

7 Noise and Vibration

EIA Addendum Update

The proposed reduction of 22 accommodation units at Woodbank and deletion of Area 10 does not change the outcome of the original assessment which raised no significant noise or vibration issues. No changes have been made to this chapter.

7.1 Introduction

- 7.1.1 This chapter of the EIAR provides an assessment of the likely significant effects of noise from the proposed tourism and recreation-led mixed-use development at Lomond Banks, Balloch, West Dunbartonshire. It describes and considers the potential for noise associated with the project, both direct and in direct, and the impact that it could have on both the proposed development receptors and the existing sensitive receptors within the surrounding area.
- 7.1.2 The assessment is based on the characteristics of the site and surrounding area and the key parameters of the proposed development detailed in **Chapter 2 – Location and Nature of Development**.
- 7.1.3 This chapter has been prepared by Stantec. In line with best practice, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this ES is provided in **Appendix 1.1 – Project Team**.
- 7.1.4 This chapter is supported by the following figures provided in **Volume 2 Appendix 7.1**:
- **Figure 7-1** Environmental Sound Survey Locations;
 - **Figure 7-2** Noise Sensitive Receptor Locations;
 - **Figure 7-3** Daytime Baseline Sound Levels $L_{A10,18\text{hour}}$;
 - **Figure 7-4** Daytime Sound Levels $L_{Aeq,16\text{hour}}$ Without Proposed Development;
 - **Figure 7-5** Daytime Sound Levels $L_{Aeq,16\text{hour}}$ With Proposed Development;
 - **Figure 7-6** Night-time Sound Levels $L_{Aeq,8\text{hour}}$ Without Proposed Development;
 - **Figure 7-7** Night-time Sound Levels $L_{Aeq,8\text{hour}}$ With Proposed Development;
 - **Figure 7-8** Daytime Change in Sound Levels $L_{Aeq,16\text{hour}}$ With and Without Proposed Development; and,
 - **Figure 7.9** Night-time Change in Sound Levels $L_{Aeq,8\text{hour}}$ With and Without Proposed Development.

7.2 Policy Context, Legislation, Guidance and Standards

Legislation

- 7.2.1 The overarching legislative framework applicable to this EIA for the proposed development is outlined in **Chapter 4 – Legislative and Planning Policy Context**.
- 7.2.2 Legislation which is also applicable to the noise and vibration assessment include:
- The Control of Pollution Act (CoPA) (HMSO, 1974); and,
 - The Environmental Protection Act (EPA) (HMSO, 1990).
- 7.2.3 Further detail of relevant legislation is provided in the **Volume 2 Appendix 7.2**, accompanying this chapter.

Policy

- 7.2.4 The planning policy framework applicable to this EIA for the proposed development is outlined in **Chapter 4 – Legislative and Planning Policy Context**.
- 7.2.5 Planning policy considerations of specific relevance to this assessment are:
- Loch Lomond and the Trossachs Local Development Plan 2017-2021 (LLTNP, 2017), in particular;
 - Natural Environment Policy 2: Amenity and Environmental Effect;
 - Scottish Planning Policy (The Scottish Government, 2014a) in particular the following relevant provisions:
 - Principal Policy on Supporting Business and Employment (paragraph 106 and 169);
 - Principal Policy on Delivering Heat and Electricity (paragraph 169);
 - Principal Policy on Supporting Aquaculture (paragraphs 252); and,
 - National Planning Framework 3 (NPF3) (The Scottish Government, 2014b).
- 7.2.6 Further detail of relevant policy is provided in the **Volume 2 Appendix 7.2** accompanying this chapter.

Guidance and Relevant Technical Standards

- 7.2.7 The following guidance and technical standards have informed this assessment:
- Planning Advice Note PAN 1/2011 Planning and Noise (LGCD, 2011a);
 - Assessment of Noise: Technical Advice Note (EFD, 2011b);
 - Department of Transport 1988: Calculation of Road Traffic Noise (CRTN) (Department for Transport Welsh Office, 1988);
 - Environmental Noise Guidelines for the European Region (WHO, 2018);
 - World Health Organisation (WHO) Guidelines for Community Noise 1999 (WHO, 1999);
 - BS 7445:2003 Part 1 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures;
 - 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise;
 - 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration;
 - British Standard 4142:2014 +A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound;
 - Design Manual for Road and Bridges – Design Manual for Road and Bridges LA 111 Traffic Noise and Vibration; and,
 - Professional Practice Guidance on Planning and Noise.
- 7.2.8 Further detail of relevant guidance and technical standards is provided in the **Volume 2 Appendix 7.2** accompanying this chapter.

7.3 Methodology

Overview

Assessment Scope

- 7.3.1 This chapter presents an assessment of likely significant effects on noise and vibration sensitive receptors in and around the Proposed Development. The assessment presented in this chapter has been prepared in accordance with the EIA Regulations.
- 7.3.2 The principal aspects considered within this assessment are:
- Noise impacts and effects associated with the change in traffic flows due to the Proposed Development;
 - Identification of mitigation and enhancement measures, where required, to address identified effects;
 - Assessment of the residual predicted effects; and,
 - Assessment of the cumulative effects on sensitive receptors as a result of road traffic noise from the Proposed Development in conjunction with other developments which could result in cumulative effects.
- 7.3.3 At the time of writing, the development is at the Planning Permission in Principle (PPiP) stage and detailed design and construction methods have not yet been determined, as such, noise assessment is not possible at this stage and is scoped out of this chapter. A Construction Environmental Management Plan (CEMP) will be prepared prior to construction. Noise and vibration suppression techniques will be included in the CEMP and it is therefore considered that significant adverse impacts from construction noise and vibration would not occur.

Assessment Process

- 7.3.4 In undertaking the assessment presented in this EIAR chapter, the following activities have been carried out:
- Existing noise sensitive receptors around the Proposed Development have been determined. Noise sensitive receptors on the Proposed Development have also been determined;
 - An environmental sound survey has been undertaken to establish the current sound climate during both daytime and evening periods at locations considered to be representative of the existing and future noise sensitive receptors;
 - A 3D acoustic model of the Site and its surroundings has been generated, based on traffic flows provided by the Transport Consultant; and,
 - An assessment of noise impact from the supplied traffic flows has been undertaken at existing and future noise sensitive receptors.

Consultation

EIA Screening and Scoping

- 7.3.5 An EIA Scoping Opinion was received by Loch Lomond and the Trossachs National Park in July 2021. In relation to noise and vibration, the Scoping Opinion stated:

“The Scoping Report notes that vibration associated with changes in traffic flows and the operation of the development are not likely to be significant and are therefore not proposed to be considered in the EIA. The response from WDC Environmental Health states that until the full development proposals are confirmed these potential effects will still require to be considered. It is suggested further consultation with WDC environmental health is undertaken with regard to inclusion (or otherwise) of these aspects during the course of developing proposals and the subsequent EIA assessment.”

The likely noise and vibration impact of the proposed transport infrastructure should also be considered.

In assessing the likely vibration impacts from piling and other construction activities on receptors, the EIA should include the loch shore environment and specifically any habitat or species that are sensitive to vibration (reflecting advice from NS). This should cross reference the Ecology Chapter.”

- 7.3.6 The assessment of noise and vibration impacts on ecological receptors is presented in **Chapter 5 Ecology**.

Post Scoping Consultation

- 7.3.7 No further consultation has been undertaken with respect to noise and vibration.

Study Area

- 7.3.8 The spatial scope of and Study Area adopted in this assessment has been determined by the extent of the Proposed Development and roads included within the Transport Assessment. Noise sensitive receptors along roads within the Transport Assessment have been included within this assessment.

Information Sources

Desktop Study

- 7.3.9 The following information has been used within the assessment:

- Masterplan design of the site;
- Traffic flow data for the surrounding road network (18 hour AAWT) including baseline year (2019), future year (2030) without the scheme and future year (2030) with the scheme;
- Topography data of the site based on topographical survey data;
- Lidar data for areas surrounding The Site; and,
- Address Base data for existing properties within the study area.

Fieldwork

- 7.3.10 An environmental sound survey was carried out on Thursday 16 December 2021. Further details of the environmental sound survey are provided in **Section 7.4**.

Approach to Assessment

- 7.3.11 The assessment considers the impacts which the Proposed Development could have on existing receptors surrounding the Site, as well as receptors within the Proposed Development.

Impact Assessment Methodology

- 7.3.12 The methodology provided in Technical Advice Note (TAN) 1/2011 'Assessment of Noise' (The Scottish Government, 2011b) has been used to assess the impacts of the Proposed Development.

- 7.3.13 The technical Advice Note details a five-stage process for assessing potential noise impacts on proposed developments. Full details of the five-stage process can be found within **Appendix 7-2** in **Section 3.1.5**.

- 7.3.14 The summarised criteria from the five-stage process is shown in the sections below.

Noise Generating Development

- 7.3.15 The magnitude of noise impact from NGDs is defined by assessing the resultant future year do something sound levels against the future year do minimum sound levels. The magnitude of impact classifications used in this assessment and shown in **Table 7-1** and are based on the classifications provided in **Table 2-3** of the Technical Advice Note of PAN 01/2011 (The Scottish Government, 2011b).

Table 7-1: Classification of Magnitude of Noise Impacts; Noise Generating Developments

Change in Noise Level, x $L_{A10,18h}$ dB	Magnitude of Impact
x = 5	Major adverse
3 = x < 5	Moderate adverse
1 = x < 3	Minor adverse
0 < x < 1	Negligible adverse
x = 0	No change
-1 < x < 0	Negligible beneficial
-3 < x = -1	Minor beneficial
-5 < x = -3	Moderate beneficial
X = -5	Major beneficial

Noise Sensitive Development

7.3.16 The magnitude of noise impact at NSDs is defined by assessing resultant do something sound levels at noise sensitive receptors. The magnitude of impact classifications used in this assessment and shown in **Table 7-2** and are based on the classifications provided in **Table 2.4** of the Technical Advice Note of PAN 01/2011 (The Scottish Government, 2011b). The below table outlines the magnitude of impact during the daytime period (07:00 – 23:00 hours).

Table 7-2: Classification of Magnitude of Noise Impacts; Noise Sensitive Developments

(Existing – 55 dB $L_{Aeq,16hour}$) Noise Level, x $L_{Aeq,16hour}$ dB	Magnitude of Impact
x = 10	Major adverse
5 = x < 10	Moderate adverse
3 = x < 5	Minor adverse
0 = x < 3	Negligible adverse
x < 0	No change

7.3.17 In relation to night-time noise, the TAN notes in paragraph 3.25 that:

“For a continuous noise source, the recommended WHO precautionary guideline internal noise levels within dwellings is 35 dB $L_{Aeq,16h}$ for day and evening periods, this is to avoid critical effects of speech intelligibility and moderate annoyance, and to avoid sleep disturbance for the night time period 30 dB $L_{Aeq,8h}$ is reported as being representative of the noise level at which the onset of effects occur, with no, single sound events exceeding 45 dB $L_{Amax,FAST}$. The effects on sleep become increasingly more marked at levels of 35 dB $L_{Aeq,8h}$ and greater. However, the WHO levels are in respect of general environmental noise and not industrial/commercial in isolation. Therefore, the nature of the noise requires to be taken into account.”

7.3.18 Based on the above guidance, internal noise levels of below 30 dB $L_{Aeq,8hours}$ are targeted within the assessment.

7.3.19 The level of significance of the noise impact at the NSR is obtained through the relationship of the receptor’s sensitivity to noise and the magnitude of the noise impact. **Table 7-3** provides a framework for determining the level of significance in relation to the magnitude of the impact and the sensitivity of the receptor. The table is based on **Table 2.6** of the Technical Advice Note of PAN 01/2011 (The Scottish Government, 2011b), and the process of determining significance in-line with **Chapter 3 EIA Process**.

Table 7-3: Matrix of Significance of Effects

Magnitude of Impact	Level of Significance Relative to Sensitivity of Receptor		
	Low	Moderate	High
Major	Minor / Moderate	Moderate / Major	Major / Substantial
Moderate	Minor	Moderate	Moderate / Major
Minor	Negligible or No Effect / Minor	Minor	Minor / Moderate
Negligible	Negligible or No Effect / Minor	Negligible or No Effect / Minor	Minor
No Change	Negligible or No Effect	Negligible or No Effect	Negligible or No Effect

7.3.20 A moderate, major or substantial effect is considered to be significant.

7.3.21 The definitions of the levels of significance are described in **Chapter 3 EIA Process**.

7.4 Baseline

The Site

7.4.1 The site is located to the north of Balloch, West Dunbartonshire on the southern shores of Loch Lomond. The site is surrounded by farming land and a golf course to the west and north-west. Loch Lomond to the north and the River Leven to the east. The land to the south and south-east consists predominately of residential and commercial properties.

Major Noise Sources

7.4.2 The engineer conducting the sound survey identified the major noise sources of the Site and surrounding area. These were noted to be:

- Road traffic on the A82 dual carriageway to the west; and,
- Road traffic on the A811 road to the south.

Receptor Sensitivity

7.4.3 The table below shows the different receptor along with their respective sensitivity areas.

Table 7-4: Receptor Sensitivity

Receptor	Sensitivity	Description
Residential dwellings, Places of worship, hospitals/residential care homes, quiet outdoor areas used for recreation (gardens).	High	Receptors where people or operations are particularly susceptible to noise.
Hotels, offices, bars/restaurants.	Medium	Receptors are moderately sensitive to noise, where it may cause some distraction or disturbance.
Buildings not occupied during daytime hours, Factories with existing high noise levels.	Low	Receptors where description or disturbance from noise is minimal.

7.4.4 The Proposed Development has hotels, bars and restaurants within the development along with commercial units.

7.4.5 A full list of the sensitive receptors can be found in the table below along with their sensitivity. The location of each receptor is identified in **Volume 2 Figure 7-2**.

Table 7-5: Noise Sensitive Receptors and Their Sensitivity

Receptor	Description	Existing or Proposed	Sensitivity
1	Residential dwelling off A82	Existing	High
2	Cameron House residential dwelling on Old Luss Road	Existing	High
3	Residential dwelling on Old Luss Road	Existing	High
4	Residential dwelling on Cameron Drive	Existing	High
5	Residential dwelling on Balloch Road	Existing	High
6	Residential dwelling on A811	Existing	High
7	Residential dwelling on A811	Existing	High
8	Residential dwelling on Balloch Road	Existing	High
9	Woodland lodge number W7	Proposed	High
10	Large Lodges number L35	Proposed	High
11	Woodland Bothy closest to A 82	Proposed	High
12	Larger Lodges number L4	Proposed	High
13	Lodge 35 of Pier Road	Proposed	High
14	Lodge 73 of Pier Road	Proposed	High

Baseline Sound Surveys

- 7.4.6 To obtain baseline sound conditions, sound levels were measured at seven locations within the Site. Sound levels at each of these positions were measured during daytime and evening periods for time periods of 30 minutes and 15 minutes respectively.
- 7.4.7 Locations of the sound survey locations are described in **Table 7-6** and identified in **Volume 2 Figure 7-1**.

Table 7-6: Environmental Sound Survey Locations

Sound Measurement Location ID	Description	Grid Reference
1	10m from A82 off Lower Stonymollan Road	E 238089 , N 681588
2	Off Lower Stonymollan Road	E 238152 , N 681619
3	Land off Old Luss Road near residential properties	E 238317 , N 681839
4	Wooded area between Lomond Shores car park and residential properties on Clairinish	E 238608 , N 681945
5	Entrance to the Lomond Shores retail park of Ben Lomond way	E 238593 , N 682190
6	Land in public park between Pier Road and River Leven	E 238766 , N 682317
7	Land on Public park behind Anchorage Guest House car park.	E 238956 , N 681995
8	On Old Luss Road outside Cameron House	E 238111 , N 682044

- 7.4.8 Measurements were carried out at Location 1 to collect data from the A82 dual carriageway road between the hours of 10:45 -13:45. The purpose of this survey location was to establish baseline sound levels from the A82. The monitoring was carried out in accordance with the shortened measurement procedure of the Calculation of Road Traffic Noise (CRTN) (Department for Transport Welsh Office, 1988)
- 7.4.9 Measurement values from the road traffic measurement (location 1) have been summarised and are shown below in **Table 7-7**.

Table 7-7: Road Traffic Noise Survey Results

Measurement Location	Date	Start Time/End Time (hh:mm)	L _{Aeq, 3hour} (dB)	Typical L _{A90, T} (dB)	Typical dB L _{AFMax} (dB)
LT	16/12/22	10:45/13:45	68		75

7.4.10 Weather conditions for the 3-hour survey are shown in **Table 7-8** below.

Table 7-8: Road Traffic Noise Survey Weather Conditions

Survey Date/Time	Weather Conditions
16/12/2022, 10:45- 13:45	9°C, 1 m/s, NW, 5/8 oktas

7.4.11 An hourly summary of results is provided in **Table 7-9**.

Table 7-9: Road Traffic Noise Survey Hourly Results

Measurement Location	Start Time/Duration hh:mm:ss	L _{Aeq, 1hour} (dB)	L _{A10, 1hour} (dB)	L _{AFMax} (dB)
LT	10:45 / 00:01:00	67	70	80
	11:45 / 00:01:00	67	70	80
	12:45 / 00:01:00	68	70	89

7.4.12 Following guidance provided in the Calculation of Road Traffic Noise (CRTN), 1dB(A) is subtracted from the average of the 3-hour L_{A10} levels to provide the L_{A10} (18 hour), as shown in **Table 7-10**.

Table 7-10: Road Traffic Noise Survey Summary of Results

Measurement Location	Measured Sound Level (dB)				
	L _{A10, 1st hour}	L _{A10, 2nd hour}	L _{A10, 3rd hour}	L _{A10, 3hr}	L _{A10 18hr}
LT	70.2	70.1	70.1	70.1	69.1

7.4.13 The results from the other measurement locations (Location 2-8) are summarised in **Table 7-11**.

Table 7-11: Sound Survey Results

Measurement Position	Date	Daytime/ Evening	Start Time/End Time hh:mm	Sound Level L _{Aeq, T} dB
2	16/12/2021	Daytime	11:00/11:30	52
	16/12/2021	Evening	19:00/19:15	49
3	16/12/2021	Daytime	11:41/12:11	52
	16/12/2021	Evening	19:31/19:46	47
4	16/12/2021	Daytime	12:40/13:10	50*
	16/12/2021	Evening	20:20/20:35	45*
5	16/12/2021	Daytime	13:19/13:49	55
	16/12/2021	Evening	20:47/21:02	44
6	16/12/2021	Daytime	13:55/14:25	44
	16/12/2021	Evening	21:15/21:30	39
7	16/12/2021	Daytime	14:30/15:00	48
	16/12/2021	Evening	21:45/22:00	43
8	16/12/2021	Daytime	15:10/15:40	53
	16/12/2021	Evening	19:52/20:07	48

7.4.14 *Values have not been used within the assessment. At Location 4 at the time of measurement, mobile construction plant was in use during the daytime and evening. The works related to the temporary construction a drive-in cinema.

7.4.15 During the site visit the noise climate at the measurement locations was noted. **Table 7-12** below summarises the events.

Table 7-12: Sound Climate at Survey Locations

Measurement Location Position ID	Measurement Location	Description of Noise Climate Experienced During Survey
LT	10m from A82 off Lower Stonymollan Road	Road traffic noise from the A 82 dominating the noise climate
2	Off Lower Stonymollan Road	Road traffic from the A82 dual carriageway Dogs barking at kennels to the south Pedestrians conversing Birdsong
3	Land off Old Luss Road near residential properties	Road traffic on A82 Road noise form Old Luss Road Ambulance passing Birdsong
4	Wooded area between Lomond Shores car park and residential properties on Clairinish	Road Traffic from local roads Dog Walkers *Unrepresentative noise from mobile plant
5	Entrance to the Lomond Shores retail park of Ben Lomond way	Road traffic from Ben Lomond Way including buses stopping for passengers Pedestrians conversing
6	Land in public park between Pier Road and River Leven	Pedestrians conversing Distant road traffic Birdsong
7	Land on public park behind Anchorage Guest House car park.	Noise from the Anchorage Guest House Dogs barking Pedestrians conversing Distant industrial noises
8	On Old Luss Road outside Cameron House	Road traffic off Balloch Road Cars using the adjacent car park Pedestrians conversing

7.4.16 Meteorological conditions were deemed suitable for an environmental sound survey throughout the surveying period. **Table 7-13** shows conditions for both daytime and evening on the day of the survey.

Table 7-13: Sound Survey Weather Conditions

Weather Conditions - Daytime	Weather Conditions - Evening
Between 8 & 10°C, wind speed between 1 - 4 m/s, between 4/8 - 8/8 Oktas.	Between 5 & 8°C, wind speed between 1-3 m/s, from NW, between 4/4 – 6/8 Oktas.

Baseline Evolution

7.4.17 Future year traffic flows used within the assessment include relevant committed development. As the environmental sound climate is dominated by noise from vehicular movements on the modelled road network, the future baseline conditions have therefore been considered within the assessment.

7.5 Embedded Mitigation

7.5.1 The development proposal has several design features and embedded mitigation which will avoid, prevent or minimise significant adverse environmental effects and to enhance beneficial effect. Embedded mitigation measures of relevance to this assessment are:

- Development, approval and implementation of noise suppression techniques as part of a Construction Environmental Management Plan (CEMP); and,

- The design mitigation features incorporated into the final masterplan design is of one stretch of 2m high close boarded timber garden fencing at the garden /terrace boundary of NSR 11.

7.6 Assessment of Likely Effects

Construction Phase

- 7.6.1 At the time of writing, the development is at the Planning Permission in Principle (PPiP) stage and detailed design and construction methods have not yet been determined, as such, a quantitative noise and vibration assessment is not possible at this stage.
- 7.6.2 Noise and vibration suppression techniques will be developed, approved and implemented as part of a Construction Environmental Management Plan (CEMP) and it is therefore considered that significant adverse impacts from construction noise and vibration would not occur.

Operational Phase

- 7.6.3 There is potential for noise produced from the proposed development to have an impact on both the existing residents outside of the Proposed Development, and occupants of the resort accommodation. At the time of writing, the development is at the PPiP/ masterplan stage, therefore detailed design information on proposed commercial and entertainment noise sources is not available. If required, an assessment of commercial or entertainment noise sources can be carried out at a later date, when sufficient design information is available.

Impact Assessment

Noise Input Parameters

- 7.6.4 A 3D model has been produced using Soundplan V8.2, to model baseline noise levels around the site and calculate the likely future sound levels, for both with and without the Proposed Development.
- 7.6.5 Soundplan uses the principal methodologies as set out in the Calculation of Road Traffic Noise 1988 (CRTN), for determining the L_{A10} basic road noise level. To consider the noise data in a comparable form to PAN 01/2011, the output from Soundplan is converted into the $L_{Aeq,T}$ within the program.

Noise Sources

- 7.6.6 The dominant sources of noise affecting the Proposed Development site and surrounding areas have been identified as being the A82, A811, Old Luss Road and Balloch Road.
- 7.6.7 18-hour Annual Average Weekly Traffic (AAWT) flows for the above roads have been provided by Stantec UK and used within the noise model.

Noise Sensitive Receptors

- 7.6.8 The noise assessment considers the proposed residential resort properties most exposed to road noise. In addition, a sample of existing noise sensitive receptors within the surrounding areas were also considered in the noise assessment. The locations of the receptors are identified in **Volume 2 Figure 7-2**.
- 7.6.9 Three different Scenarios have been considered within the Soundplan model, as shown in **Table 7-14**.

Table 7-14: Modelled Scenarios

Scenario	Assessment Year	Description
1	2019	Baseline road traffic, for noise model validation purposes against measured road traffic data.
2	2030	Baseline + future committed developments (without Proposed Development).
3	2030	Baseline + future committed developments + Proposed Development.

Other Modelling Inputs

- 7.6.10 A number of assumptions have been made within the modelling as detailed below:
- The noise model includes the effect of site design mitigation features (i.e. a 2 m high fence to be constructed along the boundary of the garden of NSR 11);
 - Baseline (2019) and 2030 models use topography supplied by Stantec UK;
 - Single storey buildings have been assumed to be 6m high. Two storey buildings have been assumed to be 8 m high;
 - Receptor heights at garden and ground floor level have been taken as being 1.5 m above the ground level;
 - Receptors at first floor levels have been taken to be a height of 4 m above ground level; and,
 - Ground absorption has been modelled as 1 (soft ground) for both scenario years.

Validation of Acoustic Model

- 7.6.11 The baseline acoustic model has been used to calculate existing noise levels for comparison with the with the results of the environmental sound surveys. The modelled and measured resulted are presented in **Table 7-15**.

Table 7-15: Measured and Modelled Sound Level Validation

Monitoring Position ID	Period	Measured $L_{A10,18\text{hour}}$ Noise Level (dB)	Modelled $L_{A10,18\text{hour}}$ Noise Level (dB)	Variance (dB)
LT	Daytime	70	72	< 2

- 7.6.12 The results in **Table 7-15** indicate a low level of variance between the modelled results and the measured data. The model is therefore considered to be representative of the current sound climate around the site.

Assessment of Impact on Noise Sensitive Receptors

- 7.6.13 The Proposed Development is expected to increase traffic flows on the local road network surrounding the site.

Comparison of Daytime Predicted Sound Levels

- 7.6.14 Sound levels in the outside amenity areas (gardens) of existing residential dwellings have been compared with and without development traffic. The results are provided in **Table 7-16**.

Table 7-16: Comparative Daytime Noise Levels, With and Without Development.

Noise Sensitive Receptor ID	2030 Without Development $L_{Aeq, 16\text{hour}}$ dB	2030 With Proposed Development $L_{Aeq, 16\text{hour}}$ dB	Difference dB	Tan 2011 Magnitude of Impact	TAN 2011 Level of Significance
1	62	62	< 1	Negligible Adverse	Minor
2	53	53	< 1	Negligible Adverse	Minor
3	51	51	< 1	Negligible Adverse	Minor
4	60	60	< 1	Negligible Adverse	Minor
5	53	53	< 1	Negligible Adverse	Minor

Noise Sensitive Receptor ID	2030 Without Development L _{Aeq, 16hour} dB	2030 With Proposed Development L _{Aeq, 16hour} dB	Difference dB	Tan 2011 Magnitude of Impact	TAN 2011 Level of Significance
6	53	53	< 1	Negligible Adverse	Minor
7	54	54	< 1	Negligible Adverse	Minor
8	66	66	< 1	Negligible Adverse	Minor

7.6.15 The results show that the increase in daytime sound levels when comparing between the with vs without development scenarios for the year of development completion (2030) varies between 0.0 dBA and 0.7 dBA. Based on guidance provided within TAN 2011, this equates to a negligible adverse impact.

7.6.16 The existing properties at which the greatest increase in noise levels are predicted are located on Balloch Road (NSR 06, 07, 08) refer to **Figure 7-2** in **Appendix 7.2**). This is due to the current traffic flows increasing due to development generated traffic. Based on residential dwellings having a high sensitivity and the impact being negligible adverse, this equates to a minor effect, which is not considered to be significant.

Comparison of Night-Time Predicted Sound Levels

7.6.17 Night-time sound levels at the façades of existing residential dwellings have been compared with and without development traffic. The results are provided in **Table 7-17**.

Table 7-17: Comparative Night-Time Noise Levels, With and Without Development.

Noise Sensitive Receptor ID	2030 Without Proposed Development L _{Aeq, 16hour} dB	2030 With Proposed Development L _{Aeq, 16hour} dB	Difference dB	Tan 2011 Magnitude of Impact	TAN 2011 Level of Significance
1	54	54	<1	Negligible Adverse	Minor
2	46	46	<1	Negligible Adverse	Minor
3	44	44	<1	Negligible Adverse	Minor
4	46	46	<1	Negligible Adverse	Minor
5	52	52	<1	Negligible Adverse	Minor
6	46	45	<1	Negligible Adverse	Minor
7	47	47	<1	Negligible Adverse	Minor
8	58	58	<1	Negligible Adverse	Minor

7.6.18 The results show that the increase in night-time sound levels when comparing between the with vs without development scenarios for the year of development completion (2030) varies between 0.0 dBA and 0.7 dBA. Based on guidance provided within TAN 2011, this equates to a negligible adverse impact.

7.6.19 The existing properties at which the greatest increase in noise levels are predicted are located on Balloch Road (NSR 06, 07, 08) refer to **Figure 7-2** in **Appendix 7.2**). This is due to the current traffic flows increasing due to development generated traffic. Based on residential dwellings having a high sensitivity and the impact being negligible adverse, this equates to a minor effect, which is not considered to be significant.

Daytime Sound Levels at Proposed Resort Accommodation

7.6.20 To assess the impact of road traffic on the proposed sensitive receptors within the Proposed Development, sound levels across the development have been assessed based on development traffic flows and are presented in **Table 7-18**. The design and mitigation features of the Proposed Development, outlined in section 3.11 have been incorporated into the acoustic model.

Table 7-18: Sound Levels at Proposed Sensitive Receptors

Noise Sensitive Receptor ID	Modelled Daytime $L_{Aeq,16hour}$ dB	Meets External Noise Criteria. Target = 55 dB $L_{Aeq,16hour}$?	Excess dB	TAN 2011 Magnitude of Impact	TAN 2011 Level of Significance
9	57	No	2.3	Negligible Adverse	Minor/Moderate
10	52	Yes	-	No Change	Negligible or No Effect
11	60	No	5.4	Minor Adverse	Moderate/Major
12	52	Yes	-	No Change	Negligible or No Effect
13	49	Yes	-	No Change	Negligible or No Effect
14	46	Yes	-	No Change	Negligible or No Effect
15	45	Yes	-	No Change	Negligible or No Effect

7.6.21 The above noise receptors were chosen as they are considered to be the most exposed to noise from road traffic on the A82 and the local road network. The results show that the external noise levels at the majority of these properties, are predicted to be within the target external noise criteria of 55dBA. Noise levels at the most exposed proposed properties exceed the noise target between 0.0dB(A) at NSR 21 to 2.9dB(A) at NSR 29. An exceedance of less than 3dB(A) is considered as a negligible adverse impact based on TAN 2011 guidance. Based on the impact being negligible adverse, and the sensitivity of residential dwellings being high, the effect of the daytime noise is minor, which is not considered to be significant.

7.6.22 As the noise is acceptable at these, the most exposed properties; it shall also be at other, less exposed parts of the development. The external daytime noise is therefore considered acceptable at the proposed development site and does not need to be reduced further.

Night-Time Noise Impact at Proposed Resort Accommodation

7.6.23 To assess the impact of road traffic on the proposed sensitive receptors within the Proposed Development, sound levels across the development have been assessed based on traffic flows inclusive of development traffic. The design and mitigation features of the proposed development, outlined in section 3.11, have been incorporated into the acoustic model. Night-time sound levels have been modelled at a height of 4 m above ground level and are presented in **Table 7-19**.

7.6.24 Based on noise intrusion through standard thermal double glazing, internal sound levels within bedrooms due to noise ingress are typically 30 dB below external sound levels with closed windows. Based on this, the calculated internal night-time average sound level is also presented in **Table 7-19**.

Table 7-19: Sound Levels at Proposed Sensitive Receptors

Noise Sensitive Receptor ID	Modelled Night-Time $L_{Aeq,8hour}$ d	Calculated Internal $L_{Aeq,8hour}$ dB
9	50	20
10	45	15
11	53	23
12	44	14
13	42	12
14	39	9
15	40	10

7.6.25 According to these results, night-time internal sound levels at the proposed properties around the periphery of proposed development; those most exposed to the main noise sources (i.e. A82, Old Luss Road, Ben Lomond Way, Pier Road and Balloch Road) are predicted to meet the guidance noise criteria of 30dBA within bedrooms during the night-time periods with closed windows.

7.7 Further Mitigation and Enhancement

Construction Phase

- 7.7.1 As stated in Section 7.6, construction phase impacts have been scoped out of this assessment.
- 7.7.2 A Construction Environmental Management Plan (CEMP) will be prepared prior to construction. Further mitigation is not expected.

Operational Phase

- 7.7.3 The level of significance of noise impact within the current masterplan is minor. The design mitigation features incorporated into the final masterplan design is of one stretch of 2m high close boarded timber garden fencing at the garden /terrace boundary of NSR 11.
- 7.7.4 Taking account of proposed mitigation and enhancement measures, the residual potential effects from the construction and operation of the proposed development are identified below.

7.8 Residual Effects

Construction Phase

- 7.8.1 As stated in Section 7.6, construction phase impacts have been scoped out of this assessment. A Construction Environmental Management Plan (CEMP) will be prepared prior to construction. Noise and vibration suppression techniques will be included in the CEMP and it is therefore considered that significant adverse impacts from construction noise and vibration would not occur.

Operational Phase

- 7.8.2 The embedded mitigation of a 2 m barrier at NSR 11 reduces the sound level at that NSR. The level of significance based on TAN 2011 is moderate/major. This calculation of amenity area has been made from the façade directly facing the A 82.
- 7.8.3 If the amenity of area of NSR 11 were to be designed to built on the eastern side of the lodge, the lodge itself would serve as a barrier to sound, and therefore reducing the sound level.
- 7.8.4 This reduction would most likely change the impact significance from moderate/major to moderate in accordance with TAN 2011.
- 7.8.5 No other residual effects have been identified.

7.9 Monitoring

7.9.1 In the absence of any likely significant adverse effects, no monitoring is considered to be proportionate or required.

7.10 Cumulative Effects

7.10.1 Cumulative effects can occur when other proposed developments would also be relevant to the setting of a sensitive receptors. There are no other proposed developments to which these criteria apply, and therefore cumulative effects have been scoped out of this assessment.

7.11 Summary

7.11.1 A noise assessment has been carried out to assess the impact of the increase in traffic noise as a result of a proposed development at Lomond Banks in Balloch.

7.11.2 The impact of road traffic noise on both existing and proposed residential receptors has been assessed against noise criteria agreed with West Dunbartonshire Council.

7.11.3 3D computer noise modelling using Soundplan v8.2 software has been carried out and validated against measured on-site road traffic noise data. The modelling considered current year (2019), and year of development completion (2030) scenarios. Vibration was scoped out of the assessment because it is considered not to be an issue.

7.12 References

- Her Majesties Stationary Office (HMSO) (1974). The Control of Pollution Act 1974.
- Her Majesties Stationary Office (HMSO) (1990). Environmental Protection Act 1990 (as amended).
- Loch Lomond & The Trossachs National Park (2017). Local Development Plan.
- The Scottish Government (2014b). Scottish Planning Policy.
- The Scottish Government (2014a). Scotland's Third National Planning Framework.
- The Scottish Government Local Government and Communities Directorate (2011a). PAN 1/2011 Planning and Noise. The Scottish Government.
- Environment and Forestry Directorate, The Scottish Government (EFD) (2011b). Assessment of Noise: Technical Advice Note.
- Department of Transport. Calculation of Road Traffic Noise, HMSO, London, 1988, ISBN 0- 11-550847-3.
- World Health Organisation (1999). Guidelines For Community Noise. Geneva: WHO.
- World Health Organisation (WHO) (2018). Environmental Noise Guidelines for the European Region.
- Loch Lomond and the Trossachs National Park. (2017). Local Development Plan.
- British Standards Institute (BSI) (2003). British Standard 7445: Part 1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures.
- British Standards Institute (BSI) (2014a). 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise.

- British Standards Institute (BSI) (2014b). 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration.
- British Standards Institute (BSI) (2019). British Standard 4142:2014 +A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound.
- Standards for Highways (2020). Design Manual for Roads and Bridges, LA 111, Noise and Vibration Revision 2.
- Institute of Acoustics (IOA), Chartered Institute of Environmental Health (CIEH) and Association of Noise Consultants (ANC) (2017). Professional Practice Guidance on Planning and Noise.