1:250 4 6 8 10 12 14 16 18

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EXTERNAL LEVEL NOTES:

1. All levels to comply with Building Regulations Part M – Part 1. Architect to confirm plots where Part M - Part 2 or Part 3 apply.
2. The approach route to any dwelling should be level, gently sloping or, where necessary ramped. On steeply sloping sites a stepped approach can be used.
3. Part M provisions to be generally provided to the principal entrance, however if this is not feasible an alternative entrance is reasonable.
4. The approach route should be a minimum 900m wide and have a maximum crossfall of 1:40.
5. A 1200x1200mm threshold to be provided at the principal access. Maximum crossfall 1:40
6. A ramped approach is acceptable with the following criteria
   a. Individual flights are:
   i. For gradients up to 1:15 - not more than 10m long
   ii. For gradients up to 1:12 - not more than 5m long
   b. Every flight has a minimum clear width of 900m
   c. Every flight has a top and bottom landing.
   d. An intermediate flight is provided between individual flights and any change in direction.
   e. Every landing is a minimum of 1200mm long, clear of the swing of any doors or gate.
7. An external stepped approach is acceptable with the following criteria
   a. Steps are uniform with a rise of 75-150mm and a minimum going of 280mm.
   b. Steps have suitable tread nosings.
   c. No individual flight has a rise of more than 1800mm between landings.
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   e. Top, bottom and intermediate landings has a minimum length of 900mm.
   f. Every flight with three or more risers has a suitable handrail to one side.
8. Should any departure from the proposed slab or external levels be considered, agreement shall be sought from the Engineer immediately and prior to the commencement or continuation of any works.
9. Threshold drainage is required where levels fall towards a flush entrance. Architect to confirm if not required.
10. Where tanking of double DPC is proposed, this should be suitably detailed and designed by the structural engineer as part of the foundations.
11. Any soft spots discovered after proof rolling shall be removed and replaced with suitable engineering fill.
12. New road levels to tie in smoothly with existing road. Levels to be confirmed prior to construction and reported to the Engineer

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- LA Highways Department
- Sewerage Undertaker

Surface levels to tie in smoothly with existing (Section 50 licence required)

KEY

- Site Boundary
- +45.00 Proposed Level
- FFL 45.250 Proposed Finished Floor Level
- Brickwork Tanking
- Brickwork Exposed
- 2xDPC Double DPC
- RW Retaining Feature
- GB Gravel Board Retention
- Minor Contour
- Major Contour

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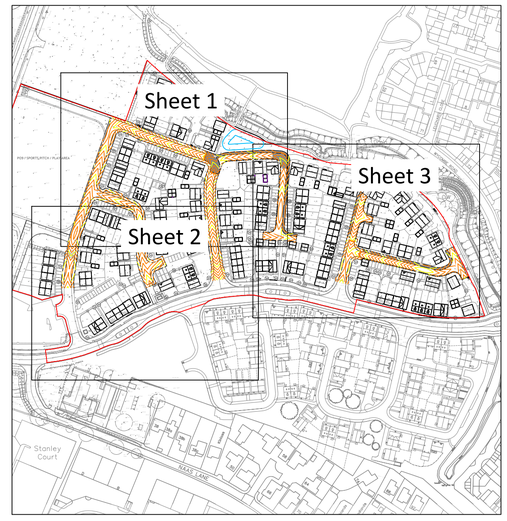
RDQUE-PJA-XX-D2-Y-0101-00
A1@

P1	01.09.22	Amended to suit revised layout.	SWJ



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CLIENT
Linden HOMES

PROJECT

DRAWING TITLE

DRAWING ISSUE STATUS
PLANNING

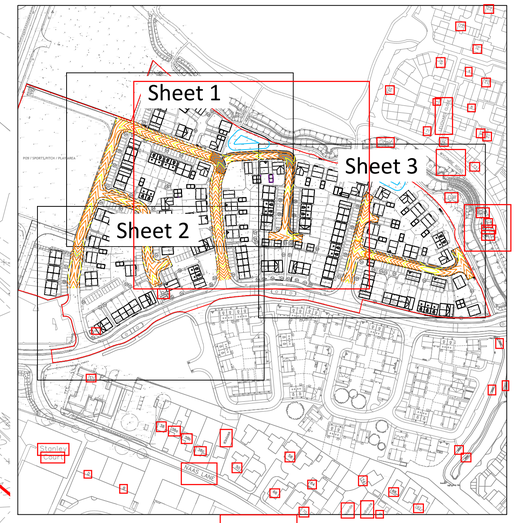
PJA JOB No. | SUB-CODE | DRAWING NO. | REVISION

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE | DRAWN | REVIEWED | DATE

1:250 4 6 8 10 12 14 16 18



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FFL 45.250	Proposed Finished Floor Level
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	Brickwork Exposed
	Double DPC
RW	Retaining Feature
GB	Gravel Board Retention
	Minor Contour
	Major Contour

P1	01:09:22	Amended to suit revised layout	SWJ

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CLIENT
Linden HOMES

PROJECT

DRAWING TITLE

DRAWING ISSUE STATUS
PLANNING

PJA JOB No. | SUB-CODE | DRAWING NO. | REVISION

BIM DRAWING REFERENCE

SCALE | DRAWN | REVIEWED | DATE

1:250 4 6 8 10 12 14 16 18

N

Impermeable area to existing 0.942Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Outfall manholes to be confirmed as part of wider drainage works

Existing roadway drainage within this area and beyond to be confirmed. Allowance for the impermeable area is made within the networks.

Note

Existing manhole references taken from information provided in drawing 0128/1001/01 Rev C located in Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Private Drainage to be developed through detailed design.

KEY

- Site Boundary
- FFL 45.250 — Proposed Finished Floor Level
- Existing Foul Sewer
- Existing Storm Sewer
- Private Foul Drains
- Private Storm Drains
- Adoptable Foul Sewers
- Adoptable Storm Sewers
- Detention basin low flow channel
- RG — Gully
- RE — Storm Rodding Eye
- Flow Control Chamber
- Proposed Sewer Easement

Sheet 1

Sheet 2

Sheet 3

Headwall is to be put forward for S104 adoption and will therefore be subject to the undertakers specific requirements. Materials and safety features to be specified during S104 discussions.

SuDS Basin designed for 1 in 100 year +40% climate change
Top of bank 23.500
Max Water Level 23.200
Invert level 21.900
Volume = 236m³
Discharge = 20L/s

2 Steps to rear

Step into dwelling level access to rear

TS PITCH / PLAY AREA

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DRAINAGE NOTES:

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2. The Contractor shall be responsible for checking all tie-ins for line and level with existing foul and surface water systems before commencing any works.
3. All drainage work is to be strictly in accordance with the requirements of the Building Regulations 2015, Approved Document Part H, "Drainage and waste disposal".
4. All existing land drains encountered on site during construction are to be re-connected.
5. Temporary protection to be provided to drainage work during construction as necessary.
6. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
7. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
8. All pipes to be 100 or 110mm dia. and laid at 1 in 80 unless stated otherwise.
9. All concrete is to be in accordance with BS EN 206-1, BS 8500 and the recommendations of BRE Special Digest (Concrete in Aggressive Ground).
- Unless specified otherwise, in situ concrete shall be designated mix Gen 3 (Grade C20), or an equivalent mix subject to the approval of the Engineer.
- The following types of pipe may be used unless noted or agreed otherwise;
  Pipes up to 300mm diameter to be Structured Walled to BS EN 13476, Polypropylene to BS EN 1852, PVC-U to BS EN 1401 or Vitrified Clay to BS EN 295.
  Pipes over 300mm diameter to be Concrete to BS 5911, Structured Walled to BS EN 13476, Polypropylene to BS EN 1852 or PVC-U to BS EN 1401.
10. Both Clay and Concrete pipes shall be strength class 120 (100/150mm min crushing strength 28kN/m). Thermoplastic pipes shall have a minimum ring stiffness of SN4.
11. Pipes which run adjacent to buildings shall be installed in strict accordance with Part H, Clauses 2.23 to 2.25. Diagrams 7 and 8 are of particular relevance and shall be complied with.
12. All pipes, chambers and fittings shall be installed, bedded and backfilled in accordance with the manufacturers instructions subject to the following minimum requirements table.

Location	Cover to crown	Bedding Clay/Concrete Pipe	Bedding Plastic Pipe	Backfill
Roads (HGV)	>1.2m <1.2m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granula
Grass / car parking	>0.9m <0.9m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granular
Hard and soft Landscaping	>0.6m <0.6m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete	Suitable as dug material

13. Pipes Penetrating Walls.
  An opening is to be formed through walls to give pipes at least 50mm clearance all round. Brickwork over shall be supported by a lintel. Opening to be masked each side with rigid sheet material.
  Pipes embedded in walls shall have joints formed within 150mm of either wall face. Adjacent rocker pipes of max 600mm length with flexible joints shall continue the pipework.
14. All pipes beneath buildings to be B&S in concrete. Where cover is less than 300mm the concrete is to be cast integrally with the floor slab.
15. All drains in the vicinity of existing or proposed trees to be constructed in accordance with the requirements of NHBC Practice Note 3.
16. Ventilation shall be provided at the head of the foul drainage runs.
17. The first flexible joint in pipes adjoining a manhole shall be a maximum length of 600mm from the inside face of the manhole, connecting to a rocker pipe. The length of the rocker pipe shall be as follows;

Pipe Dia	Length of Rocker Pipe
150-600mm	600mm
675-750mm	1000mm
over 750mm	1250mm

18. All manholes and inspection chambers situated in areas subject to vehicular loading to have class D400 covers and frames to BS EN124 and those not subject to vehicular loading may have class B125 covers and frames.
19. Manholes located within block paved areas to have 150mm deep cover frames and bedded suitable for the size of blocks in use. The concrete hauching is NOT to be broken out to allow for block paving installation.
20. Drainage frames must be tied to manhole risers by use of manufacturers ties (eg. Polypipe ref FRK500 fixing kit and FRK501 black ties.) The ground works contractor will be held fully responsible for any accidents due to incorrect fitting or failure to use the correct manufacturers fixing equipment.
21. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
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23. Requirement for Land Drains to be assessed on site by the Site Manager
24. Road gullies shall be trapped 450Ø x 900mm deep with Class D 400 frame and grating to BS EN 124.
25. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
26. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.

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CLIENT: Linden HOMES

PROJECT

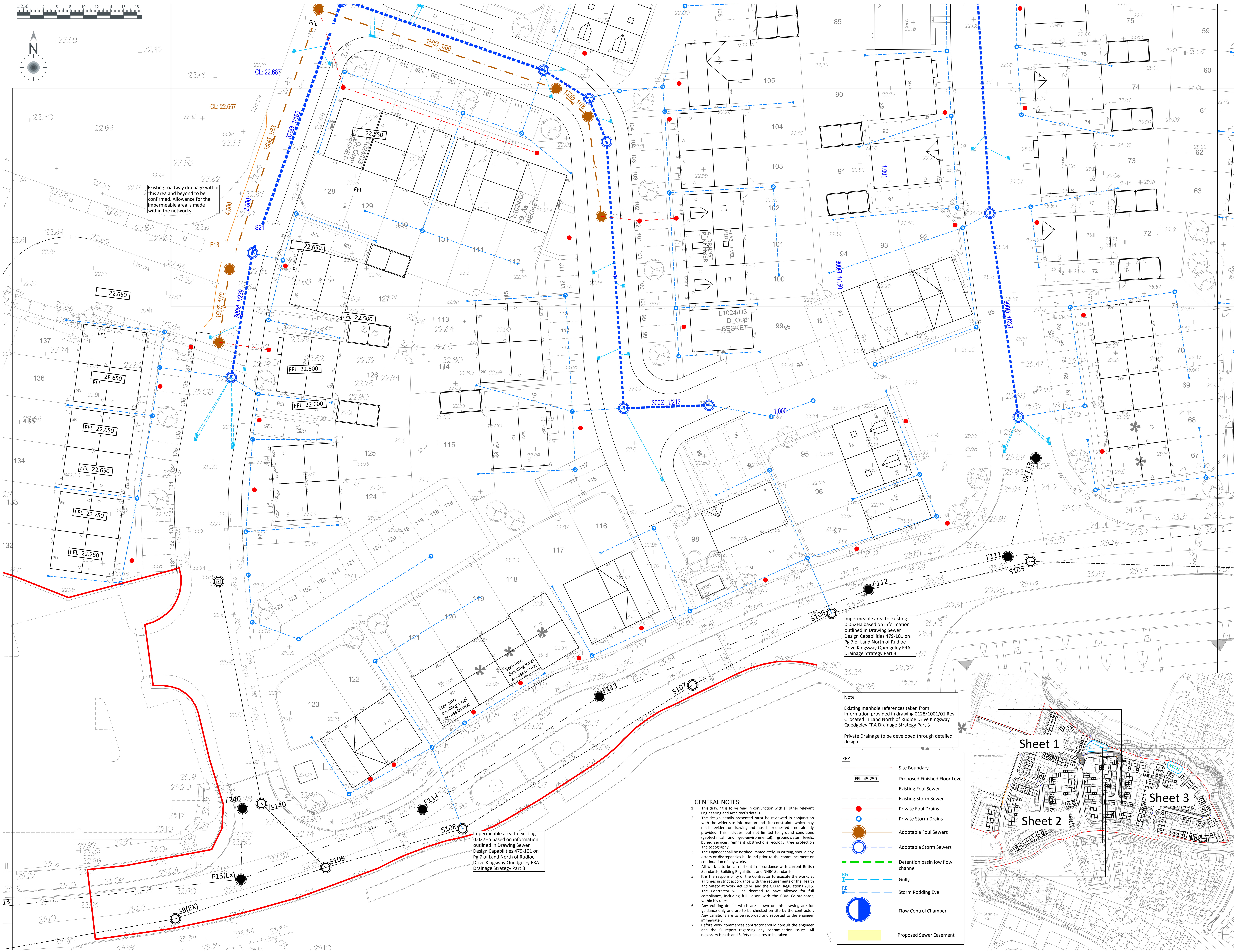
DRAWING TITLE

DRAWING ISSUE STATUS: PLANNING

PJA JOB No. | SUB-CODE | DRAWING NO. | REVISION

BIM DRAWING REFERENCE

SCALE | DRAWN | REVIEWED | DATE



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CLIENT
Linden HOMES

PROJECT
Rudloe Drive Quedgeley

DRAWING TITLE
Drainage Strategy
Sheet 2 of 3

DRAWING ISSUE STATUS
PLANNING

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
06396		0104	PI

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE
RDQUE PJA XX D2 X 0104 00

SCALE	DRAWN	REVIEWED	DATE
A			

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SuDS Basin designed for 1 in 100 year +40% climate change
Top of bank 24.500
Max Water Level 24.200
Invert level 23.000
Volume = 148m³
Discharge = 4L/s

KEY

- Site Boundary
- FFL 45.250 — Proposed Finished Floor Level
- Existing Foul Sewer
- Existing Storm Sewer
- Private Foul Drains
- Private Storm Drains
- Adoptable Foul Sewers
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- Unless specified otherwise, in situ concrete shall be designated mix Gen 3 (Grade C20), or an equivalent mix subject to the approval of the Engineer.
- The following types of pipe may be used unless noted or agreed otherwise:
  Pipes up to 300mm diameter to be Structured Walled to BS EN 13476, Polypropylene to BS EN 1852, PVC-U to BS EN 1401 or Vitrified Clay to BS EN 295.
  Pipes over 300mm diameter to be Concrete to BS 5911, Structured Walled to BS EN 13476, Polypropylene to BS EN 1852 or PVC-U to BS EN 1401.
10. Both Clay and Concrete pipes shall be strength class 120 (100/150mm min crushing strength 28kN/m). Thermoplastic pipes shall have a minimum ring stiffness of SN4.
11. Pipes which run adjacent to buildings shall be installed in strict accordance with Part H, Clauses 2.23 to 2.25. Diagrams 7 and 8 are of particular relevance and shall be complied with.
12. All pipes, chambers and fittings shall be installed, bedded and backfilled in accordance with the manufacturers instructions subject to the following minimum requirements table.

Location	Cover to crown	Bedding Clay/Concrete Pipe	Bedding Plastic Pipe	Backfill
Roads (HGV)	>1.2m <1.2m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granulo
Drives / car parking	>0.9m <0.9m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granular
Hard and soft Landscaping	>0.6m <0.6m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete	Suitable as dug material

13. Pipes Penetrating Walls.
    An opening is to be formed through walls to give pipes at least 50mm clearance all round. Brickwork over shall be supported by a lintel. Opening to be masked each side with rigid sheet material.
    Pipes embedded in walls shall have joints formed within 150mm of either wall face. Adjacent rocker pipes of max 600mm length with flexible joints shall continue the pipework.
14. All pipes beneath buildings to be B&S in concrete. Where cover is less than 300mm the concrete is to be cast integrally with the floor slab.
15. All drains in the vicinity of existing or proposed trees to be constructed in accordance with the requirements of NHBC Practice Note 3.
16. Ventilation shall be provided at the head of the foul drainage runs.
17. The first flexible joint in pipes adjoining a manhole shall be a maximum length of 600mm from the inside face of the manhole, connecting to a rocker pipe. The length of the rocker pipe shall be as follows;

Pipe Dia	Length of Rocker Pipe
150-600mm	600mm
675-750mm	1000mm
over 750mm	1250m

18. All manholes and inspection chambers situated in areas subject to vehicular loading to have class D400 covers and frames to BS EN124 and those not subject to vehicular loading may have class B125 covers and frames.
19. Manholes located within block paved areas to have 150mm deep cover frames and bedded suitable for the size of blocks in use. The concrete haushing is NOT to be broken out to allow for block paving installation.
20. Drainage frames must be tied to manhole risers by use of manufacturers ties (eg. Polypipe ref FRK500 fixing kit and FRK501 black ties.) The ground works contractor will be held fully responsible for any accidents due to incorrect fitting or failure to use the correct manufacturers fixing equipment.
21. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
22. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Sewers for Adoption, current Edition" and the Adopting Water Authority's recommendations
23. Requirement for Land Drains to be assessed on site by the Site Manager
24. Road gullies shall be trapped 450Ø x 900mm deep with Class D 400 frame and grating to BS EN 124.
25. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
26. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.

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Note

Existing manhole references taken from information provided in drawing 0128/1001/01 Rev C located in Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Private Drainage to be developed through detailed design

PRELIMINARY SCHEME
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- Development Control
- LA Planning Authority
- Environment Agency
- LA Highways Department
- Sewerage Undertaker

P1	01:09:22	Amended to suit revised layout	SWJ

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CLIENT: Linden HOMES

PROJECT

DRAWING TITLE

DRAWING ISSUE STATUS: PLANNING

PJA JOB No. | SUB-CODE | DRAWING NO. | REVISION

BIM DRAWING REFERENCE

SCALE | DRAWN | REVIEWED | DATE

1:500 10 20 30

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SPORTS PITCH / PLAY AREA

SECTION 38 NOTES:

1. Roads and footways to be adopted under Section 38 of Highways Act 1980 shall comply with the adopting Local Authority Highway Design Guidelines for New Developments and be in accordance with the Highways Agency Design Manual for Roads and Bridges.
2. All works within public highway to comply with current health and safety standards and all signing shall comply with Chapter 8 Traffic Safety measures and Signs for Roadworks and Temporary situations of the Traffic Signs Manual.
3. A Covenant will be provided to the benefit of the Local Authority ensuring that no planting or structure greater than 600mm in height to be permanently situated within any private visibility splays
4. Rear of visibility splays to be delineated with a continuous 50 x 150 PC concrete Type EF square edging set at a level to enable the grass (if any) to be cut.
5. Hand laying of bituminous materials is not permitted on adoptable carriageway
6. Tarmac road construction to comply with BS.EN.130108
7. All substrata structures and unconsolidated material, within the construction width of the highway, are to be removed.
8. Where two or more water services boundary boxes are situated together multi-meter boundary as specified by the Sewerage Undertaker are to be installed
9. Stopcock and Meter Covers shall not be located within the vehicular crossing construction
10. Hinged gully grate and frame to BS EN 124, grade D400, non-rocking with captive left hand end hinge. Minimum waterway area 900cm squared. Frame depth 100mm. Black coated ductile iron.
11. All gully pots to BS5911 or BS 65 minimum size 900mm x 450mm
12. All trenches within the adoptable areas will be backfilled with Type 1, or materials specified in Clause 6.17
13. In drainage easement areas no buildings, walls or other permanent structures and no planting of trees, or substantial shrubs/ hedges.
14. All existing drainage levels, diameters & locations need to be checked on site and any discrepancies need to be reported back to the Engineer
15. Manhole covers and gully grates to be adopted shall be kitemarked and to BS EN124. Class D400, gully grates 450mm square.
16. Manholes located within turning areas of junction to have covers treated with an anti-slip coating.
17. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels
18. In block paved areas 'Infill' type covers should not be used, and frames must be 150mm deep.
19. All gully and channel grating in shared surfaces and footways to be pedestrian friendly
20. All adoptable pipe work for Highway drains to be minimum concrete Class 120 to BS5911 or Class 120 clay or 28kN/m crushing strength if 150mm Ø to BSEN295-1 and laid on Class S granular bed unless shown otherwise.
21. Where highway drains have less than 1.2m cover under roads and 0.9m cover under drives and gardens the pipes are to be surrounded with 150mm of Class ST4/C20 concrete with flexibility joints maintained as stated in Clause 4.2.28 of the Water Services Association Guide. Any Concrete bed and surround to pipe work to be sulphate resisting cement.
22. The provision of a CCTV survey of any highway drainage, at the developers expense, is required prior to laying the wearing course.
23. All connections to highway drains must be made via factory made junctions.
24. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Sewers for Adoption current Edition" and the Sewerage Undertakers recommendations.

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KEY

- Site Boundary
- Carriageway offered for adoption
- Footpath (& other hard surfaces) offered for adoption
- Existing Carriageway
- Existing Foul Sewer
- Existing Storm Sewer
- Private Foul Drains
- Private Storm Drains
- Adoptable Foul Sewers
- Adoptable Storm Sewers
- RG Gully
- RE Storm Rodding Eye
- Flow Control Chamber

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P1	01.09.22	Amended to suit revised layout	SWJ

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Impermeable area to existing 0.942Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Outfall manholes to be confirmed as part of wider drainage works

ORTS PITCH / PLAY AREA

Impermeable area to existing 0.052Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Impermeable area to existing 0.043Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Impermeable area to existing 0.027Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Impermeable area to existing 0.078Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

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ADOPTABLE DRAINAGE NOTES:

1. This drawing is subject to approval by Local Authority, Building Control and / or Sewerage Undertaker. Any works undertaken prior to the granting of these approvals is carried out at at risk to others.
2. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
3. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
4. All manhole covers to comply with BS.EN.124, and be Kitemarked
5. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
6. In block paved areas 'infill' type covers should not be used, and frames must be 150mm deep.
7. All manhole and drainage covers shall comply with BS.EN124, BS.EN13598-1 and HA104/09.
   Cover strengths to be:-
   Class E600 in areas of heavy loading.
   Class D400 in all trafficked areas (roads, hard shoulder, parking areas and services yards).
   Manhole covers on foul only sewers shall be of low leakage types in order to prevent excessive surface water ingress.
8. Drainage pipes 100mm Ø unless stated otherwise.
   Pipes to be :-
   Vitrified clay to BS EN 295 or Concrete to BS 5911 or UPVC pipes to BS EN 1452 or Thermoplastic Structured wall pipes complying with WIS 4-35-01. BSi kitemarked. Class 8kN/m² nominal short term ring stiffness.
9. All sewer pipes 300mm diameter or larger, to be concrete pipes, to BS.5911, unless noted otherwise
10. All pipes to be laid with soffits level, unless noted otherwise.
11. Where cover to pipes is less than 1200mm under carriageway - concrete bed and surround or concrete protection slab is required.
12. All concrete to drainage, manholes bases, surrounds etc to be in accordance with the BRE special digest 1 - Concrete in aggressive ground. Refer to site investigation report for sulphate requirements.
13. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
14. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.
15. Upon completion of the drainage works all drains shall be flushed out and CCTV surveyed and shown to be free of all silt and debris and to have no joint displacements or other defects. A copy of the written report and video is to be forwarded to the Engineer for comment. Any defects shall be attributable to the contractor for rectification unless indicated otherwise by the CCTV report and agreed with the Engineers.
16. Demarcation manholes and lateral drains need to be constructed in accordance with the Water UK/WRc "Design and Construction Guidance".
17. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Design and Construction Guidance" and the Adopting Water Authority's recommendations

KEY

- Existing Foul Sewer
- Existing Storm Sewer
- Adoptable Foul Sewers
- Adoptable Storm Sewers
- Private Foul Drains
- Private Storm Drains
- RG Highway Road Gully
- Sewer Easement
- FFL 45.250 Proposed Finished Floor Level
- Site Boundary

P2	01.09.22	Updated to suit revised layout	SWJ
P1	01.07.22	Updated to latest site layout and drainage design	OB

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TS PITCH / PLAY AREA

Flow routing arrows indicated on this plan are the direction overland surface water shall flow in an exceedance event. An exceedance event is one where a storm occurs above the design criteria of the drainage system, or if the drainage system critically fails. It should be noted that the drainage system is designed to cater for all rainfall events up to a 100year return period, with an additional allowance for climate change, with NO flooding occurring within this design criteria.

All low points are designed to contain any surface water flooding away from properties, until such time as flood water receeds.

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KEY

- Adoptable Storm Sewers
- RG Highway Road Gully
- Flow Control Chamber
- FFL 45.250 Proposed Finished Floor Level
- Site Boundary
- Flow Direction Arrow
- Major Contour

P2	01.09.22	Amended for revised layout	SWJ
P1	01.07.22	Updated to latest site layout and levels design	OB

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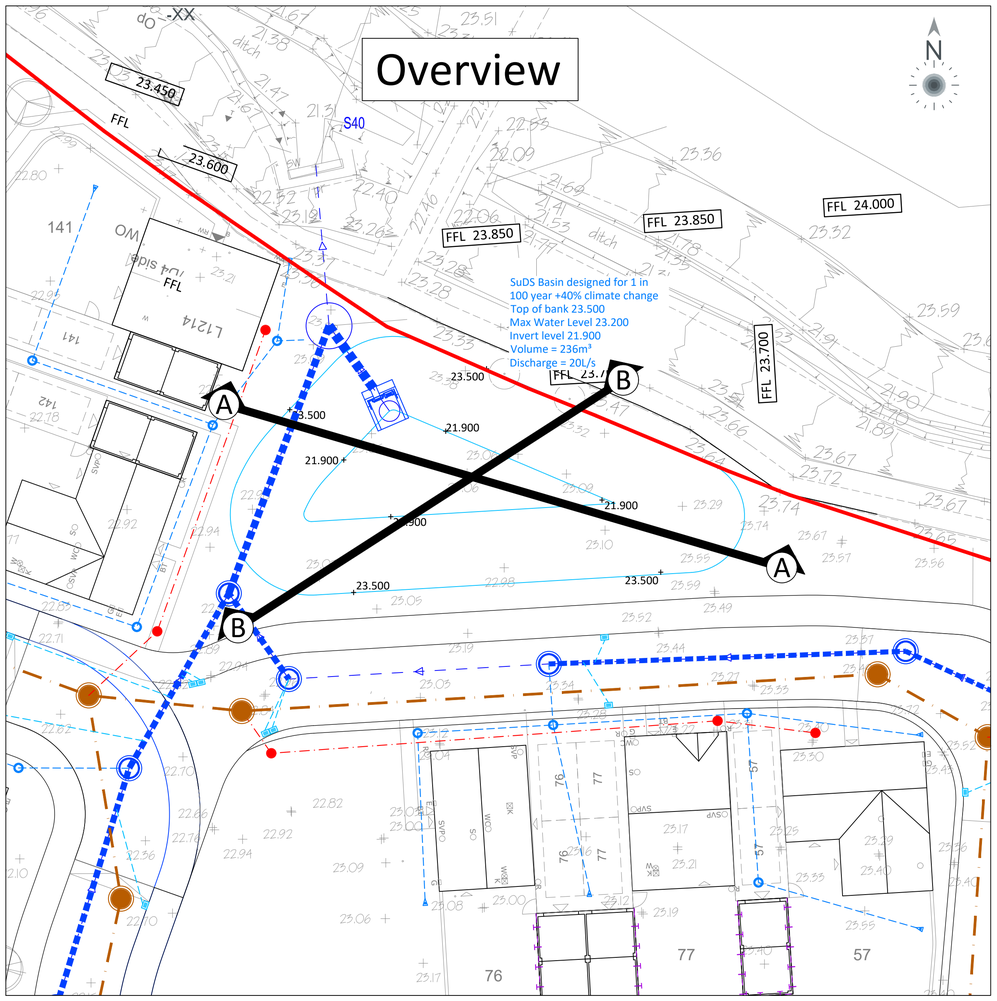
BIM DRAWING REFERENCE

SCALE | DRAWN | REVIEWED | DATE

1:200 2 4 6 8 10 12 14

Overview



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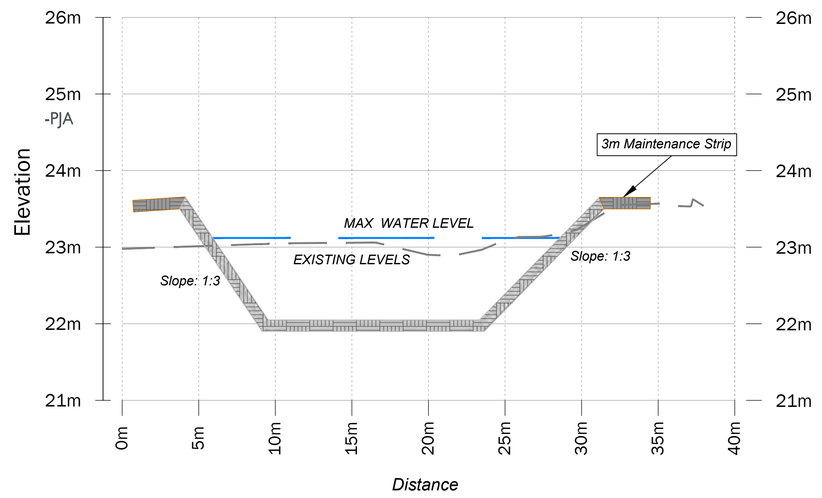
Pond 1 Cross Section A



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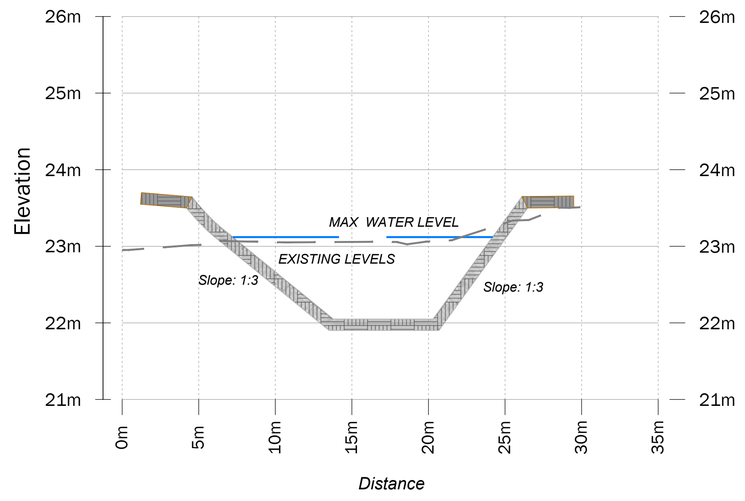
Pond 1 Cross Section B



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OVERVIEW KEY

- Site Boundary
- Adoptable Foul Sewers
- Adoptable Storm Sewers
- Private Foul Drains
- Private Storm Drains
- Gully (RG)
- Storm Rodding Eye (RE)
- Flow Control Chamber
- Cross Section Line (B B)

CROSS SECTION KEY

- Max Water Level
- Existing Levels
- Proposed Ground level around Pond
- Pond Embankment

150mm of topsoil over both the proposed ground level around the pond and the pond embankment

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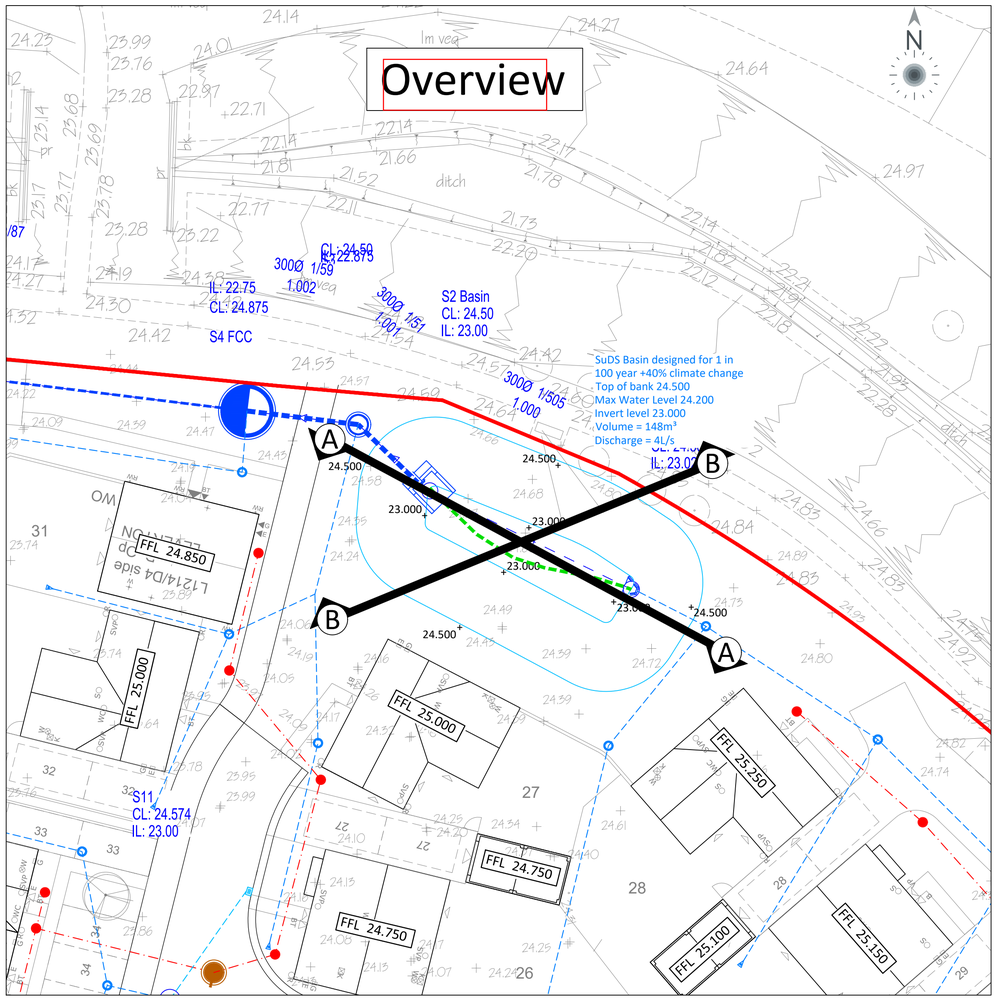

Letter : P

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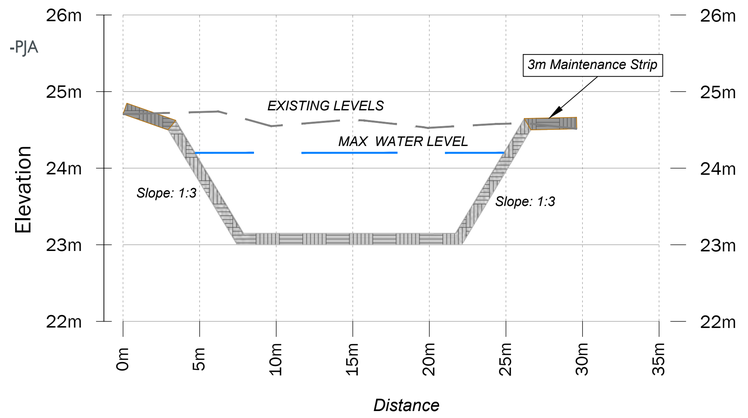
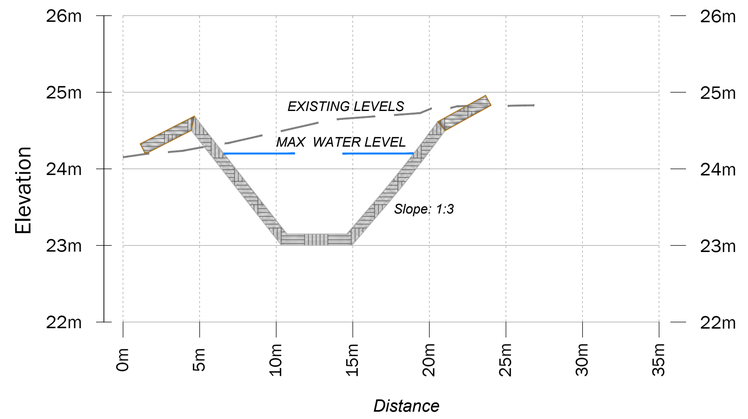
Pond 2 Cross Section A



Horizontal scale @ 1:50, Vertical scale @ 1:250

Pond 2 Cross Section B



Horizontal scale @ 1:50, Vertical scale @ 1:250

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

GENERAL NOTES:

1. This drawing is to be read in conjunction with all other relevant Engineering and Architect's details.
2. The design details presented on this drawing are prepared in conjunction with the wider site information available at the time. Some details may not be evident on drawing and must be requested if not already provided. This includes, but not limited to, ground conditions (geotechnical and geo-environmental), groundwater levels, buried services, remnant obstructions, ecology, tree protection and topography.
3. The Engineer shall be notified immediately in writing should any errors or discrepancies be found prior to the commencement or continuation of any works.
4. All work is to be carried out in accordance with current British Standards, Building Regulations and NHBC Standards.
5. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health and Safety at Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the CDM Co-ordinator, within his rates.
6. Any existing details which are shown on this drawing are for guidance only and should be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.
7. Before work commences contractor should consult the engineer and the SI report regarding any contamination issues. All necessary Health and Safety measures to be taken

Rudder Drive Queds
Pond Cross Sectio
Sheet 2 of 2
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04 17
REDQUE

OVERVIEW KEY AI@

- Site Boundary
- Adoptable Foul Sewers
- Adoptable Storm Sewers
- Private Foul Drains
- Private Storm Drains
- Gully (RG)
- Storm Rodding Eye (RE)
- Flow Control Chamber
- Cross Section Line (B B)

CROSS SECTION KEY

- Max Water Level
- Existing Levels
- Proposed Ground level around Pond
- Pond Embankment

150mm of topsoil over both the proposed ground level around the pond and the pond embankment

PRELIMINARY SCHEME
For comment and review only.
Design is based upon information available at the time.
Design is subject to full review as additional information becomes available.
Design is subject to full review upon receipt of comments from

- Development Control
- LA Planning Authority
- Environment Agency
- LA Highways Department
- Sewerage Undertaker

Seven House - High Street
Longbridge - Birmingham
B31 2UQ - Tel: [redacted]
- Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Linden HOMES

PROJECT

DRAWING TITLE

DRAWING ISSUE STATUS
PLANNING

PJA JOB No. SUB-CODE DRAWING NO. REVISION

Re

BIM DRAWING REFERENCE

SCALE DRAWN REVIEWED DATE

LFAcoustics
consulting engineers

NOISE ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT ON LAND NORTH OF RUDLOE DRIVE, KINGSWAY, GLOUCESTER

VISTRY HOMES LTD

SEPTEMBER 2022

LF Acoustics Ltd
Pond Farm
7 High Street
Pulloxhill, Beds
MK45 5HA

[redacted]

Registered in England
Company Reg: 8434608

NOISE ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT ON LAND NORTH OF RUDLOE DRIVE, KINGSWAY, GLOUCESTER

VISTRY HOMES LTD

SEPTEMBER 2022

Status	Prepared By	Date
2.0	[redacted]	1/9/22
1.0		20/5/22

CONTENTS

1. Introduction

LF Acoustics Ltd have been appointed by Vistry Homes Ltd to undertake a noise assessment for a proposed residential development of 150 dwellings on land to the north of Rudloe Drive, Kingsway.

Outline Planning Permission for the Proposed Development was granted by Gloucester City Council on 9th July 2021, subject to Conditions (Application Ref. 21/00490/OUT). Conditions 9 and 10 relate to noise and are reproduced below, for reference.

Condition 9

Reserved matters applications shall be accompanied by details , OR

Prior to the commencement of above ground development, details of façade and glazing design for all buildings with frontage to Rudloe Drive (or to be defined on a plan) shall be submitted to and approved in writing by the Local Planning Authority, to demonstrate that internal noise level criteria from BS8233:2014 (or subsequent equivalent replacement standard) for residential use within that phase can be achieved. No residential unit for which measures are identified as required within the approved details shall be occupied until those measures have been implemented in full.

Condition 10

Reserved matters applications shall be accompanied by a report setting out the mitigation measures to be adopted in the development to mitigate the impact of the public house use on the living conditions of future occupants of the development, including a Noise Report establishing that the noise levels within properties would meet the applicable standards.

This report presents an updated assessment of the noise levels within the Proposed Development and provides details of the mitigation measures to be incorporated to address the requirements of the Conditions. The assessment has been updated to reflect changes to the layout of the development since the previous noise assessment was prepared in May 2022.

Planning permission has also recently been granted for a builders' merchants to be located on land to the west of the Proposed Development (Application Ref. 21/00846/FUL). Consideration of noise from this land use has also been considered, to ensure the noise mitigation measures incorporated into that development ensure an acceptable living standard within the adjacent dwellings.

The following section of this report provides a brief description of the Standards and guidance applicable to this development. Section 3 provides a description of the site, its surroundings and an illustrative layout upon which this assessment has been based. Section 4 presents the results of a noise monitoring exercise, carried out to determine the existing noise levels across the site. Section 5 presents an assessment of the noise levels against relevant standards and guidance. Recommendations for mitigation measures to ensure a satisfactory noise environment is achieved are also discussed within this section. Finally, Section 6 provides a summary of the report and recommendations.

2. Applicable Standards and Guidance

2.1. A description of the noise units referred to in this report is provided in Appendix A.

2.2. National Planning Policy Framework

The National Planning Policy Framework (NPPF), revised in July 2021 [1], sets out the Government's planning policies for England and how these should be applied. It provides a framework upon which locally-prepared plans for housing and other development can be produced.

The purpose of the planning system is to contribute to the achievement of sustainable development and at the heart of the Framework is a presumption in favour of sustainable development.

With regards noise, the NPPF advises that local planning policies and decisions should contribute to and enhance the natural and local environment by:

- preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels noise pollution.
- mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development (including cumulative effects) – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.3. British Standard BS 8233

BS 8233 [2] recommends design aims for noise levels to be achieved in new buildings and is the most appropriate guidance in defining applicable noise levels within the proposed development. The Standard was updated in 2014 to better reflect the requirements of the NPPF in terms of impact classifications and achieving the recommended guidance values, seeks to ensure that the occupants would not be subject to any significant adverse impacts, to ensure compliance with the requirements of the NPPF.

For residential properties, the guidance recommends the following design aims for the daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods:

- 35 dB $L_{Aeq,T}$ within living rooms and bedrooms during the daytime period;
- 40 dB $L_{Aeq,T}$ within dining areas / rooms during the daytime period;
- 30 dB $L_{Aeq,T}$ within bedrooms at night; and
- 50 – 55 dB $L_{Aeq,T}$ within gardens and patios during the daytime.

With regards internal noise levels, the Standard advises:

"Where development is considered necessary or desirable, external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

Where the above limits require windows to be closed to maintain the standard of noise, there needs to be appropriate alternative ventilation provided that does not compromise the façade insulation or resulting noise level.

For outdoor amenity spaces, it is recognised in the Standard that these guideline values may not be achievable in all circumstances. Where development might be desirable, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, the development should be designed to achieve the lowest practicable levels, but should not be prohibited. Given that there is a need for the development, it is considered in this situation, that this relaxation could be applied, providing the lowest practicable levels have been achieved.

2.4. World Health Organisation Guidelines

The WHO guidance [3] provides guidance of a similar nature to BS 8233, although the emphasis is more on health effects associated with noise. The document recommends internal and external noise levels to provide an acoustic environment conducive to un-interrupted speech and sleep. The WHO guidance is summarised below for information purposes.

- It will be important to consider the maximum noise levels and number of noisy events.
- Satisfactory protection should be provided to avoid sleep disturbance, annoyance and speech communication interference.
- Recommended internal noise levels in bedrooms are given as 30 dB $L_{Aeq,T}$ for continuous noise and 45 dB $L_{Amax,F}$ for single events, during the night-time period.

2.5. British Standard BS 4142

BS 4142 [4] is the British Standard for rating and assessing noise of a commercial or industrial nature and is relevant to the noise associated with the operation of the plant at the neighbouring public house.

BS 4142 is a comparative standard in which the estimated noise levels from the proposed development are compared to the representative / typical background noise level from existing uses.

BS 4142 relates the likelihood of adverse impact to the difference between the Rating Level of the noise being assessed and the background noise level.

The background noise level is the L_{A90} noise level, usually measured in the absence of noise from the source being assessed, but may include other existing industrial or commercial sounds. The background noise levels should generally be obtained from a series of measurements each of not less than 15 minute duration.

The Rating Level of the noise being assessed is defined as its L_{Aeq} noise level (the 'specific noise level'), with the addition of appropriate corrections should the noise exhibit a marked impulsive and/or tonal component or should the noise be irregular enough in character to attract attention. The extent of the correction is dependent upon the degree of tonality or character in the noise

and is determined either by professional judgement, where the plant is not operational at present, or by measurement.

During the daytime, the specified noise levels are determined over a reference time interval of 1 hour, with a 15 minute reference period adopted when assessing night-time noise.

If the Rating Level of the noise being assessed exceeds the background level by 10 dB or more BS 4142 advises that there is likely to be an indication of a significant adverse impact, depending upon context. A difference between background level and Rating Level of around 5 dB is likely to be an indication of an adverse impact, depending upon context. The lower the Rating Level is, relative to the background noise level, the less likely the specific source will have an adverse or significant adverse impact. Where the Rating Level does not exceed the background noise level is an indication of a low impact, depending upon context

2.6. ProPG: Planning and Noise

Professional planning guidance on planning and noise was published in May 2017 [5]. The guidance seeks to provide a recommended approach to the management of noise within the planning system in England. The guidance has been prepared jointly between the Association of Noise Consultants, The Institute of Acoustics and the Chartered Institute of Environmental Health with the aim of providing a coherent approach to achieving the requirements of the NPPF.

At present, the guidance principally relates developments where noise is principally influenced by transportation sources, although it does include consideration of commercial where it is audible but not the dominant noise source.

The guidance advocates a systematic, proportionate, risk based, 2-stage approach, encouraging early consideration of noise within the design process for new residential developments:

- Stage 1 provides an initial noise risk assessment of the development site;
- Stage 2 provides systematic consideration of four key elements: demonstrating a good acoustic design process; observing internal noise level guidelines; undertaking an external amenity area noise assessment; and consideration of other relevant issues.

The initial risk assessment should identify the risk of adverse effects from noise and identifying whether the site poses a negligible, low, medium or high risk. The level of risk does not determine whether a site may be unsuitable for development, but highlights an increasing requirement for noise to be considered within the design of the development and the likelihood of a need for specific noise mitigation measures.

For a Stage 2 assessment, upon which basis this report has been prepared, the guidance refers to BS 8233 with respect of achieving an acceptable internal noise environment and within gardens.

Internally, the guidance recommends that the targets within BS 8233 are adopted as an aim. Expanding upon the guidance within BS 8233, for internal noise environments It is stated:

"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels

exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form."

Within external amenity areas, the guidance reflects BS 8233, as follows:

"These guideline values (i.e. a level of between 50 – 55 dB L_{Aeq}) may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces."

ProPG additionally provides guidance upon acceptable maximum noise levels within bedrooms at night to minimise the potential for sleep disturbance. The guidance recommends that a level of 45 dB $L_{Amax,F}$ is normally exceeded more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only upon the maximum noise levels but also other factors such as source, number, distribution, predictability and regularity of noise events.

2.7. Approved Document O

Approved Document O to the Building Regulations was published in December 2021 and came into force during June 2022. The document provides the requirements within dwellings to minimise the potential solar gains and to provide adequate means to remove heat from the indoor environment.

ADO requires excess heat to be removed by the following means:

- Opening windows;
- Ventilation louvres in external walls;
- A mechanical ventilation system; and
- A mechanical cooling system.

The building should be designed to remove excessive heat by passive means as far as reasonably practical.

With regards to noise, ADO requires the following:

In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

It is recognised in a recent document published by the CIEH [6] that the criteria contained within ADO are not reflected in the older AVO Guide (which will need to be updated). The CIEH document advises that the internal criteria within the AVO Guide, and presented in the previous sub-section, which indicates acceptable internal noise levels, should not be used, with the AVO Guide now only used for practical guidance on noise control measures. The limits specified above within ADO should therefore be used when determining the requirement for any assisted ventilation requirements.

3. Site Description and Development Proposals

The proposed residential development would be located on land to the north of Rudloe Drive, Kingsway.

It is proposed to construct a residential development of 150 dwellings on the site. The proposed development layout is indicated on Figure 1.

The A38 runs to the west of the proposed development, approximately 200 metres from the western site boundary. This road is within a cutting as it passes the site and is additionally screened from the proposed dwellings by buildings constructed alongside the A38. Traffic was also audible travelling along Newhaven Road, which also runs to the west of the site.

The southern boundary is adjacent to Rudloe Drive. This road carries local traffic into the main development area. Traffic flows along this road are gradually increasing, as more homes within the development are being completed. Consideration of this has been taken into account by assessing the noise levels along Rudloe Drive on the basis of 2024 flows with the development completed.

There are existing residential properties to the east, located along Rudloe Drive, with planning permission also having been granted for residential development on land to the south, directly opposite the Proposed Development.

The Rose Tree Farm Public House is located to the south west of the Proposed Development, along Rudloe Drive. Noise associated with the operation of the Public House has the potential to generate audible levels of noise at the proposed dwellings and has been considered within this report to address the requirements of Condition 10.

Planning permission has recently been granted for a builders' merchants on land to the east of Kingsway, as indicated on Figure 1. This development would be adjacent to the proposed dwellings within the north western area of the proposed development. A noise assessment was prepared to accompany the planning application for the builders' merchants and mitigation measures proposed, which would ensure acceptable living conditions within the proposed residential development, based upon an assessment of the indicative layout prepared to accompany the outline application. An updated assessment of the noise attributable to the operation of the builder's merchants has been made based upon the final layout for the residential development, to ensure that the noise levels remain acceptable.

4. Noise Monitoring

4.1. Unattended Noise Surveys

Unattended noise monitoring was carried out at two positions within the application site between Wednesday 6th and Friday 8th March 2019.

Weather conditions during the survey were mixed, remaining generally dry with light to moderate winds. There was a period of rain observed during Thursday afternoon, which was noted to increase the noise levels, attributable to water on the surrounding roads. The noise levels monitored during this period were considered to represent reasonable worst case conditions.

Two Rion NL-52 Class 1 Sound Level Meters were used for the survey, fitted with Rion WS-15 Class 1 outdoor microphone protection. The instruments were calibrated before and after the exercise using a Rion NC-74 Class 1 Acoustic Calibrator. The sound level measured on the instruments with the calibrator applied read 94.0 dB(A) on both occasions.

The instruments were configured to monitor noise levels over contiguous 5 minute periods for the duration of the survey, which enabled maximum noise levels associated with particular events to be identified and a comparison with the attended noise measurements to be made. In addition, the instruments were fitted with an NX-42WR Waveform Recording Option Cards, which enabled sample audio data to be captured every 10 minutes throughout the survey, enabling the principal noise sources to be identified.

One instrument was positioned along the southern boundary midway within the site and set back approximately 25 metres from Rudloe Drive.

The second instrument was positioned along the south western boundary of the site at a position representative of the closest proposed dwelling to the Rose Tree Farm Public House.

At each position, the microphone was set freefield and at a height of 1.3 metres above local ground level.

The monitoring positions are indicated on Figure 1.

The results of the surveys have been analysed into hourly periods for reporting purposes using the Rion AS-60 Data Management Software with the tabulated hourly data provided in Appendices B and C. Figures 2 and 3 provide a summary of the hourly noise levels in graphical form.

The noise levels have been analysed to provide the overall day and night-time levels, as indicated in the following tables.

Day	Period Free-field Noise Level [dB]			
	Daytime (07:00 – 23:00)		Night-time (23:00 – 07:00)	
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}
Wednesday 6/3/19	55.7*	52.6*	49.7	43.5
Thursday 7/3/19	56.6	53.2	48.4	42.9

Notes * Daytime Period includes levels measured between 09:00 – 23:00 hours Wednesday and 07:00 – 09:00 Friday

Table 4.1 Period Noise Levels Monitored at Unattended Survey Position U1, Centrally Along Rudloe Drive

Day	Period Free-field Noise Level [dB]			
	Daytime (07:00 – 23:00)		Night-time (23:00 – 07:00)	
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}
Wednesday 6/3/19	54.8*	51.9*	47.7	43.0
Thursday 7/3/19	55.2	52.1	48.1	42.5

Notes * Daytime Period includes levels measured between 09:00 – 23:00 hours Wednesday and 07:00 – 09:00 Friday

Table 4.2 Period Noise Levels Monitored at Unattended Survey Position U2, Adjacent to Rose Tree Farm P.H.

4.2. Attended Noise Surveys

To supplement the unattended noise surveys and to determine the noise levels at the properties to be constructed closest to Rudloe Drive, additional attended noise monitoring was carried out at two positions during the morning of Wednesday 6th March 2019, concurrent with the unattended noise surveys.

The measurements were made using two Rion NL-52 Class 1 Sound Levels, which were calibrated before and after the exercise using a Rion NC-74 Class 1 Acoustic Calibrator. At each position, the instrument was set freefield with the microphone at a height of 1.2 metres above the ground.

One instrument was positioned along the southern site boundary at the eastern end of the site, at a distance of 15 metres from the kerb, with the second instrument positioned centrally along the southern boundary at a distance of 12 metres from the kerb of Rudloe Drive.

The monitoring positions are indicated on Figure 1.

The results of the monitoring are provided in Appendix D, which additionally contains an analysis against the unattended survey data to determine the equivalent day and night-time noise levels, which are provided below.

Position	Period Free-field Noise Level [dB]			
	Daytime (07:00 – 23:00)		Night-time (23:00 – 07:00)	
	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}
S1 – Eastern End of Rudloe Drive (15m from kerb)	60	53	53	43
S2 – Centrally along Rudloe Drive (12m from kerb)	58	54	51	44

Table 4.3 Period Noise Levels Monitored at Attended Survey Positions

4.3. Discussion of Noise Environment

Noise levels within the application site are principally influenced by road traffic on the surrounding roads and in particular, the A38, which was a major noise source throughout the day and night-time periods.

Traffic travelling along Rudloe Drive was clearly audible, although the flow of traffic along the road was light. It was observed that the traffic was generally travelling slower towards the western end of the road, whilst the vehicles negotiated the corners and traffic calming measures, which resulted in marginally lower noise levels compared to the eastern end of the site.

It was clear, however, that the principal influence on the noise environment was attributable to traffic travelling along the A38.

Noise from plant located to the rear of the Rose Tree Farm Public House was not audible at the position of the proposed dwellings to be located at the western end of the site above the general level of road traffic. Vehicles arriving and leaving the car park of the public house were audible, in particular the closing of car doors and engines starting and whilst these activities had minimal influence on the overall noise levels at the proposed dwellings, consideration has been given to these sources when assessing the noise environment at dwellings within this part of the site.

No noise was evident from inside the premises during the survey period. The Public House is a family pub, principally food orientated. The Premise Licence for the pub includes the potential for live music events, which is often included when premises apply for licences, to avoid having to apply for temporary licences, should they ever hold an event.

Vistry Homes contacted the Public House during April / May 2022 to gain an understanding of any music events held at the pub. The managers advised that they never held any such events, as the premises were a food orientated family pub and that the noise within the pub was generally low for dining. On this basis, it has been considered appropriate to assess the operation of the pub on the basis of the current operation.

5. Assessment of Noise Levels

5.1. Assessment of Road Traffic Noise from A38

The Proposed Development would be over 200 metres from the A38 and effectively screened from the road by the buildings alongside the road and the fact that the road is within a cutting.

The results of the noise survey and observations made whilst on site during the survey period, indicated that noise levels at the western end of the development from this source were low, typically of the order of or below 55 dB L_{Aeq} during the daytime periods.

Undertaking an initial Stage 1 assessment in accordance with the ProPG guidance on this basis indicates that there would be a negligible risk from noise from this source, with no adverse effects likely. Standard construction techniques would therefore be sufficient to meet the requirements of BS 8233 internally. The provision of the proposed 1.8 metre high boundary fences around the gardens of the properties, would reduce noise levels within garden areas to a maximum between 50 – 55 dB $L_{Aeq,\ 16\ hour}$ and thus meet the requirements of BS 8233.

5.2. Assessment of Noise Levels from Traffic Using Rudloe Drive

As indicated on Figure 1, the proposed dwellings are to be constructed at a similar distance from the kerb of Rudloe Drive to dwellings recently completed and occupied along the road to the east. The closest properties would be constructed between 5 – 6 metres from the kerb.

Traffic travelling along Rudloe Drive is the main source of noise within the southern half of the proposed development. As discussed previously, traffic flows along Rudloe Drive are gradually increasing as the main development progresses and more properties are completed.

It has therefore been considered appropriate to base the current assessment upon future traffic flows along Rudloe Drive and calculate the noise levels at the properties alongside the road.

The transport assessment which has been prepared to support the planning application indicated the following AADT traffic flows along the road:

- 2019 Base – 12311 west of access / 11471 east of access; and
- 2024 Base + Proposed Development - 14337 west of access / 12446 east of access.

Utilising these figures, calculations of the road traffic noise levels have been made using the CRTN calculation methodology [6] to determine the increase in road traffic noise levels along the road, which indicates a small change of 0.7 dB(A) to the west of the development access and 0.4 dB to the east of the access.

On this basis, the following noise levels have been calculated for the proposed dwellings to be constructed closest to Rudloe Drive (5 metres from the kerb).

Position	Period Free-field $L_{Aeq,T}$ Noise Level [dB]			
	Daytime (07:00 – 23:00)		Night-time (23:00 – 07:00)	
	Noise Measurement Position	Closest Property (5m from Kerb)	Noise Measurement Position	Closest Property (5m from Kerb)
East of Development Access (15m from kerb)	61	64	54	57
West of Development Access	59	62	52	55

Table 5.1 Future Noise Levels at Closest Dwellings to be Constructed Along Rudloe Drive

During the night-time periods, consideration has also been given to the maximum noise levels generated by passing traffic. Typical maximum noise levels from passing cars would be typically 70 dB $L_{Amax,F}$, with maximum noise levels from HGVs up to 80 dB $L_{Amax,F}$.

Initial calculations of the noise levels within the properties fronting onto Rudloe Drive have been calculated on the basis of the provision of standard 4-16-4 thermal double glazed unit (providing a sound reduction of 31 dB R_{W-4CTR}), with good quality trickle vents used, with an indirect air path.

The facades of the properties would be of standard brick construction, comprising external brick, with 100mm insulation, 100mm aircrete block internally and finished with 12.5mm plasterboard. This construction will provide a sound reduction in excess of 50 dB and on this basis, the main consideration would be associated with the provision of appropriate glazing and vents.

The calculations on this basis, indicate internal noise levels within rooms facing onto the road, assuming windows closed, of 34 dB $L_{Aeq,\,16\,hour}$ daytime / 27 dB $L_{Aeq,\,8\,hour}$ night-time, with maximum noise levels of up to 49 dB $L_{Amax,F}$ attributable to passing HGV traffic. The details of the calculations are provided in Appendix D.

BS 8233 recommends internal noise levels of 35 dB $L_{Aeq,\,16\,hour}$ daytime / 30 dB $L_{Aeq,\,8\,hour}$ night-time, within habitable rooms, which would be achieved through a standard construction. However maximum noise levels within bedrooms would be above the 45 dB $L_{Amax,F}$ limit recommended within ProPG and WHO guidelines of 45 dB $L_{Amax,F}$.

Glazing with a minimum acoustic specification of 36 dB R_{W-5Ctr}, will be installed within the windows to habitable rooms in the facades highlighted on Figure 4. In addition, windows to these rooms will be fitted with acoustically treated background ventilators, with a minimum performance of 40 dB $D_{n,e,w-1Ctr}$, assuming the vents fully open to provide the required background ventilation.

The provision of this mitigation would provide a sound reduction of 34 dB(A), with the following internal noise levels calculated within the properties based upon this specification:

- 29 dB $L_{Aeq,\,16\,hour}$ daytime;
- 22 dB $L_{Aeq,8\,hour}$ night-time; and
- Maximum noise levels overnight typically < 45 dB $L_{Amax,F}$.

Consideration to the requirements of Approved Document O has also been considered for the dwellings fronting onto Rudloe Drive. ADO requires consideration of the overheating effects within the dwellings and requires consideration of additional ventilation where noise levels within bedrooms overnight exceed 40 dB $L_{Aeq, 8\ hour}$ and 55 dB $L_{Amax,F}$ assuming windows open.

Research undertaken by Napier University, indicate a partially open window providing adequate ventilation into the rooms would provide a sound reduction of 17 dB(A) between the external façade level and noise levels internally [7]. Taking this reduction into account, ambient noise levels within the bedrooms facing onto the road would be up to 40 dB $L_{Aeq, 8\ hr}$, with maximum noise levels anticipated to exceed the 55 dB $L_{Amax,F}$ criterion.

As it would not be possible to provide cross ventilation into the bedrooms, assisted ventilation would be provided within the bedrooms fronting onto Rudloe Drive to meet the requirements of ADO.

The additional glazing and ventilation to be installed within the facades of properties facing onto Rudloe Drive would ensure that the requirements of BS 8233, Condition 9 and ADO were achieved.

5.3. Assessment of Noise from Operation of the Rose Tree Farm Public House

As indicated in the previous section, noise attributable to any external plant and equipment located to the rear of the public house was not audible at a position representative of the closest proposed dwellings within the south western corner of the proposed development. Given the inaudibility of any plant noise would be a positive indication of a low impact, when assessed against the requirements of BS 4142 and thus the operation of any plant to the rear of the public house would be unlikely to result in any adverse noise impacts at the dwellings.

As discussed previously, whilst the Public House Premises Licence includes allowance for live music, it is understood from the management that it is a family pub, principally providing a food service and never holds any live music events. On this basis, it is appropriate to assess the noise levels attributable to the operation of the pub on the basis of the current operations.

The proposed layout indicated on Figure 1, indicates that the closest dwelling (Plot 132) would be constructed 12 metres from the closest parking bays within the car park (a small increase in the separation distance compared to the indicative layout assessed at the outline application stage), although the majority of the spaces would be over 25 metres from the properties.

The final layout has also taken the Public House into account by orientating the adjacent properties to be side onto the car park, thus ensuring there was no direct line of sight from windows to habitable rooms onto the vehicles parked.

Whilst vehicle movements within the car park would be unlikely to result in any adverse noise impacts upon future occupants of the neighbouring properties during the daytime periods, consideration has been given to vehicles leaving at the end of the evening.

Given the nature of the public house, it is likely that the majority of the customers would visit to eat, with the majority of the vehicles leaving before 10pm. However, there will be a number of vehicles leaving after this time, including staff and there is a potential for activity within the car park typical until around midnight.

In order to assess the noise levels attributable to the movements within the car park, calculations of the noise levels attributable to doors closing and vehicles driving off have been made on the basis of vehicles parked centrally within the car park and closest to the proposed dwellings.

The calculations, presented in Appendix D, indicate ambient (L_{Aeq}) noise levels of between 41 – 47 dB $L_{Aeq,\ 15\ minute}$ assuming one vehicle departing every five minutes. This level of noise is lower than associated with the general road traffic in the surrounding area and thus unlikely to result in any adverse noise impacts.

Consideration has also been given to the maximum noise levels attributable the car doors opening and closing and vehicles driven off, which indicates levels of between 66 – 72 dB $L_{Amax,F}$ at the closest dwelling.

As indicated above, it is likely that the majority of vehicles would leave during the late evening period, however, there are vehicles which leave later. Assuming windows closed, maximum noise levels internally would be reduced to a standard below 45 dB $L_{Amax,F}$ and thus seek to minimise any adverse noise impacts when assessed against the relevant standards for bedrooms.

With windows open, maximum noise levels would be in excess of 45 dB $L_{Amax,F}$ at the closest dwellings. Given that only a small number of vehicles would be likely to depart after 23:00 hours, with typically less than 10 events, it is considered that any potential adverse noise impacts would be minimal.

However, to ensure an acceptable standard of noise is maintained within the dwellings adjacent to the Public House, bedrooms to Plots 123 and Plots 132, which are closest to the car park, would be fitted with the same high specification glazing and assisted ventilation, as to be provided for the dwellings along Rudloe Drive.

5.4. Assessment of Noise from the Operation of the Builders' Merchants

Planning permission for a builders' merchants has recently been granted on land to the west of this development.

As indicated previously, a noise assessment was prepared to accompany the planning application for that development, which, based upon an indicative layout for the residential development, demonstrated that a satisfactory noise environment would be achieved within the dwellings with appropriate boundary mitigation and no adverse impacts identified when assessed against the requirements of BS 4142. Conditions were imposed in the planning permission for the builders' merchant, which ensures that the proposed boundary mitigation to be constructed along the residential boundary is provided and maintained for the duration of the use. Further conditions ensure that non-tonal reversing signals are fitted to vehicles operating within the yard and limit the operational hours to between 07:00 – 19:00 Mondays to Saturdays and 10:00 – 16:00 hours on Sundays / Bank Holidays.

The layout of the residential development has been revised from that indicated on the indicative layout and it has therefore been considered appropriate to provide an updated assessment of the noise levels at the closest dwellings.

The final layout provides an improvement in the design over that proposed at outline stage. It is now proposed to provide parking on the land between the builders' merchants and the dwellings, which would ensure that the dwellings are constructed 12 metres from the boundary. Furthermore, a terrace of houses is now proposed, which would front onto the parking area. The gardens would be to the rear of the properties, thus further from the builders' merchants and effectively screened by the property facades.

The results of the revised calculations, using the same source data and assumptions as presented in the noise assessment to accompany the planning application for the builders' merchants, based upon the final residential layout are presented on Figure 5.

The calculations indicate the same noise levels as predicted previously and, on this basis, a revised assessment has been made against the requirements of BS 4142.

Description	Noise Level [dB]
Calculated Noise Level at Dwelling [dB $L_{Aeq, T}$]	45
Character Correction	3
Rating Level [dB $L_{Aeq, 1\ hour}$]	48
Background Level [dB L_{A90}]	52
Excess Over Background	-4
Likelihood of Impact	Indication of Low Impact

Table 5.2 Initial BS 4142 Assessment – Closest Proposed Dwelling

The calculations and initial assessment of potential impacts indicates that the noise levels attributable to the operation of the builders' merchant, would result in rating noise levels below the prevailing background noise levels at the surrounding proposed properties. On this basis, the operation of the builders' merchants would therefore not result in any adverse noise impacts.

Consideration has also been given to the noise levels within the gardens of the adjacent properties. The calculations indicate a level below 35 dB $L_{Aeq, 1\ hr}$, thus substantially below the guideline value recommended within BS 8233 as representing an acceptable noise environment with gardens. On this basis, noise levels attributable the operation of the builders' merchant at the neighbouring properties would be acceptable and not result in any adverse noise impacts.

6. Summary

LF Acoustics Ltd were appointed to undertake a noise assessment for a proposed residential development on land to the north of Rudloe Drive, Kingsway, Gloucester.

Outline planning permission has been granted for the development, subject to conditions relating to noise, requiring further assessments of the road traffic noise and noise associated with the operation of The Rose Tree Farm public house, detailing the noise mitigation measures to be incorporated into the design of the dwellings.

Noise levels within the site are presently influenced by a mix of noise sources, including traffic travelling along the A38 and Rudloe drive and associated with vehicles accessing the car park of the Rose Tree Farm Public House.

Whilst clearly audible throughout the day, noise from traffic using the A38 to the west was found to be low and standard construction techniques would ensure a good standard of noise within the dwellings from this source.

The main source of noise was identified to be associated with traffic travelling along Rudloe Drive. An assessment of the noise levels at proposed dwellings adjacent to the road has been made on the basis of future road traffic flows, with the development completed. To ensure a satisfactory noise environment within dwellings fronting onto Rudloe Drive, habitable rooms with windows facing onto the road would be fitted with higher specification glazing and acoustically treated vents. In addition, bedrooms with windows facing onto the road would have assisted ventilation to meet the requirements of ADO.

Consideration has also been given to the use of the Rose Tree Farm Public House. The public house is a family pub, providing mainly a food service and thus generating low levels of noise. Noise from vehicles using the car park was identified to be the main source of noise likely to affect the neighbouring properties. Whilst vehicle movements within the car park would be unlikely to result in adverse noise impacts, vehicles leaving during the late evening period have the potential to impact upon the occupants of the closest dwellings. To ensure an acceptable standard of noise is achieved within the neighbouring dwellings, higher specification glazing, acoustic vents and assisted ventilation within the bedrooms would be provided within the two adjacent properties.

Planning permission has recently been granted for a builders' merchants on land to the west of the development. Mitigation measures were incorporated into the design of the builders' merchants to ensure their operations did not adversely impact upon the residential development. A revised assessment has been made, based upon the final layout for the proposed development, which indicates that the noise levels would be no worse than assessed for the builders' merchants planning application, thus ensuring that their operation would not result in adverse noise effects.

With appropriate mitigation measures for dwellings alongside Rudloe Drive and the public house, noise levels within the development would be satisfactory and fully comply with the requirements of Conditions 9 and 10 of the outline planning permission, BS 8233 and the NPPF.

References

1. Ministry of Housing, Communities and Local Government. National Planning Policy Framework. July 2021.

2. British Standards Institute. Guidance on Sound Insulation and Noise Reduction for Buildings. BS 8233. 2014.

3. World Health Organisation. Guidelines for Community Noise. Geneva. 1999.

4. British Standards Institute. Methods for Rating and Assessing Industrial and Commercial Sound. BS 4142:2014 +A1:2019.

5. ANC / Institute of Acoustics / Chartered Institute of Environmental Health. ProPG: Planning and Noise. Professional Practice Guidance on Planning & Noise. New Residential Development. May 2017.

6. Department of Transport / Welsh Office. Calculation of Road Traffic Noise. The Stationary Office. 1988.

7. The Building Performance Centre. School of the Built Environment. Napier University. NANR116: 'Open / Closed Window Research'. Sound Insulation Through Ventilated Domestic Windows. April 2007.

Figures

Figure 1:
Proposed Layout and
Noise Monitoring Positions

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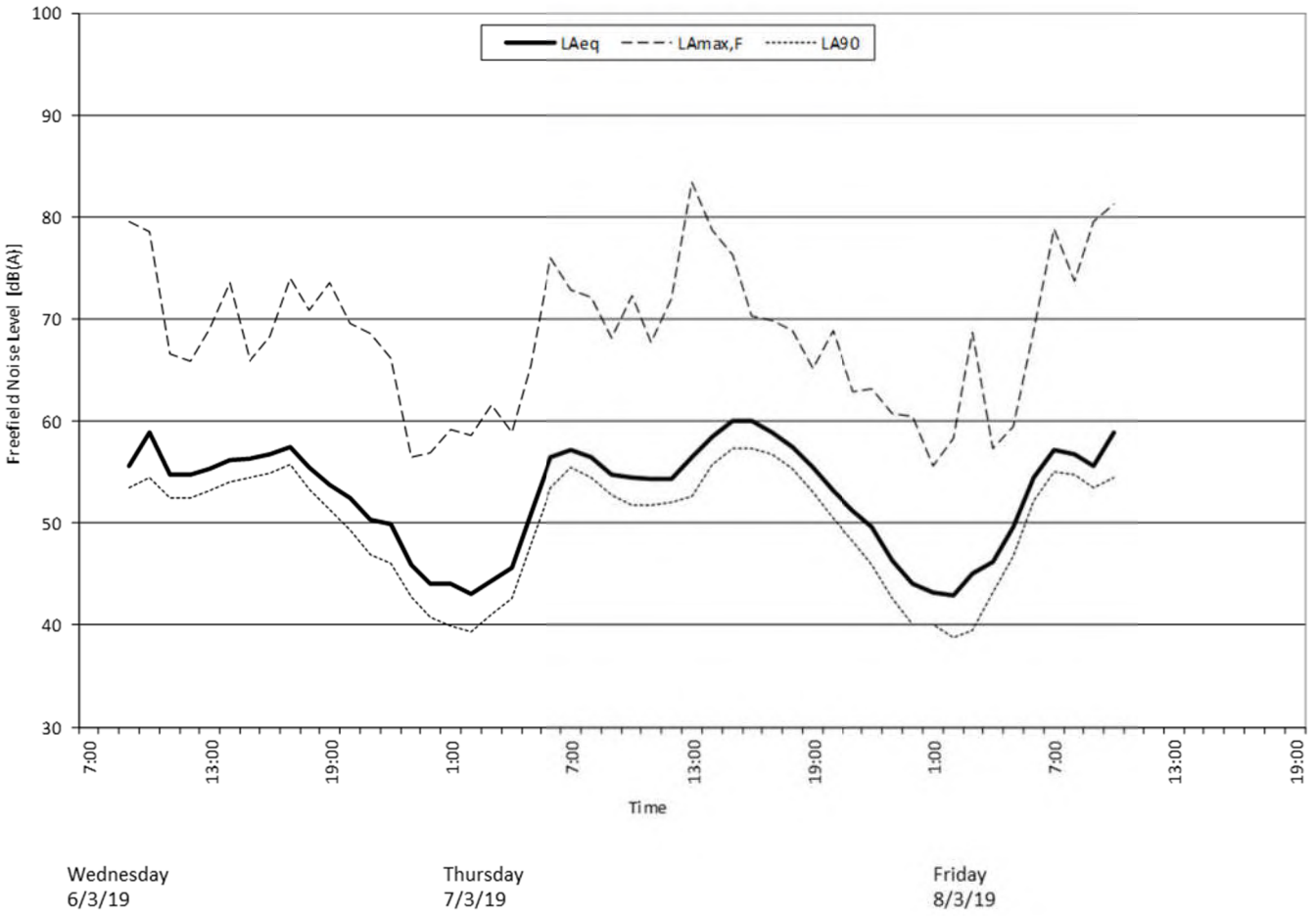

Figure 2:
Unattended Noise Survey Results - Position U1

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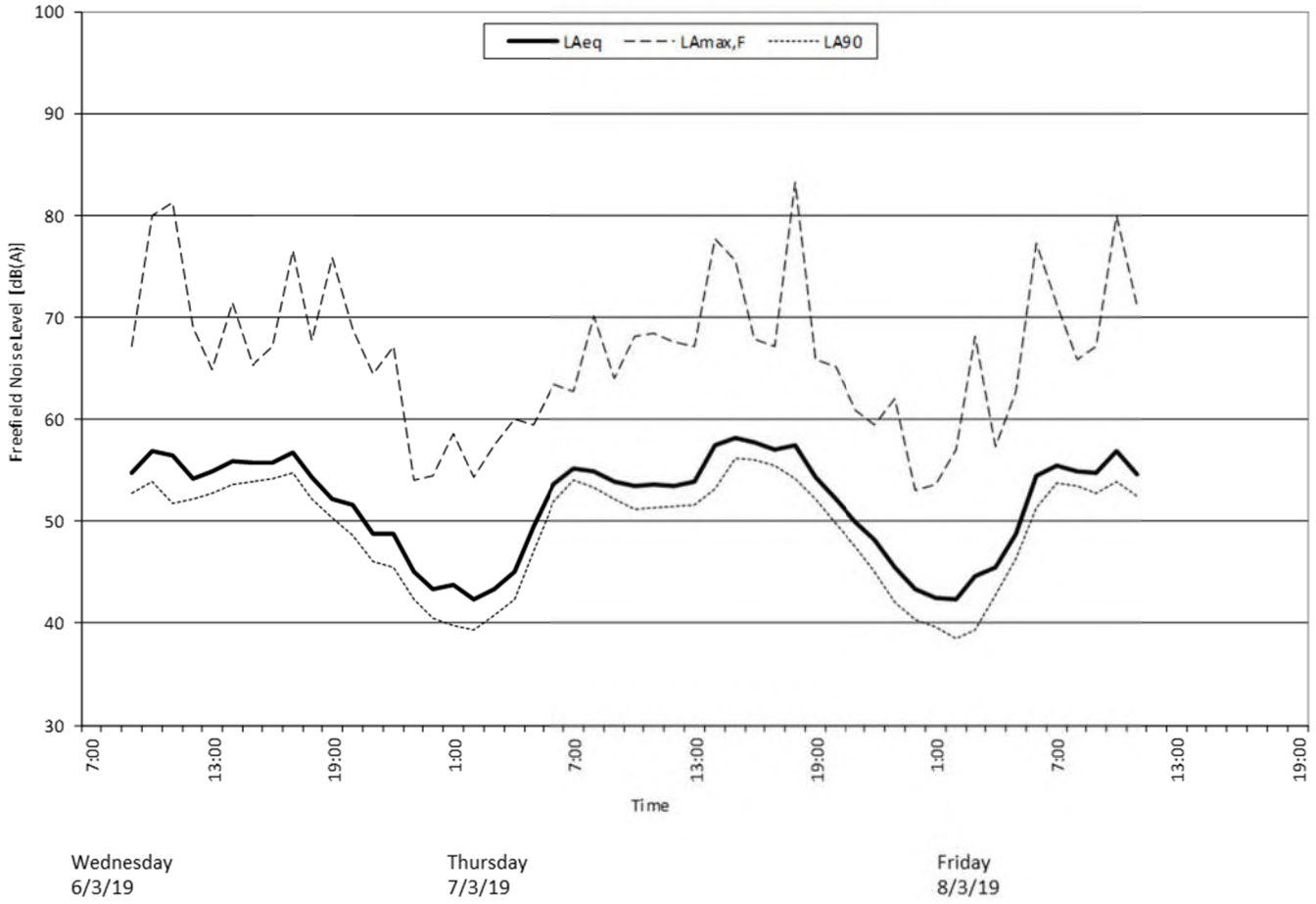

Figure 3:
Unattended Noise Survey Results - Position U2

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Key

- Windows in Façade to be Fitted with High Specification Glazing / Acoustic Vents Bedrooms to have Assisted Ventilation
- Bedroom Windows in Façade to be Fitted with High Specification Glazing / Acoustic Vent and have Assisted Ventilation

Figure 4:
Dwellings to be Provided with Additional Noise Mitigation

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Figure 5:
Calculated Noise Levels
From Builders' Merchant

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Appendix A
Noise Units

Decibels (dB)

Noise can be defined as unwanted sound. Sound in air can be considered as the propagation of energy through the air in the form of oscillatory changes in pressure. The size of the pressure changes in acoustic waves is quantified on a logarithmic decibel (dB) scale firstly because the range of audible sound pressures is very great, and secondly because the loudness function of the human auditory system is approximately logarithmic.

The dynamic range of the auditory system is generally taken to be 0 dB to 140 dB. Generally, the addition of noise from two sources producing the same sound pressure level, will lead to an increase in sound pressure level of 3 dB. A 3 dB noise change is generally considered to be just noticeable, a 5 dB change is generally considered to be clearly discernible and a 10 dB change is generally accepted as leading to the subjective impression of a doubling or halving of loudness.

A-Weighting

The bandwidth of the frequency response of the ear is usually taken to be from about 18 Hz to 18,000 Hz. The auditory system is not equally sensitive throughout this frequency range. This is taken into account when making acoustic measurements by the use of A-weighting, a filter circuit which has a frequency response similar to the human auditory system. All the measurement results referred to in this report are A-weighted.

Units Used to Describe Time-Varying Noise Sources (L_{Aeq}, L_{A90} and L_{Amax})

Instantaneous A-weighted sound pressure level is not generally considered as an adequate indicator of subjective response to noise because levels of noise usually vary with time.

For many types of noise the Equivalent Continuous A-Weighted Sound Pressure Level ($L_{Aeq,T}$) is used as the basis of determining community response. The $L_{Aeq,T}$ is defined as the A-weighted sound pressure level of the steady sound which contains the same acoustic energy as the noise being assessed over a specific time period, T.

The L_{A90} is the noise level exceeded for 90% of the measurement period. It is generally used to quantify the background noise level, the underlying level of noise which is present even during the quietest part of the measurement period.

The L_{Amax} is the maximum value that the A-weighted sound pressure level reaches during a measurement period. $L_{Amax,F}$, or Fast, is averaged over 0.125 of a second.

Appendix B
Results of Unattended Noise Survey
Position U1 – Centrally 25m from Rudloe Drive

Proposed Residential Development on Land North of Rudloe Drive, Kingsway
Results of Noise Measurements Carried Out Between
6 - 8 March 2019

Equipment Used: Rion NL-52 Class 1 Sound Level Meter (Serial No. 01021287)
Location: U1 - 25m from Kerb of Rudloe Drive
All Levels; Fast, Freefield, Mic Height 1.3 metres.

Date	Start Period	Measured Noise Levels [dB]			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
Wednesday	9:00	55.6	79.6	56.8	53.5
06/03/2019	10:00	58.9	78.6	59.2	54.4
	11:00	54.7	66.6	56.2	52.5
	12:00	54.7	65.9	56.3	52.5
	13:00	55.3	69.0	56.9	53.2
	14:00	56.2	73.6	57.6	54.0
	15:00	56.3	65.8	57.7	54.4
	16:00	56.7	68.3	57.9	54.9
	17:00	57.5	74.0	58.9	55.7
	18:00	55.4	70.8	56.6	53.3
	19:00	53.8	73.6	55.4	51.3
	20:00	52.4	69.6	53.9	49.3
	21:00	50.3	68.6	52.0	46.9
	22:00	49.9	66.2	51.9	46.0
	23:00	45.9	56.5	47.8	42.7
Thursday	0:00	44.0	56.9	46.1	40.8
07/03/2019	1:00	44.0	59.2	46.2	39.9
	2:00	43.0	58.6	45.3	39.4
	3:00	44.3	61.6	46.0	41.0
	4:00	45.6	58.8	47.3	42.6
	5:00	50.9	65.4	52.2	47.9
	6:00	56.5	76.0	57.3	53.5
	7:00	57.1	72.8	58.1	55.4
	8:00	56.4	72.1	57.8	54.5
	9:00	54.8	68.2	56.3	52.8
	10:00	54.5	72.3	56.1	51.8
	11:00	54.3	67.7	56.0	51.8
	12:00	54.3	72.0	56.0	52.0
	13:00	56.4	83.4	57.3	52.6
	14:00	58.5	78.7	60.2	55.7
	15:00	60.0	76.3	61.9	57.3
	16:00	60.0	70.3	61.8	57.3
	17:00	58.8	69.9	60.4	56.8
	18:00	57.5	68.9	59.1	55.3
	19:00	55.5	65.1	57.2	53.0
	20:00	53.2	68.8	55.0	50.4
	21:00	51.2	62.8	53.1	48.2
	22:00	49.6	63.2	51.7	45.9
	23:00	46.3	60.7	48.7	42.6
Friday	0:00	44.0	60.4	46.3	40.1
08/03/2019	1:00	43.2	55.6	45.4	40.0
	2:00	42.9	58.3	45.2	38.7
	3:00	45.1	68.7	46.4	39.5
	4:00	46.2	57.3	47.9	43.2
	5:00	49.6	59.5	51.0	46.8
	6:00	54.4	68.9	55.8	52.2

Proposed Residential Development on Land North of Rudloe Drive, Kingsway
Results of Noise Measurements Carried Out Between
6 - 8 March 2019

Equipment Used: Rion NL-52 Class 1 Sound Level Meter (Serial No. 01021287)
Location: U1 - 25m from Kerb of Rudloe Drive
All Levels; Fast, Freefield, Mic Height 1.3 metres.

Date	Start Period	Measured Noise Levels [dB]			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
Friday	7:00	57.2	78.9	58.2	55.0
08/03/2019	8:00	56.7	73.7	57.9	54.8
	9:00	55.6	79.6	56.8	53.5
	10:00	58.9	81.2	59.2	54.4

Appendix C
Results of Unattended Noise Survey
Position U2 – Boundary with The Rose Tree Farm Public House

Proposed Residential Development on Land North of Rudloe Drive, Kingsway
Results of Noise Measurements Carried Out Between
6 - 8 March 2019

Equipment Used: Rion NL-52 Class 1 Sound Level Meter (Serial No. 00231656)
Location: U2 - Representative of Closest Property to Rose Tree Farm PH
All Levels; Fast, Freefield, Mic Height 1.3 metres.

Date	Start Period	Measured Noise Levels [dB]			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
Wednesday	9:00	54.7	67.1	56.0	52.7
06/03/2019	10:00	56.9	79.9	58.4	53.9
	11:00	56.5	81.2	56.1	51.8
	12:00	54.1	69.0	55.6	52.2
	13:00	54.9	64.8	56.6	52.7
	14:00	55.9	71.4	57.2	53.6
	15:00	55.8	65.3	57.2	53.9
	16:00	55.8	67.2	57.0	54.1
	17:00	56.7	76.6	58.0	54.8
	18:00	54.3	67.7	55.5	52.2
	19:00	52.2	75.9	53.3	50.3
	20:00	51.6	68.8	52.6	48.6
	21:00	48.8	64.4	50.3	46.1
	22:00	48.8	67.1	50.3	45.5
	23:00	45.0	54.0	46.8	42.4
Thursday	0:00	43.3	54.5	45.4	40.5
07/03/2019	1:00	43.8	58.6	45.9	39.8
	2:00	42.4	54.3	44.4	39.3
	3:00	43.3	57.5	45.1	40.7
	4:00	45.1	60.0	46.8	42.3
	5:00	49.5	59.5	50.8	47.0
	6:00	53.6	63.5	54.6	51.9
	7:00	55.1	62.7	56.1	54.0
	8:00	54.9	70.1	56.0	53.3
	9:00	53.9	64.0	55.3	52.1
	10:00	53.5	68.1	55.2	51.2
	11:00	53.6	68.4	55.3	51.3
	12:00	53.5	67.6	55.0	51.5
	13:00	53.9	67.1	55.5	51.6
	14:00	57.5	77.7	58.3	53.2
	15:00	58.1	75.5	59.8	56.2
	16:00	57.7	67.8	59.0	56.0
	17:00	57.0	67.2	58.2	55.4
	18:00	57.5	83.3	56.9	54.1
	19:00	54.3	65.9	55.8	52.1
	20:00	52.2	65.2	53.7	49.8
	21:00	49.9	60.8	51.5	47.4
	22:00	48.2	59.5	50.2	45.0
	23:00	45.5	62.0	47.5	42.0
Friday	0:00	43.4	53.0	45.5	40.4
08/03/2019	1:00	42.5	53.6	44.5	39.6
	2:00	42.3	57.0	44.4	38.5
	3:00	44.6	68.1	45.7	39.3
	4:00	45.4	57.3	47.0	42.7
	5:00	48.8	62.7	50.1	46.3
	6:00	54.5	77.3	55.4	51.3

Proposed Residential Development on Land North of Rudloe Drive, Kingsway
Results of Noise Measurements Carried Out Between
6 - 8 March 2019

Equipment Used: Rion NL-52 Class 1 Sound Level Meter (Serial No. 00231656)
Location: U2 - Representative of Closest Property to Rose Tree Farm PH
All Levels; Fast, Freefield, Mic Height 1.3 metres.

Date	Start Period	Measured Noise Levels [dB]			
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}
Friday	7:00	55.4	71.3	56.4	53.7
08/03/2019	8:00	54.9	65.9	55.9	53.5
	9:00	54.7	67.1	56.0	52.7
	10:00	56.9	79.9	58.4	53.9
	11:00	54.6	71.2	56.1	52.4

Appendix D
Results of Attended Noise Measurements

Proposed Residential Development on Land North of Rudloe Drive, Kingsway
Results of Attended Noise Measurements made on 6 March 2019

Equipment Used: Rion NL-52 Class 1 Sound Level Analysers, Calibrated with Rion NC-74 Class 1 Acoustic Calibrator

		FREEFIELD Sample Measurement Results				FREEFIELD Unattended Measurement Results				Difference			
Location	Start **Time**	L_{Aeq}	$L_{Amax,F}$	L_{A10}	L_{A90}	L_{Aeq}	$L_{Amax,F}$	L_{A10}	L_{A90}	L_{Aeq}	L_{A90}		
S1	09:35	59.0	72.5	62.8	53.3	55.0	65.2	56.3	53.1	4.0	0.2		
15m from Kerb of Rudloe Drive	09:40	60.2	70.8	64.4	53.8	55.6	62.9	57.1	53.8	4.6	0.0		
Eastern End	09:45	59.8	77.7	63.4	53.4	55.7	66.6	56.9	53.8	4.1	-0.4		
1.2m Height	09:50	60.2	69.1	64.4	54.2	56.6	73.3	57.9	54.8	3.6	-0.6		
	09:55	60.0	69.5	63.7	54.3	57.7	79.6	58.3	54.4	2.3	-0.1		
	10:00	60.5	74.7	64.4	53.5	55.4	63.4	56.7	53.5	5.1	0.0		
	10:05	60.5	75.3	64.6	53.6	56.3	74.6	57.9	53.5	4.2	0.1		
	10:10	60.2	74.1	64.2	53.9	56.8	72.0	58.9	54.1	3.4	-0.2		
	10:15	59.3	73.9	62.8	54.3	56.9	70.4	58.5	54.6	2.4	-0.3		
	10:20	61.0	72.4	64.6	55.0	56.8	66.6	58.6	54.4	4.2	0.6		
	10:25	60.1	71.2	63.3	54.3	55.8	77.0	59.8	54.0	4.3	0.3		
	10:30	59.6	70.0	62.6	54.9	54.5	70.2	59.6	53.5	5.1	1.4		
		60.1				**56.2**		**Average Difference =**		**3.9**	**0.1**	60	53
S2	09:40	57.8	67.1	60.1	54.4	55.6	62.9	57.1	53.8	2.2	0.6		
12m from Kerb of Rudloe Drive	09:45	57.2	72.0	59.0	54.3	55.7	66.6	56.9	53.8	1.5	0.5		
Central	09:50	57.8	63.6	59.8	54.8	56.6	73.3	57.9	54.8	1.2	0.0		
1.2m Height	09:55	58.5	69.5	60.8	55.0	57.7	79.6	58.3	54.4	0.8	0.6		
	10:00	58.3	67.0	60.7	54.5	55.4	63.4	56.7	53.5	2.9	1.0		
	10:05	58.2	66.7	60.4	54.3	56.3	74.6	57.9	53.5	1.9	0.8		
	10:10	59.1	79.3	61.7	54.7	56.8	72.0	58.9	54.1	2.3	0.6		
	10:15	58.6	67.9	60.9	55.4	56.9	70.4	58.5	54.6	1.7	0.8		
	10:20	59.6	69.8	62.2	55.1	56.8	66.6	58.6	54.4	2.8	0.7		
	10:25	58.5	69.3	60.6	55.6	55.8	77.0	59.8	54.0	2.7	1.6		
	10:30	57.2	60.8	58.9	56.1	54.5	70.2	59.6	53.5	2.7	2.6		
	10:35	56.5	65.2	58.2	54.5	54.3	71.6	55.4	52.0	2.2	2.5		
		58.2				**56.1**		**Average Difference =**		**2.0**	**1.0**	58	51

LFAcoustics consulting engineers

Appendix E
Calculations

Proposed Residental Development on Land to North of Rudloe Drive
Calculated Noise Levels from Vehicles Using Car Park

01-Sep-2022

Receptor: Closest Property (Plot 132)
Height 4 m

Predicted Freefield Noise Levels	Ref Level @10m	Index	No./ 15 min	Source Ht	Dist S-R (Horiz)	Barrier Ht	Dist S-B (Horiz)	Distance Attenuation	CRTN Barrier Attenuation	Overall Attenuation	Façade Correction	**Façade LAeq,T Level [dB]**	**Façade LAeq,T Total [dB]**
Closest Parking Spaces													
LAeq, 15 minutes													
Car Door	64.6	SEL	6	0.5	12			-1.9	-0.1	-2.0	2.5	**43.3**	
Start Up and Pulling Out	66.2	SEL	3	0.5	12			-1.9	-0.1	-2.0	2.5	**41.9**	
Driving Off	66.1	SEL	3	0.5	12			-1.9	-0.1	-2.0	2.5	**41.8**	**47.2**
LAmax,F													
Car Door	71.7	LAmax,F		0.5	12			-1.9	-0.1	-2.0	2.5	**72.2**	
Start Up and Pulling Out	70.3	LAmax,F		0.5	12			-1.9	-0.1	-2.0	2.5	**70.8**	
Driving Off	64.3	LAmax,F		0.5	12			-1.9	-0.1	-2.0	2.5	**64.8**	**72.2**
Furthest Parking Space													
LAeq, 15 minutes													
Car Door	64.6	SEL	6	0.5	25			-8.0	-0.1	-8.1	2.5	**37.2**	
Start Up and Pulling Out	66.2	SEL	3	0.5	25			-8.0	-0.1	-8.1	2.5	**35.8**	
Driving Off	66.1	SEL	3	0.5	25			-8.0	-0.1	-8.1	2.5	**35.7**	**41.1**
LAmax,F													
Car Door	71.7	LAmax,F		0.5	25			-8.0	-0.1	-8.1	2.5	**66.1**	
Start Up and Pulling Out	70.3	LAmax,F		0.5	25			-8.0	-0.1	-8.1	2.5	**64.7**	
Driving Off	64.3	LAmax,F		0.5	25			-8.0	-0.1	-8.1	2.5	**58.7**	**66.1**

Proposed Residential Development at Rudloe Drive, Kingsway
Calculation of Internal Noise Levels

Position : Dwellings Fronting onto Rudloe Drive

Prepared By: LPJ - 1/9/22 **STANDARD GLAZING & VENTS**

Sf	Facade Area (inc Window)	10
Swi	Window Area	2
Sew	Sf-Swi	8
Srr	Area of Ceiling	10
S	Sf+Srr	20
A0	Ref Absorption Area	10

			Overall A-Wtd	1/3 Octave Band Leq 125	250	500	1000	2000	
Source Level	Leq FF	A	**64**	63	58	57	62	54	
Window Vent	Dn,e			35	35	34	36	34	Trickle Vent Direct Air Path
		B		0.00016	0.00016	0.00020	0.00013	0.00020	
Glazing	Rwi			19	16	35	45	50	Standard Glazing 4-20-4
		C		0.00126	0.00251	0.00003	0.00000	0.00000	
Wall	Rew			41	45	45	54	58	
		D		3.177E-05	1.265E-05	1.265E-05	1.592E-06	6.34E-07	
Ceiling	Rrr			24	34	40	45	49	
		E		0.0019905	0.0001991	0.00005	1.581E-05	6.295E-06	
	10Log (B+C+D+E)			-24.635238	-25.403508	-35.326502	-38.351702	-36.840671	
	A (Furnished)			11	14	16	16	15	
	10*log (S/A)			2.5963731	1.5490196	0.9691001	0.9691001	1.2493874	
	Leq,2			44.2	37.5	25.6	27.4	21.5	
	A-Weighting			-16.0	-9.0	-3.0	0.0	1.0	
	LAeq,2			28.2	28.5	22.6	27.4	22.5	

	Day	Night
LAeq, Internal	**34**	**27**
Reduction	**-30**	

Proposed Residential Development at Rudloe Drive, Kingsway
Calculation of Internal Noise Levels

Position : Dwellings Fronting onto Rudloe Drive

Prepared By: LPJ - 1/9/22 **STANDARD GLAZING & VENTS**

Sf	Facade Area (inc Window)	10
Swi	Window Area	2
Sew	Sf-Swi	8
Srr	Area of Ceiling	10
S	Sf+Srr	20
A0	Ref Absorption Area	10

			Overall A-Wtd	1/3 Octave Band Lmax 125	250	500	1000	2000	
Source Level	Lmax FF	A	**79**	77	75	77	75	70	
Window Vent	Dn,e			35	35	34	36	34	Trickle Vent Direct Air Path
		B		0.00016	0.00016	0.00020	0.00013	0.00020	
Glazing	Rwi			19	16	35	45	50	Standard Glazing 4-20-4
		C		0.00126	0.00251	0.00003	0.00000	0.00000	
Wall	Rew			41	45	45	54	58	
		D		3.177E-05	1.265E-05	1.265E-05	1.592E-06	6.34E-07	
Ceiling	Rrr			24	34	40	45	49	
		E		0.0019905	0.0001991	0.00005	1.581E-05	6.295E-06	
	10Log (B+C+D+E)			-24.635238	-25.403508	-35.326502	-38.351702	-36.840671	
	A (Furnished)			11	14	16	16	15	
	10*log (S/A)			2.5963731	1.5490196	0.9691001	0.9691001	1.2493874	
	Lmax,2			58.3	54.2	45.6	40.3	37.4	
	A-Weighting			-16.0	-9.0	-3.0	0.0	1.0	
	LAmax,2			42.3	45.2	42.6	40.3	38.4	
	LAmax, Internal		**49**						
	Reduction		**-30**						

Proposed Residential Development at Rudloe Drive, Kingsway
Calculation of Internal Noise Levels

Position : Dwellings Fronting onto Rudloe Drive

Prepared By: LPJ - 1/9/22 **IMPROVED GLAZING & VENTS**

Sf	Facade Area (inc Window)	10
Swi	Window Area	2
Sew	Sf-Swi	8
Srr	Area of Ceiling	10
S	Sf+Srr	20
A0	Ref Absorption Area	10

			Overall A-Wtd	1/3 Octave Band Leq 125	250	500	1000	2000	
Source Level	Leq FF	A	**64**	63	58	57	62	54	
Window Vent	Dn,e			43	43	39	40	48	Acoustically Treated Trickle Vent Indirect Air Path
		B		0.00003	0.00003	0.00006	0.00005	0.00001	(Munster Joinery)
Glazing	Rwi			27	32	42	43	37	SGG Glass 34 dB RW+Ctr
		C		0.00020	0.00006	0.00001	0.00001	0.00002	
Wall	Rew			41	45	45	54	58	
		D		3.177E-05	1.265E-05	1.265E-05	1.592E-06	6.34E-07	
Ceiling	Rrr			24	34	40	45	49	
		E		0.0019905	0.0001991	0.00005	1.581E-05	6.295E-06	
	10Log (B+C+D+E)			-26.484173	-35.230847	-38.797389	-41.401673	-44.5835	
	A (Furnished)			11	14	16	16	15	
	10*log (S/A)			2.5963731	1.5490196	0.9691001	0.9691001	1.2493874	
	Leq,2			42.3	27.7	22.2	24.4	13.8	
	A-Weighting			-16.0	-9.0	-3.0	0.0	1.0	
	LAeq,2			26.3	18.7	19.2	24.4	14.8	

	Day	Night
LAeq, Internal	**29**	**22**
Reduction	**-34.2**	