated reduction in traffic and related environmental impacts. The hotel building will also be constructed and operated to the highest standards of energy efficiency and sustainable design (to BREEAM Excellent levels).

7.9 As such, the proposed Hotel is considered the most appropriate and suitable location that can meet these requirements and deliver a successful and viable airport-centred facility as part of the CADP proposals. There are also several design reasons for its specific location and overall design.

7.10 The DAS (Page 83) confirms that the Hotel location has been an important consideration in guiding future dockside development, and it will establish a building line along the historic dock edge to the east of the Airport as well as along Hartmann Road to the south. Should sites to the east of the Terminal become more developed in the future, this building line will form the basis of a new public óstreet edgeô The Hotel itself is also designed and located to smooth the transition between the industrial aesthetic of the Airport Terminal itself and the residential neighbourhoods to the south.

8 SUMMARY AND CONCLUSIONS

a) Introduction

8.1 This CESA gathers together in one place all further information and clarifications on the ES which have been provided to the London Borough of Newham (LBN) since July 2013. This includes the Airport's response to three successive requests from LBN, as set out in its letters of 21st January, 23rd May and 20th August 2014.

8.2 This volume of the CESA (Part A, Volume I) provides the Airport's response to the most recent 'Regulation 22' request of 20th August which requested further details, including the consequent environmental effects, of the following:

- The Improved Construction Programme;
- Alternative Construction Methods;
- Construction Noise and Mitigation;
- Implications of the London Airspace Management Project (LAMP);
- Cumulative effects; and
- Alternatives to the proposed Hotel (CADP2);

8.3 Volume II (Parts B and C) of the CESA contains additional information that does not form part of the formal Regulation 22, but provides important supplemental information including:

8.4 **Part B** reports on the results of an EIA Sensitivity Test which assesses a plausible aircraft fleet mix that would achieve 120,000 actual aircraft movements (120,000 noise factored) by 2023, consistent with the limits that were consented by LBN in 2009 (ref 07/01510/VAR). This is compared to the 111,000 actual aircraft movements (120,000 noise factored) forecast by 2023, which comprises the principal and 'most likely' forecast assessed in July 2013 ES. This 120,000 EIA Sensitivity Test finds that the 'likely significant environmental effects' of this movement cap being reached are acceptable and not materially worse than those presented in the ES. Accordingly, it acts to demonstrate that there is no need to impose new conditions which would reduce actual aircraft movements below the previously approved 120,000 movement cap.

8.5 **Part C** describes the future system of aircraft noise control at the Airport, as required by the Aircraft Categorisation Review (ACR) contained in the Section 106 Agreement accompanying the 2009 Permission. This part of the CESA explains why the proposed noise Quota Count (QC) is an appropriate control and would be more effective and equitable than the existing Noise Factored Movement (NFM) system in operation today.

8.6 Volume III of the CESA **(Part D)** reproduces relevant extracts of the first ES Addendum (March 2014) and the second ES Addendum (May 2014) which contained the 'further information' requested in LBN's previous Regulation 22 letters of 21st January and 23rd May 2014.

8.7 Much of the information contained in this CESA has no consequence or bearing on the findings of the original ES. Instead, it simply acts to clarify, validate and elaborate upon particular matters contained within the ES and/or to provide further project details that have been requested by LBN in the intervening period.

8.8 The vast majority of the ES text remains valid and up-to-date on account of the fact that the main findings of the EIA (completed in mid-2013), including the identification of all 'likely significant environmental effects' of the CADP proposals, are not materially altered by the further environmental information or other matters of clarification which have been provided by the Airport.

8.9 However, certain changes to the CADP proposals, in particular to the construction programme together with supplemental noise and cumulative impact assessment work requested by LBN, can be regarded as 'material' additions to the original ES. Accordingly, the July 2013 ES has now been amended to account for this further information and other minor changes. The ES is reproduced in full within the **Consolidated Environmental Statement (November 2014)** (CES) which has been submitted to LBN at the same time as the CESA. The CES includes full replacements to ES Chapter 6: Development Programme, Demolition and Construction, Chapter 8: Noise and Vibration, and Chapter 18: Cumulative effects.

8.10 The CES is summarised in a revised version of the Non-Technical Summary ("NTS of Consolidated Environmental Statement", November 2014) which has also been submitted to LBN.

b) <u>Summary of CESA Part A</u>

8.11 Section 2 of Part describes the *Improved Construction Programme* prepared for the CADP, whilst Sections 3 to 7 provide the statutory 'further information' to the ES. The specific wording of each question/ item of the Council's letter has been reproduced for reference and the Airport's response set out directly below.

8.12 Following a detailed feasibility study by the Airport and its consultants the duration and extent of Out of Operational Hours (OOOH) works have been reduced as far as practicable, taking into account the overriding engineering, operational and safety considerations which apply to the Airport. Consequently, the programme now includes the following headline reductions:

- A reduction in the amount of night time piling from 70% to 30%;
- A reduction in the duration of night time works by 21 months throughout the overall CADP construction period;
- A reduction in the number of night time construction activities and frequency of others;
- A significant reduction in the duration of night time piling of approximately 10 months (45 weeks) - reducing from 77 weeks to 32 weeks;
- A reduction in the overall duration of noisier night time deck works of over 6 months (29 weeks);
- A reduction in the number of deck work activities occurring at night, including a reduction in frequency of a number of those remaining activities at night;

- All construction activities previously occurring at night south of KGV Dock moved to daytime hours, including the construction of the hotel, car parks and forecourt works; and
- Provision of an additional temporary construction noise barrier south of KGV Dock to reduce construction noise impacts in the communities south of the Airport, including North Woolwich.

8.13 In assessing the construction methodology for the proposed future development of the CADP, the safeguarding experts at the Airport have undertaken an objective risk based assessment which has in turn informed the preparation of a construction methodology (for piling) that enables a temporary relaxation of the Transitional Surfaces (TS) of the Airport during operational hours.

8.14 However, whilst the extent and duration of such OOOH construction is substantially reduced when compared to original construction programme (i.e. compared to that presented in the July 2013 ES) certain construction activities, such as work within the airfields, must still take place when the runway and apron areas are not operational. The nature of these activities and an explanation of why they must take place in the OOOH periods is Section 3 of this CESA, in response to Item 1 of LBN's 22 letter.

8.15 Additionally, LBN has requested that the Airport consider a range of alternatives to the proposed construction methodology, including: the full and partial closure of the Airport whilst the construction works take place; the use of alternative piling techniques and plant; and, 'any other scenario'. Sections 3 and 4 of the CESA provide a detailed analysis of these alternatives and their corresponding environmental and socio-economic effects.

8.16 Four potential 'closure scenarios' of have been considered in detail by the Airport and its consultants York Aviation, the results of which are reported in full at Appendix 3.1 of the CESA and summarised in Section 3. This considers the operational and socio-economic effects of: the temporary closure of the Airport for an extended period in order to allow unimpeded construction of the CADP; partial temporary closure of the Airport during the weekend period; shorter operational hours to allow construction to take place in the morning or evening period; and, a number of further variant scenarios including closure of the Airport during August and at Christmas when there are fewer business passenger using the Airport.

8.17 The analysis demonstrates that all of these suggested scenarios would have significant socio-economic impacts (i.e. loss of airlines business, loss of revenue to the local economy, and loss of local jobs). Furthermore, in the context of the *Improved Construction Programme* (with considerably reduced out-of-hours working, night-time noise and associated impacts, as described above) such restrictions are neither necessary nor proportionate to the socio-economic harm that temporary closure or reduced operational hours at the Airport would cause. In conclusion, the impacts arising from either weekend closures or restricted operating hours are considered to be completely disproportionate to any reductions in the OOOH programme.

8.18 In response to the fourth category 1(iv) 'Any other scenarios', Section 3 of the CESA considers a range of alternative construction methods which have been examined and dismissed by the Airport on the grounds of engineering feasibility, impact on programme, safety, cost, breach of planning policy and/or environmental impact. These include: damming and draining KGV Dock entirely; partially draining the KGV, Victoria and Royal Albert Docks (to different levels of up to -5m depth); placing Caissons (watertight retaining structures) in the Dock to create a base for the new Apron deck; and filling the Dock entirely with earth/ aggregate instead of piling.

8.19 None of these radical alternatives are considered to be acceptable or practical for the reasons given in Section 3.

8.20 The CESA then provides a review of alternative piling techniques and associated activities that have the greatest potential to generate noise. The piling techniques have been ranked in relation to practicality, programme, financial, operational and safety factors. It considers a wide range of alternative techniques to identify and evaluate those which could be practicable and, ultimately, lead to an improvement in terms of the night time programme and noisy works. To inform this study, extensive discussions have taken place with consultants, contractors and suppliers who work in the relevant industry.

8.21 This exercise resulted in three short-listed piling options - Vibro Piling, Rotary Bored Piling and Giken Piling, which were then assessed by the Airportôs noise consultants Bickerdike Allen Partners (BAP) in order to investigate their potential noise impacts, and the effect on programme, based on the principle of Best Practical Means (BPM).

8.22 This analysis demonstrates that the use of Vibrodriver Casing & Rotary Bore piling, representing the preferred methodology for the CADP (i.e. the base case), clearly performs better than all other options considered.

8.23 In response to Item 2 of LBNôs letter, BAP has reassessed the resultant day and night time construction noise levels as óabsoluteô levels in accordance with the required methodology (British Standard BS5228) and have also calculated the óworst caseô 15 minute reference period for night time noise to retain consistency with the original ES.

8.24 This assessment re-produces a òBook of Noise Mapsô (Appendix 4.1), as an update to the noise maps produced as part of the ESA. These maps indicate, in 3 month slices of time throughout the construction of the CADP, the noise levels expected at a typical bedroom receptor height for the OOOH periods identified in *the Improved Construction Programme.* They are based on a 15 minute assessment period and include noise effects from the haul road that extends along Hartmann Road East in order to be consistent with the noise assessment presented in the ESSA. The assessment also considers all construction activities throughout the CADP construction, as opposed to focussing solely on the potentially noisier works such as the piling and deck works.

8.25 Based on the *Improved Construction Programme*, this assessment has reviewed in further detail the number of receptors and the extent to which they are likely to be affected by construction noise over the key noise-producing periods, including during OOOH works (night time and weekends). In addition, it has taken account of the extensive noise mitigation measures that are being offered as part of CADP and as set out in the ES, ESA and ESSA to safeguard the amenity of the surrounding community.

8.26 With the offered mitigation, the residual construction noise effects will give rise to a ***negligible*** impact during daytime operational hours and ***minor adverse*** impact during Out of Operational Hours.

8.27 The re-assessment of night construction noise has found that, for the majority of the construction period, only a small number of receptors to the south of the airport may exceed noise levels in excess of 55 dB $L_{Aeq,15min}$. These are generally high level (2nd floor and above) receptors of properties closest to the works. A more significant number are exposed to levels between 50 and 55 dB L_{Aeq}. These receptors are predominately the Westland, Queensland and Dunedin House flats which overlook the Airport. These have already been treated under the Airport's earlier Sound Insulation Schemes and only a very small minority of the occupants of these flats (12 out of 233) refused access to install the insulation measures. This means that, in practice, the vast majority of these properties will already be protected as a result of treatment under the Airport's (First Tier) Sound Insulation Scheme (SIS). Moreover, the Airport has already committed to offering those properties that previously refused the Airport's offer, exposed to night time construction noise levels in excess of 50 dB $_{LAeq,}$ a further opportunity to accept the works ahead of carrying out noisy night time works.

8.28 With the exception of the properties at the eastern end of Woodman Street, no significant adverse road noise impacts are predicted. Properties in Woodman Street will only be exposed to minor absolute levels of road traffic noise and will have qualified for noise protection treatment under the Airport's Sound Insulation Scheme. The residual road traffic noise impacts have been assessed as ***negligible adverse***.

8.29 The above revised noise assessments are incorporated into the replacement ES Chapter 8 which is presented on the Consolidated Environmental Statement (November 2014).

8.30 Item 4 of LBN's letter requested further information in relation to effectiveness of proposed mitigation measures, including construction noise barriers. Therefore, noise reduction from the new Temporary Construction Noise Barrier has been modelled by BAP and the results are presented in Appendix 4.5. The location, appearance and outline acoustic specification for this barrier are provided at Appendix 4.2. It is expected that the final details of this barrier will be secured by condition.

8.31 In response to Item 5 of LBN's letter, Section 4 of the CESA also provides an evaluation of the practicality of a range of additional, more localised noise mitigation measures (such as screens around piling rigs) and identifies those which, subject to feasibility testing, will be employed by the appointed Contractor.

8.32 Various monitoring, management and mitigation measures to be implemented by the Airport and its Contractor throughout the CADP works are described within the 'Framework Construction Noise and Vibration Management and Mitigation Strategy' (CNVMMS). The CNVMMS describes how the contractor will be bound by a rigorous specification relating to the control of noise and vibration of all demolition and construction works associated with the CADP. This will include contractual obligations to ensure that they use plant in compliance with relevant standards and put in place BPM to comply with stringent noise and vibration limits at the boundary of the site.

8.33 Section 5 of the CESA describes the recent advancements in London Airspace Management Plan (LAMP) in regard to how this will influence flight paths in the immediate airspace around the Airport. It then considers the potential environmental effects (noise and air quality) consequent upon this change. This indicates that the air quality impacts would remain 'insignificant' and not be materially different from those identified and reported in the ES for the Principal Assessment Year of 2023. With regard to air noise, the assessment indicates that there is no material difference between the areas of the key noise contours and the dwelling and population counts contained within them; whether calculated from the Airport's published SIDs (as used in the ES) or the mean actual departure tracks as determined from the Airport's noise monitoring and flight track keeping system and in line with those proposed under LAMP. As a result, the conclusions concerning air noise in the noise chapter (Chapter 8) of the ES remain unchanged as a result of this analysis.

8.34 Section 6 of the CESA provides a consolidated update to the cumulative effects assessment presented in Chapter 18 of the July 2013 CADP ES, as well as the ES technical chapters dealing with noise, air quality, transport and traffic ï especially in regard to óin-combinationô construction effects. A total of nine additional developments have been identified since the completion of the July 2013 ES which may have the potential to generate cumulative effects in combination with the CADP. However, this assessment demonstrates that none of these additional developments will give rise to any materially different or otherwise significant cumulative effects to those as described in the ES.

8.35 The assessment of air noise impacts in the cumulative effects assessment update shows only minor changes to the dwelling and population counts within the noise contours, as compared to those presented in the July 2013 ES. Within the 57 dB contour, a small decrease in the number of dwellings arises. For example, in 2023 without the CADP development, the number of dwellings inside the 57 dB contour now decreases to 24,500 from 26,400. With the CADP in place in 2023, the number now decreases to 29,000 from 30,600 in the CADP ES, a reduction of 1,600 dwellings.

8.36 Additional development changes that have arisen since the completion of the CADP ES do not materially affect the number of dwellings and population that will be affected by the CADP. Therefore, this change has no impact on the air noise conclusions of the CADP ES which still remain valid.

8.37 The choice and siting of the Hotel (CADP2) was not considered to be a ómain alternativeô in the context of the EIA Regulations and would, if considered in isolation, be unlikely to constitute óEIA developmentô. However, in response to LBNõs request, consideration has been given to this matter, as set out in section 7 of the CESA. This demonstrates that the proposed location for the Hotel is appropriate and suitable to deliver a successful and viable airport-centred facility as part of the CADP proposals. There are also several design reasons for its specific location and overall design.

c) <u>Conclusion</u>

8.38 This Part of the CESA (Part A) provides the commensurate ófurther informationô requested by LBN in its letter of 20th August 2014.

8.39 Overall, the impact of the *Improved Construction Programme* and other further information requested by LBN do not give rise to any new or materially different ólikely significant environmental effectsô in comparison with those considered under the July 2013 ES. However, the duration and extent of construction noise and other effects is now predicted to be less. Furthermore, additional mitigation measures are now proposed, including a 3 metre high Temporary Construction Noise Barrier to the south of KGV Dock and a range of controls and commitments set out in the Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS). The Airport has already committed to offering those properties exposed to night time construction noise levels in excess of 50 dB LAeq, a further opportunity to accept its First Tier Sound Insulation Scheme (SIS) measures ahead of carrying out noisy night time works. Moreover, Second Tier Works (secondary or contribution towards high acoustic performance thermal double glazing) will be made available to properties predicted to exceed 55 dB LAeq regularly, subject to the thresholds set out in the CNVMMS (at Appendix 4.4).

8.40 For the sake of completeness, the ES is reproduced in full within the **Consolidated Environmental Statement (November 2014)** (CES) which has been submitted to LBN at the same time as the CESA. The amendments contained in the CES incorporate the key ‘further information’ described above and within the previous two ES Addendums – the ESA and the ESSA, relevant extracts of which are also re-presented in Part D of the CESA.

GLOSSARY AND ABBREVIATIONS

GLOSSARY

Term	Meaning
Aircraft Categorisation Review	The future system of aircraft noise control at the Airport, as required by the Section 106 Agreement between the Airport and LBN which accompanied the 2009 Permission (ref 07/01510/VAR).
Air Noise	Refers to the noise pollution produced by any aircraft or its components, during various phases of a flight.
Aircraft Movements	Any aircraft take-off or landing at an airport. These could be either commercial or non-commercial flights. For airport traffic purposes one arrival and one departure are counted as two movements.
Airfield	An area of land set aside for the takeoff, landing, and maintenance of aircraft.
Airside	The side of an airport terminal from which aircraft can be observed; the area beyond security checks and passport and customs control.
Approach	The point on the ground, on the extended centre line of the runway 2,000m from the threshold. On level ground this corresponds to a position 120 m (394ft) vertically below the 3 degree descent path originating from a point 300m beyond the threshold.
Apron	That part of an airport, other than the manoeuvring areas intended to accommodate the loading and unloading of passengers and cargo, the refuelling, servicing, maintenance and parking of aircraft, and any movement of aircraft, vehicles and pedestrians necessary for such purposes. Also referred to as the ôRampö
Arrivals Concourse	Landside area receiving arriving passengers who have emerged from the baggage reclaim or customs facilities, usually containing a ômeters and greeters areaö as well as retail and other support functions.
Baggage Reclaim	The baggage claim area is an airport terminology that describes the area of an airport terminal where one claims checked-in baggage.
Baseline	2012 constitutes the most reliable and robust ôbaseline yearö and ensures a full calendar year of data can be assessed.
Bombardier CS100	The Bombardier C Series is a family of narrow body, twin-engined, medium range jet airliners
Code C aircraft	A standard of aircraft size specified by the International Civil Aviation Organization.
Crossrail	A railway construction project under way mainly in central London. Its aim is to provide a high-frequency commuter/suburban passenger service.
Design year	This year represents the completion of the CADP1 and CADP2 works.
Dolphins	Structural remains are visible in the dock, in the form of fixed jetties known as ôDolphinsö
Eastern Ancillary Buildings	including: Taxi /Car Rental Services Building, Taxi Marshallø s Kiosk, Vehicle Control Point facility, and Eastern Energy Centre;
Eastern Energy Centre	(Specific to the Airport) Proposed Energy Centre situated in the eastern Dockside area and housing various elements of plant that service the proposed Eastern Terminal Extension and proposed Forecourt. Part of the Completed CADP.

Eastern Terminal Extension	(Specific to the Airport) Proposed Eastern Extension of the main Terminal, including the Arrivals Concourse Building, the Main Processor Building, the Outbound Baggage Extension, the Eastern Pier and Noise Barrier. Part of the Completed CADP.
Effective Perceived noise levels (EPNdB)	This is a unit of noise measurement, measured in EPNdB, Its measurement involves analyses of the frequency spectra of noise events as well as the duration of the sound
Facilitating Works	(Specific to the Airport) Part of the Interim CADP, including the temporary Coaching Building and associated link bridge, airside road alterations, extension of the concrete deck for an expanded outbound baggage facility (OBB), a new light-weight enclosure for expanded OBB, and Noise Barrier. Part of the Interim CADP.
Flyover	The point on the extended centre line of the runway and at a distance of 6.5km from the start of roll
Forecourt	(Specific to the Airport) Proposed new multi-modal transport area including pick-up and drop-off accommodation for buses, taxis, and private cars, as well as landscaped areas adjacent to the Eastern Terminal Extension. Part of the Completed CADP.
Ground Noise	Noise referred to by aircrafts on the ground
Hotel	(Specific to the Airport) Dockside facility with up to 260 bedrooms, submitted as a separate outline application: ðPlanning Application CADP2ô
Interim CADP	(Specific to the Airport) The compliment of projects that includes: Phase 1 Western Terminal Extension, Western Energy Centre, temporary OBB extension, temporary Coaching Facility, temporary Noise Barrier, additional 3 stands, and a portion of taxi lane. These elements are submitted as a separate detailed application: ðPlanning Application CADP1ô
Jet Centre	Corporate Aviation Centre located at the western side of the Airport.
LAMP	London Airspace Management Programme
L_{A90}	Statistically the LA90 value is often used to describe background noise levels and is defined as the level exceeded for 90% of the measured time.
L_{Aeq}	The Equivalent Continuous sound Level (LAeq) is the level of a notional steady sound, which at a given position and over a defined period of time would have the same A-weighted acoustic energy as the fluctuating noise.
Lift	Lift is the force that directly opposes the weight of an aircraft and holds the aircraft in the air.
Load Factors	The average assumed passenger occupancy of a flight, expressed as a percentage.
Noise Barrier	A physical barrier to provide noise insulation
Noise Contours	A continuous line on a map that represents equal levels of noise exposure.
Noise Factored Movements	A numerical factor applied to a noise source, dependent on the time, type or level of noise produced which have an effect of limiting the number a aircraft using the Airport
Out of Operational Hours (OOOH)	Periods when the Airport is closed. Out of the following operational hours: 06:30 to 22:00 hours during the week; 06:30 to 12:00 on Saturdays and, 12:30 to 22:00 on Sundays.
Pier	A building housing departing gate areas, departures corridors, as well as arrivals corridors that permit the circulation of passengers to and from the aircraft stands in a controlled fashion.

Pilling	Post like foundation driven into the ground to support a structure.
Residual Effect	The remaining effects of an impact after mitigation has been implemented
RNAV	ARea NAVigation
Service Yard	(Specific to the Airport) The triangle-shaped external space between the west extent of the existing Terminal building and Hartmann Road utilised for temporary accommodation and service deliveries. Otherwise known as the ŒTriangleâ
Sideline/lateral	For jet-powered aeroplanes: the point on a line parallel to, and 450m from, the runway centre line, where the noise level is a maximum during take-off
SIDS	Standard Instrument Departure Routes (SIDs) A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated air traffic service route, at which the en-route phase of a flight commences.
STAR	Standard Arrival Routes
Study Area	Designated area defined for an assessment.
Taxilane	Zone for circulation of aircraft moving between the runway and the stands.
Terminal	(Specific to the Airport) A temporary two-storey structure comprising three coaching gate room for departing passengers, and linked to the main terminal departures lounge at the upper level. Part of the Interim CADP.
Transitional Phase	During 2019, the majority of the proposed CADP works will be under construction. This year therefore represents an interim scenario ongoing construction and partial operation of the CADP. The forecasts that have been calculated are based on the infrastructure that will be in place at this time.
Triangle	(Specific to the Airport) See ŒService Yardâ
Western Energy Centre	(Specific to the Airport) Proposed Energy Centre situated in the western Service Yard and housing various elements of plant that services the Western Terminal Extension and the Facilitating Works Coaching Facility.

ABBREVIATIONS

Acronym	Meaning
ACR	Aircraft Categorisation Review
BAP	Bickerdike Allen Partners
CADP	City Airport Development Programme
CAH	City Aviation House
CEMP	Construction Environmental Management Plan
CLP	Construction Logistics Plan
dB	Decibel
EIA	Environmental Impact Assessment
EPNdB	Effective Perceived Noise levels (db-decibels)

ES	Environmental Statement
ESA	Environmental Statement Addendum
ESSA	Environmental Statement Second Addendum
ETE	Eastern Terminal Extension
HGVs	Heavy Goods Vehicles
LAMP	London Airspace Management Programme
LBN	London Borough of Newham
LCY	London City Airport (ñthe Airportò)
M	Metres
Mg	Milligram
NTS	Non-Technical Summary
OIP	Operational Improvements Project
OOOH	Out of Operational Hours Working
RNAV	A**R**ea **NAV**igation
SIDs	Standard Instrument Departure Routes
SIS	Sound Insulation Scheme
STAR	Standard Arrival Routes
WTE	Western Terminal Extension

APPENDIX 1.1

London Borough of Newham's Regulation 22 Letter, 20th August 2014

Colm Lacey,
Director of Strategic Regeneration, Planning and Olympic Legacy (Acting)

Development Management
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Ask for: Sunil Sahadevan

Sean Bashforth,
Quod
Quod Ingeni Building
17 Broadwick Street,
London,
W1F 0AX

Our ref: 13/01228/FUL and 13/01373/OUT
Date: 20th August 2014

Dear Sean Bashforth,

Town and Country Planning Act 1990 (As amended)
Re: London City Airport, Hartmann Road, Silvertown, London, E16 2PX
Planning Applications 13/01228/FUL (CADP1) & 13/01373/OUT (CADP2)

<u>13/01228/FUL CADP1:</u> Full planning application to demolish existing buildings and structures and provide additional infrastructure and passenger facilities at London City Airport without changes to the number of permitted flights or opening hours previously permitted pursuant to planning permission 07/01510/VAR. Detailed planning permission is being sought for:
(a) Demolition of existing buildings and structures;
(b) 4 no. upgraded aircraft stands and 7 new aircraft parking stands;
(c) Extension and modification of the existing airfield, including the creation of an extended taxilane;
(d) Emergency vehicle access point over King George V Dock;
(e) Replacement landside Forecourt to include vehicle circulation, pick up and drop off areas and hard and soft landscaping;
(f) Eastern Extension to the existing Terminal Building (including alteration works to the existing Terminal);
(g) Construction of a 3 storey passenger pier to the east of the existing Terminal;
(h) Erection of Noise Barriers;
(i) Western Extension and alterations to the existing Terminal;
(j) Western Energy Centre, storage, ancillary accommodation and landscaping;
(k) Facilitation Works including temporary coaching facility and extension to the outbound baggage area;
(l) Upgrading works to Hartmann Road;
(m) Passenger and staff parking, car hire parking, taxi feeder park and ancillary and related work;
(n) Eastern Energy Centre;
(o) Dock Source Heat Exchange System within King George V Dock; and
(p) Ancillary and related work.

<u>13/01373/OUT CADP2:</u> Outline application for the erection of a Hotel with up to 260 bedrooms, ancillary flexible A1-A4 floor space at ground floor, meeting/conference facilities together with associated amenity space, landscaping, plant and ancillary works.

Requirements under Regulation 22 (1) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011 to provide further information in respect of the Environmental Statement.

I am writing with regard to the above planning applications which are currently under consideration by this Local Planning Authority.

This letter is a formal request under Regulation 22 (1) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011 ('the Regulations') requiring the applicant to provide further information in respect of the Environmental Statement.

The applications have been subject to consultation with statutory consultees and the public. Following consideration of the planning applications and the consultation responses the Council has identified a number of areas where it is considered that further information and/or clarification is required.

This formal request is the 3rd formal request following submission of the applications on the 26th July 2013. The 1st formal Regulation 22 (1) request, was issued on the 21st January 2014, and to which you responded on the 10th March 2014. The 2nd Regulation 22 (1) request was issued on the 23rd May 2014 and you responded on the 29th May 2014.

We have now identified where further additional information and clarification is required.

<u>Regulation 22 matters – 'Further Information'</u>

Regulation 22 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011 allows a Local Planning Authority to request additional information in relation to an Environmental Statement.

The London Borough of Newham is of the opinion, pursuant to Regulation 22, that the Environmental Statement (ES) should contain the following further information in order for the Local Planning Authority to fully assess the planning applications.

Issues where further information is required have been identified in the ES generally and more specifically the following Chapters; 'Noise and Vibration', 'Air Quality', 'Cumulative Impacts' 'Alternatives and Design Evolution', as set out below.

Chapter 8 - Noise and Vibration

<u>Construction Noise</u>

1. Set out further justification as to why elements of the construction programme needs to occur outside operational hours of the Airport, and during the most noise sensitive periods for the local area. It is considered that alternatives to this construction method should be tested and presented. Accordingly, set out what impacts to the Airport there would be under the following scenarios for the duration of the out of hours construction period;

    i) Temporary closure of the Airport.

    ii) Partial temporary closure, for example at weekends.

    iii) Temporary alterations to morning and evening flights.

iv) Any other scenarios.

It would be expected that the response would consider and set out the commercial impacts (including viability of the business), flight scheduling and any other operational constraints.

2. Confirm the works to be carried out during each phase of the shorter duration of night time operations, and demonstrate the resultant day and night time construction noise levels as absolute levels in accordance with BS5228 methodology. The reference period for night time should be 15 minutes to retain consistency with the original ES.

3. Additional assessment of noise levels taking into consideration the duration of the works with a 15 dB weighting for night-time work may also be provided to enable comparison of options (such as shorter duration noisier works compared with quieter works for a longer duration).

4. Demonstrate the effectiveness of the barrier with respect to the revised proposed methods.

5. Describe other mitigation methods that have been considered and reasons for not employing them at this stage, or identifying those that may be considered in future when the contractor is known.

6. Update the Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS) where necessary to retain consistency with the revised assessment.

Chapters 8 and 9 (Noise and Vibration and Air Quality)

7. An assessment needs to be undertaken of the likely impact of London Airspace Management Programme (LAMP) proposed changes to airspace.

Chapter 18 (Cumulative Impacts)

8. Chapter 18 (Cumulative Impacts), the ES does not take into account the following live planning applications received since your response to the 2nd Reg 22 (1) letter we issued on the 23rd May 2014. These are listed below;

   a) Silvertown Quays: (Ref: 14/01605/OUT) – Outline planning application with all matters reserved except for Access for the redevelopment of the site for mixed use purposes, including the alteration, partial demolition and conversion of the Millennium Mills and the construction of buildings across the site to include Brand buildings (Sui Generis), Residential (Use Class C3), Office (Use Class B1), Retail (Use Classes A1-A5), Leisure (Use Class D2), Education (Use Class D1), Hotels (Use Class C1), other Non-Residential floor space such as community use (Use Class D1), provision of public open space, works of repair and restoration of the Dock walls, infilling and excavation of parts of the Dock area, the placing of structures in, on, or over the Dock area, utilities, construction of estate roads and the creation of new accesses to the public highway, works of landscaping and making good, creation of surface and sub-surface car parking areas.

   b) Fox and Connaught Hotel: (Ref:14/00986/FUL) - Proposed 84 bedroom hotel and associated landscaping.

Both these applications may be determined at the Council's Strategic Development Committee on the 21st October 2014 and, in the event that the Council resolves to grant planning permission, they will become committed schemes for EIA purposes. As such, a decision on these applications may occur before any decision is made on CADP1 and CADP2. In view of the specific characteristics of the proposed developments, being significant major developments within close proximity to London City Airport, we require the cumulative and interrelated impacts arising between these two developments and the CADP1/2 proposals should be considered as part of the ES. The impacts should not be assessed solely in relation to Chapter 18 but should be considered where appropriate as part of the assessment of the other relevant chapter topics, particularly in relation to Chapter 8 (noise and vibration).

Chapter 4 (Alternatives and Design Evolution)

9. The ES does not set out consideration of alternative sites for CADP 2 – the hotel development. These needs to be assessed.

<u>Summary</u>

It is the view of the Local Planning Authority that the requested information is required in order to enable a proper assessment of the likely environmental impacts of the proposal and the appropriate mitigation required. Where the applicant considers such further information, or additional information and clarification is unnecessary or has already been satisfactorily provided, the applicant should provide full details in its response to this request.

Once all the requested information has been provided the London Borough of Newham will advertise the availability of the information in accordance with the provisions of Regulation 22 of the Regulations. The advertisement will explain where the information can be viewed for a period not less than 21 days from the date of the advertisement. The Council will also write to statutory consultees notifying them that this information has been received and allowing not less than 21 days to comment.

The London Borough of Newham reserves the right to make additional requests for information where necessary.

Six hard copies and 5 digital (CD) copies of the information should be submitted.

If you require any clarification in relation to this letter please do not hesitate to contact me.

Yours sincerely,

Sunil Sahadevan
Principal Planning Officer
For the London Borough of Newham

c.c. David Thomson, RPS, 14 Cornhill, London, EC3V 3ND

APPENDIX 2.1

Improved Construction Programme - August 2014

Description of Revised OOOH Construction Activities - August 2014

Annotated Piling Zones - Working Hours Split - September 2014

Out of Operational Hours (OOOH) Programme - August 2014

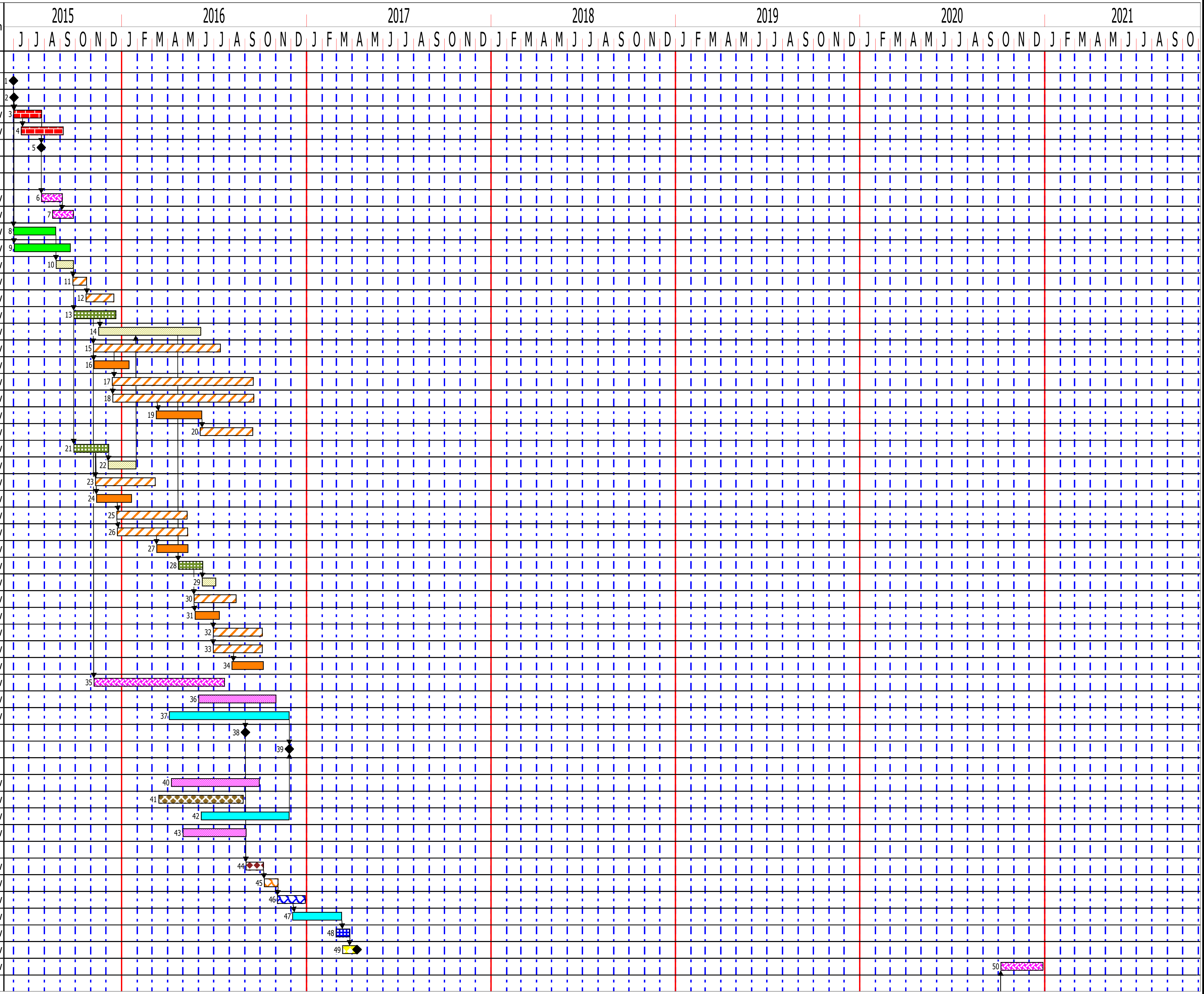
Out of Operational Hours (OOOH) Programme ï February 2014 (Now superseded and included for comparison purposes)

London City Airport

TPS

Improved Construction Programme - August 2014

Line	Name	Duration
	START / MOBILISATION	
1	**Project to Proceed**	
2	Clear Compound Site (By Others)	
3	Mobilisation	8w
4	Contractor Compound	12w
5	**Start on Site**	
	INTERIM WORKS	
	Stands, Deck & Noise Barrier	
6	Western Dolphin - Remove Deck	6w
7	Western Dolphin - Remove Piles	6w
8	Lead In For Marine Piling Equipment / Pile Casing Supply	12w
9	Lead In For Precast Beams, etc	16w
10	Deck - Section 1A - Piles (Marine)	5w
11	Deck - Section 1A - Pile Heads & Beams	4w
12	Deck - Section 1A - Deck Planks, Svcs &Topping	8w
13	Deck - Section 2A - Piles Installed OOOH	12w
14	Deck - Section 2A - Piles Installed in OH	29w
15	Deck - Section 2A - Pile Heads & Beams OH	36w
16	Deck - Section 2A - Pile Heads & Beams OOOH	10w
17	Deck - Section 2A - Deck Planks	40w
18	Deck - Section 2A - Services / Rebar	40w
19	Deck - Section 2A - Topping OOOH	13w
20	Deck - Section 2A - Topping OH	15w
21	Deck - Section 2B - Piles Installed OOOH	10w
22	Deck - Section 2B - Piles Installed in OH	8w
23	Deck - Section 2B - Pile Heads & Beams OH	17w
24	Deck - Section 2B - Pile Heads & Beams OOOH	10w
25	Deck - Section 2B - Deck Planks	20w
26	Deck - Section 2B - Services / Rebar	20w
27	Deck - Section 2B - Topping OOOH	9w
28	Deck - Section 3A - Piles Installed OOOH	7w
29	Deck - Section 3A - Piles Installed in OH	4w
30	Deck - Section 3A - Pile Heads & Beams OH	12w
31	Deck - Section 3A - Pile Heads & Beams OOOH	7w
32	Deck - Section 3A - Deck Planks	14w
33	Deck - Section 3A - Services / Rebar	14w
34	Deck - Section 3A - Topping OOOH	9w
35	Break Away Existing Dock Edge For New (Progressive)	37w
36	Noise Barrier / Edge Barriers	22w
37	Services / Lighting / Markings / Equip For New Stands	34w
38	Handover First Stand	
39	Handover Remaining Stands	
	Taxiway	
40	Edge Barriers to New Taxiway (progressive)	25w
41	Stormwater Drainage & Culvert Stage 1	24w
42	Services / Lighting / Markings, etc to New Taxiway	25w
43	New Runway Link	18w
	Coaching Facility	
44	Foundations and Preparation	5w
45	Building & Link Bridge Frame	4w
46	Building Envelope	8w
47	Internal Finishes & Services (Inc Lifts)	14w
48	Equipment Installation	4w
49	Test & Comiision / Handover	4w
50	Demolition & Reinstatement	12w
	OBB Stage 1A	



Drawn by: Planner -John Greene | Dwg No. | Revision No. 9 | Notes: Comment - Ninth Draft

Project Ref. C:\Users\jgreene\Documents\POWERPROJ12\TPS City airport\Improved Construction Programme - August 2014 Rev 1.pp

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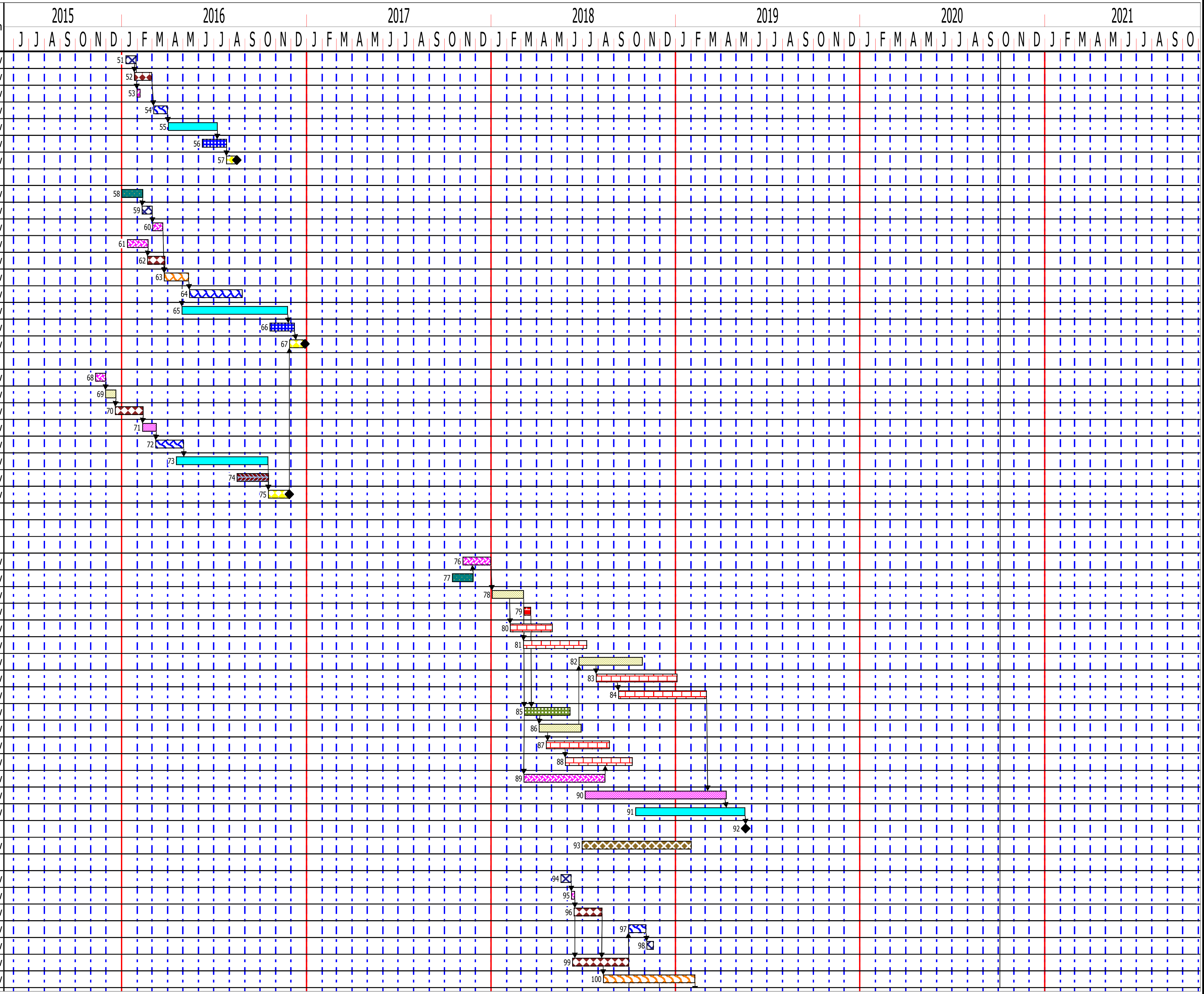
London City Airport

TPS

Improved Construction Programme - August 2014

Line	Name	Duration
51	Erect Protection Deck inside Existing OBB	3w
52	Edge Beams / Foundations for New OBB Structure	5w
53	Remove Existing OBB Tent	1w
54	Erect New OBB Tented Structure	4w
55	New OBB Finishes & Services	14w
56	New OBB Equipment Installation	7w
57	T & C and Handover new OBB	3w
	Western Terminal Extension Ph 1	
58	Relocate Internal Facilities	6w
59	Erect Weatherproof Screen Inside Building	3w
60	Remove Building Cladding	3w
61	Demolition / Clear Site / Temporary Access	6w
62	Piling & Foundations	5w
63	Frame	7w
64	Building Envelope	15w
65	Finishes & Services (Inc Lifts / Escalators)	30w
66	Equipment Installation	7w
67	Test & Commision / Handover	4w
	Western Energy Centre	
68	Clear Site / Preparation	3w
69	Secant Piling to Basement	3w
70	Excavation, Foundations and Basement	8w
71	Above Ground Structure	4w
72	Envelope	8w
73	Finshes, Services and Plant Installation	26w
74	Utilities and Services Connections	9w
75	Test & Commission / Handover	6w
	COMPLETED WORKS	
	Stands, Building Footprint & Noise Barrier	
	Eastern Stands / Taxiway Extension	
76	Enabling Works - Remove Quayside Covered Walkways	8w
77	Enabling Works - Relocate Car Rental Offices	6w
78	Deck - Section 1B Piles (Marine & Land - 2 Rigs all in OH)	9w
79	Remobilise Rig 2 - Land to Marine	2w
80	Deck - Section 1B Pile Heads and Beams	12w
81	Deck - Section 1B Deck Planks, Svcs and Topping	18w
82	Deck - Section 2C Piles (All OH)	18w
83	Deck - Section 2C Pile Heads & Beams	23w
84	Deck - Section 2C Deck Planks, Svcs & Topping	25w
85	Deck - Section 3B Piles - Installed OOOH (2 Rigs)	13w
86	Deck - Section 3B Piles - Installed in OH (In // to OOOH)	12w
87	Deck - Section 3B Pile Heads & Beams	18w
88	Deck - Section 3B Deck Planks, Svcs & Topping	19w
89	Break Away Existing Dock Edge For New (progressive)	23w
90	Noise / Edge Barriers to New Deck	40w
91	Services / Lighting / Markings / Equip for New Stands	31w
92	Open For Traffic	
93	Airside Drainage & Culvert Works Stage 2	31w
	Eastern Terminal Extension - Main Building	
94	Preparation - Erect Protection Deck Inside OBB	3w
95	- Dismantle OBB Tent	1w
96	- Prepare For Installation of New Terminal Frame	8w
97	- Temporary Weatherproofing to OBB Space	5w
98	- Remove Protection Deck	2w
99	Prepare For Frame	16w
100	Frame Construction	26w



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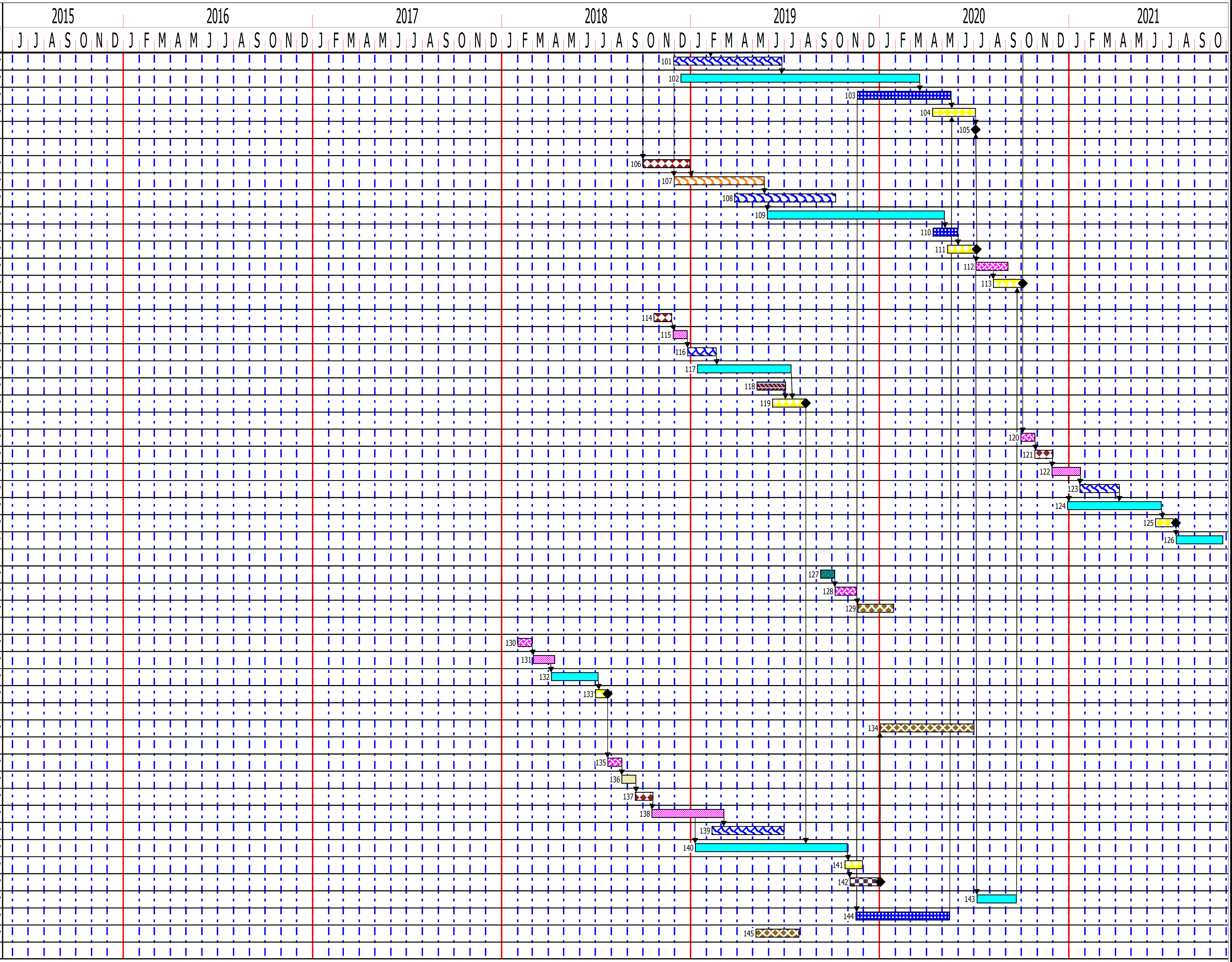
London City Airport

TPS

Improved Construction Programme - August 2014

Line	Name	Duration
101	Building Envelope	30w
102	Internal Finishes & Services	66w
103	Equipment & Systems Installation and Testing	26w
104	Operational Testing & Proving	12w
105	Ternimal Open for Traffic	
	Eastern Terminal Extension - Piers	
106	Prepare For Frame	13w
107	Frame Construction	25w
108	Building Envelope	28w
109	Internal Finishes & Services	49w
110	Equipment Installation and Testing	7w
111	Test & Commission / Handover Eastern End Piers	8w
112	Dismantle Existing Eastern Pier & Make Good	9w
113	Complete and Handover Remaining Piers	8w
	Eastern Energy Centre	
114	Foundations	5w
115	Structure	4w
116	Envelope	8w
117	Finishes Services and Plant Installion	26w
118	Utilities and Services Connections	8w
119	Test & Commission / Handover	9w
	Western Terminal Extension Phase 2	
120	Demolition	4w
121	Foundations	5w
122	Structure	8w
123	Envelope	11w
124	Finishes / Services	26w
125	Test & Commission / Handover	5w
126	**Terminal Reconfiguation**	**13w**
	Forecourt Road, etc.	
127	Decant City Aviation House	4w
128	Strip Out & Demolish City Aviation House	6w
129	Civils works	10w
	Car Park Deck	
130	Preparation / Clear Site	4w
131	Erect Deck Structure	6w
132	Surfacing, Finishes and Services	13w
133	Test & Commission / Handover	3w
	Dockside Upgrade + Surface Car Park	
134	Civils Works	26w
	Hotel	
135	Preparation / Clear Site	4w
136	Piling	4w
137	Foundations / Substructure	5w
138	Frame	20w
139	Envelope	20w
140	Finishes & Services	42w
141	Test & Commission	5w
142	F F & E / Handover	8w
143	**Western Link Corridor**	11w
144	**OBB Stage 2**	26w
145	**Floating RVP Pontoon**	12w



Build Stages

Milestones	Deck OH	Piling OOOH	Deck OOOH	Structure	Envelope	Relocation / Decant	Services	Piling OH	Infrastructure
Mobilisation	Deck	Finishes / Services		Building Frames	Equipment	T & C	Substructure	Demolition / Clear site	F F & E

Procurement

Temporary Works

Drawn by: Planner -John Greene | Dwg No. | Revision No. 9 | Notes: Comment - Ninth Draft

Project Ref. C:\Users\jgreene\Documents\POWERPROJ12\TPS City airport\Improved Construction Programme - August 2014 Rev 1.pp

Planned by *PowerProject*

Description of Revised Out of Operational Hours (OOOH) Construction Activities

These descriptions are to be read in conjunction with the *Improved Construction Programme - August 2014* and the *Annotated Piling Zones-Working Hours Split.* All of these documents sit within Appendix 2.1 of the CESA. The numbers below relate to the IDs listed on the *Improved Construction Programme-August 2014*.

The following provides a brief explanation of how the Out of Operational Hours (OOOH) working has been reduced following an examination of proposed working methods and a temporary relaxation of the Transitional Surfaces (TS) of the Airport during Operational Hours (OH) as described fully within Section 2 of the CESA.

4 ï Contractorõs Compound. This activity was previously included in OOOH because it was expected that this task would require some OOOH for temporary and marine works, road works and utilities hook-ups. Following technical review this requirement will now be minimised.

13/14 ï Zone 2A piling, OOOH / OH - the band of piling alongside the northern quay will need to be carried out OOOH with night working for an estimated 12 weeks, but once a section of this has been completed, Operational Hours piling works can start in parallel. For the main body of these works, Piling Rig 2 will move into this area after Zone 2B, but cannot continue to the end of the period due to marine plant congestion. The programme has been specifically updated to clarify when OOOH activity will take place and the OOOH activities have been aligned with Zone 2B works to minimise the period of OOOH working.

15/16 ï Zone 2A pile heads and beams. OOOH working will now generally be limited to the area immediately adjacent to the northern quay edge, reducing the need for OOOH working.

17 - 20 - Zone 2A ï Deck Planks, Services and Topping. From discussions with the previous deck contractor and within the airport team, a number of potential measures to reduce night working have become apparent. This include enhanced weekend daytime working, and the potential use of purpose ï designed table lifters for plank installation, together with placing more of the topping concrete during normal hours by enabling access for concrete deliveries through the airfield and the use of low ï headroom plant. This item has been further split out on the latest programme to clarify the OOOH working.

21/22 ï Zone 2B Piling OOOH / OHï A second marine piling rig will be mobilised to start in this zone, and once the OOOH night works piling has been completed over an estimated period of 10 weeks, the OH piling will be progressed. On completion, the rig will move into Zone 2A. The programme has been specifically updated to clarify when OOOH activity will take place and the OOOH activity aligned with that in Zone 2B to minimise the period of OOOH working.

23/24 - Zone 2B pile heads and beams ï As Items 15/16

25 - 27 ï Zone 2B ï Deck Planks, Services and Topping ï As item 16, though the saving effect is less pronounced as this zone is proportionally nearer the runway and hence more affected by the operational airport.

28/29 - Zone 3A Piling OOOH / OH ï working in a similar manner to Zone 2B, the rig will move from Zone 2A when it becomes too congested for 2 rigs to safely and efficiently work in that area. An estimated period of 7 weeks will be required to install the OOOH piling over nights and weekends, which will be followed by the installation of the OH piling.

30/31 ï Zone 3A Pile Heads and Beams ï As Items 15/16

32 - 34 ï Zone 3A ï Deck Planks, services and topping ï As Items 25 - 27

36 ï Noise Barrier / Edge Barrier. Feedback from previous installations and consideration of methods and plant used indicated that the increased use of daytime weekend working would generally reduce the need for night working for this activity.

37 ï Services / Lighting / Markings ï As Item 36

40 ï Edge Barriers to New Taxiway ï As Item 36

41 ï Storm water Drainage and Culvert Stage 1 ï the present location of this work within the runway strip will require the activity involved to be carried out OOOH. For the retention culvert, this will mean that each activity of the works be made safe before handing back for flight operations.

44 ï Coaching Facility ï Foundations and Preparation. ï The need for OOOH working will be intermittent, and increased use of weekend daytime working and permitted working during normal hours should reduce the night working required. The location of the Coaching Facility means that the Pier and Terminal buildings to the south would act as a noise barrier and shield residents to the south from noise impacts related to these construction activities.

45 ï Coaching Facility ï Frame ï As Item 44 - The link bridge is one element of this activity and will be prefabricated off site and lifted in OOOH during the weekend closure.

50 ï Coaching Facility ï Demolition ï As 44. The facility will be specifically designed for simple and speedy disassembly.

51 ï 54 ï OBB Activities. Works on the OBB will be constrained by operational and safety considerations associated with an operational workplace, which will require that at least part of the work be carried out OOOH. However, these works will be local to the OBB area and of limited impact in terms of disturbance. Internal works in the OBB will have some shielding from the adjacent existing and proposed structures.

63 ï WTE Frame. Previously it was expected that the some OOOH working would be needed as the cranage required would penetrate the transition surface for part of the frame erection. A reassessment of this task means that a combination of daytime weekend working and permitted crane management will be used to minimise the impact and reduce OOOH working.

76 ï Remove Quayside Covered Walkways ï purely from the point of view of public safety and minimising traffic disruption, it was considered that some OOOH working would be needed for this operation. However, it can be managed so that night time impact will be minimal.

77 ï Relocate Car Rental ï As Item 76. This may still require a weekend changeover of the facility during daylight weekend hours.

85/86 ï Zone 3B Piling OOOH and OH Worksï To expedite these works, 2 rigs will be simultaneously employed, one each working eastwards from the west end and centre of this section of the works. The piles within the adjacent OH sector will be installed during day shift more or less in parallel to the OOOH night and weekend working, which has been estimated to last for a period of about 13 weeks.

87 - Zone 3B Pile Heads and Beams ï This will be similar to Items 15/16, although the specific breakdown in OH and OOOH working has not been shown. Construction of the beams at the east end of the zone will be more complex than in other similar areas, due to the shape of the structure and the connections to the existing deck.

88 ï Zone 3B ï Deck Planks, Services and Topping. Use of methods and techniques covered in Items 17 - 20 will reduce the OOOH needs.

90 ï Noise / Edge Barriers to New Deck ï As Item 36.

91 ï Services / Lighting / markings for New Stands ï As Item 37.

93 ï Air Side Drainage and Culvert stage 2 ï as Item 41.

95 ï 98 ï OBB activities ï as Items 51 ï 54.

99 ï Prepare for ETE Frame ï It was anticipated that this activity would involve intermittent OOOH working in and around the operational OBB and dockside areas. With due planning and design development, it is now believed that most of this requirement can be eliminated.

100 ï EFE Frame Construction ï similar to Item 63, although the works above the operational OBB facility will require some OOOH working.

106 ï Pier ï Prepare for Frame ï The use of permitted working during normal hours and weekend daytime working should minimise the night-time working requirement for this activity.

107 ï Pier - Frame Construction ï the proximity of this 3 storey structure to the airport operation areas and its height mean that a considerable amount of this activity will need to be OOOH. However the development of a unitised design, weekend daytime working and permitted normal hours working should be able to lessen OOOH impact.

108 ï Pier - Envelope ï As Item 107.

112 ï Dismantle Existing East Pier ï will be scheduled for weekend working where practical.

113ï Complete and Handover Remaining Piers ï Partially internal works. Will be scheduled and executed as far as is practical during normal hours or in daytime weekends.

120 ï WTE Phase 2 Demolitions. Internal strip out and removal of existing building will be scheduled as far as is practical during Normal working hours or at daytime weekends.

121 ï WTE Phase 2 Foundations ï It was expected that the installation of foundations, drainage, etc could interfere with the adjacent operational buildings, and may need an element of intermittent OOOH working. This will be minimised.

122 ï WFE Phase 2 Structure ï similar to Item 53, but this frame will be proportionally nearer to the runway.

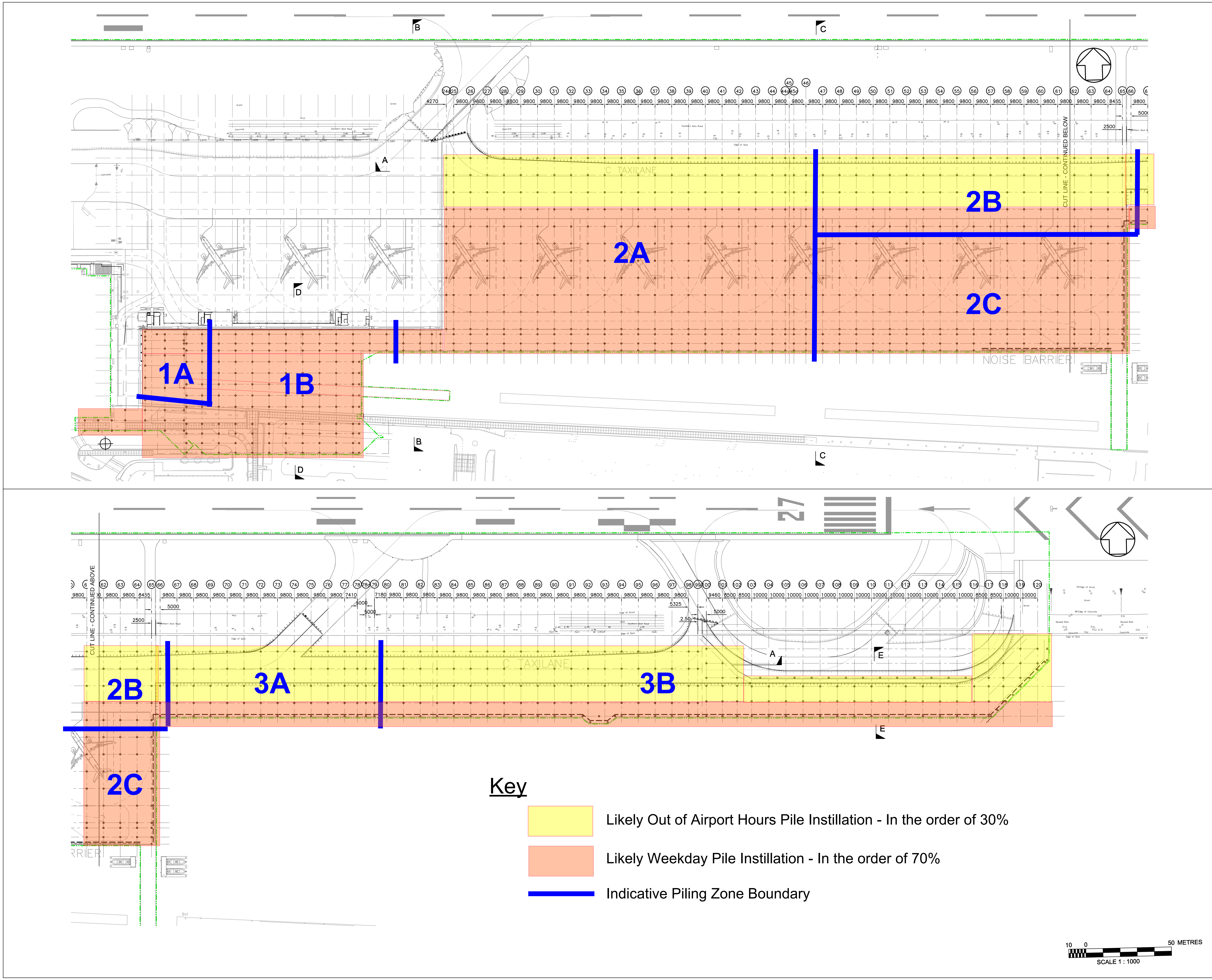
128 - CAH Strip Out and Demolish - A reassessment of the scope of this activity has concluded that the vast majority of this work could be carried out during daylight hours.

129 ï Forecourt Civils ï an element of these works may require that traffic and services diversion and similar works to be carried out OOOH, but this would be minimised.

134 - Dockside Upgrade Civils - As Item 129.

138 ï Hotel Frame ï the present outline design for this building indicates that the top of the frame will touch or come close to the transition surface. This OOOH impact will be reduced either by selecting one of the lower building options or by using weekend daytime working or permitted cranage to minimise the impact.

139 ï Hotel Impact ï As 138, but including the possible use of man-handleable cladding units to minimise cranage requirements.



NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. ALL LEVELS ARE IN METRES ABOVE ORDNANCE SURVEY DATUM.
3. FOR SECTIONS REFER TO Dwg.Nos. CA0L-910, CA0L-911 AND CA0D-921.
4. PILE POSITIONS MAY BE SUBJECT TO ADJUSTMENT AT DETAIL DESIGN STAGE

KEY

PROPOSAL BOUNDARY – ALL INFORMATION OUTSIDE OF THE PROPOSAL BOUNDARY IS FOR ILLUSTRATION PURPOSES ONLY.

Rev	Revised By	Date	Checked By	Date
E	R.WOOD	02/07/2013	W.HELLYER	02/07/2013
ISSUED FOR PLANNING. REVISED TO LCY COMMENTS				
D	R.WOOD	13/06/2013	W.HELLYER	13/06/2013
ISSUED FOR PLANNING. REVISED TO LCY COMMENTS				
C	R.WOOD	04/04/2013	W.HELLYER	04/04/2013
ISSUED FOR PLANNING. REVISED TO LCY COMMENTS				
B	R.WOOD	22/03/2013	W.HELLYER	22/03/2013
ISSUED FOR PLANNING				
A	R.WOOD	11/03/2013	W.HELLYER	11/03/2013
PRELIMINARY PLANNING SET				

Draft - For Illustration

LondonCityAirport
Royal Docks London E16 2PB

Project
CITY AIRPORT
DEVELOPMENT PROGRAMME

Annotated Piling Zones - Working Hours Split - September 2014

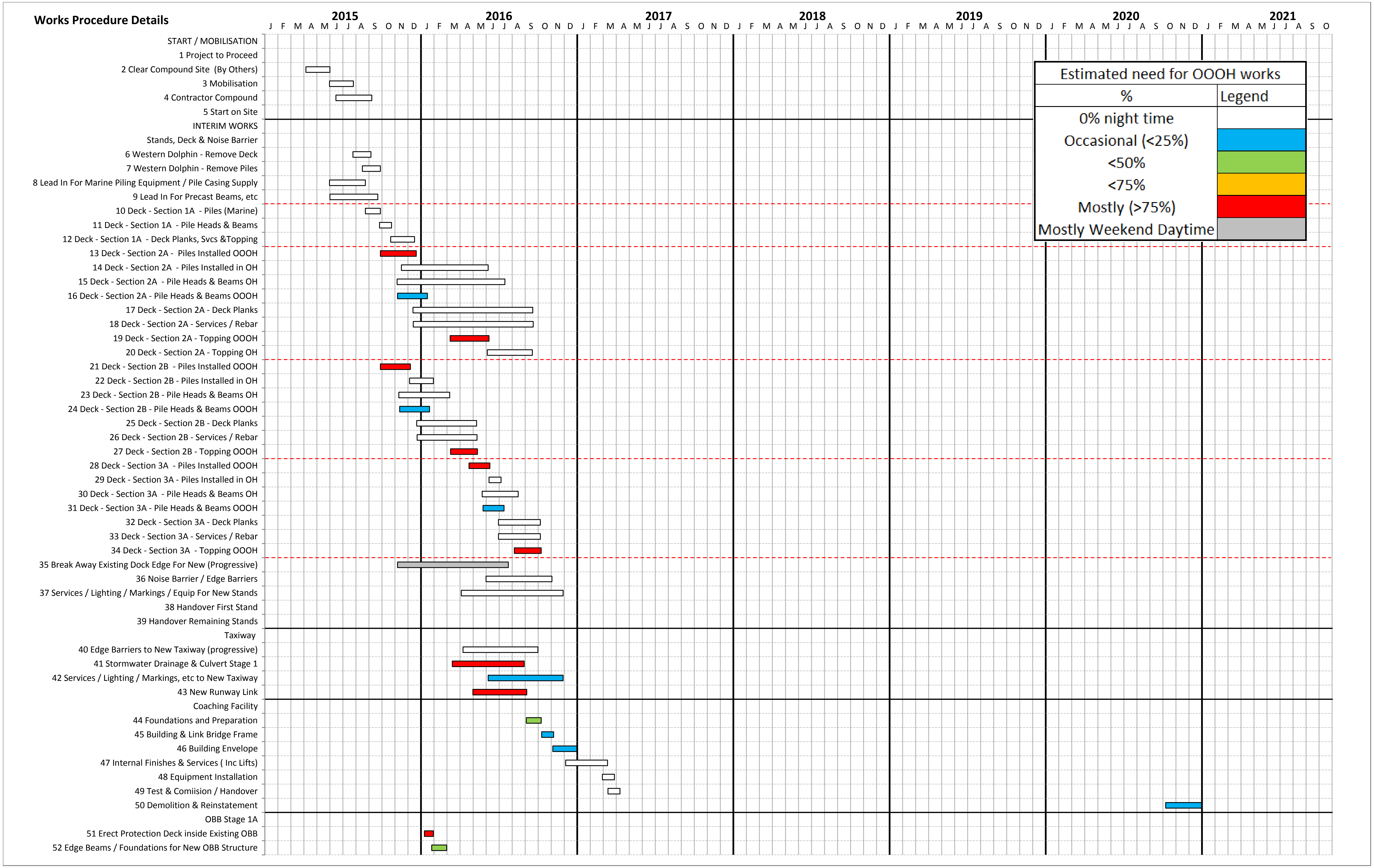
(Markup of Drawing CA0L-900 Rev E)

USERNAME ACAD 2010
PLOT SCALE 1=1

August 2014

London City Airport - Out of Operational Hours (OOOH) Programme

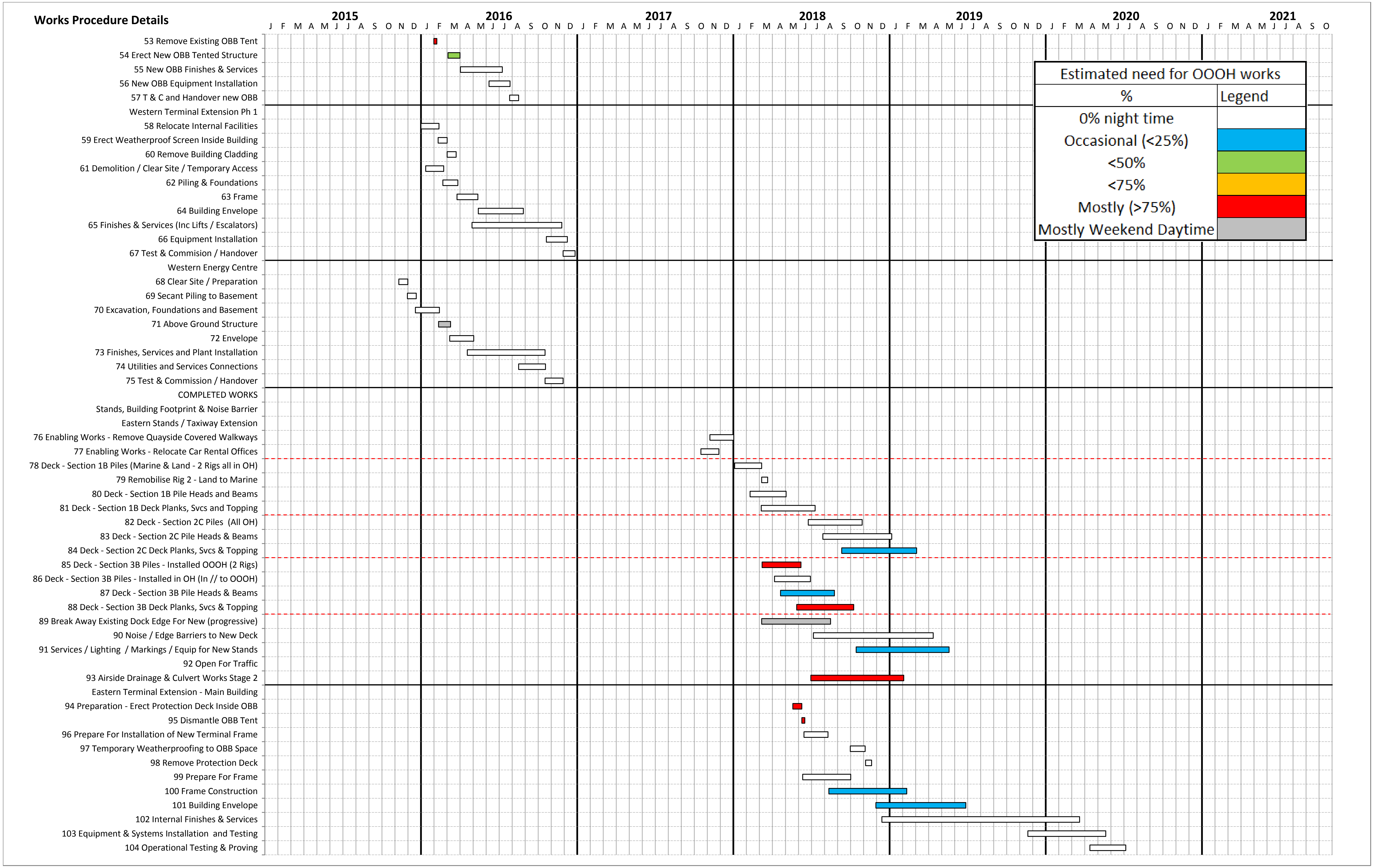
Bickerdike Allen Partners
Architecture Acoustics Technology



August 2014

London City Airport - Out of Operational Hours (OOOH) Programme

Bickerdike Allen Partners
Architecture Acoustics Technology



August 2014

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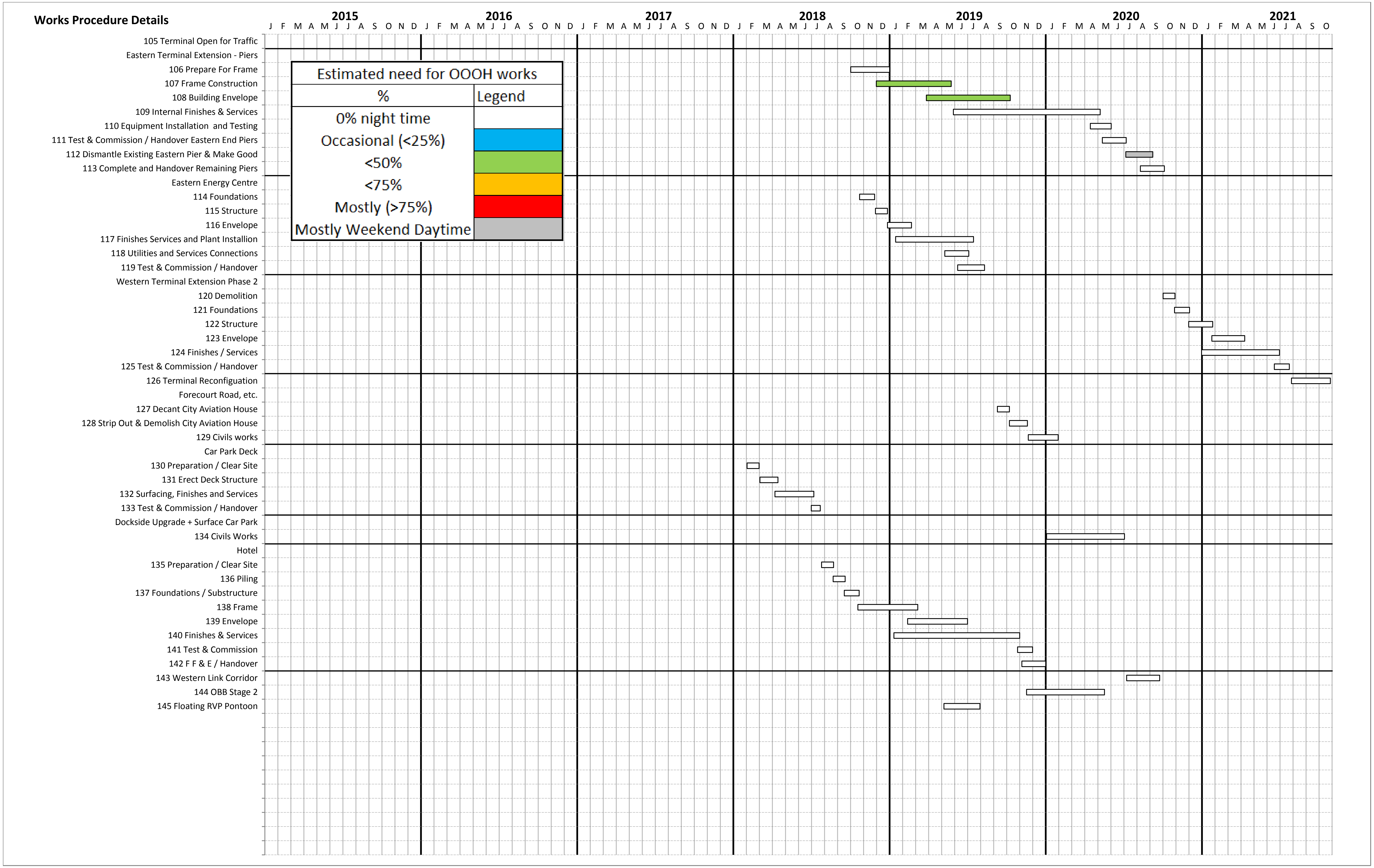
Architecture Acoustics Technology

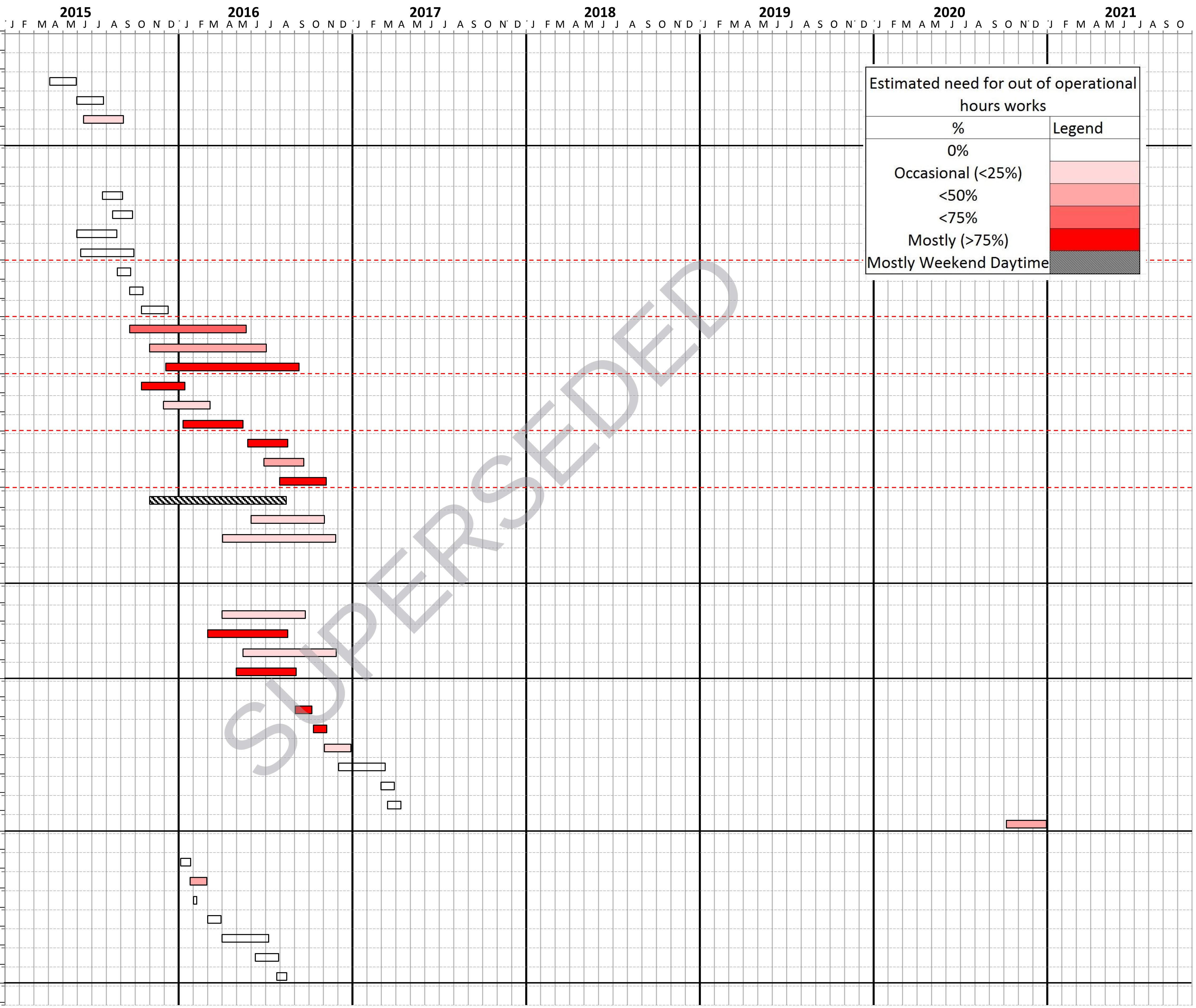


27/02/2014

London City Airport - Out of Operational Hours (OOOH) Programme

Bickerdike Allen Partners

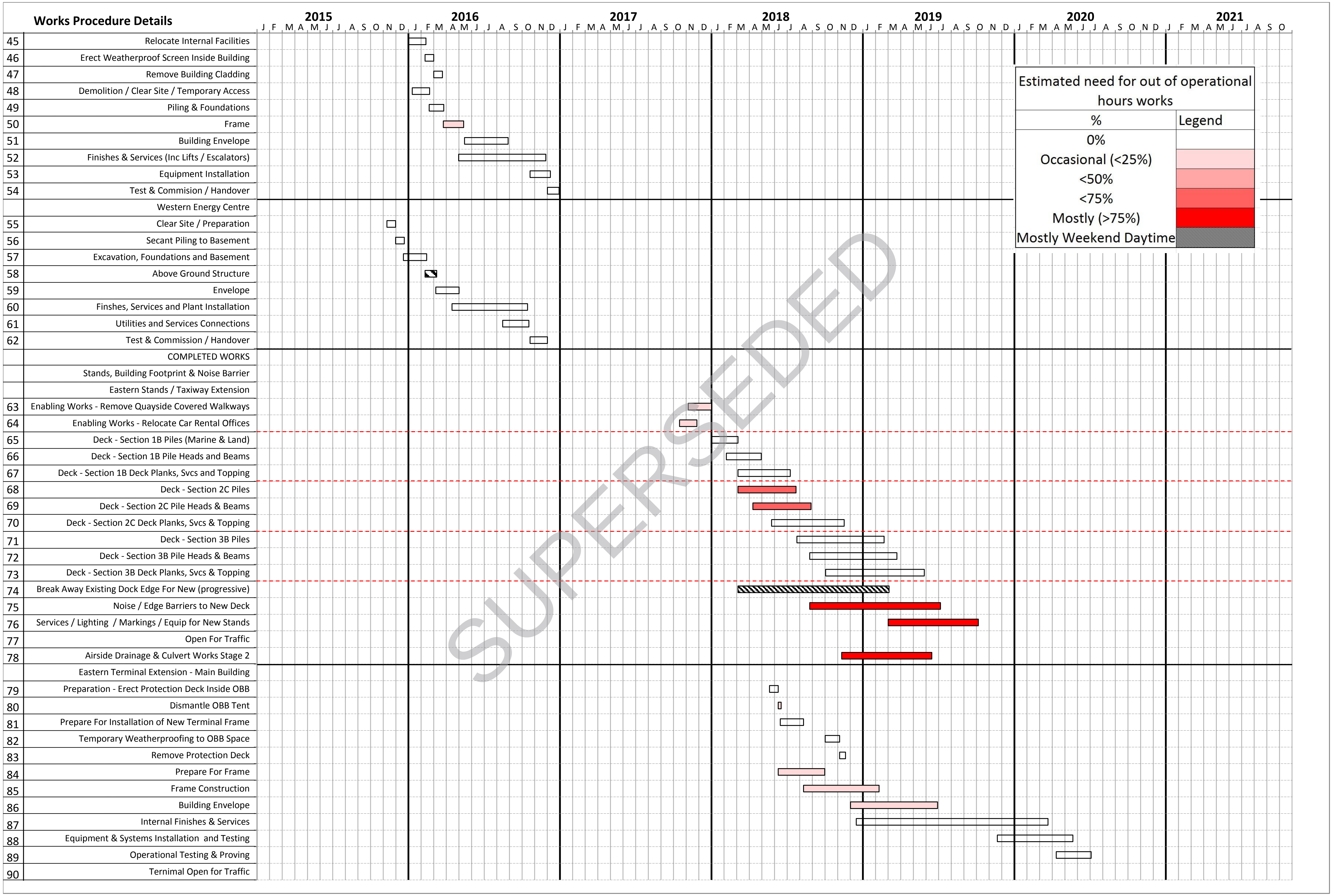
	Works Procedure Details
	START / MOBILISATION
1	Project to Proceed
2	Clear Compound Site (By Others)
3	Mobilisation
4	Contractor Compound
5	Start on Site
	INTERIM WORKS
	Stands, Deck & Noise Barrier
6	Western Dolphin - Remove Deck
7	Western Dolphin - Remove Piles
8	Lead In For Marine Piling Equipment/Pile Casing Supply
9	Lead In For Precast Beams, etc
10	Deck - Section 1A Piles (Marine)
11	Deck - Section 1A Pile Heads & Beams
12	Deck - Section 1A Deck Planks, Svcs &Topping
13	Deck - Section 2A Piles
14	Deck - Section 2A Pile Heads & Beams
15	Deck - Section 2A Deck Planks, Svcs & Topping
16	Deck - Section 2B Piles
17	Deck - Section 2B Pile Heads & Beams
18	Deck - Section 2B Deck Planks, Svcs & Topping
19	Deck - Section 3A Piles
20	Deck - Section 3A Pile Heads & Beams
21	Deck - Section 3A Deck Planks, Svcs & Topping
22	Break Away Existing Dock Edge For New (Progressive)
23	Noise Barrier / Edge Barriers
24	Services / Lighting / Markings / Equip For New Stands
25	Handover First Stand
26	Handover Remaining Stands
	Taxiway
27	Edge Barriers to New Taxiway (progressive)
28	Stormwater Drainage & Culvert Stage 1
29	Services / Lighting / Markings, etc to New Taxiway
30	New Runway Link
	Coaching Facility
31	Foundations and Preparation
32	Building & Link Bridge Frame
33	Building Envelope
34	Internal Finishes & Services (Inc Lifts)
35	Equipment Installation
36	Test & Comiision / Handover
37	Demolition & Reinstatement
	OBB Stage 1A
38	Erect Protection Deck inside Existing OBB
39	Edge Beams / Foundations for New OBB Structure
40	Remove Existing OBB Tent
41	Erect New OBB Tented Structure
42	New OBB Finishes & Services
43	New OBB Equipment Installation
44	T & C and Handover new OBB
	Western Terminal Extension Ph 1



27/02/2014

London City Airport - Out of Operational Hours (OOOH) Programme

Bickerdike Allen Partners

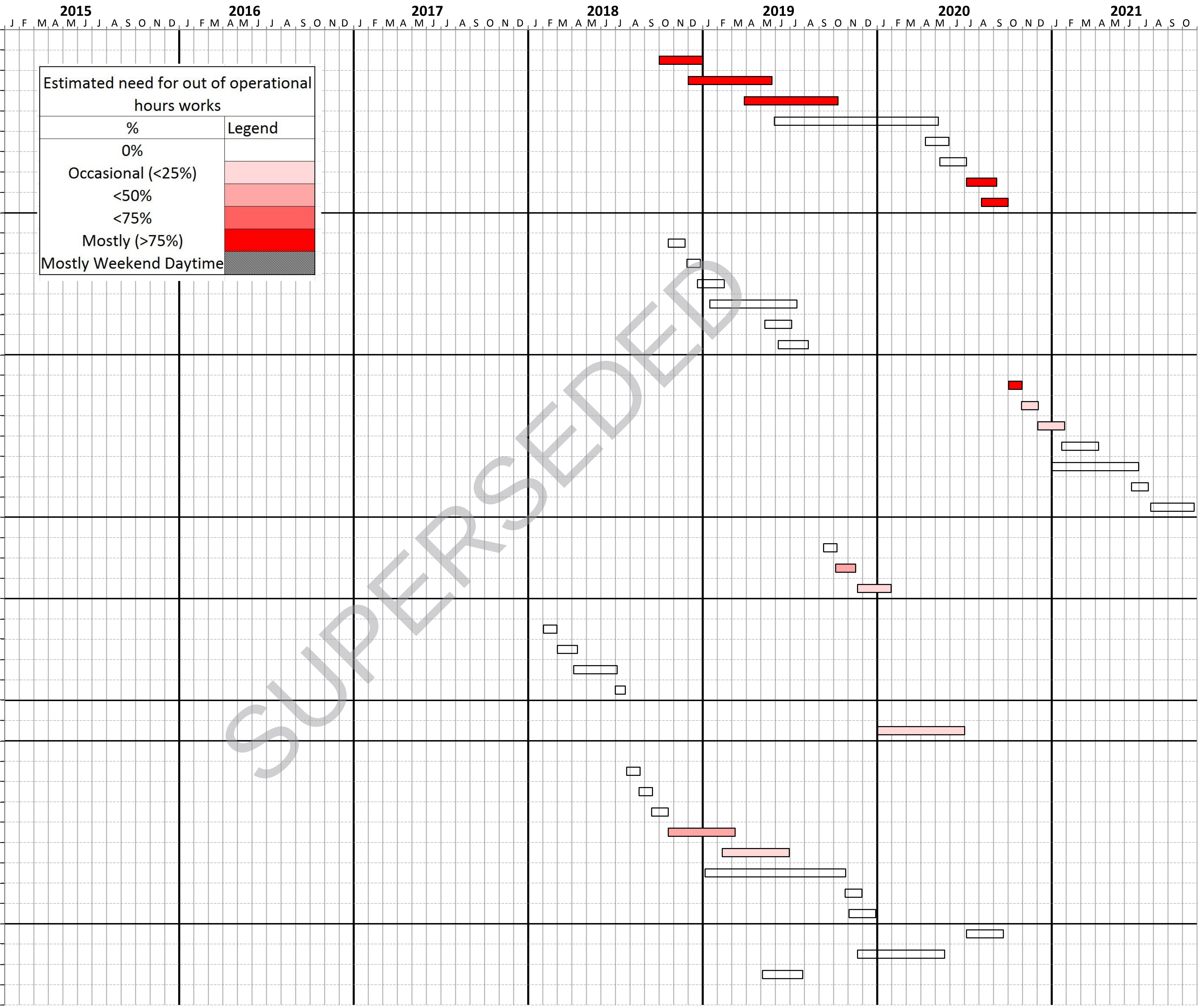


27/02/2014

London City Airport - Out of Operational Hours (OOOH) Programme

Bickerdike Allen Partners

	Works Procedure Details
	Eastern Terminal Extension - Piers
91	Prepare For Frame
92	Frame Construction
93	Building Envelope
94	Internal Finishes & Services
95	Equipment Installation and Testing
96	Test & Commission / Handover Eastern End Piers
97	Dismantle Existing Eastern Pier & Make Good
98	Complete and Handover Remaining Piers
	Eastern Energy Centre
99	Foundations
100	Structure
101	Envelope
102	Finishes Services and Plant Installion
103	Utilities and Services Connections
104	Test & Commission / Handover
	Western Terminal Extension Phase 2
105	Demolition
106	Foundations
107	Structure
108	Envelope
109	Finishes / Services
110	Test & Commission / Handover
111	Terminal Reconfiguation
	Forecourt Road, etc.
112	Decant City Aviation House
113	Strip Out & Demolish City Aviation House
114	Civils works
	Car Park Deck
115	Preparation / Clear Site
116	Erect Deck Structure
117	Surfacing, Finishes and Services
118	Test & Commission / Handover
	Dockside Upgrade + Surface Car Park
119	Civils Works
	Hotel
120	Preparation / Clear Site
121	Piling
122	Foundations / Substructure
123	Frame
124	Envelope
125	Finishes & Services
126	Test & Commission
127	F F & E / Handover
128	Western Link Corridor
129	OBB Stage 2
130	Floating RVP Pontoon



Estimated need for out of operational hours works	
%	Legend
0%	
Occasional (<25%)	
<50%	
<75%	
Mostly (>75%)	
Mostly Weekend Daytime	

APPENDIX 2.2

CADP Safeguarding Assessment, Eddowes Safety Limited (November 2014)

City Airport Development Programme: Construction Safeguarding Assessment

P1054/R1

Report prepared on behalf of London City Airport

November 2014

Eddowes Aviation Safety Ltd
Specialist Aviation Assessments

Authorisation Sheet

Report Title:	City Airport Development Programme: Construction Safeguarding Assessment
Client:	London City Airport
Project Reference:	P1054
Report Number:	P1054/R1
Issue:	Issue 1
Distribution List:	

Issued by:	Mark Eddowes	M A Eddowes	06 11 2014

Summary

1. Under the City Airport Development Programme (CADP), London City Airport (the Airport) is proposing new airfield infrastructure and extended passenger facilities to enable it to operate up to the existing permitted number of maximum flights. The development proposals under CADP1 include provision of additional aircraft stands and ground movement areas on a deck or platform provided over the King George V Dock that is located south of the runway, immediately to the east of the existing terminal building and existing aircraft stands.

2. The proposed construction process for the CADP works is informed by the '*Improved Construction Programme',* as presented in Section 2 of the Consolidated Environmental Statement (CES). It involves vibro-piling from a floating rig, a process that has successfully been employed for the previous construction project at the Airport in 2007 (Operational Improvements Project (OIP)). When carrying out detailed technical analysis to finalise the *Improved Construction Programme* a number of alternative piling options were considered but discounted for a number of reasons including, inter alia, greater overall rig heights. Such increased heights above those associated with the proposed vibro-piling would have greater impacts on aircraft operations and are therefore likely to reduce the amount of piling that could be undertaken whilst the Airport is operational. The consideration of alternative piling options is presented in Section 3 of the Consolidated ES Addendum (CESA).

3. The Airport had originally proposed that CADP construction works such as these that involve OLS penetrations should normally be undertaken outside of operation hours of the airport (OOOH). This was borne out in the construction programme presented in the July 2013 ES. However, the London Borough of Newham (LBN), as the local planning authority, has expressed concerns about the level of disturbance to local residents that might arise from these OOOH works in particular. The Airport has subsequently given further consideration to the likely impacts of the piling operations on aircraft safety if these were to be undertaken during normal airport operational hours. This assessment has been brought forward to an earlier stage of the project than would normally be the case in order to undertake further analysis of the minimum night time working requirements, as requested by LBN. Ordinarily, such risk assessment would be undertaken once a contractor is appointed.

4. Temporary OLS penetrations caused by construction work associated with the OIP works and extension of the Docklands Light Railway to and beyond the airport have previously been accepted after specific assessment of the anticipated impacts on operations, as have short-term mooring of ships in the dock.

5. Detailed assessment of the OLS penetrations associated with the proposed vibro-piling technique has been undertaken to determine whether at least some of the works might be undertaken during operational hours without an unacceptable impact on operational safety and efficiency, and to what extent. In the first instance, it has been shown that the instrument approach procedures in place at the Airport would not be adversely affected by the penetrations. The operational procedures in use at the Airport are already subject to some restrictions in terms of the Obstacle Clearance Altitude (OCA). The OCA is the minimum altitude to which aircraft may descend at times of limited visibility and is set at a safe height that can accommodate the existing obstacle environment. It is found that the existing restrictions will adequately accommodate the penetrations associated with the proposed vibro-piling without any additional restrictions being required. Overall, it may be concluded that the penetrations would not adversely impact on these normal operations.

6. In addition to normal operations, some non-standard operations and reasonably foreseeable fault conditions may be identified that may lead to aircraft deviating from the intended flight paths and hence potentially leading to a risk of collision if new OLS penetrations were permitted. In this respect the late go-around below the normal OCA is identified as a fairly common non-standard operation that will merit specific attention. Go-arounds below the OCA may be initiated, for example, if the approach is not adequately stabilised shortly before landing or in the event of a runway incursion. For the late go-around, executed below the normal OCA, aircraft will have dropped below the level at which it can be guaranteed, on the basis of normal operational criteria, that a safe vertical margin can be maintained with respect to all obstacles in the go-around path. There is a possibility during these operations that aircraft may drift from the runway aligned path. It is therefore important to establish that either an adequate lateral margin or vertical margin, or some combination of both is maintained during this operation.

7. Following an approach that has been employed previously, the collision risks for the proposed piling works associated with the late go-around below the OCA have been estimated. As expected, the risk modelling exercise indicates that the risks will be higher for piling operations closer to the runway than further from it. Based on the estimated collision risks for individual piling locations it has been determined that the collision risk associated with a programme of piling works for the piling of rows D and those rows to the south of this point (see Figure A1.2: Proposed Split of OOOH and Operational Hours Piling Works at Appendix 1) during operational hours would meet an identified target level of safety of one collision in a thousand million aircraft movements that can be considered to represent a negligible and acceptable risk. Whilst such a programme of works would involve temporary penetrations of the Transitional Surface that would not normally be permitted, the conduct of the works during operational hours is perceived to provide benefits in terms of the avoidance of disturbance to local residents and is therefore identified as justified, having regard to the acceptable level of risk being achieved. The piling programme proposed in the *Improved Construction Programme* at Appendix 2.1 of the CESA has been finalised based on the acceptable level of risk identified in this report.

Contents

1 Background

1.1 Under the City Airport Development Programme (CADP), London City Airport (the Airport) is proposing new airfield infrastructure and extended passenger facilities to enable it to operate up to the existing permitted number of maximum flights. The development proposals under CADP1 include provision of additional aircraft stands and ground movement areas on a deck or platform provided over the King George V Dock that is located south of the runway, immediately to the east of the existing terminal building and existing aircraft stands.

1.2 The proposed construction process for these works involves vibrodriver casing and rotary bore piling from a floating rig, a process that has successfully been employed for the previous construction project at the Airport in 2007 (Operational Improvements Project (OIP)). The proposed piling rig is 22 m in height above the impounded water level in the dock, including the associated crane, and will represent a penetration of the Transitional Surface, one of the obstacle limitation surfaces (OLS) at the airport which define the airspace normally kept free of obstacles in order to ensure the safety of aircraft operations.

1.3 The Airport had originally proposed that CADP construction works such as these that involve OLS penetrations should normally be undertaken outside of operation hours of the airport (OOOH). This was borne out in the construction programme presented in the July 2013 ES. However, the London Borough of Newham (LBN), as the local planning authority, has expressed concerns about the level of disturbance to local residents that might arise from these OOOH works in particular. The Airport has subsequently given further consideration to the likely impacts of the piling operations on aircraft safety if these were to be undertaken during normal airport operational hours. This assessment has been brought forward to an earlier stage of the project than would normally be the case in order to undertake further analysis of night time working requirements, as requested by LBN. Ordinarily, such risk assessment would be undertaken once a contractor is appointed.

1.4 Temporary penetrations caused by construction work associated with the OIP works and extension of the Docklands Light Railway to and beyond the airport has previously been accepted after specific assessment of the anticipated impacts on operations, as have short-term mooring of ships in the dock. Similar arrangements that allowed some of CADP construction works to be undertaken during the hours of operation of the Airport may be able to address the concerns identified by LBN. However, it will be necessary for the Airport to be able to demonstrate that these works would not adversely affect the safety of operations.

1.5 Following an approach similar to that adopted in respect of previous temporary OLS penetrations at the Airport, the impacts of the proposed piling operations have been carefully considered, taking account of the range of distances from the operational runway that would be involved. In general terms, any risks posed by the piling operations can be expected to decrease progressively with increasing distance from the runway. Penetrations of the OLS associated with piling operations further from the runway will be of lesser concern. Overall, some balance whereby piling operations closer to the runway are undertaken outside operational hours whilst piling operations further away from the runway occur during operational hours would therefore seem to offer a potential practical solution.

1.6 This report presents an assessment of the vibrodriver casing and rotary bore piling method (the Proposed Piling Operations) as proposed for the construction of CADP and set out in Section 2 of the Consolidated Environmental Statement Addendum (CESA). It comprises the following elements that are addressed in turn:

- A summary specification of the proposed piling operations, having particular regard to their locations relative to the runway centreline and landing thresholds;
- An evaluation of the sizes of the penetrations against the OLS and other safeguarding criteria;
- An operational risk assessment that considers the risks of aircraft collision with the piling operations during normal operations and reasonably foreseeable non-standard operations;
- Some conclusions concerning the acceptability of penetrations associated with the CADP piling operations when runway operations are taking place.

2 Vibro-piling Operations Summary

2.1 It is proposed that a floating pile rig is employed. The piling rig is 22 m high above the impounded water level. During casing lift operations the unit will temporarily extend to 27 m above impounded water level. Impounded water level in the King George V Dock is identified as being 4.24 m AOD.

2.2 The made ground of the quayside that forms the current runway strip at the airport extends to 75 m from the runway centre line. It is proposed that piles be placed in a series of eleven rows, A to L, at increasing distances from the runway centre line. The first row is located at 8.32 from the edge of the runway strip and, for the most part, the rows of piles are spaced at 10 m interval and are located from 83.32 m and up to 183.32 m from the runway centreline. The pile locations are shown on Figure A 1.1 at Appendix 1.

2.3 The rows extend longitudally alongside the runway eastwards from the edge of the existing stands and terminal building at approximately 510 m East of the Runway 09 landing threshold for approximately 530 m to a point approximately 295 m West of the Runway 27 landind threshold. Immediately to the East of the existing stand area, the piles will extend laterally to the full distance of 183.32 m from the runway centreline and the new ground created will provide additional aircraft stand capacity. Further to the East, the piles will extend just over 120 m from the runway centreline and the new ground created will provide additional taxiway.

2.4 Full details of the proposed piling operations are set out in the following CADP Application Drawings: 5.14 Proposed Deck Structure Foundations - GA 1:1000 CA0L-900 TPS; 5.15 Proposed Deck Structure – Typical Longitudinal Section 1:500 & 1:50 CA0S-910 TPS; 5.16 Proposed Deck Structure – Typical Transverse Sections 1:500 CA0S-911 TPS; 5.17 Proposed Deck Structure - Engineering Details – Sheet 1 1:100 & 1:20 CA0D-920; and 5.18 Proposed Deck Structure - Engineering Details – Sheet 2 1:100 & 1:20 CA0D-921. A revised mark up of piling zones (distinguishing between piling during operational hours and out-of-operational hours (OOOH) is at Appendix 2.1 of the CESA (this is represented in Appendix 1 below for ease of reference).

2.5 Based on previous experience from the OIP works in 2007, it is anticipated that between one and two piles will be installed in a normal working day. There are a total of 412 piles to be installed. Whilst no detailed schedule has been provided for the works, it is evident that they will be of a significant duration. Any risks associated with them therefore cannot readily be discounted on the basis that the period of exposure is limited.

3 Safeguarding Assessment against OLS Criteria

3.1 A number of distinct aviation-related height constraints apply in respect of the safeguarding of operations at London City Airport:

- General safeguarding criteria, prescribed by the UK Civil Aviation Authority, which are defined by a series of Obstacle Limitation Surfaces (OLS), as described in Civil Aviation Publication 168 on the licensing of aerodromes. The OLS are a set of planar surfaces arranged about the runway and flight paths to and from it. Penetrations of the OLS are generally not permitted but penetrations of some surfaces may be allowed where it can be shown that these would not adversely affect the safety or regularity of aircraft operations.
- More specific criteria for the protection of flight procedures undertaken at individual airports, in accordance with standards and practices of the International Civil Aviation Organisation (ICAO), as defined in ICAO PANS-OPS [1]. These criteria, defined in terms of a set of Obstacle Assessment Surfaces (OAS), take account of the existing obstacle environment during the design of specific instrument flight procedures at individual airports. These criteria may place some restrictions on operations, the safety of which might otherwise be compromised by the existing obstacle environment. It is important from the perspective of the airport operator that new structures would not introduce any additional restrictions that might adversely affect operational safety or efficiency. On the other hand, where some restrictions already apply due to existing obstacles, this may allow some flexibility in respect of new developments, provided that these can be accommodated by those existing restrictions.

3.2 The safeguarding assessment begins with an initial screening assessment against the general safeguarding criteria defined in terms of the OLS. Where this initial assessment indicates that there may be some flexibility in the height restrictions that apply at the site in question, further assessment of specific flight operations by reference to the OAS is undertaken. In principle, both departure and approach procedures may require consideration where there are OLS penetrations but, given the location of the piling operations, the primary concern in this case will be approach procedures and, in particular, missed-approach operations when an approach must be discontinued, requiring aircraft to fly over the runway and climb away past the intended landing threshold.

3.3 Screening assessment against the OLS identifies that the piling operations would be penetrations of the Runway 09 and Runway 27 Transitional Surfaces. The Transitional Surfaces rise from the edge of the runway strip laterally with a slope of 1 in 6 from the aerodrome reference elevation of 4.95 m AOD up to a height of 45 m above aerodrome reference elevation. In accordance with its slope of 1 in 6, the height of the Transitional Surfaces increases progressively with increasing distance from the origin at the edge of the runway strip and the extent of the estimated penetrations of the surface by the piling rig decrease progressively with increasing distance from the runway.

3.4 CAP168 OLS criteria and the ICAO Annex 14 Standards and Recommended Practices that they implement in the UK generally do not allow new penetrations of the Transitional Surface. However, taking account of the temporary nature of the proposed penetrations and the perceived benefits in terms of reduced impacts associated with the construction process if they were to be permitted, further consideration has been given to the likely scale of the operational implications in practice.

3.5 Although not formally specified at London City Airport, it is instructive to consider the relation of the obstacles presented by the piling rig at different locations to the specification of the Inner Transitional Surface. The Inner Transitional Surface is part of the Obstacle Free Zone (OFZ). According to CAP 168, the OFZ is intended to protect aeroplanes from fixed and mobile obstacles during Category I, II or III operations when approaches are continued below decision height and during any subsequent missed approach or baulked landing with all engines operating normally. The OFZ is normally established at Cat II and Cat III approach runways and in that context is seen to provide important protection where aircraft undertaking an instrument approach descend close to the runway without visual reference.

3.6 The specification for the Transtional Surface, which is intended to provide protection during approach operations and is a requirement only at runways used for landing, was defined relatively early in the process of development of the international standards for the OLS that underpin the physical specifications for safeguarding airspace at aerodromes, following the Chicago Convention on Civil Aviation in 1944. The specification was based primarily on expert judgement and on the limited operational experience that was available at that time. The specification for the Inner Transitional Surface was developed well after that for the Transitional Surface, as part of the process intended to safeguard the introduction of precision instrument approaches in the 1970s and made reference to studies of the accuracy with which aircraft on an instrument approach could maintain their position close to the intended fight path, aligned with the runway. On that basis, the Inner Transitional Surface may be considered to provide a better indication of the area that needs to be maintained free of obstacles in order to provide an appropriate level of aircraft safety during the types of operations undertaken at the airport than the Transitional Surface. Screening against this OLS criterion shows that the piling operations would be a penetration of the Inner Transitional Surface when positioned at Rows A, B and C (as illustrated on Figure A1.2: Proposed Split of OOOH and Operational Hours Piling Works at Appendix 1) but not at Row D and further south.

3.7 The primary instrument procedures at the airport that require consideration as part of this safeguarding assessment are the Runway 09 and Runway 27 precision (ILS/DME/NDB) approaches. In practice, the piling rigs are of relatively limited height compared with a number of existing obstacles in the vicinity of the airport that must be taken into account in the design of the published precision instrument approach procedures. It can readily be seen by reference to the relevant PANS-OPS criteria that the Obstacle Clearance Altitudes (OCA) for these procedures, which are set to accommodate the existing obstacle environment, will accommodate the piling rigs. It can therefore be concluded that the proposed piling operations will have no adverse impact upon these procedures. The same conclusions can readily be drawn also in respect of the Runway 09 and Runway 27 non-precision (LOC/DME/NDB) Approaches.

3.8 The piling rig locations lie to the side of the runway before the departure end of runway (DER). ICAO Annex 14 specifications for the OLS appropriate for take-off runways identify no height limit for obstacles located laterally beyond the limit of the runway strip and before the DER. Similarly ICAO Annex 6 requirements for obstacle clearance during departure operations and PANS-OPS criteria for Standard Instrument Departures identify no requirements for obstacle clearance before the DER. It can therefore readily be seen that the proposed piling operations will have no adverse impact upon departure operations.

3.9 In summary, the safeguarding assessment against the OLS criteria identifies that the piling rigs would be penetrations of the Transitional Surface when employed at each of the pile locations. If the normal safeguarding process were to be followed, these penetrations would not be permitted. The likely significance of the penetrations has been assessed by reference to the specification for the Inner Transitional Surface, which may be considered to be a more reliable guide to the area that needs to be maintained free of obstacles in order to provide an appropriate level of aircraft safety during the types of operations undertaken at the airport. This assessment shows that whilst piling operations at Rows A to C pile locations would be penetrations of this surface, operations at Row D and further south would not. The safeguarding assessment has also shown that the penetrations associated with the piling rig would not have any adverse impact on the precision and non-precision instrument approach procedures which must accommodate a number of existing obstacles that are more significant when assessed against the relevant PANS-OPS OAS criteria. Departure operations would also not be be affected.

4 Operational Safety Assessment

4.1 The analysis presented in Section 3 has assessed the potential impacts of the proposed piling operations (vibrodriver casing and rotary bore piling method) on flight operations by reference to PANS-OPS criteria which are intended to provide safe vertical and lateral clearance margins when aircraft are following normal operational procedures. The assessment has indicated that there will be no adverse impacts on normal operations. In addition to normal operations, some non-standard operations and reasonably foreseeable fault conditions may be identified that may lead to aircraft deviating from the intended flight paths and hence potentially leading to a risk of collision. In this respect the late go-around below the normal OCA is identified as a fairly common non-standard operation that will merit specific attention. Go-arounds below the OCA may be initiated, for example, if the approach is not adequately stabilised shortly before landing or in the event of a runway incursion or the failure of another aircraft to vacate the runway.

4.2 Experience at other airports indicates a late go-around rate of the order of 1 in 300 approaches. For the late go-around, executed below the normal OCA, aircraft will have dropped below the level at which it can be guaranteed, on the basis of normal PANS-OPS criteria, that a safe vertical margin can be maintained with respect to all obstacles in the go-around path. There is a possibility during these operations that aircraft may drift from the runway aligned path. It is therefore important to establish that either an adequate lateral margin or vertical margin (free of obstacles), or some combination of both is maintained during this operation.

4.3 Given the proposed piling locations, the piling operations may potentially present a risk to both Runway 09 and Runway 27 late go-around operations, according to the combination of lateral and vertical margins that are achieved. Both operations have been systematically assessed for a range of go-around initiation points between the normal OCA and runway level. Collision risks during the late go-around after the OCA have been estimated using a modified version of the ICAO Collision Risk Model (CRM) which was developed to support the design of safe instrument approach procedures, takign account of the accuracy with which aircraft can be expected to adhere to the intended runway-aligned flight path.

4.4 As dicussed further in Section 5, based on the reference point of the recent historical accident rate of 1×10^{-7} per take-off or landing movement, introduction of a new contributor to the take-off and landing risk of that order would generally not be considered acceptable. On the other hand, a risk of the order of 1 x 10^{-9} or less per take-off or landing movement (one in a thousand million), about a hundred times smaller than the recent historical accident rate, could be considered to be small and acceptable. On that basis, the late go-around risk estimates indicate that the collision risks associated with piling at rows further from the runway will be negligible and acceptable whereas the collision risks associated with locations closer to the runway will not be acceptable.

4.5 The safeguarding assessment against the Inner Transitional Surface criterion has indicated that undertaking piling operations for Rows D to L may be an acceptable option. The risks associated with the late go-around for this option, as estimated using the CRM, have been assessed against the above target level of safety of 1 x 10^{-9} per take-off or landing movement (one in a thousand million) and have been found to be below that level. The risks associated with piling of Rows D to L during operational hours are therefore identified as being negligible and acceptable when set against the risks inherent in civil aviation.

4.6 It may be noted that the estimated collision risks at any given lateral distance from the runway would increase if an alternative piling method requiring a taller rig were to be employed. Adoption of the vibrodriver casing and rotary bore piling method so as to minimise the rig height should therefore maximise the potential for piling during the hours of operation of the Airport.

5 OLS Penetrations Associated with Other Works

5.1 As set out in CES Chapter 6 on the Development Programme and Construction, cranes are considered to be essential in fabricating a project of this nature, especially when utilising precast and modular elements. Extensive use of cranes is therefore expected to be made during construction of the various elements of the project in addition to the piles. Due to the close proximity to the runway, tower cranes are not typically suitable due to the limitations of the transitional surface and it is therefore expected that mobile cranes will be employed. The height of these cranes will vary depending on the specific task. The following anticipated crane heights are identified in CES Chapter 6:

- New East Pier and ETE building - Typical maximum of 25m, but potentially up to 30m for exceptional plant deliveries;
- Materials Storage Yard – Typically 30m;
- Piled Deck construction – Typically 30m:
- Other buildings – Typical maximum of building height + 10m.

5.2 It may be noted that the maximum anticipated crane heights are at or marginally above the height of the 27 m identified for the piling rig that has been assessed in detail, as described in Section 4. It may also be noted that the locations for the works concerned are, for the most part at least, at distances from the runway for which the estimated collision risks will be at the lower end of the range identified. It can therefore be expected that it will be possible to undertake the majority of these crane operations during the operational hours of the airport, the exception being piled deck construction in locations closer to the runway. It is proposed that further and more detailed consideration be given to these works in due course during the development of more detailed methods statements in order to maximise the amount of work to be undertaken during operational hours and to develop the appropriate safety justifications that the Airport will require.

6 Risk Evaluation and Conclusions

6.1 Quantitative risk assessment has been used extensively to support the prioritisation of safety management actions and the optimisation of resources across a wide range of industries that present potential hazards to people. Risks cannot be eliminated altogether but actions need to be taken to ensure that they are maintained at an acceptably low level. Safety management measures involve costs, including financial costs and costs in terms of other impacts. It is important also to ensure that these costs are in proportion to the safety benefits provided. When adopting a systematic approach to safety management, supported by quantitative risk assessment and an evaluation of costs and benefits, it is helpful to make reference to quantitative risk standards. The application of this approach in the aviation sector has been reviewed extensively [2]. Based on that previous work, a quantitaive target level of safety of 10^{-9} per take-off and landing movement (1 in a thousand million) is considered to represent an appropriate reference point for use in the current context.

6.2 Based on the findings of the collision risk assessment it has been concluded that the collision risk associated with a programme of piling works for the piling of rows D and those rows to the south of this point during operational hours would meet the identified target level of safety and would therefore represent an acceptable risk. Together with the safeguarding assessment against the Inner Transitional Surface, the findings of this risk assessment have informed the split of piling between operational and out of operational hours (OOOH) works as is detailed in the *Improved Construction Programme* at Section 2 of the CESA (see also Appendix 2,1 of CESA). Piling works to the north of Row D would be installed in the OOOH period whilst those at Row D and to the south would be installed during operational hours, given the acceptable risk associated with such works, based on the above assessment. Whilst such a programme of works would involve temporary penetrations of the Transitional Surface that would not normally be permitted, the conduct of the works during operational hours is perceived to provide benefits in terms of the avoidance of disturbance to local residents and is therefore identified as potentially justified, subject to an acceptable level of risk being achieved.

6.3 Assessment against the PANS-OPS criteria for vertical and lateral clearance during instrument approach procedures has shown that normal operations would not be adversely affected. It can therefore be concluded that the carrying out of piling works during operational hours to the extent shown on Figure A1.2. at Appendix 1 would be acceptable from that perspective.

6.4 In accordance with the CAA approval process set out in CAP 791, when undertaking works such as those proposed under CADP, the airport, as the aerodrome licence holder, must demonstrate to the CAA that the project will be managed safely. The CAA will expect aerodrome licence holders to develop safety assurance documentation for Part 2 of the CAP 791 submission procedure that describes how the aerodrome will manage the construction works and operating procedures, to ensure that aerodrome operations can continue safely during the project. This will involve the development and implementation of a formal system for the strict control, safety management, safeguarding and safety coordination of all airside works. The Part 2 submission would be submitted to the CAA once a contractor is appointed as detailed construction method statements need to be submitted.

6.5 However, the responsibility for construction risk assessments lies with the aerodrome licence holder and as such London City Airport are satisfied that the proposed construction works can be managed safely.

References

1 Procedures for Air Navigation Services: Aircraft Operations (Doc 8168), International Civil Aviation Organisation.
2 Final Report on the Risk Analysis in Support of Aerodrome Design Rules. Mark Eddowes, Jon Hancox & Anne MacInnes, A report produced for the Norwegian Civil Aviation Authority, 2001. http://www.luftfartstilsynet.no/incoming/article2032.ece/BINARY/AEA_Final_Report_Version+1A.pdf

Appendix 1 Plans of Proposed Pile Locations

Figure A1.1: Pile Locations

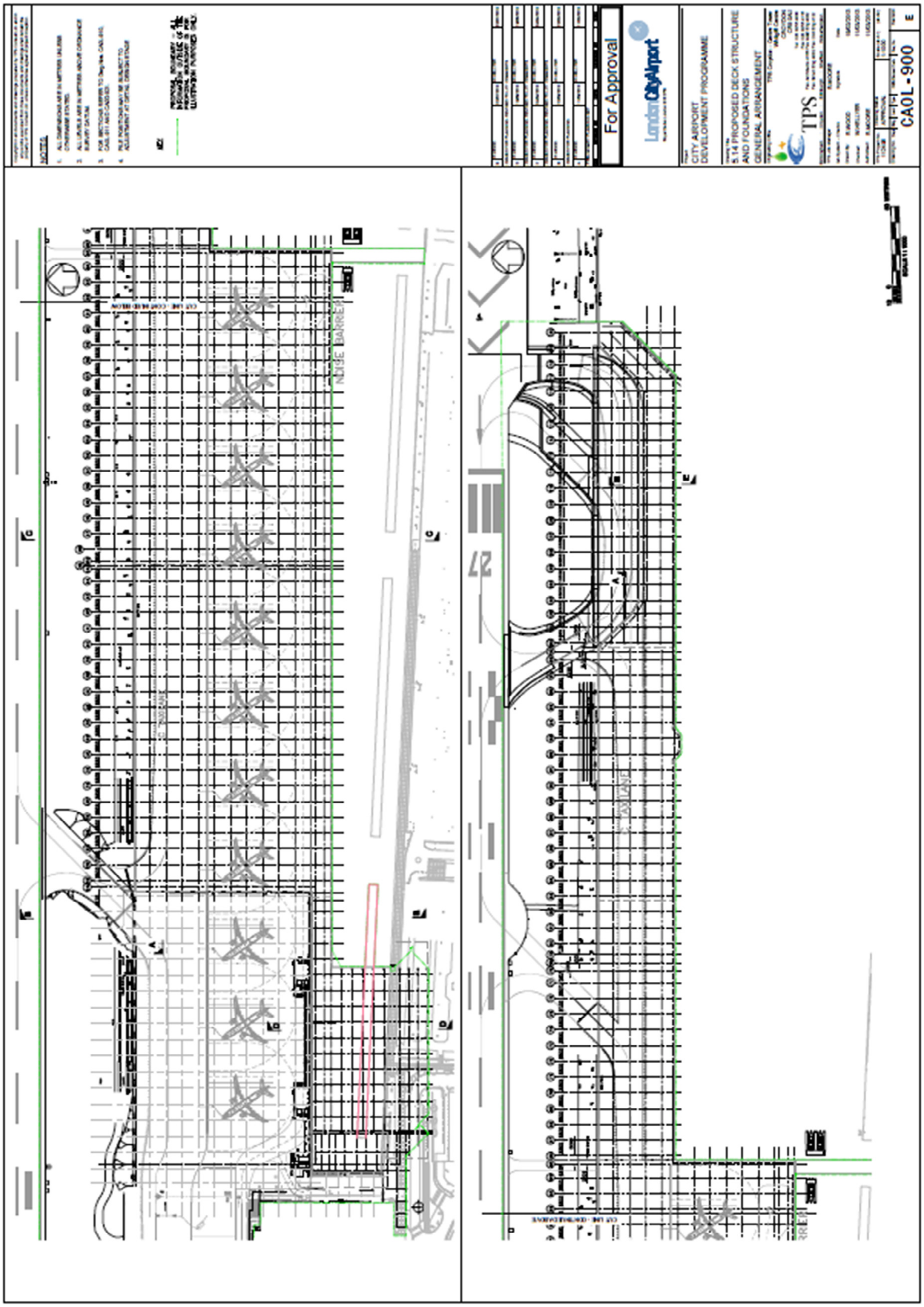
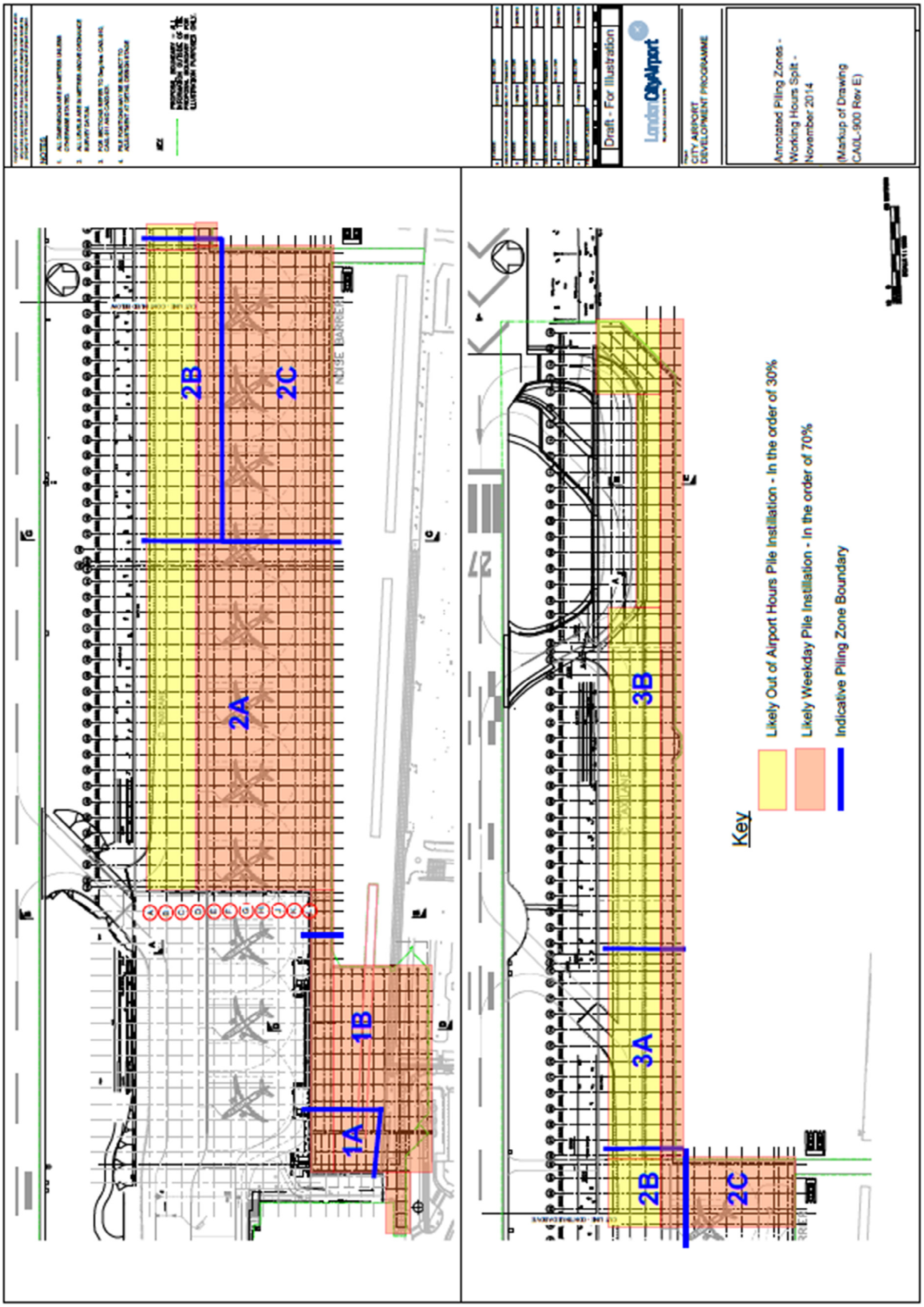


Figure A1.2: Proposed Split of OOOH and Operational Hours Piling Works



APPENDIX 3.1

Operational Impact of Construction Related Airport Closures or Restricted Opening Hours (York Aviation, September 2014)

York Aviation

LONDON CITY AIRPORT

OPERATIONAL IMPACT OF CONSTRUCTION RELATED AIRPORT CLOSURES OR RESTRICTED OPENING HOURS

FINAL REPORT

NOVEMBER 2014

York Aviation	**Originated by: Louise Congdon** **Dated: 6th November 2014** **Reviewed by: Richard Connelly** **Dated: 6th November 2014**

LONDON CITY AIRPORT

OPERATIONAL IMPACT OF CONSTRUCTION RELATED AIRPORT CLOSURES OR RESTRICTED OPENING HOURS

Contents

1. SUMMARY CONCLUSIONS

1.1 On 20 August 2014, London Borough of Newham (LBN) requested the Airport to consider the impacts of temporary closures; weekend closures; or alterations to flights to avoid/reduce Out of Operational Hours (OOOH) (weekend and night-time) construction of the City Airport Development Plan (CADP). York Aviation, with input on construction timeframes from TPS (CADP Project Engineers), has undertaken a detailed qualitative and quantitative assessment of both the commercial and wider implications of these scenarios, as presented this report. The summary conclusions of this assessment are briefly set out below, with **Table 1.1** illustrating the significance of the potentially severe impacts.

1.2 Subsequently, consideration of a number of additional variant scenarios was requested by LBN, following the receipt of further technical advice. The implication of these additional scenarios, for weekend closure or restricted operations for the duration of the night-time piling works only, is also considered in this report and the impacts summarised, in Table 1.1 which shows that the impacts are not materially different from those scenarios originally proposed by LBN.

1.3 At the outset, it is important to note that the impact of any closure of London City Airport, however temporary, will have wider ramifications for airline scheduling and the effective use of airport capacity in the UK and Europe. If airlines are required to re-schedule, they will have to do so within the constraints of available capacity and it cannot be assumed that this will be possible. Hence, the implications for airlines and passengers may be substantial and these are over and above the directly measurable local implications.

1.4 Whilst the complete closure of the Airport for several months or weeks respectively, for either the extended duration of Out of Operational Hours (OOOH) construction or piling only, may deliver modest reductions in the total duration of night-time construction works, the socio-economic impacts would be extremely severe, placing all of the employment generated by the Airport, amounting to 1,900 direct FTE[1] jobs and 570 indirect/induced FTE jobs in 2012, at risk. Alongside the loss of jobs, there would be a loss of the contribution which the Airport makes to the GVA of the local area, amounting to almost £110 million in 2012, as well as a broader loss to the UK economy of a further £640 million of wider impacts on passengers and business. Millions of passenger journeys would also be lost or heavily disrupted as it is highly unlikely that the airlines could realistically relocate operations, in whole or in part, to other London airports. The impacts on the Airport and, more importantly, its users would be very significant such that the ongoing viability of airline operations at the Airport could be put at risk, with a high probability that some or all of the airlines would not recommence operations following the closure, so placing the viability of the Airport and associated employment in jeopardy.

1.5 Weekend closures would also have significant impacts on the airlines and passengers using the Airport, resulting in the loss of between 435,000 and 664,000 passengers, if weekend closures were imposed for the full duration of the planned OOOH construction works. Weekend closures would also result in substantially reduced employment of up to 260 annual FTE jobs during each of the construction phases and up to £27 million of lost GVA in the local area over the two construction phases. Furthermore, to the extent that airline operations were no longer economically viable, could result in deeper and longer lasting reductions in employment. Even shorter duration weekend closures would give rise to a substantial risk that airlines could find that operations from the Airport were no longer economically viable if restrictions on the utilisation of aircraft resulted in unacceptable losses.

1.6 Significantly, notwithstanding any impact of weekend closures on the Airport, the reductions in OOOH construction duration would be modest at best (reducing OOOH working from 37 to 36 months overall or a reduction of 2 weeks OOOH piling in both phases) and the closures would further reduce the already restricted (6 day) utilisation which based airlines could make of their London City aircraft. Some further reductions to night-time piling of between 4-6 weeks in may be achievable in both phases if it was assumed that 24 hour continuous working window would be allowed throughout the whole weekend for the duration of piling. This would mean that the local community would not benefit from any noise respite period whatsoever during the week or over the weekend, from either aircraft or construction noise. Notwithstanding this, the socio-economic impacts, when coupled with the other potential impacts on both the Airport and airlines, would be significant in the case of weekend closures and would be completely disproportionate to the very modest reductions in the overall OOOH construction programme.

[1] FTE ï full time employment.

1.7 To the extent that the impacts on the airlines and passengers might be mitigated by allowing a shorter period of operations on Saturdays and Sundays, there would be no material gain in construction production rates or a shortening of the OOOH works overall.

1.8 In terms of adjustments to the Airportÿs operational hours, only two of the scenarios (curtailing flights by an additional 5 hours to between 08.00hrs and 18.30hrs or by 7 hours between 10.00 and 17.00 or 09.30 and 16.30) would deliver any notable reduction in OOOH construction duration of 4 weeks and 3-4 weeks respectively in the duration of night-time piling works in each construction phase, although the impact on the overall construction programme would be negligible. Curtailing flights for lesser periods at the beginning/end of the day or during the early afternoon is unlikely to have any effect on reducing the duration of noisier construction activities, such as piling, as it would not provide sufficient time for a second pile to be completed within the night-time window, as discussed further at Section 3 of the Consolidated Environmental Statement Addendum (CESA). This needs to be set against the significant impact which further curtailing flight times would have, particularly during the important peak hours each day, on the airlines and their ability to use their aircraft assets efficiently and productively and to maximise passenger throughput. Any curtailment of activity during these peak hours would have severe implications for the whole aircraft schedule, particularly for based carriers, but could also result in some non-based airlines dropping London City from their schedules altogether.

1.9 The peak period represents the optimum travel period for business passengers and, therefore, the implications of a further 5 hour curtailment of the operational day[2] for the whole duration of OOOH construction works would be very severe, with a minimum loss of passengers carried through the Airport of 1.4 million during the Interim Works and 2.8 mppa during the Full Works, with job losses of 870 FTEs and 1,150 FTEs respectively, with a potential local GVA loss of over £100 million over the two construction phases. Even for the duration of the night-time piling works, the reduction of passengers at each phase from a 5 hour curtailment or 7 hour midday closure would exceed 300,000, with a loss of 220 to 350 FTE jobs in total and £11 to £17 million in local GVA at each phase. The effect on the airlinesô utilisation of aircraft would be substantial and is likely to have long term implications on the viability of fleet replacement and expansion at London City. The socio-economic impacts and impacts on both airlines and passengers would be significant and would be completely disproportionate to the relatively modest reductions in the overall OOOH construction programme.

[2] At LBNÿs request, the 7 hour closure was considered only for the duration of the night-time piling works.

1.10 LBN also requested consideration to be given to closure of the Airport for the duration of the night-time piling works during August and at Christmas. However, TPS consider this not to be practical in terms of the required sequencing of construction activities and the requirement to carry out these specific works at a fixed point on the construction programme. Furthermore, 24 hour piling work during the Christmas period may have adverse impacts on local residents. The report nonetheless illustrates the implications of such a scenario (if it were feasible) and shows it to be similar to that for a full temporary closure for the duration of the night-time piling works, albeit there are fewer passengers using the Airport over the Christmas period and there are less business passengers in August. TPS has considered whether there would be scope to extend the August closure to provide a viable construction window comprising the whole of August and additional weekend closures to complete piling works as a feasible alternative with similar characteristics in terms of reducing the impact on business passengers. The implications of such a scenario are also illustrated. Again, the impacts are very similar to those assessed for a full temporary closure for the duration of the night-time piling works.

1.11 In short, the impacts of any full closure or restricted operations scenarios in order to avoid or further reduce OOOH construction works would be severe. Table 1.1 sets out in more detail the potential impacts under each scenario.

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	**Impacts**
Scenarios 1 & 2. Temporary Airport Closure for in lieu of planned Duration of OOOH[3] Works – Day working or 24 hour working: *Closure of the Airport for between 10 and 12 months during the construction of Interim Works and between 13 and 16 months during the construction of Full Works dependent on*	• Reduction in total OOOH construction programme by between 9 months (24%) with day working and 14 months (38%) with 24 hour working.	• A conservative estimate of the annualised reduction in the number of direct, indirect and induced full time equivalent (FTE) jobs sustained by the Airport of between 2,340 and 2,450 during the Interim Works construction period and 2,630 FTE jobs during the Full Works construction, with an associated loss of gross value added (GVA) in the local area of between £111 million and £117 million during the Interim Works and £136 million during the Full Works;

[3] Out of operational hours.

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	**Impacts**
whether 24 hour or day time only working is assumed respectively.		• Loss of all of the Airport's business for the duration, amounting to 3.5 million to 4.2 million fewer passengers being able to use the Airport during Interim Works construction and 5.3 million to 6.5 million fewer during Full Works construction; • Journey time penalties to passengers of between £112 million and £135 million during Interim Works construction and between £169 million and £208 million during Full Works construction; • A direct loss to the overall Airport revenues of between £94 million and £113 million at Interim Works and between £142 and £175 million at Full Works construction; • Significant operational impacts on the airlines; • Significant long term risk of airlines relocating elsewhere and employment being lost permanently, including the risk that the loss of skilled staff would prevent the Airport from reopening.
Scenarios 1 & 2. Temporary Airport Closure for Duration of Night-Time Piling Works – Day working or 24 hr working:	• Reduction total duration of piling by 6 weeks (19%) to 26 weeks with day working. • Duration of total	• A conservative estimate of the annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 420 and 750 during the Interim Work construction period and between

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	**Impacts**
Closure of the Airport for between 8 and 16 weeks during the Interim Works construction and between 5 and 10 weeks during the Full Works construction, dependent on whether 24 hour or day time only working is assumed respectively.	night-time piling works reduced by 19 weeks (60%) to 13 weeks overall if 24 hour working.	280 and 420 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £20 and £40 million during Interim Works construction and between £15 million and £29 million during the Full Works construction; • 647,000 to 1.3 million fewer passengers being able to use the Airport during the Interim Works construction and 470,000 to 940,000 fewer during Full Works construction; • Journey time penalties to passengers of between £21 million and £41 million during Interim Works construction and between £15 million and £30 million during Full Works construction; • A direct loss to the overall Airport revenues of between £15 million and £31 million at Interim Works construction and between £11 and £22 million at the Full Works construction but taking into account the effect of the closures on the airlines and the high probability that some or all of them might not return to the Airport following the closure, the overall financial impacts could be significantly greater; • Substantial long term risk of airlines relocating elsewhere and employment being lost permanently.

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	Impacts
Scenario 3. Weekend Closure for Duration of Works: *Weekend closures of the Airport for periods of 15 and 21 months during both the Interim and Full Works construction respectively in the event of closure for the full duration of the OOOH construction works, and 17 and 11 weeks respectively if closure was just for the period of the night-time piling works and night-time working was not permitted at weekends. If the weekend closure was solely for the period of the night-time piling works and 24 hour working was permitted at weekends, the duration of the night-time piling works could be reduced to 13 and 9 weeks*	• Reduction in total OOOH construction programme by 1 month (3%) to 36 months. • Duration of total night-time piling works reduced by 4 weeks (12%) to 28 weeks.	• An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 60 and 260 during the Interim Works construction period and between 50 and 260 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £3 and £13 million during Interim Works construction and between £2 million and £14 million during the Full Works construction; • 83,000 to 435,000 fewer passengers being able to use the Airport during Interim Works construction and 66,000 to 664,000 fewer during Full Works construction; • Journey time penalties to passengers of between £3 million and £14 million during Interim Works construction and between £2 million and £21 million during Full Works construction; • A direct loss to the overall Airport revenues of between £2 million and £10 million during the Interim Works construction and between £2 and £16 million during the Full Works construction; • Weekend closures would not achieve any material reduction in overall OOOH construction (3% reduction). Only by permitting

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	**Impacts**
		24 hour continuous working at weekends would there be any meaningful reduction in the period of night-time piling but there would still be little reduction in the overall period of OOOH works. • Substantial loss of utilisation for the airlines with operational/fleet scheduling difficulties for airlines and/or the cost of splitting operations; • Significant reduction in choice of flights for passengers, particularly at the beginning and end of the working week; • Substantial long term risk of airlines relocating.
Scenario 4. Restricted Opening Hours: *Restrictions on operating hours for a period of 15 months during the Interim Works construction and between 21 and 22 months during the Full Works construction if the restrictions are for the full duration of the OOOH construction works, and between 15 and 19 weeks during the Interim Works construction*	• Improvements to overall duration of works and night-time piling only where the Airport closes in the early mornings and during evenings (5 hour daily restriction, before 0800 and after 1830) ï 1 month improvement to overall duration to 36 months (3%) and 7 weeks (22%) improvement to night-time piling duration to 25 weeks, or where closure of the Airport for 7 hours in the middle of the day is	• An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of up to 870 during the Interim Works construction period and up to 1,150 FTE jobs during the Full Works construction, with an associated loss of GVA in the local area of up to £41 million during the Interim Works construction and up to £60 million during the Full Works construction; • Up to 1.4 million fewer passengers being able to use the Airport during the Interim Works construction and up to 2.9 million during the Full Works construction;

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	**Impacts**
and 9 and 13 weeks during the Full Works construction if the restriction is for the duration of night-time piling.	contemplated.	• Journey time penalties to passengers of up to £46 million during the Interim Works construction and up to £92 million during the Full Works construction; • A direct loss to the Airport revenues of between up to £34 million during the Interim Works construction and up to £69 million during the Full Works construction; • Fundamental operational/fleet scheduling difficulties for airlines and loss of aircraft utilisation; • Significant reduction in choice of flights for passengers; • Early morning and evening closure would not achieve a material reduction in overall OOOH construction (3%). • Substantial risk of the airlines relocating and not returning to the Airport.
Scenario 5. Closure in August and at Christmas: *Closure for a 4 week period in August and a 2 week period at Christmas, during periods of lower business passenger demand, to allow 24 hour night-time piling*	• It is not considered feasible or practical to contain OOOH construction or night-time piling works to these specific periods. Assuming 24 hour piling works, periods of 8 and 5 weeks closure respectively would be required to complete	• An estimate of the annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 240 and 270 during the Interim Work construction period and between 250 and 320 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £11 and £13 million during Interim Works

Table 1.1: Summary of Impacts		
	Effect on OOOH Construction Duration	**Impacts**
works if it was feasible to manage the works within these time frames and at these times of year. In the alternative closure for the whole of August at each phase followed by closure for 5 weekends to complete the piling work at Phase 1 and 1 weekend at Phase 2, with 24 hour working in each case.	the OOOH piling (as assessed in scenario 2)	construction and between £13 and £17 million during the Full Works construction; • 368,000 to 422,000 fewer passengers being able to use the Airport during the Interim Works construction and 416,000 to 533,000 fewer during Full Works construction; • Journey time penalties to passengers of between £7 and £8 million during Interim Works construction and between £8 and £11 million during Full Works construction; • A direct loss to the overall Airport revenues of between £9 and £10 million at Interim Works construction and between £10 and £13 million at the Full Works construction but taking into account the effect of the closures on the airlines and the probability that some or all of them might not return to the Airport following the closure, the overall financial impacts could be significantly greater; • Substantial long term risk of airlines relocating elsewhere and employment being lost permanently.

1.12 In the event of such closures, airlines are likely to substantially and permanently downscale their operations and may relocate to serve other markets completely. It is unlikely that operations at London City would recover immediately and there will be long term implications for the business and its ability to deliver economic growth for East London. There will be wider implications for passengers and the business community in the City of London and Canary Wharf. The implications will be substantially greater than the direct and quantifiable implications of the closure itself which are set out above. This applies whether a full closure is contemplated or simply a restriction of weekend or weekday operating hours, although clearly the magnitude of the impacts is significantly greater with a full closure than with smaller scale restrictions to operations. That said, the impacts of smaller scale operational restrictions remain significant.

1.13 The impact of a shorter length of full closure, for the duration of the night-time piling works, would be less but would still generate a notable risk of long term damage to the Airport's business. There remains a high risk that some or all of the airline operations would not return to the Airport following a period of closure.

1.14 Even shorter length restrictions to the operating hours or on weekends could have an impact on airline finances as their already curtailed aircraft utilisation (limited to 6 days out of 7) would be further impacted. This could damage their willingness or ability to grow at London City and could result in deferral of plans to introduce new quieter aircraft.

1.15 Overall, the implications of periods of closure during the OOOH works have the potential to seriously undermine the Airport's business model, which in a competitive market may not fully recover. There is a high risk of this occurring with any extended period of closure or restriction but the risks remain with even shorter periods of closure or restricted operations. The extent to which benefits would be gained from relatively short reductions in construction periods have to be weighed against the potential risks to the Airport's business model overall.

1.16 Overall, it is considered that any closure or restriction of operations for the full duration of the OOOH works is likely to have long term implications for London City Airport in terms of it achieving its growth potential as outlined for CADP. This would have substantial implications for the employment and economic activity supported by the Airport in the local area and in the contribution which the Airport makes to the wider economy of London. All of the employment at the Airport could be put at risk with a period of full closure, whilst shorter duration closures will have longer lasting impacts on the economic activity which the Airport supports.

2. BACKGROUND

2.1 On 20th August 2014, London Borough of Newham (LBN) requested that London City Airport provides justification for the Out of Operational Hours (OOOH) construction programme for the City Airport Development Programme (CADP) and whether this could be improved so as to reduce the duration of night-time working/periods of disruption to the local community by either closing or restricting the operational hours of the Airport. In particular, it requested that the Airport set out what impacts there would be under the following scenarios for the duration of the Out of Operational Hours construction period:

- i) Temporary closure of the Airport (Scenarios 1 and 2);
- ii) Partial temporary closure, for example at weekends (Scenario 3);
- iii) Temporary alterations to morning and evening flights (Scenario 4); and
- iv) Any other scenarios (variants of the above).

2.2 The Airport was also requested to consider the commercial impacts (including viability of the business), flight scheduling and any other operational constraints under the above scenarios.

2.3 In all cases, the implications have been considered alternatively for the complete duration of the proposed OOOH construction works as well as the duration of the night-time piling works only. This approach was agreed with LBN Officers and their technical advisors at a meeting on 3rd September 2014.

2.4 Subsequently, on further reflection with their technical advisors, LBN Officers requested that consideration be given to some additional variations to the above scenarios. In particular, these were:

- The effect on the duration of weekend closures if continuous 24 hour working is assumed throughout the weekend closure period (included as a variant under Scenario 3);

- The effect of an extended period of daytime closure of 7 hours (10.00-17.00 or 09.30-16.30) on the basis that the proportions of business travel and airline yields will be lower during the middle of the day period, and the extent to which the impacts of this scenario could be mitigated by allowing the Airport to operate on an unrestricted basis between 06.00 and 07.00 (included as an additional variant under Scenario 4);

and

- An additional scenario (Scenario 5) whereby the Airport closes during August and over the Christmas period when levels of business demand are believed by LBN to be lower.

2.5 The additional variations to the assessed scenarios have been considered only in terms of the effect on the duration of night-time piling works and with 24 hour working where appropriate. This approach is considered to directly address the issues raised by LBNõs technical advisor.

2.6 The duration of closure/temporary alterations under each scenario have been derived by using the Improved Construction Programme (August 2014) (see Appendix 2.1 of CESA) as the baseline for the assessment and then estimating the resulting reduction in construction duration if the Airport was closed or operating hours restricted under the various scenarios. A detailed technical note prepared by TPS that sets out the assumptions under each scenario is attached at **Appendix A** to this report. It should be noted that the Improved Construction Programme has already achieved a significant reduction in the amount and duration of OOOH working (including night-time piling) in comparison to that previously assessed in the Environmental Statement (July 2013) and its subsequent Addenda (March 2014 and May 2014). The improvements are presented in Section 2 of the CESA.

2.7 Whilst the extended closure scenarios may achieve a reduction in OOOH works that would need to be balanced against the impacts of closing the Airport, it is important to note that both weekend closures and/or temporary alterations to operating hours would not necessarily result in a substantial reduction in construction programme when limitations such as mobilisation, demobilisation, piling production rates and other construction related factors are considered. It is in this context that the socio-economic and commercial implications for the Airport and, more importantly, its airline customers must be considered.

3. AIRPORT OPERATIONAL CONTEXT

3.1 London City Airport is unique in terms of the market which it serves and the time sensitive nature of its passengers, the majority of whom are travelling for business purposes. This places particular requirements on airline operations from the Airport which, when coupled with the specific operational requirements of the infrastructure, limits the realistic alternatives for airlines and passengers which would necessarily be displaced from the Airport if there was any period of closure or extended operating restrictions during the construction of CADP.

3.2 The Airport already operates with substantial restrictions on its operating hours, particularly in terms of closing for 1 full day at weekends. Its operations are already limited on weekdays to between 06.30 and 22.00 (with additional limitations on the number of movements between 06.30 and 07.00 and on Bank Holidays), representing a shorter operating day than other airports serving London. Weekend operations are limited to the period 06.30 to 12.30 on Saturdays and 12.30 to 22.00 on Sunday. This already restricts airline operations from the Airport as based airlines, in particular, are unable to attain optimum use of the aircraft compared to what can be achieved at other airports where operations can be scheduled throughout the full operating day, typically 06.00 to 23.30, and at weekends.

3.3 An important consideration is the nature of activity at London City. According to CAA survey data, some 55% of passengers are travelling for business purposes[4], which is a significantly higher proportion than at any other UK airport including Heathrow[5]. Importantly, at weekends, 33% of passengers also travel for business reasons. This means that, even at weekends, London City handles a higher proportion of business travellers than any other London airport over the week as a whole. Business passengers are much more time sensitive and the weekend use of services reflects those returning home after business meetings on a Friday or travelling on a Sunday to be ready for work on a Monday morning. Further curtailment of operating hours, be it during the week or at weekends, could have substantial adverse implications for such airport users, with reduced business days in London and consequential loss of productivity, which would have wider economic consequences in terms of doing business in London. Use of alternative airports would not overcome this problem.

3.4 A critical consideration under any scenario is the specific nature of the airlines which operate at London City and their pattern of operations. Movements at the Airport are dominated by a small number of airlines. Based on the schedule for the coming winter into 2015, BA Cityflyer, Cityjet and Flybe will account for 75% of all movements, with Swiss the next most significant airline. In total, 9 airlines are expected to use the Airport in 2015.

[4] The Airportôs own surveys give a higher figure of 63%.
[5] CADP Need Statement Table 3.4.

3.5 For BA Cityflyer and Cityjet, London City represents by far their most significant operation. In BA Cityflyer's case, it represents 100% of the airline's scheduled operations, although a small number of charter flights operate seasonally from Edinburgh at weekends. For Cityjet, operations to and from London City represent over 75% of its activity. For Flybe, London City will be its primary London operation once services commence in October 2014[6] and the airline specifically chose London City to meet its requirements following the cessation of its principal London operation at Gatwick. The impacts on these carriers from any operating restrictions or closures would be disproportionately severe as London City represents a very high proportion of their London operations and, in the case of BA Cityflyer and Cityjet, they do not operate from any other London airport. Hence, any disruption to the operations at London City would directly impact on the airlines' utilisation of aircraft or potentially require the airline to incur the substantial costs of setting up an operation at an alternative airport, if indeed capacity was available elsewhere. It is entirely possible that these airlines will not be able to find suitable alternatives nor adapt their operations in the event of closures or operating restrictions at London City. This could place the ongoing operations of the airlines in their current form in jeopardy.

3.6 Airlines, such as BA Cityflyer and Cityjet, with aircraft and crews effectively based at London City, already operate at a competitive disadvantage as their operations are restricted to six days a week and with a shorter operational day than is available at other airports. Given that aircraft only make money for airlines when they are flying with passengers on board, a relevant measure is the proportion of time which they are operational[7]. For example, BA Cityflyer aircraft are operational for around 33% of the available hours each week[8], due principally to the limited operational hours at London City, whereas airlines such as Ryanair and easyJet typically attain an utilisation rate of around 57% of the available hours on their aircraft. This gives an indication of the extent to which London City's based airlines are already operating at a disadvantage in what is a heavily competitive market, particularly now that these other airlines are targeting short haul business passengers. Any further restrictions on the hours which the airlines could operate, even if these are temporary and/or limited to weekends could make them less competitive and impact on their business model and/or the long term viability of operations from London City. Such further erosion of their ability to productively use their expensive aircraft assets could have substantial implications for their viability. Either the airlines will need to seek other profitable opportunities to deploy aircraft or they will need to downsize. Either way, this will have long term implications for the volume of services and passengers which can use London City Airport.

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[6] Although Flybe does have a small franchise operation from Southend Airport and retains PSO funded operations to Stansted from Dundee and may retain the PSO funded Newquay to Gatwick route.

[7] The time from a flight being scheduled to depart to scheduled to arrive.

[8] OAG week commencing 8th September 2014.

3.7 For the other airlines, London City represents a significant operation as, in many cases, it is the preferred alternative airport for airlines which are being squeezed out from Heathrow on short haul services due to its ability to serve key business markets. This is evident, for example, in the growth of activity by Swiss at the Airport in response to constraint at Heathrow and to serve the important financial services sector in the City and Canary Wharf. The analysis below considers the alternatives open to such airlines in the event of operations to London City being restricted for a period and the extent to which operating restrictions could reduce the Airport's attractiveness for key segments of the business market. In some cases, these carriers have attempted services at other London airports, such as Lufthansa's services to London Gatwick, but have been unable to make these services viable due to the catchment area offering substantially lower number of business travellers. This highlights the importance of London City in meeting the needs of the wider London system. As explained later in this note, the analysis undertaken indicates that, in any event, there is very little spare capacity available in peak periods to meet the needs of business travellers across the London airports as whole.

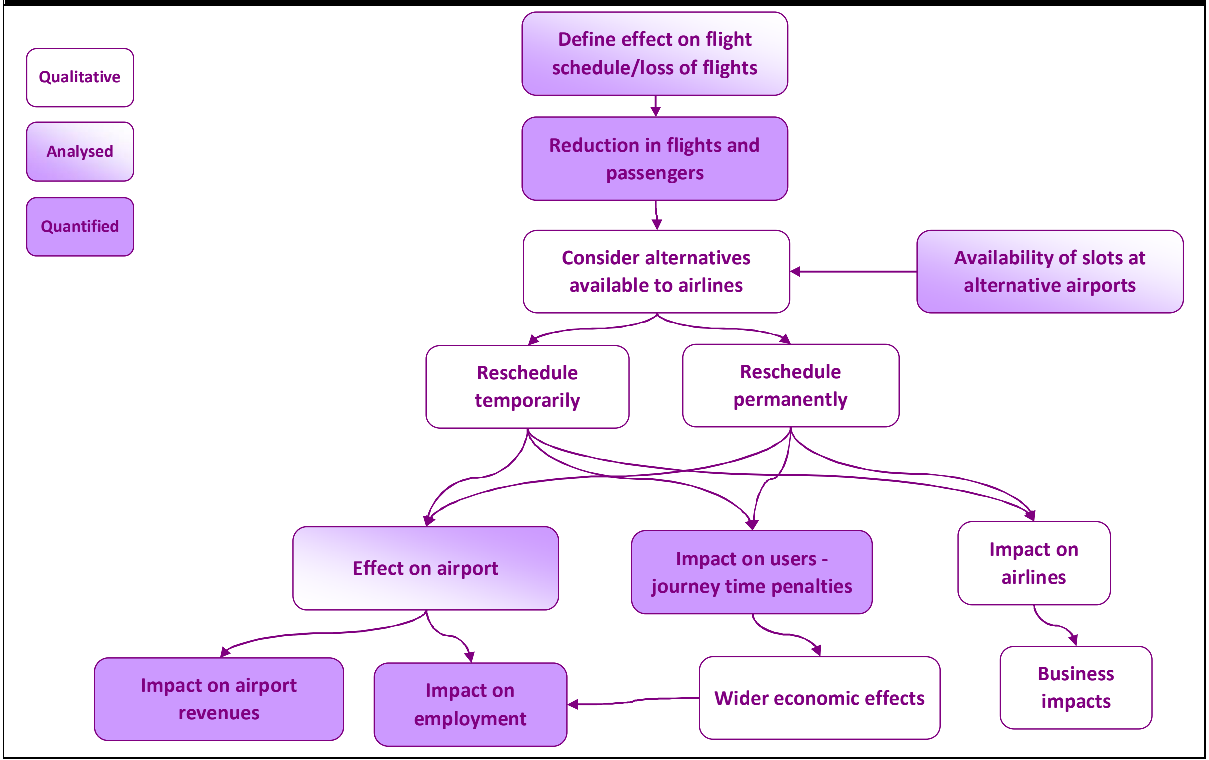
3.8 If some or all of the airlines were forced to relocate some or all of their operations or to cease operations altogether for the period of closure or restricted operating hours, there is no contractual commitment on them to return to London City. So the impact of any period of closure or restriction is likely to be of a substantially greater and longer lasting nature than that of the period of closure itself.

3.9 Overall, the implications of any temporary restrictions on the Airport's operating hours, even at weekends, or potential closures for the duration of the OOOH works has to be seen within the specific and unique context of the market which it serves and the dependence that both the airlines and passengers have on London City to serve the important business markets, particularly in Canary Wharf and the City of London.

4. ANALYSIS FRAMEWORK

4.1 As agreed with Officers at LBN at a meeting on 3rd September 2014, the analysis presented below has considered the implications for airline scheduling and operations. Consideration has then been given to the commercial and wider economic implications. The framework of analysis is set out in **Figure 4.1**. As can be noted, some elements are capable of quantification, whilst others are not. Quantitative evidence has been provided wherever possible, subject to the requirements of commercial confidentiality, particularly with respect to the airlines operating at the Airport. Some elements of the impact are described in more general qualitative terms.

Figure 4.1: Framework of Analysis



Basis of Scenarios Considered

4.2 The approach to defining the scenarios has been to assess the extent to which different periods of Airport closure or restricted operational hours would likely result in a consequent reduction in the duration of Out of Operational Hours (OOOH) (weekend and night-time) construction activities. The impacts have been considered in relation to the full duration of OOOH construction activities[9] and also on the basis of the restrictions applying only for the duration of the night-time piling works, which are considered the most impactful on the local population. The effect of the scenarios was considered in the context of potential improvements in piling production rates during closures/restricted operational hours and the reduction in duration of night-time piling this may achieve. The basis upon which the improvements in construction duration have been estimated for each scenario are set out in **Appendix A** prepared by TPS (CADP project engineers).

4.3 The scenarios tested in this assessment were agreed with Officers at LBN, including the additional variant scenarios subsequently requested, and are set out in **Table 4.1** overleaf, which shows the potential closure periods (resulting from reduced OOOH/piling durations when compared to the Improved Construction Programme (see **Appendix 2.1 of CESA**)) as given to us by TPS. Where a range is stated, the mid-point of the estimated duration of construction works has been used, including an allowance for ðfloatô (over-running of works) rounded to the nearest full month or week as appropriate. This approach is common in such complex construction projects.

4.4 It should be noted that, whilst a reduced duration for the night-time piling works has been shown for Scenario 5a) - Temporary Closure during August and at Christmas, the analysis by TPS shows that there would be insufficient time during either closure window to complete the required night-time piling works within these periods. Hence an alternative Scenario 5b) has been assessed with closure during August at each phase and for a subsequent number of weekends to allow the night-time piling works to be carried out, with 24 hour working assumed. Further commentary on the constraints of this scenario is provided in Appendix A ï TPS Note.

[9] This solely relates to the OOOH working period, where night-time and weekend working is required, which is not the same as the full duration of construction. The overall CADP construction programme is expected to be in the region of 6 years on a phased basis as set out in Appendix 2.1 of the CESA.

Table 4.1: Construction Durations under different Scenarios

Scenario	Full Duration of OOOH Works		Duration of Night-Time Piling Works	
Current planned duration of construction	Interim Works 15 months Sept 2015-Dec 2016	Full Works 22 months Mar 2018 to Jan 2020	Interim Works 12 weeks starting Sept 2015 and 7 weeks starting Apr 2016	Full Works 13 weeks starting Mar 2018
	Reduced Equivalent Closure Periods			
Scenario 1. Temporary Airport Closure for Duration of Works ï Day working	12 months	16 months	10 weeks and 6 weeks	10 weeks
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working	10 months	13 months	5 weeks and 3 weeks	5 weeks
Scenario 3. Weekend Closure for Duration of Works				
a) assuming no 24 hour working at weekends	15 months	21 months	10 weeks and 7 weeks	11 weeks
b) assuming 24 hour working at weekends			8 weeks and 5 weeks	9 weeks
Scenario 4. Restricted Opening Hours[10]				
a) 07.00-20.00 (additional 2.5 hours construction)	15 months	22 months	12 weeks and 7 weeks	13 weeks
b) 08.00-18.30 (additional 5 hours construction)	15 months	21 months	9 weeks and 6 weeks	10 weeks

10 Night-time working is assumed to continue under all of these scenarios.

c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	15 months	22 months	12 weeks and 7 weeks	13 weeks
d) closure for 7 hours during the middle of the day			9 weeks and 6 weeks	9 weeks
Scenario 5. Temporary Closure during August and at Christmas				
a) Closure during August and at Christmas (required duration) [11]			5 weeks and 3 weeks	5 weeks
b) Alternative closure of August and subsequent weekends			August (4.4 weeks) and 5 weekends	August (4.4 weeks) and 1 weekend
Source: TPS				

[11] There is a mismatch between the suggested closure period and the time required to complete the piling works so effectively this is the same duration as Scenario 2 above.

5. QUANTIFIABLE DIRECT IMPACT ON PASSENGERS AND MOVEMENTS AT LCY

5.1 As a start point for the analysis, the direct operational implications on airline schedules of closure of the Airport for a period of restricted operating hours have been considered. Further detail of how this was assessed based on the current operating timetable for winter 2014/5 (representing the 2015 Interim Works construction start) based on the current airline schedules and taking into account faster growth in the short term due to the commencement of operations by Flybe and a projected future timetable for 2019 (representing the Full Works construction window), drawing on the principles set out in the CADP Need Statement are given in **Appendix B**.

5.2 The direct consequences in terms of the number of passengers and scheduled aircraft movements which the Airport would not be able to handle during the periods of construction related closure under the different scenarios are set out in **Table 5.1**. It should be noted that these exclude any business aviation movements which may also be lost as a consequence of the closures.

5.3 The analysis set out in Table 5.1 represents the minimum impact on the Airport assuming that the airlines seek to minimise the impact of any closure by rescheduling to optimise their activity at London City within the restricted operating windows and as far as possible based on slot availability and that they re-commence operations as soon as the Airport re-opens. It also assumes that the curtailment of operating hours and the loss of weekend return flight opportunities does not result in any reduction in passenger volumes carried on some remaining flights. For reasons set out in the section on the airlines impacts, this is unlikely to be the case and the full impact is likely to be significantly greater than indicated by simply considering the direct implications of any closure or restriction period in isolation. This is particularly the case for the based airlines. Overall, the impacts are expected to be far more substantial and long lasting than the quantifiable impact during the period of closure or restriction itself.

5.4 In relation to Scenario 4d), consideration was given, at the request of LBN, to the extent to which the effects of a 7 hour closure during the day might be mitigated by allowing the Airport to operate unrestricted between 06.00 and 07.00. For the reasons set out in Appendix B, it was determined that airlines would make little use of greater flexibility in this time period as the majority of operations are inbound to London City in the mornings so any mitigation of the impacts would be negligible.

Table 5.1: Direct Impact on Passengers and Scheduled Movements during Closure Periods

Scenario		Full Duration of OOOH Works		Duration of Night-Time Piling Works	
Construction Phase		**Interim Works**	**Full Works**	**Interim Works**	**Full Works**
Scenario 1. Temporary Airport Closure for Duration of Works ï Day working	Passengers	4,207,600	6,506,700	1,294,600	938,500
	Scheduled Movements	82,500	131,700	25,400	19,000
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working	Passengers	3,506,300	5,286,700	647,300	469,200
	Scheduled Movements	68,800	107,000	12,700	9,500
Scenario 3. Weekend Closure for Duration of Works					
a) assuming no 24 hour working at weekends	Passengers	435,200	664,000	113,800	80,300
	Scheduled Movements	8,500	13,400	2,200	1,600
b) assuming 24 hour working at weekends	Passengers			82,800	65,700
	Scheduled Movements			1,600	1,300
Scenario 4. Restricted Opening Hours					
a) 07.00-20.00 (additional 2.5 hours construction)	Passengers	278,500	659,100	81,400	89,900
	Scheduled Movements	5,500	12,600	1,600	1,700

b) 08.00-18.30 (additional 5 hours construction)	Passengers	1,432,100	2,887,900	330,500	317,400
	Scheduled Movements	28,100	55,100	6,500	6,100
c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	Passengers	802,200	1,812,500	234,500	247,200
	Scheduled Movements	15,700	34,600	4,600	4,700
d) closure for 7 hours during the middle of the day	Passengers			459,000	396,600
	Scheduled Movements			9,000	7,800
Scenario 5. Temporary Closure during August and at Christmas					
a) Closure during August and at Christmas only[12]	Passengers			422,000	533,000
	Scheduled Movements			8,900	10,500
b) Alternative closure of August and subsequent weekends	Passengers			368,000	416,000
	Scheduled Movements			7,700	8,100
Source: York Aviation					

[12] This quantified analysis of this scenario shows the impact if the works could be contained within this precise closure period.

5.5 As noted that the estimated effects for Scenario 5 - Temporary Closure during August and at Christmas relate to the effect on passengers and movements if closure was contemplated during that period, as detailed in Appendix B. However, the analysis by TPS suggests that, in practice, having to concentrate piling activity during these periods would result in significant risks to the construction programme overall and the OOOH works could not in any event be contained within this period. For illustrative purposes only, the effects of closure during August and at Christmas have been considered, notwithstanding that this scenario is not believed to be practicable or deliverable within the shorter holiday periods of August and Christmas and even if 24 hour piling works were acceptable to the community over Christmas. In practice, the overall duration would need to be the same as in those in Scenario 2 ï Temporary Closure for the duration of the night-time piling works, albeit with a smaller number of passengers affected during the Christmas period and a lower proportion of business travelers in August. An alternative scenario of closure in August and for a number of subsequent weekends has been assessed to demonstrate the impact of a feasible closure period on the same principle of seeking to reduce the impact on business passengers.

6. IMPACT ON AIRLINES

6.1 The key consideration in assessing the full impact of any periods of operational closure or restricted hours is the effect on the airlines that use London City, not least as they already operate with restricted aircraft utilisation as a consequence of the current limitations on opening hours and at weekends. Hence, in the first instance, it is necessary to consider how airlines would respond to any period of closure be it for the full duration of planned OOOH construction activities or just the night-time piling periods. The airlines are the direct customers of the Airport and determine the impact which closure scenarios would have on the Airport and on its wider role in the local economy. They will be driven by their own commercial considerations and the impact is unlikely to be neatly contained to the period of closure in isolation, as discussed below. This presents substantial commercial risk to the Airport that would be largely outside of its control.

6.2 The issues for the airlines would vary depending on the duration of the closure or operational restriction. They would also be different for based airlines with substantial fleets dedicated to LCY operations[13] and those which, in essence, fly in from their home base. **Table 6.1** seeks to illustrate the potential wide range of considerations for airlines in such circumstances but it is by no means exhaustive. The longer the period of closure the greater the potential risk that an airline would simply adopt its new operating pattern on a permanent basis.

6.3 It is important to remember that the airline market is fully liberalised and competitive so it has to be assumed that the airlines are currently choosing to serve the market in the optimum manner, all other things being considered[14] and that any other solution is likely to be sub-optimal for them in terms of either revenues or costs. A further consideration is that airlines tend to operate with relatively low profit margins, particularly smaller niche airlines such as those operating at London City. To some degree, this is already a reflection of the restrictions on their operations caused by the Airport's limited opening hours and closure of for 24 hours each weekend. Key considerations are discussed in more detail below:

[13] In many cases, these aircraft overnight away from LCY so as to meet the requirements of the predominantly inbound flow to London in the morning. However, they are effectively LCY based aircraft which operate only to and from the Airport as distinct from aircraft based at another airport and flying a range of routes from there.

[14] Such as the effect of severe capacity shortages at Heathrow.

Table 6.1: Summary of Likely Airline Considerations

	Based Airlines	Non-Based Airlines
Scenarios 1 & 2. Temporary Closure of the Airport	• Can we relocate in entirety to another London airport? • What are the costs of doing so? • Can we find alternative uses for our aircraft and staff? • If not, is our airline still viable given its high dependence on LCY? • If we relocate during the closure, do we return to LCY when the Airport reopens and what would the cost of returning be?	• Can we continue to serve London at another airport either using existing slots with larger aircraft or by gaining new slots? • If so, do we return to LCY when the Airport reopens and what would the cost of returning be?
Scenario 3. Weekend Restrictions	• What effect do weekend closures have on the viability of our LCY operation? • Can we reschedule affected flights to another airport? • What are the incremental costs of a split operation? • Do we relocate our full operation to an alternative airport? • Is it more cost effective to simply reduce our fleet at LCY to a viable level and reduce the number of routes served? Do we recommence the full operations, in whole or in part, at LCY when the Airport reopens, taking into account additional aircraft may need to be re-obtained?	• Can we reschedule weekend operations to another airport? • What are the incremental costs of a split operation? • Do we relocate our full operation to an alternative airport? • Is it more cost effective to suspend weekend flying and use the aircraft on other non-London routes? • Do we recommence operations, in whole or in part, at LCY when the Airport reopens?

Scenario 4. Restricted Operating Hours	• Does the restricted operating time result in the London City operation no longer being viable? • Can we reschedule affected flights to another airport, taking into account slot availability? • What are the incremental costs of a split operation? • Do we relocate our full operation to an alternative airport? • Is it more cost effective to simply reduce our fleet at LCY to a viable level and reduce the number of routes served? • Do we recommence the full operations, in whole or in part, at LCY when the Airport reopens, taking into account additional aircraft may need to be re-obtained?	• Can we reschedule affected flights to another airport? • What are the incremental costs of a split operation? • Do we relocate our full operation to an alternative airport, taking into account slot availability? • Is it more cost effective to simply reduce frequency to London and what impact does this have on the viability of the route(s)? • Do we recommence the full operations, in whole or in part, at LCY when the Airport reopens?

Availability of Alternatives

6.4 A key consideration, given the shortage of capacity at key airports serving London, is the extent to which there would be slots available to the airlines to reschedule should the Airport close or further restrict operational hours during the period of OOOH working or night-time piling. Slots at suitable airports at attractive times are unlikely to be available as set out in **Appendix C**. Capacity constraints are also likely to limit the extent to which some airlines, which already serve more than one London airport, have any ability to accommodate some part of the displaced London City demand on their other services.

6.5 The proportion of the displaced movements which would need to be accommodated at other airports under each scenario, as set out in Table 2, for each of the largest carriers with based aircraft and for other airlines combined is shown in **Table 6.2**. Accommodating the displaced movements would require substantial blocks of slots to be available at suitably attractive airports, having regard to both the capacity available and the proximity to the market which London City serves. If these airlines are to continue serving the routes which they currently operate or are expected to operate, spare capacity would need to be found to accommodate the displaced activity of each airline as a single entity, as further splitting operations across a number or airports would not be acceptable to the airlines due to the inefficiency and additional costs involved. The consideration of whether there are viable alternatives varies according to the carrier and the number of movements which would need to be accommodated and the duration for which any relocation of services would need to be accommodated at an alternative airport, given the seasonal pattern of demand and limited capacity in peak periods at the other airports.

6.6 For BA Cityflyer, a based airline at London City, network synergies means that the only commercially realistic alternatives would be Heathrow or Gatwick if slots were available, given the parent airline's bases at these two airports and given their primary role serving business markets. However, slots are simply not available at the required times and in sufficient numbers at either of these airports, nor at Luton or Stansted. The airline would be unlikely to contemplate using Southend Airport given its business model is driven by meeting the needs of the core business markets, for which proximity and timely access to air services is key.

6.7 For other airlines, there is less allegiance to any other airport. Flybe chose to commence its own operation at London City to serve core business markets, indicating that it does not consider other airports, such as Southend, suitably located for such markets due to its location some distance away from the City and Canary Wharf.

6.8 Given that both BA Cityflyer and Cityjet are effectively based at London City, with all of the operational and technical infrastructure in place to support the operation of their dedicated fleets, duplicating these activities and installations to enable operations from alternative airports, even if there was capacity available, would be disproportionate and uneconomic. The same will be true to a greater or lesser extent for the other airlines.

Table 6.2: Proportion of Displaced Movements by Airline								
Scenario	Interim Works				Full Works			
	BA Cityflyer	Flybe	CityJet	Other	BA Cityflyer	Flybe	CityJet	Other
Scenario 1. Temporary Airport Closure for Duration of Works - Day working (12 & 16 month)	41.0%	13.0%	21.0%	25.0%	41.0%	13.0%	21.0%	25.0%
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working (10 & 13 month)	41.0%	13.0%	21.0%	25.0%	41.0%	13.0%	21.0%	25.0%
Scenarios 3a) and 3b). Weekend Closure for Duration of Works	34.7%	17.9%	25.3%	22.1%	33.9%	17.7%	25.0%	23.4%
Scenario 4a) 07.00-20.00 (additional 2.5 hours construction)	71.4%	14.3%	14.3%	0.0%	54.5%	9.1%	18.2%	18.2%
4b) 08.00-18.30 (additional 5 hours construction)	48.7%	10.3%	12.8%	28.2%	41.3%	13.0%	17.4%	28.3%
4c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	65.4%	11.5%	15.4%	7.7%	51.5%	15.2%	21.2%	12.1%

4d) closure for 7 hours during the middle of the day	44.0%	12.0%	20.0%	24.0%	39.0%	10.0%	18.0%	33.0%
Scenario 5a) Temporary Closure during August and at Christmas	41.0%	13.0%	21.0%	25.0%	41.0%	13.0%	21.0%	25.0%
5b) Alternative closure of August and subsequent weekends	39.3%	15%	22.7%	23.0%	36.4%	13.9%	21.5%	28.2%
Source: York Aviation								

6.9 The preference for Heathrow is also likely to be strong for most of the other network airlines operating at London City, including Alitalia, Lufthansa and Swiss. However, it is well known that there is effectively no spare capacity at Heathrow and capacity to reschedule year round peak period operations to Gatwick is simply not feasible.

6.10 It is not simply overall capacity which is a consideration but the availability of slots at specific times suitable to the network of services being operated. All of the London airports, except Southend, are fully coordinated airports[15] for airline scheduling purposes. This means that slots in peak periods are in short supply and that airline demand for these slots exceeds available capacity. London City is itself coordinated. Slots are allocated at specific times for whole scheduling seasons and the availability of slots for short term relocation of services will be problematic. So, whilst there might be some capacity potentially available during the Interim Works period at Luton and Stansted in the hours necessary to accommodate a part of the peak traffic displaced from London City under the various scenarios, this does not automatically mean that slots are available at precisely the same times that would be suitable for the airlines to maintain the integrity of their operational timetables.

6.11 Even if slots could be found at other airports serving London, to the extent that the overseas airports are also fully coordinated, there will also be difficulties in airlines ensuring that they have viable slot pairs at both ends of a route so as to continue to operate an integrated schedule. This may constrain operations for the airlines away from an optimum operating pattern, with consequential impacts on operating costs, passenger demand and potential operational viability if the pattern of aircraft rotations cannot be maintained. Rescheduled operations at congested European airports, such as Frankfurt or Amsterdam, could result in slots being lost permanently so impacting on the ability to reinstate operations back to the original pattern even when London City reopens. This problem could also arise if the airlines were required to reschedule to fit within London City's restricted opening hours even under the shorter duration scenarios. There is already evidence that the airlines find it very difficult to reschedule their London City operations when faced with reduced operating hours on bank holidays. It is not inevitable that existing slots would be retained at overseas airports to allow the original operating pattern to be reinstated at London City following a period of closure. This could have consequences for the airlines being able to operate a commercially attractive and viable schedule in the longer term as well as just the period for which restrictions are in force.

[15] Coordinated airports are those airports which are deemed to be congested or operating under capacity constraints at least at peak periods. At these airports, slots are allocated to airlines through a formal process and the availability of spare slots is limited. Airlines cannot simply retime flights without first checking that a slot is available at the requested time.

6.12 So, for the Interim Works period, the scope for the principal based airlines to relocate any services displaced from London City to other airports is highly limited and whether they would do so or simply suspend operations is ultimately driven by commercial considerations. Although some capacity may be available, this is unlikely to be at airports which may be suitable to serve the same market as London City and at commercially attractive times. Hence, any relocated operations would be fundamentally sub-optimal for the airlines with implications for their operations as discussed further below at paragraph 6.16 There can be no certainty that the airlines would find it commercially acceptable to simply relocate within the London market and be in a position to return full operations to London City following closure or restriction. Relocation to Stansted, Luton or Southend could place these airlines in competition with low fare airlines and so erode their market given that these airports are further away from the core business markets.

6.13 By 2019, for the Full Works, assuming growth in traffic more generally across the London system, there would be substantially greater difficulty in accommodating any displaced airline activity. Although, it might theoretically be possible to accommodate the displaced activity of Cityjet and/or Flybe at that date, as their operations might individually fit within available capacity remaining at Luton, Stansted or Southend, this is unlikely to be commercially viable for them due to the competition from low fare airlines and the relative lack of accessibility to the core business market. This further increases the risk that the airlines would not simply relocate within the London market or be in a position to return full operations to London City following closure or restriction. It would simply not be possible to accommodate the BA Cityflyer operation in its entirety at any other London airport.

6.14 For the non-based airlines, although it is theoretically possible that they might find slots available to accommodate their individual operations at one of the airports serving London in the event of London City being closed or operating with restricted opening hours, they are less likely to do so if this means further splitting their operations as many already serve Heathrow as well as London City. For these airlines, too, a key consideration will be proximity to the key business markets in the City of London and Canary Wharf. More likely, these airlines would seek to accommodate passengers on services operated already to other London airports to the extent possible given high load factors and this may entail operating larger aircraft if they have them available. It is likely that some airlines/routes may simply cease to serve London at all. In the 2015 schedule, there are certain routes that look particularly vulnerable as there are no obvious alternatives for either of these services, however the impacts in terms of reductions in service frequency are likely to go far wider. There can be no confidence that the other airlines will be able to absorb displaced passengers easily. Shortage of capacity to key destinations may force up air fares across the London system as a whole to the detriment of passengers.

6.15 Overall, the likelihood of airlines successfully relocating services during a period of closure or restricted operating hours is not simply a matter of capacity being available at one of the other airports serving London. Other important considerations are discussed below, not least the cost to the airlines of relocating on a temporary basis.

The Immediate Implications of Relocating

6.16 Although availability of capacity is an important consideration, the needs of the market are also a vital consideration for the airlines. If serving London becomes more expensive and difficult, particularly for the business market which London City serves, airlines may well choose to use their aircraft capacity to serve other markets. Although, theoretically, there might just be enough spare slot capacity across the London airports to accommodate much of the traffic displaced from London City in the event of a total closure for the Interim Works construction period or displaced weekend or peak period operation, it is commercially unattractive for the airlines to relocate as they command a yield premium at London City due to its proximity to the key business markets (see paragraph 6.20). It is more likely that the airlines would look for other profitable opportunities in other market, for example BA Cityflyer could decide to redeploy its aircraft within the IAG group. Flybe and Cityjet may simply decide to exit the market and seek more profitable opportunities elsewhere. Either way, this substantially diminishes the likelihood of them returning to the Airport following the disruption to their operations.

6.17 If the airlines do decide that it is commercially attractive to them to relocate at least some of the displaced services, the considerations are different if it is a full relocation of all of an airlinesôLondon City activity for a period than if it is only selected flights which would need to operate from an alternative airport for a period.

Scenarios 1 and 2 - Full Closure

6.18 In the case of a period of complete closure, an airline has a choice whether to operate from another airport or whether it would better to close down the operation for a period and deploy the aircraft elsewhere. Given the high cost of aircraft ownership, this could result in airlines which are heavily dependent on London City having to close down their operations permanently. Clearly, this would have severe implications on the future operation of the Airport if it had to seek alternative airlines with suitable aircraft to operate at London City to deliver the growth projected with CADP. There would be issues with retaining skilled staff locally, which are considered further in the next section.

6.19 This dilemma arises because the availability of spare capacity at other airports is not on its own sufficient for the airlines to be willing to relocate. A principal consideration will be the market which they are seeking to serve and the competition from other airlines/airports. Whereas for a small number of non-based airlines with more dependence on leisure passengers, such as Skywork which has relocated the only London service to Bern to Southend Airport from October, other airports may provide a viable alternative. This is more likely to be the case where a route is not served from any other London airport or has a higher percentage of leisure passengers. However, such a relocation further away from the City and Canary Wharf is much less likely to be a realistic option for many of London City's largest routes which have higher than average proportions of business passengers, such as Zurich at 59%, Edinburgh at 76%, Frankfurt at 74%, Glasgow 73% and Rotterdam 73%. For such routes, switching to the possible alternatives at Luton, Stansted or Southend would almost certainly result in passengers being lost to other airlines at Heathrow or Gatwick as passengers choose alternative more convenient routings dependent on their surface location. Even if such rescheduling were possible, there would be consequential costs to passengers from increased surface access journeys and loss of productive working time, which could deter some business visitors from doing business in London. The impact on passengers of having to use alternative airports is considered in **Section 7** below.

6.20 For the <u>non-based airlines</u>, there might be a degree of mitigation of the impact from a closure of London City to the extent that they might retain some passengers on their own services from Heathrow (e.g. Swiss and Lufthansa). However, this is more likely to be the case where a route is not otherwise served directly from London. Even to the extent that passengers were retained by the airlines, there would be detrimental financial consequences for the airlines as London City routes command an air fare yield premium of 8% over Heathrow based on a basket of European routes (average over the last 10 years)[16], reflecting its convenient location. However, if flights and passengers have to be accommodated at other airports, the airline revenue effects may be more extreme as London City has commanded an air fare premium of 92% over the other London airports over a basket of European routes over the last 10 years due to the higher proportion of business passengers and the convenience which the Airport offers which means that passengers are willing to pay more to use it. Although the impact on airline operating costs is likely to be small from any temporary relocation if passengers can be accommodated on existing services, the loss of revenue may be material. This may also be the case even if airlines avail of lower airport charges at airports other than Heathrow as the revenue consequences are likely to outweigh any savings in airport charges. Overall, there will be re-location costs to non-based airlines if they are unable to use London City for a period of full closure. Even so, there remains a risk that airlines which find alternative ways of accommodating the demand may be less willing to re-open services to London City when it becomes available again, potentially extending the period of detriment to the Airport and its passengers.

[16] This does not necessarily mean that an individual passengers is paying more on a like for like basis, rather than London City services carry more proportionately more passengers on full fare or business class tickets resulting in the average fare paid being higher.

6.21 For the main based airlines, however, the implications are likely to be significant and go far beyond the cost of simply setting up operations at the other airports even if there was capacity available for them to do so. The biggest risk is that the loss of passenger volume overall may undermine the viability of their operations, particularly in the case of BA Cityflyer and Cityjet, where London City makes up all/a very high proportion of their overall route networks. Any loss of passenger volume or revenue as a consequence of operating from another airport could result in the airline having to review number of routes or operate a reduced number of aircraft. There will also be costs in establishing a base at another airport, which may extend to setting up maintenance or crew bases, particularly if the relocation is for any material duration.

6.22 Given that these based airlines typically have relatively low profit margins in the range 1-2%[17], there is little scope for these airlines to absorb reduced revenues or higher costs. These airlines already suffer a loss of aircraft utilisation due to London Cityôs current restricted operating hours and curtailed 6 day operations. Any further reduction in operating hours could erode the business cases for existing services and could ultimately tip them into losses. This would arise as the consequence of reduced operations is that any fixed costs would need to be spread over a smaller number of flights and passengers. This could make many services uneconomic and could result in a downsizing of the airline or the relocation of the aircraft capacity to serve other less restricted markets. It would also likely have the impact of slowing further investment in new, quieter and more efficient aircraft types.

Scenarios 3 and 4 - Weekend Closure or Restricted Hours

6.23 In these two scenarios, the issues relate principally to whether the airlines will be willing to incur the costs associated with split operations, including bussing of crews and duplication of facilities between two airports for the durations of the closures or restricted hours. This could impact on airlinesô willingness to serve London City at all or may simply result in them having no choice but to operate curtailed schedules in order to avoid the additional costs.

6.24 In any event, assuming that any relocation of services would, at most, only be partial, even shorter duration restrictions on operating hours would have negative impacts on aircraft utilisation. In some ways, the impact of restricted operating hours could be more severe on airlinesô finances than a decision to relocate away from the London market in its entirety for the longer term.

6.25 Whilst, to some extent, passengers may be able to re-plan their journeys to alternative flights within the reduced operating hours, this is less easy for business passengers than for leisure passengers. The effect on the airlines would still be substantial in terms of lost utilisation and the cost of disruption.

[17] Operating profit as a percentage of operational revenues based on CAA Airline Financial reports for 2012.

6.26 So, whilst the immediate loss of passenger numbers as a consequence of limited hours or closure at weekends may be substantially less than with a full closure of the Airport, the financial implications for the airlines may be just as severe. For a complete closure of the Airport, there is an option to relocate away from London and to serve other profitable markets. In the more limited closure options, the airlines would have to incur increased costs and lower revenues for the period in addition to the existing restrictions on their operations. This could result in the decision to relocate in the entirety even in a more limited closure period if limited operations at London City cease to be viable. It is possible that the actual impact of short term restrictions could be substantially greater than can be easily quantified if airlines reduce capacity still further over and above the minimum level estimated.

Scenario 5 – Closure in August and at Christmas

6.27 Although there are fewer passengers at Christmas, there would still be implications for the airlines if closure was contemplated during this period, albeit there would be relatively few business passengers affected. To that extent, closure during this period would be less impactful on the airlines than at other times of the year. However, the utilisation of their aircraft would still be adversely affected and this could be material to their overall financial health.

6.28 In August, overall passenger numbers are similar to at other times of the year and the airlines restructure their networks, to a degree, to accommodate more leisure passenger and fewer business passengers. Although on a like for like basis, business passengers typically pay more for their tickets than leisure passengers, it does not necessarily follow that the airlines will earn substantially less in this period from a different pattern of operations.

6.29 The extent of the closures required to accommodate the night-time piling works would result in an impact on the airlines very similar to that under Scenario 2 and the implications would be substantial.

Longer Term Effects

6.30 Although London City is highly attractive to the airlines because of its proximity to the key business markets in the City of London and Canary Wharf, there can be no guarantee that airlines would return services to the Airport following a period of closure. Whilst London City does command a yield premium for the airlines across their route networks, this may not be sufficient for them to return if they have become embedded at other airports, which may well be cheaper to operate from once the initial relocation costs have been incurred. This is particularly the case as the 6-day a week opening restricts their operations and returns overall, despite the higher average yields. There would be substantial costs associated with re-launching and remarketing services after a period of closure and this will act as a deterrent. To a large extent, the impact depends on the period of the closure but the longer its duration, the more likely it is that, to the extent that airlines have been able to operate from other airports, they will have adjusted their operating patterns and may be reluctant to incur the costs of rescheduling for a second time. It is important to remember that in a fully liberalised European air transport market, airlines are not captive to serving London and are highly likely to move capacity to alternative markets if the operating conditions in their preferred market become too restrictive. Airlines which have relocated to alternative markets or downsized their operations are highly unlikely to return.

6.31 Even for those airlines that do wish to recommence operations at London City, the timing of when airlines return to the Airport is more likely to be extended, so resulting in slower growth than projected with CADP and result in a greater number of passengers and flights being lost than shown in terms of the basic impact of the closures for the duration of the works as set out in Table 2. For example, airlines may prefer to reschedule on a seasonal basis[18], consistent with slot allocation at major airports and airline marketing seasons more generally and so the loss of passengers would extend to a full 5 or 7 month season even if the actual closure period was less than the full scheduling season. This problem could be exacerbated if the works straddle two seasons.

6.32 At worst, displaced airlines may not return at all, particularly if the closure or period of restriction has been of a longer duration and they have become embedded at another airport or have downsized their fleets. Although airlines operate under contractual terms at London City, these contracts would effectively be null and void if the Airport closed for an extended period. Even an extension to the current restrictions on the operating hours could negate the contracts and might leave the Airport open to substantial claims for compensation or, at the very least, a difficult commercial position when it comes to renegotiating a return to full operations. Overall, it is difficult to quantify the effects but the overall commercial risks are summarised at the end of this section.

[18] November ï March and April - October.

6.33 Crucially, the runway length and post-CADP infrastructure will continue to limit the number of airlines in Europe that could serve the Airport and thus any losses may not easily be backfilled by new carriers if the current incumbents relocate to other airports on a permanent basis. Whilst it is not entirely implausible that new airlines with the right aircraft fleets could emerge to take up the market opportunities at London City over the longer term, this would represent a high risk to the business and create significant uncertainty to airlines when making re-fleeting decisions. It could also affect investor confidence in a number of regeneration projects in and around the Royal Docks. This is discussed further in Section 7.

Precedents Elsewhere

Full Closure

6.34 There are relatively few precedents for complete airport closures, other than for very limited periods and often only at night whilst runway maintenance works are completed. Only two recent examples of complete airport closures have been identified, although neither of these is strictly relevant to the nature of the carriers and the market which London City Airport serves:

- *Venice Treviso Airport*, which closed for works for 3 months in 2011. Airlines relocated to Venice Marco Polo Airport temporarily as it had spare capacity but then returned to Treviso. The Airport is principally used by low fares and charter airlines, which are not based at the Airport and were able to adjust their operations relatively easily. Lower airport charges will also have been a powerful driver of the decision to relocate back to Treviso.

- *Modlin Airport* is the second airport for Warsaw, some distance from the City, and opened in July 2012 with services by low fares airlines, Ryanair and Wizzair. It closed to larger aircraft in December 2012 to allow runway works to be undertaken and reopened in July 2013. Both airlines relocated to the main Warsaw Airport, which had spare capacity, but only Ryanair relocated back to Modlin when it reopened, attracted by lower airport charges. Wizzair has remained at the main Warsaw Airport. At the time of the closure, neither airline had aircraft based at the Airport so rescheduling was relatively easy.

6.35 In both these cases, the carriers affected were principally low fare and charter airlines who are more mobile and better able to adjust capacity to serve different markets than those airlines based at London City, which are fundamentally seeking to serve the short haul business market and the financial services sector based in the City of London and Canary Wharf in particular. In both identified cases, the periods of restriction were for a relatively short duration and there was spare capacity available at neighbouring airports serving the same city and in closer proximity to the city. In other words, the alternatives available to the airlines were better located, albeit more expensive to operate from. In other words, there are no recent precedents for any complete closure of an airport for any duration which required airlines to operate from a less conveniently located airport.

6.36 LBN has also drawn attention to Stuttgart Airport as a relevant example of closure of an airport during construction works. Whilst the Airportõs main runway did close for a period of just over 2 months in 1995, the Airport maintained a short runway throughout which allowed most of the scheduled airlines to keep their operations intact, albeit with different aircraft types in some cases. This option is simply not feasible at London City. The major effect was on the charter airlines which, as indicated above, are more mobile than the type of airlines operating at London City and can relocate services relatively easily and, in any event, there was greater scheduling flexibility for airlines within their networks some 20 years ago as overall congestion in the air traffic system was less. As such, it does not represent a comparable example for a closure of London City even for an equivalent period.

6.37 The circumstances at London City are different, relating both to its primary role in serving key business markets in the city and in the lack of available capacity at conveniently located airports. As discussed, there is limited ability for the airlines to reschedule due to the lack of spare capacity at the other airports. On the one hand, this may make it more likely that they would return to London City following the closure period. On the other hand, it might make it more likely that those based airlines would alter their operating models to move away from dependence on London City or even shut down their London operations altogether, making a return to the Airport less likely. To some extent, this would mirror the position seen at Warsaw, where Wizz Air relocated to the main airport serving the city and decided to remain there as it better suited their core market, albeit that other competitive factors may have been at play in that case. Nonetheless, the risk that at least some airlines might find operations at an alternative airport acceptable, to the extent that spare capacity exists, represents an unacceptable risk to the Airport. However, the greater risk is that the main based airlines might restructure their operations altogether and not return to London City at all or in their current form.

Weekend Closures

6.38 There are no known examples of such a pattern of closures but the impacts on airline businesses may be expected to less than for full closure, albeit not trivial and with potentially wider ranging implications given the effect on aircraft utilisation for the airlines. It is these aircraft utilisation effects which are likely to be most significant for the airlines given the high cost of aircraft ownership and the existing operating restrictions at London City which already curtail the extent to which aircraft can be used to their optimal extent.

Restricted Operating Hours

6.39 Although there are more precedents for short duration closures, particularly at night, the circumstance of short duration night closures are very different from restricting the operating hours of an airport impinging on its peak operating times or even during the middle of the day. For night closures, airlines typically reschedule around the restrictions or sometimes operate night flights to/from alternative neighbouring airports. However, night closure periods typically involve largely charter flights or a very small number of flights at either end of the operating day. The closure periods seldom impact on the peak operating hours so the only equivalent scenario under consideration here is that relating to the most marginal curtailment of the operating hours at London City to 07.00 to 20.00 each day, which of itself has no effect on the construction programme. However, in this case, the concentration of movements into the peak periods at London City would limit the ability of airlines to reschedule later in the morning or earlier in the evening due to slot constraints. For the reasons outlined in Appendix B, there would be an overall loss of movements and passengers for the duration of the restrictions due to the restricted hours despite the reduced operating hours bringing about no reduction in the construction duration.

6.40 Where restricted operational hours have been in force at airports for construction works to be carried out, these have usually not exceeded 6 months duration and these are normally planned to avoid the busiest times of the year and to impinge as little as possible on busy day time operating hours, e.g. the night closures at Birmingham to allow construction of the runway extension from November 2013 to April 2014. In general, such closures have had no noticeable long term impact on the traffic using an airport due to the off-peak nature of the periods of restriction. Although, to some degree the same could be said to apply to the additional closure scenario of closure during August and at Christmas, as suggested by LBN, this would only realistically apply to the Christmas period where volumes of passengers are substantially lower, as set out in Appendix B. However, for reasons explained in Appendix A, there would be no realistic gain in terms of the construction programme as the 2 week closure would not be sufficient to make a material difference to the duration of the works and would not necessarily fit within the construction sequence.

6.41 Overall, the circumstances at London City are substantially different to the extent that any restrictions would impinge on core operating times and the attractiveness of services to the primary business travel market. This is particularly the case as curtailment of the opening hours would force passengers to arrive later at London City or depart earlier so reducing the available working day. This is far more likely to have implications for passengersô travel plans than an alteration to an infrequent leisure trip. It is less easy to simply ódirectô that traffic to use an alternative airport, as would be the case for a charter flight for example. For this reason, the impact of curtailed operating hours would have a greater impact on the airlinesô activity overall than limited night closure periods affecting largely discretionary leisure flying. This renders comparison between London City and the implications of short term restrictions at other airports inappropriate.

Summary of Airline Impacts by Scenario

6.42 Although it is not possible to be precise about how airlines would respond to periods of closure, the analysis above sets out the broad considerations. The implications for the airlines under each scenario need to be set against the effectiveness of the potential additional closure periods in delivering shorter OOOH construction works and in terms of the longer term implications for the Airport's ability to support economic growth in East London. The likely implications by scenario are summarised below:

Scenarios 1 and 2 - Full Closure – Long Term to avoid any OOOH works

6.43 In the event of lengthy closures of the Airport for a year of more to allow the construction of CADP Phases 1 and 2, the most likely assessment is that:

- CityJet could, hypothetically, relocate to Stansted, probably with a reduced operation and Flybe could, hypothetically, relocate to Southend. However, this would result in both having to compete directly with low cost airlines at these airports. Both airlines would also be expected to downsize their operations substantially and might cease serving the London market altogether, at least in terms of serving core business routes;

- BA Cityflyer is much less likely to relocate as the alternatives do not fit its business model. It is more likely that the BA Cityflyer operation would be absorbed back into IAG and the aircraft deployed elsewhere.

- Non-based airlines may seek to continue to serve the London market, principally through absorbing passengers on Heathrow operations to the limited extent that they are able.

6.44 In these circumstances, there is a significant risk that the airlines would not return to London City in full following the closure period.

Scenarios 1 and 2 - Full Closure – Night-Time Piling Works Duration only

6.45 With a shorter duration full closure, the airline relocation options would remain as with a longer duration closure. However, for the reasons outlined above, their return to London City in full cannot be assured and some airline activity is likely to be lost permanently and may not be replaced.

Scenario 3 - Weekend Closure – Full Duration of Works

6.46 The existing weekend operational hour restrictions already result in constrained operations and lower fleet utilisation for airlines currently operating out of the Airport. For one day of every week, the airlinesôcostly aircraft and associated operational and ground infrastructure are not making a financial return on the investment made in them. The Airport has reached a sustainable balance with airlines to maintain a 6 day a week service from London City. However, any further operational constraints at weekends would impact the ability to attract and retain airlines in comparison to other airports, potentially resulting in airlines moving away by virtue of services becoming uneconomic, this is particularly so in the light of the low profitability of the airlines.

6.47 Morning arrivals on a Saturday from some destinations compensate for the inability to offer a late evening service back to the Airport on a Friday because of the flying time involved. Therefore, to serve this part of the business market, the carrier must be able to offer a service on a Saturday morning. A similar situation arises on a Sunday evening where, because of the services provided, passengers are able to fly to their destination ready for an early appointment on a Monday morning. Without these services, this important flexibility would be lost. Sunday flights also provide an important service to Londonôs commuter market (e.g. those who have family homes elsewhere but work in London and vice versa). Similarly, the inbound city break leisure market often flies in on a Friday and return on Sunday evenings.

6.48 In addition, some airlines operate limited services to leisure-orientated destinations at weekends in order to improve the viability of services generally. The primary focus of the carriers at the Airport is the midweek business routes, but being able to operate at weekends is critical to maintaining aircraft utilisation and allows them to deliver business services at a reasonable cost. As noted above, the airlines can only presently operate 6 days a week and are, therefore, disadvantaged in comparison to those competitor airlines operating at other airports. Operating 6 days a week ensures continued viability, any further reduction in this, would erode the business cases for existing services and make new services harder to attract.

6.49 Whilst, with a long period of weekend closures, there might be some scope for the airlines to develop alternative operating patterns for weekend services, this will still be unattractive for the airlines. In practice, it is expected that some routes and services would simply be suspended for the period of the closure, whilst others might be operated in a different weekend pattern involving other airports, albeit with additional costs due to crew bussing and setting up support services at the alternative airport. Passengers would also be inconvenienced if they find that they fly out from London City then back into another airport[19] (or vice versa). Airlines may simply deploy their aircraft at weekends into different markets altogether, particularly to take advantage of leisure market opportunities elsewhere.

[19] Cars being parked at the wrong airport, additional taxi costs, more limited public transport etc.

6.50 To the extent that there are losses of revenue to the airlines as a consequence of disrupted operations for an extended period of time, this could have detrimental effects on their financial performance and result in a longer term slowing of growth or actual downscaling if the disruption impacts are of a long duration. The effect would be a likely slowing of growth at London City following the closure compared to the CADP forecasts. This represents a substantial risk to the Airport.

Scenario 3 - Weekend Closure – Night-Time Piling Works Duration only

6.51 With shorter duration weekend closures, the airlines might be able to absorb the impact of the restricted operations with limited long term effects, deploying the same alternatives as for the longer duration weekend closures. Some may choose to operate some weekend flights from other airports to mitigate the effects or they may simply accept reduced operations for a short period. However, this will still have adverse implications on airline finances and could result in a slowing of investment in new equipment and developing additional services at London City. There would be detrimental effects on passengers and on the wider economy with no real reduction in construction duration.

6.52 To the extent that the duration of the closure could be reduced by allowing 24 hour continuous working during the period of weekend closure, the risk of airlines not reinstating their full flying programmes or deferring investment decisions following the closure would be less due to the shorter duration of the closure but the risk would remain.

Scenario 4 - Restricted Hours – Full Duration of Works

6.53 With a long term restriction on opening hours, airlines will have little option but to reschedule or downsize their operations. As noted above, this would require them to adjust slots across their network and this may be difficult at some of the larger and more congested European airports. With a lengthy period of closure, the implication of the airlines having to reschedule over more than one scheduling season may constrain their ability to simply revert to their original operating pattern following the period of closure.

6.54 Fundamentally, any reduction in the number of daily rotations will result in lower still aircraft utilisation and damage airline profitability. This is likely to result, at the very least, in a slowing of growth even after the period of restricted operations, with longer term consequences for the Airport. It cannot absolutely be ruled out that one or more of the airlines might relocate some or all of their flying away from London City if the integrity of their whole operation is damaged due to the curtailment of the operating day for an extended period of time. This presents a substantial risk to London City Airport and to its wider economic role again with no improvement in the construction duration.

Scenario 4 - Restricted Hours – Night-Time Piling Works Duration only

6.55 In the case of a more limited duration of a few weeks for restricted operating hours, it is possible that the airlines may be willing to absorb the effects, as seen with temporary restrictions at other airports. A principal difficulty would remain the need to reschedule to a different flying pattern and whether this could be achieved on a part season basis given slot constraints both at London City and elsewhere. However, such a scenario would still result in airlines losing valuable aircraft utilisation so damaging their financial position. This could tip some airlines into a decision to relocate services away from London City on a permanent basis, particularly in the event of a longer closure during the day time period (Scenario 4d) which would have very severe implications on the number of flights which could be operated each day. At the very least, it will slow investment in new and quieter aircraft fleets yet deliver no real reduction in OOOH construction durations.

Scenario 5 – Closure in August and at Christmas – Night-Time Piling Works Duration only

6.56 In practice, passenger numbers and load factors during August are not materially less than at other times of the year. Although to some extent, airlines switch capacity from business routes to leisure routes, the effect is to see load factors at broadly the same level overall. Although there are lower numbers of business passengers in August (40% compared to the year round average of 55%[20]), this does not necessarily result in lower airline earnings as those that are travelling may still be using full fare tickets. During the two week Christmas period, data would suggest that there are very few business passengers but the fact that the airlines continue to operate much of their flying programme indicates the important contribution to overall profitability which such operations make. Overall, then, given the magnitude of the impact on passenger numbers and flights in total, the overall impact of closures during these periods would not be dissimilar to Scenario 2 for the duration of the night-time piling works only, with the airlines seeking to relocate their flights as grounding their operations for this period of time would fundamentally undermine their financial viability. The impacts on the airlines would still be substantial and these closures could damage the integrity of their whole London City operation.

[20] CAA Survey data 2013.

Financial implications on Airlines

6.57 In all of the assessed scenarios, there would be material to substantial cost implications for the airlines. It is not possible to quantify these but, by way of example, BA Cityflyer earned £108 in operational revenue for each passenger carried in 2012[21]. So the effect on the airlines of any reduction in passenger volume will be significant. It is more difficult to quantify the costs of relocation or the extent to which overall airline costs could be reduced during a temporary period of closure or disruption, although this is expected to be negligible. Airlines have high fixed costs in the short term due to the costs of aircraft ownership. In the longer term, some of these costs can be defrayed by returning or leasing out aircraft.

6.58 Although it may be true that airlines earn less for weekend flights and for off-peak services during the middle of day than for peak period services, this does not mean that it is economic for them to simply park the aircraft and not operate during this period as is suggested under the scenario of a 7 hour closure during the middle of the day or the weekend closure periods. All operations contribute to covering the fixed costs of aircraft ownership and any restriction on the airlinesô ability to utilise their assets effectively will impact on their financial viability. To some degree, airlines are deliberately using their available aircraft assets during the middle of the day to operate services to more leisure oriented destinations. Paradoxically, these may command higher fares where they are to niche destinations not otherwise served from London. However, on high frequency routes the middle of the day services provide valuable flexibility for business passengers travelling on flexible tickets. Hence, it is overly simplistic to suggest that middle of the day operations are not important and that their loss would have relatively little impact on the airlines. For the reasons outlined in Appendix B, the same is true of the August and Christmas periods.

6.59 Whether these cost impacts have longer term implications for the viability of the airlines depends to a large extent on whether the Airport will need to compensate the airlines for disruption to their operations, thereby passing the burden of cost from the airlines to the Airport. Currently, the contracts do not provide for any compensation to be payable.

6.60 The biggest financial risk relates to loss of aircraft utilisation. Against a backdrop where the based airlines at London City achieve only 33% utilisation of their aircraft compared to the 57% achieved by other European short haul airlines, the effect of the inevitable curtailment in utilisation is likely to be substantial, even for weekend closures or reduced operating hours. Loss of utilisation, when coupled with increased operating costs as a result of any split operations may be expected to have material repercussions in terms of the current and future operations and growth, particularly of the based airlines.

[21] CAA Airline Financial Data

Summary of Implications for the Airlines

6.61 Ultimately, a key consideration for the airlines will be the lack of alternative airport capacity to accommodate any displaced peak period activity, particularly once the need to be closely located to key business markets is taken into account. The airlines could be faced with penal costs as a result of any extended period of disruption to their operations which runs the risk of pushing those airlines heavily dependent on London City out of business given their operations are already constrained by the existing operating hours. Overall, in the context where airlines at London City already suffer from reduced aircraft utilisation as a consequence of the existing restricted operating periods, any further curtailment of the operating hours is likely to have a disproportionate impact on the airlines and their operational viability in the London market.

6.62 A full closure of the Airport for an extended period is likely to result in the airlines relocating their aircraft on a permanent basis, even potentially outside of the UK market.

6.63 With short term closures, there is still a real risk that airlines will relocate or downsize their operations due to the increased cost of operating at London City and the reduction in revenues which can be earned there. Even relatively short periods of closure are likely to lead to some permanent adjustment to the scale of airline operations at the Airport, with the result that the CADP growth forecasts are unlikely to be achieved. Predicting the full extent of these long term impacts is virtually impossible but does represent a significant risk to the Airport's business.

7. SOCIO-ECONOMIC IMPACTS

7.1 The effect of the Airport closing for a period or having its operating hours restricted will have wider socio-economic effects. In the first instance, a reduction in flying would give rise to permanent or temporary losses in employment based on the estimated direct reduction in passenger numbers during the period of the closure or restriction. However, even in these terms, it is not straightforward to estimate the effects. The longer term impact on the nature of the Airportõs operation will give rise to even more significant effects which are difficult to estimate given the uncertainty about how the airlines will react in the longer term.

Employment and GVA[22]

Scenarios 1 and 2 - Full Closure

7.2 With a full closure of activity for a substantial period of time, there would clearly be significant redundancies as neither the Airport nor companies operating there could be expected to retain employees for a period of complete closure of around a year or more. This could place all of the employment generated by the Airport, amounting to 1,900 direct FTE[23] jobs and 570 indirect/induced FTE jobs in 2012, at risk. Alongside the loss of jobs, there would be a loss of the contribution which the Airport makes to the GVA of the local area, amounting to almost £110 million in 2012, as well as a broader loss to the UK economy of a further £640 million of wider impacts on passengers and business.

7.3 Given a desire to retain skilled employees for the longer term, it is possible that companies operating at London City might try to redeploy some skilled staff to other airports for the period of the closure, otherwise there would be significant recruitment and retraining costs when the Airport reopened, but it is unlikely that the majority of staff could be redeployed. Ultimately, however, skilled employees such as air traffic controllers would be lost and it is far from certain that these could easily be replaced to enable the Airport to reopen. To the extent that staff could be redeployed, some local employees would remain in employment but they would face long journeys, with added costs, to other places of employment. To the extent that the airlines relocated their activity, air crew would continue to be employed.

7.4 It is impossible to quantify the extent to which employment would effectively be retained in the local study area, as used as the basis for employment assessments in the ES, so to illustrate the potential effects, the employment impacts have been estimated on a full time equivalent basis for the Airport as a whole but assuming that 10% of employees are retained associated with London City Airport for the duration of the closure. The loss of employment would extend beyond those directly employed in the operation of the Airport to those employed in the supply chain and in the induced effects through secondary rounds of spending.

[22] GVA ï gross value added.
[23] FTE ï full time employment.

Scenarios 3 and 4 - Restricted Operations

7.5 For shorter periods of closure, it is assumed that shift patterns would be adjusted, resulting in an overall loss in full time equivalent employment if not actual employees. This would mean reduced hours and wages for individual employees. To the extent that airlines operated some flights from other airports at weekends or during the restricted operating hours, the effects may be marginally overstated. These are also set out in Table 7.1.

Scenario 5 – Closure in August and at Christmas – Night-Time Piling Works Duration only

7.6 As indicated in Section 6, the implications of such a closure would be significant and similar in magnitude to Scenario 2 for the period of the night-time piling works giving rise to the issues connected with staff relocation and retention.

Summary of Employment and GVA Effects

7.7 The estimated annualised effects on full time equivalent employment in the peak construction years for each phase, including direct on-site employment at the Airport as well as induced and indirect effects, and GVA are set out in **Tables 7.1** and **7.2**. In this case, it is assumed that all airline employment will be retained and we have made an approximate adjustment for this. This could materially understate the loss of employment in the longer term to the extent that the airlines, in particular BA Cityflyer, reduce their flying programmes overall as a consequence of having to operate from less well located airports or relocate activity away from London in the entirety. The estimates of job losses are, hence, conservative.

7.8 Overall, the loss of employment is considerable. Although the estimates of employment reductions are not precise, they do give an order of magnitude of the impacts. Whereas for short term operational restrictions, the reductions in full time equivalent employment in the relevant years are smaller, they are much more material in the full closure scenarios even if these are for short durations related to the night-time piling works. Under all scenarios, a reduction of full time equivalent employment of 50 or more jobs would be expected and this could rise to over 2,000 full time equivalent jobs in the longer duration full closure scenarios.

7.9 Consequential GVA impacts could also be significant. Although the shorter duration periods of restricted operations might only give rise to a loss to the local economy of between £2 and £12 million a year, longer term periods of restricted operation, other than on the lowest impact basis, would result in a loss to the local economy of between £20 and £134 million in the relevant construction years.

Table 7.1: Annualised Estimate of the Full Time Equivalent Loss of Jobs				
Total FTEs lost (including indirect and induced effects)	**Full Duration of OOOH Works**		**Duration of Night-Time Piling Works**	
	Interim Works	**Full Works**	**Interim Works**	**Full Works**
Scenario 1. Temporary Airport Closure for Duration of Works ï Day working	2,450	2,630	840	560
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working	2,340	2,630	420	280
Scenario 3. Weekend Closure for Duration of Works				
a) assuming no 24 hour working at weekends	260	260	90	60
b) assuming 24 hour working at weekends			60	50
Scenario 4. Restricted Opening Hours				
a) 07.00-20.00 (additional 2.5 hours construction)	170	250	60	60
b) 08.00-18.30 (additional 5 hours construction)	870	1,150	250	220
c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	490	690	180	170
d) closure for 7 hours during the middle of the day			350	280
Scenario 5. Temporary Closure during August and at Christmas				

a) Closure during August and at Christmas only			270	320
b) Alternative closure of August and subsequent weekends			240	250
Source: York Aviation				

Table 7.2: Reduction in GVA				
Total GVA lost (£millions)	**Full Duration OOOH of Works**		**Duration of Night-Time Piling Works**	
	Interim Works	**Full Works**	**Interim Works**	**Full Works**
Scenario 1. Temporary Airport Closure for Duration of Works ï Day working	£117	£136	£40	£29
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working	£112	£136	£20	£15
Scenario 3. Weekend Closure for Duration of Works				
a) assuming no 24 hour working at weekends	£13	£14	£4	£3
b) assuming 24 hour working at weekends			£3	£2
Scenario 4. Restricted Opening Hours				
a) 07.00-20.00 (additional 2.5 hours construction)	£8	£13	£3	£3
b) 08.00-18.30 (additional 5 hours construction)	£41	£60	£12	£11
c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	£23	£35	£8	£9
d) closure for 7 hours during the middle of the day			£17	£14
Scenario 5. Temporary Closure during August and at Christmas				

a) Closure during August and at Christmas only			£13	£17
b) Alternative closure of August and subsequent weekends			£11	£13
Source: York Aviation				

7.10 To the extent that the implications of any closure or operating restrictions is to slow the growth of passengers and movements at London City overall, then there will be longer term implications on the extent of additional employment which would be added as a result of the CADP development. At worst, if the airlines do not return to the Airport on a permanent basis and the viability of the Airport is undermined, this could put all of the employment at the Airport at risk. Overall, give the expectation that additional restrictions on the Airport's operation during the OOOH works will have longer term consequences for the scale of airline operations at the Airport, the reduction in employment and loss of economic benefits is expected to be substantially greater than the immediate impact during the closure periods alone.

7.11 Whilst airport operational employment will be adversely impacted as a consequence of any additional OOOH working related restrictions, it is assumed that there will be no material impact on overall construction employment, despite the reduced durations of the works as construction employment is estimated by reference to construction costs over the duration of the project rather than on an annual or simultaneous basis. As the scope of works is largely the same, it is assumed that the overall level of construction employment would be unaffected, assuming of course that the long run effects on the airlines did not result in the Full Works not proceeding.

Wider Impacts

7.12 There will also be wider socio-economic implications as a consequence of the closure or restriction of the Airport's operation. Closure or restriction would put at risk the wider contribution which the Airport makes to London's economy, estimated at £750 million in 2012, including its immediate contribution to local GVA amounting to almost £110 million, although clearly this would depend on the extent and duration of the restrictions. To the extent that there were long term implications for the route network and airline schedules operated from London City, there may also be implications for the regeneration of the area more widely if businesses choose not to locate in the area because the air service offer is more restricted and other locations provide better and more convenient access to some destinations.

7.13 Passengers who have to use other less conveniently located airports will face increased surface journeys to reach any alternative airport, with a consequent loss of productive working time. However, potentially more significant is the effect on key businesses located in the City and Canary Wharf which may find their efficiency and productivity affected if inbound visitors cannot reach them in time to do a full day's business. This loss of connectivity may ultimately impact on some business location decisions. It is not realistic to quantify these wider effects in terms of employment, inter alia, in the financial services sector but to the extent that the impact for passengers is quantifiable, this is set out below.

Impacts on Passengers

Scenarios 1 and 2 - Full Closure

7.14 In the case of the full closure of the Airport for a period and if airlines did seek to operate their full flying programmes from other airports (albeit this is unlikely to be the case in the entirety as set out above), it is possible to quantify the impact on passengers. In the case of BA Cityflyer, although it is considered unlikely that they would be able to relocate to an airport fitting their business model, the journey time implications for passengers have been estimated on the purely hypothetical basis of a relocation of operations to Southend as this is the only airport which might have capacity available in the short term. To the extent that BA Cityflyer did not operate their full programme, there would be different impacts on passengers which are more difficult to quantify, particularly if some important business journeys became significantly more difficult to make. To that extent, the impacts presented here understate the full impact of closures or restrictions at London City.

7.15 Taking the City of London as the centre of London City's catchment area, the additional public transport journey times to the other airports would be as follows:

- Stansted with a journey time penalty of 31 minutes[24];
- Southend with a journey time penalty of 39 minutes;
- Heathrow with a journey time penalty of 28 minutes.

This gives a weighted average surface access journey time penalty across all passengers of 35 minutes approximately taking the airline market shares into account. In addition, passengers will be faced with a longer time at the Airport compared to the speed of transit through London City which is a key part of its service proposition.

7.16 The weighted average value of time for London City Airport passengers based on the current split between UK/Foreign business and leisure passengers is approximately £55 an hour[25]. So for each displaced passenger under the scenarios, the additional time cost would be of the order of £32[26]. On this basis, the estimated additional surface access time penalties over the closure periods would be as set out in **Table 7.3** for each of the scenarios full closure scenarios.

[24] Google maps.
[25] Based on the values of time used by the Department for Transport in aviation appraisals of £82.2 per hour for business passengers and £13.8 per hour for leisure passengers at 2014 prices.
[26] For Scenario 5, the value of £20 per hour has been used on the basis of 40% business travel in August and a negligible amount at Christmas.

Table 7.3: Estimated Journey Time Penalties to Passengers as a Consequence of the Closure or Restriction Scenarios (£millions)

Scenario	Full Duration of OOOH Works		Duration of Night-Time Piling Works	
Construction Phase	**Interim Works**	**Full Works**	**Interim Works**	**Full Works**
Scenario 1. Temporary Airport Closure for Duration of Works ï Day working	£135	£208	£41	£30
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working	£112	£169	£21	£15
Scenario 3. Weekend Closure for Duration of Works				
a) assuming no 24 hour working at weekends	£14	£21	£4	£3
b) assuming 24 hour working at weekends			£3	£2
Scenario 4. Restricted Opening Hours				
a) 07.00-20.00 (additional 2.5 hours construction)	£9	£21	£3	£3
b) 08.00-18.30 (additional 5 hours construction)	£46	£92	£11	£10
c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	£26	£58	£8	£8
d) closure for 7 hours during the middle of the day			£15	£13
Scenario 5. Temporary Closure during August and at Christmas				
a) Closure during August and at Christmas only			£8	£11
b) Alternative closure of August and subsequent weekends			£7	£8

Source: York Aviation

7.17 The costs to users, and consequential impacts on business, are significant in scenarios where complete closure of the Airport is contemplated, possibly as high as £200 million if complete closure of the Airport took place for the Full Works construction period. Even with more limited operating restrictions in force, the costs to users would exceed £15 million even if the closures were restricted to the duration of night-time piling works only. These costs represent a substantial cost to the economy, over and above the GVA effects set out in Table 7.2 and may be expected to influence, at least to some degree, the attractiveness of doing business in East London.

Scenarios 3 and 4 - Restricted Operating Periods

7.18 Under the scenarios where there are restricted operating hours or weekend closures, the extent to which surface access journey time penalties would be incurred would depend on the extent to which airlines rescheduled flights to other airports. If they did, then the order of magnitude of the penalties would be as shown in Table 7.3. However, to the extent that the airlines curtailed their operations, passengers would not incur these additional journey time costs directly but they would experience substantial loss of utility as a result of not being able to travel at all. Generally, economic convention is to assume the ‘rule of a half’ in these circumstances, meaning for passengers who did not travel at all, the penalty would be half that shown under the scenarios where there is weekend only closure or restricted weekday hours. In practice, there is likely to be a mix of the two effects dependent on how airlines and passengers react to any temporary operating restrictions.

7.19 A further impact on those who do travel is in relation to their working day, particularly for those scenarios where there are restricted weekday opening hours. By examining the flights which would need to alter their timings to fit within restricted operating hours, it is possible to estimate the extent to which the working day in London would be reduced and how many passengers would be affected. For the purpose of this exercise, only business passengers have been considered on the basis of an average of 55% per flight, although it is possible that peak period flights might have a slightly higher proportion of business passengers. The implications are set out in **Table 7.4**. There will also be a loss in the effective business day for those passengers which are displaced to other less well located airports. There is no direct effect on the length of the business day with an extended period of closure during the daytime only (Scenario 4d) as the early morning and evening operational hours are unaffected in this scenario.

7.20 Overall, those seeking to do a working day in London would lose at least 30 minutes of productive working time under all scenarios. In the case of the more restricted opening hours between 08.00 and 18.30, the loss of productive working time would be nearer an hour, with a substantially greater number of passengers affected.

Table 7.4: Number of Business Passengers affected by Reductions in the Day in London

	Interim Works		Full Works	
Scenario 4 – Restricted Opening Hours	Passengers Affected	Average Loss Of Time in London (Mins)	Passengers Affected	Average Loss Of Time in London (Mins)
a) 07.00-20.00	63,814	36	93,427	43
b) 07.00-12.00 + 14.00-20.00	63,814	36	102,769	43
c) 08.00-18.30	391,999	56	757,924	50

Scenario 5 – Closure in August and at Christmas – Night-Time Piling Works Duration only

7.21 Due to the lower numbers of business passengers at Christmas and in August, the costs to users would be less as leisure users have a lower value of time than business passengers. Even so, the costs to passengers of closures even at the so-called óoff peakô periods of the year would still exceed £7 million from closures during these periods.

8. IMPACT ON THE AIRPORT

8.1 There will also be a direct measureable impact on the Airport business itself from any period of closure or restriction. At the very least, it is possible to quantify the implications of the closures or restrictions on opening times on the revenues of the Airport, albeit this may significantly understate the impact to the extent that the airlines make long term alterations to their operating patterns or the difficulty which the Airport might have in recommencing operations following a period of full closure if skilled staff were lost.

8.2 In 2013, operational revenue per passenger at London City was £23.86[27], including aeronautical income, retail and catering income, and car parking income but excluding property income. This included income from the Jet Centre movements but it is reasonable to assume that such operations would be similarly impacted by any closures or restrictions on a pro-rata basis. In a full closure scenario of any duration, it is probable that the property revenues would be impacted bringing the losses closer to overall revenues per passenger of £26.82. The latter revenue figure has been used for the full duration closures and the lower figure for the shorter duration closures.

8.3 Using the lower revenue per passenger figure, it is possible to calculate the minimum financial impact of the potential closure scenarios on the Airport business in terms of lost revenues. Using the estimates of passengers lost from Table 5.1, the minimum revenue implications would be as set out in **Table 8.1**. These are by definition estimated in 2013 prices, without taking inflation into account. The direct financial losses to the Airport lie in the range of £26 million, in the case of night-time piling durations, to £288 million for a full operational closure of the Airport for the duration of the OOOH construction works over the two phases. For weekend closures or restricted operating hours, the lost revenues for the Airport would be in the range of up to £69 million for little to no reduction in overall duration of OOOH construction activities. To the extent that there are longer term implications for the airlinesô operations at the Airport, these financial impacts are likely to be materially understated in the direct calculation, which also excludes the cost of any damages payable to, for example, concessionaires due to loss of revenues.

8.4 There would be some ability to save costs dependent on the duration of the closures or operating restrictions through reducing staff or curtailing shift patterns for example. However, airports are characterised by high fixed costs. So it is highly unlikely that the lost revenues could be entirely mitigated. Thus, any period of restricted operation would impact to some degree on the Airportôs profitability and its ability to afford the costs of CADP construction in any event. In the extreme, the effect of having to close for a substantial period is more likely than not to jeopardise the Airportôs ability to deliver CADP, however a full viability assessment is not possible at this stage as the longer term reaction of the airlines is not possible to predict in detail. Even shorter duration periods of restricted operations may have some implications for maintaining existing operations and future growth (including CADP) given the inherent risk of airlines not returning to the Airport once restrictions/closures are lifted.

[27] London City Airport Statutory Accounts.

Table 8: Direct Loss of Airport Revenues under Different Closure Scenarios (£ millions)

Scenario	Full Duration of Works		Duration of Night-Time Piling Works	
Construction Phase	Interim Works	Full Works	Interim Works	Full Works
Scenario 1. Temporary Airport Closure for Duration of Works ï Day working	£113	£175	£31	£22
Scenario 2. Temporary Airport Closure for Duration of Works ï 24 hr working	£94	£142	£15	£11
Scenario 3. Weekend Closure for Duration of Works				
a) assuming no 24 hour working at weekends	£10	£16	£3	£2
b) assuming 24 hour working at weekends			£2	£2
Scenario 4. Restricted Opening Hours				
a) 07.00-20.00 (additional 2.5 hours construction)	£7	£16	£2	£2
b) 08.00-18.30 (additional 5 hours construction)	£34	£69	£8	£8
c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	£19	£43	£6	£6
d) closure for 7 hours during the middle of the day			£11	£9
Scenario 5. Temporary Closure during August and at Christmas				
a) Closure during August and at Christmas only			£10	£13
b) Alternative closure of August and subsequent weekends			£9	£10

Source: York Aviation

8.5 The effect on the airlines of any reduction in passenger volume will be significant and even a relocation, if possible at all, could result in substantially lower revenues as well as the cost of disruption to the operation. It is more difficult to quantify the costs of relocation or the extent to which overall airline costs could be reduced during a temporary period of closure or disruption. Airlines have high fixed costs in the short term due to the costs of aircraft ownership. In the longer term, some of these costs can be defrayed by returning or leasing out aircraft. Overall, it could be expected that the airlines may seek some financial redress from the Airport. It would certainly damage the Airport's negotiating position in terms of seeking to re-establish operations following any period of closure or disruption.

8.6 It is also likely that the Airport would need to make compensation payments to its concessionaires for lost business as many of these will be operating on guaranteed minimum payments related to projected passenger volumes. It is probable that the combined effect of compensation payments may far exceed the direct loss of operational revenues to the Airport itself under any scenario. Clearly, the revenue losses and compensation payments both need to be taken into account when considering the full impact on the Airport business and the consequential implications for the project.

9. OVERALL CONCLUSIONS

9.1 It is important to note that the impact of any closure of London City Airport, however temporary, will have wider ramifications for airline scheduling and the effective use of airport capacity in the UK and Europe. If airlines are required to re-schedule, they will have to do so within the constraints of available capacity and it cannot be assumed that this will be possible. Hence, the implications for airlines and passengers may be substantial and these are over and above the directly measurable local implications summarised here.

Summary of Key Impacts by Scenario

9.2 In this section, the key impacts are summarised for each of the closure scenarios and temporary alterations to operating hours as considered in the remainder of this paper. The quantified implications are summarised but it is important to recognise that these represent the absolute minimum impact during the period of closure/restrictions only. In practice, the implications will be wider ranging and for longer duration than the quantified impacts set out here. These wider and longer term impacts have been discussed above but cannot be quantified.

Scenarios 1 and 2 - Full Duration of Planned OOOH Construction

9.3 Complete closure of the Airport for the duration of the proposed Out of Operational Hours (OOOH) construction works would have potentially serious detrimental impacts on the Airport and its customers, as well as resulting in substantial job losses up to the full employment supported by the Airport, amounting to 2,470 direct, indirect and induced FTE jobs in 2012 and almost £110 million of GVA in the local economy. This would give rise to substantial economic damage to airlines, passengers, and the local economy, at the very least for the duration of the closure. It is likely that the business of the Airport would be severely impacted and it is more likely that key airlines would not return to the Airport following any period of closure. The longer term impacts would be extreme with the Airport potentially losing its airlines and businesses and the economic losses becoming permanent, with wider implications for the economy of London as a whole, amounting to some £750 million in total in 2012. As an absolute minimum, closure under scenarios 1 and 2 would result in:

- Closure of the Airport for between 10 and 12 months during the construction of Interim Works and between 13 and 16 months during the construction of Full Works dependent on whether 24 hour or day time only working is assumed respectively;

- Substantial implications for the airlines in having to relocate all their business away from London City Airport for the duration of the closure;

- All of the Airportís business for the duration, amounting to 3.5 million to 4.2 million fewer passengers being able to use the Airport during Interim Works construction and 5.3 million to 6.5 million fewer during Full Works construction;

- An annualised reduction in the number of direct, indirect and induced full time equivalent (FTE) jobs sustained by the Airport of between 2,340 and 2,450 during the Interim Works construction period and 2,630 FTE jobs during the Full Works construction, with an associated loss of gross value added (GVA) in the local area of between £111 million and £117 million during the Interim Works and £136 million during the Full Works;

- Journey time penalties to users of between £112 million and £135 million during Interim Works construction and between £169 million and £208 million during Full Works construction;

- A direct loss to the overall Airport revenues of between £94 million and £113 million at Interim Works and between £142 and £175 million at Full Works construction.

Scenarios 1 and 2 – Night-Time Piling Works Duration only

9.4 Complete closure of the Airport for the duration of the night-time piling works would also have serious detrimental effects. It is likely that some or all of the airlines would not return to the Airport following the period of closure. The severity of the impact of these closure scenarios is high and would result in substantial economic damage to the airlines, passengers, the local economy and to the Airport itself. As an absolute minimum, closures under scenarios 1 and 2 for the period of piling would result in:

- Closure of the Airport for between 8 and 16 weeks during the Interim Works construction and between 5 and 10 weeks during the Full Works construction, dependent on whether 24 hour or day time only working is assumed respectively;

- Major disruption to airline operations during the closure period, with a requirement for them to relocate their operations;

- 647,000 to 1.3 million fewer passengers being able to use the Airport during the Interim Works construction and 470,000 to 940,000 fewer during Full Works construction;

- An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 420 and 750 during the Interim Works construction period and between 280 and 420 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £20 and £40 million during Interim Works construction and between £15 million and £29 million during the Full Works construction;

- Journey time penalties to users of between £21 million and £41 million during Interim Works construction and between £15 million and £30 million during Full Works construction;

- A direct loss to the overall Airport revenues of between £15 million and £31 million at Interim Works construction and between £11 and £22 million at the Full Works construction but taking into account the effect of the closures on the airlines and the high probability of than some or all of them might not return to the Airport following the closure, the overall financial impacts could be significantly greater.

Scenario 3 - Weekend Closures only

9.5 In the event of closure during the weekends and dependent upon whether the closures are for the whole duration of the works or just for the duration of the night-time piling works, the impact would be substantial. The airlines already suffer a loss of aircraft utilisation due to London City's current restricted operating hours and curtailed 6 day operations. Any further reductions could erode the business cases for existing services given that airlines typically have relatively low profit margins. Airlines would be faced with substantial increases in fixed cost to split their operations over a smaller number of flights and passengers or face unacceptable further reductions in the utilisation of their expensive aircraft. Furthermore, many passengers using the Airport at weekends are travelling on business and loss of the ability to return from a business trip on a Saturday morning or depart on a Sunday afternoon would be a substantial economic penalty for locally based businesses. Overall, the impact of weekend closures either for the period of night-time piling or the full duration of OOOH construction would be substantial. There would be disruption and inconvenience to passengers as well as losses in employment of up to 520 FTE jobs and wider economic detriment in terms of lost GVA of up to £27 million over the two phases. Given the costs and lost revenues incurred by the airlines, extended periods of weekend closure could have longer term implications for the existing Airport business and future growth at a time where it is seeking to invest in new infrastructure. As an absolute minimum, restrictions under scenario 3 (assuming 12 hour working shifts on both Saturday's and Sunday's) would result in:

- Weekend closures of the Airport for periods of 15 and 21 months during both the Interim and Full Works construction respectively in the event of closure for the full duration of the OOOH construction works, and 17 and 11 weeks respectively if closure was just for the period of the night-time piling works;

- Further loss of aircraft utilisation for the airlines;

- 114,000 to 435,000 fewer passengers being able to use the Airport during Interim Works construction and 80,000 to 664,000 fewer during Full Works construction;

- An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 90 and 260 during the Interim Works construction period and between 60 and 260 FTE jobs during Full Works construction, with an associated loss of GVA in the local area of between £4 and £13 million during Interim Works construction and between £3 million and £14 million during the Full Works construction;

- Journey time penalties to users of between £4 million and £14 million during Interim Works construction and between £3 million and £21 million during Full Works construction;

- A direct loss to the overall Airport revenues of between £3 million and £10 million during the Interim Works construction and between £2 million and £16 million during the Full Works construction.

- The socio-economic impacts when coupled with the other potential impacts on both the Airport and airlines, would be severe in the case of weekend closures and would be completely disproportionate to the relatively modest reductions in OOOH programme.

9.6 If continuous 24 hour working is assumed during the entirety of the weekend closure period and if the closure was confined to the night-time piling works only, this may reduce the period of night-time piling overall and, therefore, the extent of weekend closures in comparison to scenario 3a. However, it would still represent unacceptable economic damage and the risk of airlines not reinstating full operations after the period of closure would remain. In this case, such weekend closures would result in:

- The weekend closures of the Airport would still cover 13 and 9 weeks respectively during both the Interim and Full Works construction respectively;

- Further loss of aircraft utilisation for the airlines;

- 83,000 fewer passengers being able to use the Airport during Interim Works construction and 66,000 fewer during Full Works construction;

- An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of 60 during the Interim Works construction period and between 50 jobs during Full Works construction, with an associated loss of GVA in the local area of £3 million during Interim Works construction and £2 million during the Full Works construction;

- Journey time penalties to users of £3 million during Interim Works construction and £2 million during Full Works construction;

- A direct loss to the overall Airport revenues of £2 million at each of the Interim Works construction and the Full Works construction.

9.7 The socio-economic impacts when coupled with the other potential impacts on both the Airport and airlines, would be substantial in the case of weekend closures and would be completely disproportionate to the reduction in night-time piling. In addition, 24 hour working at weekends would erode the community's respite from noise which is provided by the planning requirement for the Airport to close between 12:30pm on Saturdays and 12:30pm on Sundays.

Scenario 4 - Restricted Weekday Hours

9.8 As with weekend closures, given the restrictions on airline operating hours at London City, further restrictions to operating hours would damage the competitiveness of airlines operating at the Airport with potentially substantial longer term consequences for their businesses and that of the Airport. Any alterations would significantly damage the ability to cater for the business passenger at peak times when they wish to travel. Closures during the middle of the day would in many ways be more impactful on the integrity of the airlinesô operations. Reductions in operating hours could erode the business cases for existing services and there would be notable disruption and inconvenience to passengers as well as losses in employment of up to 2,000 FTE jobs over the two phases and wider economic impacts, including a loss of local GVA of over £100 million. The impacts on airlines and passengers in the case of restricted operations and would be completely disproportionate to the modest reductions in OOOH programme. With restrictions on the Airportôs operating hours in the early morning and evening, dependent on number of restricted hours and whether the restrictions are in force for the whole duration of the OOOH construction works or just the period of night-time piling works, the implications would likely be as follows:

- Restrictions on operating hours for a period of 15 months during the Interim Works construction and between 21 and 22 months during the Full Works construction if the restrictions are for the full duration of the OOOH construction works, and between 13 and 19 weeks during the Interim Works construction and 9 and 13 weeks during the Full Works construction if the restriction is for the duration of night-time piling;

- Significant implications for the airlines in terms of the need to reschedule and loss of effective aircraft utlisation;

- 81,000 to 1.4 million fewer passengers being able to use the Airport during the Interim Works construction and 90,000 to 2.9 million during the Full Works construction;

- An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 60 and 870 during the Interim Works construction period and between 60 and 1,150 FTE jobs during the Full Works construction, with an associated loss of GVA in the local area of between £3 and £41 million during the Interim Works construction and between £3 million and £60 million during the Full Works construction;

- Journey time penalties to users of between £3 million and £46 million during the Interim Works construction and between £3 million and £92 million during the Full Works construction;

- A direct loss to the Airport revenues of between £2 million and £34 million during the Interim Works construction and between £2 million and £69 million during the Full Works construction.

9.9 As indicated, given the risk that airlines will simply adapt to new operating patterns, particularly if the Airport is closed or operations disrupted for a substantial period of time, it is more likely that the detrimental impacts will be greater and longer lasting than the quantified outcomes set out above. The competitiveness of the airlines operating at London City will have been severely damaged in what is a highly competitive market across 6 airports serving London. Airlines operating at London City must, of necessity, operate smaller aircraft than from competitor airports, which result in higher seat mile costs. They also suffer from reduced operating hours normally. However, any periods of closure or restriction could have substantial impacts on airline finances. This could have wider ramifications for the main airlines with substantial bases at London City which could, under some scenarios, down size their operations on a permanent basis or relocate to other markets, with substantial long term implications for the Airport and its role in the economy of Newham, east London and the wider City of London.

Scenario 5 – Closure in August and at Christmas

9.10 The effect of this scenario is similar to Scenario 2 ï a temporary closure for the duration of the night-time piling works, albeit the number of passengers at Christmas is lower than at other times of the year and there are fewer business passengers in August. However, in practice, the night-time works could not be contained within this precise closure period. The potential impact has been quantified as if such a closure would be practicable in terms of the night-time piling works. In the alternative, a closure for August and a number of subsequent weeks necessary to complete the night-time piling works, with work assumed to be on a 24 hour basis. The implications would be:

- Significant implications for the airlines in terms of the need to reschedule and loss of effective aircraft utlisation;

- 366,000 to 422,000 fewer passengers being able to use the Airport during the Interim Works construction and 416,000 to 533,000 during the Full Works construction;

- An annualised reduction in the number of direct, indirect and induced FTE jobs sustained by the Airport of between 240 and 270 during the Interim Works construction period and between 250 and 320 FTE jobs during the Full Works construction, with an associated loss of GVA in the local area of between £11 and £13 million during the Interim Works construction and between £13 and £17 million during the Full Works construction;

- Journey time penalties to users of between £7 and £8 million during the Interim Works construction and between £8 and £11 million during the Full Works construction;

- A direct loss to the Airport revenues of between £9 and £10 million during the Interim Works construction and between £10 and £13 million during the Full Works construction.

Summary Conclusions

9.11 Overall, it is considered that any closure or restriction of operations for the full duration of the OOOH works is likely to have long term implications for London City Airport in terms of it achieving its growth potential as outlined for CADP. This would have substantial implications for the employment and economic activity supported by the Airport in the local area and in the contribution which the Airport makes to the wider economy of London. All of the employment at the Airport could be put at risk with a period of full closure, whilst shorter duration closures will have longer lasting impacts on the economic activity which the Airport supports.

9.12 Airlines are likely to substantially and permanently downscale their operations and may relocate to serve other markets completely. It is unlikely that operations at London City would recover immediately and there will be long term implications for the business and its ability to deliver economic growth for East London. There will be wider implications for passengers and the business community in the City of London and Canary Wharf. The implications will be substantially greater than the direct and quantifiable implications of the closure itself which are set out above. This applies whether a full closure is contemplated or simply a restriction of weekend or weekday operating hours, although clearly the magnitude of the impacts is significantly greater with a full closure than with smaller scale restrictions to operations. That said, the impacts of smaller scale operational restrictions remain significant.

9.13 The impact of a shorter length of full closure, for the duration of the night-time piling works, would be less but would still generate a notable risk of long term damage to the Airport's business. There remains a high risk that some or all of the airline operations would not return to the Airport following a period of closure.

9.14 Even shorter length restrictions to the operating hours or on weekends could have an impact on airline finances as their already curtailed aircraft utilisation would be further impacted. This could damage their willingness or ability to grow at London City and could result in deferral of plans to introduce new quieter aircraft.

9.15 Overall, the implications of periods of closure during the OOOH works have the potential to seriously undermine the Airport's business model, which in a competitive market may not fully recover. There is a high risk of this occurring with any extended period of closure or restriction but the risks remain with even shorter periods of closure or restricted operations. The extent to which benefits would be gained from relatively short reductions in construction periods have to be weighed against the potential risks to the Airport's business model overall.

APPENDIX A:

TPS TECHNICAL NOTE

Introduction

This technical note has been prepared in response to the specific matters raised by the London Borough of Newham (LBN) in its Regulation 22 letter dated 20th August 2014, namely item 1 (i) to (iv) which requests the Airport to assess the impacts of four potential scenarios: temporary closure of the Airport for an extended period in order to allow unimpeded construction of the City Airport Development Programme (CADP); partial temporary closure of the Airport during the weekend period; shorter operational hours to allow construction to take place in the morning or evening period; and any other scenarios.

The note is intended to provide a high level guide as to the reduced construction durations that could arise should any of the above scenarios occur. The duration of Out of Operational Hours (OOOH) (night-time and weekend) construction works and associated piling works as set out within the Improved Construction Programme (August 2014) (see Appendix 2.1 of Consolidated ES Addendum) have been used to inform this exercise.

Context

Situations to be assessed

Following detailed technical review and discussions with LBN dated 03 September 2014 and subsequent feedback from LBN in conjunction with its technical advisor on 30 October 2014, the scenarios as set out below were agreed. Within such scenarios it was agreed to quantify whether closure for specific periods would enable OOOH works to be carried out during the day (e.g. if the airport closed for 36 months either in one block or staggered then would this eradicate night-time working). It was also agreed to quantify if there would be a reduction in duration of works/closure as a result, noting that this quantification would need to be high level e.g. 10% or 20% and should also consider 24 working and the pros and cons of such.

Based on feedback received from the LBN and its technical advisor, some of the scenarios are only assessed with respect to the duration of night-time piling and on the basis of 24 hour working to the extent possible.

Temporary closure

- Long term ï duration of 36 months of OOOH works with daytime working
- Long term ï to cover remaining 36 months of OOOH works (but for 24 hour working option)
- Short term ï to cover period of OOOH piling works ï c. 5 months and 3 months
- Short term ï to cover period of OOOH piling works ï c. 5 months and 3 months (but for 24 hour working option)

Weekend Closure

- Long term ï to reduce period of remaining 36 months of OOOH works

  (agreed to assume 12 hour working both Sat and Sunday)

Short term - weekend closures to allow piling to be completed quicker

(agreed to assume 12 hour working both Sat and Sunday)

Short term 24 hour working - weekend closures to allow piling to be completed quicker

(agreed to assume 24 hour working both Sat and Sunday)

Restricted Opening Hours

Long term ï to reduce period of remaining 36 months of OOOH works

Restricted opening hours to 07.00 to 20.00 (allows additional 2.5 hours construction)

Restricted opening hours to 08.00 to 18.30 (allows additional 5 hours construction)

Restricted opening hours to 07.00 to 12.00 and 14.00 to 20.00 (allows additional 4.5 hours of construction)

Short term ï to cover period of OOOH piling works ï c. 5 months and 3 months

Restricted opening hours to 07.00 to 20.00 (allows additional 2.5 hours construction)

Restricted opening hours to 08.00 to 18.30 (allows additional 5 hours construction)

Restricted opening hours to 07.00 to 12.00 and 14.00 to 20.00 (allows additional 4.5 hours of construction)

Restricted opening hours to 06:30-10:00 and 17:00-22:00 (allows additional 7 hours construction) *Night-Time Piling Works Only*

Closure over holiday periods

Closure of the Airport for the Christmas period and for August as appropriate in each phase.

Improved Construction Programme

The Improved Construction Programme (August 2014) (see Appendix 2.1 of CES) is used as the base case for the assessment of any reduction in out of hours working. This programme contains the following out of operational hours (OOOH) construction periods:

OOOH duration:

During the ìInterim Worksò period of the programme the OOOH night works starts with the ìDeck section 2A Piles OOOHò in September 2015 and finishes with the ìcoaching facility building envelopeò in December 2016. This is a period of 15 months.

The Completed Works OOOH night works starting with the ñDeck ï Section 3B Piles ï Installed OOOHò in March 2018 and ends with the ñEastern Terminal Extension Piers Building Envelopeò in October 2019, a period of 19 months. There is also a 3 month period of the coaching station demolition outside of this. Total Completed Works OOOH night 22 months.

Total = 37 months (approx 3 years)

<u>Night-time piling duration</u>:

Interim works ï Starts in September 2015 with section 2A for a duration of 12 weeks. Then followed by a section 3A in April 2016 for a duration of 7 weeks. Total 19 weeks.

Completed Works ï Starts in March 2018 with section 3B for a duration of 13 weeks.

Total night-time piling duration = 32 weeks.

Assessment

Based on the scenarios described in section 2.1 above the assessment has been broken down into the following headline topics:

1. Temporary Airport Closure for Duration of OOOH Construction ï Day Working

2. Temporary Airport Closure for Duration of OOOH Construction ï 24 Hour Working

3. Weekend Closure for Duration of OOOH Construction

    3 a) - 12 Hour Working

    3 b) - 24 Hour Working (*Night-Time Piling Works Only)*

4. Restricted Opening Hours

    4 a) - 07.00-20.00 (additional 2.5 hours construction)

    4 b) - 08.00-18.30 (additional 5 hours construction)

    4 c) - 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)

    4 d) - 06:30-10:00 and 17:00-22:00 (additional 7 hours construction) *Night-Time Piling Works Only*

5. Closure over Christmas or August Holidays

The topics have been assessed against two scenarios:

i) Full Duration of OOOH Works

ii) Duration of Night-time Piling Works

The topics and scenarios are described further in the following sections and a summary table is also included in section 4.0.

As stated above, this assessment has been performed at a high level to give an initial view on the resultant durations of construction should any of the above scenarios be considered. It is noted that the reduced durations for each scenario are only intended to provide an indicative reduction in duration of construction.

In consideration of the period for which airport closure or operational restrictions would need to be in place, there needs to be some allowance for potential construction over-runs. Therefore a float period has been included within the estimated durations. This provides increased confidence in achieving the construction within the proposed timeframe. A higher float of 20% has been taken for the full airport closure as the proposed construction hours could not be extended outside of this period without significant amendment. A lower float of 10% has been taken for the weekend closure and the restricted opening hours as construction could continue outside of these periods with a small change in working hours. This is a standard approach on projects of this scale.

Scenario 1. Temporary Airport Closure for Duration of OOOH Construction - Day time Working

i) Full Duration of Works

A high level review has been undertaken of the Improved Construction Programme to estimate the reduction in construction duration under the above scenario. From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï 10 months (reduced from 15 months)

Completed Works ï 13 months (reduced from 22 months)

The completed works is reduced by a greater degree as the closure of the airport would result in the OOOH element of the deck and buildings being performed in parallel. This would require a re-sequencing of the works to reduce the airport closure.

Programme float is not included; it is suggested to include 20% for this scenario. Therefore the estimated durations of temporary airport closure with float included are:

Interim Works ï 12 months

Completed Works ï 16 months

ii) Duration of Night-Time Piling Works

The assessment of the programme reduction for this scenario is based on a high level judgement on the expected improvement in piling production rate. This suggests that the programme duration would reduce to the order of 60% of the duration set out in the Improved Construction Programme (August 2014). From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï 8 weeks & 5 weeks (reduced from 12 weeks & 7 weeks)

Completed Works ï 8 weeks (reduced from 13 weeks)

If this scenario was to be delivered then detailed contractor input would be required to confirm that the piling rates could be achieved within the expected durations.

Programme float is not included; it is suggested to include 20% for this scenario. Therefore the estimated durations of temporary airport closure with float included are:

Interim Works ï 10 weeks & 6 weeks

Completed Works ï 10 weeks

Scenario 2. Temporary Airport Closure for Duration of Works – 24 Hour Working

i) Full Duration of Works

Similar to the assessment for scenario 1 i) above a judgement has been made (following a high level technical review) as to the impacts on construction durations should 24 hour working be adopted. Whilst 24 hour working would include a significant departure from the Improved Construction Programme, and in the absence of an appointed contractor, it is estimated that a reduction in the range of 60% to 100% of the duration stated in 1 i) may be expected. From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï Range of 6 to 10 months (reduced from 15 months)

Completed Works ï Range of 8 to 13 months (reduced from 22 months)

Similar to item 1 i) above, a programme float is recommended at 20%. Therefore the estimated durations of temporary airport closure with float included are:

Interim Works ï Range of 8 to 12 months

Completed Works ï Range of 10 to 16 months

ii) Duration of Night-Time Piling Works

The assessment of the programme reduction for this scenario is based on a high level judgement on the expected improvement in piling production rate. This suggests that the programme duration would reduce to the order of 30% of the duration set out in the Improved Construction Programme (August 2014). From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï 4 weeks & 2 weeks (reduced from 12 weeks & 7 weeks)

Completed Works ï 4 weeks (reduced from 13 weeks)

If this scenario was to be delivered then detailed contractor input would be required to confirm that the piling rates could be achieved within the expected durations.

Programme float is not included; it is suggested to include 10% for this scenario. Therefore the estimated durations of temporary airport closure with float included are:

Interim Works ï 5 weeks & 3 weeks

Completed Works ï 5 weeks

Scenario 3 a) Weekend Closure for Duration of Works – 12 hour working

These scenarios are based on 12 hour construction windows on both Saturday and Sunday daytime. In this situation it is deemed that there will be no flights due to the construction activities. The removal of flights on Saturday and Sunday has the construction benefit that the airport does not need to be returned to an operationally safe state on Saturday morning and midday Sunday. If an alternative approach was developed where limited flights were included on Saturday and Sunday then the durations for this scenario may increase due to the additional work required to return the airport to an operationally safe state.

i) Full Duration of Works

A high level review has been undertaken of the Improved Construction Programme to estimate the reduction in construction duration under the above scenario. From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï 13 months (reduced from 15 months)

Completed Works ï 19 months (reduced from 22 months)

Programme float is not included; it is suggested to include 10% float for this scenario. Therefore the estimated durations of temporary weekend closure with float included are:

Interim Works ï 15 months

Completed Works ï 21 months

ii) Duration of Night-Time Piling Works

The assessment of the programme reduction for this scenario is based on a high level judgement on the expected improvement in piling production rate. This suggests that the programme duration would reduce to the order of 75% of the duration set out in the Improved Construction Programme (August 2014). From this it is estimated that the following durations of temporary weekend closure would be required.

Interim Works ï 9 weeks & 6 weeks (reduced from 12 weeks & 7 weeks)

Completed Works ï 10 weeks (reduced from 13 weeks)

If this scenario was to be delivered then detailed contractor input would be required to confirm that the piling rates could be achieved within the expected durations.

Programme float is not included; it is suggested to include 20% for this scenario. Therefore the estimated durations of temporary weekend closure with float included are:

Interim Works ï 10 weeks & 7 weeks

Completed Works ï 11 weeks

Scenario 3 b) Weekend Closure for Duration of Works – 24 hour working

This scenario is based on 24 hour construction windows on both Saturday and Sunday. In this situation there will be no flights due to the construction activities. The removal of flights on Saturday and Sunday has the construction benefit that the airport does not need to be returned to an operationally safe state on Saturday morning and midday Sunday. However, there would be continuous construction throughout the period of closure with no respite whatsoever from noise for local residents, as would be the case under the Improved Construction Programme.

This is only assessed for the out of hours piling construction in response to feedback received from LBN and its technical advisors on 30 October 2014. Therefore scenario ñ) Full Duration of Worksòhas not been included.

ii) Duration of Night-Time Piling Works

The assessment of the programme change for this scenario is based on a high level judgement on the expected change in piling production rate. This suggests that the programme duration would reduce to the order of 55% of the duration set out in the Improved Construction Programme (August 2014). From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï 7 weeks & 4 weeks (reduced from 12 weeks & 7 weeks)

Completed Works ï 8 weeks (reduced from 13 weeks)

If this scenario was to be delivered then detailed contractor input would be required to confirm that the piling rates could be achieved within the expected durations.

Programme float is not included; it is suggested to include 10% for this scenario. Therefore the estimated durations of temporary airport closure with float included are:

Interim Works ï 8 weeks & 5 weeks

Completed Works ï 9 weeks

Scenario 4. Restricted Opening Hours

Scenario 4 a) 07.00-20.00 (additional 2.5 hours construction)

It is currently expected that this limited extension to the night-time closure would not give significant benefit to production rates at this stage. To identify any small savings that may be possible for this scenario would require a more advanced design and more detailed contractor involvement that would happen at a later stage of the project. If there are any small savings they are expected to be greatly outweighed by the impact on the business and therefore it is not proposed to bring forward this very detailed planning. The reason for the view that the production rates are not improved is that the relatively short extension to the working window is likely to give greater surety on obtaining the programme by ensuring that the work programmed for this night shift is completed although it will not give enough time to give a significant increase in the amount of work that is attempted at this stage.

This is particularly true for the piling where from a construction point of view, alterations to operational hours at the beginning and end of the day in the region of 2.5 hours are unlikely to have any significant effect on reducing the duration. Production rates for piling for the CADP are based on a production rate of one pile per night, as was achieved during the construction of the Operational Improvements Project (OIP) by the Airport in 2007. This includes for the mobilization, casing installation, boring and concreting of the supporting piles for the proposed deck.

Therefore, for each weeknight the duration of the operational hours window remains constant in order to undertake the required mobilisation, boring, concreting and demobilization to one pile. A relatively small increase in construction hours under the above scenario will not give sufficient time to perform the works to a whole second pile. It is not practical to construct part of a pile within a nightshift and complete on the following shift, as a bored pile is likely to collapse if it is not concreted on the same working shift.

Against this background a small increase in the night-time working period will not give a notable change to the overall project duration and critically, the amount of night-time working.

Scenario 4 b) 08.00-18.30 (additional 5 hours construction)

i) Full Duration of Works

A judgement has been made (following a high level technical review) as to the reduction of construction duration under the above scenario. While there would be increased working hours over scenario 3a) i) above (weekend closure), the increased night-time hours for this scenario is more restricted as there is a requirement to ensure that the airport returns to an operational state requiring increased mobilisation, demobilisation and temporary works. This will restrict the amount of construction activities that can be delivered in the increased working window. On balance it is estimated that the reduced programme durations will be similar to those of scenario 3a) i) above. Therefore it is estimated that the following durations of temporary weekend closure would be required.

Interim Works ï 13 months (reduced from 15 months)

Completed Works ï 19 months (reduced from 22 months)

Programme float is not included; it is suggested to include 10% float. Therefore the estimated durations of restricted opening hours with float included are:

Interim Works ï 15 months

Completed Works ï 21 months

ii) Duration of Night-Time Piling Works

The assessment of the programme reduction for this scenario is based on a high level judgement on the expected improvement in piling production rate. This suggests that the programme duration would reduce to the order of 67% of the duration set out in the Improved Construction Programme (August 2014). From this it is estimated that the following durations of restricted opening hours would be required.

Interim Works ï 8 weeks & 5 weeks (reduced from 12 weeks & 7 weeks)

Completed Works ï 9 weeks (reduced from 13 weeks)

If this scenario was to be delivered then detailed contractor input would be required to confirm that the piling rates could be achieved within the expected durations.

Programme float is not included; it is suggested to include 10% float. Therefore the estimated durations of restricted opening hours with float included are:

Interim Works ï 9 weeks & 6 weeks

Completed Works ï 10 weeks

Scenario 4 c) 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)

This scenario would give additional time in two separate windows: during the night-time; and during lunch time.

The extension in the night-time construction is the same as option 4a) ï ñ07.00-20.00 (additional 2.5 hours construction)ò above and the benefit of this extension is the same as option 4a) above. Therefore there is not expected to be a reduction in the programme at this stage for the extended night-time period.

The scenario also gives a 2 hour lunchtime closure which will not give enough time to attempt to perform any meaningful construction activities. This is due to the periods for mobilisation and demobilisation of the works reducing the time frame available to an insignificant amount. Works may also be restricted at the start of the shift due to delayed departures and aircraft clearing the local airspace. Works will be restricted at the end of the shift due to allowing time for cleaning up and handing back the airfield for airport operations. Therefore the 2 hour out of operational hours period over lunch time will not provide any programme benefit.

Consequently this option does not give any significant programme benefits because the time is split into two areas where increased production cannot be achieved.

Scenario 4 d) 06:30-10:00 and 17:00-22:00 (additional 7 hours construction) *Night-Time Piling Works Only*

This is assessed for the duration of OOOH piling only.

This scenario provides an extended airport closure during the middle of the day. This period is shorter then the existing night-time construction, therefore the programme would increase if night working was avoided. Therefore, the programme reduction considered has been for parallel day and night-time construction during the period of restricted opening hours.

ii) Duration of Night-Time Piling Works

The assessment of the programme change for this scenario is based on a high level judgement on the expected change in piling production rate. This suggests that the programme duration would reduce to the order of 59% of the duration set out in the Improved Construction Programme (August 2014). From this it is estimated that the following durations of temporary airport closure would be required.

Interim Works ï 8 weeks & 5 weeks (reduced from 12 weeks & 7 weeks)

Completed Works ï 8 weeks (reduced from 13 weeks)

If this scenario was to be delivered then detailed contractor input would be required to confirm that the piling rates could be achieved within the expected durations.

Programme float is not included; it is suggested to include 10% for this scenario. Therefore the estimated durations of temporary airport closure with float included are:

Interim Works ï 9 weeks & 6 weeks

Completed Works ï 9 weeks

Scenario 5. Closure over Christmas or August Holidays

Scenario 5 a). OOOH piling within airport closures within the Christmas and August periods.

This option is to consider airport closure over the Christmas and August holidays for the out of operational hours (OOOH) construction. This can only be assessed for the piling construction as the overall construction programme is significantly greater than the suggested closure periods.

The duration of these extended closure periods is similar to scenario 1 ii) (day working) and scenario 2 ii) (24 hour working) presented above. The difference being that the construction would occur in a fixed point on the construction programme. This is extremely restrictive in terms of the sequencing of construction activities and delivery of the Improved Construction Programme.

It would be a significant challenge to commit to the required piling construction within these periods and 24 hour working would be required to get closest to the available closures. Therefore 24 hour working similar to that considered under scenario 2 ii), is the only one being considered for this scenario. The expected timeframes from scenario 2 ii) would be as follows:

Interim Works ï 5 weeks & 3 weeks (including float)

Completed Works ï 5 weeks (including float)

Based on these durations the construction could not be achieved within a 2 week Christmas or 4.4 week August closure. The closure period in one or both of these periods would need to be greater then two or 4.4 weeks, with the total period similar to the above.

If construction was limited to within these periods it would pose a significant constraint on the construction programme. This is likely to have significant risks on the delivery dates for the CADP infrastructure. If this scenario was required then a number of construction related issued would need to be resolved:

1. If the out of operational hours (OOOH) piling construction was carried out at Christmas and during August there will be a period of 4 to 7 months between the construction windows. Firstly this may delay the construction programme to align with these fixed periods. Secondly the gap between these periods may be un-productive time for the piling. Thirdly if the gap in construction is unproductive time for the piling the piling trade will need to be remobilised. This remobilisation may add to the construction programme as a period of time will be required to reach the peak piling production rates.
2. Plant breakdown is a risk to achieving the construction programme. Over the Christmas period the response times to any plant breakdowns are likely to be significantly longer. This may mean that increased durations will be required over that stated above.
3. Any requirement for closure within a short period is susceptible to delays due to weather. The main risk would be high winds. This is likely to be a higher risk over the Christmas period than August - another reason why construction within a defined short closure is not desirable.
4. Delivery of construction materials, particularly wet concrete, is restricted over the Christmas period and special arrangements would need to be in place to ensure that the materials required for the construction could be delivered.
5. The availability of construction workers could be restricted over these holiday periods. The relevant skilled staff would need to be sourced with multiple shifts to enable 24 hour working to be achieved.

It is expected that 24 hour working around Christmas would not be desirable for the local residents as it is a holiday period.

This scenario is not thought to provide a practical approach to delivering the Improved Construction Programme for the CADP infrastructure and could lead to increased risk in terms of delays and deliverability.

Scenario 5 b). OOOH piling in an August full airport closure reverting to weekend closure beyond August.

Scenario 5 a) is not though to provide a practical approach to delivering the required construction. Based on the topics assessed in scenario 5 a) and the disadvantages that were identified the project team has looked to see if an alternative solution could be developed to provide an improvement in the delivery while minimising the impact of airport closure.

This has resulted in the identification of scenario 5 b). This option was developed on the following principles:

1. The Christmas closure has a higher risks around weather, materials supply and plant breakdown.
2. 24 hour construction over Christmas is likely to be less desirable for the local population who will be enjoying a period of rest and festivities.

3. The construction programme would be better suited to one period and the August closure (4.4 weeks) is longer than the Christmas closure (2 weeks).
4. Construction could extend beyond the August closure. This could be achieved by weekend airport closure and 24hr working to minimise the OOOH construction programme.

This has resulted in the formulation of the following assessment scenario:

The airport would close for 4.4 weeks (31 days) in August during the interim works and the completed works to allow uninterrupted piling construction. This is referred to as the ñfull closureò and 24 hour working would be used to maximise production. This concept is similar to scenario 2 presented previously.

Beyond the full closure the airport would be closed on the weekends to further reduce the OOOH piling duration. This is referred to as the ñweekend closureò. The duration of the weekend closure would be set to achieve the remaining OOOH piling construction. 24 hour working would be utilised on the weekends to minimise the duration of OOOH piling works. This concept is similar to scenario 3 b) presented previously.

While this minimises the disadvantages of scenario 5a) it still restricts the airport to construction within a fixed period of time. This means that the delivery of the infrastructure could be delayed by up to a year.

The assessment of the programme change for this scenario is based on a high level judgement based on combining scenarios 2 and 3 b). From this it is estimated that the following durations of temporary airport closure would be required.

Scenario	i) Full Duration of Works		ii) Duration of Night-Time Piling Works	
Current planned duration of construction	15 months Sept 2015-Dec 2016	22 months Mar 2018 to Jan 2020	12 weeks starting Sept 2015 and 7 weeks starting Apr 2016	13 weeks starting Mar 2018
	Reduced Equivalent Closure Periods			
1. Temporary Airport Closure for Duration of Works ï Day Working	10 months **No float suggest 20%**	13 months **No float suggest 20%**	8 weeks & 5 weeks **No float suggest 20%**	8 weeks **No float suggest 20%**
2. Temporary Airport Closure for Duration of Works ï 24 Hour Working	Range 6 to 10 months **No float suggest 20%**	Range 8 to 13 months **No float suggest 20%**	4 weeks & 2 weeks **No float suggest 20%**	4 weeks **No float suggest 20%**
3. Weekend Closure				
3 a) - 12 Hour Working	13 months **No float suggest 10%**	19 months **No float suggest 10%**	9 weeks & 6 weeks **No float suggest 10%**	10 weeks **No float suggest 10%**
3 b) - 24 Hour Working	N/A	N/A	7 weeks & 4 weeks **No float suggest 10%**	8 weeks **No float suggest 10%**
4. Restricted Opening Hours				
4 a) - 07.00-20.00 (additional 2.5 hours construction)	N/A	N/A	N/A	N/A
4 b) - 08.00-18.30 (additional 5 hours construction)	13 months **No float suggest 10%**	19 months **No float suggest 10%**	8 weeks & 5 weeks **No float suggest 10%**	9 weeks **No float suggest 10%**
4 c) - 07.00-12.00 and 14.00-20.00 (additional 4.5 hours construction)	N/A	N/A	N/A	N/A
4 d)- 06:30-10:00 and 17:00-22:00 (additional 7 hours construction)	N/A	N/A	8 weeks & 5 weeks **No float suggest 10%**	8 weeks **No float suggest 10%**

APPENDIX B:

ASSESSMENT OF DIRECT OPERATIONAL IMPACTS BY SCENARIO

For the purpose of this analysis, indicative airline schedules for 2015 and 2019 have been used to assess the direct effects on the schedule of the potential closure scenarios for the Interim Works and Full Works out of hours works respectively. In respect of the Interim Works construction, a 2015 timetable based on OAG data for winter 2014/5[28] has been used on the basis that there will be limited scope for movement growth in 2015 and 2016 due to the current infrastructure being full in peak periods. In respect of the Full Works construction, the forecast schedule of movements used to inform the CADP Need Statement and ES assessments for 2019 has been used but with adjustments made to allow for changes in the airline mix reflecting recent network developments. As noted at paragraph 3.44 of the Need Statement, the detailed schedules produced for the assessment years were broadly indicative of the overall markets and the profile of demand but not necessarily definitive in terms of specific routes and airlines in any given year. Nonetheless, these schedules are considered to be a reasonable basis for assessing the order of magnitude of the impacts of the potential closure periods.

Scenarios 1. and 2. - Temporary Airport Closure for Duration of Works:

For both the Interim Works and the Full Works construction periods, the approach remains the same. The total forecast annual movements and passenger numbers for 2015 and 2019 are pro-rata increased or decreased to cover the respective closure periods of 12 and 16 months or 10 and 13 months respectively, dependent on whether the allowance is made for day time only or 24 hour working during the closure period.

Scenario 3. - Weekend Closure for Duration of Works:

For the weekend closures, the approach remains consistent for both the Interim Works and the Full Works construction periods. This is based on the ratio of weekend to weekday movements over the year as a whole applied to the relevant closure period. For 2015, it is assumed that 12.05% of movements occur on a weekend based on the planned pattern of operations. For 2019, the percentage of weekend movements is assumed to be 12.35%, based on the historical average and as assumed in the CADP forecasts.

In addition, in both cases, adjustments are also made for aircraft which would normally operate through the weekend but could be out of position for Monday morning if a Friday evening service were to be operated or for non-based carriers which are unlikely to accept their aircraft being ‘stranded’ at LCY over the two weekend days. In 2015, this affects one British Airways movement on a Friday evening which is unlikely to depart to Edinburgh, otherwise it would be out of position for its scheduled Monday morning departure from LCY[29] if it could not return on a Sunday. The projected 2019 schedule does not contain any movements with this pattern. By only omitting this one movement, the assessment may be somewhat conservative as both BA and Cityjet do have aircraft which depart London City on a Friday night and return on Saturday mornings, such as to Madrid and Rotterdam. Similarly, there are Sunday afternoon departures returning on Monday morning. In these cases, we have conservatively assumed that the airlines would be content for the aircraft to spend 2 nights at the away base with additional crew and accommodation costs or that they could reschedule their aircraft to avoid this difficulty. It is also possible that the weekend movements could operate to an alternative airport if the closure was for a short duration, albeit there would be cost implications for the airlines and for passengers. By omitting the potential impact on these movements, the assessment may understate the impact.

[28] Including an allowance for Cityjet based on its current timetable as it has not yet submitted its winter programme for 2014/5 to OAG.

[29] This will have implications for any charter programme which is currently operated from EDI using this aircraft or, if that programme is to be maintained, would mean the loss of the Monday movement at LCY.

By 2018, however, our assumption is that Swiss would recommence their previous operating pattern with aircraft overnighting at LCY in order to meet demand. With a weekend closure in force, this operating pattern would be impacted as Swiss would need the aircraft available for the weekend operations from Switzerland and this would prevent them overnighting at LCY on Fridays and Mondays. As a result two arrivals on a Friday evening and two Monday morning departures (4 movements total) are assumed to be lost, covering one of each to/from Zurich and Geneva.

The weekend ratio of movements and the individual adjustments were combined to give a weekly impact which was then multiplied appropriately for the monthly or weekly closure periods[30].

The passenger numbers for 2015 and 2019 are calculated on the basis of the assumed average number of passengers per movement (51 for 2015 as current and 49 in 2019 as set out in the Need Statement).

Scenario 4. - Restricted Opening Hours:

Based on the variable durations for which restricted opening hours would apply under the various scenarios, a similar approach has been adopted in order to assess the impact in each case, albeit with individual adjustments made where necessary to reflect the expected specific impact of particular closure periods on certain movements.

In considering the impacts of restricted hours during the Interim Works construction, the starting point has been to consider the use of aircraft and airport slots by each airline based on the expected 2015 schedule. The schedule shows 276 total movements (138 departures and arrivals) on each weekday. Of these, 41% are operated by BA Cityflyer (excluding Sun-Air and New York services), whilst 13% are operated by Flybe and 21% operated by CityJet. The remainder are operated by a variety of airlines, including Swiss and Lufthansa.

In 2015, BA Cityflyer has 17 aircraft allocated to LCY and 112 movements per day achieving an average of 3.29 departures from LCY per day per aircraft. Flybe, with 6 aircraft allocated to LCY, will achieve 3 departures per day per aircraft. Cityjet have around 9 aircraft allocated to operations to/from LCY, generating 56 movements and 3.11 departures per aircraft per day. The approach to calculating the impact of different closure periods is largely based on adjustments to the number of departures each LCY dedicated aircraft could be expected to operate each day for the three largest airlines carriers with aircraft. It is assumed that the carriers would readjust their schedules to optimise the use of the aircraft within the restricted opening hours.

For 2019, the indicative CADP schedule has been used and the number of aircraft allocated to LCY by the three largest airlines is based on the assumption that their market share remains as 2015. This has been used to apportion the projected weekday movement level of 356. This generates (on a rounded basis):

- 144 movements for BA Cityflyer, equating to 22 aircraft at the existing 3.29 departures per aircraft;
- 48 movements by Flybe based on 8 aircraft operating 3 departures per aircraft; and
- 76 movements by CityJet based on 12 aircraft operating 3.11 departures per aircraft.

Adjustments to the number of movements by these carriers at 2019 are, therefore, based on these projections.

[30] Taking 1 year as 52 weeks and 1 month as 1/12 of a year.

In order to assess the impact of the potential restricted operating hours on the overall use of these aircraft, account has been taken of the number of daily departures which each aircraft could still perform based on an average BA Cityflyer flight duration of 85 minutes, for Flybe of 94 minutes, and for CityJet of 83 minutes based on current operating patterns and route structure. Including the flying time, a 30-minute turnaround at LCY and a 1 hour turnaround at the destination[31], this equates to an average of 260 minutes for a return BA Cityflyer service, 278 minutes for a return Flybe service and 256 minutes for a return CityJet service.

Individual adjustments are then made for other carriers where relevant based on the current schedule or our 2019 CADP schedule where growth is expected for these carriers. For the purpose of this analysis, it is assumed that airlines other than the principal based airlines will have greater flexibility to adjust their schedules.

a) 07.00-20.00 Restricted Opening

These operating hours amount to 780 minutes available for services. On the basis that the carriers would retain similar networks in the future, the number of possible rotations per allocated aircraft for each of the three largest airlines is estimated by dividing the available time by the average full rotation times shown above. This results in the following reductions to the numbers of departures (and arrivals) which are possible during the weekday operating window.

- BA Cityflyer - 3 departures per day for each aircraft, down from 3.29 currently:
    - 2015: 102 movements per day (down by 10 movements or 9%) with 17 aircraft;
    - 2019: 132 movements per day (down by 12 or 8%) with 22 aircraft.
- Flybe - 2.9 departures per day for each aircraft, down from 3 currently:
    - 2015: 34 movements per day down by 2 movements, or 6%) with 6 aircraft.;
    - 2019: 46 movements per day (down by 2 or 4%) with 8 aircraft.
- Cityjet - 3 departures per day for each aircraft, down from 3.11 currently:
    - 2015: 54 movements per day (down by 2 movements or 4%) with 9 aircraft.
    - 2019: 72 movements per day (down by 4 or 5%) with 12 aircraft.

In 2015, it is assumed that, based on the expected schedule, no other carriers would need to reduce their LCY operations, although Swiss would need to reschedule a service by 5 minutes around the closure period. In total, therefore, in 2015, 14 aircraft movements would be lost each weekday. Over a 15 month closure period, this equates to some 5,500 movements[32]. It is assumed that the carriers will need to continue operating some leisure destinations in order to prevent overcapacity on some city destinations through the middle of the day. However, in so far as some destinations may no longer be served, it is expected that the carriers would still prioritise the retention of business related services. Hence, the restricted opening hours would impact on the available working day in London for some core routes, such as Amsterdam, Edinburgh and Rotterdam rather than the availability of such services.

In 2019, it is likely that there may be some additional impact from these restrictions. The CADP forecasts project that Swiss will reinstate two overnight aircraft (to serve Zurich and Geneva) in order to meet demand. With restricted opening hours, these services would also be lost, amounting to 4 movements per day. No other operators are expected to be impacted. In total, therefore, in 2019, 22 movements per day would be lost, equating to some 12,600 movements over a 22 month closure period.

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[31] Taking into account current observed turnaround times on LCY flights at relevant airports.

[32] Weekly movements are calculated assumed a 5 day week plus an allowance for weekend flying as appropriate. Annual movements are calculated as 52 times weekly movements, which are then pro-rated over the 12 months. Numbers are presented rounded to the nearest 100 movements.

Shorter duration impacts for the duration of the night-time piling works only are calculated pro-rata in all cases.

b) 08.00-18.30 Restricted Opening

These operating hours amount to 630 minutes available for services. On the basis that the carriers would retain similar networks in the future, the number of possible rotations per allocated aircraft is determined by dividing this by the average full rotation times shown above. The results by airline are as follows:

- BA Cityflyer ï 2.4 departures per day for each aircraft, down from 3.29 currently:
  - 2015: 82 movements per day (down by 30 movements or 27%) with 17 aircraft;
  - 2019: 106 movements per day (down by 38 or 26%) with 22 aircraft.
- Flybe - 2.25 departures per day for each aircraft, down from 3 currently:
  - 2015: 28 movements per day (down by 8 movements, or 22%) with 6 aircraft.;
  - 2019: 36 movements per day (down by 12 or 25%) with 8 aircraft.
- Cityjet ï 2.5 departures per day for each aircraft, down from 3.11 currently:
  - 2015: 46 movements per day (down by 10 movements or 18%) with 9 aircraft.
  - 2019: 60 movements per day (down by 16 or 21%) with 12 aircraft.

In addition, in 2015, if schedules could not be readjusted due to current congestion in the peak periods at LCY or slot constraints elsewhere, there is some risk the following would also be lost as they could not be accommodated at viable times for the business travel market:

- Swiss ï 10 movements per day;
- Luxair ï 6 movements per day; and
- Others ï 8 movements per day (Lufthansa/Aurigny/Blue Islands/BA JFK service 2 each)

Conservatively, these additional reductions do not take account of the impact on the carriersô remaining services, as the lack of peak services by each carrier may lead them to suspend all services. For the purpose of this operational analysis, we have assumed that airlines do not withdraw entirely in the first instance.

In total, therefore, in 2015, 72 movements per weekday would be lost, which equates to some 28,100 movements over a 15 month period and pro rata for shorter duration restrictions for night-time piling works only.

By 2019, if schedules could not be readjusted due to congestion in the peak periods, then the number of lost services by other carriers would increase to:

- Swiss ï 14 movements per day;
- Luxair ï 6 movements per day; and
- Others ï 8 movements per day (Lufthansa/Aurigny/Blue Islands/BA JFK Service 2 each)

In total, therefore, in 2019, 92 movements per weekday would be lost, equating to some 55,100 movements over a 19 month period and pro rata for shorter duration restrictions for night-time piling works only.

c) 07.00-20.00 + 12.00-14.00 Restricted Opening

Although the outer periods of these restricted hours match those assessed earlier, the middle of the day closure disproportionately impacts on the three main carriers because the pattern of operations for aircraft dedicated to LCY leads to some movements needing to occur in this period, whereas for other airlines the middle of the day activity takes place at their home base. The effect of this may increase operating costs for the home based carriers due to longer parking periods, particularly if not at LCY.

These operating hours amount to 660 minutes available for services. On the basis that the carriers would retain similar networks in the future, the number of possible rotations per allocated aircraft and the impacts by airline for the three largest airlines are as follows:

- BA Cityflyer ï 2.5 departures per day for each aircraft, down from 3.29 currently:
  - 2015: 86 movements per day (down by 26 movements or 23%) with 17 aircraft;
  - 2019: 110 movements per day (down by 34 or 23%) with 22 aircraft.
- Flybe - 2.4 departures per day for each aircraft, down from 3 currently:
  - 2015: 30 movements per day (down by 6 movements, or 17%) with 6 aircraft.;
  - 2019: 38 movements per day (down by 10 or 21%) with 8 aircraft.
- Cityjet ï 2.5 departures per day for each aircraft, down from 3.11 currently:
  - 2015: 48 movements per day (down by 8 movements or 14%) with 9 aircraft.
  - 2019: 62 movements per day (down by 14 or 18%) with 12 aircraft.

In 2015, Swiss would also be required to cease some services in the middle of the day, removing 4 movements. In total, therefore, in 2015, 44 movements per weekday would be lost, equating to some 15,700 movements over a 15 month period and pro rata for shorter duration restrictions for night-time piling works only.

By 2019, the impact on Swiss would be a loss of 8 movements from a combination of middle of the day and over-nighting operations, equating to some 34,600 movements and pro rata for shorter duration restrictions for night-time piling works only.

d) 7-Hour Middle of Day Closure

In considering the impact of a seven hour closure in the middle of the day, we have reviewed both the options of a 09.30-16.30 and 10.00-17.00 closure. We have determined that whilst these times have different impacts at a route and individual aircraft level, in aggregate the magnitude of impact is virtually the same. In determining the impacts, it is important to recognise some key points:

- For aircraft which over-night at LCY, some (but not all) may be able to arrive back at LCY before a 10.00 closure providing they depart earlier than they currently do (although this would be limited by the current planning constraints), but they would be unable to depart again before the Airport closed. These aircraft would then need to depart once the Airport re-opened in the late afternoon;
- No over-nighting aircraft would be able to operate a return flight back to LCY before 09.30 even if they were scheduled to depart earlier, so these aircraft would need to return once the Airport re-opened;
- In the case of 10.00-17.00 closure, any over-night based aircraft at LCY would only be able to operate one return service in the remaining period of the evening, even if they departed immediately after the Airport reopened, because there would be insufficient flying time available for them to operate a further return service before the Airport closed for the night;
- In the case of 09.30-16.30 closure, any over-nighting aircraft that arrived immediately upon the Airport re-opening would then only be able to operate one further return service because there would be insufficient flying time available to them to operate a further return service before the Airport closed for the night;

Clearly, in the middle of the day, there would be no rotations from any airlines based at LCY or those with inbound aircraft. In some cases, there would be scope for aircraft to depart back to LCY in time to arrive at 16.30, although this will be limited by two key factors:

- Runway and stand capacity limits would prevent all the aircraft from immediately returning in a short space of time as they could not be physically accommodated;
- Key destinations which are served by multiple frequencies would not be likely to see departures back to LCY following each other immediately. Given the need for a degree of spread in the timing of flights, this is likely to lead to further loss of rotations if airlines are constrained from operating a spread of departure and arrival times to meet market demand and the need for a degree of flexibility for full fare business passengers.

For aircraft operated by based carriers, such as BA Cityflyer, a key consideration is the average return sector time against the available opening time in the evening. With the Airport open for 330 minutes from 16.30, this is time for little more than one return sector at 260 mins after departure from LCY; the same would be true for Flybe (278 minutes) and Cityjet (256 minutes). For an aircraft arriving at 16.30, this would mean all these carriers could do one further full rotation, but this would only be acceptable if the aircraft was then based overnight at LCY (for which demand is lower) because on the whole it is unlikely that any of the Airportôs key passenger demographic would be interested in flights then departing again at around 21.30-22.00. Further, the airlines would not be able to operate such a concentrated pattern of flying within the constraints on capacity at London City and there would also be issues of slot availability at many of the airports at the other ends of the routes. In summary, it would be impractical to expect this pattern of services to be operated, even if it were commercially attractive for the airlines do so.

Therefore, for airlines with aircraft based at LCY, we believe that they would generate only one return movement at the Airport for any aircraft not over-nighting at LCY and for those based overnight, this may be one return frequency and then one arrival. For those carriers without aircraft based at LCY, then the projected impact would be minimal in so far as their services arrived after the Airport re-opened at 16.30. However, there would be some constraints due to congestion on the ground as a consequence of bunching of flights which might prevent some operations.

In total, this means that any over-night based aircraft would be only be able to operate four flights (two return flights) per day, although when these flights occur would vary dependent on the timing of the 7 hour closure, either as 1xAM/3xPM flights in the case of a closure from 9.30 to 16.30 or 2xAM/2xPM flights for a closure between 10.00 and 17.00. Regardless, of the precise time of the 7 hour window, this would reduce the number of departures for each over-night based aircraft to 2 a day from the 510 minutes available for services. Similar constraints would apply to the non-based aircraft.

In considering the implications for aircraft which do not over-night at LCY and those operated by non-based airlines, we have taken the closure period to be 09.30-16.30. For those aircraft arriving at the Airport during the early morning period, it would be possible to achieve one arrival and one departure (on the basis that the average sector length is too great to fly in, turn-around, depart, turn-around and then return to LCY). For airlines, such as Luxair or Swiss, which operate multiple inbound flights during this period (i.e. not reliant on LCY ôbasedô aircraft such as BA Cityflyer and CityJet), there would be little impact on their morning operations providing they are scheduled to depart before the time of closure.

In summary:

- For **BA Cityflyer** aircraft, only 68 movements would be achieved per day in 2015 (down by 44 movements or 39%) with 17 aircraft. In 2019, this would lead to 88 movements per day (down by 56 or 39%) with 22 aircraft.

- For **Flybe** aircraft, only 24 movements would be achieved per day in 2015 (down by 12 movements or 33%) with 6 aircraft. In 2019, this would lead to 32 movements per day (down by 14 or 33%) with 9 aircraft.
- For **Cityjet** aircraft, only 36 movements would be achieved per day in 2015 (down by 20 movements or 36%) with 9 aircraft. In 2019, this would lead to 48 movements per day (down by 26 or 39%) with 12 aircraft.

In addition, in 2015, the following movements would also likely be lost:

- Swiss ï 8 movements per day;
- Luxair ï 4 movements per day;
- Alitalia ï 6 movements per day; and
- Others ï 6 movements per day (Lufthansa/Aurigny/ /BA JFK service 2 each)

Conservatively, these additional reductions do not take account of the impact on the carriersô remaining services, as restrictions on peak period capacity caused by a bunching of flights could lead to some airlines suspending all services for the duration of the closure. For the purpose of this operational analysis, we have assumed that airlines do not withdraw entirely and seek to operate as much of their schedule as it is possible to do so. This is a conservative assumption.

In total, therefore, in 2015, 100 movements per weekday would be lost, which equates to some 9,000 movements over a 15 week period. This equates to 5,100 passengers lost per week, or 459,000 over a 15 week closure.

By 2019, the following movements would also likely be lost:

- Swiss ï 16 movements per day;
- Luxair ï 4 movements per day;
- Lufthansa ï 18 movements per day; and
- Others ï 10 movements per day (Austrian/Aurigny/LOT/SAS/BA JFK Service 2 each)

In total, therefore, in 2019, 144 movements per weekday would be lost, equating to some 7,800 movements over a 9 week period. This equates to 7,344 passengers lost per weekday, or 396,600 over a 9 week closure.

In the case of 7-hr closures during the day, there may be some benefits derived from unrestricted operating conditions in the 06.30-06.59 period, but these may be of little real benefit to the carriers for a number of reasons:

- Very few aircraft over-night at LCY, reflecting the predominant inbound flow of passengers in the mornings. Hence, there is unlikely to be substantial additional demand for departure flights during the 06.00-06.59 period.
- There are very few destinations which could see an aircraft depart at 06.30 and return in time for a closure at 09.30, and many would be unable to return even before 10.00. It would not be feasible to schedule a return from any destination with over 1-hr of scheduled flying time, including Dublin (1hr 15m with BA), Amsterdam (1h 05m with BA), Edinburgh (1h 25m with BA) and Glasgow (1h 20m with BA), in the period before 9.30 and, even if the closure time was extended to 10.00, this still would not allow time for aircraft to turn-around and depart again. On this basis, there would be no incentive for carriers to switch from an inbound pattern in the mornings.
- For inbound aircraft, very few arrive in this period (only 1 presently at 06.55), with the greatest demand for inbound services being between 07.30-09.00. In order to arrive between 06.00-06.59, the departure times may be highly unattractive to passengers and there would likely be long periods of wasted time spent in London before the working day commences that would be unattractive to business passengers.

Departures from Edinburgh would likely need to be around 04.30-05.30 in order to arrive during this period, whilst from Frankfurt and Zurich this would involve departures at 05.30-06.00 from each. .

Table C1 illustrates the required departure time from key origins to arrive at LCY by 6.45 in the morning and illustrates that, in most cases, the departure time would be commercially unattractive to most carriers, particularly in the light of the core business market being served.

Table C1: Required Local Departure Times to Arrive at LCY by 6.45

	Required Local Departure Time
Aberdeen	4.55
Amsterdam	6.40
Antwerp	6.40
Basle	6.05
Belfast (BHD)	5.15
Dublin	5.25
Edinburgh	5.20
Frankfurt	6.15
Geneva	6.05
Glasgow	5.20
Madrid	5.20
Milan (LIN)	5.55
Paris (ORY)	6.25
Rome (FCO)	5.20
Rotterdam	6.50
Zurich	5.55

In some cases, these departure times would not even be possible as they would need to occur before an overnight curfew on operations is lifted and/or the Airport opens. Examples of this include at Belfast City (opens 6.30), Aberdeen (opens 6.10) and Zurich (opens 6.00).

Overall, we believe that there would be very little mitigation on passenger number reduction by removing restrictions in the early morning period to compensate for a 7 hour period of closure during the day.

Scenario 5. – Temporary Seasonal Closures:

a) Close in August and at Christmas

August

Between 2010 and 2014[33], August typically generates an average of 8.3% of all annual passengers, proportionally equal to 1/12th of the year. During this month, the based carriers adjust their schedules to reduce some flying to major city destinations, mainly through reduced frequencies in the middle of the day allowing business passengers to continue to take advantage of peak services to city destinations, and increase their flying to leisure destinations. Indeed, during August, some city destinations register their highest average load factors through the year, albeit this is set against the backdrop of less capacity and fewer flights. In practice, demand to many key city destinations remains strong in August,

[33] Provisional September passenger numbers and Oct-Dec grown at 3% from 2013 based on average growth rate over first 9 months of year.

albeit the airlines take advantage of the seasonal leisure markets. Over the 12-months ending September 2014:

- To Frankfurt, 7.4% of the annual passengers flew in August, slightly higher than in December, January and February;
- To Zurich, 7.7% of annual passengers flew in August, slightly higher than in December, January and February;
- To Dublin, 8.4% (more than 1/12th) of annual passengers flew in August, higher than in October, December, January, February, March and April;
- To Geneva, 8.0% of annual passengers flew in August, higher than in October, December, January, February, March and April;
- To Milan, 10.8% of passengers flew in August, making this jointly the third busiest month of the year on this route.

A similar pattern exists across a number of key routes, including Edinburgh and Glasgow. Whilst the mix of traffic may change to some degree, even on these city routes, this is a key element of the airlineś annual passenger mix.

The adjustment to the passenger number for the closure of the whole of August is, therefore. based on 8.3% of the total passengers in the relevant years. At 2015, this equates to 318,000 less passengers in the year, increasing to 404,000 by 2019.

A similar approach to movements shows that between 2010 and 2014, on average 8% of movements occurred in each August. This has then been applied to the commercial movements figure to estimate the impact on movements.

<u>2-Week Christmas Period</u>

Despite the reduced business demand around Christmas, parts of December have relatively strong load factors, with the month overall having a higher average share of the annual passengers than January over the last 4 years. However, movements do drop significantly during the holiday period. In November 2013 there were 433,000 seats available to/from LCY and in January 2014 this figure was 421,000, whilst in December 2013, the figure was 354,000.

In estimating the impact of a total closure in the Christmas period, it is necessary to isolate the level of frequency operated during the seasonal period. If the typical November and January seat capacities are averaged it equates to 427,000 seats and this serves as a proxy for December without the Christmas period impact. If it is assumed that half of this proxy capacity would be in the first half of the month (2.2 weeks), then the seasonal period is operating at roughly 35% below this level.

Assuming that the November average load factor applies to the first half of the month (65.5%), then around 60% of passengers in December 2013 were carried in the first half and 40% in the second half of the month (with a slightly higher load factor of 66.1% resulting from the contraction of services). Overall, around 2.7% of annual passengers are carried during the 2 week Christmas period. In estimating the effect of a closure, this proportion has then been applied to both 2015 and 2019 annual passenger forecasts.

A similar approach can be applied to the movements, which would suggest that around 62% of movements occur in the first half of December, and 38% in the later half. This equates to around 2.6% of annual commercial movements which has then been applied to the 2015 and 2019 annual movement totals.

b) Combined August and Weekend Closures

We have estimated the impact of closing the Airport for the whole of August and then again over a number of weekends following this by combining the approaches taken to the each of these time periods above. The August closure is simply the whole August figure, and the weekend figure has been determined by multiplying the weekly impact by the number of weeks over which closure may occur. These two calculations have then been added together to estimate the total impact.

APPENDIX C:

SLOT AVAILABILITY AT ALTERNATIVE AIRPORTS

Overall, spare capacity is limited in peak periods across the London Airports and this will act as a powerful constraint on the airlines ability to serve markets efficiently in the event of restrictions on London City. To the extent that spare capacity would exist to accommodate at least a proportion of the displaced flights should the Airport close for any period or in the event of operating restrictions displacing peak activity, it is likely to be limited:

- *Heathrow* – there is no available spare slot capacity for additional weekday flights in the London City Airport peak periods[34], nor could additional weekday flights be accommodated in any of the specific weekday closure periods under consideration. There would be some scope to accommodate a small number of displaced weekend flights but this would be very limited. Realistically, Heathrow only provides an alternative for some airlines, e.g. Swiss or Lufthansa to accommodate some of the displaced passengers by using larger aircraft on its existing Heathrow services.

- *Gatwick* – there is only very limited spare slot capacity at Gatwick in the London City Airport peak periods and this is unlikely to be sufficient to accommodate daily weekday services on a regular pattern. Nor is there significant spare capacity in the time periods which might be considered for the specific closure times under consideration. If anything, weekend capacity at Gatwick is even more limited. Some displaced passenger demand might be accommodated on low fare services operated from that Airport but this is less likely to provide an attractive alternative for business travellers used to the high frequencies of operation from London City on most key routes. Gatwick does not offer a realistic or feasible alternative to London City operations

- *Luton* – the Airport has some spare capacity in the London City peak periods as its capacity peak is for very early morning departures in the 06.30 to 08.00 period. In the short term, the spare movement capacity in the 08.00 hour is around 5 runway movements, which would be insufficient to accommodate the programmes of any of the 3 London City based airlines in their entirety. In the medium term, during the Full Works construction, some additional spare runway capacity is expected to be available once Luton completes its full parallel taxiway, which may be expected by 2019. However, Luton is unlikely to provide sufficient spare capacity to accommodate the entirety of the operation of more than one of Cityjet or Flybe if displaced from LCY for the period of any closure or even just any displaced movements in the early mornings and evenings in a scenario of restricted operating hours.

- *Stansted* – the Airport currently has around 10 spare runway slots in the relevant London City peak periods. This would be sufficient to accommodate the entire operation of either Cityjet or Flybe if displaced but insufficient to accommodate both airlines together or the BA Cityflyer operation. By 2019, given growth commitments at Stansted by both Ryanair and easyJet, there is likely to be more limited availability of spare slot capacity by the time of the Full Works construction.

[34] Airport Coordination Start of Season Reports 2014 for each of the relevant airports.

- *Southend* ï the Airport is limited by an overall movement limit of 53,300 movements a year. It is currently operating at around 10,500 movements a year. It would, thus, have spare capacity in overall terms in the short term to accommodate two of the three London City based airlines; Flybe and one of BA or Cityjet based on 2015 market shares in the event of the complete closure of London City for the full duration of the construction works. By 2019, and allowing for its own growth, accommodating BA Cityflyer would not be a possibility assuming it maintains its share of the London City market. In all cases, the ability to accommodate any traffic displaced from London City would be limited by the constraints of terminal and apron capacity, having regard to expected growth at Southend in the meantime. So, whilst Southend may be able to accommodate some displaced movements for shorter term periods of closure or restricted opening hours, it would not be able to accommodate all of the displaced flights.

APPENDIX 3.2

Assessment of Piling Noise for Best Practicable Means

Bickerdike Allen Partners
Architecture
Acoustics
Technology

Project: **LONDON CITY AIRPORT CADP – ASSESSMENT OF PILING NOISE FOR BEST PRACTICABLE MEANS REVIEW**

File Ref: A9575.N19a.PH

1.0 INTRODUCTION

The City Airport Development Programme (CADP) will involve construction activities in two distinct phases, both of which will take place for a number of months. Much of the works will take place during the daytime, when the airport is operational. Some works will also take place during out of operational hours (OOOH) at weekends and during the night. A detailed review of the construction programme has been undertaken as a result of which the extent of daytime working has been maximised and night time working minimised. This assessment is based on this significantly improved programme – the *Improved Construction Programme – August 2014* (see Appendix 2.1 of CESA)

In order to mitigate adverse impacts arising from construction works, the principle of best practicable means (BPM) will be deployed with respect to the choice of construction methods and processes.

BPM and the choice of any given construction method requires consideration of various factors. Noise is one of these factors. For a project such as CADP, which involves a programme of works over a number of months, the noise produced by a construction method is relevant as well as when during the day it occurs and also for how long it occurs.

A key example of this is the piling proposed under CADP. There are over 400 piles to be installed in Phase 1 (the Interim stage of the works) and Phase 2 (the Completed stage of the works) which will involve some OOOH works for a number of weeks. Some of this work will be undertaken during the day but, due to airport safeguarding issues, some will need to take place during OOOH and particularly during the night. The amount of night time and OOOH piling works has been significantly reduced as set out in Section 2 of the Consolidated Environmental Statement Addendum (CESA). With respect to the remaining piling works, the question arises whether it would be better to use a method that is slightly noisier but faster (to reduce the programme time) or quieter but slower. Also, the extent to which daytime working can be maximised is also considered to be an advantage.

The three principal piling methods assessed in this BPM report are listed below and correspond with those identified as being potentially practical, subject to various technical and deliverability points, following a detailed technical review of a number of alternative piling methods as presented in Section 3 of the CESA (Part A). A number of piling methods were assessed but discounted based on their ranking order which was derived by assessing a combination of factors including practicality; programme; financial; and safety. Only 3 piling methods were considered to be potentially 'practical' and hence are considered in this BPM assessment:

- Vibratory piling
- Large rotary bored piling
- Giken tubular piling

In order to assist in assessing these different piling methods, taking account of their durations and times of operation, a method of noise assessment has been agreed with the London Borough of Newham (LBN) and this proposes a quantitative approach for rating different construction options, taking account of both the level of noise and its resulting noise exposure over a typical daytime, evening or night-time period, as well as its programmed duration. As requested by LBN in their Regulation 22 letter, a 15 dB night-time weighting factor has been applied. For the evening periods and weekend periods, a 5 dB weighting factor has been used.

The methodology, the results of which are presented here for different piling options, assesses the magnitude of construction noise exposure based on a consideration of the following:-

i) The noise exposure level arising at a receptor or reference point (taken as 10 metres away) from typical piling activities during a typical day, evening or night period.

ii) The duration (number of weeks or months) over which a receptor or reference point is exposed to a given noise exposure level.

2.0 NOISE EXPOSURE LEVEL AND TIME OF DAY

The noise exposure level at a given receptor arising as a result of a single construction activity or a sequence of construction activities can be determined in a conventional manner using a recognised standard methodology such as set out in BS 5228-1:2009+A1:2014[1]. This type of approach has been followed in the production of the construction noise predictions and noise maps presented in the July 2013 Environmental Statement (ES), the ES Addendum (March 2014), the ES Second Addendum (May 2014) and the CESA (November 2014)

In this section, consideration is given simply to a reference point located at a distance of 10 metres from the specified piling operation. The aim here is to compare different piling operations based on their likely durations over the programme period, taking into account the daytime, evening and night-time periods over which they are expected to operate.

The time period used to assess the noise exposure over a given day depends on the time at which the works will take place. The conventional time periods associated with the acoustical analysis of the daytime, evening and night-time periods are as follows:-

Day: 07.00 – 19.00 hours (12 hours)

Evening: 19.00 – 23.00 hours (4 hours)

Night: 23.00 – 07.00 hours (8 hours)

These time periods differ from those used in the assessment of CADP to rate the impacts of construction noise and to determine the need or otherwise for mitigation. In the assessment of CADP, a time period of 10 hours was used for a weekday analysis, 5 hours for a Saturday morning, 1 hour for Saturday afternoon, Sunday and evenings, and 15 minutes for a night assessment. For this type of analysis however, where the key purpose is to compare one

[1] Code of practice for noise and vibration control on construction and open sites :Noise

methodology with another for the purposes of establishing BPM, the above conventional day, evening and night periods are considered appropriate

In the context of rating a construction method in a BPM assessment, the key information relates to its noise characteristics over each of the above conventional averaging periods. For a steady noise source, such as that produced by the engine of a piling rig, this is straightforward. The same reference noise level for such a source[2] would apply for each of the above averaging periods.

For a more variable source, such as that produced by a vibro-driven piling rig, where the noisiest activity might relate to vibrating the casings into the ground, consideration needs to be given to how often this noisier activity is likely to occur in the given averaging period.

To account for the activity that is likely to take place over a 24 hour period, a conventional procedure has been used following the standard procedure used in BS 5228 where the percentage "on-time"[3] of a given constructional process is taken into account over the period of the day, evening or night.

3.0 DURATION OF EXPOSURE

The duration and location of the piling works during both the Interim and Completed Works is illustrated within CESA Appendix 2.1 which includes the *Improved Construction Programme - August 2014* and the *Annotated Piling Zones-Working Hours Split*. As described within Section 2 of the CESA, there is a reduction in Out-of-Operational Hours (OOOH) night time working, including a reduction in the amount of night time piling from 70% to 30%.

The construction programme is based on the use of the vibratory piling method that has been used previously at the Airport, including the Eastern Apron Extension Project (part of the Operational Improvement Project, 2007).

The duration of operational hours (OH) and OOOH required to install the piles during the Interim Works and also during the Completed Works has been predicted in the Improved Construction Programme. These durations given in the programme are based on the use of the vibratory piling method. The *Annotated Piling Zones-Working Hours Split* (CESA Appendix 2.1) shows the piling zones for the CADP project and identifies (in yellow) those piles which, due to their close proximity to the runway, have to be installed OOOH. Those zones (in pink) are also identified where piling can be undertaken during OH.

- During the Interim works, piling will take place in zones 1A, 2A, 2B and 3A
- During the Completed works, piling will take place in zones 1B, 2C and 3B

For other piling methods, there remain some uncertainties over their suitability for use on the CADP which are explained in more detail in Section 3 of the CESA (Part A). Nevertheless, this noise analysis considers their use at the Airport to enable a direct noise comparison to be

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[2] The noise level measured at a reference distance, say, of 10 metres

[3] Typical "on-times" for plant are presented in BS 5228:Part 1:2009

made between methods. If these alternative piling methods do prove suitable for use, they are highly likely to necessitate an increase in the duration of OOOH works. This likelihood arises partly as a result of increased piling rig heights (26 metres) and associated aircraft safeguarding issues, but also as a result of uncertainties about attaining a comparable piling rate and increased periods of repositioning and mobilisation. The likely effect of this has been considered in this analysis by increasing where appropriate the number of piles to be installed during OOOH and by correspondingly reducing the number during the OH period. Some consideration has also been given to an extension in programme time overall given the additional time required to mobilise a rotary bored piling rig or Giken piling rig over a vibro-driven piling rig.

The rotary method of installing a casing (used by the rotary piling and Giken piling methods) provides less flexibility in relation to accommodating the piling operation around the operational constraints of the airport. This is due to the increased time required at height and the increased time required to mobilise the jack-up barge associated with this method. As a minimum, it is estimated that this is likely to lead to an extension of the piling programme by 27%, affecting both OOOH and OH in a similar way. In practice, the impact on programme could well be greater than this given the additional risk to the attainment of a piling rate of one complete pile per night. This is the rate that is achievable using the vibro-driven piling method.

For the default situation where a vibratory (vibro-driven) piling rig is used, the following durations have been assumed in this analysis:-

<u>Vibratory Piling Durations</u>

INTERIM WORKS

Days of Vibratory Piling during OH	=	322
Days of Vibratory Piling during OOOH	=	203

COMPLETED WORKS

Days of Vibratory Piling during OH	=	273
Days of Vibratory Piling during OOOH	=	91

To determine the likely durations of other piling methods, such as rotary boring, two alternative scenarios have been considered. With reference to the piling zones in the *Annotated Pining Zones-Working Hours Split* (CESA Appendix 2.1), the first scenario assumes that one horizontal line[4] of piles shown in the OH zone (pink) moves into the OOOH zone (yellow). This is considered to be a minimum consequence of using a rotary bored method of installing the casings over the vibro-driven method. The second scenario assumes that two horizontal lines of piles move from the OH zone into the OOOH zone.

The calculated durations for each of these scenarios are as follows:-

[4] Horizontal line refers to a line of piles parallel to the runway centreline.

Rotary Boring Piling Durations	Scenario 1	Scenario 2
Days of Rotary Boring Piling during OH =	283	222
Days of Rotary Boring Piling during OOOH =	242	303
COMPLETED WORKS		
Days of Rotary Boring Piling during OH =	227	192
Days of Rotary Boring Piling during OOOH =	137	172

In addition to the above, the duration of both OOOH and OH works would be extended by 27%, the minimum additional time expected to be added to the piling programme overall should a rotary piling method or Giken piling method be adopted.

4.0 RESULTS

The results of the BPM analysis are presented in Tables 1 and 2 for the Interim works and Tables 3 and 4 for the Completed works.

4.1 Interim Works

Table 1 describes the different forms of piling that have been assessed including vibratory piling, rotary bored piling and Giken tubular piling. For the rotary bored piling option, various possible noise mitigation measures are presented. The extent to which any of these measures can be implemented within the context of BPM on this project will remain uncertain until a contractor is appointed and detailed research work undertaken.

The source of reference noise data presented in Table 1 is identified in column 7 of the table and, where relevant, information included in appendices to this report. The final column records the result of the noise exposure calculation for the given piling method. Table 2 provides details of the piling calculation which has been undertaken in accordance with the procedures described in BAP Note 14a.

The results show that when comparing the vibratory piling method (with a total daily noise exposure at 10 metres of 91.3 dB(A)) with the rotary bored piling method under Scenario 1, the two methods produce a similar overall noise dose, with the rotary method slightly quieter, by 0.7 dB. Under Scenario 2, the two methods produce virtually the same noise dose. When considering night-time noise effects only, the reverse is the case, with the two methods producing very similar noise dose levels under Scenario 1 but the vibratory piling method being quieter by 0.8 dB under Scenario 2.

Table 1 includes a series of noise mitigation measures for the Bauer rotary bored piling method. The indication is that these measures, if practicable, could give rise to a significant reduction in noise exposure of up to nearly 5 dB. This includes the use of local screening from an enlarged barge which may have practical and programme implications. The practicalities of incorporating any of these measures are however uncertain at this stage.

The Giken tubular piling method is presented although there is some uncertainty about the accuracy of the noise information for this method. This is because of the “field” or survey nature of the noise data provided and the fact that it relates to the use of a rig installing a smaller pile diameter than proposed on this contract. On this basis however, the indications are that this is significantly quieter than the vibratory piling method.

4.2 Completed Works

Table 3 presents the results of the piling noise comparison for the Completed works where the ratio of OH to OOOH works differ to those during the Interim works. In this case, for both Scenarios 1 and 2, the vibratory piling method produces the slightly lower noise dose than the rotary boring method, with the vibratory piling method being around 1 dB quieter under Scenario 2. When considering night-time noise effects only, vibratory piling is nearly 1 dB quieter than rotary bored piling under Scenario 1 and nearly 2 dB quieter under Scenario 2. Similar improvements arise from the proposed mitigation measures to those observed for the Interim works although the same comments apply in respect to the practicalities of implementation.

For the Giken tubular piling method, again a significant reduction in noise dose is indicated when compared to that produced by the vibratory piling method. The same caveats apply however as highlighted for the Interim works, namely that the quality of noise data provided is limited and relates to a smaller pile diameter than proposed for this contract.

5.0 SUMMARY

In order to mitigate adverse impacts arising from the CADP construction works, the principle of best practicable means (BPM) will be deployed with respect to the choice of construction methods and processes. BPM and the choice of any given construction method requires consideration of various factors of which noise is just one. The various factors, including noise, are considered in Section 3 of the CESA Part A.

Consideration has been given to the three different types of piling determined as potentially practical from Section 3 of the CESA and the noise exposure likely to result from each has been assessed for a reference point located at a distance of 10 metres from the specified piling operation. This allows a comparison to be made between different piling operations based on their likely durations over the programme period, taking into account the daytime, evening and night-time periods over which they are expected to operate. A noise weighting has been included in the calculation to account for the greater disturbance that arises when works are undertaken during the weekend, evenings or night-time.

The results of this assessment, excluding consideration of any specific additional noise mitigation measures, show little difference between two of the piling methods, the vibratory piling and rotary boring piling, although the former method scores slightly better in terms of noise. For the third piling method, Giken tubular piling, a significantly lower noise dose has been identified although the quality of noise data available is limited and this finding relates to In addition, the smaller pile diameter than proposed for this contract.

In noise terms alone therefore, based on information available to date, some of which is limited in extent, the piling methods score as follows with the first being the quietest method:-

1) Giken piling
2) Vibratory piling

3) Rotary bored piling

As stated within Section 3 of the CESA, there are other factors (apart from noise) to consider in terms of the chosen piling methodology, including implications on practicality, programme, finances and safety. Whilst Giken considers that a solution could be achieved in terms of applying this piling method to the CADP, there remain various overriding programme and installation constraints that indicate that this is unlikely. In addition, there is currently there is no evidence of a similar installation and there would be several technical issues to overcome to enable this. Moreover, the programme impact is expected to be high due to the combination of the following:

i. The installation requires a jack-up barge which will take longer to mobilise;
ii. The equipment is different to that typically used for sheet piling and Giken have stated that the specific “Gyropress” module required is not currently available in the UK, therefore this is an uncertainty;
iii. The equipment is only available from a single supplier and the method relies on a specific model which may be committed to other projects at the time of construction.

The overall programme implications are likely to be a minimum increase of approximately 27% installation time. However, this could be much more as there may be a significant impact on the works that can be scheduled in the night time window.

The financial impact would also be high as the construction relies on a single piece of equipment and requires a jack-up barge. There are significant engineering and deliverability issues to overcome and the solution only addresses the casing installation which is a shorter element of the work when using other construction techniques.

As summarised within Section 3 of the CESA, the use of Vibrodriver Casing & Rotary Bore piling is ranked as the best option when considering all the factors as illustrated within Table 3.2.

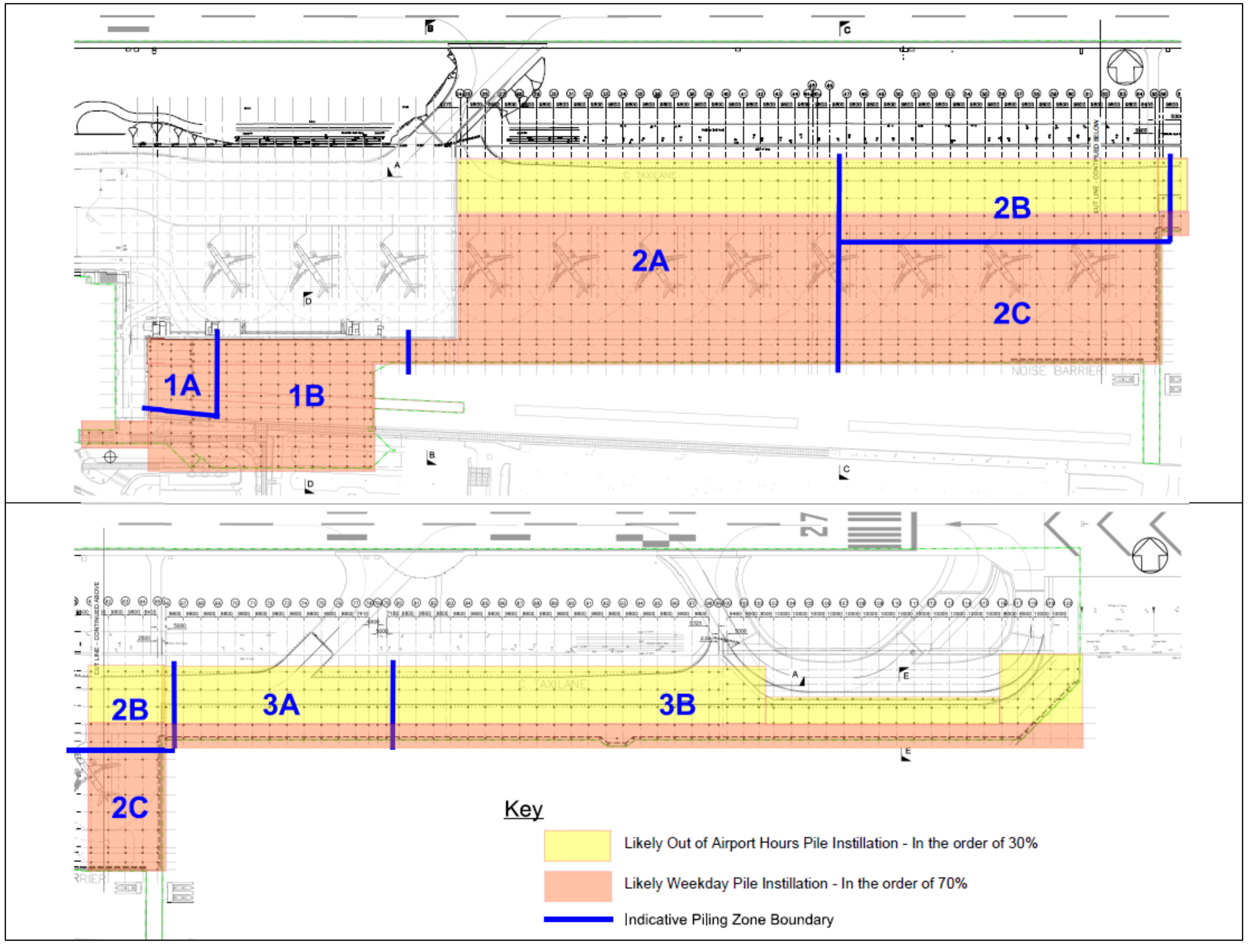

Figure 1 – CADP Piling Zone Layout for Vibratory Piling

LONDON CITY AIRPORT - CADP PILING NOISE REDUCTION REVIEW

TABLE 1 - Predicted Daily Noise Exposure Level at 10 metres from Piling Operations - INTERIM WORKS

Ref:	Piling Technique	Operation	% on times (T = 15 MIN)	dB LAeq,T at 10 metres	Noise Reduction Expected (Note 1) re: Ref 1) and 2)	Reference Material	Comments	Total Daily Noise dB(A)
1	Vibratory piling rig	Vibrating steel casings into ground	40	88	N/A	BS 5228:2009, Table C3, ref 8.	Worst case: Used in ES	
2	Crawler mounted rig	Auger rotary piling	100	79	N/A	BS 5228:2009, Table C3, ref 21.	Worst case: Used in ES	
	COMBINATION OF 1) AND 2)			85	0 dB		**Based on OOOH Programme**	**91.3**
3a	Large rotary bored piling rig	Rotary boring of casings and auger	100	83	2 dB	BS 5228:2009, Table C3, ref 14.	Generic rotary boring rig. No use of vibratory methods (assumes **1 row of additional piles bored at night**)	**90.6**
3b	Large rotary bored piling rig	Rotary boring of casings and auger	100	83	2 dB	BS 5228:2009, Table C3, ref 14.	Generic rotary boring rig. No use of vibratory methods (assumes **2 rows of additional piles bored at night**)	**91.4**
4	Bauer casings, rotary boring	Rotary boring of casings and auger	100	79	6 dB	See Appendix A for data sheets	Uses twin walled casings and rotary method for sinking casings **(assumes 2 rows of additional piles bored at night)**.	**87.4**
5	Bachy Soletanche, rotary boring	Rotary boring of casings and auger	100	79 - 83	2 - 6 dB		Similar to Bauer rig but uses single walled casings from large barge **(assumes 2 rows of additional piles bored at night)**.	**91.4**
5a	As above, with acoustic screening		100	74 - 78	7 - 11 dB	See Appendix B for vinyl curtain data sheet.	Heavy curtain material fixed to scaffold on barge to provide acoustic screen **(assumes 2 rows of additional piles bored at night).**	**86.4**
6	Giken Tubular Piling	Rotary boring / press in	100	76	9 dB	See Appendix C for noise data received from piling manufacturer.	Based on noise measurements undertaken on 800mm diameter piling **(assumes 2 rows of additional piles bored at night).**	**84.4**

Note 1 - Noise reductions relate to the combined noise level of the vibro piling technique (ref 1 and 2).

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LONDON CITY AIRPORT - CADP PILING NOISE REDUCTION REVIEW

Weighting: 0 dB | Weighting: 5 dB | Weightin: 5 dB | Weighting: 15 dB

TABLE 2 - Calculation of Predicted Daily Noise Exposure Level at 10 metres from Piling Operations - INTERIM WORKS

							WEEKDAY				WEEKEND DAY				EVENING				NIGHT				
Ref:	Piling Technique	dB LAeq,T at 10 metres	Comments	OH days	OOOH days	Total days	RNL dB(A)	Ddo Days	Duration dB(A)	Ddo Noise dB(A)	RNL dB(A)	Ddw Days	Duration dB(A)	Ddw Noise dB(A)	RNL dB(A)	De Days	Duration dB(A)	De Noise dB(A)	RNL dB(A)	Dn Days	Duration dB(A)	Dn Noise dB(A)	Total Daily Noise dB(A)
1	Vibratory piling rig	88	Worst case: Used in ES																				
2	Crawler mounted rig	79	Worst case: Used in ES																				
	COMBINATION OF 1) AND 2)	85	**Based on OOOH Programme**	322	203	525	85	0.22	-6.6	**78.4**	90	0.04	-13.6	**76.4**	90	0.14	-8.5	**81.5**	100	0.11	-9.6	**90.4**	**91.3**
3a	Large rotary bored piling rig	83	Generic rotary boring rig. No use of vibratory methods (assumes **1 row of additional piles bored at night**)	283	242	525	83	0.24	-6.1	**76.9**	88	0.05	-13.1	**74.9**	88	0.02	-17.4	**70.6**	98	0.17	-7.8	**90.2**	**90.6**
3b	Large rotary bored piling rig	83	Generic rotary boring rig. No use of vibratory methods (assumes **2 rows of additional piles bored at night**)	222	303	525	83	0.19	-7.2	**75.8**	88	0.04	-14.2	**73.8**	88	0.02	-17.4	**70.6**	98	0.21	-6.8	**91.2**	**91.4**
4	Bauer casings, rotary boring	79	Uses twin walled casings and rotary method for sinking casings **(assumes 2 rows of additional piles bored at night)**.	222	303	525	79	0.19	-7.2	**71.8**	84	0.04	-14.2	**69.8**	84	0.02	-17.4	**66.6**	94	0.21	-6.8	**87.2**	**87.4**
5	Bachy Soletanche, rotary boring	79 - 83	Similar to Bauer rig but uses single walled casings from large barge **(assumes 2 rows of additional piles bored at night)**.	222	303	525	83	0.19	-7.2	**75.8**	88	0.04	-14.2	**73.8**	88	0.02	-17.4	**70.6**	98	0.21	-6.8	**91.2**	**91.4**
5a	As above, with acoustic screening	74 - 78	Heavy curtain material fixed to scaffold on barge to provide acoustic screen **(assumes 2 rows of additional piles bored at night).**	222	303	525	78	0.19	-7.2	**70.8**	83	0.04	-14.2	**68.8**	83	0.02	-17.4	**65.6**	93	0.21	-6.8	**86.2**	**86.4**
6	Giken Tubular Piling	76	Based on noise measurements undertaken on 800mm diameter piling **(assumes 2 rows of additional piles bored at night).**	222	303	525	76	0.19	-7.2	**68.8**	81	0.04	-14.2	**66.8**	81	0.02	-17.4	**63.6**	91	0.21	-6.8	**84.2**	**84.4**

Note 1 - Noise reductions relate to the combined noise level of the vibro piling technique (ref 1

Abbreviations:

OH	Operational Hours
OOOH	Out of Operational Hours
RNL	Reference Noise Level
Ddo	Weekday
Ddw	Weekend Day
De	Evening
Dn	Night
Duration	Correction to account for duration of activity during the 24 hour day
Ddo Noise	Contribution of noise from duration of weekday activities

Schedule Reference A9575-SCH-PIL-01-2- 26/9/14

LONDON CITY AIRPORT - CADP PILING NOISE REDUCTION REVIEW

TABLE 3 - Predicted Daily Noise Exposure Level at 10 metres from Piling Operations - COMPLETED WORKS

Ref:	Piling Technique	Operation	% on times (T = 15 MIN)	dB LAeq,T at 10 metres	Noise Reduction Expected (Note 1) re: Ref 1) and 2)	Reference Material	Comments	Total Daily Noise dB(A)
1	Vibratory piling rig	Vibrating steel casings into ground	40	88	N/A	BS 5228:2009, Table C3, ref 8.	Worst case: Used in ES	
2	Crawler mounted rig	Auger rotary piling	100	79	N/A	BS 5228:2009, Table C3, ref 21.	Worst case: Used in ES	
	COMBINATION OF 1) AND 2)			85	0 dB		**Based on OOOH Programme**	**90.0**
3a	Large rotary bored piling rig	Rotary boring of casings and auger	100	83	2 dB	BS 5228:2009, Table C3, ref 14.	Generic rotary boring rig. No use of vibratory methods (assumes **1 row of additional piles bored at night**)	**90.3**
3b	Large rotary bored piling rig	Rotary boring of casings and auger	100	83	2 dB	BS 5228:2009, Table C3, ref 14.	Generic rotary boring rig. No use of vibratory methods (assumes **2 rows of additional piles bored at night**)	**91.1**
4	Bauer casings, rotary boring	Rotary boring of casings and auger	100	79	6 dB	See Appendix A for data sheets	Uses twin walled casings and rotary method for sinking casings **(assumes 2 rows of additional piles bored at night)**.	**87.1**
5	Bachy Soletanche, rotary boring	Rotary boring of casings and auger	100	79 - 83	2 - 6 dB		Similar to Bauer rig but uses single walled casings from large barge **(assumes 2 rows of additional piles bored at night)**.	**91.1**
5a	As above, with acoustic screening		100	74 - 78	7 - 11 dB	See Appendix B for vinyl curtain data sheet.	Heavy curtain material fixed to scaffold on barge to provide acoustic screen **(assumes 2 rows of additional piles bored at night).**	**86.1**
6	Giken Tubular Piling	Rotary boring / press in	100	76	9 dB	See Appendix C for noise data received from piling manufacturer.	Based on noise measurements undertaken on 800mm diameter piling **(assumes 2 rows of additional piles bored at night).**	**84.1**

Note 1 - Noise reductions relate to the combined noise level of the vibro piling technique (ref 1 and 2).

Schedule Reference A9575-SCH-PIL-01-3- 26/9/14

LONDON CITY AIRPORT - CADP PILING NOISE REDUCTION REVIEW

TABLE 4 - Calculation of Predicted Daily Noise Exposure Level at 10 metres from Piling Operations - COMPLETED WORKS

							WEEKDAY				WEEKEND DAY				EVENING				NIGHT				
							Weighting: 0 dB				Weighting: 5 dB				Weighting: 5 dB				Weighting: 15 dB				
Ref:	Piling Technique	dB LAeq,T at 10 metres	Comments	OH days	OOOH days	Total days	RNL dB(A)	Ddo Days	Duration dB(A)	Ddo Noise dB(A)	RNL dB(A)	Ddw Days	Duration dB(A)	Ddw Noise dB(A)	RNL dB(A)	De Days	Duration dB(A)	De Noise dB(A)	RNL dB(A)	Dn Days	Duration dB(A)	Dn Noise dB(A)	Total Daily Noise dB(A)
1	Vibratory piling rig	88	Worst case: Used in ES																				
2	Crawler mounted rig	79	Worst case: Used in ES																				
	COMBINATION OF 1) AND 2)	85	**Based on OOOH Programme**	273	91	364	85	0.27	-5.7	**79.3**	90	0.05	-12.7	**77.3**	90	0.14	-8.5	**81.5**	100	0.07	-11.5	**88.5**	**90.0**
3a	Large rotary bored piling rig	83	Generic rotary boring rig. No use of vibratory methods (assumes **1 row of additional piles bored at night**)	227	137	364	83	0.28	-5.5	**77.5**	88	0.06	-12.5	**75.5**	88	0.18	-7.4	**80.6**	98	0.14	-8.6	**89.4**	**90.3**
3b	Large rotary bored piling rig	83	Generic rotary boring rig. No use of vibratory methods (assumes **2 rows of additional piles bored at night**)	192	172	364	83	0.24	-6.2	**76.8**	88	0.05	-13.2	**74.8**	88	0.18	-7.4	**80.6**	98	0.17	-7.7	**90.3**	**91.1**
4	Bauer casings, rotary boring	79	Uses twin walled casings and rotary method for sinking casings **(assumes 2 rows of additional piles bored at night)**.	192	172	364	79	0.24	-6.2	**72.8**	84	0.05	-13.2	**70.8**	84	0.18	-7.4	**76.6**	94	0.17	-7.7	**86.3**	**87.1**
5	Bachy Soletanche, rotary boring	79 - 83	Similar to Bauer rig but uses single walled casings from large barge **(assumes 2 rows of additional piles bored at night)**.	192	172	364	83	0.24	-6.2	**76.8**	88	0.05	-13.2	**74.8**	88	0.18	-7.4	**80.6**	98	0.17	-7.7	**90.3**	**91.1**
5a	As above, with acoustic screening	74 - 78	Heavy curtain material fixed to scaffold on barge to provide acoustic screen **(assumes 2 rows of additional piles bored at night).**	192	172	364	78	0.24	-6.2	**71.8**	83	0.05	-13.2	**69.8**	83	0.18	-7.4	**75.6**	93	0.17	-7.7	**85.3**	**86.1**
6	Giken Tubular Piling	76	Based on noise measurements undertaken on 800mm diameter piling **(assumes 2 rows of additional piles bored at night).**	192	172	364	76	0.24	-6.2	**69.8**	81	0.05	-13.2	**67.8**	81	0.18	-7.4	**73.6**	91	0.17	-7.7	**83.3**	**84.1**

Note 1 - Noise reductions relate to the combined noise level of the vibro piling technique (ref 1

Abbreviations:

OH	Operational Hours
OOOH	Out of Operational Hours
RNL	Reference Noise Level
Ddo	Weekday
Ddw	Weekend Day
De	Evening
Dn	Night
Duration	Correction to account for duration of activity during the 24 hour day
Ddo Noise	Contribution of noise from duration of weekday activities

Schedule Reference A9575-SCH-PIL-01-4- 26/9/14

APPENDIX A

Data Sheets for Bauer Casings Rotary Boring

Testal

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DE55 4QQ

Tel 01773 526370
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NOISE ASSESSMENT

CONTRACT: ***Liverpool Street Advanced Works: Moorgate Shaft Pile Extraction Noise Assessment***

TEST DATE: ***5th March 2012***

JOB RERFERENCE: ***W0740-R01***

Report By ***A. Staines***..........................

Checked By ***D. Sissons***

Date **26th March 2012**......................

Testal

CONTENTS	PAGE NO.

1. Object

The brief as set by Bauer Technologies Limited was to undertake a noise measurement survey of a Bauer BG40 piling rig during the excavation of a 600mm large diameter bored pile.

Testing and Analysis Limited (Testal) have been asked to undertake this study on behalf of Bauer Technologies Limited and this report details the results of the monitoring exercise which was carried out at Crossrail's Liverpool Street Station Advanced Works, Moorgate Shaft, and was conducted on 5th March 2012.

2. Site and Plant Details

The Moorgate Shaft basement is a small site measuring approximately 50m by 50m and is bounded by Moorgate (A501) to the East, London Wall (A1211) to the South, Barbican to the West and Moorgate Station to the North.

Ongoing site works consisted of breaking the perimeter walls that run adjacent to Moorgate and the extraction of large diameter bored piles. The following plant items were operating on site:

- 1 number Bauer BG40 BS100 Large Diameter Rotary Drilling Rig;
- 2 number Hyundai Robex 145LCR–9 360^{o} Excavators;
- 2 number Zaxis 210LC Hydraulic Breakers;
- 1 number 80T handling cranes;
- 1 number 9T dumper;
- 1 number MEWP;
- 1 number generator;
- Bentonite Plant including storage silos, de-sander/de-silter unit, pumps and generator.

It is fair to say that the site was relatively congested with items of plant often working in fairly close proximity to each other. To combat the acoustic impact of other items of plant, all noise measurements of the Bauer BG40 rig were taken during a period where the majority of plant was not working.

3. Noise Monitoring

3.1 Instrumentation

Two number Norsonic NOR118 Type 1 Real Time Sound Level Meters (Serial Numbers: 31841 & 31382) were used to undertake the sound pressure measurements.

The instruments were set up to record in the following default parameters:

- A weighting
- Fast response

The instrument was programmed to record the pile excavation process in 1 second intervals. Parameters recorded were L_{Aeq}, L_{MAX} and octave band frequency measurements, thus enabling further selective analysis of the recorded data to be carried out.

A Norsonic NOR1251 Type 1 Sound Calibrator (Serial Number 31526) was used to perform a field calibration on both of the analysers prior to and on completion of the monitoring period.

The manufacturers' calibration dates for the instrumentation are as follows:

- NOR118 Sound Level Meter (31708) – 04/08/2011
- NOR118 Sound Level Meter (31382) – 13/07/2010

The recommended maximum time interval between manufacturers' calibrations is 2 years for sound level meters.

3.2 Methodology

Monitoring of noise from the pile extraction process was carried out in accordance with the guidelines in Section 8.5 and Annex G of BS 5228:2009 Part 1 [1].

The NOR118 sound level meters (SLM) were fixed to a camera-type tripod which was extended to a height of 1.5m above ground level and set up at various aspects (see Appendix II) from the main noise source (Bauer BG40 rig) at a minimum distance of 5 metres from any reflecting boundary (except the ground). The measurements of the extraction process were selected at a time to minimise noise interference from other plant items working on site. The majority of the measurements were taken whilst the site was on quiet time (i.e. only the piling rig operating), although in practise some interference was recorded (see Tables 1 and 2 and Appendix III), as it was not possible to stop other works being carried out towards the end of the monitoring periods.

In general 11 complete 10 minute cycles of the excavation process were recorded at various distances and locations.

Noise measurements were carried out by Andy Staines and Daniel Sissons on 5th March 2012. Both are employed by Testing and Analysis Limited (Testal).

3.3 Weather Details

The following weather conditions were recorded on site during the monitoring periods:

Date: 5th March 2012

Dry, scattered clouds, sunny intervals, wind westerly, 10-15mph, temperature 6^{o}C.

4. Noise Data

In accordance with standard practise all sound pressure levels have been rounded to the nearest 0.5 dB.

Table 1 – Summary of Noise Data recorded on 5th March 2012
Nor118-31841

Time	Monitoring Location/ Aspect	Distance from Main Noise Source (m)	Sound Pressure Level (dBA)			Comments
			L_{eq}	L_{Max}	L_{90}	
12:01 to 12:10	Centre of site	N/A	77.5	92.5	75.5	Piling rig not operational. Hydraulic breaker nearby and general site activities
14:05 to 14:15	Rear of Rig	40.0	77.0	92.0	72.5	Only piling rig excavating, coring and augering. Influence from road traffic noise on Moorgate
14:15 to 14:25	Rear of Rig	20.0	76.5	89.5	71.5	Only piling rig excavating, coring and augering. MEWP and handling crane working
14:25 to 14:35	Rear of Rig	10.0	88.0	116.5	77.5	Only piling rig excavating, coring and augering. Spin-off from auger cause of high noise levels
14:40 to 14:50	Rear of Rig	5.0	85.5	94.5	81.0	Piling rig excavating, coring and augering. Hydraulic breakers commenced breaking
15:00 to 15:10	Front of Rig above site	30.0	83.5	96.5	75.5	On public walkway to West of site, adjacent to 'City Boot' bar. Piling rig excavating, coring and augering. Hydraulic breakers operational

Table 1 – Summary of Noise Data recorded on 5th March 2012
Nor118-31382

Time	Monitoring Location/ Aspect	Distance from Main Noise Source (m)	Sound Pressure Level (dBA)			Comments
			L_{eq}	L_{Max}	L_{90}	
14:07 to 14:17	Drivers side of rig	15.0	84.5	96.5	78.5	Only piling rig excavating, coring and augering.
14:17 to 14:20	Drivers side of rig	10.0	85.0	99.5	76.5	Only piling rig excavating, coring and augering. MEWP and handling crane working
14:21 to 14:31	Drivers side of rig	10.0	77.5	90.5	71.0	Only piling rig excavating, coring and augering. Spin-off from auger cause of high noise levels
14:31 to 14:40	Drivers side of rig	10.0	86.0	88.5	85.0	Only piling rig excavating, coring and augering. Spin-off from auger cause of high noise levels
14:40 to 15:00	Drivers side of rig	5.0	86.5	101.0	77.5	Close to drivers' side of rig, excavating, coring and augering. Hydraulic breakers commenced breaking
15:00 to 15:07	Drivers off side, above basement	30.0	83.0	95.5	76.0	On site access route on site above the basement workings, adjacent to stairway. Breaking nearby
15:07 to 15:15	Drivers off side, above basement	45.0	76.5	96.5	69.5	Positioned at the security hut by the main access/egress entrance

5. Comments and Observations

Due to the relatively small area of the Moorgate Shaft Site and the tight working programme it is very difficult to measure noise levels from individual items of plant in isolation. Some degree of cumulative noise from the various plant items was to be expected, although monitoring noise levels from the piling rig alone was achieved during a short period when the majority of the site operatives were on lunch break. When comparing the levels recorded during this survey with previously recorded data on a large open site, indicates that the degree of interference is relatively small in terms of measured L_{Aeq} levels.

Summarised noise data is shown for both aspects of the sound level monitoring points, at the Moorgate Shaft Site, can be seen in Tables 1 and 2, whilst the octave band analysis are presented in Appendix II.

Referring to Tables 1 and 2 it can be seen that during the recorded periods for the L_{Aeq} levels during the pile extraction process show a steady increase in proximity to the operation, however, some of the values were influenced from noise levels generated by intermittent plant activities working on the site.

The recorded period levels between 14:00 and 14:45 were with no other plant items operating in the vicinity of the monitoring locations. In both Tables 1 & 2 it can be seen that the L_{Aeq} levels at 10.0 metres distance are as high as the 5.0 meters recorded levels, this is primarily due to the noise from the spin-off process clearing the auger from spoil and the reflected noise from the surrounding buildings.

As a guide the noise attenuates with distance based on measurements undertaken, at both aspects, using the standard calculated point source attenuation value, of 6dB per doubling of distance. It should be noted that this rate of attenuation will not hold true if other plant items are in close proximity to the BG40 Rig.

Appendix II shows the octave band analysis for the BG40 Rig and associated operations.

References

[1] BS 5228:2009 Noise and vibration control on construction and open sites.
London BSI
Part 1: Noise

Appendix I

Noise Terminology and Abbreviation

Noise Terminology

Decibel (dB) The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).

dB(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq} The Equivalent Continuous Sound Level, can be considered as the continuous steady noise which would have the same total A-weighted acoustic energy as the real fluctuating noise level over the same period of time. It is a measurement unit suited to intermittent noises such as those associated with construction plant.

L_{Amax} The maximum 'A' weighted sound pressure level measured during the survey period.

L_{A90} The A-weighted sound pressure level that is exceeded for 90% of a given time interval and is representative of the general background noise level.

Appendix II

Octave Band Analysis

Drivers side - Octave Band Measurements - 31382

Octave Band (Hz)	8.0	16.0	31.5	63.0	125.0	250.0	500.0	1.0k	2.0k	4.0k	8.0k	16.0k
Site activity and generator No augering	84.0	80.6	83.6	86.9	80.6	79.0	73.7	70.5	66.8	61.6	53.1	42.9
15.0m from augering operation	82.9	79.2	76.6	83.8	87.8	83.1	81.9	80.5	75.2	67.8	60.4	49.5
10.0m from augering operation	82.7	79.3	77.8	86.1	88.0	84.1	83.9	80.4	74.5	68.5	61.1	48.9
10.0m from augering operation	78.9	75.2	76.0	87.0	83.9	76.1	73.8	71.3	69.6	67.1	63.7	56.4
10.0m from augering operation	81.9	77.9	75.4	87.0	86.6	83.6	84.6	81.7	75.0	68.0	61.7	51.3
5.0m from augering operation	78.0	75.8	76.5	83.1	88.0	86.2	84.8	82.0	76.7	70.9	64.4	52.6
On site walkway 30.0m from augering	74.1	73.7	80.4	84.6	80.7	79.7	79.7	78.9	76.9	68.5	60.1	48.9
At security hut, main entrance	67.7	68.8	74.3	82.1	73.9	72.4	74.2	72.5	69.0	62.6	52.1	39.9

Rear of Rig - Octave Band Measurements – 31841

Octave Band (Hz)	8.0	16.0	31.5	63.0	125.0	250.0	500.0	1.0k	2.0k	4.0k	8.0k	16.0k
Site activity No augering	84.0	80.8	86.8	87.8	80.6	78.3	74.9	72.3	69.1	64.4	57.0	47.2
Site activity No augering	83.6	80.4	87.7	86.1	82.7	79.5	78.3	74.8	72.6	68.2	60.0	48.4
40.0m from rear of rig	80.0	75.6	75.1	78.0	80.3	74.3	74.4	72.5	69.5	61.6	51.8	37.3
20.0m from rear of rig	79.8	75.9	76.3	84.4	84.4	75.0	73.5	71.0	68.6	60.9	52.6	43.3
10.0m from rear of rig	83.2	79.3	76.3	79.3	83.4	82.7	84.6	84.1	80.6	73.3	65.7	55.5
5.0m from rear of rig	80.7	77.2	78.7	81.4	84.6	84.5	82.5	80.4	77.8	70.7	62.6	52.1
On walkway above site, 'City Boot'	89.6	85.8	81.3	79.4	77.9	80.6	81.4	79.6	74.7	67.6	55.5	41.3

Appendix III

Images of monitoring at Moorgate Shaft

Rear aspect to Rig (20.0m)


Rear aspect to Rig (20.0m)

Rear aspect to the rear of the Rig (10.0m)

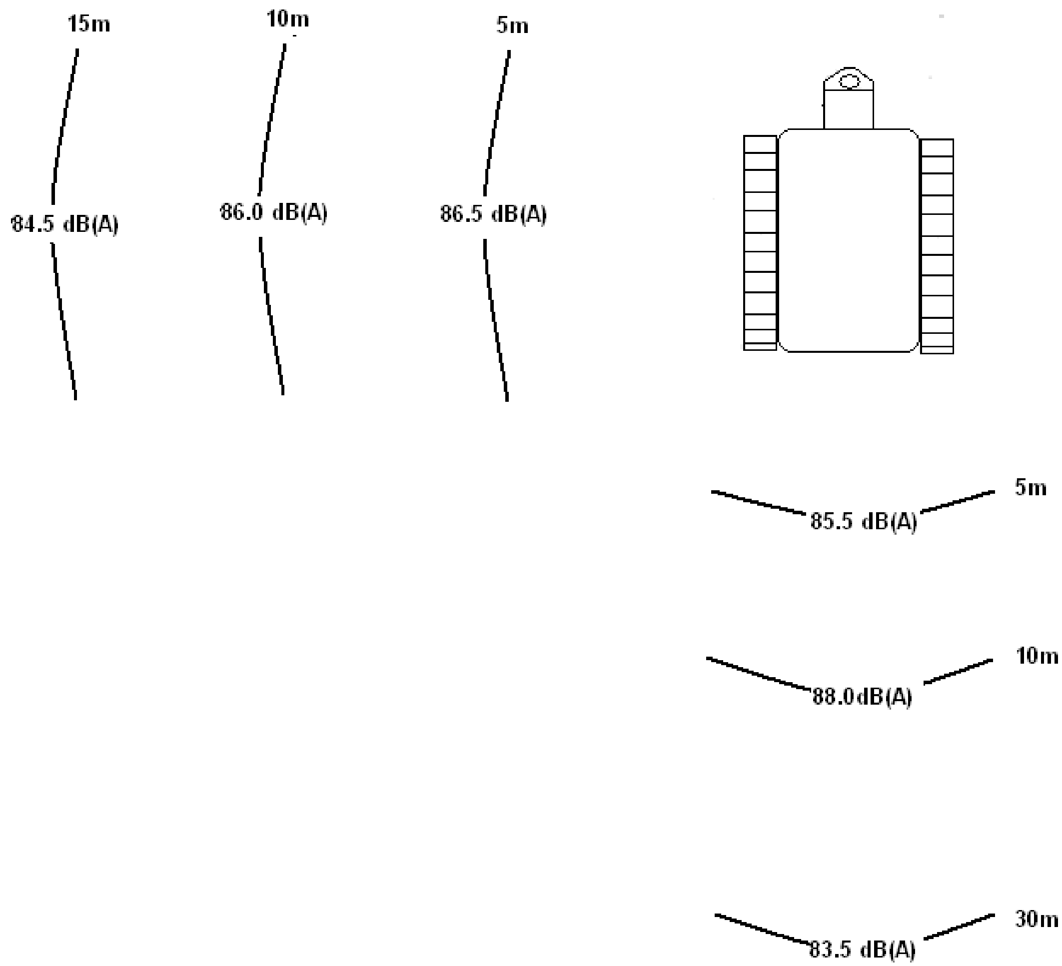
On pedestrian walk over near ‘City Boot’ inn

Rear of the Rig – in the basement workings


Casings and Auger

Appendix IV

Noise Contour Plot



15m
10m
5m
84.5 dB(A)
86.0 dB(A)
86.5 dB(A)
5m
85.5 dB(A)
10m
88.0dB(A)
30m
83.5 dB(A)

APPENDIX B

Data Sheets for Vinyl Curtains

ECHO BARRIER®
Environmentally Sound

H Series Noise Barrier Performance Guide

3 factors must be exactly right to get high performance from Noise Barriers *in practice*.

1. Barrier Geometry

The larger the acoustic shadow, the greater the barrier attenuation…

Barriers are used to block the line of sight between the noise source and the noise sensitive location, creating an "acoustic shadow". The larger the shadow, the greater the attenuation provided by the barrier. In addition, the higher the frequency of the sound, the larger the shadow as low frequencies (throbs, hums etc…) are not so directional and will diffract more round the screen. Consequently, the important principle is that you should place the barrier as close to the noise source as is practical to ensure good performance.

Contact us for advice on your installation options for best performance

2. Barrier Mass

There is a perfect weight for optimum real world performance…

The mass of the solid, impermeable material used as part of barriers determines the drop in noise (or transmission loss) between the two sides of the barrier. The heavier the material, the greater the attenuation - but only provided the barrier is infinitely large! In practice, geometry limits the attenuation as noise passes over the top of the barrier. Consequently, there is a minimum mass required to give high attenuation. Once this is reached, the law of diminishing returns sets-in very rapidly and any additional mass provides no acoustic benefit - but makes transportation, manual handling and fitting much more difficult. This calculation is the basis for the H series Echo Barrier construction. They are designed to hit the "sweet spot", providing the maximum attenuation for the minimum weight in real life applications. Heavier barriers generate much more hassle for a negligible increase in performance, whilst lighter barriers seriously compromise attenuation e.g. a 250gm/m2 barrier would have only 10% of the attenuation. In the few cases where added mass would increase the attenuation, Echo Barriers are designed to be doubled-up locally - a more effective, more convenient and very efficient innovation.

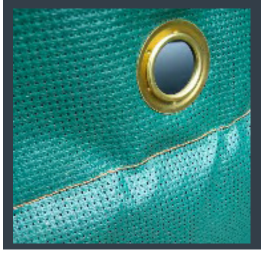
Insulating mass layer

3. Barrier Acoustic Absorption

Barriers without the right thickness of acoustic absorbent can actually increase noise levels…

The solid material in a barrier reflects the noise back towards the noise source. This actually increases the noise level on the source side of the screen. If there are other reflecting surfaces nearby (walls, Portacabins, plant and machinery etc), then this makes the situation even worse by bouncing the noise in all directions. In extreme cases, placing a badly designed barrier in front of a noise source can actually increase the off-site noise! A well designed barrier must incorporate acoustic absorbent material (not rockwool or fibreglass - these generate manual handling issues due to the fibres) on the noise source side to soak-up the sound and minimise reflections. This increases the barrier performance, but adds to the barrier thickness and, conventionally, adds a material that also soaks up water - which also adds mass and mess (water leaks in vehicles and stores, mould etc). Due to the laws of physics, the minimum thickness of absorption required is around 30mm - any thinner and the performance is seriously compromised. Echo Barriers use a specially designed "high tech" tuned absorbent construction that provides high performance without holding water, once again hitting the technical "sweet-spot".

Sound Absorbing Layer



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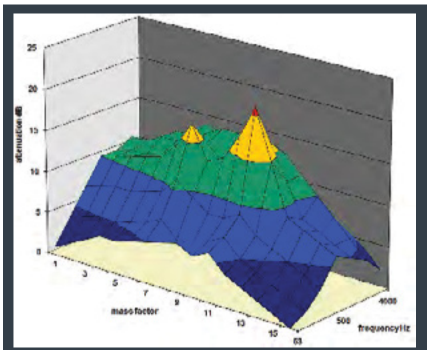
Environmentally Sound

Acoustic Data

A Uniquely Effective Hi-Tech Material Combination

Echo Barriers have been very carefully designed to provide a uniquely high level of performance in practice, on site and not just in lab tests. This has been achieved via a synthesis of acoustic insulation and high tech acoustic absorption materials coupled with a mechanical design that hits the perfect "sweet spot" for maximum performance at minimum weight.

On site, this means lower noise levels, a *70% or more reduction* in fitting time plus easy transport, mechanical handling and storage.



Designed to the mass / performance "sweet spot"

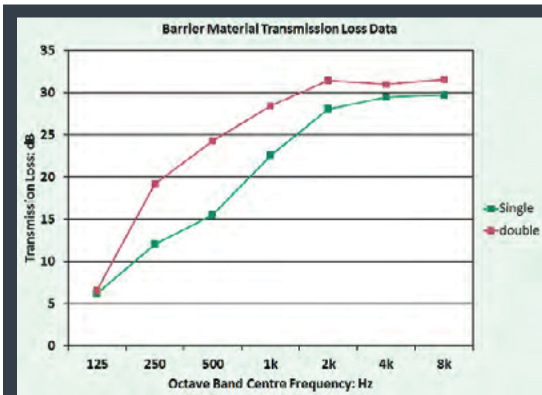
Easy Transport, Handling and Storage

Sound Transmission Loss (TL) - real world data

Up to 32dB TL; < *half the typical weight; field test data....*

The single barrier layer transmission loss data plot* shows the class leading performance of the materials - this is particularly impressive given the light weight of the barriers (5.8kg each - wet or dry compared with the more typical 12 - 15kg…). It is even more impressive when you consider that this is field data. However, note that the field performance of barriers on site is almost invariably determined by the installed geometry. In the rare cases where geometry is not the determining factor, Echo Barriers are uniquely designed to allow for a second layer to be very easily added local to the source, increasing the attenuation by a factor of up to six times.

**Field test data: measured insertion loss of barriers, 1m source/receiver, 4m in front of reflecting surface, natural leakage paths. Lab test T. Loss data to BS EN 717 / 345 / 2750 is misleading as these tests are not designed to measure the performance of barriers as fitted. They test the* TL of an artificially sealed material sample in a concrete test chamber.



Barrier Material Transmission Loss Field Data - dB

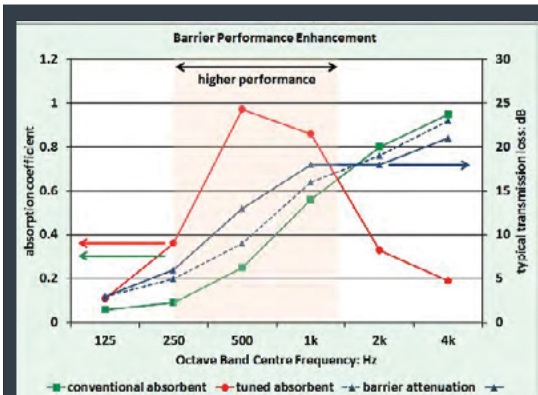
Hz	125	250	500	1k	2k	4k	8k
single	6	12	16	23	28	30	30
double	7	19	24	28	32	31	32

Unique Tuned Acoustic Absorption

Soaks up to 100% of the sound without soaking up water

The high tech acoustic absorbent composite has been designed and tuned to provide high absorption over the key 250Hz - 1kHz frequency range to maximise the field performance of the barriers. It also avoids the fibre shedding / mechanical handling safety problems associated with traditional fibre materials.

Conventional absorbent materials soak up rainwater. This substantially increases the weight of the barriers, creating handling issues and a host of the other practical problems that are associated with pools of water inside vehicles and storage areas. A unique feature of the Echo Barriers is that their class leading performance has been achieved without retaining water, so no weight increase and no mess.



Absorption coefficient of 1 = 100% efficiency

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APPENDIX C

Field Noise Data for Giken Piling Rig

1. CONDITION OF THE TESTING

Date	5-Aug-04
Location	Kochi, Japan
Monitoring Items	Noise and Vibration
Monitoring Point	7m and 20m from the pile to be pressed-in
Wheather	Cloudy
Press-in Machine	Gyro Piler
Ground Condition	Sandstone (UCS 25-35N/mm^2)
Type of Pile	Tubular Pile 800mm O.D. L=10.0m

2. Monitoring Data

2. 1 Noise Level (dB)

At 7m

Time	L5 7m
10:58	72.6
11:00	73.2
11:10	70.0
11:20	76.0
11:30	76.3
11:40	75.2
11:50	75.1

At 20m

Time	L5 20m
10:58	66.9
11:00	68.0
11:10	55.3
11:20	70.9
11:30	71.3
11:40	70.4
11:50	70.5

2. 2 Vibration Level (dB)

At 7m

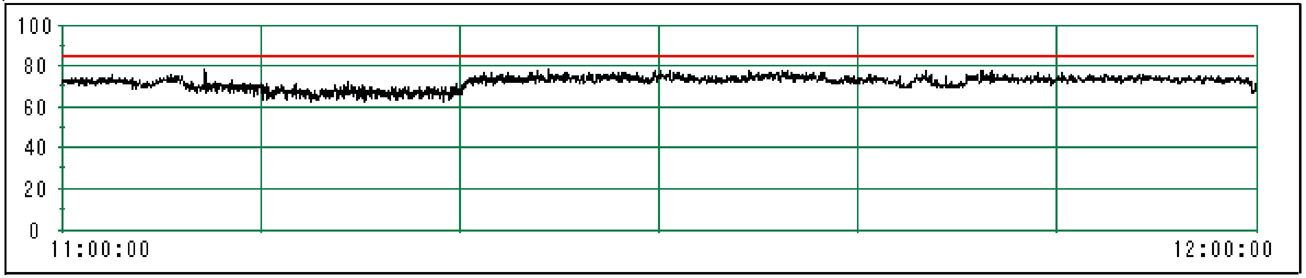
Time	L10 7m
10:58	34.6
11:00	39.3
11:10	16.1
11:20	45.8
11:30	43.1
11:40	42.0
11:50	40.8

At 20m

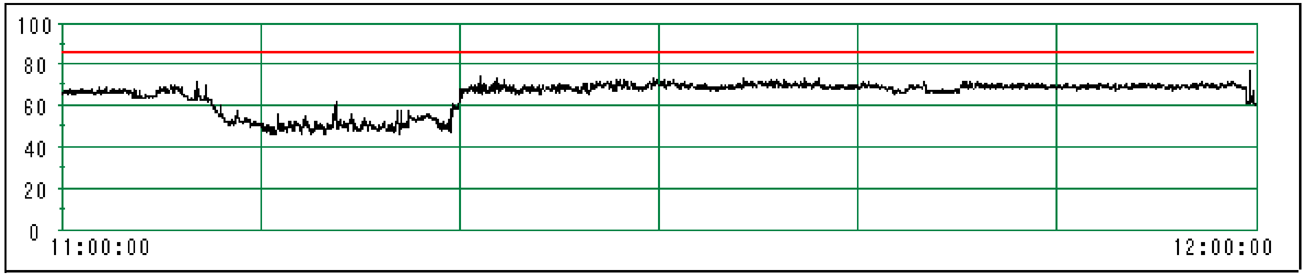
Time	L10 20m
10:58	26.2
11:00	29.5
11:10	15.0
11:20	34.6
11:30	33.5
11:40	32.4
11:50	31.1

3. PEAK LEVEL (dB)

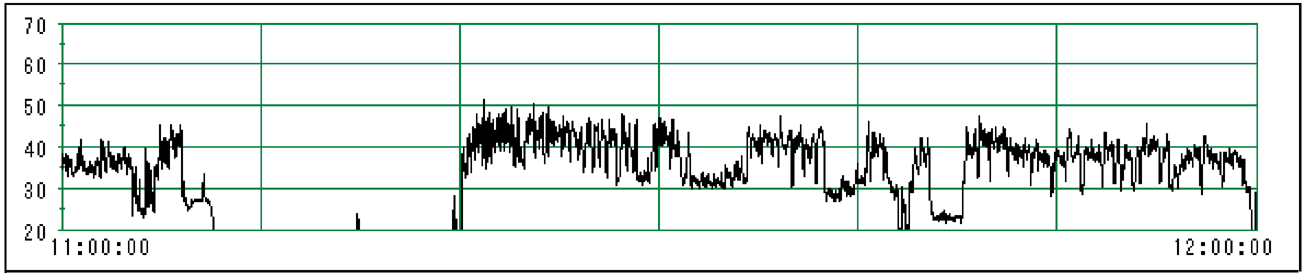
Noise
at 7m
0.1sec sampling



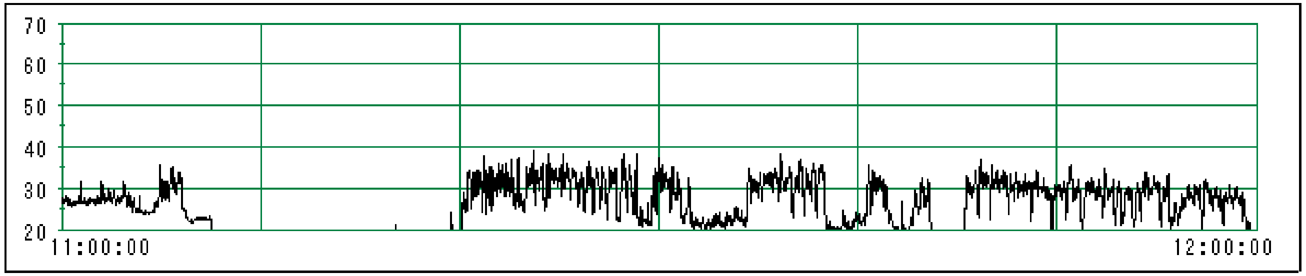
Noise
at 20m
0.1sec sampling

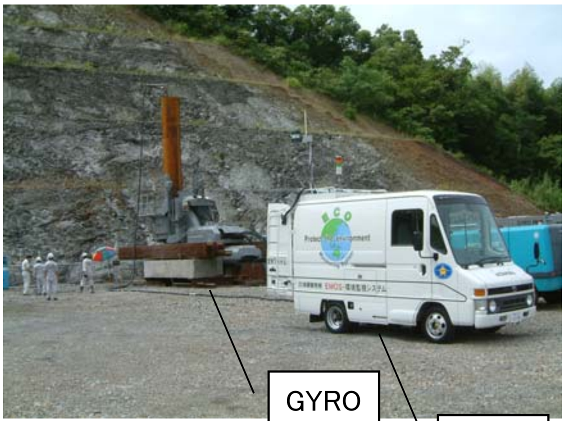


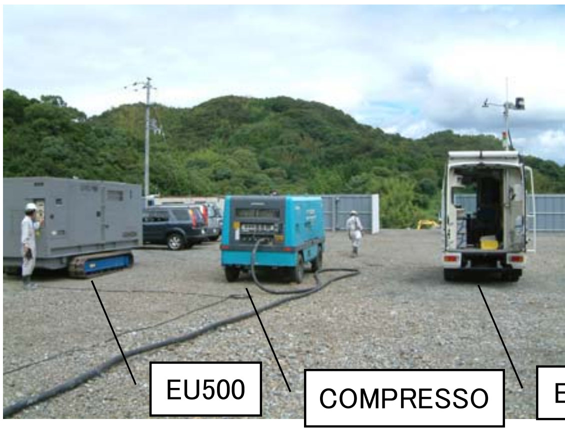
Vibration
at 7m
1sec sampling

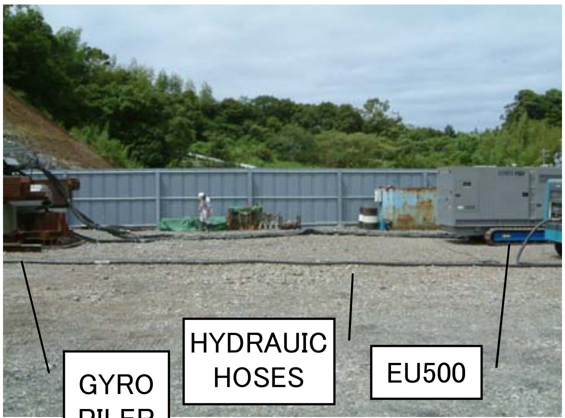


Vibration
at 20m
1sec sampling




GYRO PILER
EMOS


EU500
COMPRESSO
EMOS


GYRO PILER
HYDRAUIC HOSES
EU500

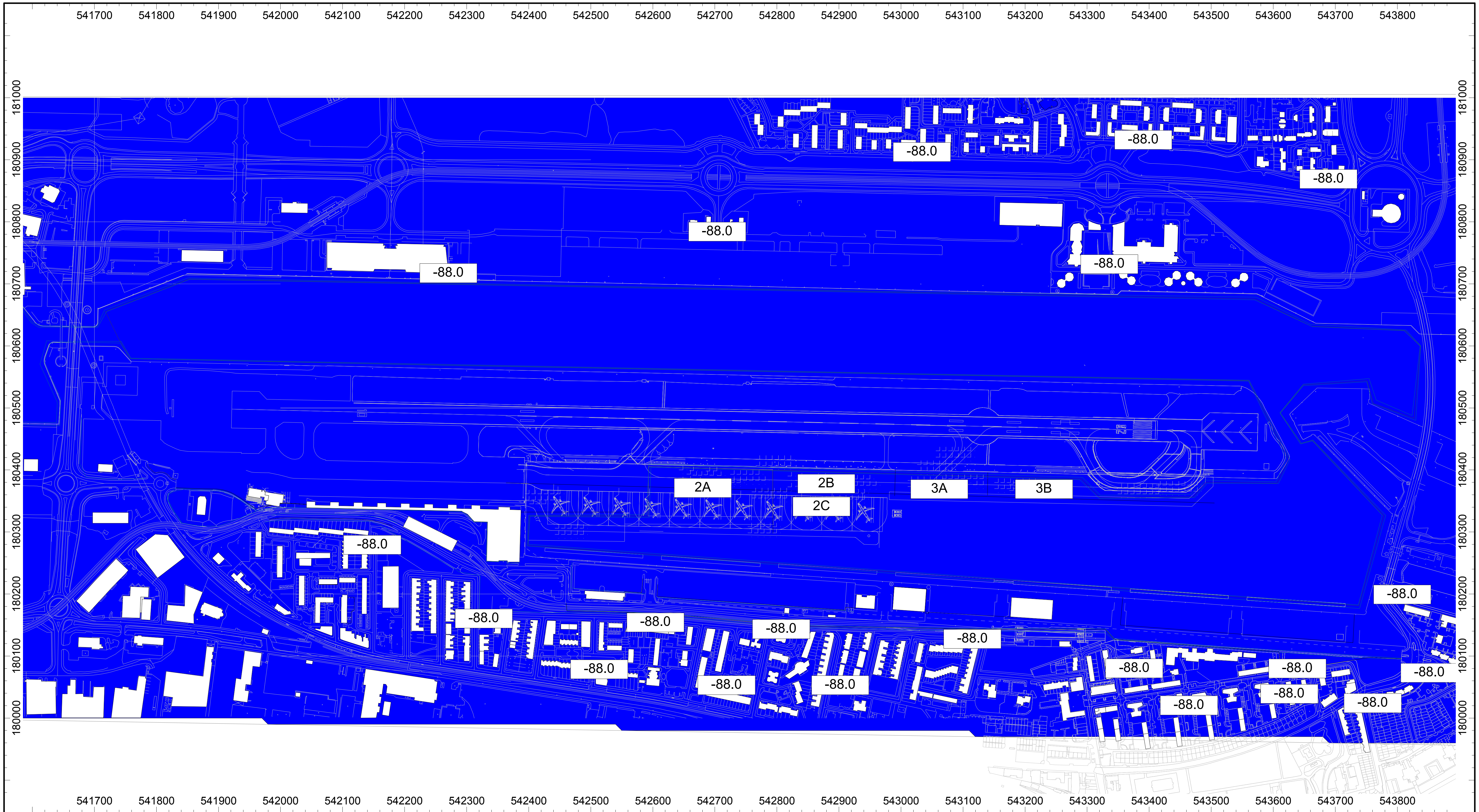

SOURCE OF NOISE & VIBRATION


GYRO PILER
VIBRATIO N
NOISE MONITOR


VIBRATION MONITOR
NOISE MONITOR

APPENDIX 4.1

Book of Construction Noise Maps (Out of Operational Hours Construction Works-LAeq, 15mins)



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

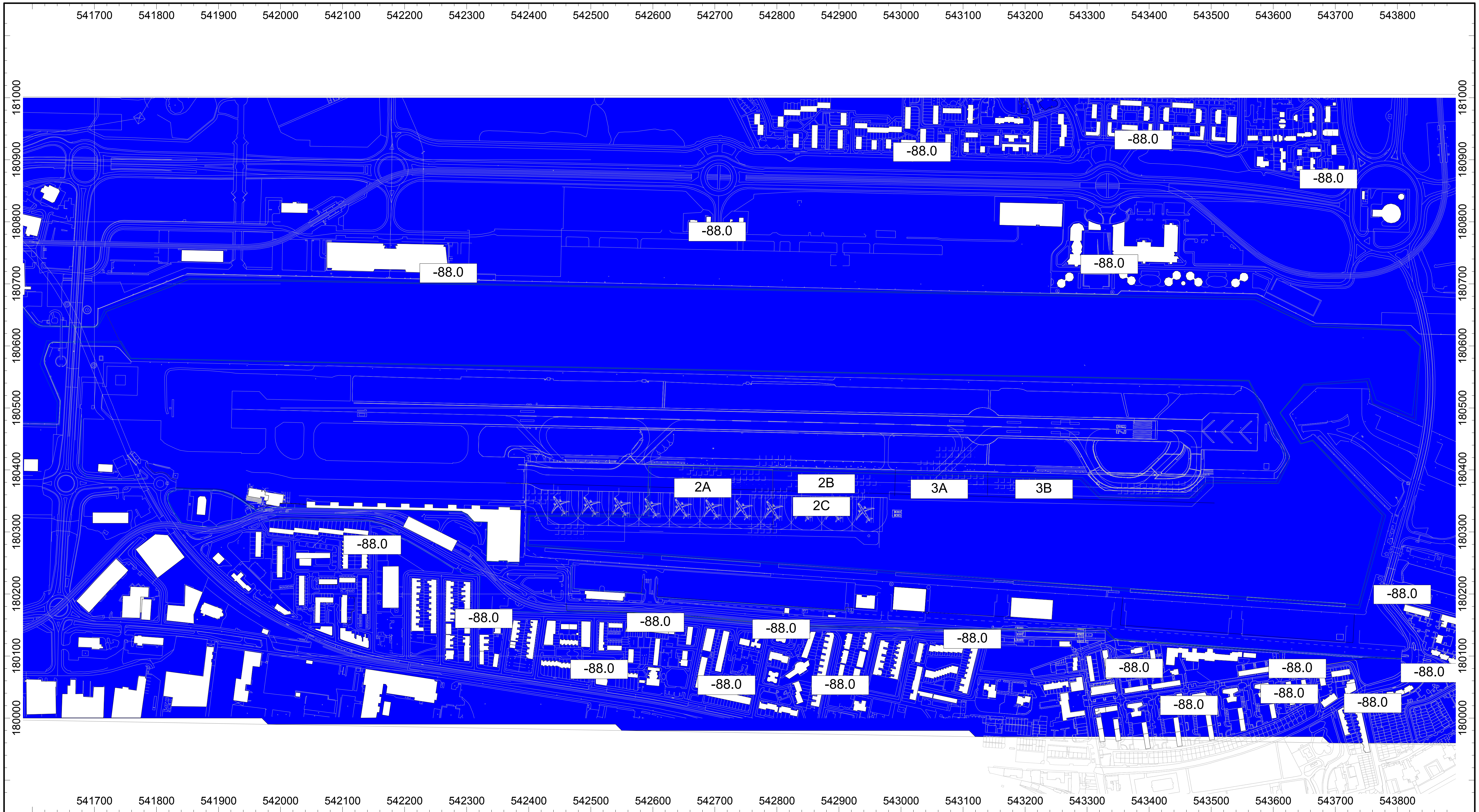
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

1. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2015

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

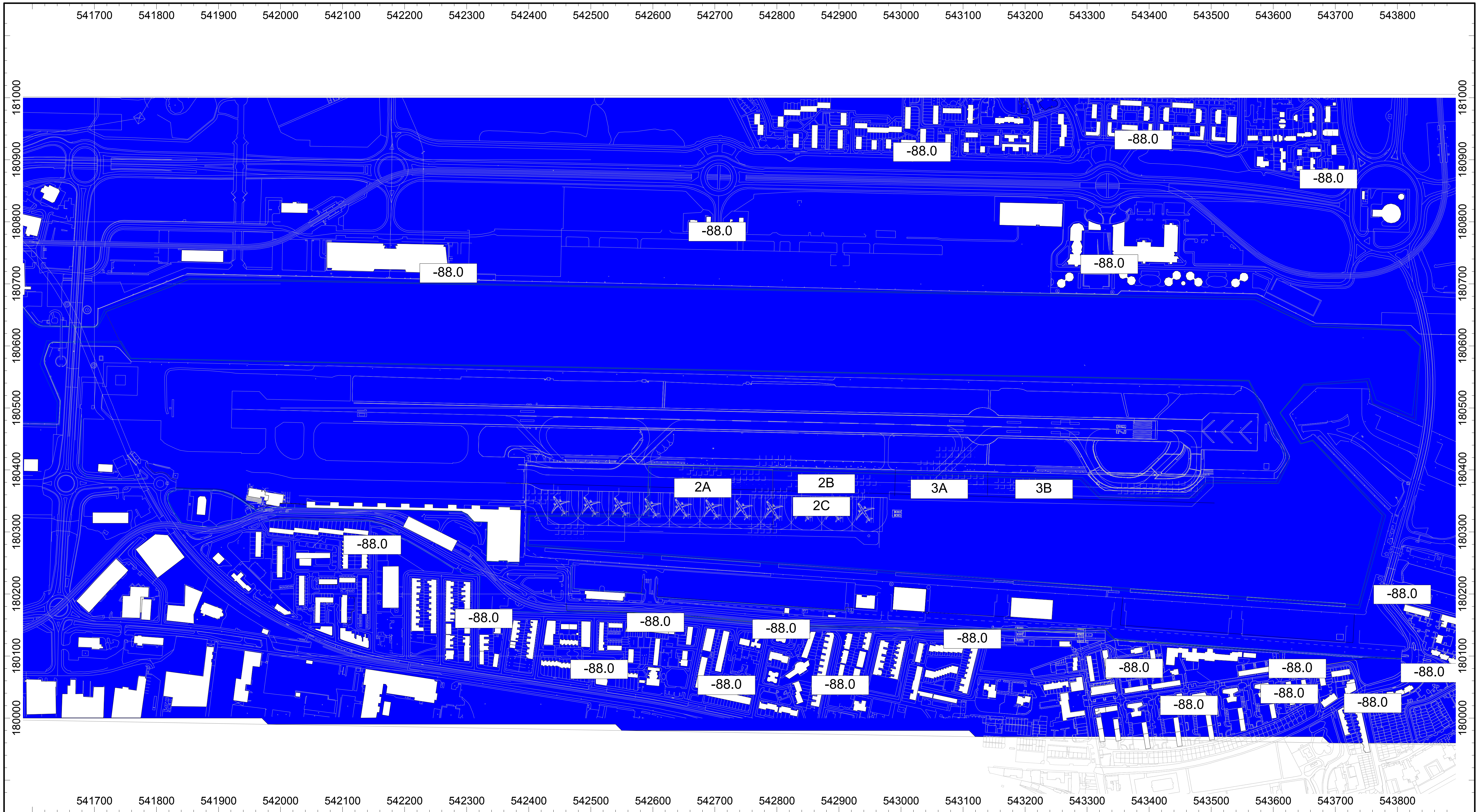
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

Blue	... < 35.0 dB(A)
Navy	35.0 <= ... < 40.0 dB(A)
Dark navy	40.0 <= ... < 45.0 dB(A)
Green	45.0 <= ... < 50.0 dB(A)
Dark green	50.0 <= ... < 55.0 dB(A)
Yellow	55.0 <= ... < 60.0 dB(A)
Orange	60.0 <= ... < 65.0 dB(A)
Dark red	65.0 <= ... < 70.0 dB(A)
Red	70.0 <= ... dB(A)

2. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2015

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

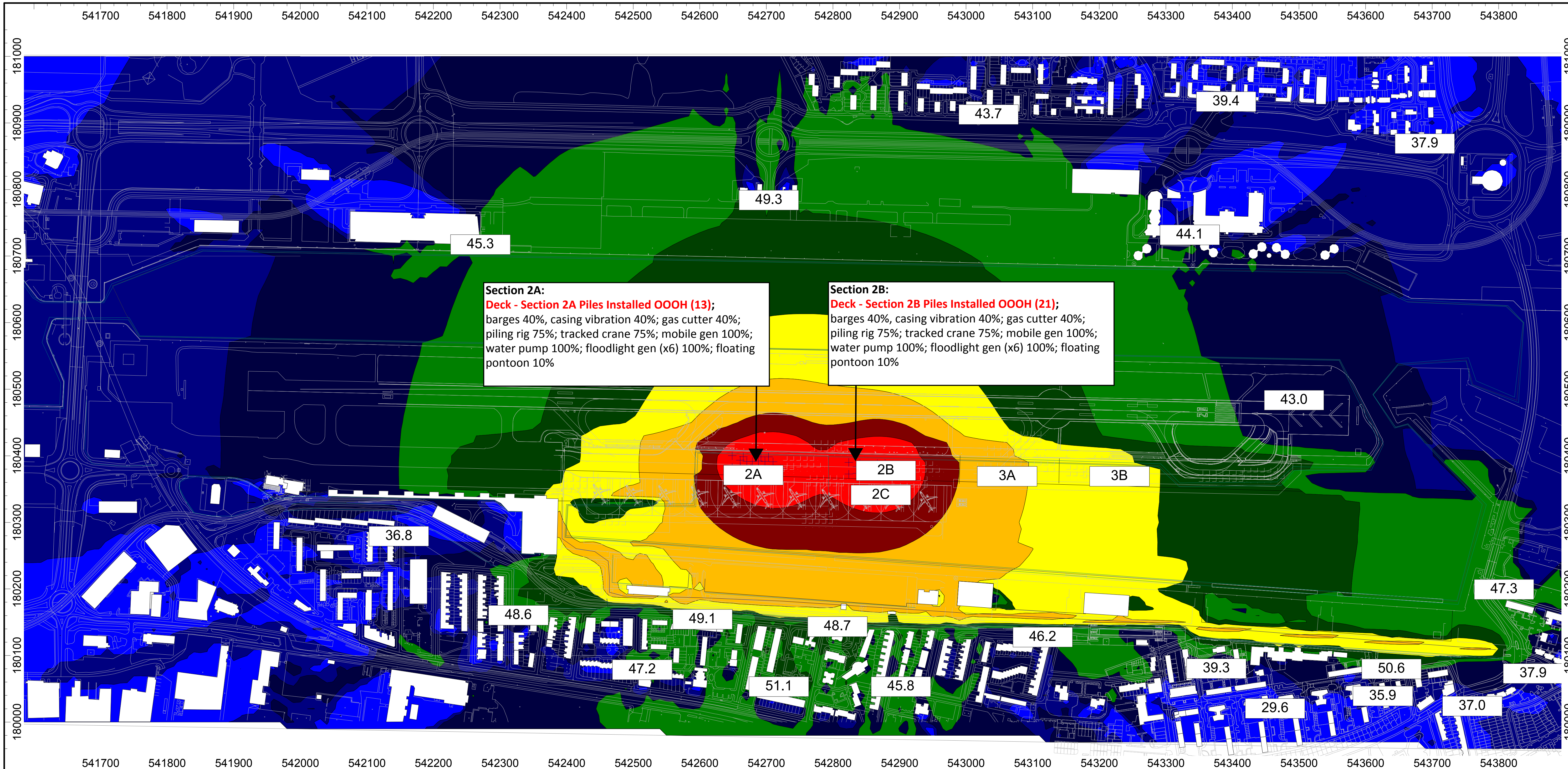
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

3. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2015

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Legend
... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

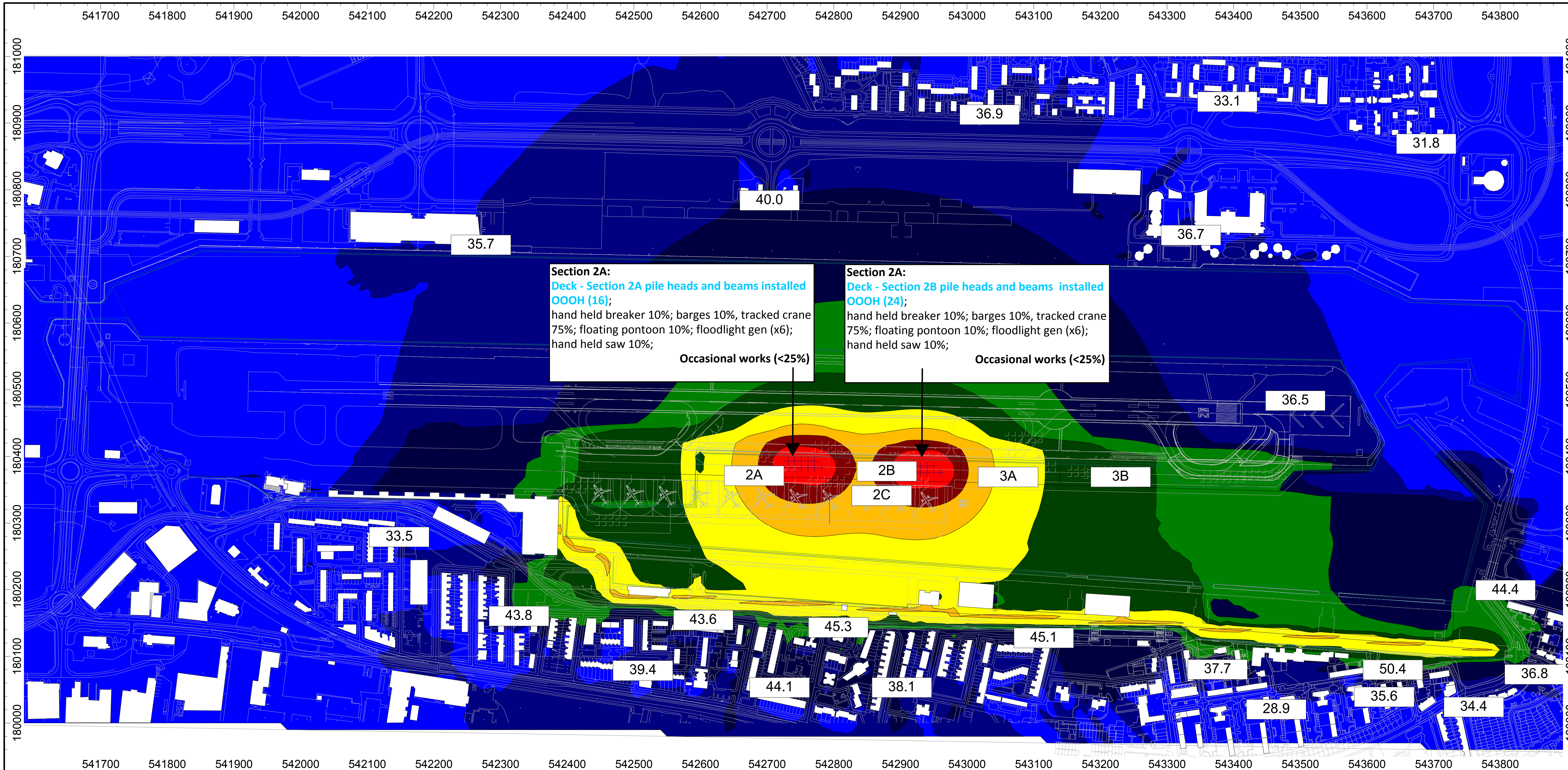
Not to scale

A9575 v1.0 28.02.14

A9575 - London City Airport - Construction Noise

4. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2015

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

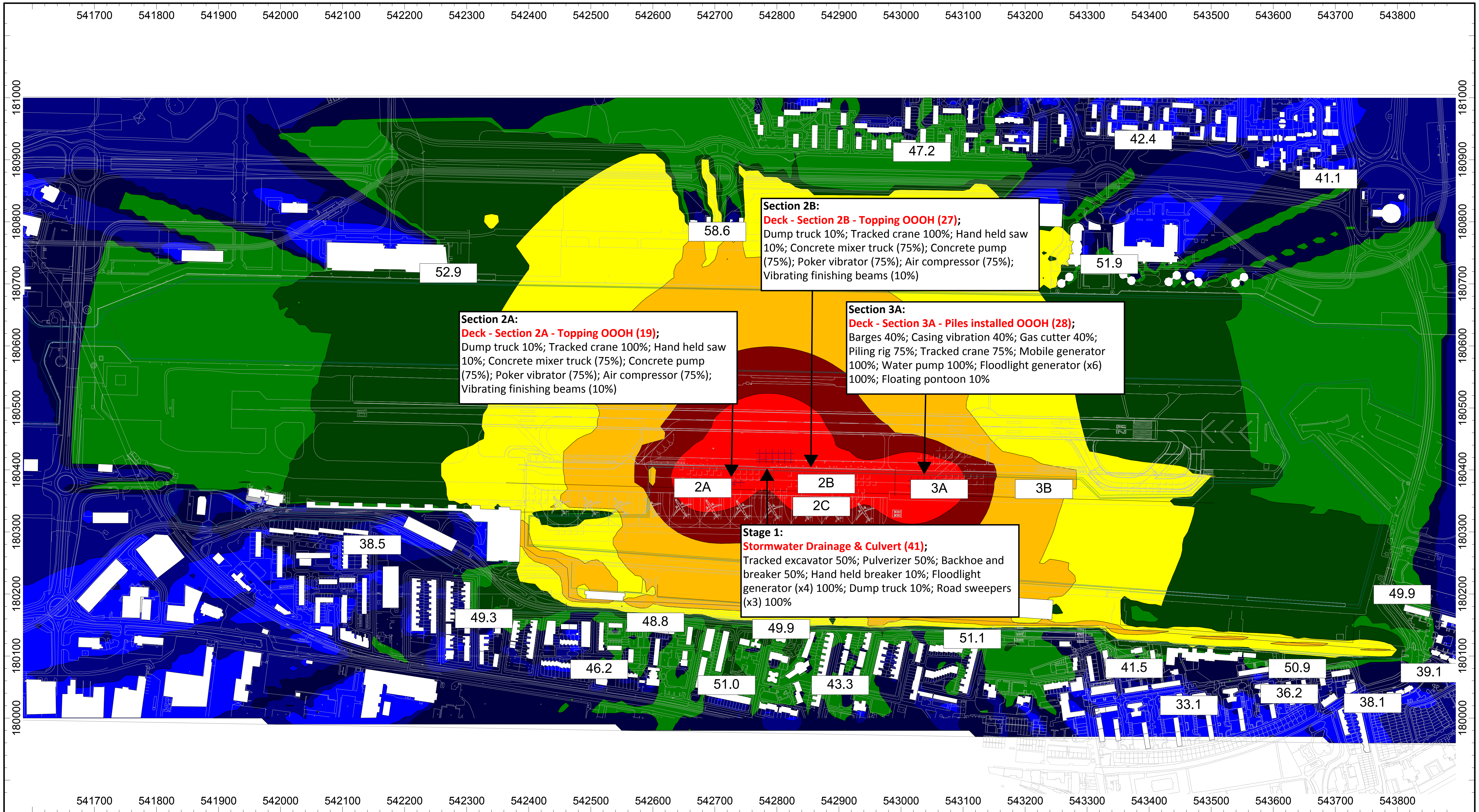
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

5. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2016

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

- ... < 35.0 dB(A)
- 35.0 <= ... < 40.0 dB(A)
- 40.0 <= ... < 45.0 dB(A)
- 45.0 <= ... < 50.0 dB(A)
- 50.0 <= ... < 55.0 dB(A)
- 55.0 <= ... < 60.0 dB(A)
- 60.0 <= ... < 65.0 dB(A)
- 65.0 <= ... < 70.0 dB(A)
- 70.0 <= ... dB(A)

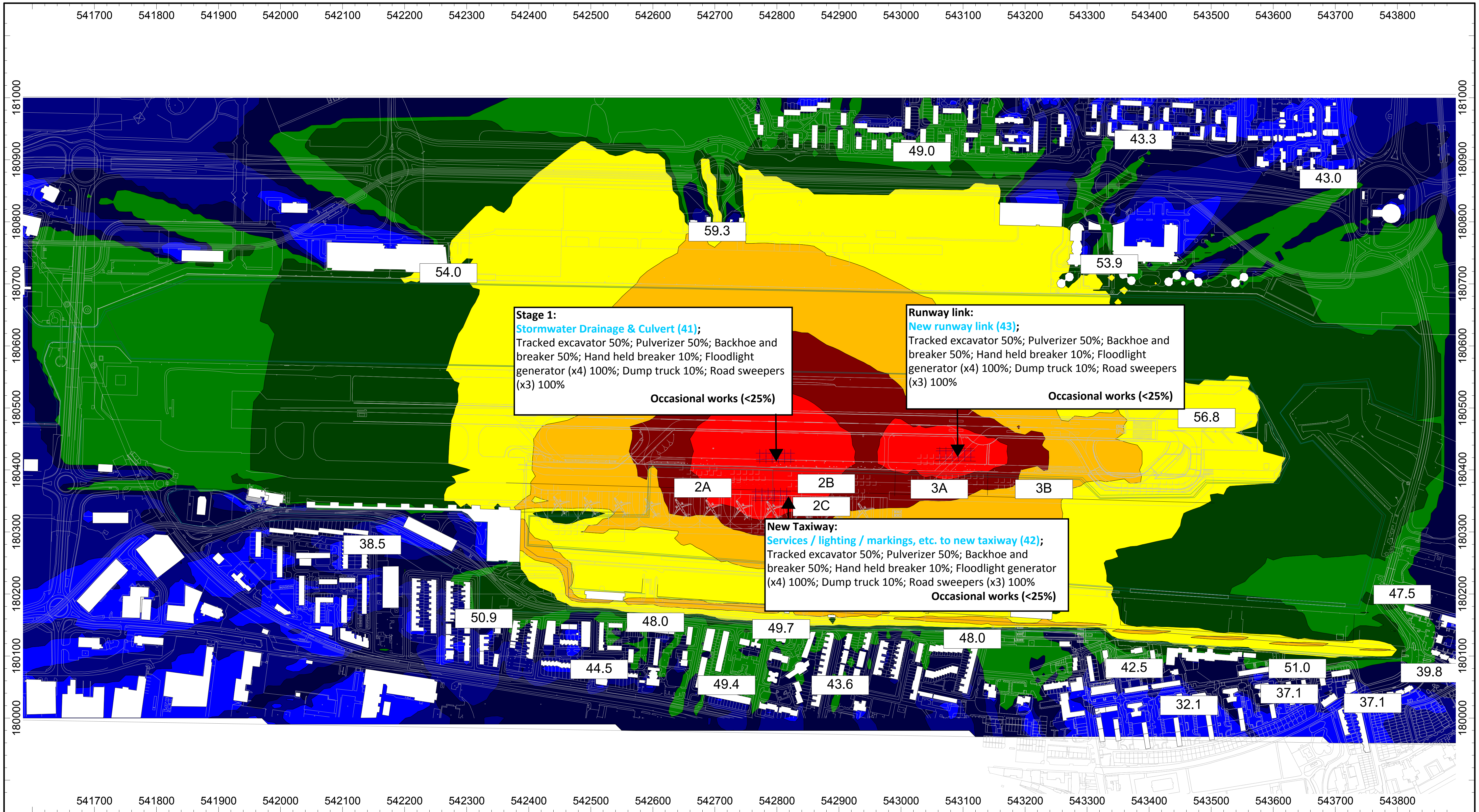
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

6. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2016

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

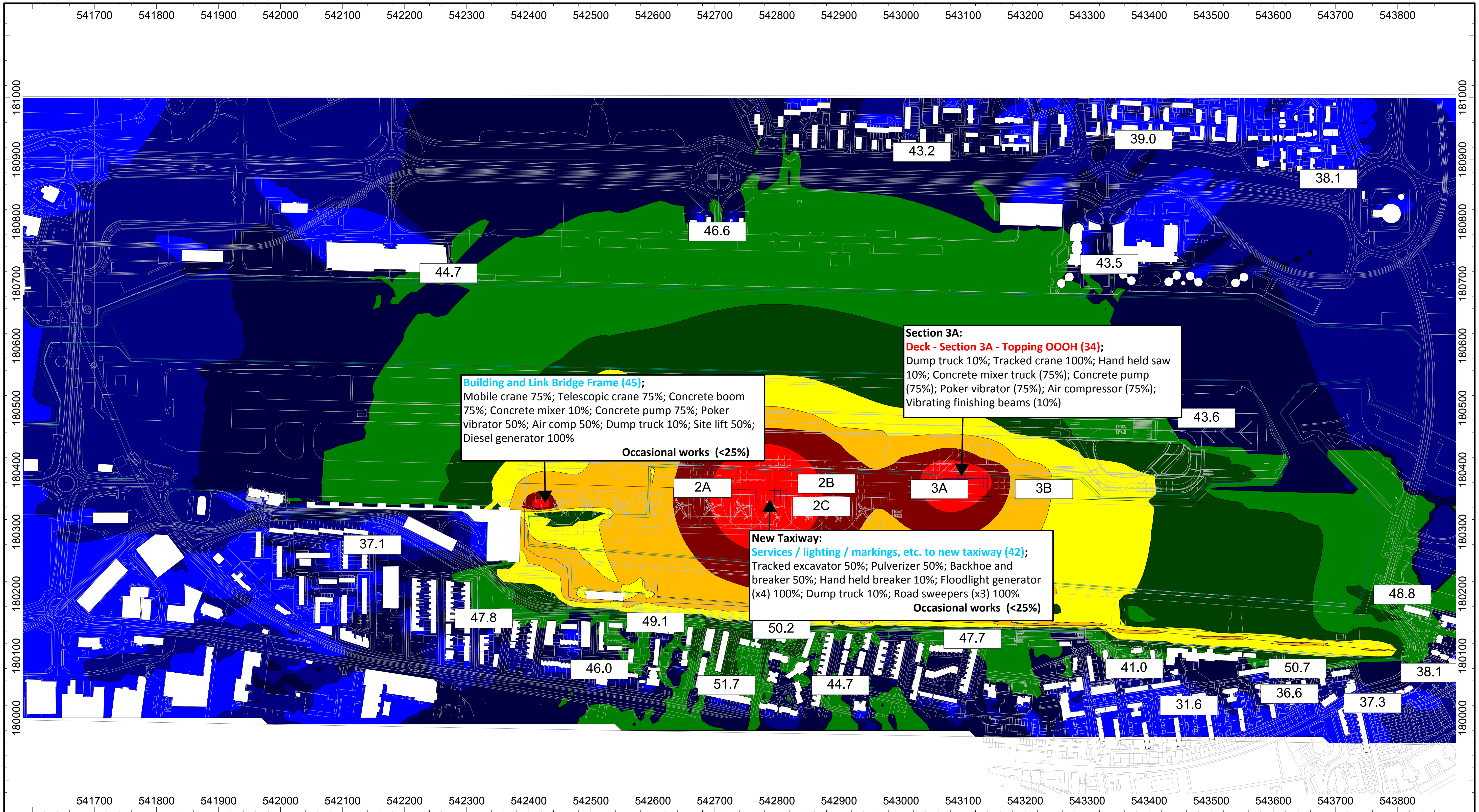
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

Colour	Level
Blue	... < 35.0 dB(A)
Dark blue	35.0 <= ... < 40.0 dB(A)
Navy	40.0 <= ... < 45.0 dB(A)
Green	45.0 <= ... < 50.0 dB(A)
Dark green	50.0 <= ... < 55.0 dB(A)
Yellow	55.0 <= ... < 60.0 dB(A)
Orange	60.0 <= ... < 65.0 dB(A)
Dark red	65.0 <= ... < 70.0 dB(A)
Red	70.0 <= ... dB(A)

7. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2016

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Blue	... < 35.0 dB(A)
Dark blue	35.0 <= ... < 40.0 dB(A)
Navy	40.0 <= ... < 45.0 dB(A)
Green	45.0 <= ... < 50.0 dB(A)
Dark green	50.0 <= ... < 55.0 dB(A)
Yellow	55.0 <= ... < 60.0 dB(A)
Orange	60.0 <= ... < 65.0 dB(A)
Dark red	65.0 <= ... < 70.0 dB(A)
Red	70.0 <= ... dB(A)

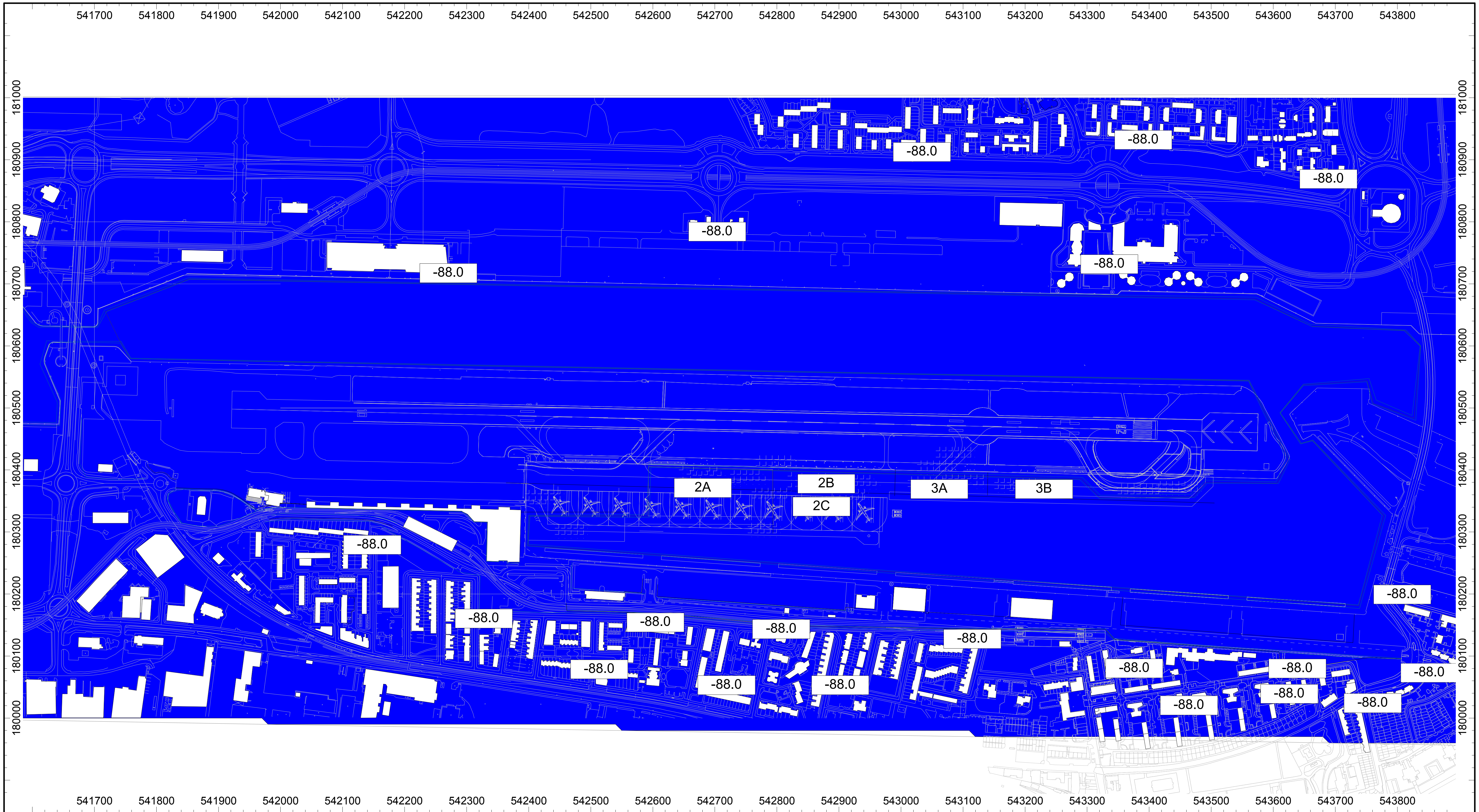
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

8. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2016

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

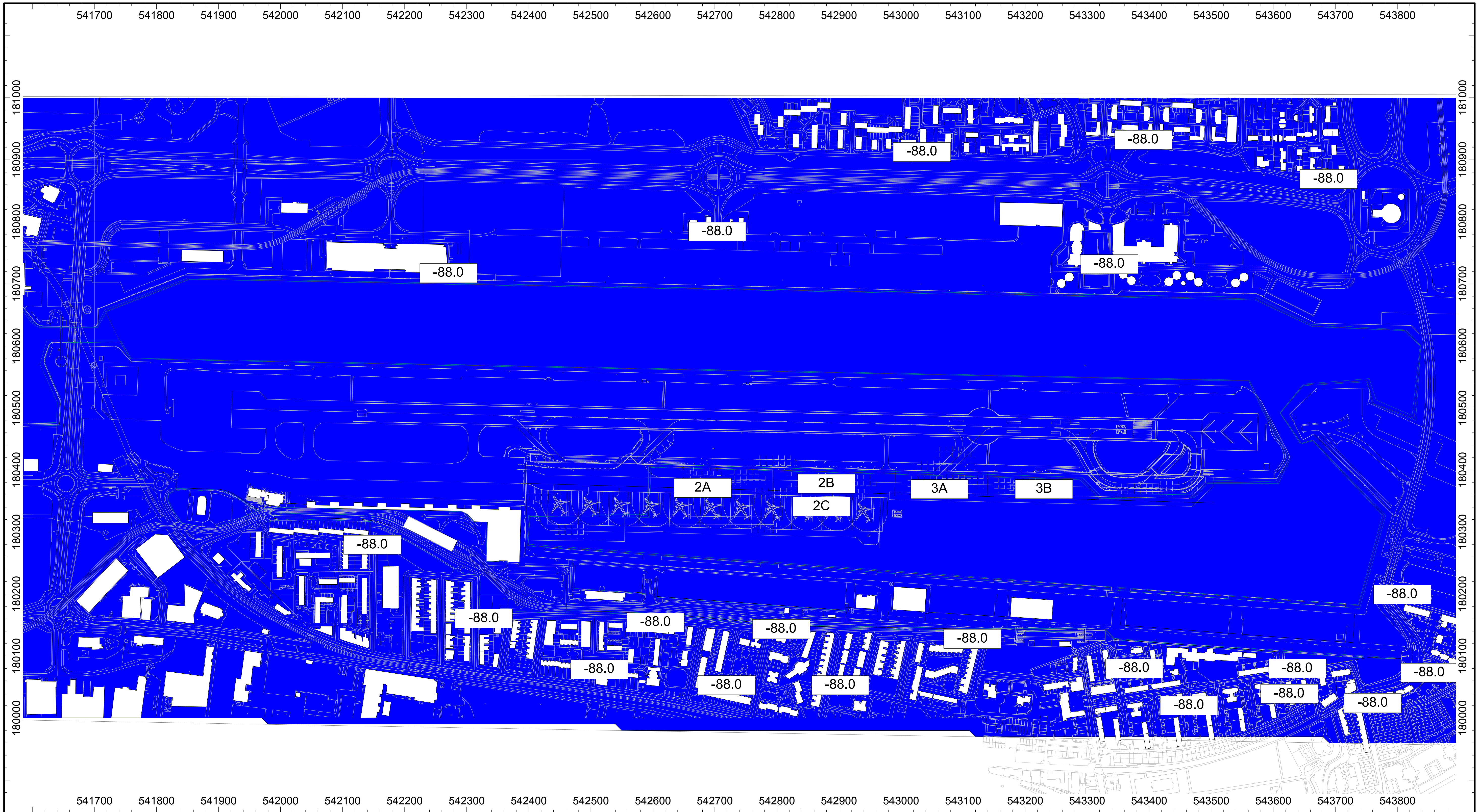
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

9. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2017

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

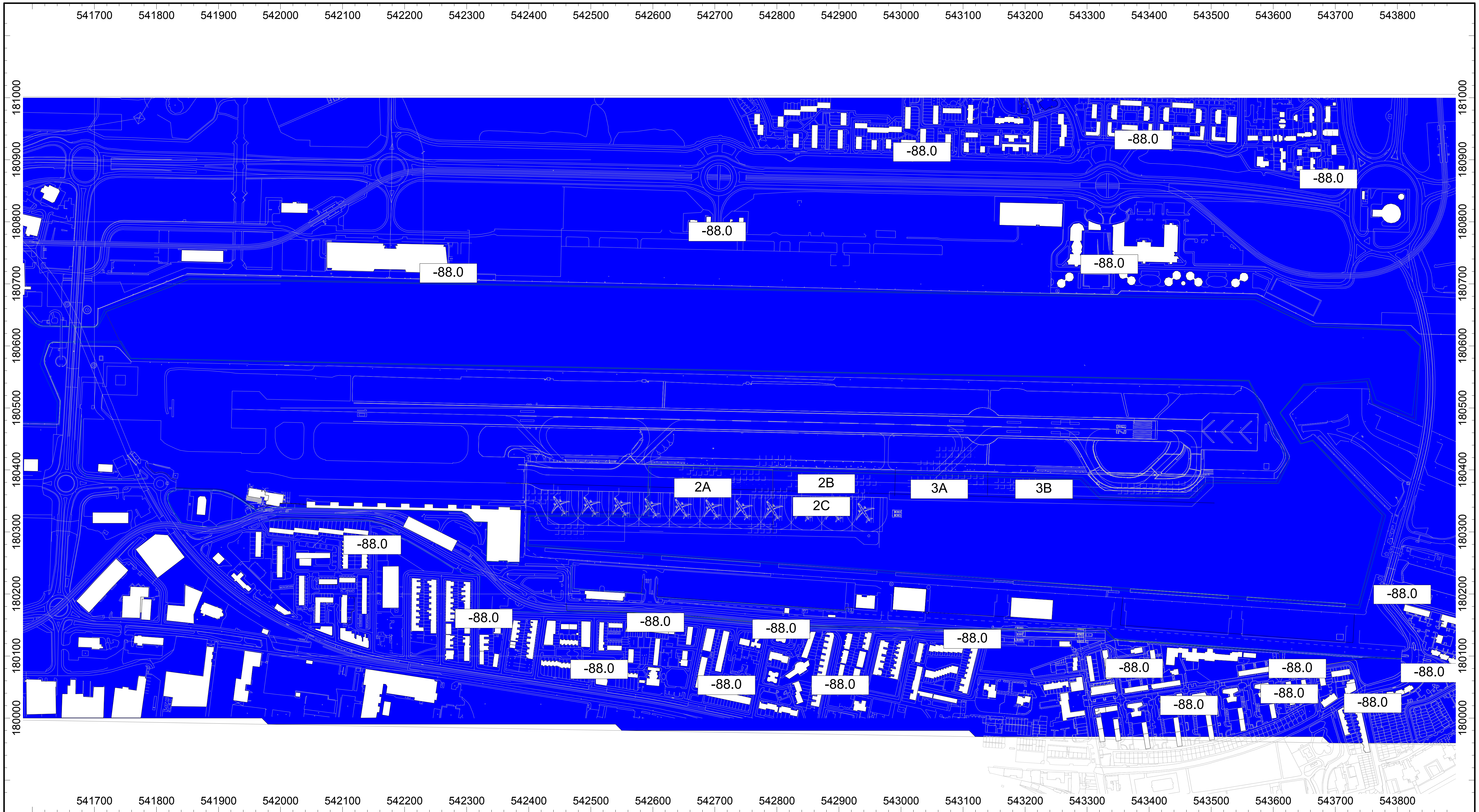
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

10. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2017

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

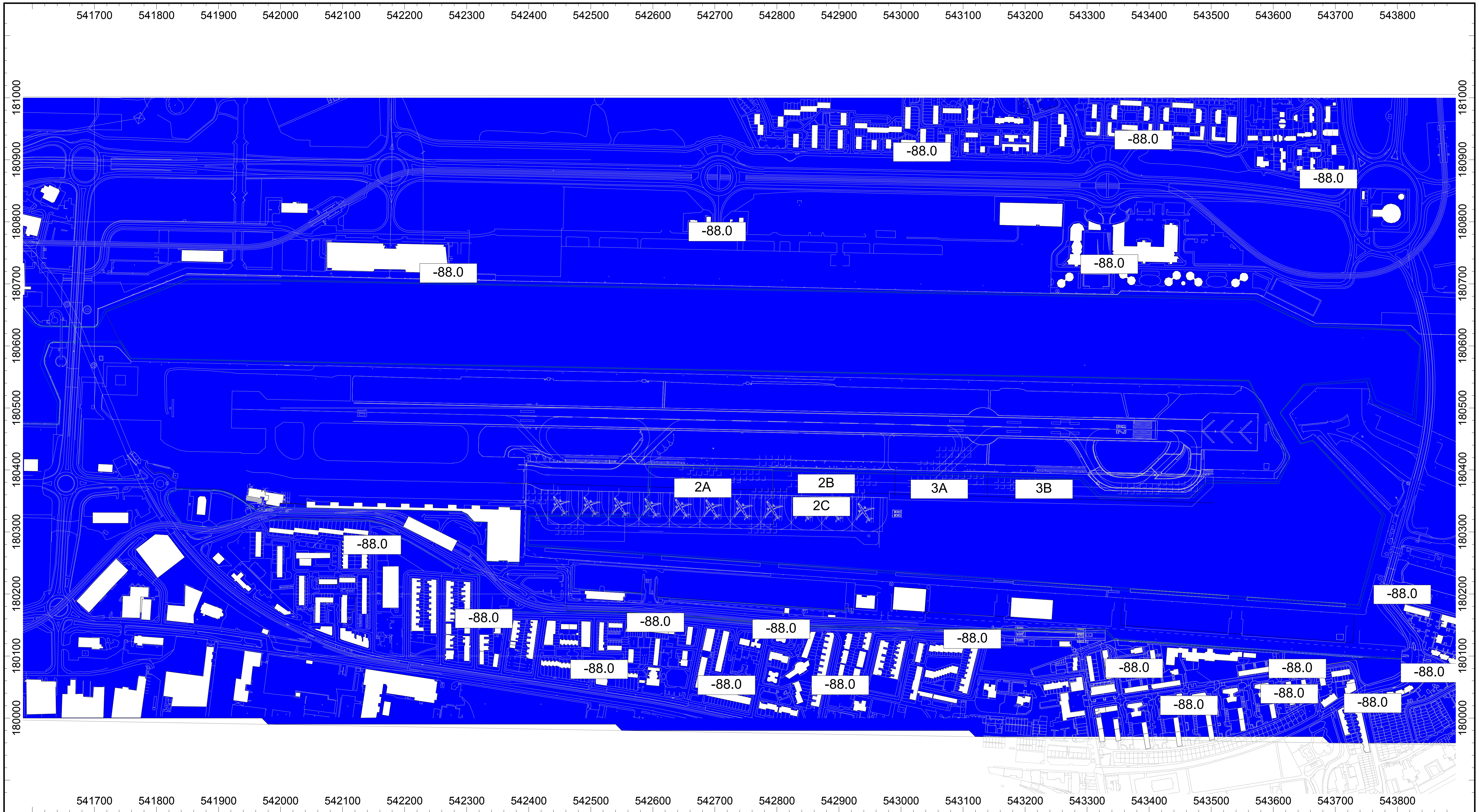
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

11. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2017

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Legend
... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

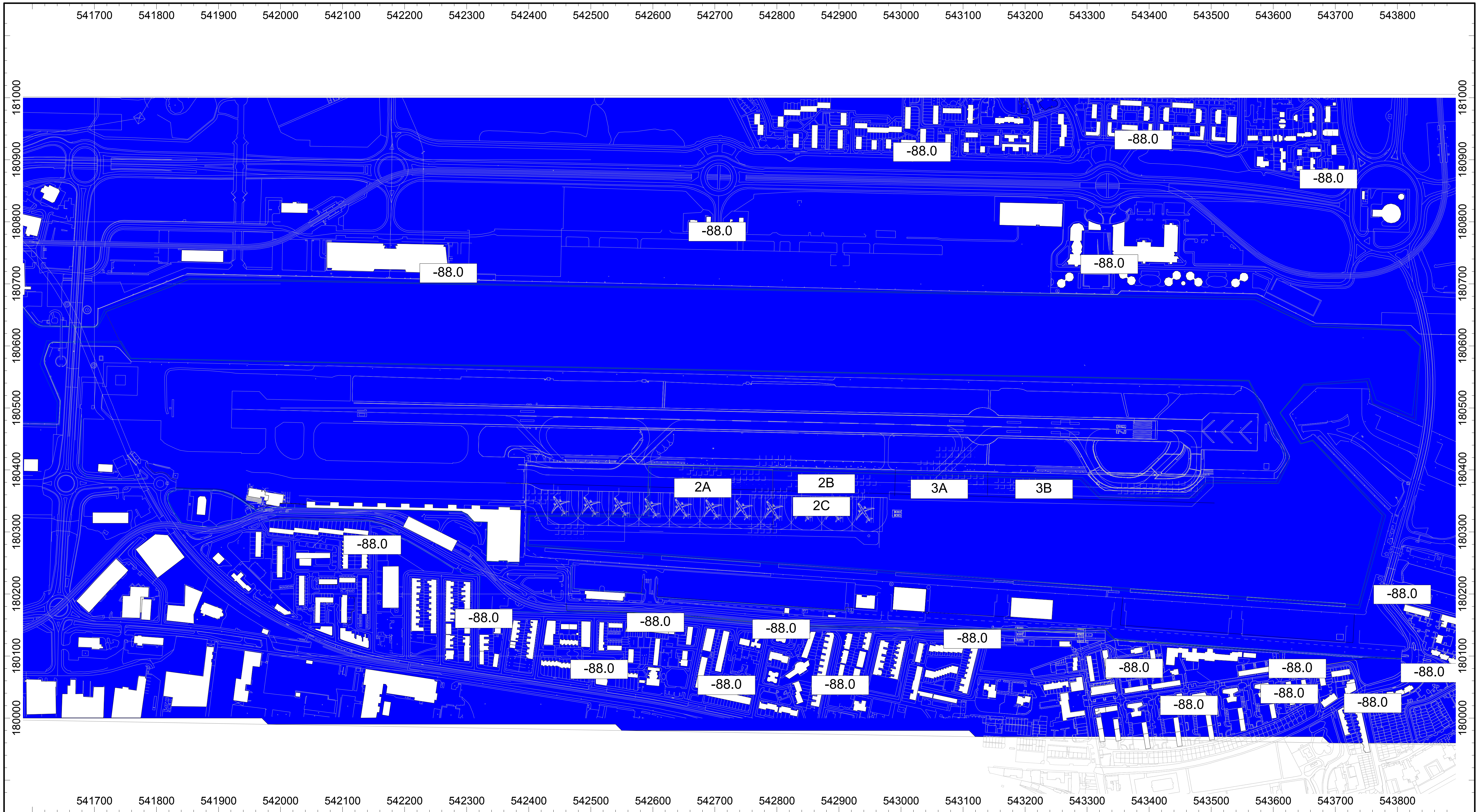
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

12. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2017

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

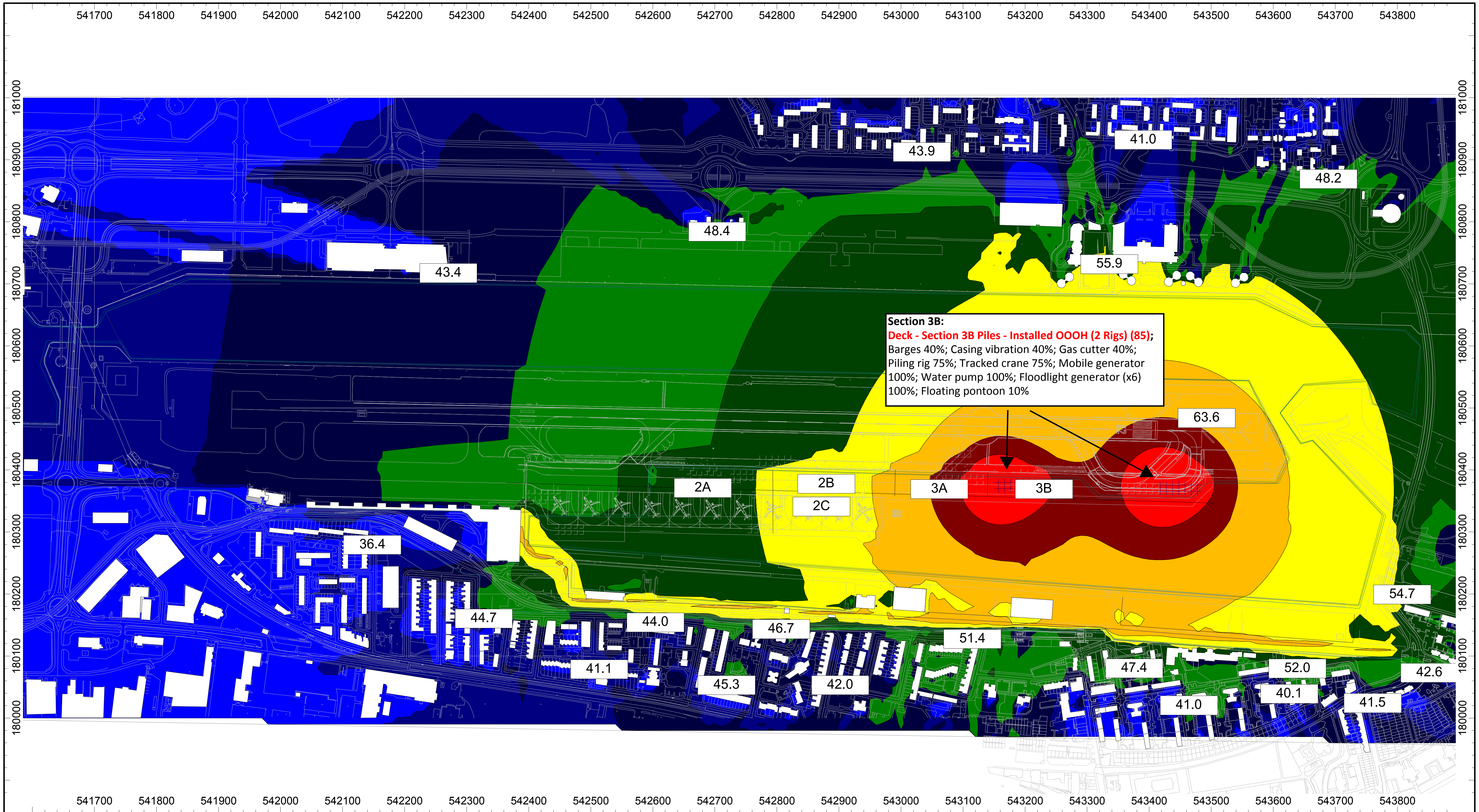
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

13. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2018

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

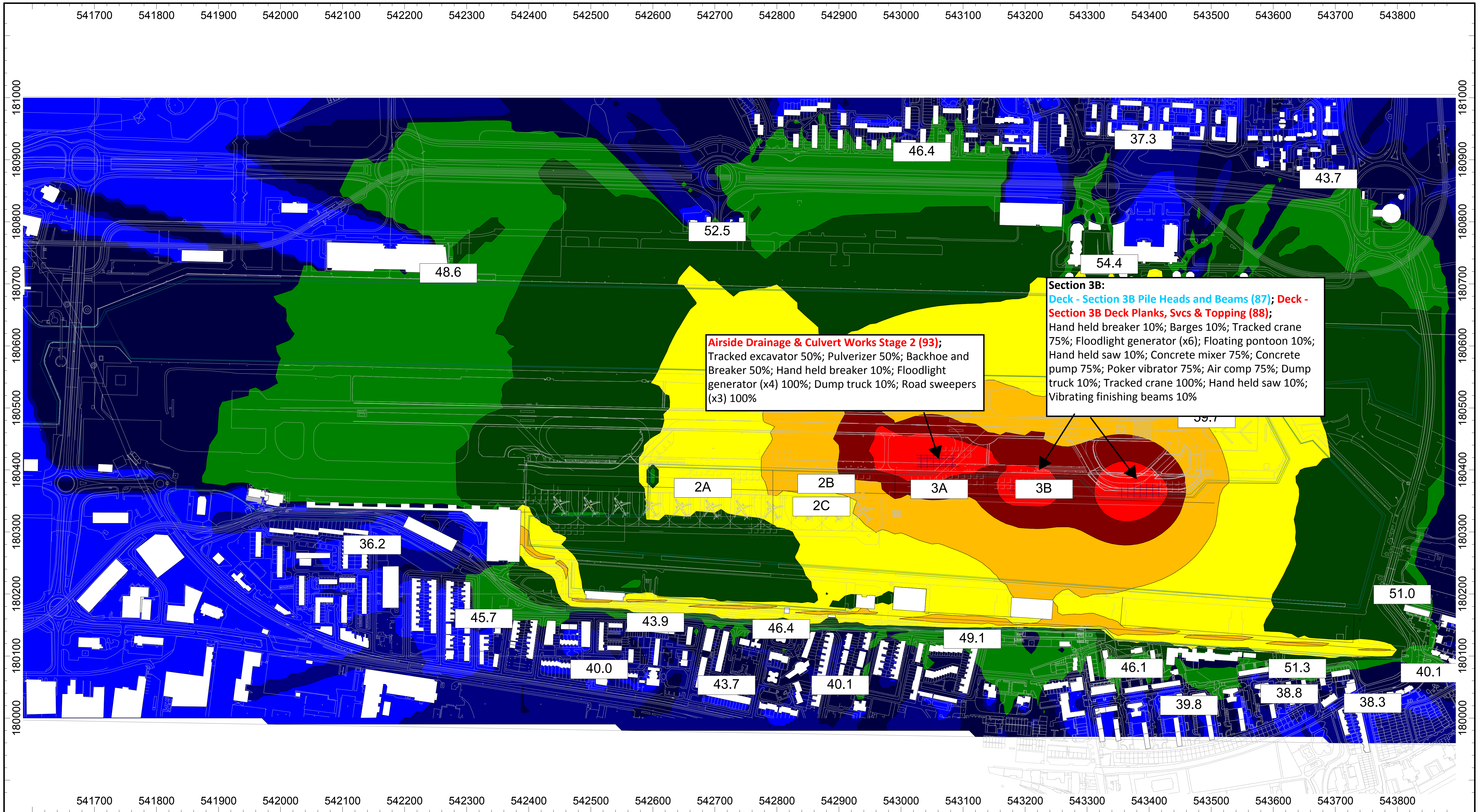
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

14. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2018

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

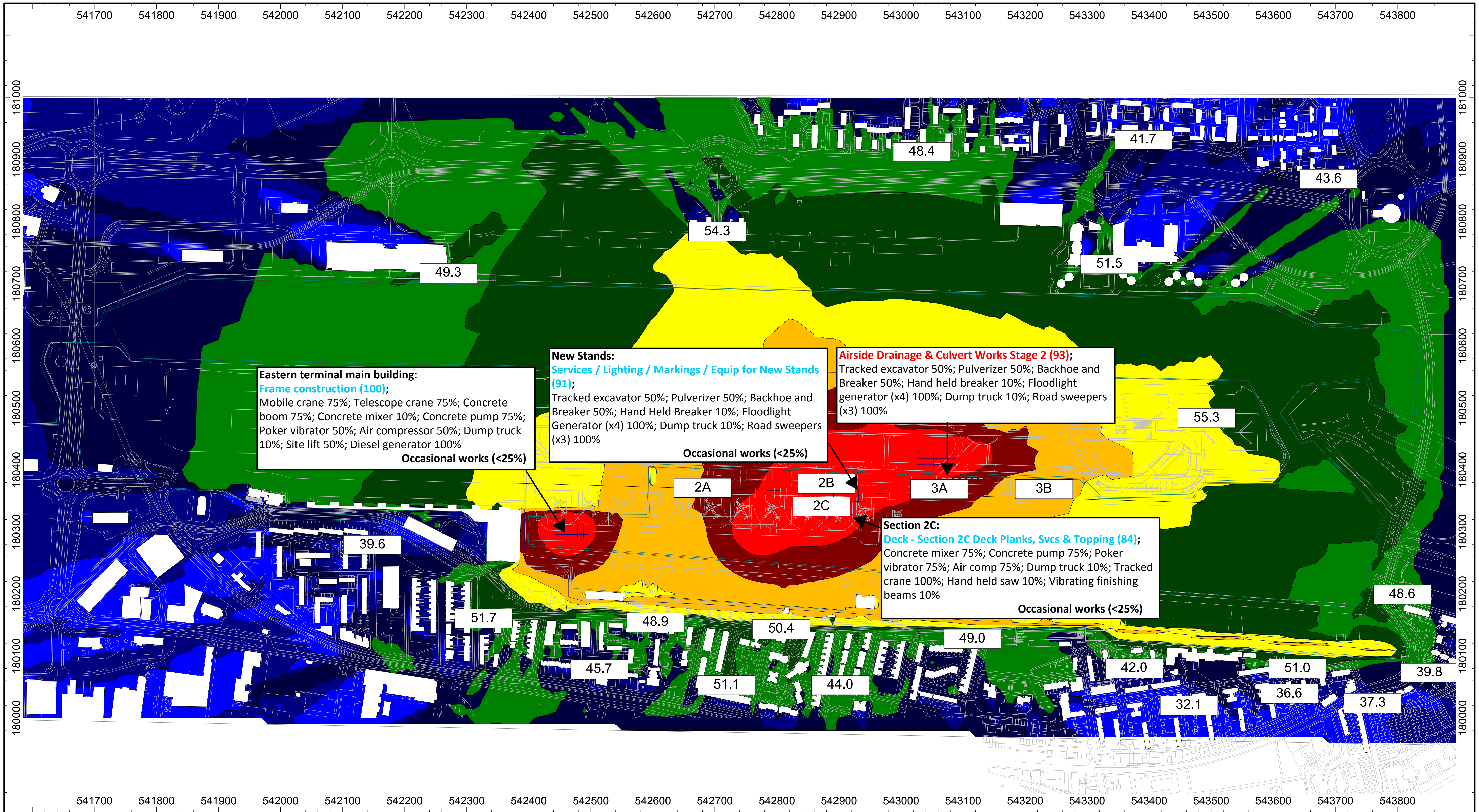
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

15. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2018

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

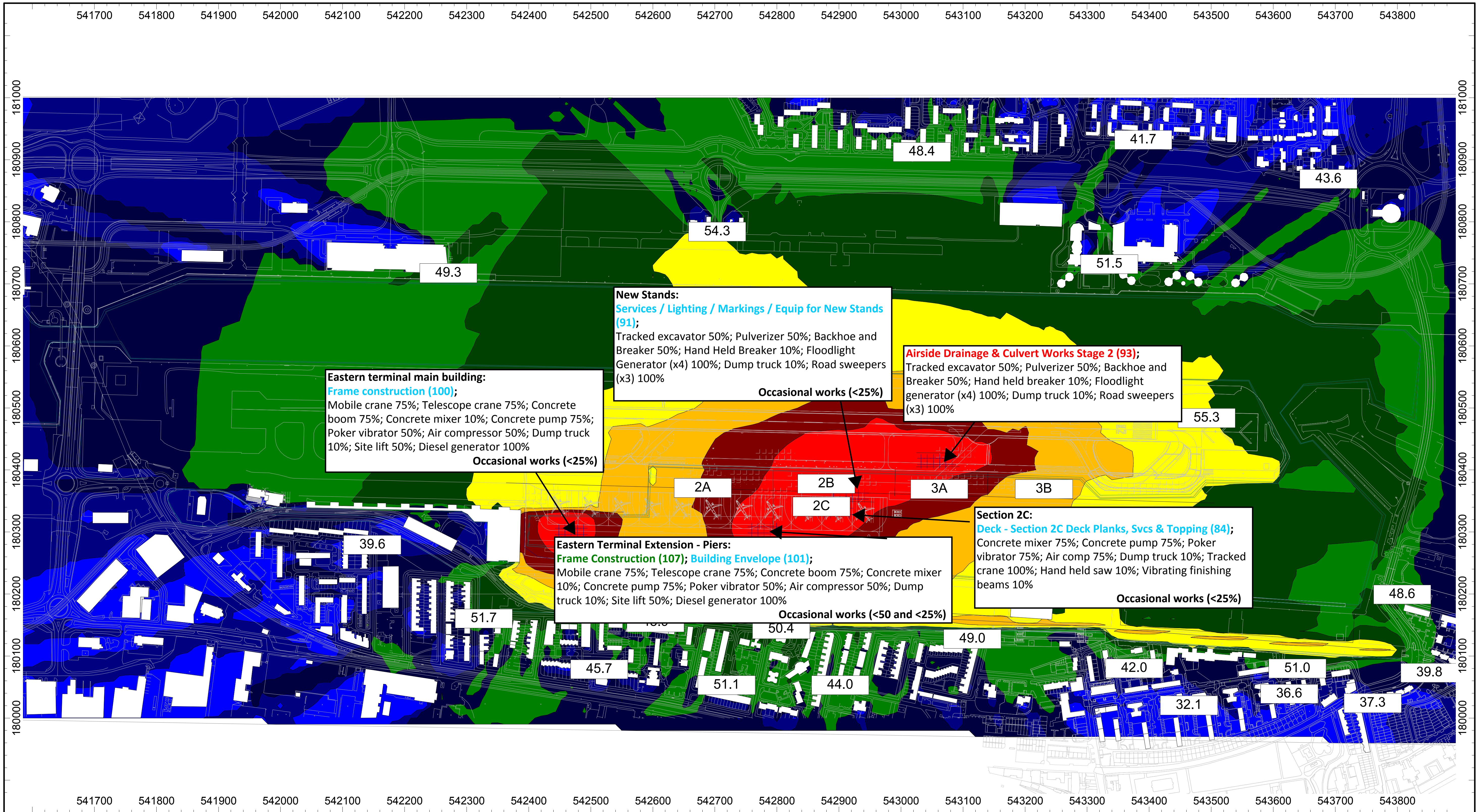
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

Legend
... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

16. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2018

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

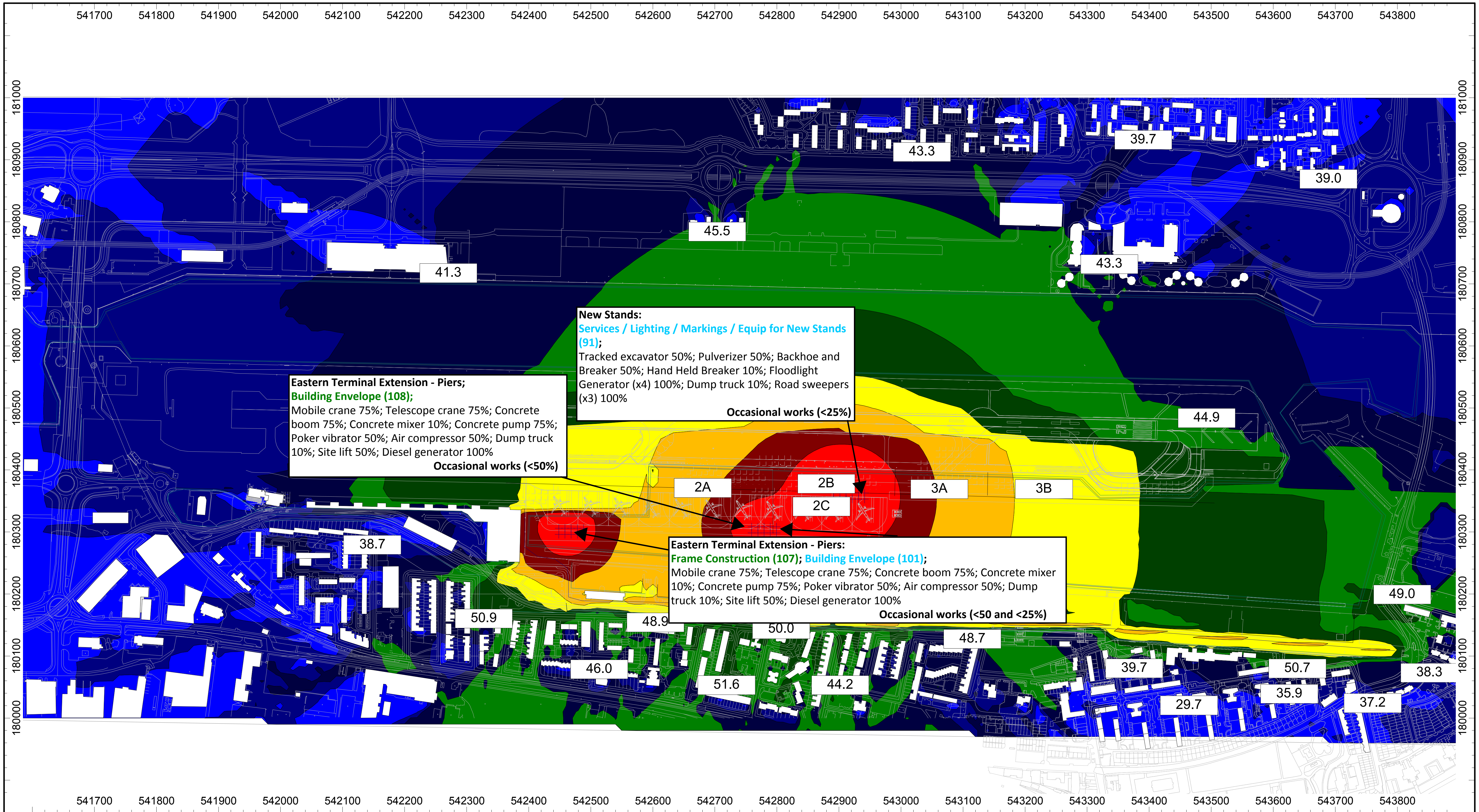
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

- ... < 35.0 dB(A)
- 35.0 <= ... < 40.0 dB(A)
- 40.0 <= ... < 45.0 dB(A)
- 45.0 <= ... < 50.0 dB(A)
- 50.0 <= ... < 55.0 dB(A)
- 55.0 <= ... < 60.0 dB(A)
- 60.0 <= ... < 65.0 dB(A)
- 65.0 <= ... < 70.0 dB(A)
- 70.0 <= ... dB(A)

17. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2019

CadnaA Construction Noise OOOH Works



Not to scale

A9575 v6.0 30.08.14

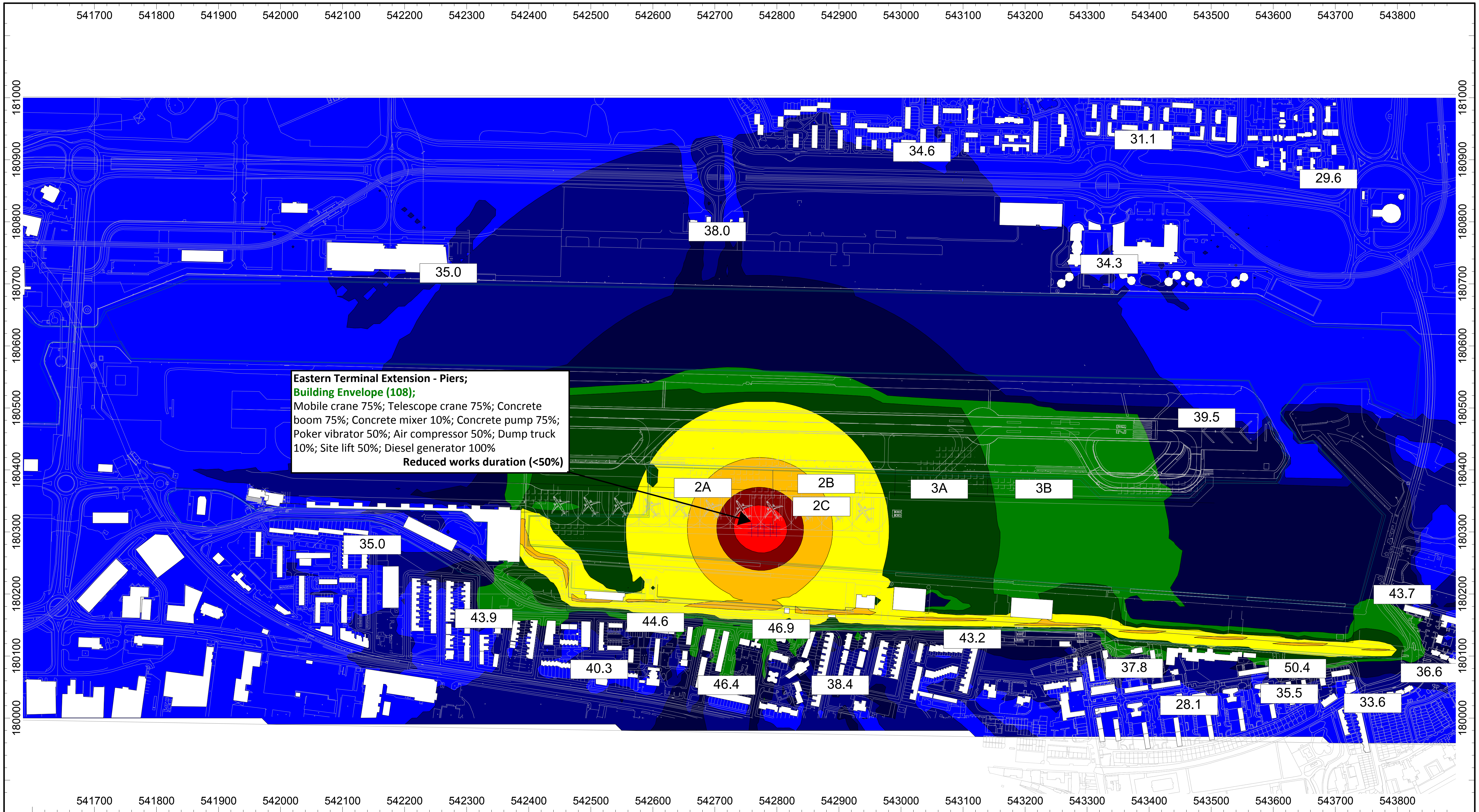
Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

A9575 - London City Airport - Construction Noise

- ... < 35.0 dB(A)
- 35.0 <= ... < 40.0 dB(A)
- 40.0 <= ... < 45.0 dB(A)
- 45.0 <= ... < 50.0 dB(A)
- 50.0 <= ... < 55.0 dB(A)
- 55.0 <= ... < 60.0 dB(A)
- 60.0 <= ... < 65.0 dB(A)
- 65.0 <= ... < 70.0 dB(A)
- 70.0 <= ... dB(A)

18. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2019

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

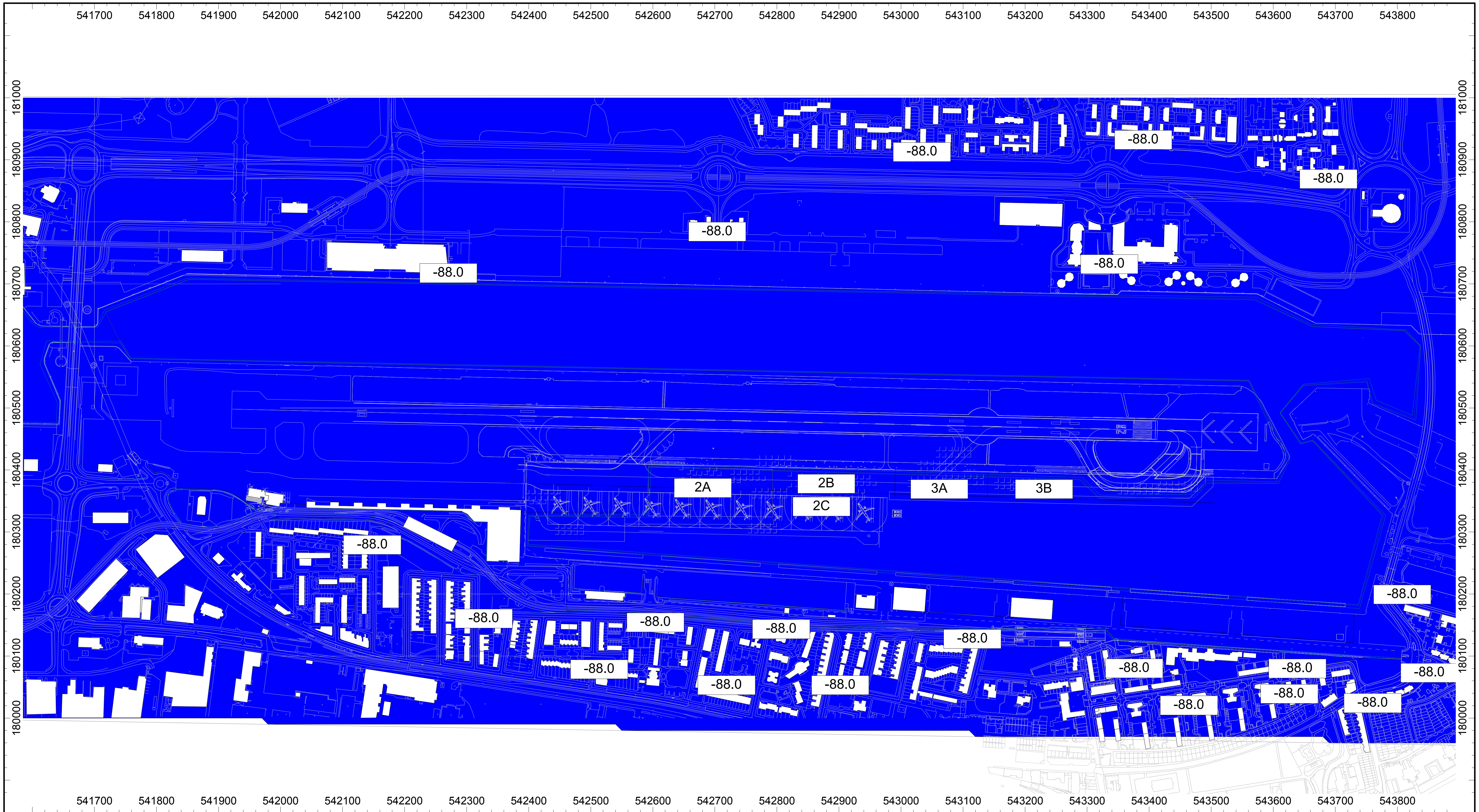
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

19. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2019

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Colour	Level
Blue	... < 35.0 dB(A)
Dark blue	35.0 <= ... < 40.0 dB(A)
Navy	40.0 <= ... < 45.0 dB(A)
Green	45.0 <= ... < 50.0 dB(A)
Dark green	50.0 <= ... < 55.0 dB(A)
Yellow	55.0 <= ... < 60.0 dB(A)
Orange	60.0 <= ... < 65.0 dB(A)
Dark red	65.0 <= ... < 70.0 dB(A)
Red	70.0 <= ... dB(A)

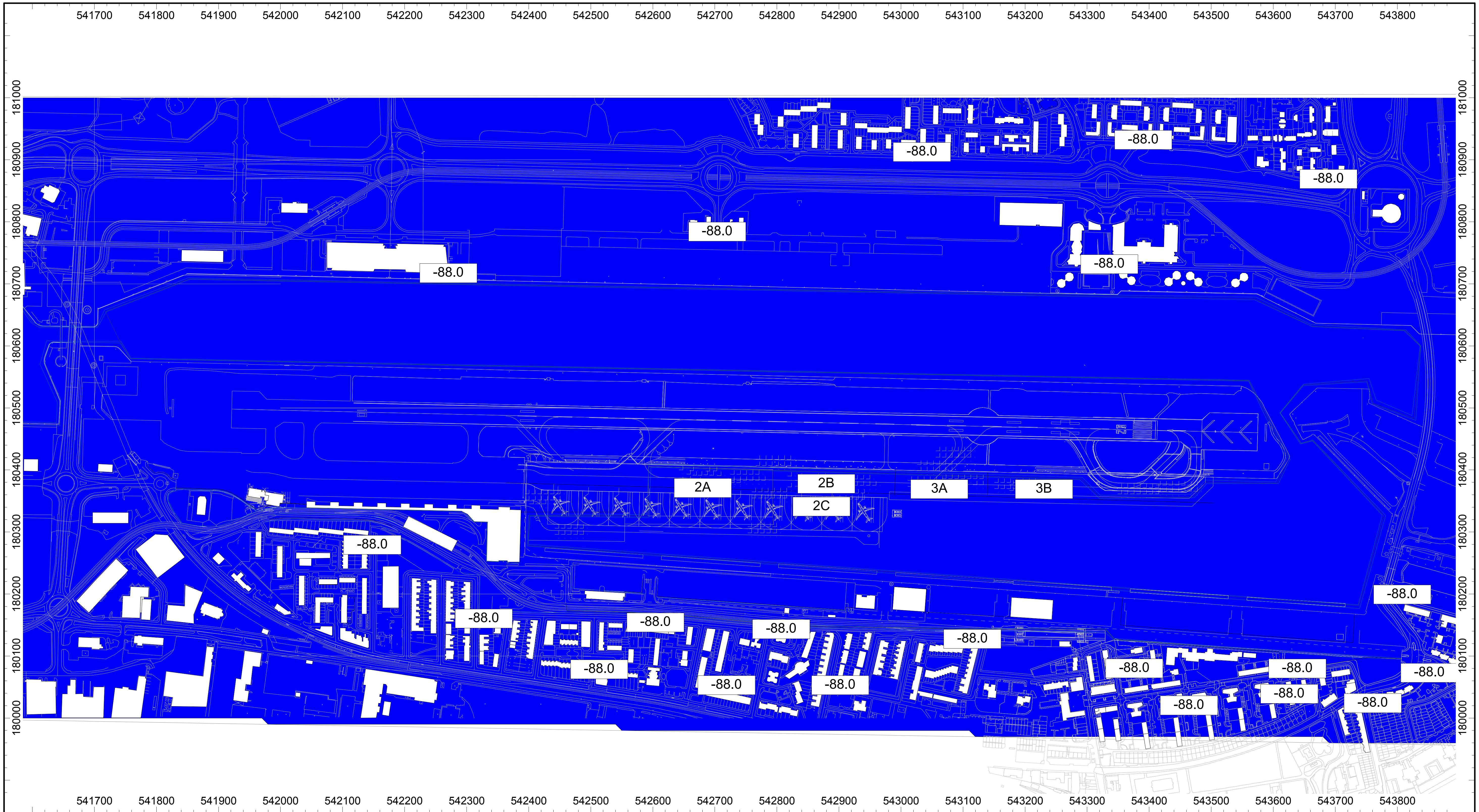
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

20. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2019

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

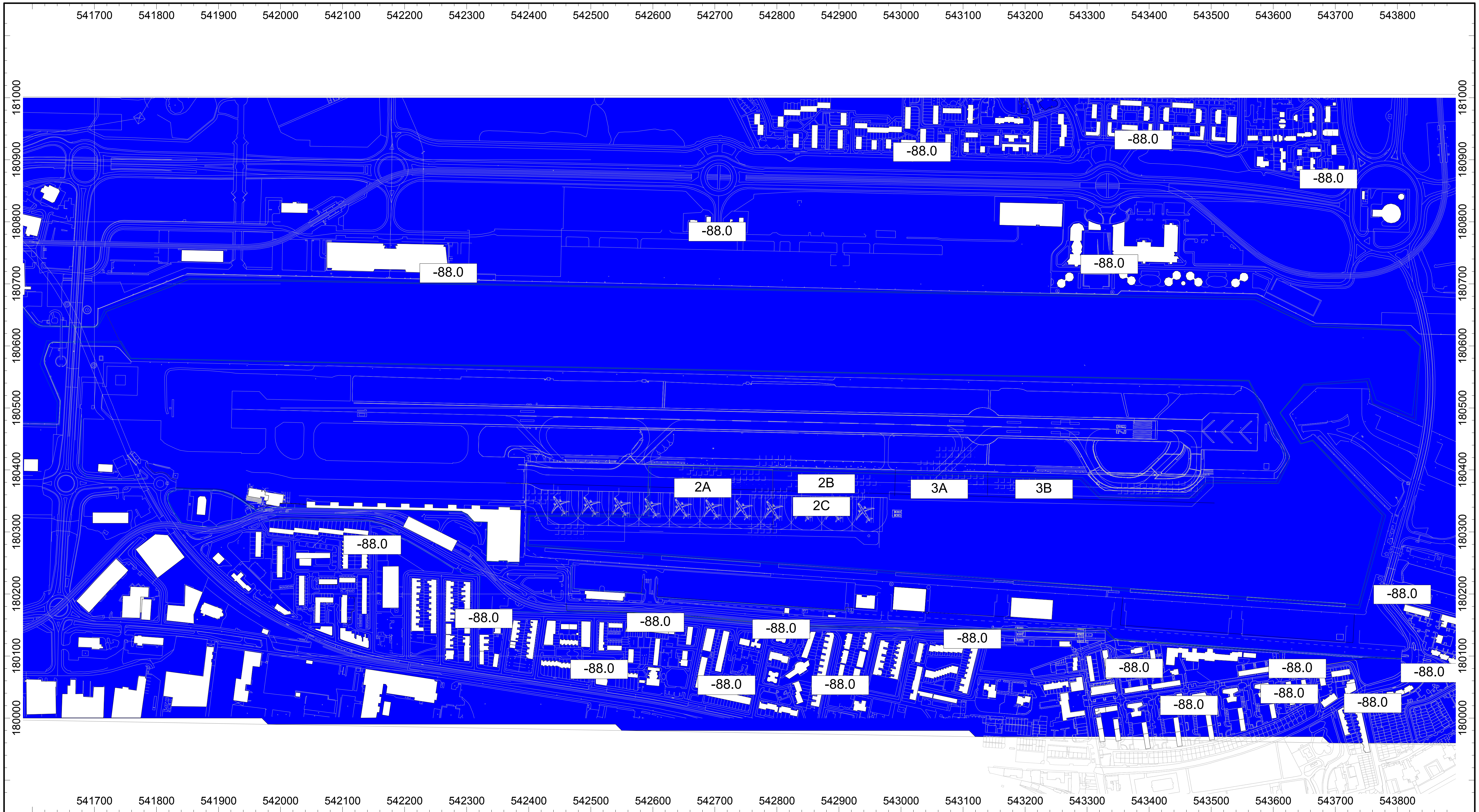
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

21. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2020

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

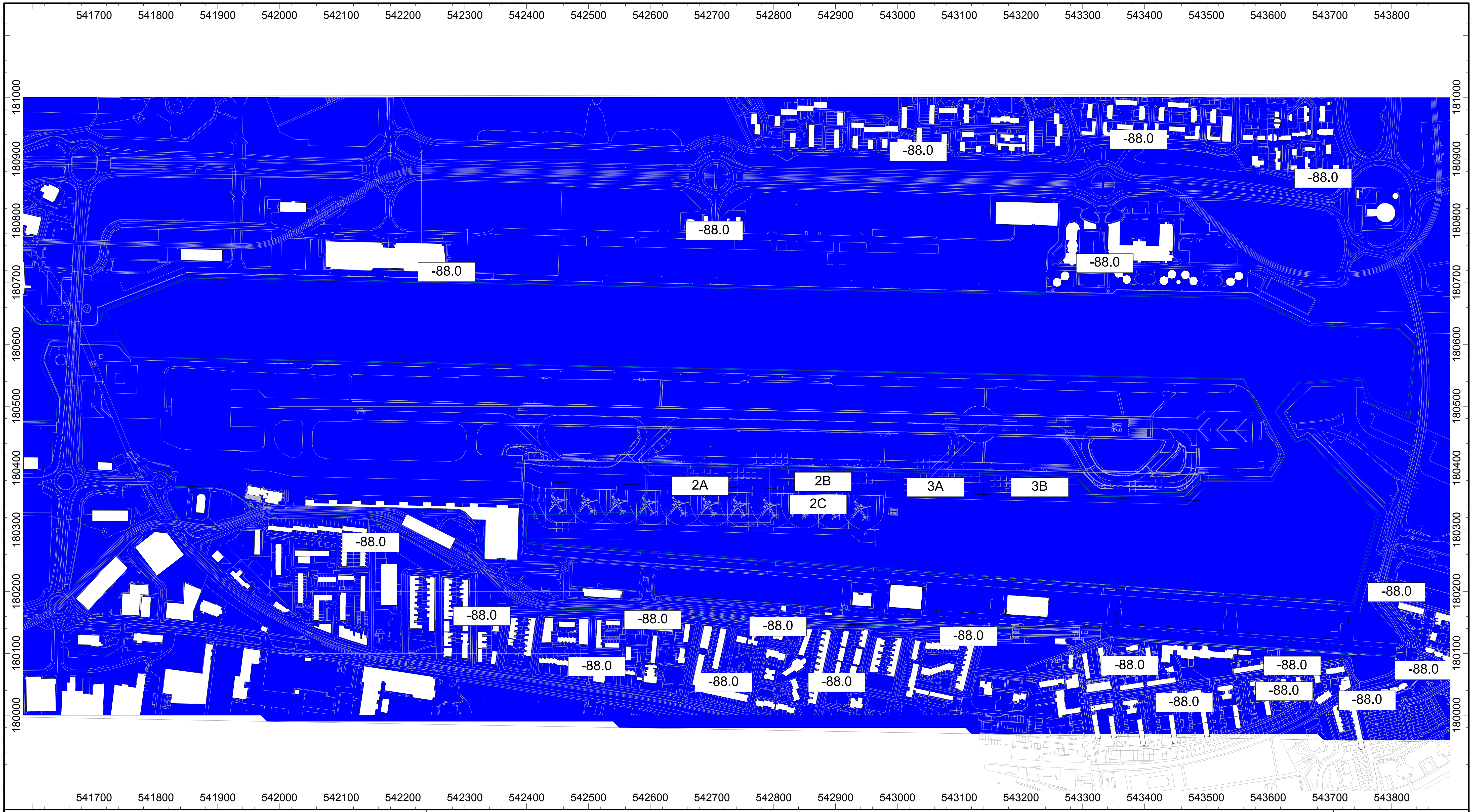
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

22. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2020

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

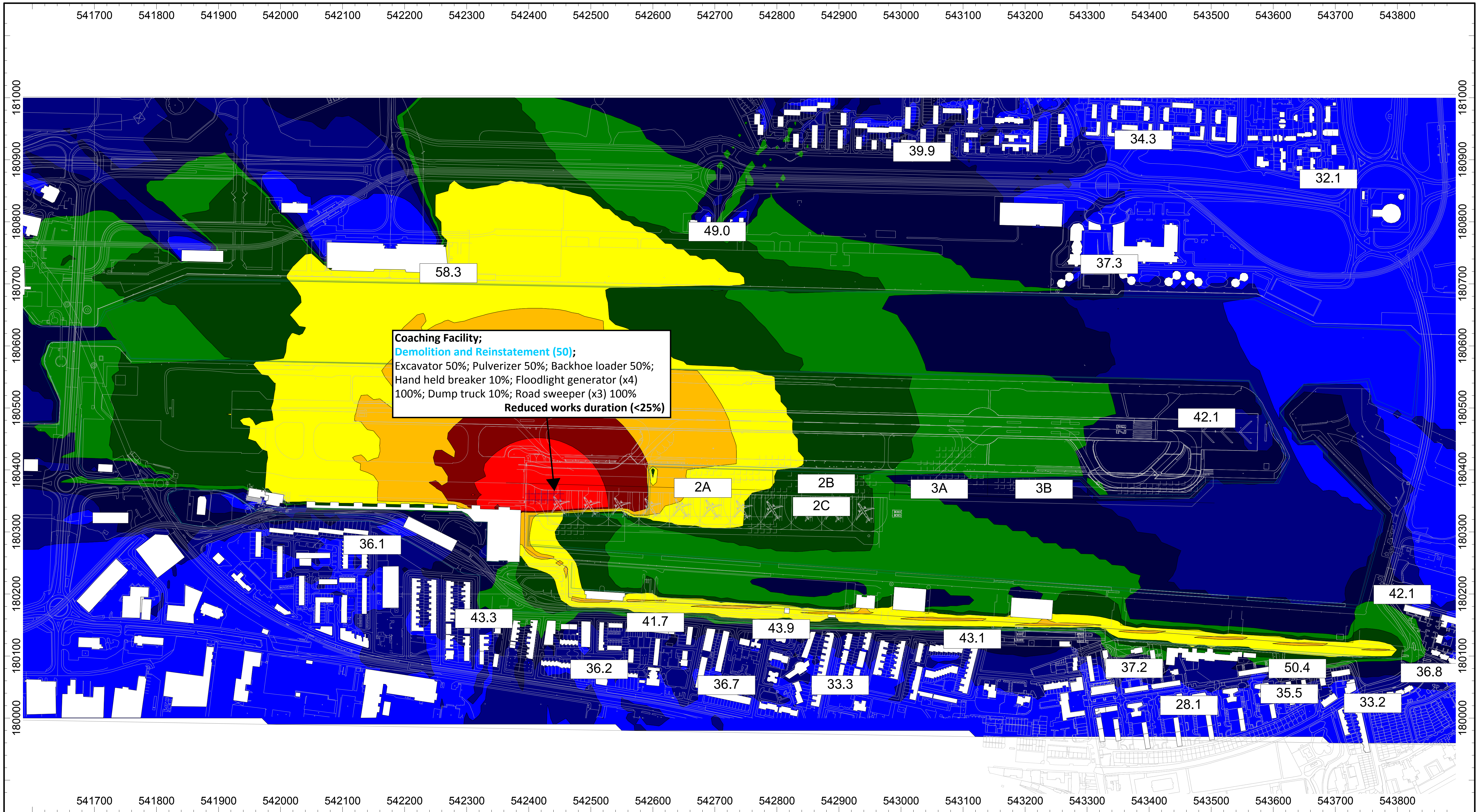
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

23. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2020

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

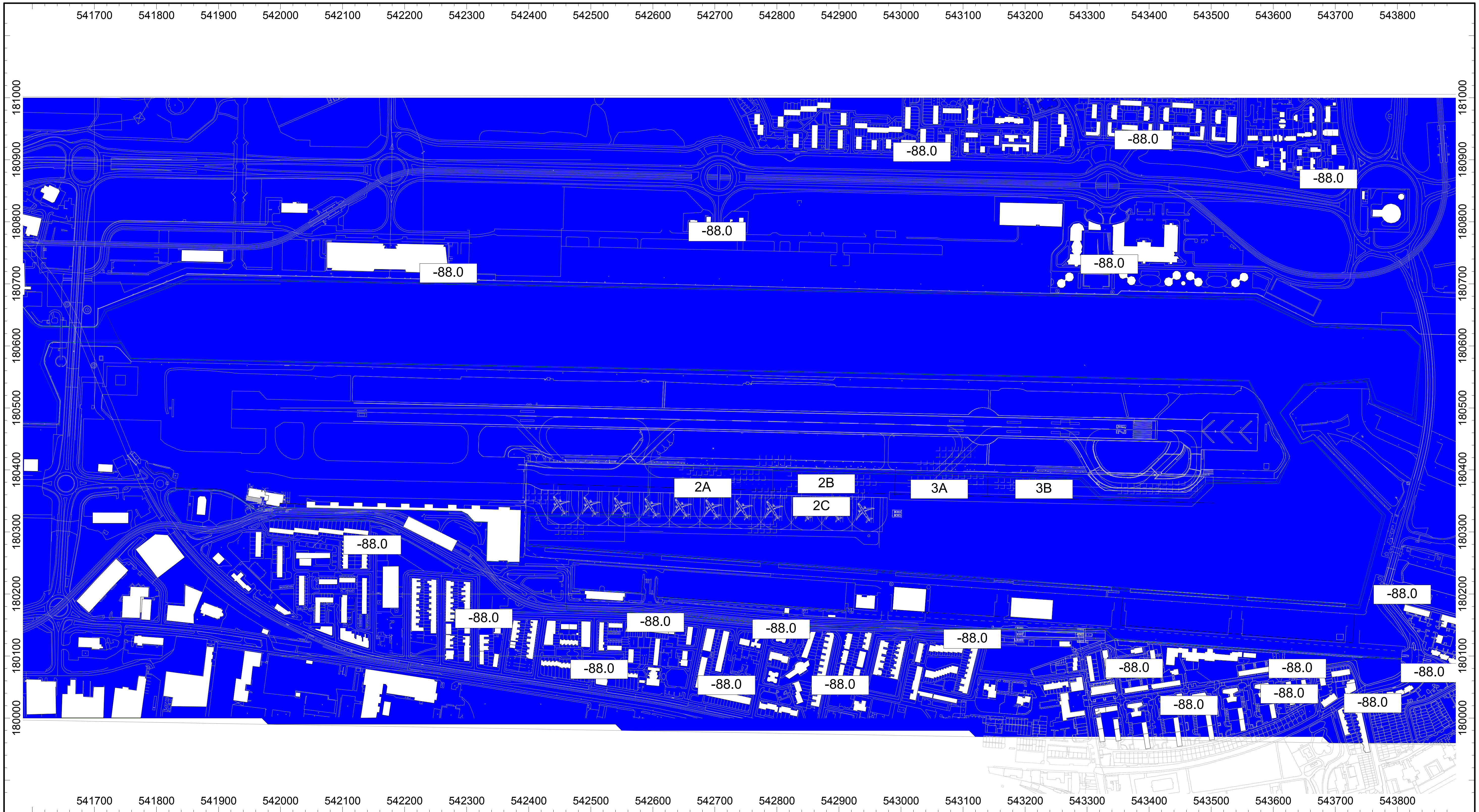
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

24. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2020

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

	... < 35.0 dB(A)
	35.0 <= ... < 40.0 dB(A)
	40.0 <= ... < 45.0 dB(A)
	45.0 <= ... < 50.0 dB(A)
	50.0 <= ... < 55.0 dB(A)
	55.0 <= ... < 60.0 dB(A)
	60.0 <= ... < 65.0 dB(A)
	65.0 <= ... < 70.0 dB(A)
	70.0 <= ... dB(A)

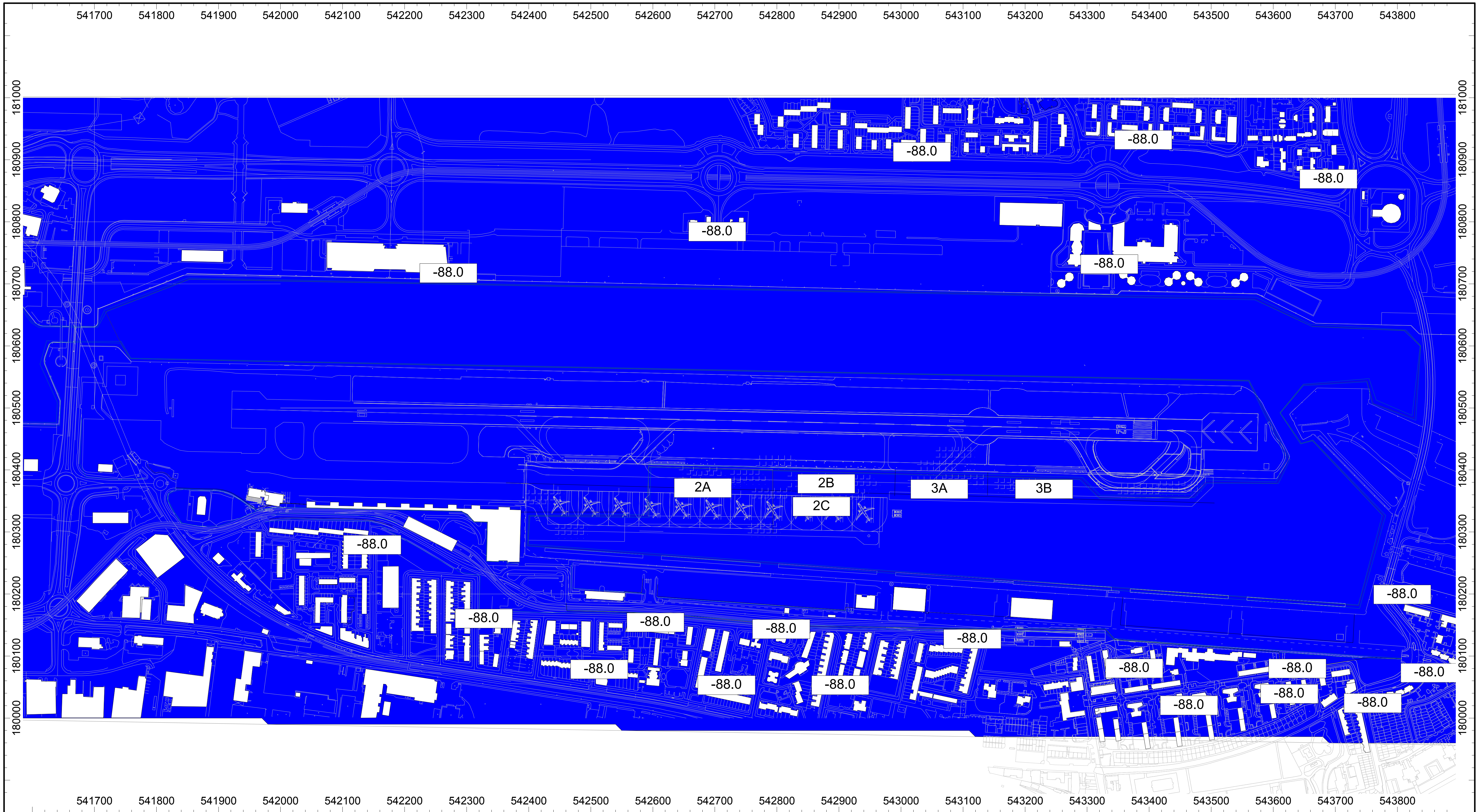
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

25. London City Airport - Out of Operational Hours (OOOH) Programme 1st January 2021

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

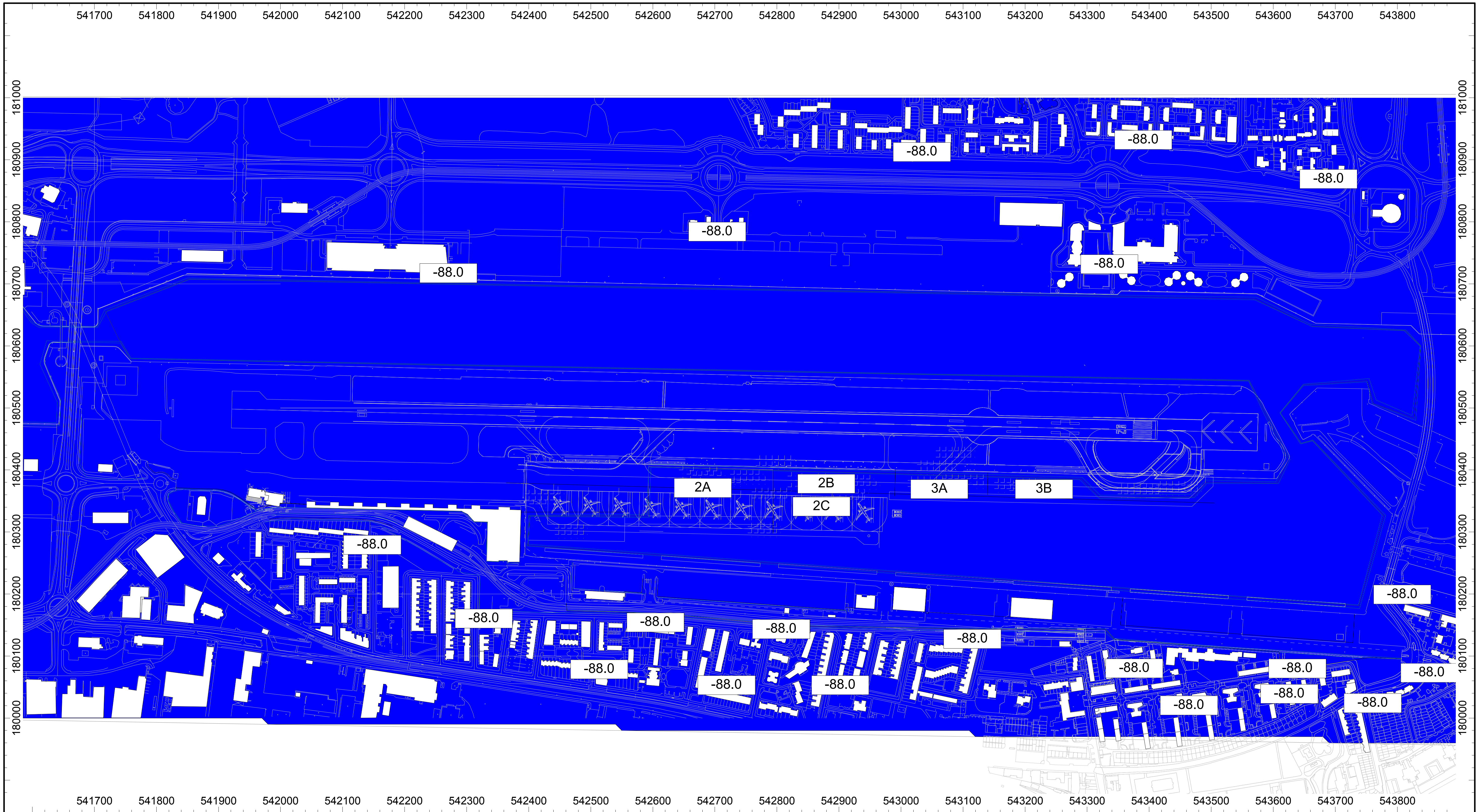
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

26. London City Airport - Out of Operational Hours (OOOH) Programme 1st April 2021

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

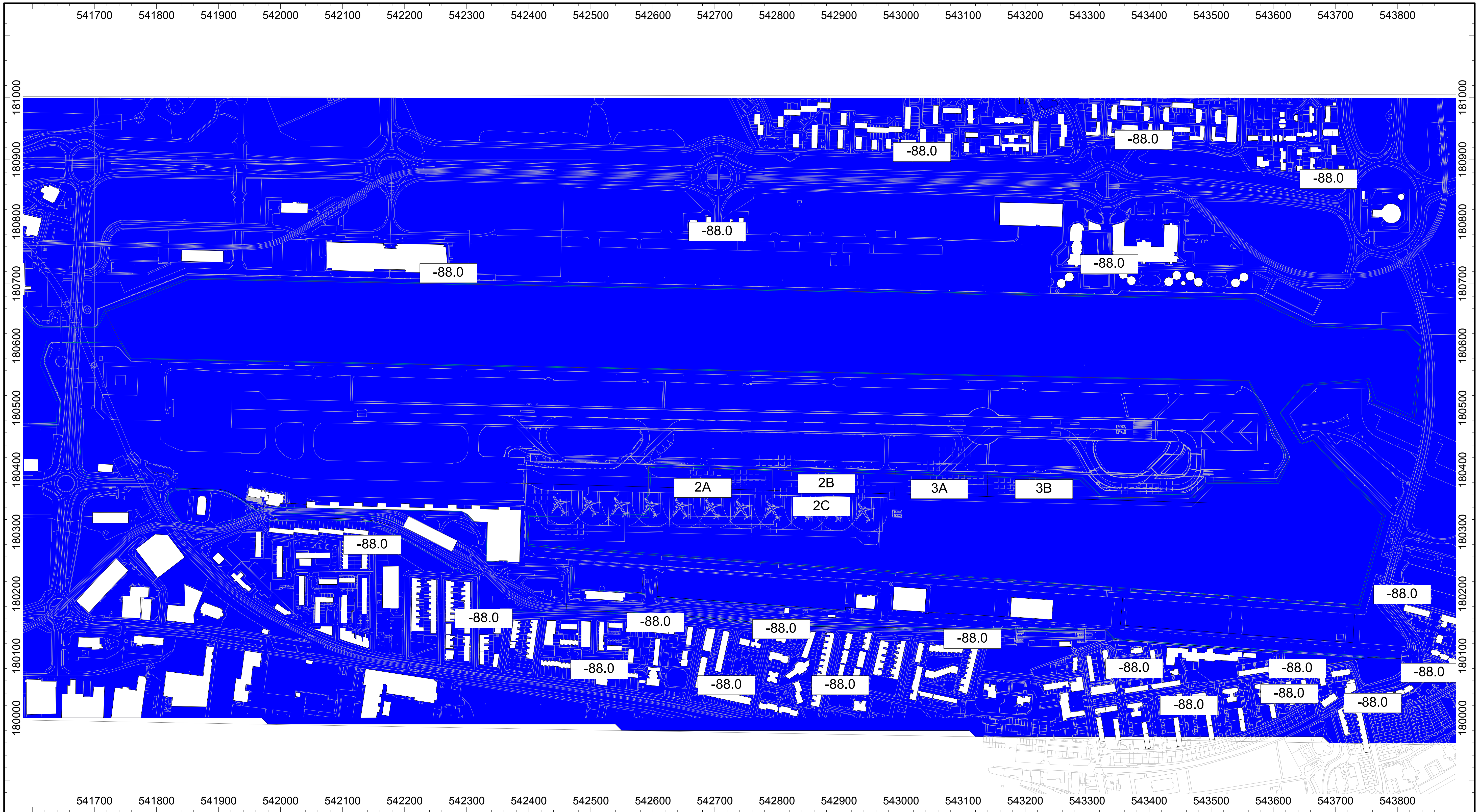
A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

27. London City Airport - Out of Operational Hours (OOOH) Programme 1st July 2021

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

Legend
... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

28. London City Airport - Out of Operational Hours (OOOH) Programme 1st October 2021

CadnaA Construction Noise OOOH Works

APPENDIX 4.2

Location and Extent of Temporary Construction Noise Barrier

APPENDIX 4.2

LOCATION AND EXTENT OF TEMPORARY CONSTRUCTION NOISE BARRIER

1 As detailed within CESA Section 4 a temporary construction noise barrier is proposed south of KGV Dock to reduce construction noise impacts in the communities south of the Airport, including North Woolwich.

2 The noise barrier will be located south of KGV Dock and extend to 3 metres in height. Its extent will vary according to the phasing of construction as the works progress eastwards across the site. The location and extent of the barrier is indicatively shown on the drawings below.

3 The temporary construction noise barrier shall be 3m in height above local ground level. The specific details of the barrier will need to be confirmed prior to installation but it is recommended that as a minimum, the following standards should be met:

- The barrier will also be imperforate (i.e. there should be no gaps at joints or the base).
- The minimum superficial surface mass shall be at least 7 kg/m2 (18mm exterior grade plywood will meet this mass requirement). Any other material which exceeds the minimum mass requirement would also be acceptable. An example of a proprietary acoustic barrier that would satisfy this specification is a Jackson Jakoustic (or similar approved). These are designed to be permanent barriers and are therefore designed to a higher specification than required for temporary use.

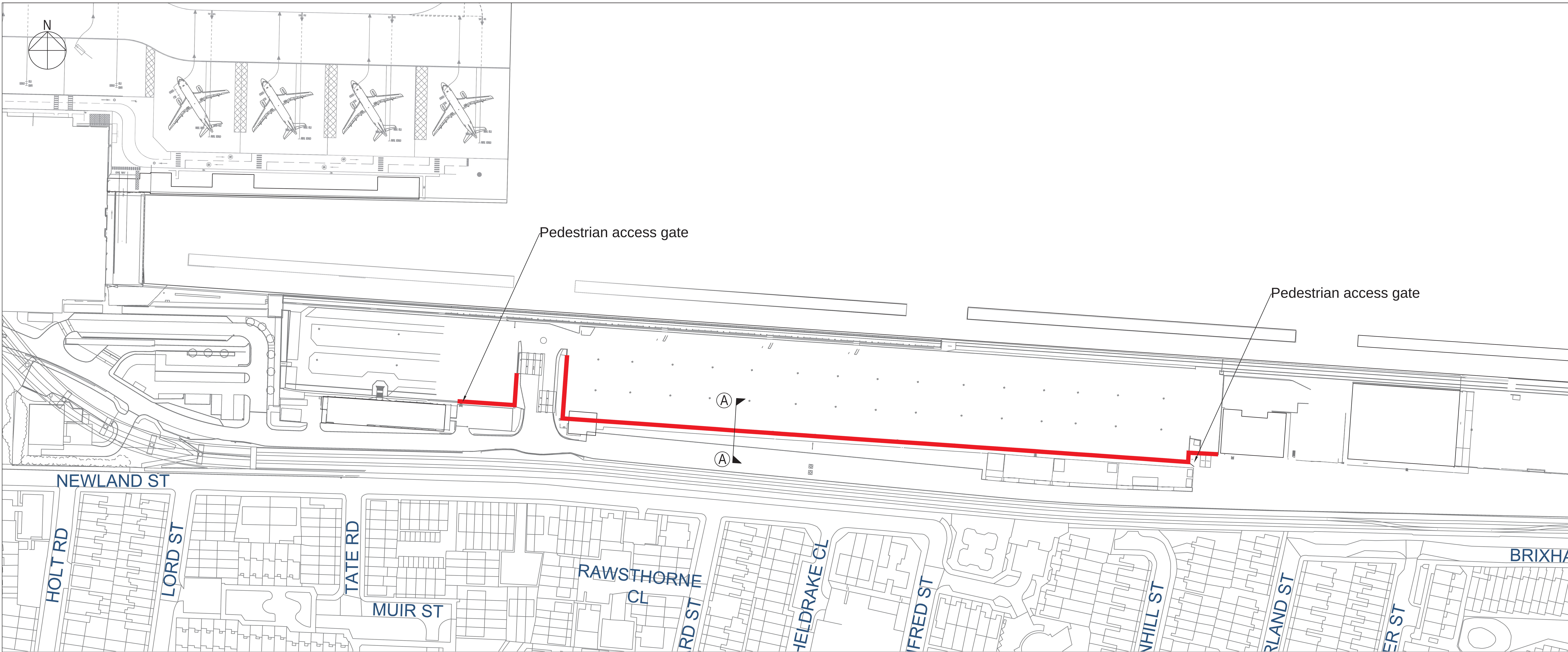
4 The relevant phases will be installed prior to the commencement of any pile and deck installation works in King George V Dock. It is recommended that the barrier remains in place for the duration of such works in each relevant phase of the CADP construction.

5 It is proposed that the temporary noise barrier could be secured by way of an appropriate planning condition, as follows:

A) Prior to commencement of any pile and deck installation works in King George V Dock details of a 3 metre high temporary noise barrier along the southern boundary of the application site together with a phasing plan showing the phases of the works during which each section of the noise barrier shall be erected and maintained shall be submitted to and approved in writing by the local planning authority. The details of the temporary noise barrier shall be in accordance with the specification (including noise attenuation properties) given in Appendix 4.2 the Consolidated Environmental Statement Addendum submitted with the planning application.

B) Prior to the commencement of each phase of the pile and dock installation works in King George V Dock, the section of the approved temporary noise barrier which relates to that phase as shown in the approved phasing plan shall be erected and subsequently maintained in accordance with the approved details and phasing plan to the reasonable satisfaction of the local planning authority.

C) Upon completion of the pile and dock installation works in King George V Dock the temporary noise barrier shall be dismantled removed from the site in its entirety.



BARRIER SEGMENT 1 - PHASE 1 LAYOUT PLAN
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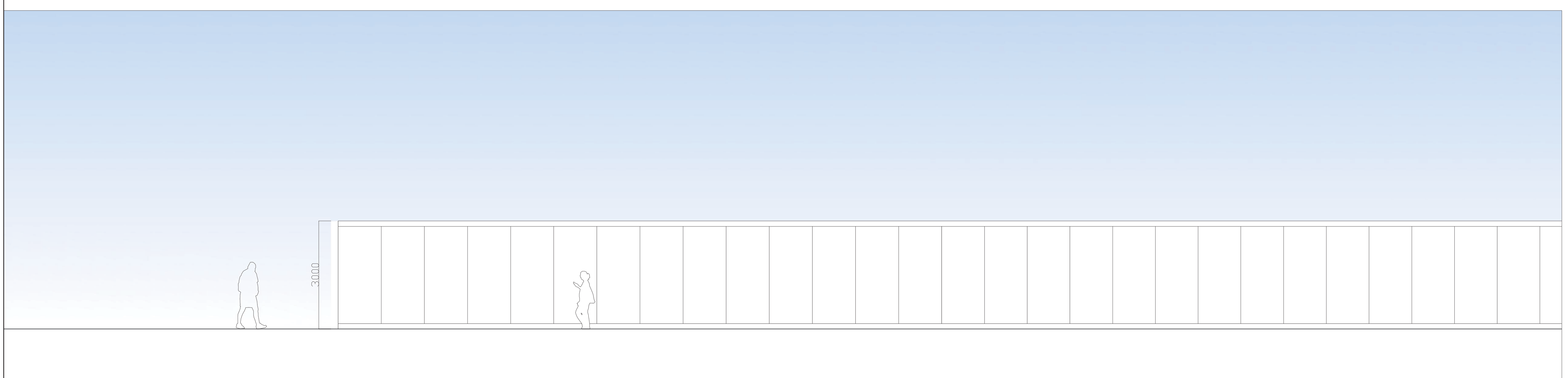

BARRIER SEGMENT 1 - PHASE 1 ELEVATION
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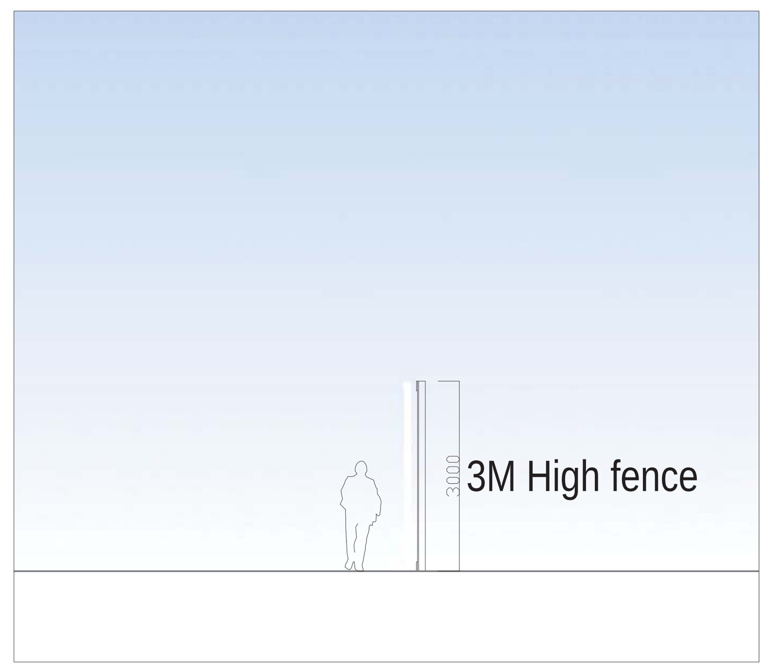

SECTION A-A
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ILLUSTRATIVE DETAIL

ATKINS

KEY

(red line)	Construction noise barrier

DRAWING FOR ILLUSTRATIVE PURPOSES ONLY

Atkins Landscape
Euston Tower, 286 Euston Road, London NW1 3AT
Tel (020) 7121 2000 Fax (020) 7121 2806

Client: London City Airport

Project: City Airport Development Programme

Title: Hartmann Road Construction Noise Barrier

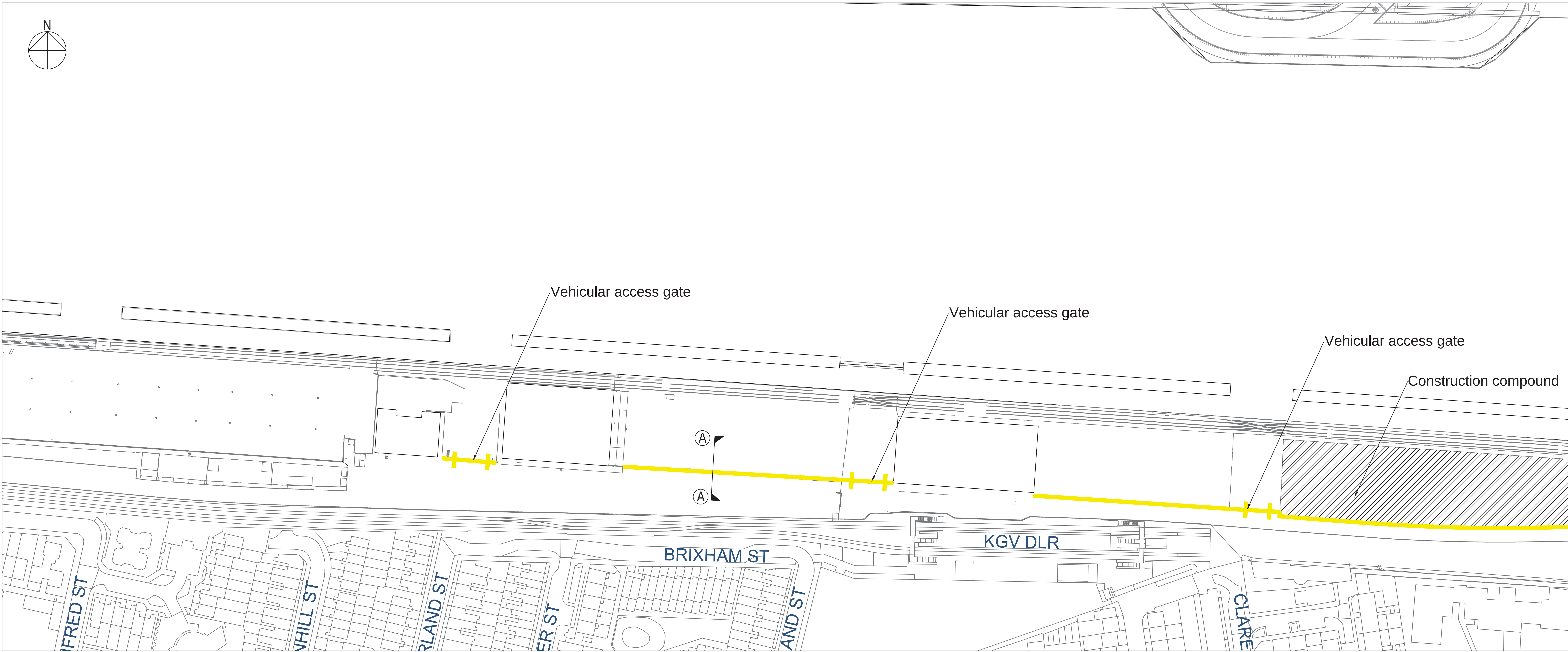
Scale: 1:1000		Original Size: A1	
Originator: EJB	Drawn:	Checked: PR	Authorised:
Date: 06.11.14	Date:	Date: 06.11.14	Date:
Status:	Drawing Number:		Rev:

ATKINS

KEY

Construction noise barrier

Construction compound



BARRIER SEGMENT 2 - PHASE 2 LAYOUT PLAN
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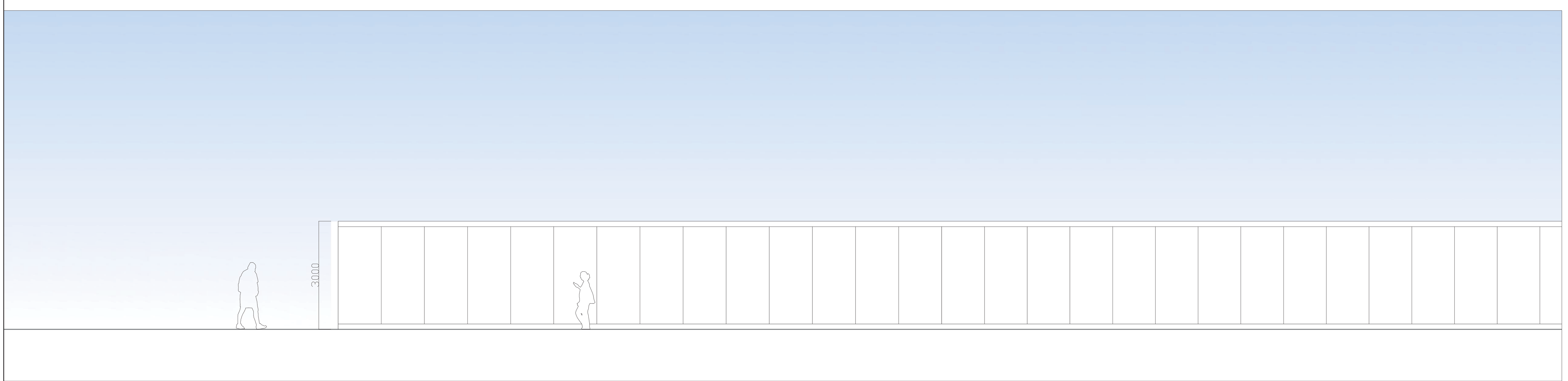


BARRIER SEGMENT 2 - PHASE 2 ELEVATION
1:100@A1

SECTION A-A
1:100@A1

ILLUSTRATIVE DETAIL

DRAWING FOR ILLUSTRATIVE PURPOSES ONLY

Atkins Landscape
Euston Tower, 286 Euston Road, London NW1 3AT
Tel (020) 7121 2000 Fax (020) 7121 2806

Client: London City Airport

Project: City Airport Development Programme

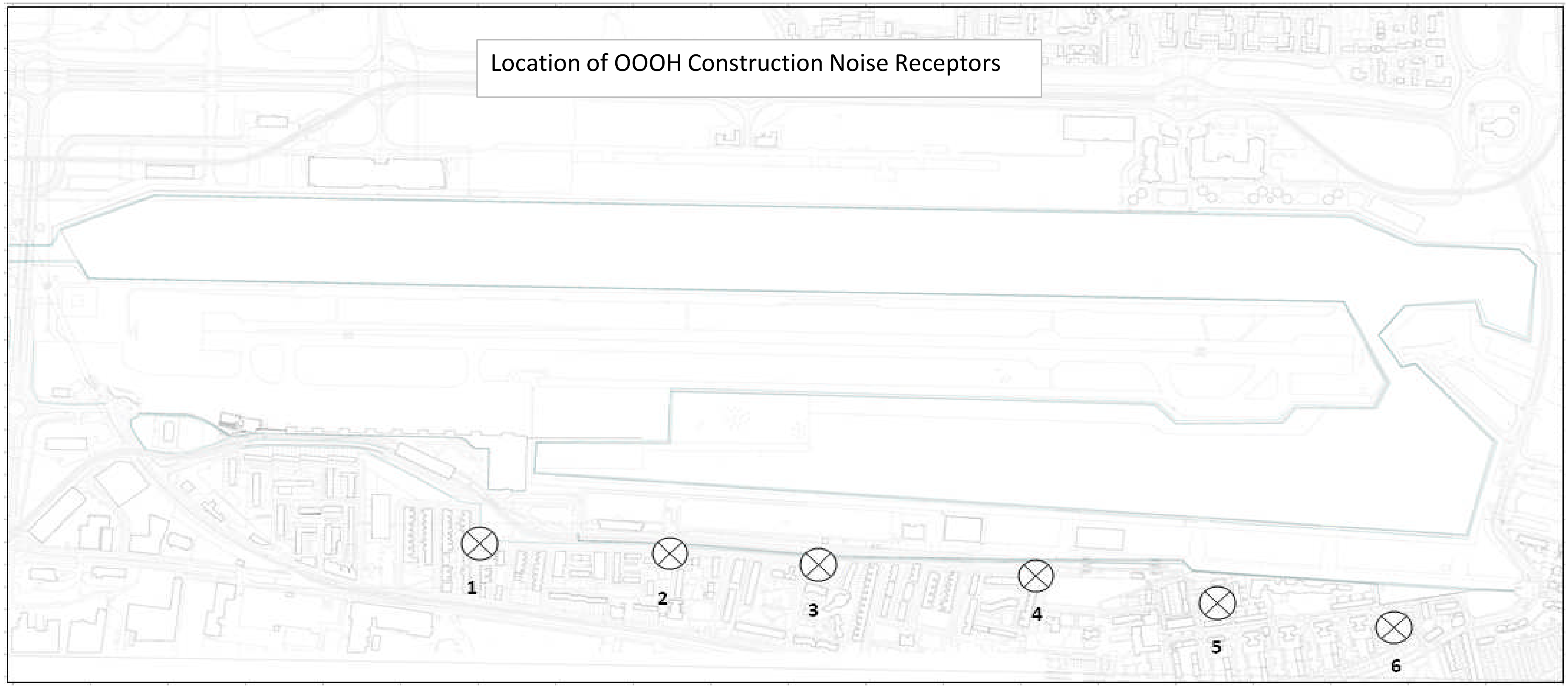
Title: Hartmann Road Construction Noise Barrier

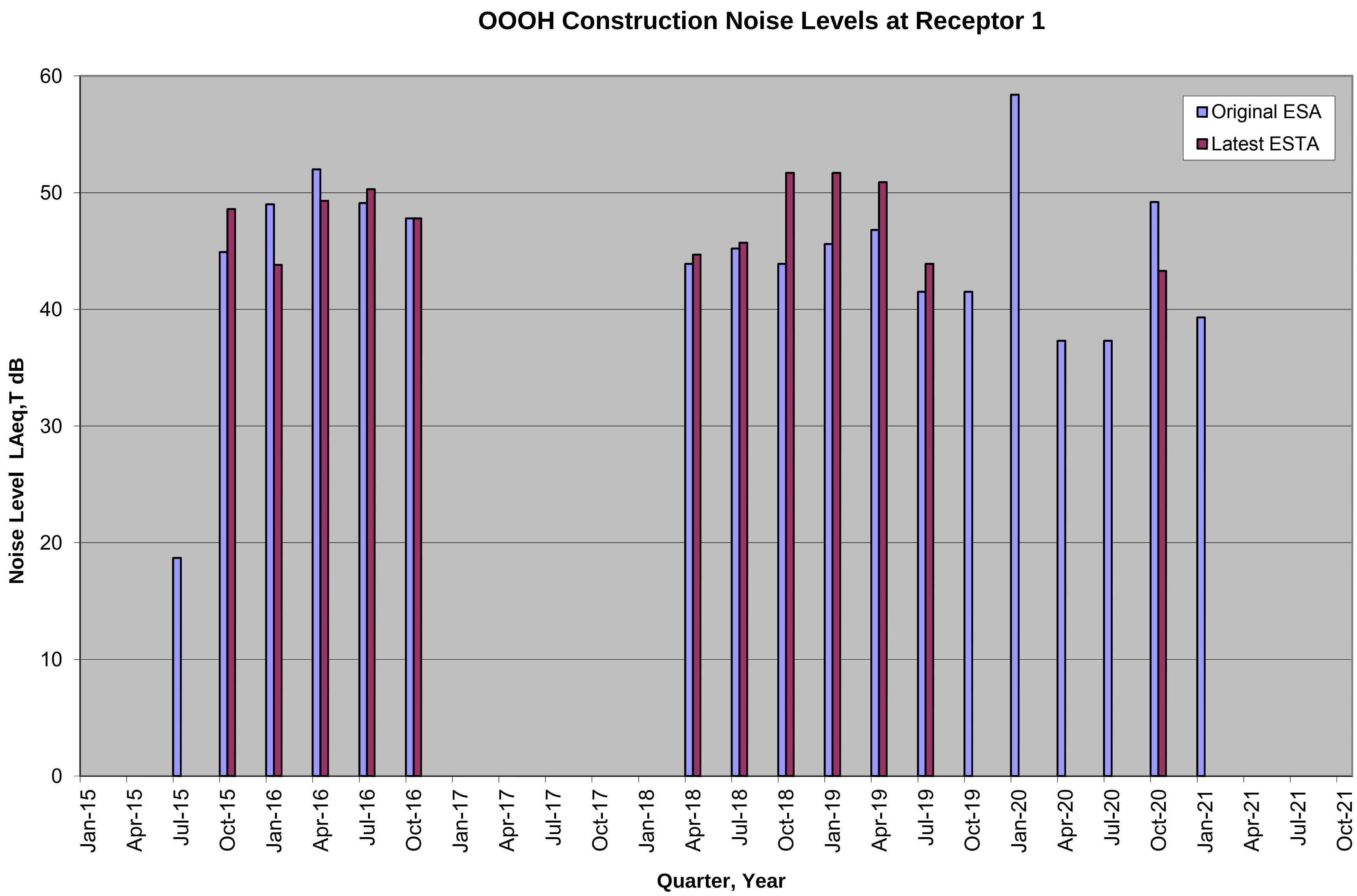
Scale: 1:1000		Original Size: A1	
Originator: EJB	Drawn:	Checked: PR	Authorised:
Date: 06.11.14	Date:	Date: 06.11.14	Date:
Status:	Drawing Number:		Rev:

APPENDIX 4.3

Location of OOOH Construction Noise Receptors

Graphs 1-6 - OOOH Construction Noise Levels at Receptors


Location of OOOH Construction Noise Receptors
1
2
3
4
5
6


OOOH Construction Noise Levels at Receptor 1
Noise Level LAeq,T dB
0
10
20
30
40
50
60
Original ESA
Latest ESTA
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
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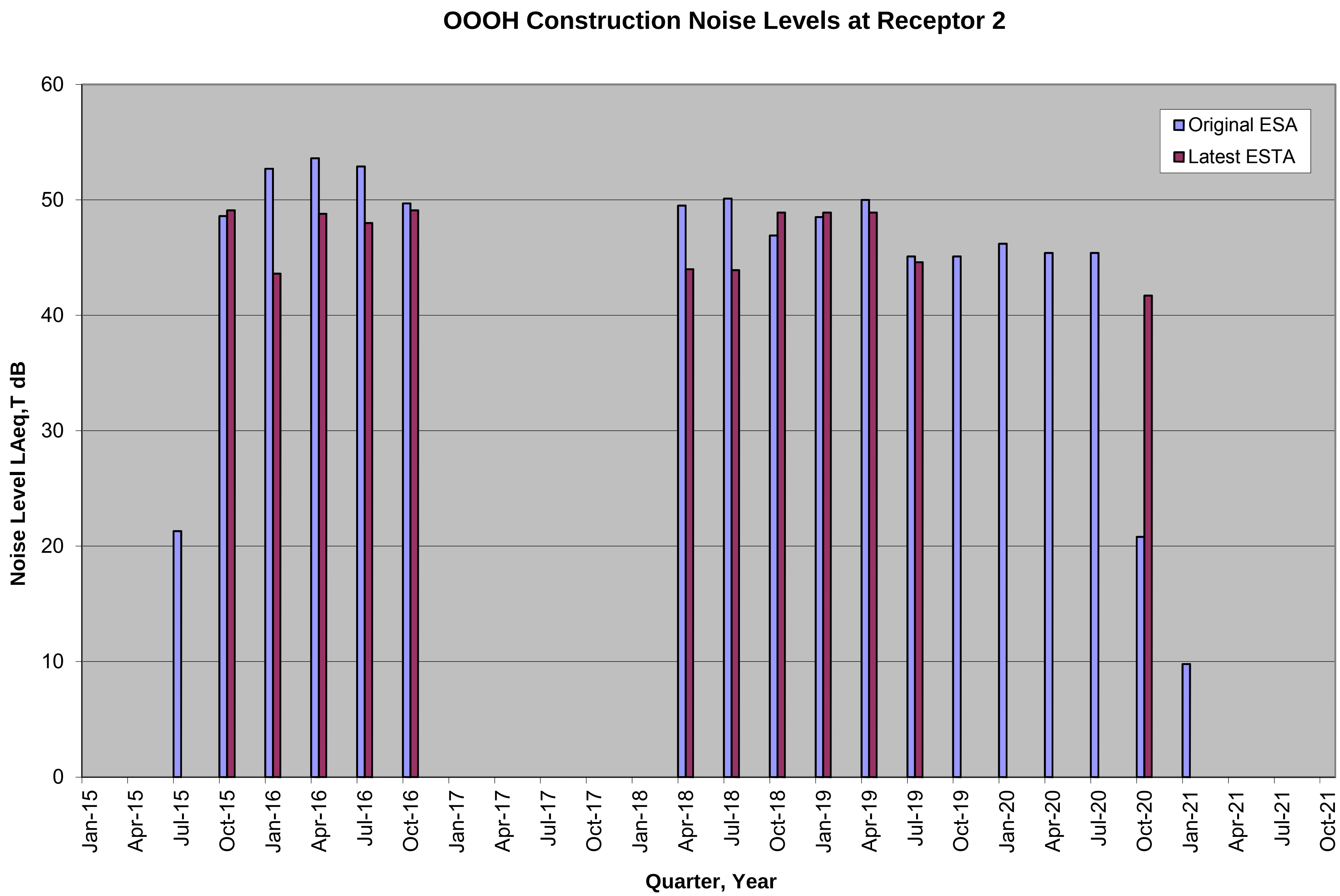
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Quarter, Year


OOOH Construction Noise Levels at Receptor 2
Noise Level LAeq,T dB
Quarter, Year
Original ESA
Latest ESTA
0
10
20
30
40
50
60
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
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Jan-18
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Jul-18
Oct-18
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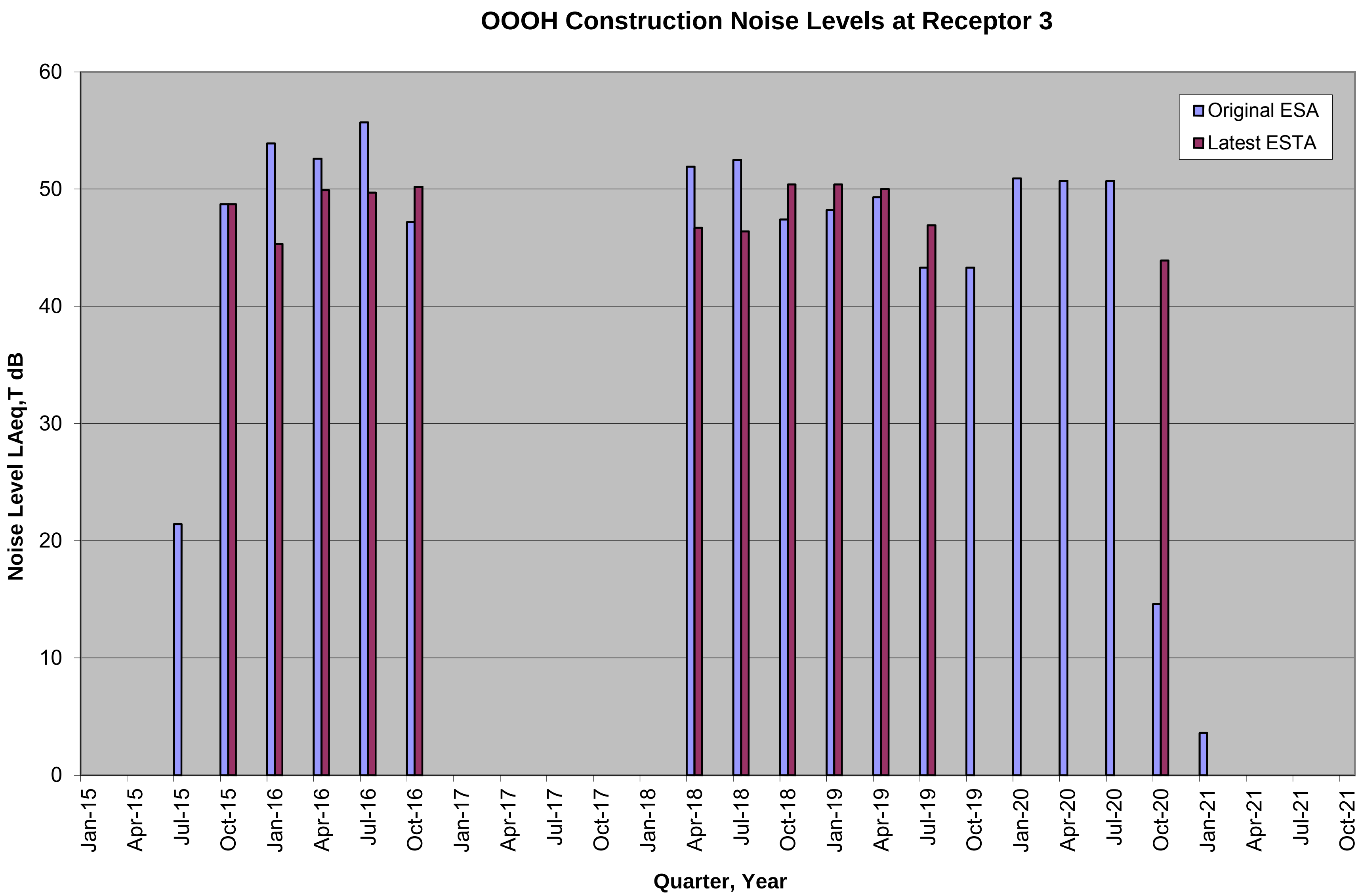
Apr-21
Jul-21
Oct-21


OOOH Construction Noise Levels at Receptor 3
Original ESA
Latest ESTA
Noise Level LAeq,T dB
60
50
40
30
20
10
0
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
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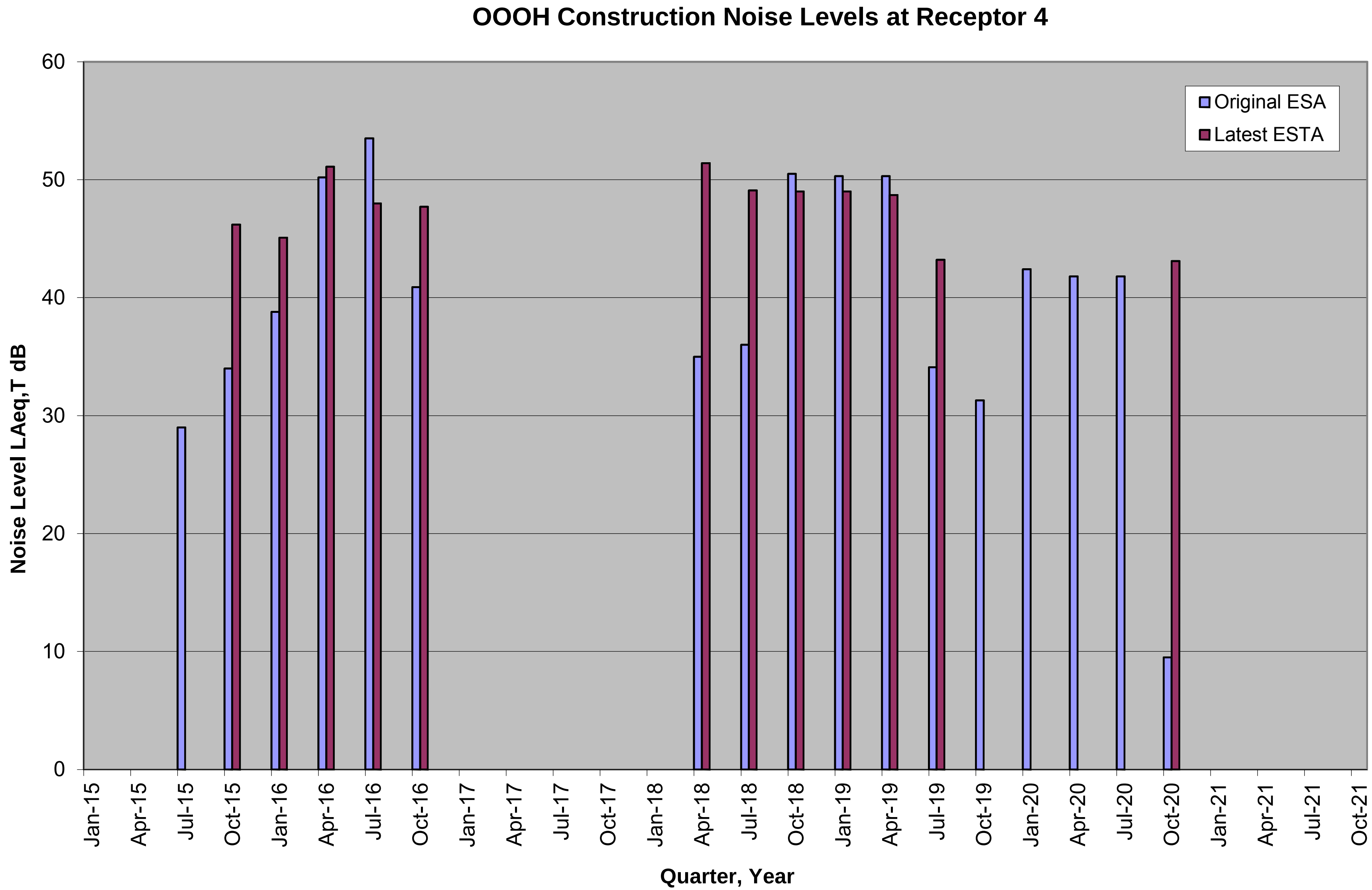
Jul-21
Oct-21
Quarter, Year


OOOH Construction Noise Levels at Receptor 4
Noise Level LAeq,T dB
Quarter, Year
Original ESA
Latest ESTA
0
10
20
30
40
50
60
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
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Oct-17
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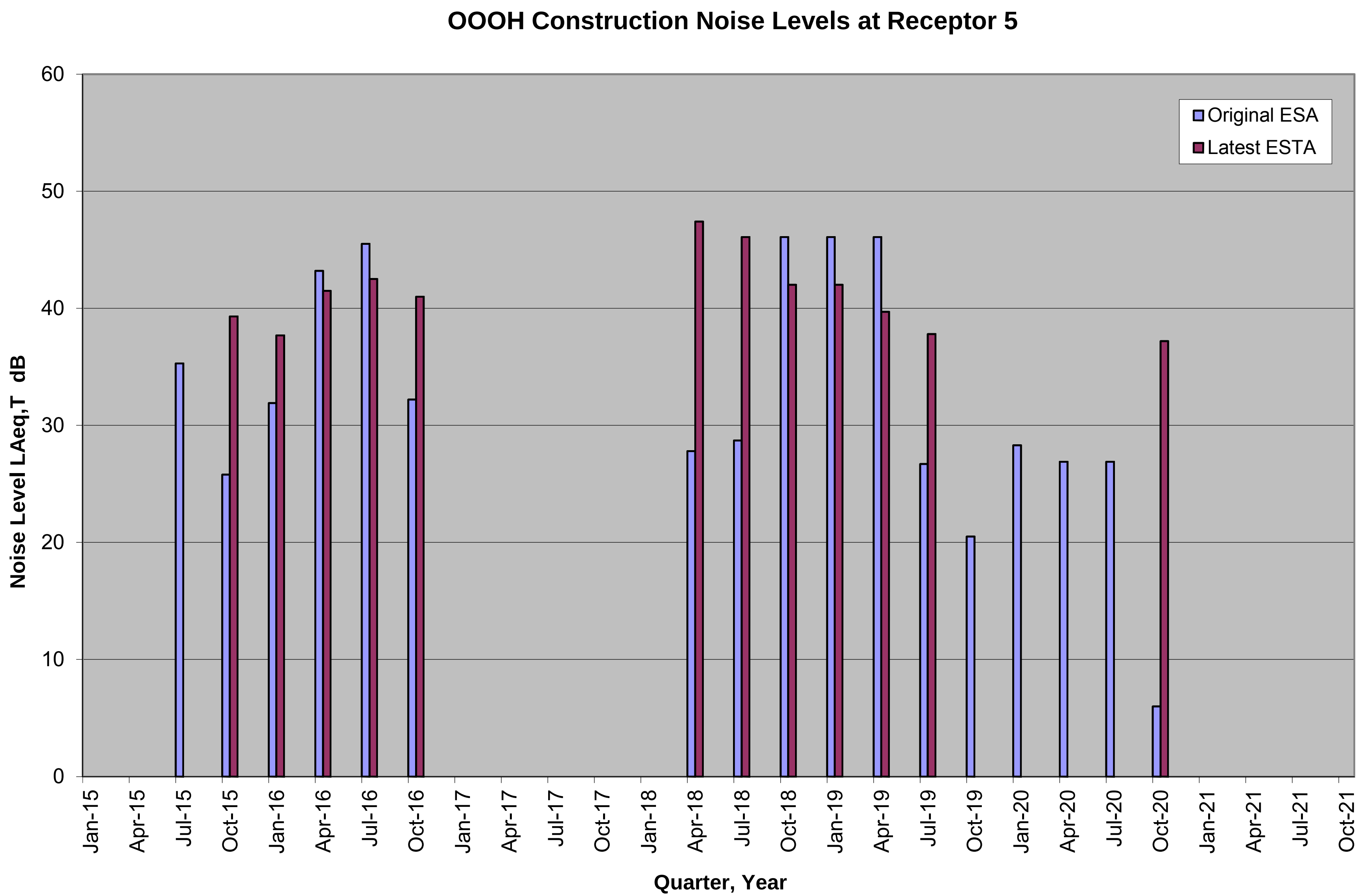
Apr-21
Jul-21
Oct-21



OOOH Construction Noise Levels at Receptor 5
Original ESA
Latest ESTA
Noise Level LAeq,T dB
Quarter, Year
60
50
40
30
20
10
0
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
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Apr-19
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Jan-21
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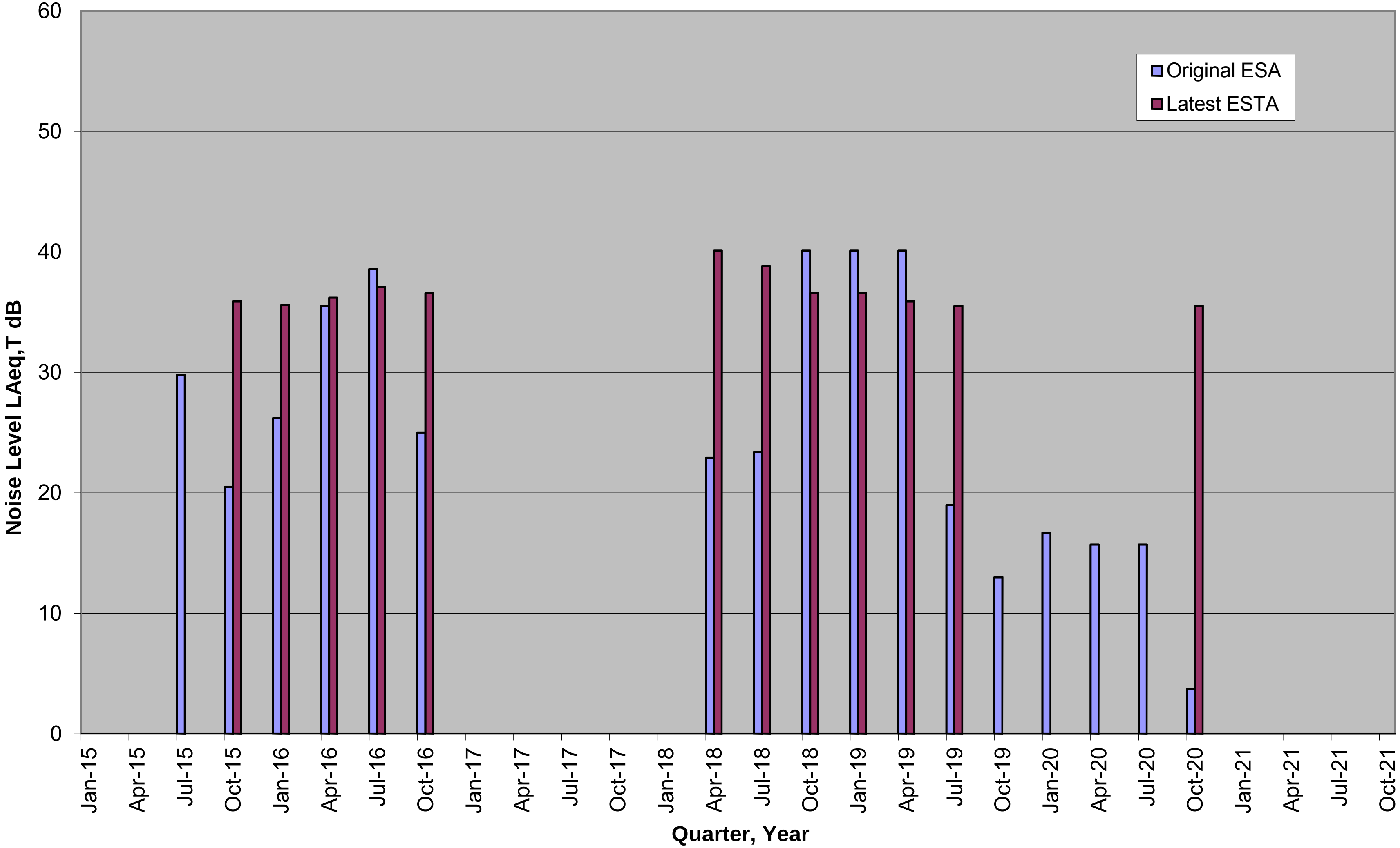
Jul-21
Oct-21

OOOH Construction Noise Levels at Receptor 6



APPENDIX 4.4

Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS)

Bickerdike Allen Partners
Architecture Acoustics Technology

APPENDIX 4.4

LONDON CITY AIRPORT

FRAMEWORK CONSTRUCTION NOISE AND VIBRATION MANAGEMENT AND MITIGATION STRATEGY

1.0 INTRODUCTION

The construction works associated with City Airport Development Programme (CADP) will take place periodically over a number of years, with some works taking place at night. An assessment has been undertaken and is reported in the original Environmental Statement (ES) issued in July 2013, the updated ES Noise and Vibration Chapter 8 and Consolidated Environmental Statement Addendum (CESA) to minimise the amount of night works that need to be undertaken; although there will be periods of weeks or months when such works will be necessary. The nature of the works will be similar in extent and noise emissions to those undertaken for other projects undertaken in the past at London City Airport (LCY), such as the Runway 28 Hold and Eastern Apron Works (known collectively as the Operational Improvement Programme (OIP) works), both of which involved night working.

This Framework Construction Noise and Vibration Management and Mitigation Strategy (CNVMMS) builds on the principles of a scheme that has been used successfully by Bickerdike Allen Partners (BAP) on other sensitive developments, such as the British Museum and also the Victoria and Albert Museum, where the concept of seeking a dispensation is adopted in the event that any works are expected to produce noise and vibration levels above a set threshold level. This ensures that any such works can be reviewed in advance and all appropriate mitigation measures put in place prior to the works commencing.

A key feature of the strategy would require that LCY would undertake noise monitoring as a means of ensuring limits are not exceeded by any appointed contractor. For the CADP, the contractor would still be responsible for monitoring noise and vibration levels as well, to comply with contractual obligations, but would have a secondary responsibility to ensure the overall airport noise limits were not exceeded.

While the first section of this strategy document relates to management of noise, the second section describes the mitigation measures that will be applied where it is demonstrated by measurement or prediction that any dwelling is likely to become exposed to a specified level of construction noise.

2.0 THE MANAGEMENT STRATEGY

2.1 Mechanism of Control

The contractor will be bound by a specification relating to the control of noise and vibration of demolition and construction works. This will set out the contractual obligations to the contractor to ensure that they use plant in compliance with relevant standards and put in place best practicable means wherever necessary to comply with the stringent noise and vibration limits at the boundary of the site. The contractor will be required to produce a detailed Construction Noise and Vibration Management and Monitoring Strategy document that sets out the procedures they propose to comply with such a specification and, as part of the tender process, would need to demonstrate an understanding of the noise and vibration control requirements on the project. The principles of the CNVMMS are set out below and it is proposed that a detailed CNVMMS will be secured by conditions.

2.2 External Noise and Vibration Limits - Contractor

The contractor will be bound by a set of external noise and vibration limits which relate to the boundary of the site where he will be able to monitor noise and vibration within his controlled site. They will be determined by measurement and/or calculation to account for the position of the site boundary relative to the nearest noise sensitive receptor.

The limits will differ according to the times of day and also the period over which the noise is produced, and would be controlled by appropriate planning conditions. .

This concept is much the same as the noise control procedures used on many other building projects and therefore will be familiar to a contractor.

2.3 External Noise Limits - LCY

LCY will deploy one or up to a maximum of two mobile noise monitoring terminals in the region of the nearest noise sensitive buildings to where the construction works are to take place. The mobile nature of the monitor(s) allows ease of deployment from one area to another, as the works progress along the dock.

The external noise limits will relate to levels agreed pursuant to planning conditions, adjusted as necessary to account for the location in which the monitors are to be deployed. For example, if the LCY monitor is closer to the site than the nearest noise sensitive building, which is likely to be the case, an adjustment to account for the different separation distance from the works site will be included. Any mechanism for making such adjustments would be subject to approval with the London Borough of Newham so that these limits are agreed by all relevant parties.

For avoidance of doubt, if the LCY monitors were to be deployed at the site boundary, the limits would be identical to those applicable to the contractor, all else being equal.

2.4 Special Dispensation

If it is expected or predicted that an essential demolition and construction operation is likely to give rise to noise levels at the site boundary higher than the limit(s) specified in the planning conditions and in the contract, then permission must be sought and agreement reached with the LCY Project Manager (PM) before any such operation commences. Permission will be subject to demonstrating that all best practicable measures have been incorporated, including the use of local screening where practicable. Any such permission will be subject to agreement with the local authority and the contractor shall provide all plant and operational data together with associated noise information and expected duration of the works as necessary to secure such an agreement. A full method statement with planned durations of operations and associated noise levels will be submitted to the LCY PM with this request. Any request for this special dispensation, along with associated supporting documentation, must be lodged with the PM at least 14 days before the operation is due to take place. The PM reserves the right to approve or reject the request.

2.5 Community Liaison and Complaint Handling

A key aspect of minimising the impact of noise and vibration around the site will be the maintenance of good relations with those people living and working in the vicinity of the Airport site. The Airport or its contractors will appoint a person to be responsible for liaison with the local community in order to keep them informed of progress and for providing a means of treating complaints fairly and expeditiously. A progress reporting procedure shall be put into place by the contractor to regularly inform a community liaison committee comprising resident representatives (for example from the airport's Consultative Committee), London Borough of Newham representative and airport representative.

A comprehensive complaints management scheme will be put in place by the contractor and a dedicated channel (telephone line) provided to facilitate and receive complaints on a 24 hour basis. The scheme will define the means by which complaints are received, recorded, monitored, actioned and reported. Such a scheme will be subject to approval by the PM and also the London Borough of Newham.

2.6 Noise and Vibration Monitoring

2.6.1 Noise Measurement

The Contractor will be required to undertake noise monitoring continuously throughout the contract to ensure that demolition and construction works and associated activities are being undertaken in a manner that ensures compliance with the specified noise level limits. The Contractor will also be required to undertake manual short-term noise measurements regularly as necessary to verify that the continuous noise monitoring is adequately reflecting the impact of noise on the surrounding buildings.

Additional to the above, noise monitoring will be undertaken at one or more locations continuously around the site throughout the duration of the works by LCY to verify that the continuous noise monitoring is adequately reflecting the impact of noise on the surrounding buildings and that the construction noise levels are in compliance with planning requirements.

2.6.2 Vibration Measurement

The Contractor shall have available on site suitable vibration monitoring equipment to demonstrate compliance with the specified vibration level limits. The equipment shall be capable of monitoring peak particle velocity in three mutually perpendicular axes and shall be capable of measuring down to 0.1 mm/s.

2.6.3 Contractor Noise Monitoring Alert System

The contractor shall operate an alert or traffic light type system to warn operatives and the construction manager when the site boundary noise limit is being approached and when it is being exceeded. This will provide the facility for LCY and the construction team to monitor whether limits are being approached.

2.6.4 Presentation of Noise Data

The contractor shall ensure that the noise data from its continuous noise monitoring system is accessible in real time (as far as practically possible) via a web based system that is available to all relevant parties for viewing.

2.6.5 LCY Noise Monitoring System

LCY shall independently operate an alert system associated with their noise monitoring system that identifies when the planning boundary limit is being approached (First Action Level - Orange alert) and when it has been exceeded (Second Action Level - Red alert). Text and e-mail alerts will be sent to the contractor and other relevant personnel to advise of this situation. An agreed procedure will be in place concerning what action arises as a result of such alerts occurring. The expectation is that works would be ceased on site should a red alert occur until an agreed set of actions are undertaken to reduce the noise levels to within agreed limits.

2.7 Liability for Cessation of Works due to noise Limit Exceedance

It shall be the liability of the contractor to ensure works are carried out in a manner that conforms with the noise and vibration limits specified at the site boundary. In the event that an exceedance of the first or second action level of the LCY system occurs and it becomes necessary to cease works, an investigation shall be undertaken to check whether the cause of the exceedance is due to contractor related construction processes and also whether the noise limit requirements specified in the contract at the site boundary have been exceeded. If either is proven, the Contractor shall be held responsible for the cessation of the works. If the site boundary limits are not exceeded, and the cause of the exceedance does not relate to site activity, liability for cessation will not lie with the Contractor (for example, this could occur in the event that a car or lorry, not related to the works, parks close to the LCY monitor with its engine running).

3.0 THE MITIGATION STRATEGY

3.1 Construction Noise Insulation Scheme

The detailed CNVMMS to be prepared by the contractor will include provisions for a noise insulation scheme where appropriate. The scheme is intended to provide additional protection to residents in the event that it is not practicable to mitigate or reduce exposure to construction noise, during certain construction phases. The contractor will undertake and submit the results of a construction noise assessment to LCY. In doing so, it will identify any properties that it expects to be eligible for sound insulation works under this scheme. It will do this at least six months prior to starting the relevant phase of work on site or such time appropriate to the scale and nature of the works, as agreed with LCY.

The contractor will use best practicable means to minimise the extent to which noise insulation works to dwellings adjacent to the works need to be considered.

A two tier construction noise insulation scheme will be offered which in principle will provide the same packages of sound insulation improvement measures that are offered under the airport's existing sound insulation scheme.

The First Tier Works package will be offered to qualifying parties that previously did not accept treatment under the airport's existing sound insulation scheme if construction noise levels are predicted or measured to exceed at night (between the hours of 23.00 and 07.00) 50 dB $L_{Aeq,15min}$ (for at least ten days out of any period of fifteen consecutive days or alternatively 40 days in any six month period.

The Second Tier Works package will be offered to qualifying parties if noise levels are predicted or measured to exceed the relevant trigger level defined in Table 1 for at least ten days out of any period of fifteen consecutive days or alternatively 40 days in any six month period.

The relevant trigger levels are shown in Table 1.

Day	Time	Averaging period, T	Noise insulation trigger level L_{Aeq}
Monday to Friday	0800 to 1800	10	75
	1800 to 2300	1 hr	55
Saturday	0800 to 1300	5 hr	75
Saturday	1300 to 2300	1 hr	55
Sunday	0800 to 2300	1 hr	55
Any day	2300-0800	15 min	55

Table 1 - Construction noise thresholds for noise insulation

Eligibility for the scheme will depend on the predicted or measured noise level following the re-assessment that will be carried out for that purpose once detailed construction plans are in place and as proposed by way of condition. The method of construction noise assessment shall be in keeping with recognised good practice and in accordance with recognised standards and guidelines. If the noise assessment indicates that a property is eligible, the offer of noise insulation will be made in accordance with the First or Second Tier Works Procedure (which ever is relevant) set out in LCY's current Section 106 Agreement dated July 2009 or in accordance with an alternative procedure and timescales as agreed with LCY and the Local Authority. If accepted and all necessary approvals obtained, the insulation works shall be installed before the construction works that are assessed to impact the dwelling shall commence.

The form and extent of works to be offered to the owner/occupier of an eligible dwelling will be in line with the First Tier Works or Second Tier Works described in LCY's current Section 106 Agreement dated July 2009 or as alternatively agreed with LCY and the London Borough of

Newham. The First Tier Works and Second Tier Works and First Tier Works Procedure and Second Tier Works Procedure on which the scheme will be based are described in Appendix A of this CNVMMS.

3.2 Construction Noise Additional Mitigation for Exceptional Circumstances

The CNVMMS to be prepared by the contractor will include provision~~s~~ for construction noise mitigation where, by prediction or measurement, it is established that residents will or have become exposed to construction noise levels above specified trigger levels —which shall be representative of exceptional circumstances.

The contractor will also make provision within the CNVMMS for acceptance at the PM's discretion of applications from residents for additional construction noise mitigation supported by evidence of other exceptional circumstances, such as night shift working patterns, those working in home occupations, local businesses or buildings that provide community facilities requiring a particularly quiet environment and those with a medical condition which will be seriously aggravated by construction noise.

The contractor, with PM agreement, will specify the additional mitigation which will be made available in these exceptional circumstances and consideration will be given to the possibility of introducing a scheme for temporary re-housing if appropriate.

4.0 THE OPERATION OF THIS STRATEGY

The intention would be for this strategy to be in place throughout the duration of the CADP construction activity. This will ensure that the community is adequately protected throughout the works and at all times of the day or night when construction works are likely to take place.

* * * * * * * * * *

APPENDIX A

LCY FIRST AND SECOND TIER WORKS AND FIRST AND SECOND TIER WORKS PROCEDURES

(ExtractS from Planning Obligation by Deed of Agreement under Section 106 of the Town and Country Planning Act 1990 relating to London City Airport, The Royal Docks, London E16 2PX dated July 2009)

FIRST TIER WORKS AND

FIRST TIER WORKS PROCEDURE

First Tier Works mean:

1 Scope of Works

Subject to the remainder of this Part of the Ninth Schedule:

(a) for single-glazed properties, secondary glazing and sound-attenuating vents;

(b) for double-glazed properties, sound-attenuating vents only.

2 Elevations to be treated

Windows and external doors to Habitable Rooms on the following elevations:

(a) for premises in zones A and C identified on the Elevation Treatment Plan all elevations;

(b) for premises in zone B identified on the Elevation Treatment Plan only the south east and west facing elevations;

(c) for premises in zone D identified on the Elevation Treatment Plan only the north east and west facing elevations.

3 Rooms to be treated

Habitable Rooms.

4 Acoustic standard

The installation shall produce an average sound reduction not less than 25 dB averaged over 100 to 3150 Hz in accordance with the procedure of British Standard Publication BS EN ISP 140: Part 5.

5 Glazing specification

5.1 An initial survey of the windows to be treated shall be undertaken followed by a schedule of existing defects which is to be agreed by LCA the Council and the occupiers of the properties. LCA and the Council shall agree which defects must be remedied to ensure that the noise insulation meets the required acoustic standard and/or so that it can be satisfactorily fixed, and shall also agree how the costs of any such remedial work shall be apportioned.

5.2 The Airport Companies shall carry out the works required under paragraph 1(a) of this Part unless the defects referred to in paragraph 5.1 of this Part are so considerable that the Airport Companies are unable to carry out the works effectively in which case they will notify the owner/occupier of the relevant property as well as the Council with a view to the defects being remedied by the owner/occupier following which the works required under paragraph 1(a) of this Part will be undertaken.

5.3 The type of secondary glazing units fitted shall relate to the form of the primary windows. The design of secondary units shall be such as to facilitate cleaning of both surfaces of the primary windows from within the treated room. Secondary units shall be either a side-hung casement type, or horizontally or vertically sliding units. Quotations shall be accompanied by full details of the systems offered.

5.4 The secondary system shall generally comprise 4mm float glass within white polyester powder-coated aluminium frames. 6mm float glass and toughened glass shall be used where required by B.S. 6206 for safety reasons. Anodic oxidation shall comply with British Standard 1615.

5.5 The minimum air gap between primary and secondary panes is to be 100mm, where this can be accommodated within existing reveals.

(d) Where the reveal depth is insufficient to achieve an air gap of 100mm, secondary glazing shall be fitted flush with the inner face of existing walls subject to a minimum of 50mm being achieved.

(e) Where a minimum air gap of 50mm cannot be achieved within existing reveals and with the secondary glazing fitted flush with the inner face of existing walls boxing out of the reveals will be necessary. In these cases the reveals shall be boxed out to achieve a minimum reveal depth of 67mm.

(f) In all cases where a minimum gap of 100mm cannot be achieved the glass thickness of the secondary pane shall be increased to 6mm.

(g) The top and side reveals between primary and secondary windows are to be lined with an approved sound absorbent material treated with a suitable fungicide.

5.6 The secondary glazing system is to be mounted on a timber frame with white gloss painted finish. Any gaps between sub-frame and reveal shall be sealed with an approved resilient sealant.

5.7 Where it is necessary to remove and refix existing curtain tracks, pelmets etc., this is to be undertaken by the secondary glazing installer.

6 Doors

External doors to habitable rooms will be fitted with weatherstrip seals (approved by the Council) to the thresholds, jambs and heads. Opening fanlights over doors shall be sealed and fixed in a closed position. Glazed doors and fanlights shall not be fitted with secondary glazing where the sealing measures meet the performance required in paragraph 4.

7 Ventilation

7.1 Existing air bricks within Habitable Rooms shall be replaced by permanent sound-attenuating passive vents.

7.2 In addition to the replacement of existing air bricks by permanent sound attenuating vents, either two permanent sound attenuating vents or one combined mechanical and permanent sound-attenuating vent shall be provided in each room. All vents shall be in accordance with the standards given in the Noise Insulation Regulations. Mechanical vents shall be wired to the domestic supply in compliance with current IEE Regulations. Suitable ducting shall be provided from room to outside air, complete with an external grille.

8 Building and gas regulations

8.1 The secondary glazing installer shall be responsible for ensuring that the property meets the ventilation requirements of the current Building and Gas Regulations on completion of sound insulation works. All additional ventilation shall be sound attenuated as provided in paragraph 7.2.

8.2 Any requirements for additional ventilation in the future arising from amendments to the building, to its gas appliance or the Regulations, shall be the responsibility of the building owner.

9 Blinds

Free hanging venetian blinds, or similar, are to be supplied and fitted between primary and secondary windows to eligible rooms and elevations. Blinds are to be white, with tilt mechanism. In no case shall it be required that blinds be fitted where following the agreement of the owners of the property it is decided that such installation would be impracticable.

Part 1 - First Tier Works Procedure

3 When it has been established that premises have First Tier Works Eligibility the Airport Companies shall notify within 30 days the owner and the occupier of such premises of the First Tier Works Eligibility and subsequently within six months of establishing First Tier Works Eligibility seek permission from the occupier and owner (if different) of such premises to carry out the First Tier Works.

2 Subject to the grant of the requisite permission as provided in paragraph 3 of this Part and subject to paragraph 3 of this Part, the Airport Companies shall carry out the First Tier Works to such premises within six months (or such longer period as shall be agreed in writing with the Council) of the receipt of such permission.

3 In the event that the existing defects referred to in paragraph 5.1 of Part 5 of this Schedule (First Tier Works) are so considerable that the Airport Companies are unable to carry out the works at paragraph 1(a) of Part 5 of this Schedule the Airport Companies shall first notify the owner/occupier of the relevant property and request that the owner/occupier undertakes remedial measures in respect of those defects and the Airport Companies shall only be obliged to carry out such works after the defects have been remedied and within six months of receipt of written notice confirming the same.

4 When permission is sought to carry out the First Tier Works in any premises which have single-glazed windows and doors the Airport Companies shall offer in the alternative to undertaking the glazing elements of the First Tier Works a contribution towards the cost of installation of new double glazing which provides sound insulation to the same acoustic standard as the First Tier Works Provided That such contribution shall be a sum of money equivalent to the cost that the Airport Companies would have incurred in the provision and installation of the secondary glazing to the relevant premises as calculated at the date of the proposed installation of the First Tier Works (for the avoidance of doubt excluding the cost of installation of sound attenuated passive or mechanical ventilation and other measures specified in the First Tier Works).

5 For the avoidance of doubt in relation to any residential premises the Airport Companies shall be deemed to have fully discharged from their obligations to undertake the First Tier Works in the event that:

(a) the First Tier Works if required at the premises have been completed satisfactorily or any payment in the alternative to the First Tier Works has been made;

(b) the Airport Companies have under paragraph 3 of this Part notified the owner/occupier of the relevant premises and the Council of the existing defects in the relevant premises and requested that they are remedied on at least two occasions and the Airport Companies have not received notice confirming that such defects have been remedied PROVIDED THAT:

(i) the second occasion on which the Airport Companies give notice is at least three months after the first occasion; and

(ii) on the second occasion the owner and the occupier (if different) are notified in writing that this represents the final opportunity to remedy existing defects and benefit from the First Tier Works; and

(iii) at least three months have elapsed since the second occasion; and

(iv) the Airport Companies have notified the Council in writing of the events set out in paragraphs 5(b)(i) to (iii) of this Part;

(c) the Airport Companies shall have sought permission for the First Tier Works and/or in the case of a Listed Building permission for inspection of the premises pursuant to paragraph 3 of Part 2 of the Fourth Schedule from the owner and the occupier of the premises on at least two occasions and such permission has not been given by the owner and/or the occupier (either because it has been refused or the owner or the occupier has failed to answer) PROVIDED THAT:

(i) the second occasion on which the Airport Companies seek permission is at least three months after the first occasion; and

(ii) on the second occasion the owner and the occupier (if different) are notified in writing that this represents the final opportunity to give permission and benefit from the First Tier Works; and

(iii) at least three months have elapsed since the second occasion;

(iv) the Airport Companies have notified the Council in writing of the events set out in paragraphs 5(c)(i) to (iii).

SECOND TIER WORKS AND

SECOND TIER WORKS AND PROCEDURE

1 *Second Tier Works*

Second Tier Works means: the works described in this Part to improve further the standard of sound insulation specified in the First Tier Works and provision of any necessary acoustic ventilation as specified in the First Tier Works.

2 *Eligible rooms*

2.1 Any Habitable Room is eligible.

3 *Elevations to be treated*

3.1 All elevations are eligible for Second Tier Works.

4 *Glazing specification*

4.1 The Second Tier Works contractor shall initially carry out a survey of the windows to be treated and shall produce a survey report including information on current window specification (secondary glazing/thermal double or single), opening type, and any significant defects to the primary and, if applicable, secondary glazing to be agreed by LCA the Council and the occupiers of the properties. LCA and the Council shall agree which defects must be remedied to ensure that the Second Tier Works noise insulation meets the required acoustic design standard and/or so that it can be satisfactorily fixed, and shall also agree how the costs of any such remedial work shall be apportioned.

4.2 Where reasonably practicable an offer of secondary glazing and sound attenuating ventilators or a contribution towards the cost of installing high acoustic performance double glazing and sound attenuating ventilators will be made for habitable rooms with existing thermal double or single glazing of a satisfactory standard PROVIDED THAT:

(a) The type of secondary glazing units fitted shall relate to the form of the primary windows. The design of secondary units shall be such as to facilitate cleaning of both surfaces of the primary windows from within the treated room. Secondary units shall be either a side-hung casement type, or horizontally or vertically sliding units. Quotations shall be accompanied by full details of the systems offered.

(b) The installation of the high acoustic performance double glazed windows and sound attenuating ventilators will be carried out by the Second Tier Works contractor.

(c) Any contribution payable by LCA shall be equivalent to the cost of installing secondary glazing and sound attenuating ventilators.

4.3 Where it is not reasonably practicable to install secondary glazing over a primary thermal double glazed window within a habitable room an offer of a contribution towards high acoustic performance replacement double glazed windows and sound attenuating ventilators will be made up to a limit of 25% above the cost of installing secondary glazing and sound attenuating ventilation.

4.4 Where a surveyed existing double glazed window within a habitable room is found to have defects as a result of reasonable use the residential building owner will be entitled to either:

(d) remedial works to the existing double-glazed window and the provision of a secondary system as described below and sound attenuating ventilators; or

(e) a contribution towards the cost of installing high acoustic performance double glazing and sound attenuating ventilators (payable on such installation) equivalent to the cost of the remedial works referred to in paragraph 4.4(a) above.

4.5 Where a surveyed secondary glazed window within a Habitable Room with a primary single-glazed window is found to be in satisfactory order an offer of sound attenuating vents will be made if not present and an offer to alter the existing secondary glazed window to achieve an equivalent mean sound reduction index (100 to 3150 Hz) to the secondary glazing specification described in 4.6 and 4.7 below as determined using BS EN ISO 140 Part 1 as set out in 4.7 below.

4.6 The secondary system shall generally comprise 4mm float glass within white polyester powder-coated aluminium frames. 6mm float glass and toughened glass shall be used where required by B.S. 6206 for safety reasons. Anodic oxidation shall comply with British Standard 1615.

4.7 The minimum air gap between primary and secondary panes is to be 100mm, where this can be accommodated within existing reveals PROVIDED THAT:

(a) Where the reveal depth is insufficient to achieve an air gap of 100mm, secondary glazing shall be fitted flush with the inner face of existing walls subject to a minimum of 75mm being achieved.

(b) Where a minimum air gap of 75mm cannot be achieved within existing reveals and with the secondary glazing fitted flush with the inner face of existing walls boxing out of the reveals will be necessary. In these cases the reveals shall be boxed out to achieve a minimum reveal depth of 75mm.

(c) In all cases where a minimum gap of 100mm cannot be achieved the glass thickness of the secondary pane shall be increased to 6mm.

(d) The top and side reveals between primary and secondary windows are to be lined with an approved sound absorbent material treated with a suitable fungicide.

4.8 The secondary glazing system is to be mounted on a timber frame with painted finish. Any gaps between sub-frame and reveal shall be sealed with an approved resilient sealant.

4.9 The high acoustic performance double glazed unit shall generally comprise 10mm glass /12mm cavity/6.8mm acoustic laminated glass within a UPVC or aluminium frame. Toughened glass shall be used where required for safety reasons.

4.10 The high acoustic performance double glazed unit shall be designed to comply with relevant thermal efficiency requirements of the Building Regulations (Approved Document L).

4.11 Where it is necessary to remove and refix existing curtain tracks, pelmets etc., this is to be undertaken by the Second Tier Works contractor.

5 *Doors*

5.1 External doors to Habitable Rooms will be fitted with high acoustic and weather specification seals (approved by the Council) to the thresholds, jambs and heads. Opening fanlights over doors shall be sealed and fixed in a closed position. Glazed doors and fanlights shall be evaluated on an individual case by case basis to ensure sufficient sound insulation provision is achieved.

5.2 Fully glazed or patio doors or French windows will be treated as windows for consideration of eligibility.

6 *Ventilation*

6.1 Second Tier Works will only be carried out with appropriate sound attenuating ventilators.

6.2 Existing air bricks within habitable rooms shall be replaced by permanent sound- attenuating vents.

6.3 In addition to the replacement of existing air bricks by permanent sound attenuating vents, either two permanent sound attenuating vents or one combined mechanical and permanent sound-attenuating vent shall be provided in each room. All vents shall be in accordance with the standards given in the Noise Insulation Regulations. Mechanical vents shall be wired to the domestic supply in compliance with current IEE Regulations. Suitable ducting shall be provided from room to outside air, complete with an external grille.

7 *Loft insulation*

7.1 Where applicable an offer of installation of loft insulation will be made.

7.2 Where no loft insulation is present 250mm thick thermal grade mineral wool insulation will be laid in the loft.

7.3 Where existing loft insulation is found to be unsatisfactory further layers of insulation will be added to increase the total thickness of insulation to 250mm.

8 *Building, gas and electric regulations*

8.1 The Second Tier Works installer shall be responsible for ensuring that the property meets the ventilation requirements of the current Building and Gas Regulations on completion of sound insulation works. All additional ventilation shall be sound attenuated as provided in paragraph 6 of this Part.

8.2 Any requirements for additional ventilation in the future arising from amendments to the building, to its gas appliance or the Regulations, shall be the responsibility of the building owner or occupier, as the case may be.

9 *Blinds*

9.1 Free hanging venetian blinds are to be supplied and fitted between primary and secondary windows to eligible rooms. Blinds are to be white, with tilt mechanism. In no case shall it be required that blinds be fitted where following the agreement of the owners of the property it is decided that such installation would be impracticable.

Part 2 - Second Tier Works Procedure

1 When it has been established that premises have Second Tier Works Eligibility LCA shall within 30 days notify the owner and the occupier of such premises of the Second Tier Works Eligibility and subsequently within six months of establishing Second Tier Works Eligibility (except in the first year of establishing Second Tier Works Eligibility when the period shall be nine months and otherwise unless the Council agrees to a longer period) seek permission from the occupier and owner (if different) of such premises to carry out the Second Tier Works.

2 Subject to the grant of the requisite permission as provided in paragraph 1 of this Part, LCA shall carry out the Second Tier Works to such premises within six months of the receipt of such permission (except in the first year of establishing Second Tier Works Eligibility when the period shall be nine months and otherwise unless the Council agrees to a longer period).

3 In the event that the existing defects referred to in paragraph 4.1 of Part 15 of this Schedule (Second Tier Works) are so considerable that the Airport Companies are unable to carry out the glazing elements of works referred to at paragraph 1 of Part 15 of this Schedule, the Airport Companies shall first notify the owner/occupier of the relevant premises and request that the owner/occupier undertakes remedial measures in respect of those defects and the Airport Companies shall only be obliged to carry out such works after the defects have been remedied and within six months of receipt of written notice confirming the same (or in the first year of establishing Second Tier Works Eligibility, within nine months of receipt of written notice confirming the same).

4 For the avoidance of doubt in relation to any residential premises the Airport Companies shall be fully discharged from their obligations to undertake the Second Tier Works in the event that:

(a) the Second Tier Works if required at the premises have been completed satisfactorily or any payment in the alternative to the Second Tier Works has been made;

(b) the Airport Companies under paragraph 3 of this Part have notified the owner/occupier of the relevant premises and the Council of the existing defects in the relevant premises and requested that they are remedied on at least two occasions and the Airport Companies have not received notice confirming that such defects have been remedied PROVIDED THAT:

(i) the second occasion on which the Airport Companies give notice is at least three months after the first occasion; and

(ii) on the second occasion the owner and the occupier (if different) are notified in writing that this represents the final opportunity to remedy existing defects and benefit from the Second Tier Works; and

(iii) at least three months have elapsed since the second occasion; and

(iv) the Airport Companies have notified the Council in writing of the events set out in paragraphs 4(b)(i) to (iii) of this Part;

(c) the Airport Companies shall have sought permission for the Second Tier Works and/or in the case of a Listed Building permission for inspection of the premises pursuant to paragraph 3 of Part 3 of the Fourth Schedule from the owner and the occupier of the premises on at least two occasions and such permission has not been given by the owner and/or the occupier (either because it has been refused or the owner or the occupier has failed to answer) PROVIDED THAT:

(i) the second occasion on which the Airport Companies seek permission is at least three months after the first occasion; and

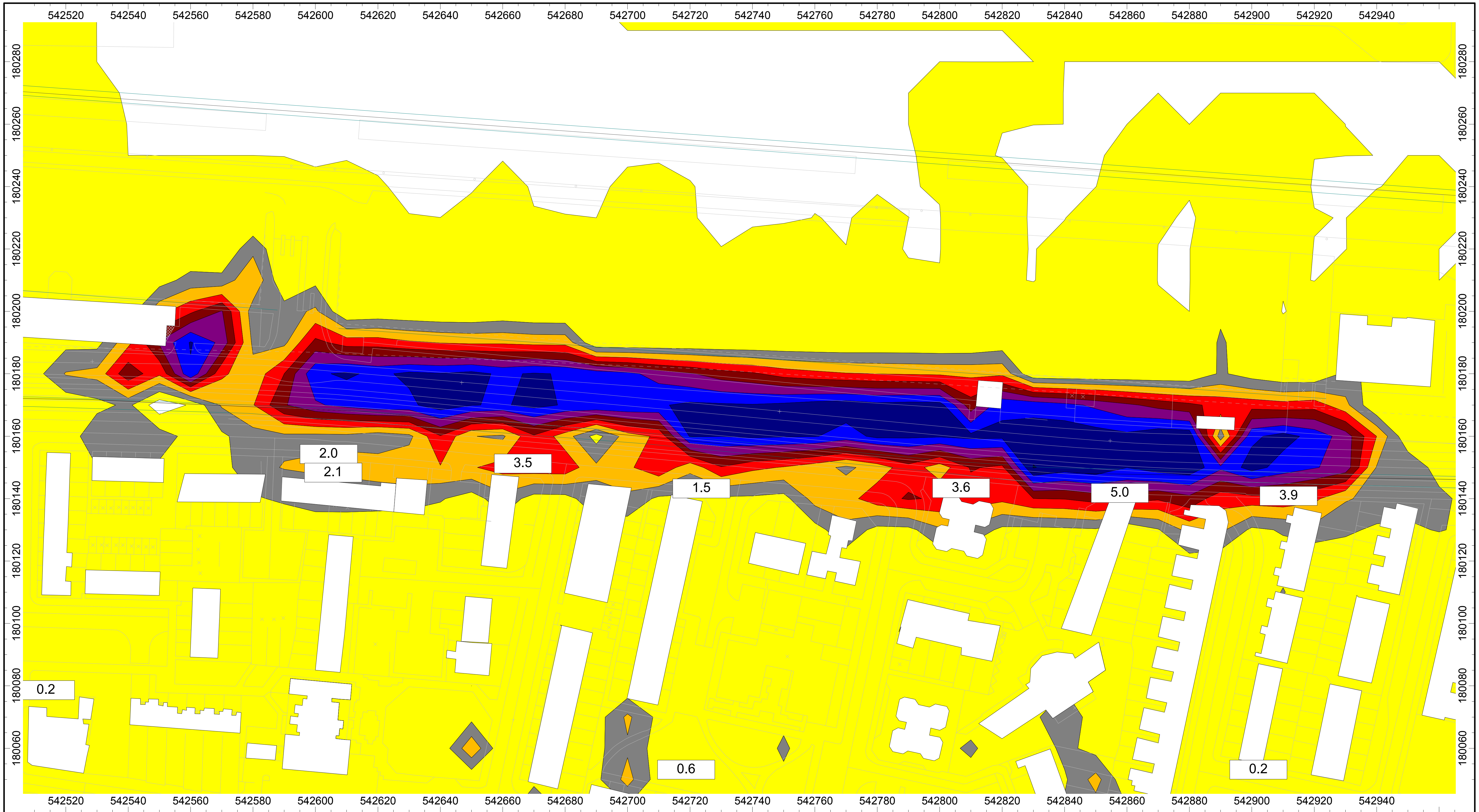
(ii) on the second occasion the owner and the occupier (if different) are notified in writing that this represents the final opportunity to give permission and benefit from the Second Tier Works;

(iii) at least three months have elapsed since the second occasion;

(iv) the Airport Companies have notified the Council of the events set out at paragraphs 4(c)(i) to(iii) of this Part.

APPENDIX 4.5

Noise Reduction from Temporary Construction Noise Barrier



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

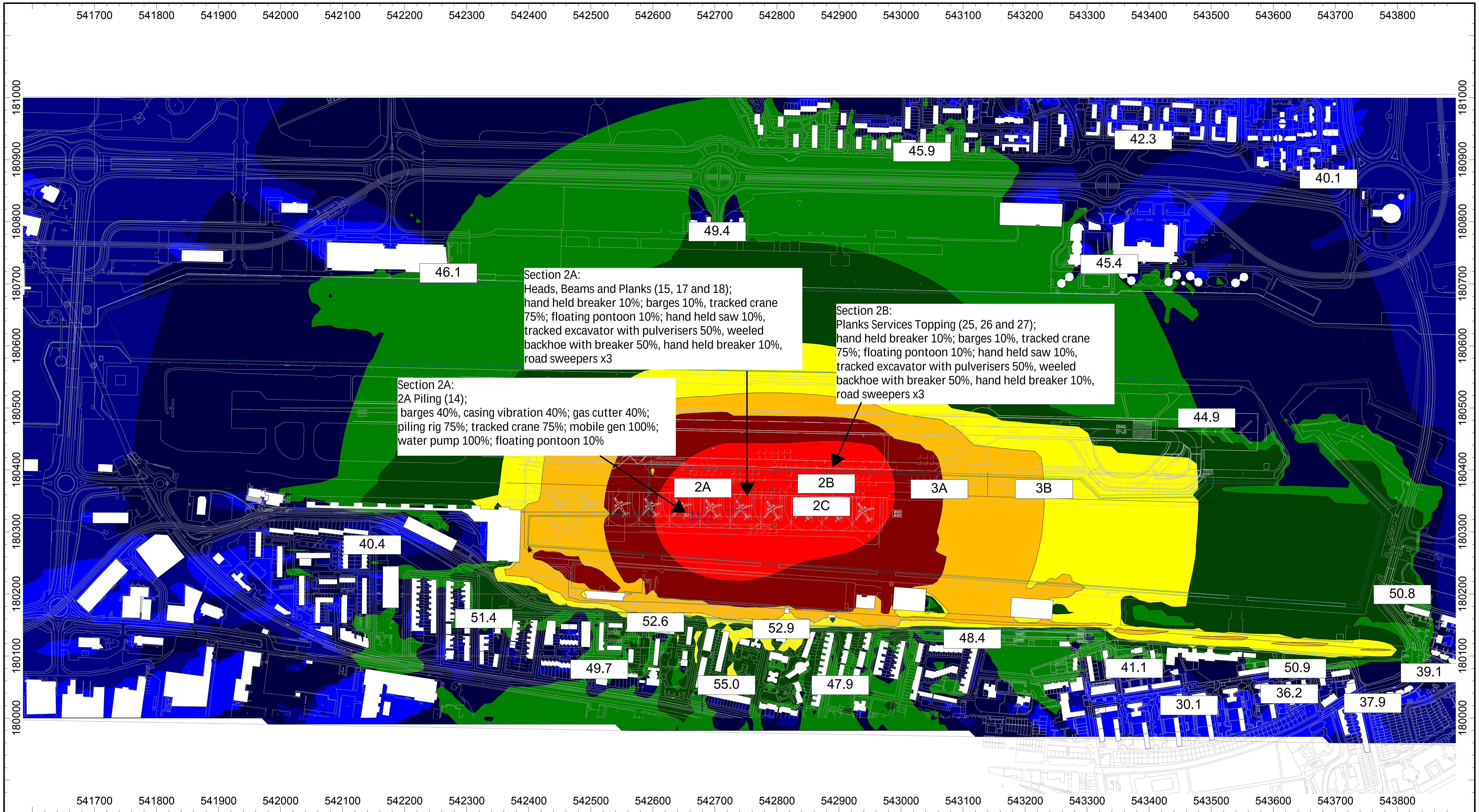
> 0.0 dB dB(A)
> 1.0 dB dB(A)
> 2.0 dB dB(A)
> 3.0 dB dB(A)
> 4.0 dB dB(A)
> 5.0 dB dB(A)
> 6.0 dB dB(A)
> 7.0 dB dB(A)
> 8.0 dB dB(A)

X.3. London City Airport - Out of Operational Hours Reduction in noise levels at +4m with Temporary Noise Barrier

CadnaA Construction Noise OOOH Works

APPENDIX 4.6

Daytime Construction Noise Contours (LAeq)



Construction Noise LAeq,1hr dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

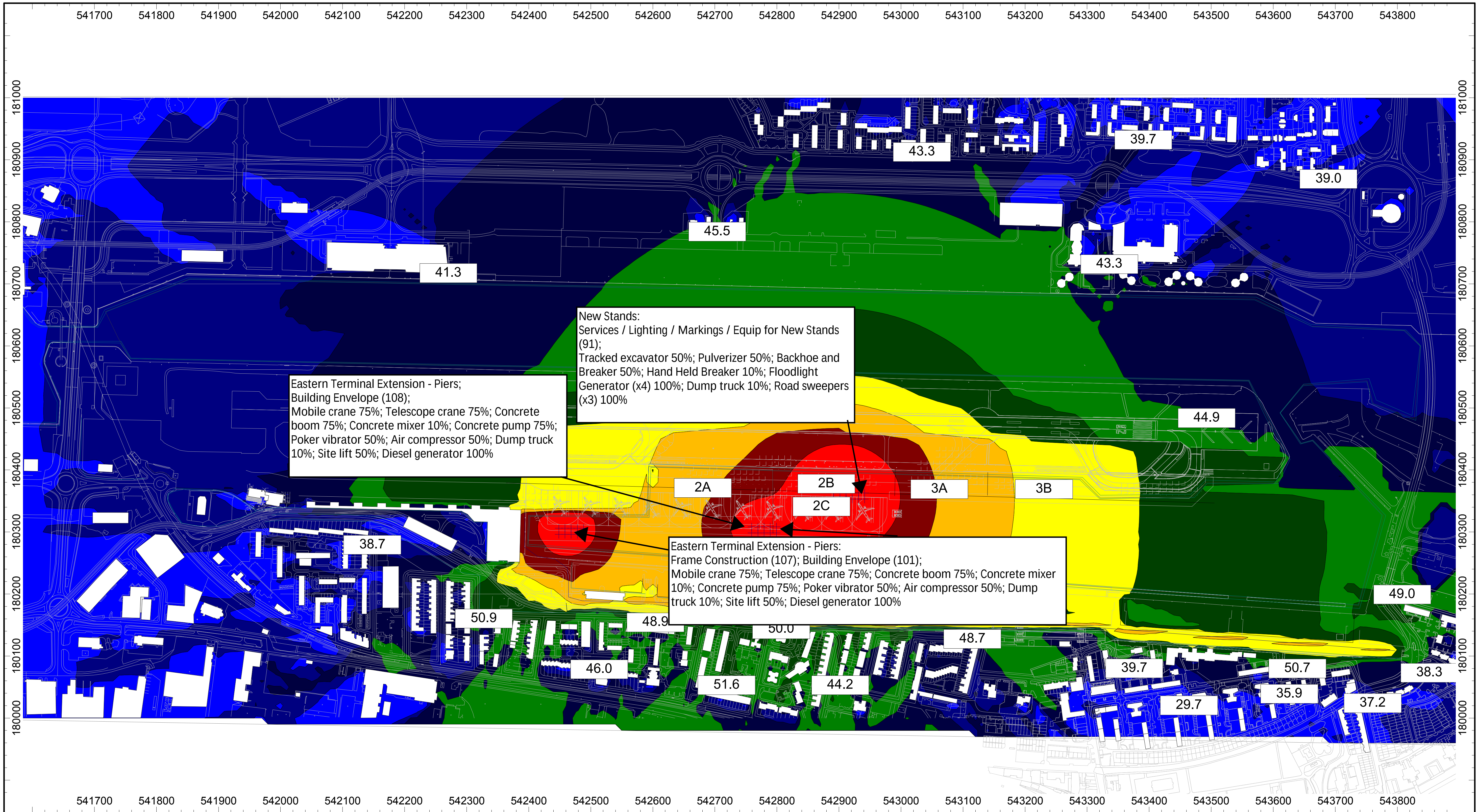
Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

London City Airport - Typical daytime deck works

CadnaA Construction Noise OOOH Works



Construction Noise LAeq,15min dB(A)
Receiver height 4m
Grid spacing 10 x 10 m

Not to scale

A9575 v6.0 30.08.14

A9575 - London City Airport - Construction Noise

... < 35.0 dB(A)
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... dB(A)

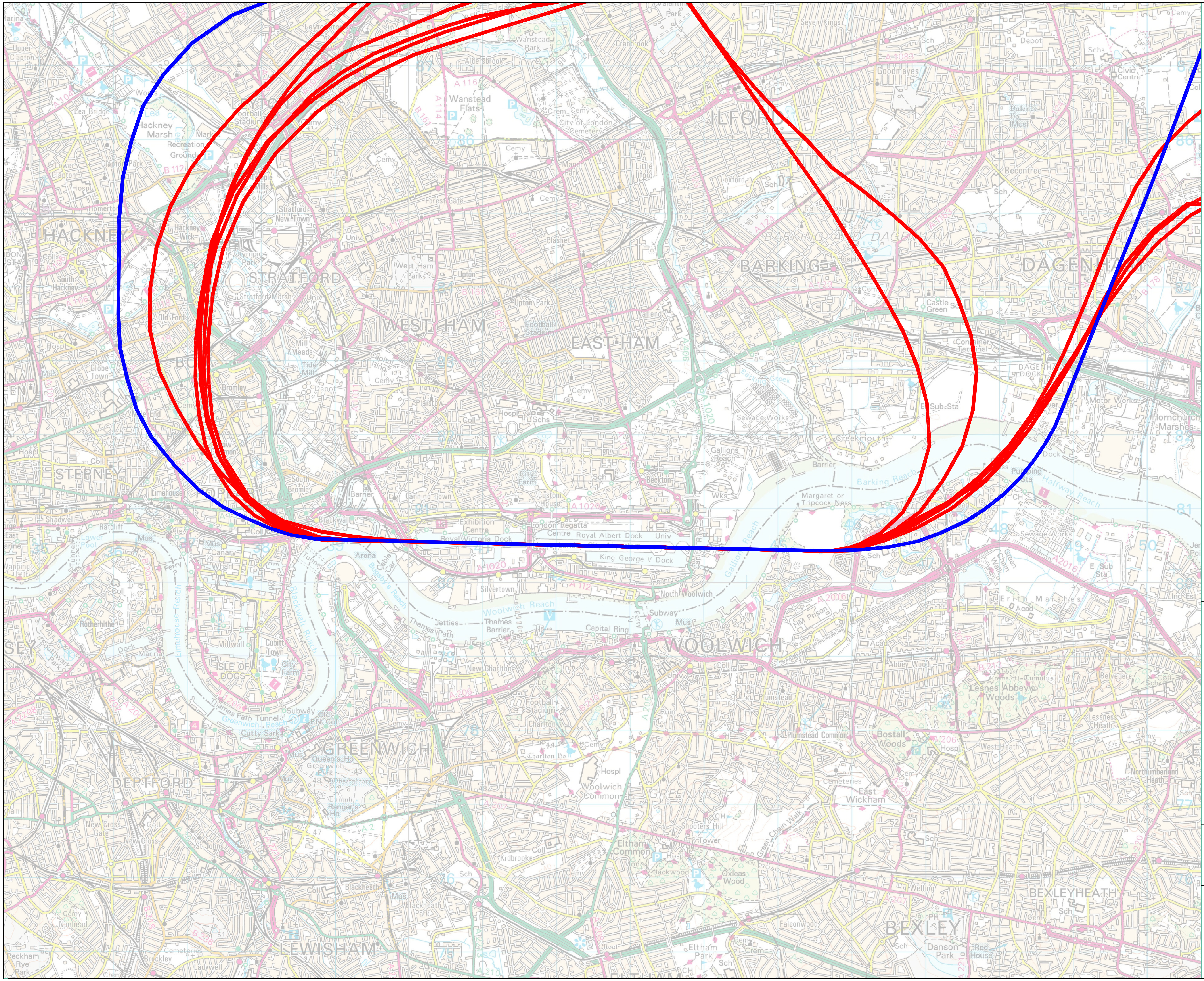
London City Airport - Typical daytime building and deck works

CadnaA Construction Noise OOOH Works

RPS

APPENDIX 5.1

Comparison between LCY SIDs and Actual Mean Departure Tracks



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Drawing Title
LONDON CITY AIRPORT

Comparison between LCY SIDs and Actual Mean Departure Tracks - Revised to account for LAMP

Scale at A3: 1:50,000

Date: August 2014

Drawing Number: A9575/N17/01

APPENDIX 5.2

Airborne aircraft noise contours - Comparison showing revised track effect with LAMP

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Legend

Mean Actual Departure Track Contours (Dispersed)

Mean Actual Departure Track Contours (No Dispersion)

SIDs Contours

Drawing Title

LONDON CITY AIRPORT

$L_{Aeq,16h}$ airborne aircraft noise contours

54 - 72 in 3 dB steps

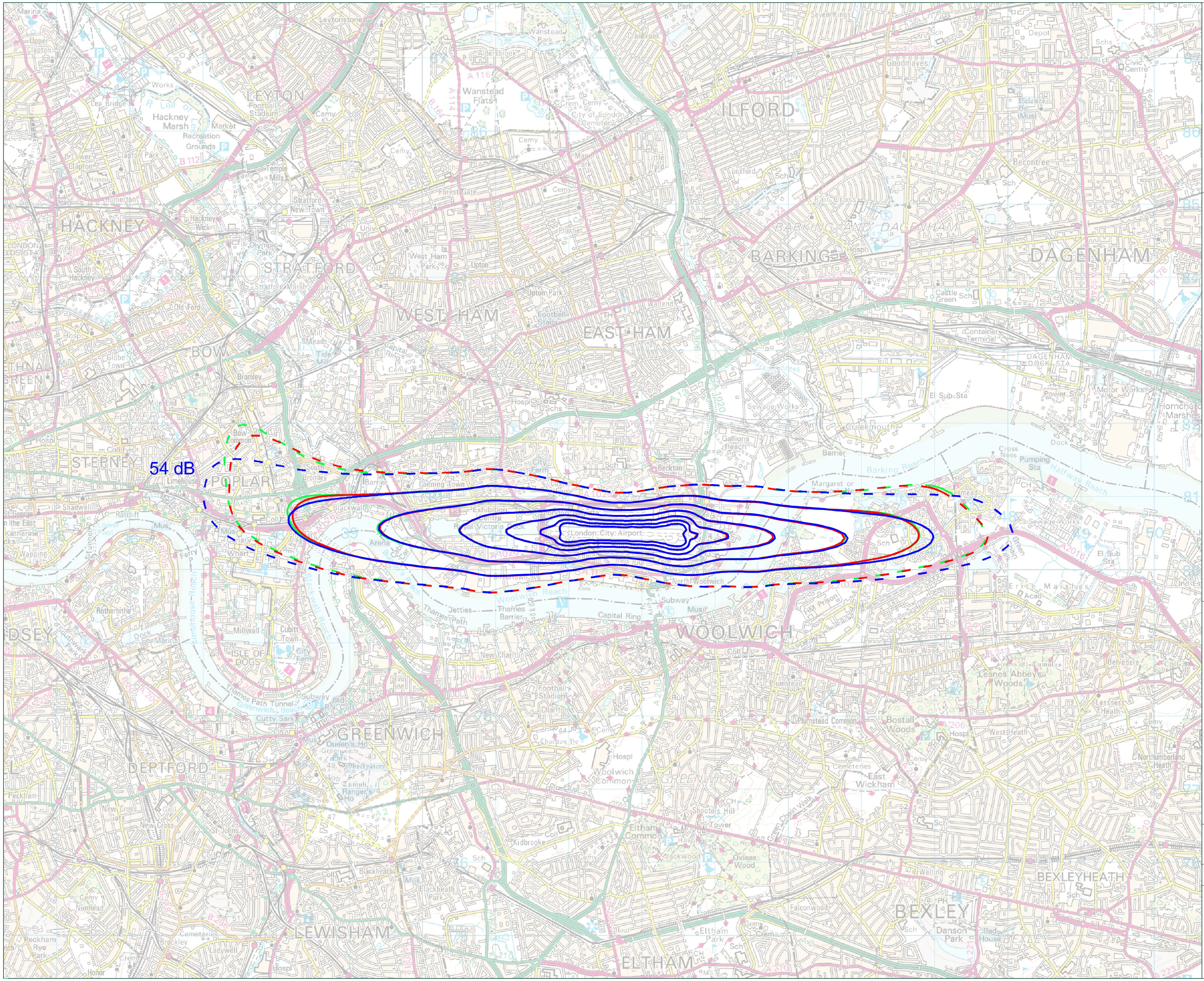
2012 - Summer Average Mode

Comparison showing revised track effect - Revised to account for LAMP

Scale at A3 1:50,000

Date: August 2014

Drawing Number A9575/N17/02



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Legend

Mean Actual Departure Track Contours (Dispersed)

Mean Actual Departure Track Contours (No Dispersion)

SIDs Contours

Drawing Title

LONDON CITY AIRPORT

$L_{Aeq,16h}$ airborne aircraft noise contours

54 - 72 in 3 dB steps

2023 - Summer Average Mode
Without CADP

Comparison showing revised track effect
- Revised to account for LAMP

Scale at A3

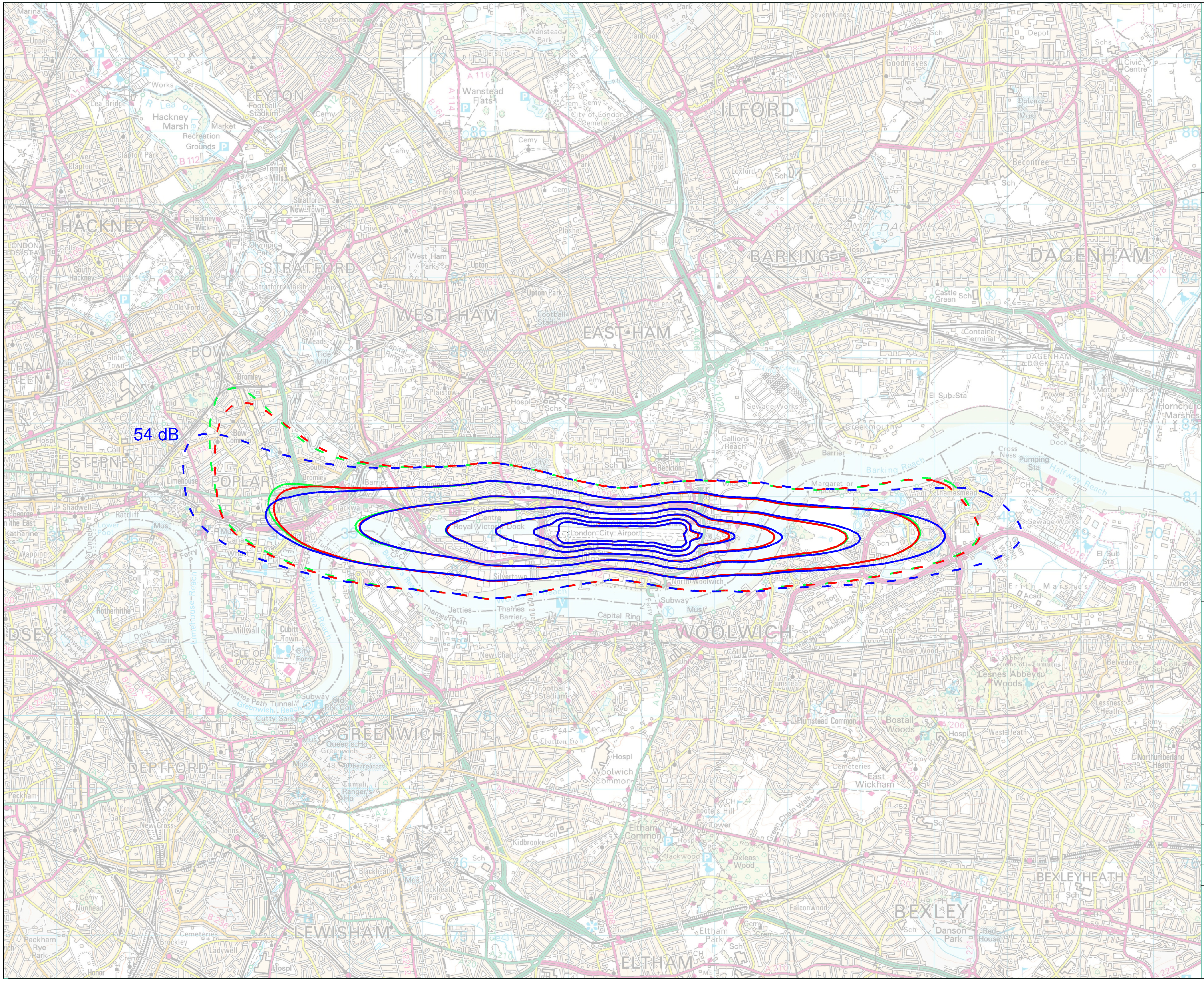
1:50,000

Date:

August 2014

Drawing Number

A9575/N17/03



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Legend

Mean Actual Departure Track Contours (Dispersed)

Mean Actual Departure Track Contours (No Dispersion)

SIDs Contours

Drawing Title

LONDON CITY AIRPORT

$L_{Aeq,16h}$ airborne aircraft noise contours

54 - 72 in 3 dB steps

2023 - Summer Average Mode With CADP

Comparison showing revised track effect - Revised to account for LAMP

Scale at A3

1:50,000

Date:

August 2014

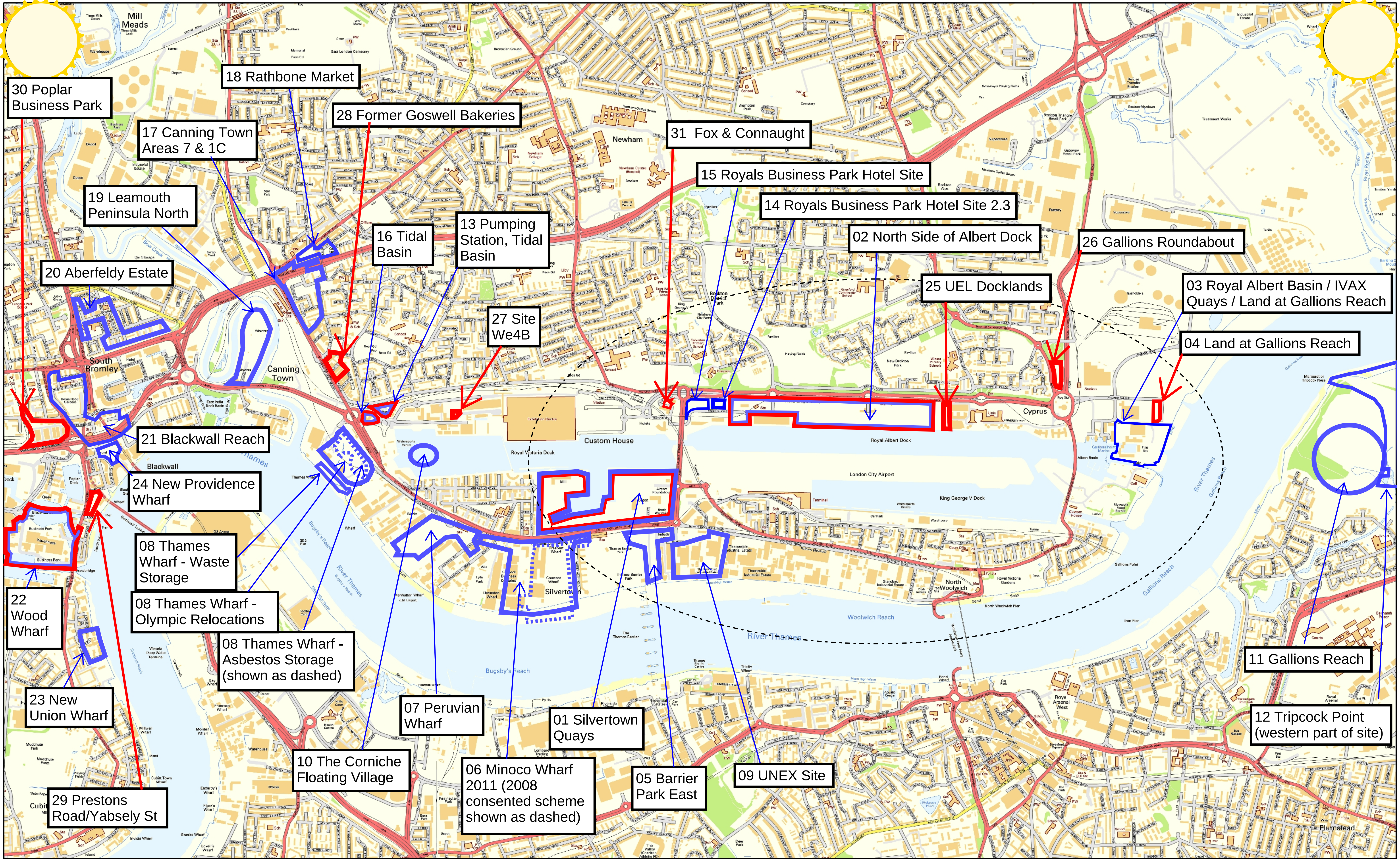
Drawing Number

A9575/N17/04

RPS

APPENDIX 6.1

Updated Schedule of Cumulative Schemes



Cumulative Schemes - August 2014 Update

Cumulative Schemes - 2013 Environmental Statement

N

Date: August 2014

Project No: Q10064

1:18,500 @ A3

0 0.5 1 Km

Quod

LCY: Cumulative Schemes