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NOISE AND LIGHTING IMPACT ASSESSMENT
BUILDING 2 DEVELOPMENT APPLICATION
PORTSIDE WHARF DEVELOPMENT
HAMILTON

Prepared for:
Brookfield Multiplex

Prepared by:
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11 November 2008

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1.0 INTRODUCTION

1.1 Study Brief

This report is prepared in support of an application for a Development Approval for Building 2 of the Portside Wharf development at Hamilton.

The Portside Wharf site is located at 5 & 19 Hercules Street and 37 Harbour Road, Hamilton. Building 2 is located on the southern portion of the Portside Wharf site on land described as Lots 802, 804 and common property on SP172618, Lot 907 on SP169072 and Lot 817 on SL3772.

The Portside Wharf development is anchored by the Brisbane Cruise Ship Terminal and incorporates a range of uses including residential, retail and commercial uses as part of the overall Masterplan.

Building 2 is a proposed residential use development in a multi storey building.

This report considers the impact of noise from surrounding land uses upon the residential components of the Building 2 development and also considers the potential reverse amenity impacts of the development upon existing surrounding land uses.

The report also considers the impact of lighting, in particular headlight glare from the proposed Portside Wharf Building 4 above podium car parking levels, upon the development.

Previous reporting has been prepared by MWA Environmental (formerly Max Winders & Associates) for the Portside Wharf development at the Masterplan Stage. This report utilises the significant work undertaken for the current approval as a basis for assessment of the Building 2 development approval.

The report has been prepared from detailed field surveys and data acquisition from Brisbane City Council, the Environmental Protection Agency and surrounding land occupiers including P&O Ports.

This report has been prepared in accordance with the requirements of applicable Australian Standards and with the requirements of the Brisbane City Council (BCC) Brisbane City Plan 2000, Noise Impact Assessment Planning Scheme Policy (NIAPSP).

1.2 Site Description

The subject site is described as:

Street Address	5 & 19 Hercules Street and 37 Harbour Road
Suburb	Hamilton
Real Property Description	Lots 802, 804 and common property on SP172618, Lot 907 on SP169072 and Lot 817 on SL3772, Parish of Toombul
Site Area	2.97 ha
Area Classification under City Plan	Lots 802 & 804 on SP172618 – Special Purpose Centre (Port) Lot 907 on SP169072 – Special Purpose Centre (Port) Lot 817 on SL3772 – Special Purpose Centre (Port)
Name of Owner	Lots 802 & 804 on SP172618 – Multiplex Portside Wharf Pty Ltd Lot 907 on SP169072 – Multiplex Portside Wharf Pty Ltd Lot 817 on SL3772 – State of Queensland (represented by the Coordinator General)
Name of Ward	Hamilton

The site location is shown on **Figure 1**.

1.3 Surrounding Land Uses

A detailed review of surrounding land uses has been previously undertaken to identify any environmental and amenity issues that may conflict with the Portside Wharf development. Study methodologies adopted have been visual surveys of land uses, requests to the Brisbane City Council and the Environmental Protection Agency (EPA) to obtain factual data on Environmental Licences and approvals including Flammable and Combustible and Dangerous Goods Licensing, investigation of complaints registers of Brisbane City Council and the EPA to understand any complaints made regarding existing industrial and commercial uses and discussions and meetings with surrounding land users to identify their operations and constraints imposed on the subject development.

From the detailed surrounding land use studies, the following were identified as potential noise impacts upon the Portside Wharf development:

- Aircraft noise;
- Traffic noise;
- Cruise Terminal operation;
- Port activities noise; and,
- Surrounding land use noise (i.e. plant and equipment, car parking, etc).

These potential noise impacts will each be investigated as impacting upon the proposed Building 2 development.

1.4 Proposed Development

The proposal is to develop Building 2 as part of the Brisbane Cruise Terminal project.

The Building 2 development plan provides for the following:

- Basement car parking;
- Ground level pool and recreation area; and,

- Residential apartments from ground level to level 14. Indicative design drawings are included as **Attachment 1**.

2.0 EXISTING ENVIRONMENT

2.1 Existing Noise Environment

2.1.1 Existing Noise Sources

The site is located in an inner urban area adjacent to industrial land uses with proximity to a number of significant noise sources. The prominent noise sources at the site are aircraft noise, vehicular traffic noise and noise from port activities and other surrounding land uses.

2.1.2 Existing Noise Levels

To enable an assessment of the existing noise exposure of the subject site detailed short-term and long-term noise measurements have been undertaken. The noise data utilised in this assessment is that from the 2003 report for Portside Wharf. Short term measurements have been undertaken in 2006 which demonstrate that the noise data from 2003 is still relevant for assessment of noise amenity aspects of the development.

The short-term statistical noise levels recorded by sound level meter are listed below in **Table 2.1** with monitoring locations shown on **Figure 2**. Noted peak noise levels from discrete noise sources are provided in **Attachment 2** and summarised in the appropriate sections of this report for each noise source.

The recorded noise levels are presented as statistical components, which are described as:

- L_1 : Noise level exceeded for 1 percent of the measurement period, referred to as the adjusted maximum sound pressure level.
- L_{10} : Noise level exceeded for 10 percent of the measurement period, referred to as the averaged maximum sound pressure level.
- L_{90} : Noise level exceeded for 90 percent of the measurement period. AS1055.1-1997¹ notes that the L_{90} is described as the background sound pressure level.
- L_{eq} : An "average" measurement, and as per AS1055.1-1997 defined as the value of the sound pressure level of a continuous steady sound state, that within a measurement period, has the same mean square sound pressure as a sound under consideration whose level varies with time.

¹ Australian Standard AS 1055.1-1997 *Acoustics – Description and measurement of environmental noise, Part 1: General procedures*

Table 2.1: Recorded Short-Term Statistical Noise Levels - dB(A)

#	LOCATION	DATE	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)					COMMENTS
				L ₁	L ₁₀	L ₅₀	L ₉₀	L _{eq}	
1	Centre of Eastern Boundary	10-04-03	1225 - 1535	62.9	60.2	58.7	57.7	59.1	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
		10-04-03	1545 - 1545	67.6	57.0	54.3	53.0	56.7	Alblasgracht gone, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways
	South-eastern Corner of Site	10-04-03	1238 - 1045	67.5	61.6	59.2	58.1	60.5	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
		14-04-03	1035 - 1045	64.5	60.1	56.9	53.6	57.8	Parkgrascht' berthing at Hamilton 1 under tug power, forklift, beeper, truck and loading noise at P&O store building
2	South-eastern Corner of Site	14-04-03	1105 - 1115	60.0	55.6	51.8	49.4	53.2	Parkgrascht' berthed at Hamilton 1 generator running, forklift, beeper, truck and loading noise at P&O store building, trucks on surrounding roadways
		14-04-03	1330 - 1330	67.2	58.6	51.9	49.4	56.2	Parkgrascht' berthed at Hamilton 1 generator running, forklift, beeper, truck and loading noise at P&O store building, trucks on surrounding roadways
	Centre of Western Boundary	10-04-03	1307 - 1317	60.6	56.2	53.9	52.6	54.4	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
		14-04-03	1130 - 1140	70.2	63.6	53.4	49.4	60.2	Parkgrascht' berthed at Hamilton 1 generator running, forklift, beeper, truck and loading noise at P&O store building, trucks on surrounding roadways
5	Centre of Western Boundary	02-08-06	1425 - 1435	81.3	70.9	60.0	56.7	68.9	Traffic noise on Hercules St, Distant traffic noise on Kingsford Smith Dr, Many trucks and commercial vehicles, forklift and parking noise, distant construction noise from site building 1 to south
		10-04-03	1332 - 1342	57.4	56.0	54.1	52.8	54.4	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
	Northern Boundary of Site	02-08-06	1410 - 1420	80.4	68.7	59.6	56.2	66.8	Traffic noise on Hercules St, Distant traffic noise on Kingsford Smith Dr and Remora Rd, Many trucks and commercial vehicles
		10-04-03	1400 - 1430	72.0	64.0	59.0	54.5	61.5	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
7	Northern Boundary of Site	02-08-06	1440 - 1450	85.0	69.1	58.9	56.1	69.8	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
		10-04-03	1405 - 1415	73.1	62.5	56.6	54.0	61.1	Parkgrascht' berthed at Hamilton 1 generator running, forklift, beeper, truck and loading noise at P&O store building, trucks on surrounding roadways
8	North-eastern Corner of Site	14-04-03	1120 - 1130	70.4	62.1	56.4	52.4	59.9	Generator on 'Alblasgracht' at Hamilton 1, Unloading fertiliser on 'Vega Eternity' by crane to trucks at Hamilton 2, Trucks on surrounding roadways, planes
		10-04-03	1405 - 1415	73.1	62.5	56.6	54.0	61.1	Parkgrascht' berthed at Hamilton 1 generator running, forklift, beeper, truck and loading noise at P&O store building, trucks on surrounding roadways

The noise levels experienced throughout the site due to specific noise sources are discussed in the relevant sections of the report.

The short-term noise monitoring was undertaken with a Rion NL-21 Precision Sound Level Meter, internally pre-calibrated to 94 dB at 1kHz. There was no deviation from this level at post-calibration.

To provide further data on the diurnal variation of noise in the locality, detailed noise datalogger measurements were conducted by MWA Environmental over a continuous seven day period from 7 to 14 April 2003 at locations as shown on **Figure 2**. The logging was undertaken to assess the current noise environment at the vicinity of the site. The datalogger recorded noise levels are included as graphical traces of noise level versus time in **Attachment 3**. The noise dataloggers used were Acoustic Research Laboratories noise dataloggers, model EL-215, programmed to provide statistical analysis results based on 15-minute sampling periods. The dataloggers were pre-calibrated to 94 dB at 1kHz using a Rion Sound Level Calibrator, model NC-73, and displayed a deviation of less than ± 0.5 dB from this level at post-calibration.

The results of the noise datalogger measurements are summarised in **Tables 2.2 to 2.5** below.

Table 2.2: Range of Recorded Noise Levels - dB(A)
Location 1 – Hercules Street
7 to 14 April, 2003

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dB(A)		
		MINIMUM	MAXIMUM	AVERAGE
L_{max}	Daytime (7am-6pm)	62.5	90.5	75.7
	Evening (6pm-10pm)	54.5	89.5	68.8
	Nighttime (10pm-7am)	51.5	84.5	68.5
L_1	Daytime (7am-6pm)	58.5	80.0	69.6
	Evening (6pm-10pm)	51.0	72.0	62.3
	Nighttime (10pm-7am)	46.5	79.5	61.7
L_{10}	Daytime (7am-6pm)	50.5	70.0	61.8
	Evening (6pm-10pm)	48.0	64.5	54.7
	Nighttime (10pm-7am)	43.5	68.5	53.0
L_{90}	Daytime (7am-6pm)	41.0	59.0	49.7
	Evening (6pm-10pm)	41.5	55.5	46.9
	Nighttime (10pm-7am)	38.0	61.5	44.5
L_{eq}	Daytime (7am-6pm)	48.0	67.0	58.7
	Evening (6pm-10pm)	45.5	61.5	52.6
	Nighttime (10pm-7am)	41.0	65.5	51.3

Table 2.5:
Recorded Noise Level Statistics - dB(A)
Location 2 – Centre of Site
7 to 13 April, 2003

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dB(A)		
		MINIMUM	MAXIMUM	AVERAGE
L _{max}	Daytime (7am-6pm)	55.5	82.5	68.7
	Evening (6pm-10pm)	50.5	79.5	62.9
	Nighttime (10pm-7am)	46.0	85.0	61.0
L ₁	Daytime (7am-6pm)	48.5	77.5	60.7
	Evening (6pm-10pm)	48.0	79.0	57.5
	Nighttime (10pm-7am)	43.5	71.5	54.2
L ₁₀	Daytime (7am-6pm)	44.0	75.5	53.8
	Evening (6pm-10pm)	46.0	78.0	51.4
	Nighttime (10pm-7am)	40.5	68.5	50.1
L ₉₀	Daytime (7am-6pm)	37.5	55.0	47.5
	Evening (6pm-10pm)	41.5	52.5	46.8
	Nighttime (10pm-7am)	38.0	55.5	45.7
L _{eq}	Daytime (7am-6pm)	42.0	70.0	52.1
	Evening (6pm-10pm)	44.0	74.5	50.1
	Nighttime (10pm-7am)	39.5	62.5	48.4

Table 2.4: Range of Recorded Noise Levels - dB(A)
Location 2 – Centre of Site
7 to 13 April, 2003

DATE	STATISTICAL NOISE LEVEL - dB(A)	
	$L_{10}(18hr)$	$L_{eq}(24hr)$
07/04/03	-	-
08/04/03	61.0	55.8
09/04/03	60.8	56.6
10/04/03	61.0	56.8
11/04/03	60.9	55.9
12/04/03	55.4	54.3
13/04/03	53.6	49.7
14/04/03	-	-

Table 2.3:
Recorded Noise Level Statistics - dB(A)
Location 1 – Hercules Street
7 to 14 April, 2003

3.0 ASSESSMENT OF NOISE IMPACTS ON DEVELOPMENT

3.1 Aircraft Noise Impact Assessment

3.1.1 Aircraft Noise Criteria

The eastern portion of the Portside Wharf site is located adjacent the ANEF 20 contour for the proposed future parallel runway at the Brisbane Airport. As such, an aircraft noise assessment is warranted.

The applicable standard with respect to development suitability within aircraft noise affected areas is *AS 2021-2000 Acoustics - Aircraft noise intrusion - Building siting and construction*. The effect of an ANEF on land use planning may be summarised in the Table 3.1, (Table 2.1 from AS2021-2000):

Table 3.1: Building Site Acceptability Based on ANEF Zones (to be used in conjunction with Table 3.3 from AS2021-2000)

Building Type	ANEF zone of site		
	Acceptable	Conditional	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES:(from AS2021-2000)

1. The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside but near to the 20 ANEF contour.
2. Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (see also Figure A1 of Appendix A).
3. There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases Table 2.1 should be used to determine site acceptability, but internal design noise levels within the specific spaces should be determined by Table 3.3.

The Standard then requires the following actions:

- 1 **Acceptable**
If from Table 2.1, the building site is classified as "acceptable", there is usually no need for the building construction to provide protection specifically against aircraft noise.
- 2 **Conditional**
If from Table 2.1, the building site is classified as "conditional", the maximum aircraft noise levels for the relevant aircraft and the required noise reduction should be determined from the procedure of Clauses 3.1 and 3.2, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3.

Unacceptable If, from Table 2.1, the building site is classified as "unacceptable", construction of the proposed building should not normally be considered.

NOTE: In certain circumstances it may be proposed to construct or upgrade buildings on sites that could be classified as unacceptable, e.g. a hotel in the immediate vicinity of an aerodrome. In these cases, refer to Note 2 of Clause 1.1. This does not apply to sites to be used for residential purposes.

For the assessment of internal aircraft noise levels within the proposed residential units, Table 3.3 of AS2021-2000 provides design indoor sound levels for aircraft noise reduction assessment. It provides for:

Houses, home units, flats, caravan parks

Sleeping areas, dedicated lounges	50 dB(A) indoor design sound level
Other habitable spaces	55 dB(A) indoor design sound level
Bathrooms, toilets, laundries	60 dB(A) indoor design sound level

The potential for aircraft noise to cause sleep disturbance at the proposed residences is assessed as per the *FICAN (Sleep Awakenings due to Aircraft)* methodology of the Brisbane City Council NIA PSP Guidelines. This criterion requires a maximum internal aircraft noise level of $L_{Aeq} 65$ dB(A) to be achieved within sleeping areas.

3.1.2 Existing Aircraft Noise Levels

Maximum noise levels of aircraft were recorded at the site during the short-term noise monitoring (Table 2.1). The recorded aircraft noise levels varied significantly dependant upon the aircraft flight path. The loudest peak aircraft noise levels were associated with planes approaching from the west and banking above the site before aligning with the runway for landing. Recorded peak aircraft noise levels ranged 54.6 to 71.8 dB(A).

The noise measurements conducted demonstrated that aircraft noise currently impacts on the subject site. However, the issue of future aircraft noise at the site relates to air traffic using a future proposed parallel runway at the Brisbane Airport for which the site is adjacent the ANEF 20 contour. As such, future aircraft noise levels for assessment purposes will be determined by calculation, not by measurement.

3.1.3 Predicted Future Aircraft Noise Levels at Development

The eastern portion of the Portside Wharf site is located adjacent to the ANEF 20 contour for a proposed future parallel runway at the Brisbane Airport. Thus, the site is potentially affected by aircraft noise and should incorporate appropriate noise control measures (i.e. building construction) to provide suitable internal acoustic amenity as per Table 3.3 of AS 2021-2000. These standards requires that internal aircraft noise levels, calculated as per AS 2021-2000, are a maximum of the levels detailed in Section 3.1.1 above for various internal areas.

The site location with respect to the proposed future parallel runway flight path was defined in terms of DS, DL and DT as per Clause 3.4 of AS 2021-2000 as follows:

Table 3.2: Site Locational Data (as per AS 2021-2000)

SITE LOCATIONAL DATA (Clause 3.4 of AS2021-2000)		
DS	DL	DT
420	6550	9650

AS 2021-2000 considers noise levels generated by numerous types of aircraft that are active in Australia. The noise levels at the subject site of aircraft that use the Brisbane Airport were calculated as per *Tables 3.4 to 3.13 and 3.17 to 3.18* of AS 2021-2000 using the locational data detailed in **Table 3.2** above. The predicted noise levels are outlined in **Table 3.3** below:

Table 3.3: Predicted Future Aircraft Noise Levels (as per AS 2021-2000)

Aircraft Type	Predicted Future Aircraft Noise Level - dB(A)	
	Takeoff	Landing
Boeing 747-200B	88 (long range)	79
	80 (short range)	
Boeing 727 (Hush Kitted)	84	73
Boeing 747-400	83 (long range)	78
	77 (short range)	
Boeing 737-300, -400, and Airbus A320	72	71
BAe146	70	68

Many of the noisier aircraft considered in AS 2021-2000 use the Brisbane Airport relatively infrequently and thus have a much lesser potential to result in a loss of acoustic amenity. It is thus considered that as a realistic approach to providing for a reasonable level of internal noise amenity that the more prevalent Boeing 747-400, Boeing 737-300, -400, Airbus A320 and Bae146 should be used as a planning tool for acoustic ratings on the building components for the proposed Building 2 development.

As such, the design external aircraft noise level at the site as per **Table 3.3** is taken as 83 dB(A) for assessment purposes.

Based upon the 83 dB(A) aircraft noise level, building componentry calculations shall be performed in accordance with *Appendix F* of AS 2021-2000 to determine the minimum Weighted Sound Reduction Index (R_w) of typical building components in order to achieve the appropriate internal noise levels. It is recommended that at the Building Approval stage when construction drawings are available that the calculations be conducted to ensure appropriate acoustic elements are incorporated for the final design.

MWA Environmental's involvement with the Portside Wharf development dictates that the required R_w ratings can be achieved with available glazing elements and other standard residential construction materials. In some cases thicker glazing may be required to the most affected external façade elements.

Indicative building componentry requirements are provided in **Section 4.0**.

The effect of the noisier but less frequent aircraft on general living amenity is assessed with respect to their potential to result in sleep disturbance, assessed in accordance with the **FICAN (Sleep Awakenings due to Aircraft)** methodology of the Brisbane City Council NIAPSP Noise Management Guidelines. The appropriate criteria are:

C.2 Noise Limits

NIA PSP has adopted the FICAN 1997 curve in relation to aircraft noise. This curve is:

$$\text{Percentage Awakenings} = 0.0087^{L_{AE}} - 30^{1.79}$$

Where L_{AE} is the indoor sound exposure level (see AS1055.1 for a definition of this parameter). NIA PSP uses the 5% awakening level as the maximum allowable L_{AE} . As a result the maximum allowable L_{AE} is 65 dB(A).

With the L_{AE} typically 2 to 5 dB(A), nominally 3 dB(A), below the L_{max} (observed values of aircraft flyover noise), then the maximum aircraft noise level of 88 dB(A) from Table 3.3 above, would approximate an L_{AE} of 85 dB(A) (external).

Given that the R_w ratings shall be designed to achieve a noise reduction of 33 dB(A) within sleeping areas (83 dB(A) external to 50 dB(A) internal), then an internal noise level of 52 dB(A) L_{AE} will result from an external noise level of 85 dB(A) L_{AE} . Thus, internal noise levels due to the noisiest aircraft using the Brisbane Airport will satisfy the 65 dB(A) L_{AE} FICAN criterion within sleeping areas. Sleep disturbance potential should thus be minimal.

3.2 Traffic Noise Impact Assessment

3.2.1 Traffic Noise Criteria

The EPP (Noise) includes criteria levels of external traffic noise exposure. This requires that a criteria traffic noise exposure level of 63 dB(A) L_{10} (18 hour) be achieved at the facade of the most exposed part of a residential dwelling nearest the subject roadway(s), and should otherwise be achieved for at least one outdoor recreation area. This criterion has been used as an assessment methodology. Additionally, the Brisbane City Council NIA PSP requires that the design of residential developments in locations adjacent to roadways with over 15,000 vehicles per day (vpd) to consider internal noise levels as contained in Australian Standard AS2107:2000², determined in accordance with AS3671-1989³.

Table 1 of AS2107:2000 includes for houses and apartments near major roads the following:

This Standard requires the following Design Sound Levels (L_{Aeq} (dB(A)):

Type of occupancy/activity	Recommended design sound level, L_{Aeq} dB(A)	Satisfactory	Maximum
7 RESIDENTIAL BUILDINGS			
Houses and apartments near major roads-	35		45
Living areas	30		40
Sleeping areas	35		45
Work areas	45		55
Apartment common areas (e.g. foyer, lift lobby)			

² Australian Standard AS2107:2000 Acoustics – Recommended design sound levels and reverberation times in building interiors

³ Australian Standard AS3671 –1989 Acoustics – Road traffic noise intrusion – Building Siting and construction

For external noise amenity the following is taken from the BCC NIAPSP Guidelines as the relevant criteria:

B.2.3 Special Notes about Outdoor Recreation Areas

AS2107 does not include limits for outdoor recreation areas. A reasonable level of outdoor amenity must be maintained for residential and other similar uses in areas where outdoor recreation may occur. In such areas the maximum L_{eq} in any one hour period should not exceed 60dB(A) and the L_{eq} averaged over a 24 hour period should not exceed 55 dB(A).

3.2.2 Traffic Data

Existing and ultimate traffic data for Kingsford Smith Drive, Hercules Street and Remora Road past the subject site was supplied by Brisbane City Council City Design Transport, Structures and Survey in 2003.

The proposed development includes provision for traffic calming on Harbour Road to reduce the number of heavy vehicles that use Harbour Road as a connection to Kingsford Smith Drive. Under the proposed changes, trucks would access the Caltex service station on Hercules Street from Remora Road then exit to Remora Road. If approved, these traffic changes would significantly reduce the level of traffic noise experienced at the Harbour Road boundary of the subject site and also reduce traffic noise levels at the Brett's Wharf residential development. As a worst-case the traffic noise assessment assumes that the surrounding roadways will remain as currently exists.

Existing and ultimate data was supplied as 45,000 vehicles per day (vpd) in 2003 and 62,000 vpd in 2013 for Kingsford Smith Drive. The commercial vehicle content was provided as 13%. The annual growth rate was determined to be 3.26% from the supplied data. This growth rate was used to calculate an ultimate traffic volume for Year 2018 of 72,787 vpd.

Existing and ultimate traffic data for Hercules Street and Remora Road past the subject site was supplied as volumes of 2,000 vpd in 2003 and 3,000 vpd in 2013 for both roadways. A commercial vehicle content of 17% was supplied for Hercules Street and 18% for Remora Road. The annual growth rate was determined to be 4.14% from the supplied data. This growth rate was used to calculate an ultimate traffic volume for Year 2018 of 3,454 vpd for both roadways.

The daily traffic flow data has been scaled by a factor 0.94 to represent the 18 hour traffic flow data necessary to make the L_{10} (18 hour) traffic noise predictions. Traffic flow data for the surrounding roadways is displayed in Table 3.4 below.

Table 3.4: Existing and 10 Year Design Horizon Traffic Volumes

Roadway	VPD			VP18hr		%CV
	2003	2013	2018	2003	2018	
Kingsford Smith Drive	45000	62000	72787	42300	68420	13.00
Hercules Street	2000	3000	3675	1880	3454	17.00
Remora Road	2000	3000	3675	1880	3454	18.00

3.2.3 Traffic Noise Model Validation

The first step in the predictive traffic noise process is to validate the model to the recorded noise levels, i.e. the aim being to predict the to within ± 2 dB of the recorded level, with selected parameters used in the future traffic (ten year horizon) noise modelling scenarios.

The model used in the traffic noise modelling process was SoundPLAN 6.5. This model uses the CoRTN methodology for traffic noise prediction, a method accepted by regulatory bodies in Queensland.

As discussed in **Section 2.1**, the results of long-term noise monitoring conducted at the Hercules Street frontage of the site included a maximum recorded L_{10} (18 hour) of 61.0 dB(A). This monitoring location had line of sight to traffic on Hercules Street and Remora Road.

The model prediction for the monitoring location was an L_{10} (18 hour) of 61.1 dB(A), hence within the 2dB(A) tolerance applied to demonstrate validation of predicted to modelled flows.

The model layout and results of the SoundPLAN validation model are provided in **Attachment 4**.

3.2.4 Predicted Future Traffic Noise Levels

In order to determine the traffic noise amelioration measures that are required for the proposed development, 10-year design horizon traffic noise predictions have been made external to the proposed development building. The future traffic noise modelling has considered the proposed building location and floor levels as per the *Alex Popov & Associates* drawings included in **Attachment 1**. The topography of the site and surrounding areas was modelled to be flat.

The SoundPLAN 6.5 model was setup to predict the external L_{10} (18 hour) traffic noise levels under Year 2018 traffic conditions. A table of the results, predicting Year 2018 L_{10} (18 hour) noise levels (including facade reflection) at each level of the proposed Building 2 development was produced. See **Attachment 5** for the model layouts and modelling results.

Based upon ultimate traffic flow data for the adjacent roadways, as provided by BCC, the following **Table 3.5** is an assessment on the ultimate traffic noise level impacts on the proposed residential Building 2.

Table 3.5: Year 2018 Predicted Traffic Noise Levels for Proposed Residential Building 2 – dB(A) (including façade correction)

Building Façade	Floor Level	L ₁₀ 18hr	L _{eq} (1hr) 7am - 10pm	L _{eq} (1hr) 10pm - 7am	L _{eq} (24hr)
		dB(A)	dB(A)	dB(A)	dB(A)
East	1st	37.0	40.4	40.3	33.5
	2nd	37.2	40.6	40.5	33.7
	3rd	37.5	40.9	40.8	34.0
	4th	38.1	41.5	41.4	34.6
	5th	39.5	42.9	42.8	36.0
	6th	42.4	45.8	45.7	38.9
	7th	44.2	47.6	47.5	40.7
	8th	44.5	47.9	47.8	41.0
	9th	44.7	48.1	48.0	41.2
	10th	44.8	48.2	48.1	41.3
	11th	45.1	48.5	48.4	41.6
	12th	45.5	48.9	48.8	42.0
	13th	46.3	49.7	49.6	42.8
	14th	48.5	51.9	51.8	45.0
North	1st	52.2	55.6	55.5	48.7
	2nd	52.8	56.2	56.1	49.3
	3rd	53.3	56.7	56.6	49.8
	4th	53.8	57.2	57.1	50.3
	5th	54.3	57.7	57.6	50.8
	6th	55.0	58.4	58.3	51.5
	7th	55.7	59.1	59.0	52.2
	8th	56.9	60.3	60.2	53.4
	9th	58.6	62.0	61.9	55.1
	10th	61.2	64.6	64.5	57.7
	11th	63.1	66.5	66.4	59.6
	12th	64.0	67.4	67.3	60.5
	13th	64.3	67.7	67.6	60.8
	14th	64.7	68.1	68.0	61.2
South	1st	37.3	40.7	40.6	33.8
	2nd	37.3	40.7	40.6	33.8
	3rd	37.4	40.8	40.7	33.9
	4th	37.5	40.9	40.8	34.0
	5th	37.8	41.2	41.1	34.3
	6th	38.2	41.6	41.5	34.7
	7th	39.0	42.4	42.3	35.5
	8th	40.1	43.5	43.4	36.6
	9th	41.9	45.3	45.2	38.4
	10th	44.0	47.4	47.3	40.5
	11th	47.4	50.8	50.7	43.9
	12th	51.5	54.9	54.8	48.0
	13th	52.5	55.9	55.8	49.0
	14th	53.5	56.9	56.8	50.0
West	1st	50.1	53.5	53.4	46.6
	2nd	50.7	54.1	54.0	47.2
	3rd	51.2	54.6	54.5	47.7
	4th	51.8	55.2	55.1	48.3
	5th	52.4	55.8	55.7	48.9
	6th	53.0	56.4	56.3	49.5
	7th	53.8	57.2	57.1	50.3
	8th	55.0	58.4	58.3	51.5
	9th	56.6	60.0	59.9	53.1
	10th	59.4	62.8	62.7	55.9
	11th	62.0	65.4	65.3	58.5
	12th	63.2	66.6	66.5	59.7
	13th	63.8	67.2	67.1	60.3
	14th	64.6	68.0	67.9	61.1

The above noise levels demonstrate the likely noise levels external the Building 2 residential facades, based on indicative drawings included as **Attachment 1**. While slight exceedance of the 63 dB(A) L_{10} (18 hour) criterion does occur at the upper levels of the northern and western facades, it should be noted that the above predictions take no account of noise amelioration measures at the receiver in the form of solid balcony balustrades or possible full height balcony sides (i.e. side wall between unit balconies – not total enclosure of balcony). Under these conditions, attenuation of 3 to 8 dB(A) can be expected, such that the 63 dB(A) L_{10} (18 hour) criterion should be readily achievable at upper level northern and western external balcony areas if required. All other building facades are predicted to experience traffic noise levels satisfying the 63 dB(A) criterion.

The predicted traffic noise levels indicate some exceedance of the BCC external traffic noise criteria at the upper floor levels of the northern and western building facades. Considering the potential for balcony balustrade barrier attenuation, the 55 dB(A) L_{eq} (24 hour) criterion and the 60 dB(A) L_{eq} (1 hour) criterion should be achievable for at least one outdoor area of each residence. This notwithstanding that the common outdoor recreation area and pool area proposed at ground level and also the public walkway and Portside Wharf areas are well removed from the noise of road traffic and are also shielded by the proposed building structures such that the 60 dB(A) L_{eq} (1 hour) and the 55 dB(A) L_{eq} (24 hour) traffic noise criteria of BCC will readily be satisfied. As such, all future residents will have access to common outdoor recreation areas satisfying the external traffic noise criteria of the BCC.

As Kingsford Smith Drive carries more than 15,000 vehicles per day, the BCC criteria states (**Section 3.2.1**) that it will be necessary to conduct an internal noise assessment. It is recommended that at the Building Approval stage when construction drawings are available that the calculations be conducted to ensure appropriate acoustic elements are incorporated for the final design.

The internal traffic noise calculations should be based on predicted Year 2018 maximum 1 hour L_{Aeq} noise levels with the design objective of providing suitable internal amenity for living areas during the daytime period and for sleeping areas during the night-time period:

Living Area:	45 dB(A) Maximum L_{Aeq} (1hr) 7am to 10pm
Sleeping Area:	40 dB(A) Maximum L_{Aeq} (1hr) 10pm to 7am

Using the noise levels predicted in the modelling and following the methodology of AS3671 in considering traffic noise exposure, indicative Weighted Sound Reduction Indices (R_w s) will be identified for the building components as required for traffic noise attenuation to achieve the above internal traffic noise levels.

MWA Environmental's involvement with the Portside Wharf development dictates that the required R_w ratings can be achieved with available glazing elements and other standard residential construction materials. In some cases thicker glazing may be required to the most affected external facade elements.

Indicative building component requirements are provided in **Section 4.0**.

3.3 Port Activities Noise Impact Assessment

3.3.1 Port Activities Noise Criteria

The NIAPSP outlines assessment methodologies that should be used based on the noise source(s) characteristics and the time of day at which they occur. The noise sources associated with the surrounding land uses as considered for the assessment of the noise of port activities are the following:

- Plant and equipment noise, e.g. ship generator, air-conditioner noise;

- Loading / unloading noise, e.g. loading banging, noise of cranes and hydraulic buckets;
- Site vehicle noise, e.g. truck and vehicle movements on site, forklifts;
- Communications, e.g. alarms, PA system, beepers; and,
- Noise of ships arriving / leaving port, e.g. engine / propeller noise, noise of horns.

The range of noise sources and the potential for noise impact from the on-site and adjoining port operations to occur over a 24-hour per day period dictates that several noise assessment methodologies are required. The following paragraphs contain assessment methodologies in ***bold & italic*** type that are taken from titled assessment methodologies in the Brisbane City Council NIAPSP and the accompanying *NIAPSP Guidelines*.

3.3.1.1 Plant and Equipment Noise Criteria

For plant and equipment noise, an appropriate assessment is using Australian Standard **AS2107**, *AS2107:2000 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* as a basis for determining the potential for noise intrusion into adjacent habitable dwellings from steady-state noise sources that operate during all hours of the day.

The noise limits are:

The maximum recommended design sound levels stated in Table 1 of AS2107.

Table 1 of AS2107:2000 is as follows:

Type of occupancy/activity	Recommended design sound level, <i>L_{Aeq}</i> dB(A)	
	Satisfactory	Maximum
7 RESIDENTIAL BUILDINGS		
<i>Houses and apartments near major roads-</i>		
Living areas	35	45
Sleeping areas	30	40
Work areas	35	45
Apartment common areas (e.g. foyer, lift lobby)	45	55

As such, the appropriate criteria for the assessment of the noise of plant and equipment associated with the adjoining port use is a maximum level of 40 dB(A) within sleeping areas and 45 dB(A) within living areas.

3.3.1.2 Loading Noise and Port Vehicle Noise Criteria

The noise from ships entering / leaving the port, loading / unloading activities at the port (cranes, loading banging etc.) and from port vehicles (trucks, cars, forklifts etc.) are typically noise events of a short duration and are best assessed using a comparison of like parameters or ***Descriptors***, with the criteria as follows:

The chosen parameter for assessing the impact of the development does not exceed the corresponding parameter describing the ambient noise by more than 3 dB(A).

Such an assessment applies for the periods 7am to 6pm (Daytime) and 6pm to 10pm (Evening). As there is the likelihood for port related activities in the period 10pm to 7am (Night-time) potential for noise amenity impacts uses an assessment of **Sleep Disturbance due to Sources Other than Aircraft**, which also considers the resultant internal noise level at the nearest future habitable dwellings from the intrusive source. This criteria is as follows:

Research adopted by the World Health Organisation (WHO), concludes that for short duration variable noise sources the onset of sleep disturbance commences at internal L_{max} noise levels of between 45 dB(A) and 50 dB(A).

Accordingly, for these noise sources measured internal maximum noise levels in area categories:

- R1-R3 must not regularly exceed 45 dB(A) &
- R4-R6 must not regularly exceed 50 dB(A)

Here "regularly" refers to the likelihood the noise levels would be exceeded by certain events (e.g. passing trucks) throughout the night.

From AS1055.2-1997⁴, which contains the 'R' noise area category rating (Appendix A), and the ambient recorded noise levels at the centre of the site on Tuesday 8th April, 2003 when there were minimal port activities, the location would be described as an R3 to R4 noise area category. The average background ($L_{A90,T}$) A-weighted sound pressure levels from AS1055.2-1997 for an R3 noise area category are 50, 45 and 40 dB(A) and for an R4 noise area category are 55, 50 and 45 dB(A) for the Daytime, Evening and Night-time periods respectively, compared with the recorded levels of 48, 46 and 44 dB(A) (Table 2.4) for the corresponding periods. As such, the appropriate criteria for the assessment of the noise of loading / unloading activities and vehicles associated with the adjoining port use is a maximum internal noise level of 45 dB(A).

3.3.2 Noise of Adjoining Port Operations

Noted noise levels at the site from plant and equipment associated with the adjoining port was limited to a noise level of 60 dB(A) at a distance of 85 metres from a generator on the 'Alblasgracht' which was docked at Hamilton 1 wharf.

The noise of a ship leaving port under its own power was recorded when the 'Alblasgracht' left the Hamilton 1 wharf on Thursday 10 April, 2003. The ship had been unloaded and the propeller was thus high in the water, generating higher than average noise at the propeller / water interface. The noise level of this ship leaving port was recorded as approximately 73 dB(A) at a distance of 75 metres. The noise impact was noticeable for a period of approximately 6 minutes.

The noise of fertiliser and metal pipe unloading activities at the Hamilton 2 wharf was audible at most locations throughout the subject site. Noise sources noted included the noise of cranes, hydraulic buckets, small and large forklifts, a dozer and general loading barking noise. Additionally, there was occasional noise from reversing beepers, alarms and from the PA system. The noise peaks from these activities at the site were generally below 60 dB(A), with occasional louder noise up to 68.2 dB(A) from barking associated with the loading of metal pipes. These activities, as conducted at Hamilton 2 wharf would have generated higher noise levels at the subject site if conducted at the Hamilton 1 wharf, nearest to the subject site.

⁴ Australian Standard AS 1055.2-1997 *Acoustics - Description and measurement of environmental noise, Part 2: Application to specific situations*

Scrap metal is loaded for export at the adjoining port facility. Previous noise monitoring conducted has measured the noise level of scrap metal loading at the port to be approximately 63 dB(A) at a distance of 50 metres.

The typical noise of slow-speed passenger vehicles has been previously recorded by MWA Environmental as approximately 75 dB(A) at a distance of 3 metres. Similarly, trucks of the type generally used at the port have been previously measured as producing a noise level of approximately 85 dB(A) at a distance of 3 metres. The recorded noise level of trucks on the adjoining port at the eastern boundary of the subject site were below 60 dB(A) and generally in the range 45 to 55 dB(A). These trucks were operating approximately 200 metres from the noise monitoring location at Hamilton 2 wharf. The noise of trucks and passenger vehicle at the adjoining wharf would have been higher if activities were focussed at the Hamilton 1 wharf which is nearer to the subject site.

The existing terminal and apartment building located on the eastern extent of the site and other proposed residential buildings (i.e. Buildings 3 and 4) provide substantial shielding of noise from the P&O Ports facility at the proposed Building 2 component of the Portside Wharf site.

3.3.3 Predicted Port Activities Noise Levels at Development

3.3.3.1 Plant and Equipment Noise

During the noise monitoring the noise level of two ship generators was recorded as 54.5 dB(A) at 75 metres and 60 dB(A) at 85 metres. The assessment of the noise from ship generators at the adjoining port use is a worst-case assessment assuming that the loudest recorded ship generator noise source is operating at the Hamilton 1 wharf (nearest to the subject site). These worst case assumptions related to a maximum ship generator noise level external to the most potentially affected building façade (upper levels of Building 2 which are not shielded by the development buildings) of 55 dB(A). Thus, in order to achieve the required internal plant and equipment noise levels of 40 dB(A) within bedrooms and 45 dB(A) within living areas, the eastern facade of the upper levels of Building 2 will be required to achieve a minimum noise attenuation of 10 to 15 dB(A). This level of noise attenuation will be readily achieved using standard residential grade building components.

The existing Terminal and apartment building, up to 10 storeys in height, along the eastern site boundary and also other proposed residential buildings provides substantial shielding of the noise of P&O Ports activities at the ground level outdoor areas and at the lower and middle levels of the residential Building 2. Thus, the ground level outdoor areas are shielded from the adjoining port and will have satisfactory noise environments. As such, the noise of port related plant and equipment is not predicted to adversely impact on amenity at the proposed Building 2 development.

3.3.3.2 Noise of General Port Activities

The noise monitoring conducted identified distinct noise levels from port activities such as truck and forklift movements, cranes, loading banging noise and others as detailed above. The assessment of the noise from loading / unloading and site vehicles at the adjoining port use is a worst-case assessment assuming that the loudest recorded port activity noise source is operating at the Hamilton 1 wharf (nearest to the subject site). These worst case assumptions related to a maximum port activity noise level external to the potentially most affected building facade (upper levels of Building 2 which are not shielded by the Terminal Building) of 72 dB(A). Thus, in order to achieve the required internal peak noise level of 45 dB(A), the affected

facades of the upper levels of Building 2 will be required to achieve a noise attenuation of up to 27 dB(A). This level of required noise attenuation will necessitate the provision of acoustically rated building components to the eastern facade of the proposed Building 2.

The large Terminal and apartment building, up to 10 storeys in height, along the eastern site boundary and also other proposed residential buildings provides substantial shielding of the noise from the P&O Ports activities at the ground level outdoor areas and at the lower and middle levels of the development building. Thus, the lower levels of Building 2 and ground level outdoor areas are shielded from the noise of port activities by existing and proposed building structures such that they will be exposed to lower external peak noise levels than that detailed in the above paragraph.

It is considered that the noise of general port activities has the potential to only impact upon eastern building facades of the upper levels (i.e. above Level 10) of proposed Building 2. As such, it is recommended that at the Building Approval stage, when construction drawings are available, that building componentry calculations of the required Rw values for the eastern facade of Level 10 and above of Building 2 be conducted to ensure appropriate acoustic elements are incorporated for the final design.

MWA Environmental's involvement with the Portside Wharf development dictates that the required Rw ratings can be achieved with available glazing elements and other standard residential construction materials. In some cases thicker glazing may be required to the most affected external facade elements.

Lower levels of Building 2 are sufficiently shielded from the adjoining port by the large Terminal and apartment building and will thus require a lower acoustic standard from building components to achieve the criteria internal noise level from port activities. It is considered that the noise of port activities on lower levels (and also the southern, northern and western building facades) will also be attenuated on the account of traffic noise and aircraft noise Rw ratings. As such, with the provision of appropriate acoustic design and acoustically rated building components, the noise of port related activities is not predicted to adversely impact on amenity at the proposed residences. Indicative building componentry requirements are provided in **Section 4.0**.

3.4 Surrounding Land Uses Noise Impact Assessment

3.4.1 Surrounding Land Uses Noise Criteria

The Brisbane City Council NIAPSP outlines assessment methodologies that should be used based on the noise source(s) characteristics and the time of day at which they occur. The noise sources associated with the surrounding land uses (other than the port activities) as considered for the assessment are the following:

- Plant and equipment noise, e.g. air-conditioning, refrigeration, exhaust vents;
- Service noise, e.g. truck, forklift and vehicle movements; and,
- Car parking and associated vehicle noise.

Surrounding existing land uses (other than Port land uses) that have the potential to impact on noise amenity at the site are limited to Sammys Girl Seafood with respect to plant and equipment noise. All other sites are currently under redevelopment or form part of the Portside Wharf Masterplan development.

The Caltex service station (24-hour truck stop) located to the north, across Hercules Street has little potential to impact on the site considering that the proposed

residences will receive louder and more frequent noise peaks from trucks on Hercules Street than those at the service station. Plant and equipment associated with the service station was minimal and was not audible at the subject site during site inspections.

The range of noise sources and the potential for noise impact from the surrounding land uses to occur over a 24-hour per day period dictates that several noise assessment methodologies are required. The following paragraphs contain assessment methodologies in ***bold & italic*** type that are taken from titled assessment methodologies in the Brisbane City Council NIAPSP and the accompanying *NIAPSP Guidelines*.

3.4.1.1 Plant and Equipment Noise Criteria

For plant and equipment noise, an appropriate assessment is using Australian Standard ***AS2107, AS2107:2000 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*** as a basis for determining the potential for noise intrusion into adjacent habitable dwellings from steady-state noise sources that operate during all hours of the day.

The noise limits are those defined in ***Section 3.3.1.1*** above for plant and equipment associated with the adjoining port uses.

3.4.1.2 Car Parking and Site Vehicle Noise Criteria

The noises from vehicle related activities and from general car park activity are typically noise events of a short duration and are best assessed using a comparison of like parameters or ***Descriptors***, with the criteria as follows:

The chosen parameter for assessing the impact of the development does not exceed the corresponding parameter describing the ambient noise by more than 3 dB(A).

Such an assessment applies for the periods 7am to 6pm (Daytime) and 6pm to 10pm (Evening). As there is potential for vehicle related activities in the period 10pm to 7am (Night-time) potential for noise amenity impacts uses an assessment of ***Sleep Disturbance due to Sources Other than Aircraft***, which also considers the resultant internal noise level at the nearest future habitable dwellings from the intrusive source. This criterion is as defined in ***Section 3.3.1.2*** above for night-time noise associated with the loading and vehicles activities at the adjoining port uses.

3.4.2 Noise of Surrounding Land Uses

Plant and equipment associated with Sammys Girl was not generally distinguishable above the ambient background noise level at any point on the subject site.

3.4.3 Predicted Surrounding Land Use Noise Levels at Development

PLANT AND EQUIPMENT NOISE

Previous reporting and monitoring conducted at the site, identified a maximum noise level from surrounding fixed plant and equipment of approximately 55 dB(A) from Sammy's Girl plant and equipment at proposed Building 5. Building 2 is significantly further separated and shielded from Sammy's Girl plant than is Building 5 and hence, the maximum plant noise level is considered to be much less than 55 dB(A) at Building 2. Thus, in order to achieve the required internal plant and equipment noise

levels of 40 dB(A) within bedrooms and 45 dB(A) within living areas, the northern facade of the Building 2 will be required to achieve a maximum noise attenuation of less than 15 dB(A). This level of noise attenuation will be readily achieved using standard residential grade building components. All other proposed Building 2 facades are further setback and shielded from the surrounding fixed plant and equipment and will thus also have satisfactory internal noise environments. As such, the noise of surrounding fixed plant and equipment is not predicted to adversely impact on amenity at the proposed residences.

CARPARKING AND SERVICE VEHICLE NOISE

Given that the only car parking and service vehicle noise from off-site uses will be on Hercules Street and Harbour Road, this noise source is not considered a constraint to residential development.

MWA Environmental and others have previously recorded general car park and slow vehicle drive-by noise levels as typically 75 dB(A) at three metres. The assessment of car parking noise has considered car parking activities and slow speed traffic on access driveways and car parking areas surrounding Building 2.

This noise source is typified by short-term events, and so an appropriate like parameter for *Descriptors* assessment is the L_1 noise level. From the noise monitoring undertaken, the minimum ambient L_1 during the daytime and evening periods when car parking will generally occur was 48.0 dB(A), for which a criterion noise level would be 51 dB(A).

The noise level of slow speed traffic and car starts / door slams has previously been recorded by MWA Environmental as approximately 75 dB(A) at a distance of 3 metres. The shortest distance from adjoining car parking to a proposed residential facade is approximately 11 metres.

The likely maximum resultant car parking / slow speed vehicle noise level at the Building 2 is 64 dB(A), calculated as follows:

Source noise level (L_{p1}): 75 dB(A) at 3 metres (r_1)

Distance from source to residential facade: 11 metres (r_2)

$$\begin{aligned} L_{p2} &= L_{p1} - 20 \log(r_2/r_1) \\ &= 75 - 20 \log(11/3) \\ &= 63.7 \text{ dB(A)} \end{aligned}$$

This level is above the adopted criterion noise level, but it should be noted that the ambient L_1 noise levels ranged 48.0 to 79.0 dB(A) at the centre of the site noise logger during the daytime and evening periods. Given that ambient L_1 noise levels currently exceed the maximum predicted car parking noise level; it is judged that the noise of adjoining car parking does not have the potential to impact on future residential amenity. Furthermore, the required Rw ratings to attenuate traffic noise, aircraft noise and port activity noise sources shall also attenuate the noise of car parking activities at internal residential areas.

3.5 Noise Impact of Terminal and Commercial Precinct at On-Site Residences

3.5.1 Noise of Ships at Port

The use of the cruise wharf is primarily for one ship per week on average during the cruise season.

Noise sources associated with the ships berthing at the Portside Wharf include:

- Ship engine noise and/or tug boat engine when arriving and departing;

- Auxiliary engine and generator noise when at dock;
- Any on-board amplified entertainment noise; and,
- Noise of on-board patrons.

The level of noise from engines and generators on passenger cruise ships would be expected to be lower than from commercial ships due to the requirement to provide a suitable level of amenity for on-board guests.

Inspection of recent cruise ships docked at Portside Wharf demonstrates that noise from the ships is apparent on the site. The acoustic design of future apartments requires consideration of existing traffic and aircraft noise in addition to port operation noise.

Based upon the noise monitoring at the subject site and observations, the noise level of a typical passenger cruise ship at the dock (i.e. the noise of auxiliary engines and generators) is taken as 50 dB(A) at 75 metres for assessment purposes. Considering that Building 2 is located approximately 29 metres from a docked cruise ship, a noise level of approximately 58 dB(A) external to the nearest proposed on-site residential façade is adopted.

Thus, in order to achieve the required internal noise levels of 40 dB(A) within bedrooms and 45 dB(A) within living areas, the most exposed southern façade of Building 2 will be required to achieve a minimum noise attenuation of 13 to 18 dB(A). This level of noise attenuation will be readily achieved using standard residential grade building components, however, as noted above, much higher acoustic design requirements will be required for the external façade due to transportation noise constraints. As such, the noise of cruise ships berthed at the Portside Wharf is not predicted to adversely impact on amenity at the proposed Building 2 residences.

3.5.2 Noise of Terminal Building and Commercial Precinct

The existing terminal building and associated commercial uses, along with existing restaurant uses at the ground level of Building 3 have the potential to generate noise at the Building 2 on-site residences.

The existing commercial uses at Portside Wharf, located to the east of Building 2, incorporate restaurants, cinemas, function rooms and markets. Retail uses are also proposed to be located at the ground level of future residential buildings at the site, including Building 4 located to the north. The exact nature or future tenants of the retail tenancies are not known at this stage, however, it is considered that the uses would be similar to the existing uses at Portside Wharf.

Typical noise sources associated with the commercial and retail uses are likely to include:

- Amplified entertainment noise;
- Noise of outdoor dining / patrons;
- Noise of fixed plant and equipment;
- Noise of service vehicles and service activities;
- Noise of car parking; and,
- Noise of persons exiting / entering berthed ship.

It is considered that, with appropriate design and amenity controls, the noise of ground level retail uses (including the Building 4 site) and also the noise of the surrounding commercial precinct and the operation of the terminal building would not cause adverse impacts on residential amenity at proposed Building 2. Furthermore, the required Rw ratings to attenuate traffic noise, aircraft noise and port activity noise sources would also attenuate the noise of any potential amplified entertainment and outdoor dining activities at internal residential areas.

To further clarify this and to provide a quantitative assessment, MWA Environmental have recently conducted additional noise measurements at the site to identify any entertainment and outdoor dining noise impacts from the existing commercial and retail precinct. The monitoring was conducted on Saturday 3 March 2008 during a period of what is considered to be busy dining time. As such the results are considered appropriate for the assessment of entertainment and outdoor dining noise from the existing Portside Wharf commercial precinct. The short-term statistical noise levels recorded by sound level meter are listed below in Table 3.6.

Table 3.6: Recorded Short-Term Noise Levels – dB(A)
3 March 2008

#	LOCATION	TIME	RECORDED STATISTICAL NOISE LEVEL - dB(A)					COMMENTS
			L ₁	L ₁₀	L ₅₀	L ₉₀	L _{eq}	
1	South of Building 3. At cruise terminal wharf. 15m to nearest restaurant.	2030 – 2040	62.9	59.9	57.7	56.1	50.2	Outdoor dining noise at Building 3 & 7 restaurants
2	Southeast of Building 4 site. Adjacent to existing restaurant. 10m to nearest restaurant.	2050 – 2100	67.2	63.0	60.5	58.8	61.3	Outdoor dining noise at Building 3 & 7 restaurants Background music at some restaurants – not influential
3	East of Building 4 site To north of existing restaurant uses. 20m to nearest restaurant.	2105 – 2115	61.9	59.3	57.0	55.3	57.5	Outdoor dining noise at Building 7 restaurants Background music at some restaurants – not influential

The short-term noise monitoring was undertaken with a Rion NL-21 Precision Sound Level Meter, internally pre-calibrated to 94 dB at 1kHz. There was no deviation from this level at post-calibration.

The monitoring undertaken indicates that the noise of amplified entertainment noise at the existing commercial and retail precinct located to the east of the Building 2 site was not noted to be influential on ambient noise levels. It was noted that some of the restaurants were playing light background music, however the noise impact was very minimal in comparison to more frequent noise sources such as traffic noise, car parking noise and outdoor dining noise. As such, it is not considered necessary to assess the existing impact of entertainment noise from the commercial precinct. It will be, however, necessary to provide further acoustic assessment if significant entertainment noise, i.e. Nightclub uses, were proposed at the Portside Wharf site.

Additionally, the monitoring undertaken indicates that there was some noise impacts associated with outdoor dining activities at existing restaurants surrounding the site. The noise impact, however, is noted to be fairly minimal and it is not considered that it would cause any adverse impacts upon future residential amenity (especially considering the future design of proposed Building 2 to mitigate traffic noise, aircraft noise and port activity noise). This notwithstanding, further assessment has been carried out for outdoor dining noise impacts upon proposed Building 2 residential facades to ensure residential amenity is not adversely impacted.

3.5.3 Outdoor Dining Noise Impacts

The shortest distance from existing outdoor dining areas to a proposed Building 2 residential façade is approximately 15 metres.

Assessment of daytime and evening period (7am to 10pm) outdoor dining noise impacts using the comparison of like parameters or descriptors methodology is considered to be best determined using the statistical noise parameter L_{10} . The L_{10} parameter is considered appropriate given the nature of outdoor dining noise.

The applicable criteria are that the chosen parameter for assessing the impact of the development does not exceed the corresponding parameter describing the ambient noise by more than 3 dB(A). From **Section 2.1.2**, the average recorded L_{10} noise level at the datalogger located on the centre of the Portside Wharf site (see **Table 2.4**) was 51.4 dB(A) during the evening period. Thus, the appropriate design outdoor dining noise criterion is **54 dB(A)** external to proposed Building 2 residential facades.

As some outdoor dining may occur during the night-time period (10pm to 7am), the assessment has also considered the NIAPSP **Sleep Disturbance due to Noise Sources Other than Aircraft** methodology. The criteria from the NIAPSP Guidelines are as follows:

Research adopted by the World Health Organisation (WHO), concludes that for short duration variable noise sources the onset of sleep disturbance commences at internal L_{max} noise levels of between 45 dB(A) and 50 dB(A).

Accordingly, for these noise sources measured internal maximum noise levels in area categories:

- **R1-R3 must not regularly exceed 45 dB(A)&**
- **R4-R6 must not regularly exceed 50 dB(A).**

Here "regularly" refers to the likelihood the noise levels would be exceeded by certain events (e.g. passing trucks) throughout the night.

Hence, given the area is defined as an R3-R4 category area as per AS1055.2-1997, the internal noise level not to be exceeded is **45 dB(A) L_{max}** internally at the proposed Building 2 residential units.

The noise of a loud group of dining patrons has previously been recorded by MWA Environmental to be approximately 55 dB(A) at a distance of 30 metres (85 dB(A) at 1 metre). This corresponds well with the noise measurements recorded at the site (see **Table 3.6**).

The resultant noise level of ground level outdoor dining patron noise affecting the nearest proposed Building 2 residential facade is calculated to be 61 dB(A), as follows:

Source noise level (L_{p1}):	55 dB(A) at 30 metres (r_1)
Distance from source to residential facade:	21 metres (r_2)
Resultant noise level at receiver (L_{p2}):	L_{p2} $= L_{p1} - 20 \log (r_2/r_1)$ $= 55 - 20 \log (15/30)$ $= 61.0 \text{ dB(A)}$

Thus, the noise of outdoor dining is predicted to slightly exceed the external noise criteria at the nearest proposed Building 2 residential facade. However, to achieve the internal sleep disturbance 45 dB(A) criteria, a maximum 16 dB(A) of noise attenuation is required. This would be comfortably achieved when considering that all Building 2 residential facades are proposed to be air-conditioned and acoustically treated to attenuate traffic noise, aircraft noise and port activity noise sources as required. Furthermore, the 16 dB(A) noise reduction would be achieved with standard residential grade building components. All other proposed Building 2 residential facades are further separated and/or shielded from the existing outdoor dining areas and thus will not be adversely affected.

The above calculations demonstrate that outdoor dining noise associated with the existing commercial and retail uses at the Portside Wharf site shall not adversely impact on proposed Building 2 residential amenity. This assessment further clarifies the observations of the recent site inspection and noise monitoring conducted at the site.

It is also important to note that the management of any licensed premises has a "duty of care" under licensing provisions to ensure that the behaviour of patrons entering and leaving a licensed premises does not cause undue annoyance or disturbance to persons living, working or doing business in the neighbourhood. Management will be required to act to ensure that patrons are supervised whilst on site to minimise noise from external areas.

It is also considered that any future outdoor dining noise impacts associated with future retail areas at other surrounding buildings would similarly not have an adverse impact upon the acoustic amenity at Building 2 on-site residences.

3.5.4 Noise of Potential Night-clubs

It has been confirmed by Brookfield Multiplex that the proposed Nightclub use, which was applied for as part of the MCU development permit application for the Portside Wharf development, is no longer proposed as self assessable development. It is intended that any future night-club use proposals would be made code assessable and as such would be subject to detailed acoustic assessment in order to satisfy the requirements of the Brisbane City Council NIAPSP.

3.6 Noise Impact of Subject Site on Adjacent Residential Land Uses

3.6.1 Noise of Residential Building

The proposed residential Building 2 is located on the southern portion of the site, significantly separated and shielded to existing ("Brett's Wharf") and future (residential) lots at south-western corner of site) surrounding residences.

As discussed in previous sections, any fixed plant and equipment associated with residential Building 2 will be selected, located and/or acoustically treated to achieve the appropriate limits external to neighbouring on-site and surrounding off-site residential facades.

3.6.2 Noise of Car Parking Activities

Building 2 car parking is proposed to be located within a basement level.

The noise of basement car parking activities will generally be contained to within the basement structure with little potential to adversely impact on surrounding land uses.

4.0 OVERALL BUILDING COMPONENTRY RECOMMENDATIONS

As the site is affected by aircraft noise, road traffic noise and noise from the adjoining port operation, it is recommended that at the Building Approval stage, when construction drawings are available, Rw calculations be conducted for each of the noise sources to ensure appropriate acoustic elements are incorporated for the final design and that satisfactory internal residential amenity is achieved.

An outline of the building componentry calculation requirements required for the Building 2 development are outlined below in **Table 4.1**:

Table 4.1: Building Componentry Calculation Requirements

Noise Source	Assessment Methodology	Maximum External Noise Level dB(A)	Internal Noise Criteria – Bedrooms dB(A)	Internal Noise Criteria – Living Areas dB(A)	Facades Affected
Aircraft	AS 2021-2000	83 L _{max}	50 L _{max}	60 L _{max}	All
Traffic	AS 3671 AS 2021-2000	As per Table 3.5	40 L _{eq}	45 L _{eq}	All
Port	AS 2021-2000	72 L _{max}	45 L _{max}	50 L _{max}	Eastern Facade, Levels 10 and above

It is recommended that the development approval conditions require the design of acoustic treatments for the building at the detailed design stage to ensure appropriate internal amenity is achieved. The Rw calculations should be conducted for aircraft noise, traffic noise and port activity noise sources with the maximum Rw value as calculated from the three noise sources being assigned to each building component. The assessment methodologies, maximum external noise predictions, internal noise criteria and affected facades for each noise source are outlined above in **Table 4.1**.

MWA Environmental's involvement with the Portside Wharf development dictates that the required Rw ratings can be achieved with available glazing elements and other standard residential construction materials. In some cases thicker glazing may be required to the most affected external façade elements.

From experience, the following indicative building componentry requirements are provided in **Table 4.2** below. Note that these are indicative only and should only be used as a general guide to what shall be required for the final design.

Table 4.2: Indicative Building Componentry Requirements

Element	Typical Rw Range
Wall	30 to 42
Window	30 to 38
Sliding Glass Door	32 to 42

It is considered that the provision of building components achieving the R_w ratings specified at the detailed design stage will ensure satisfactory internal noise amenity within the proposed Building 2 units.

5.0 LIGHTING IMPACT ASSESSMENT

The impact of lighting glare from vehicular headlights utilising the proposed Portside Wharf Building 4 Levels 1 to 3 car parking areas is to be considered at the Building 2 residential facades. The proposed Building 4 car parking areas are located to the north of the site and were assessed as part of the development application for Building 4 conducted by MWA Environmental title Noise and Lighting Impact Assessment – Building 4 Development Application – Portside Wharf Development – Hamilton (Reference 06-128, dated 21 August 2007). The following is taken from Section 5.0 of the 21 August 2007 report:

The impact of glare from vehicular headlights utilising the proposed Levels 1 to 3 car parking areas is to be considered at surrounding residential facades. Vehicles accessing the car parking Levels 1 to 3 during the more sensitive curfewed hours are considered to be minor when compared to the more frequent vehicle movements during non-curfewed hours. It is proposed to provide either solid masonry full height walls or a combination of full height external perforated screening and 1.4 metre high internal solid concrete wall safety barrier to the perimeter of car parking Levels 1 to 3. The headlight glare from cars utilising the car parking Levels 1 to 3 will be largely contained by the solid wall or 1.4 metre high safety wall elements such that unacceptable impact is not caused at surrounding residential facades. Additionally, the perforated screen elements shall also be effective in minimising the impact of headlight glare at surrounding residential facades.

The head lighting from vehicular movements within Building 4 proposed car parking Levels 1 to 3 will be contained on site with appropriate 1.4 metre high safety wall, solid wall and perforated screening elements. The potential for adverse glare from vehicle head lighting at surrounding residential facades is considered minimal and will not result in unacceptable impact upon amenity of existing residential areas.

As such, it is considered that the lighting impacts from the proposed Building 4 development shall not cause adverse impacts at the proposed Building 2 development. There are no other surrounding land uses considered to have the potential to impact upon lighting amenity at the proposed development.

6.0 CONCLUSIONS

This report is a Noise and Lighting Impact Assessment for the proposed residential Building 2 of the 'Portside Wharf' development at Hamilton (see **Figure 1**).

The Portside Wharf development is anchored by the Brisbane Cruise Ship Terminal and incorporates a range of uses including residential, retail and commercial uses as part of the overall Masterplan.

Building 2 is a proposed residential use development in a multi storey building, and is located on the southern portion of the Portside Wharf site.

This report considers the noise impact of surrounding land uses on the development and the potential for reverse amenity impacts of the development upon existing surrounding land uses. This report has been prepared in accordance with the requirements of applicable Australian Standards and with the requirements of the Brisbane City Council (BCC) *Brisbane City Plan 2000, Noise Impact Assessment Planning Scheme Policy* (NIAPSP).

The report has been prepared from detailed field surveys and data acquisition from Brisbane City Council, the Environmental Protection Agency and surrounding land occupiers including P&O Ports and DPI Food Research.

As the site is affected by aircraft noise, road traffic noise and noise from the adjoining port operation, it is recommended that at the Building Approval stage, when construction drawings are available, Rw calculations be conducted for each of the noise sources to ensure appropriate acoustic elements are incorporated for the final design and that satisfactory internal residential amenity is achieved. Given substantial experience with the Portside Wharf development, it is considered that the required Rw ratings can be achieved with available glazing elements and other standard residential building components. In some cases thicker glazing may be required to the most affected external façade elements.

Additionally, the report has determined that noise of ships at port, noise from on-site restaurants and noise from car parking will be within appropriate limits internally given the requirement to achieve a high level of aircraft, traffic and port noise attenuation at the proposed residences.

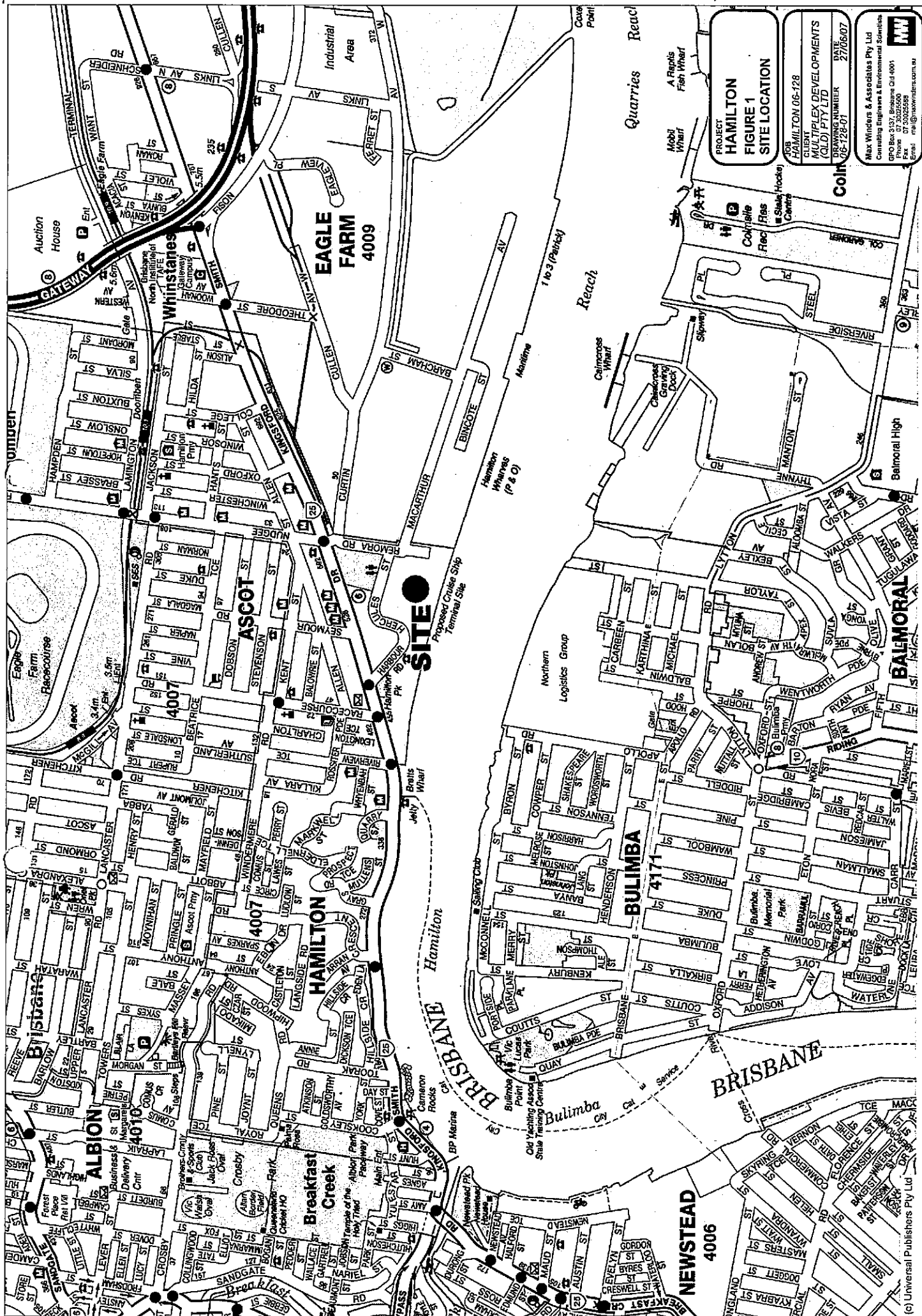
The assessment concluded that any external plant and equipment associated with the proposed development can be located and/or acoustically treated to provide satisfactory noise levels at on-site and surrounding residential premises.

A lighting impact assessment for the proposed Portside Wharf Building 4 car parking levels 1 to 3 has previously been conducted by MWA Environmental. It is considered that the lighting impacts from the proposed Building 4 development shall not cause adverse impacts at the proposed Building 2 development. There are no other surrounding land uses considered to have the potential to impact upon lighting amenity at the proposed development.

In summary, our experience dictates that the development can be constructed to readily comply with relevant acoustic and lighting design standards and that future residential amenity will be of an appropriate standard.

MWA Environmental
11 November 2008

FIGURES



PROJECT HAMILTON
FIGURE 1
SITE LOCATION

CLIENT
MULTIPLEX DEVELOPMENTS
(QLD) PTY LTD

DRAWING NUMBER
06-128-01

DATE
27/06/07

COIN
HAMILTON 06-128

Max Winters & Associates Pty Ltd
Consulting Engineers & Environmental Scientists
GPO Box 337, Brisbane Qld 4001
Tel: 07 33025555
Fax: 07 33025558
Email: max@maxwinters.com.au



NOTES
Google Airphoto is not orthorectified.
DNRM&E Cadastral overlay is best fit only.

Scale 1:4,000 @ A4



BRISBANE RIVER

Image © 2006 DigitalGlobe

LEGEND
[Symbol] Noise Dataloggers (2)
[Symbol] Short Term Noise Monitoring Locations (8)

PROJECT
HAMILTON
FIGURE 2
NOISE MONITORING LOCATIONS

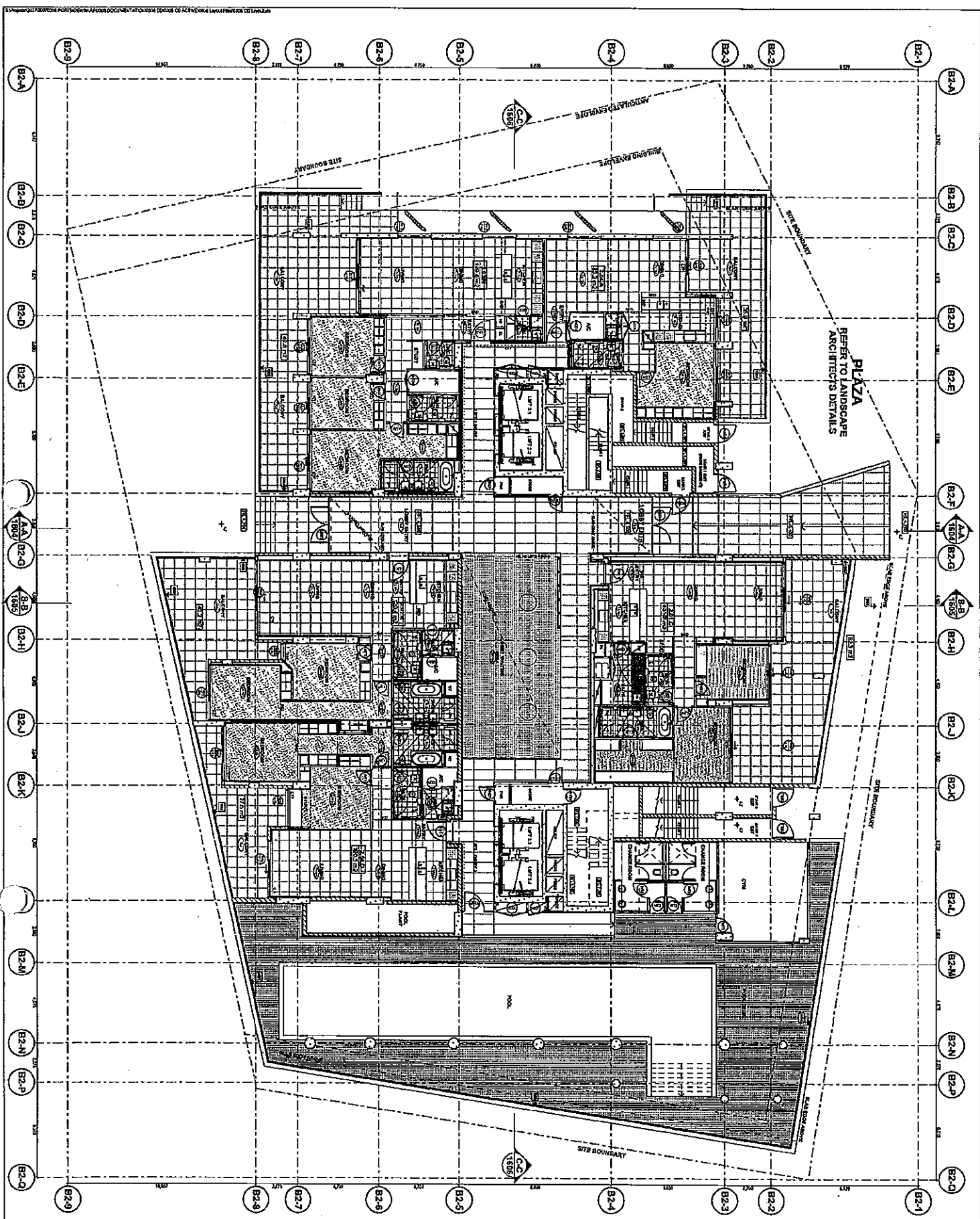
003
HAMILTON 06-128
CLIENT
MULTEX DEVELOPMENTS
(QLD) PTY LTD
DRAWING NUMBER
06-128-02
DATE
27/06/07

Max Winders & Associates Pty Ltd
Consulting Engineers & Environmental Scientists
GPO Box 3137, Brisbane Qld 4001
Phone 07 30055500
Fax 07 30055501
Email mwa@maxwinders.com.au

MW

ATTACHMENT 1

Indicative Design Drawings



Brookfield
MULTIPLEX
portside wharf
HAMILTON

apa

GENERAL ARRANGEMENT PLANS
STAGE 2 - BUILDING 2

Portside Wharf
STAGE 2 - BUILDING 2

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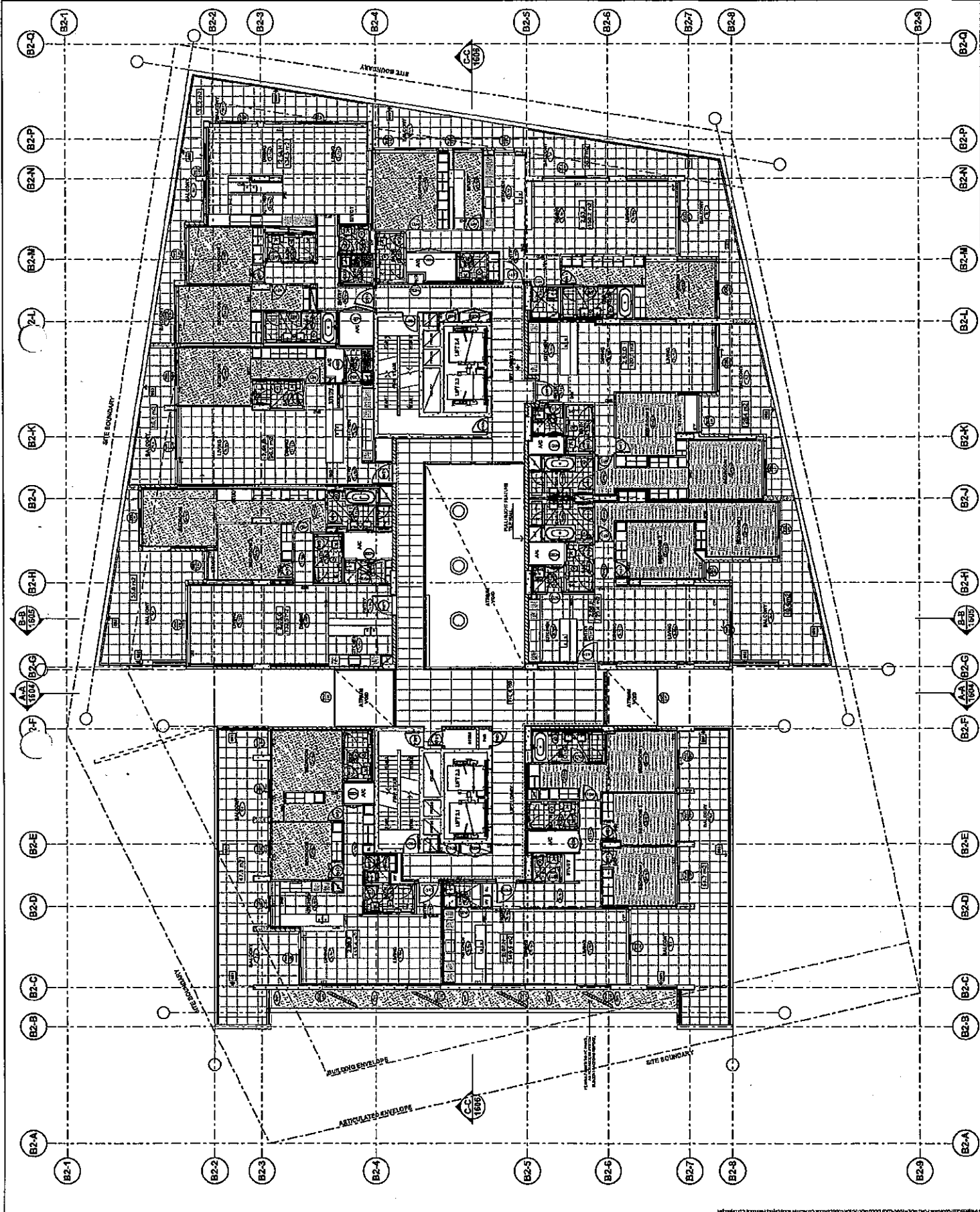
Brookfield
MULTIPLEX
portside wharf
HAMILTON

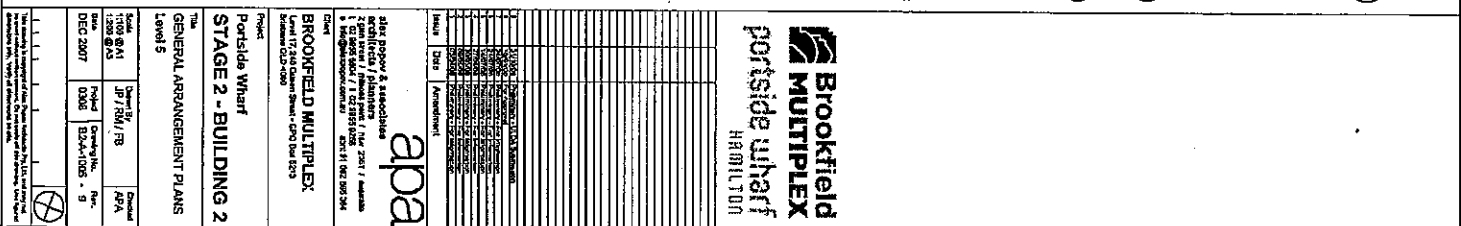
apa

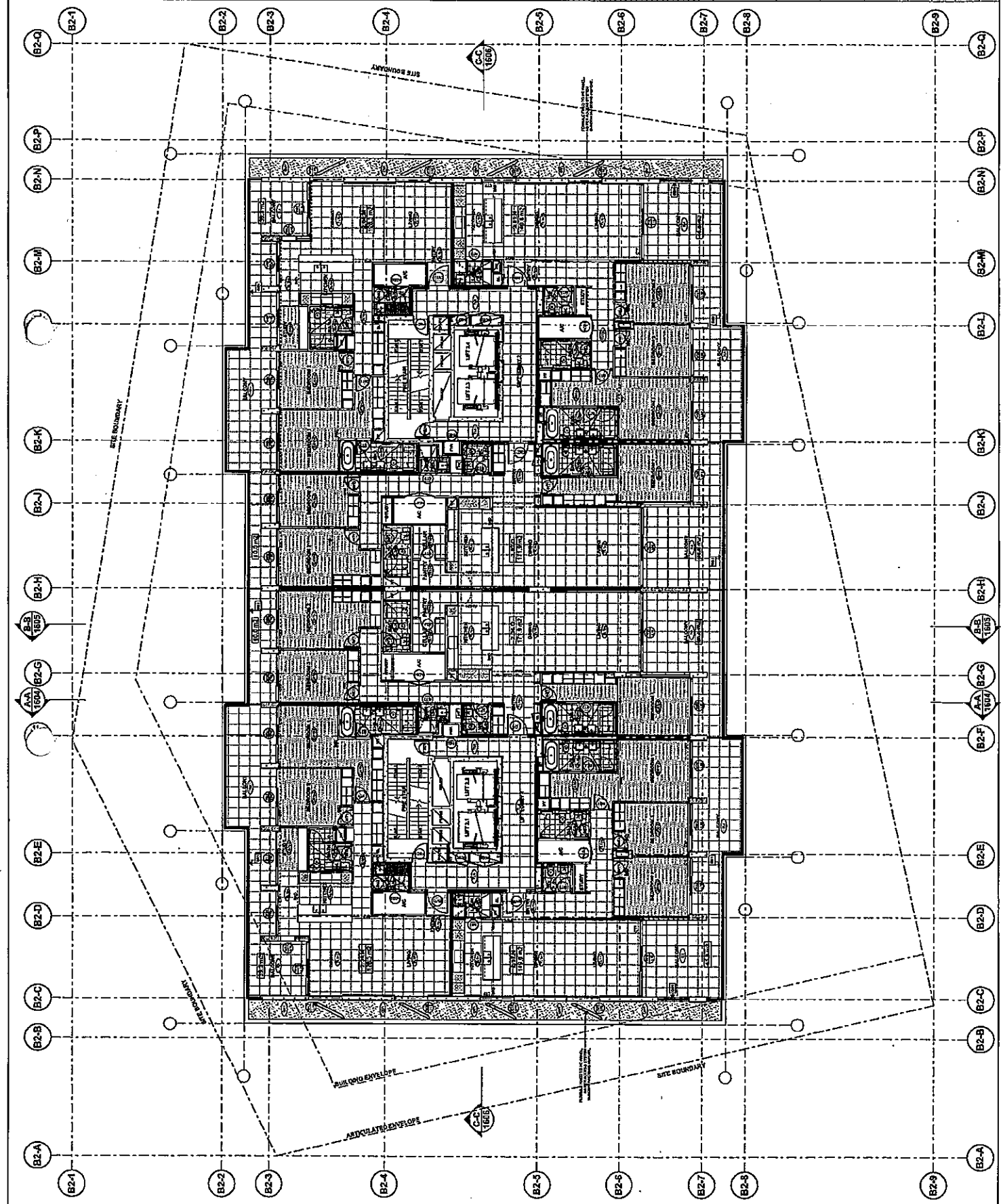
GENERAL ARRANGEMENT PLANS
STAGE 2 - BUILDING 2

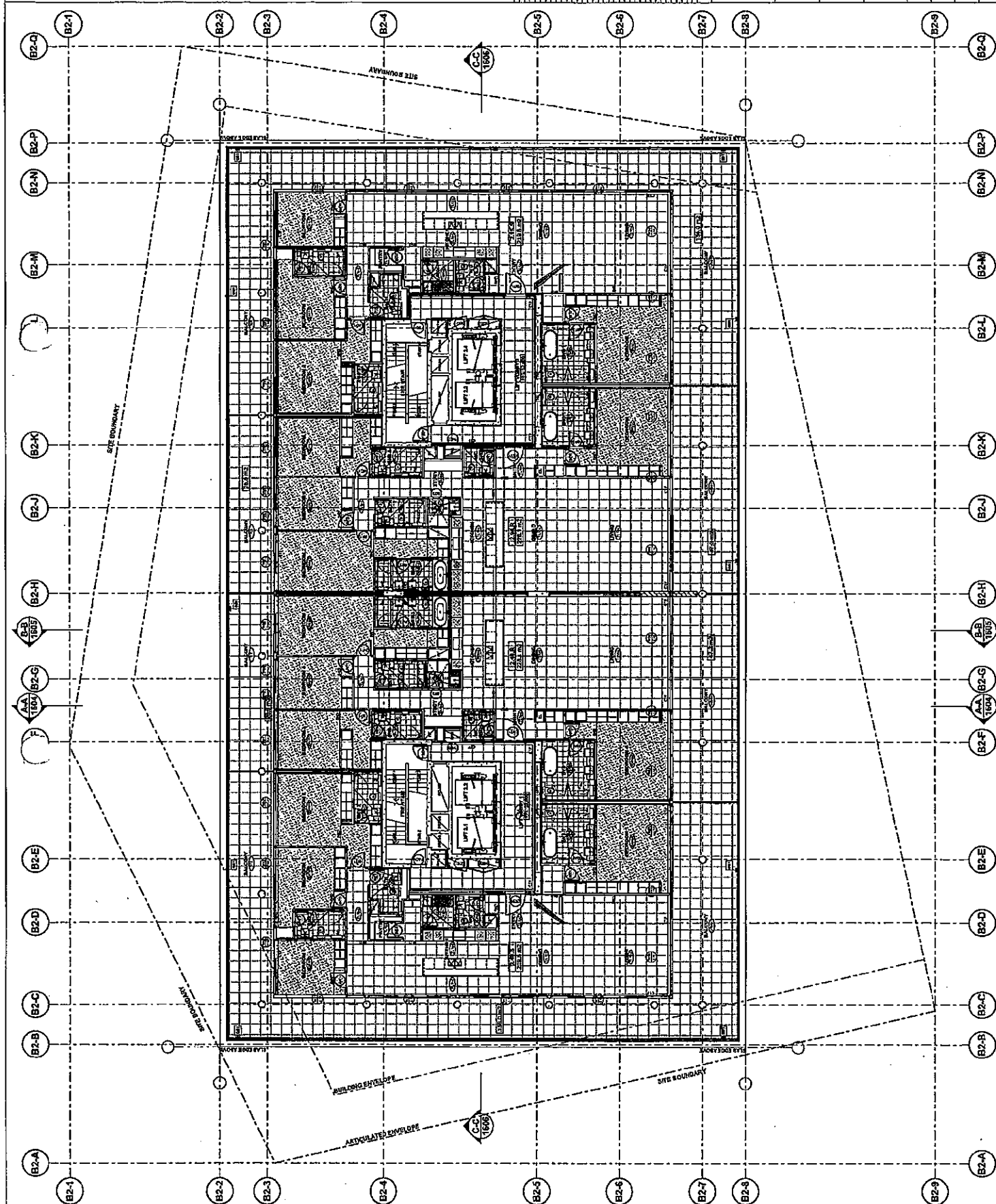
Portside Wharf
STAGE 2 - BUILDING 2

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FOR THE
FAMILY

2103

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CHART

BROOKFIELD MULTIPLEX
Level 17, 241 Queen Street - City Box 4543
Brisbane QLD 4000

Portside Wharf STAGE 2 - BUILDING 2

ELEVATIONS & SECTIONS

Scale 1200 @ A1 1/4" = 1' AS	Drawn By JP / RM / FB	Checked APR
Date DEC 2007	Project 0308	Drawing No. E2-A-1600 - 7

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ATTACHMENT 2

Peak Noise Level Summary

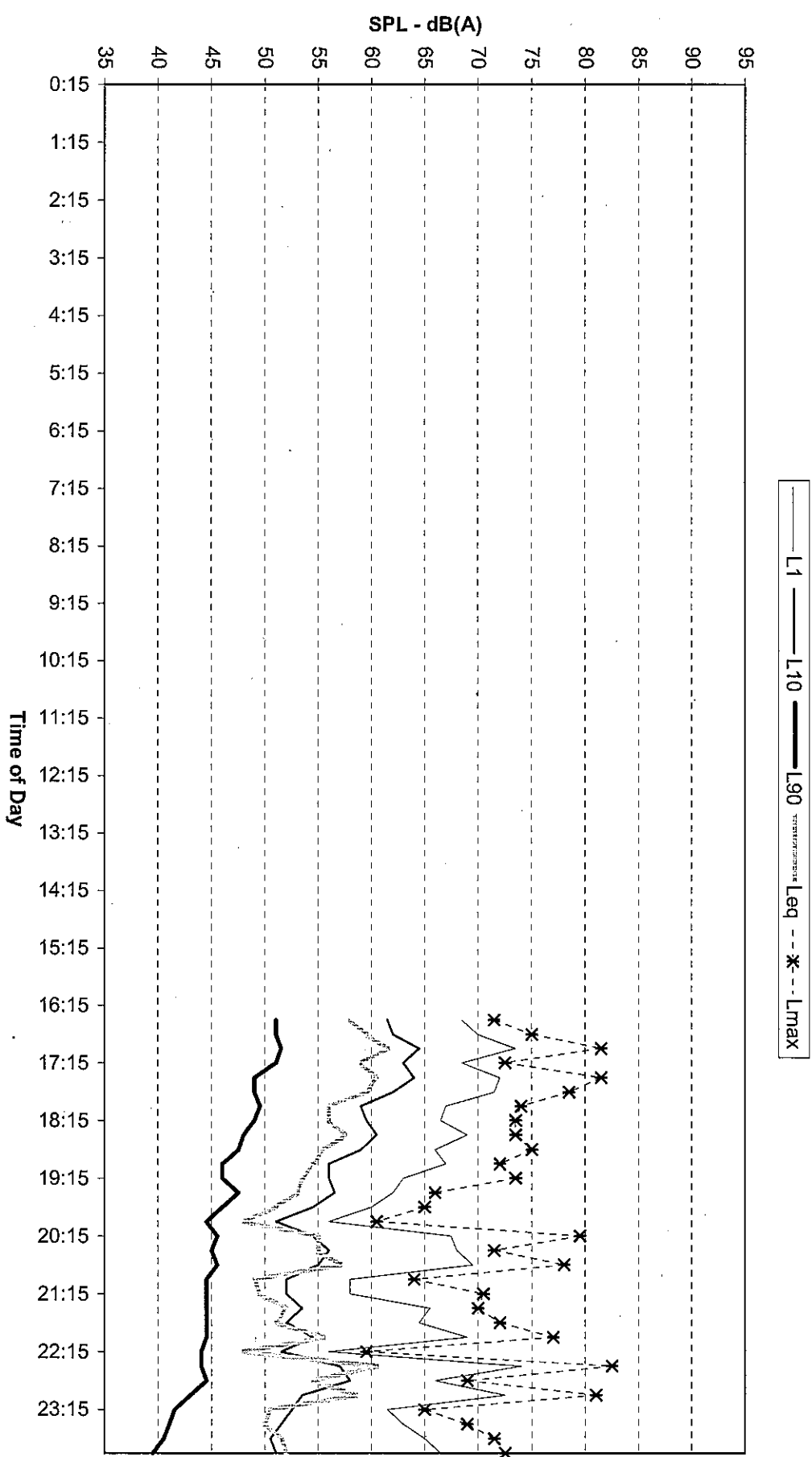
Portside Site, Hamilton - Recorded Short-Term Statistical Noise Levels

P&O Noise Levels		
Noise Source	Locn	Level
Notes		
65.3 dB(A) at 300m		
68.2 dB(A)		
63.4 dB(A) at 250m		
63.0 dB(A) at 250m		
61.1 dB(A) at 250m		
62.0 dB(A) at 225m		
63.0 dB(A) at 200m		
61.7 dB(A) at 200m		
58.4 dB(A) at 250m		
58.3 dB(A) at 250m		
58.2 dB(A) at 250m		
60.0 dB(A) at 200m		
60.0 dB(A) at 200m		
60.0 dB(A) at 200m		
60.0 dB(A) at 200m		
57.6 dB(A) at 250m		
57.2 dB(A) at 250m		
55.8 dB(A) at 250m		
55.5 dB(A) at 250m		
60.0 dB(A) at 130m		
54.2 dB(A) at 250m		
59.5 dB(A) at 130m		
54.5 dB(A) at 200m		
60.0 dB(A) at 85m		
61.0 dB(A) at 75m		
54.6 dB(A) at 150m		
61.0 dB(A) at 70m for 5 minutes		
52.5 dB(A) at 150m		
63.6 dB(A) at 30m		
52.5 dB(A) at 100m		
54.5 dB(A) at 75m		
52.5 dB(A) at 50m		
63.0 dB(A) at 50m		
Scrap Metal Loading		
63.0 dB(A) at 50m		

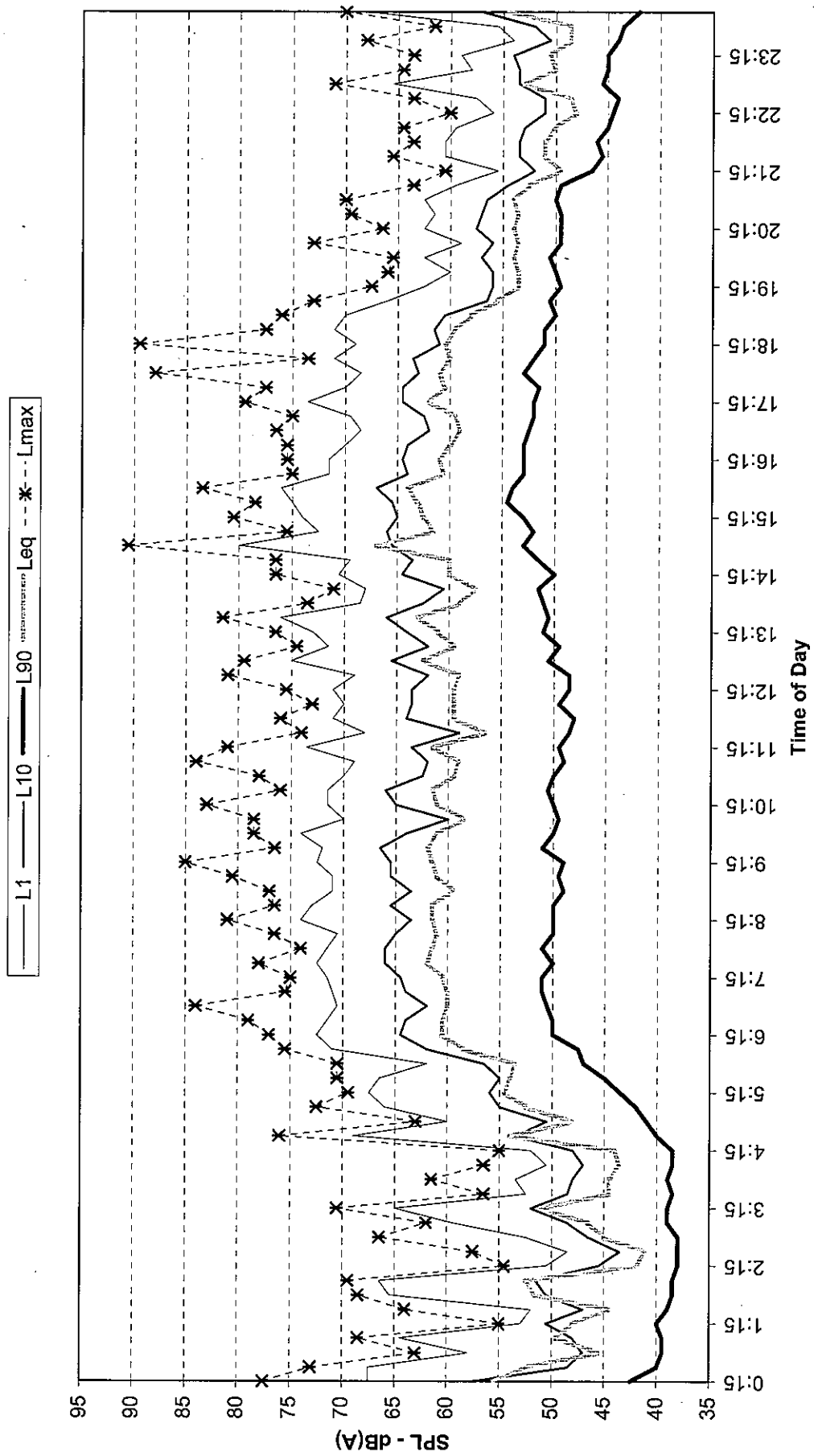
ATTACHMENT 3

Datalogger Noise Traces

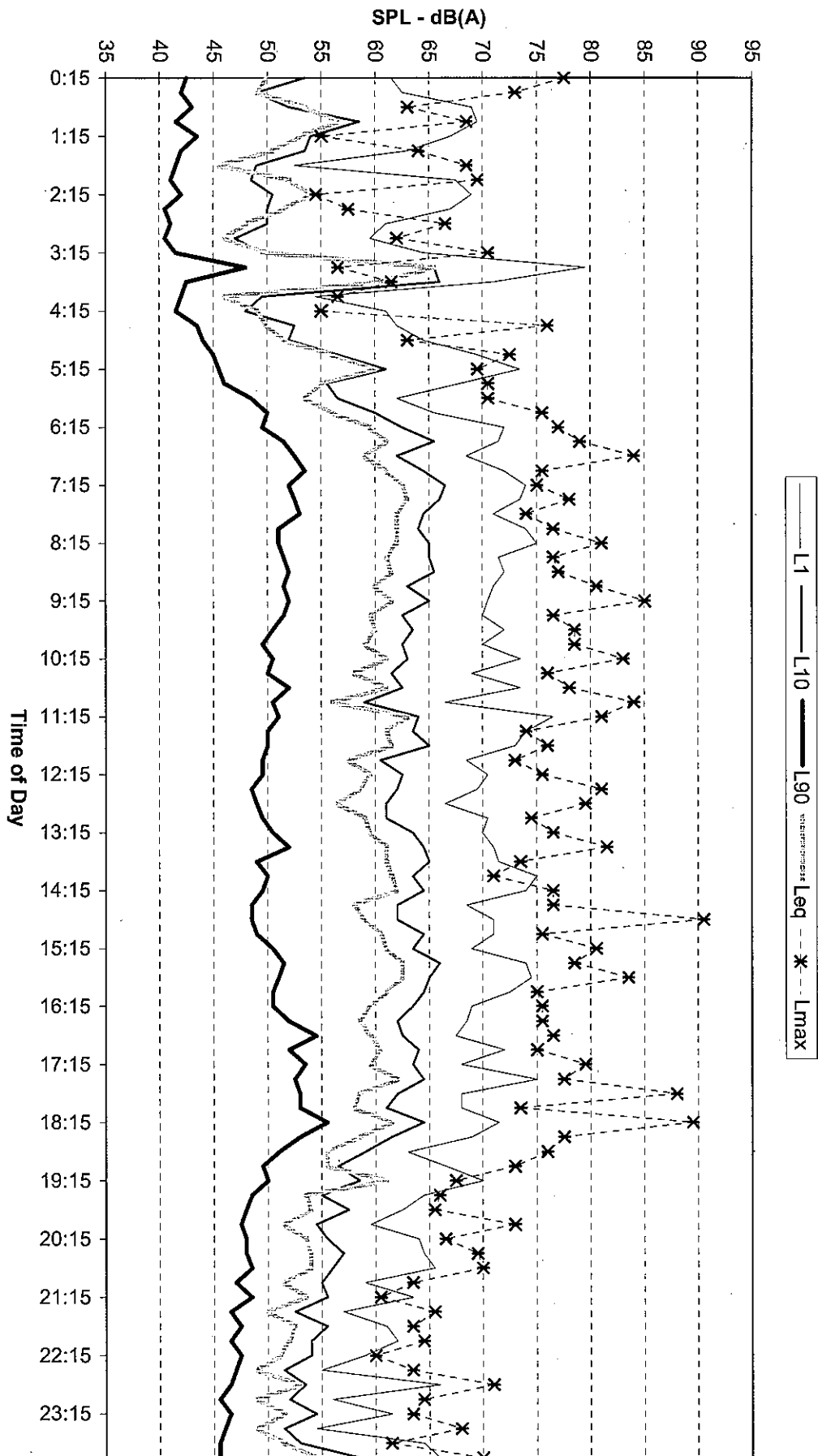
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 7 April, 2003



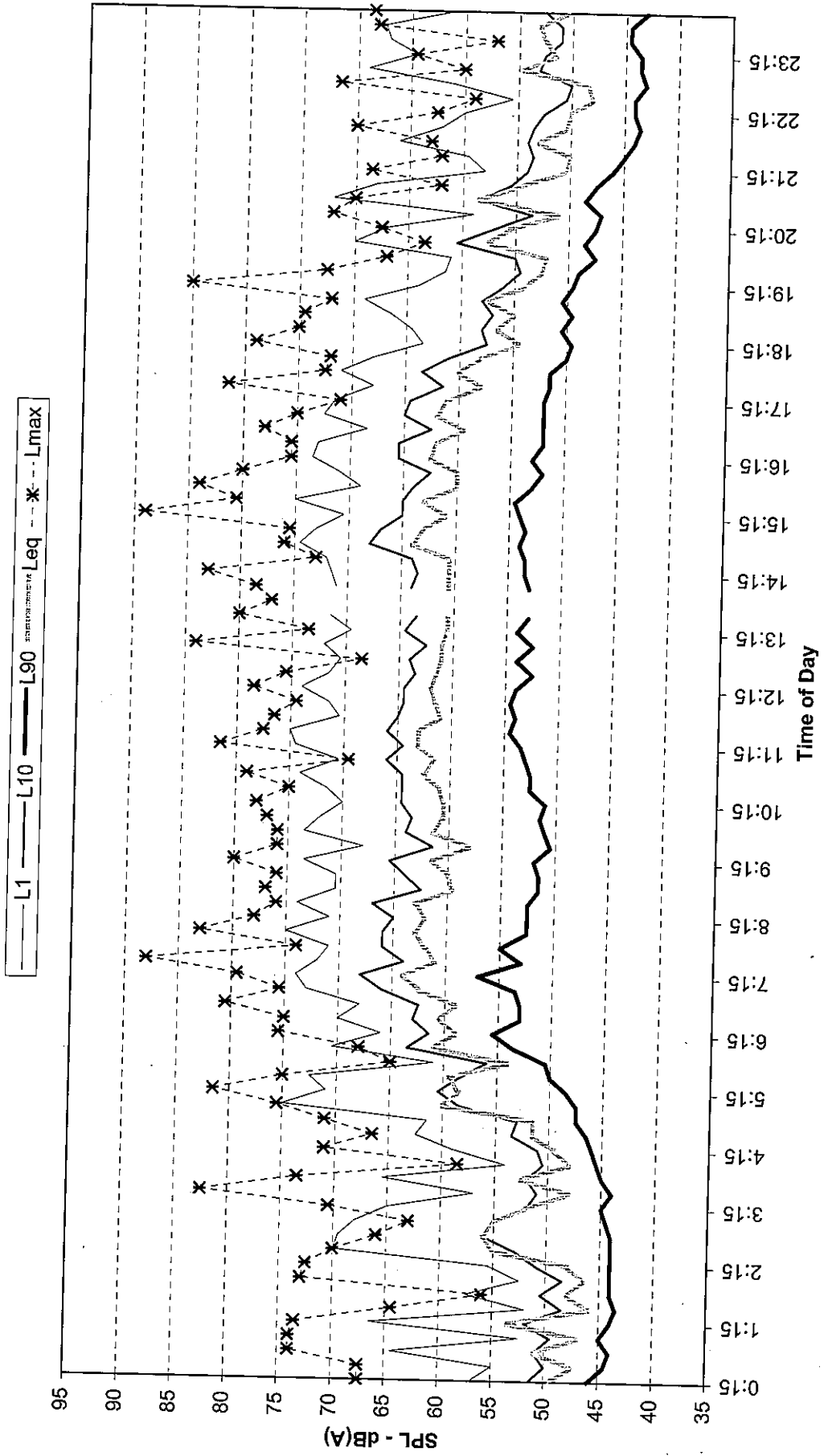
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 8 April, 2003



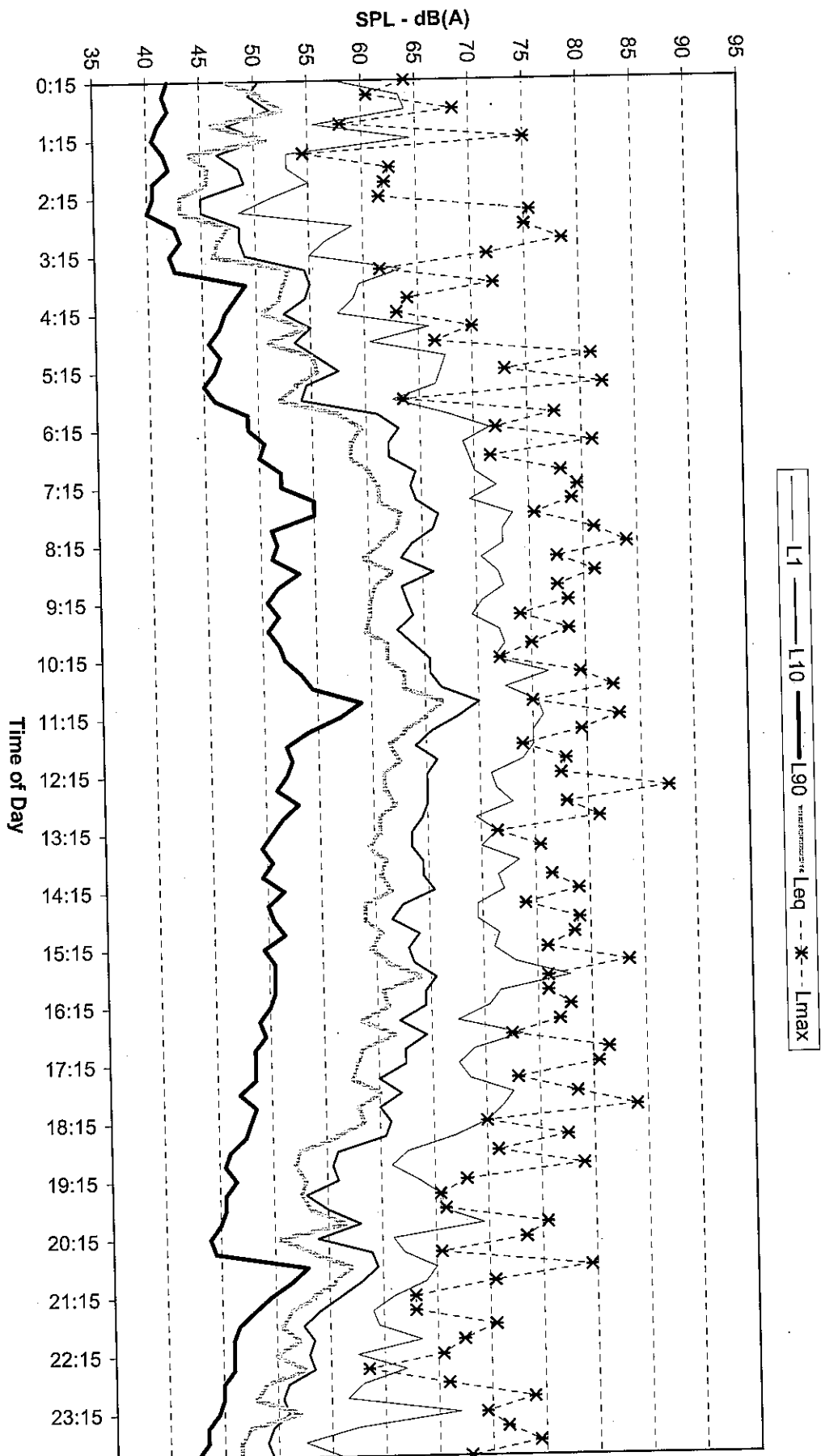
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 9 April, 2003



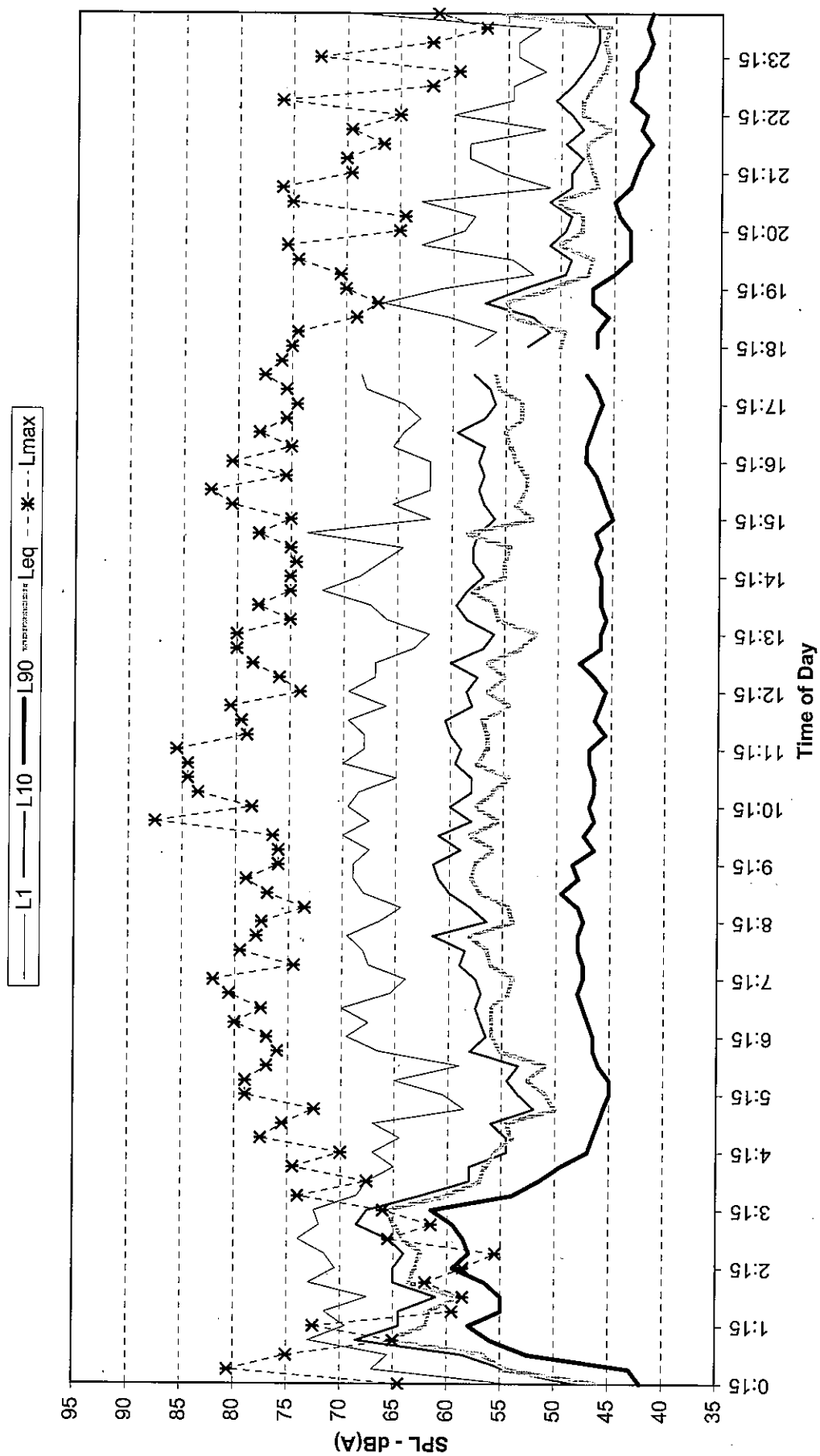
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 10 April, 2003



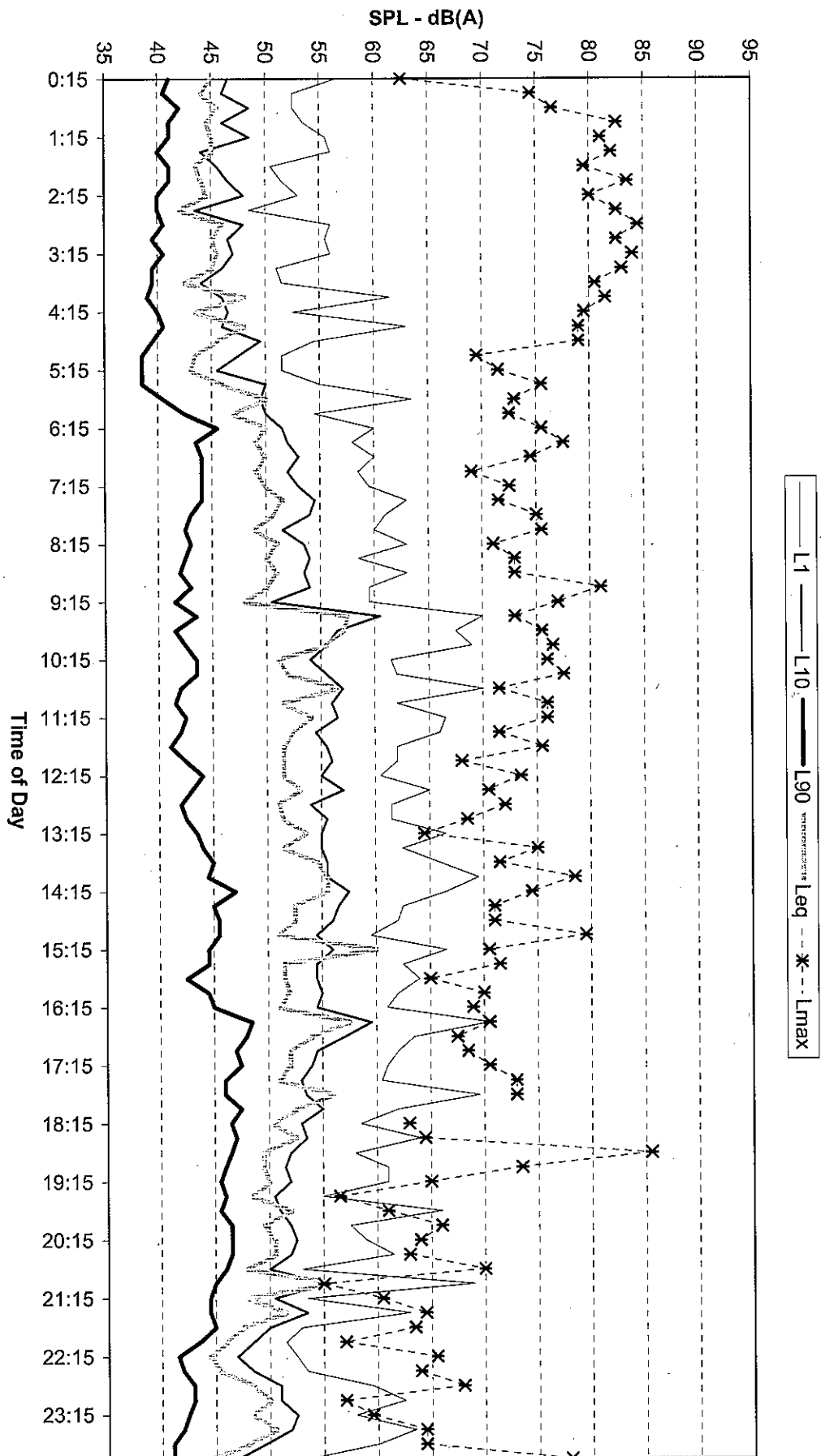
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 11 April, 2003



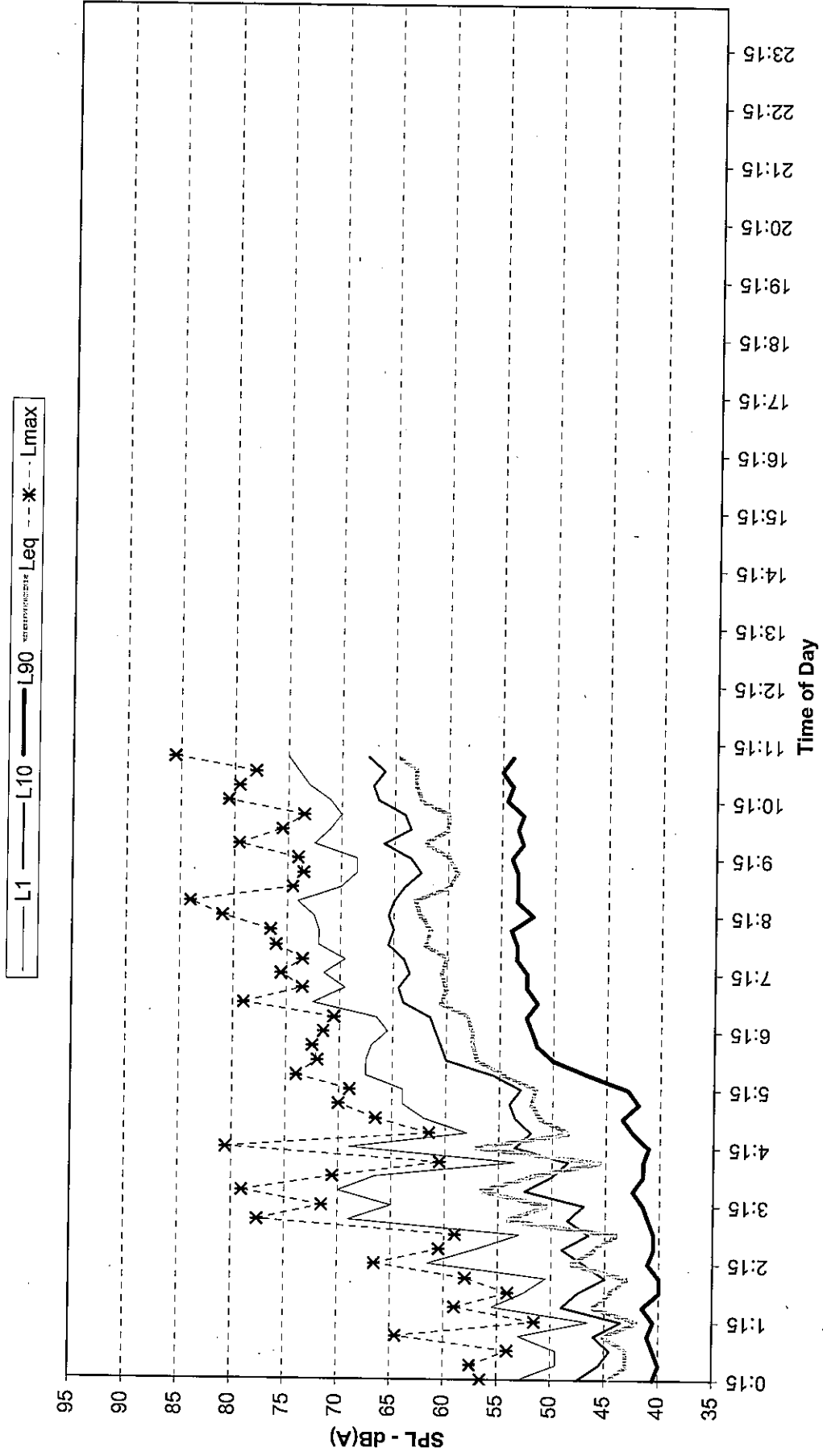
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 12 April, 2003



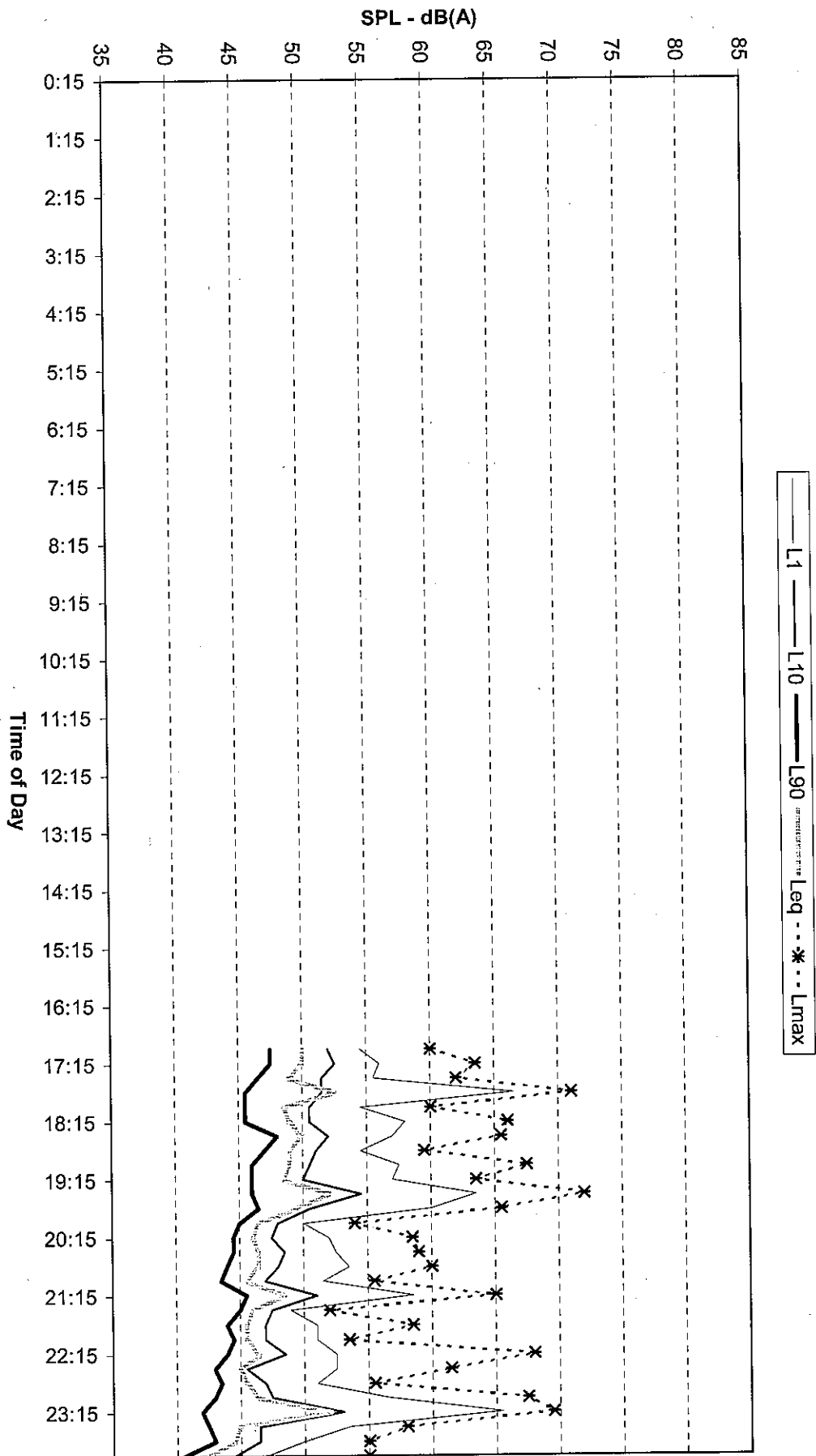
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 13 April, 2003



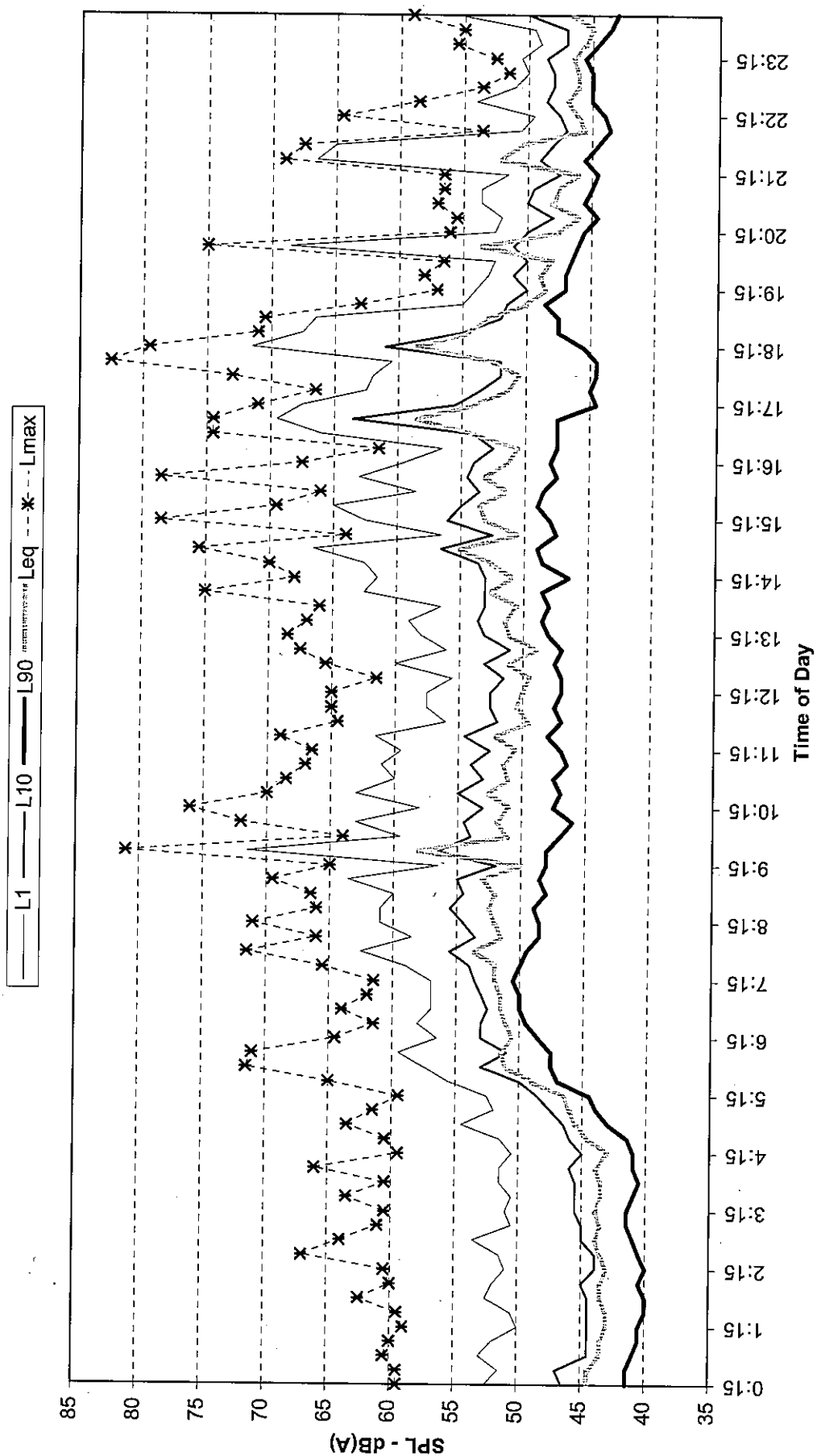
Recorded Statistical Noise Levels - Hercules St Frontage of Portside Wharf Site - 14 April, 2003



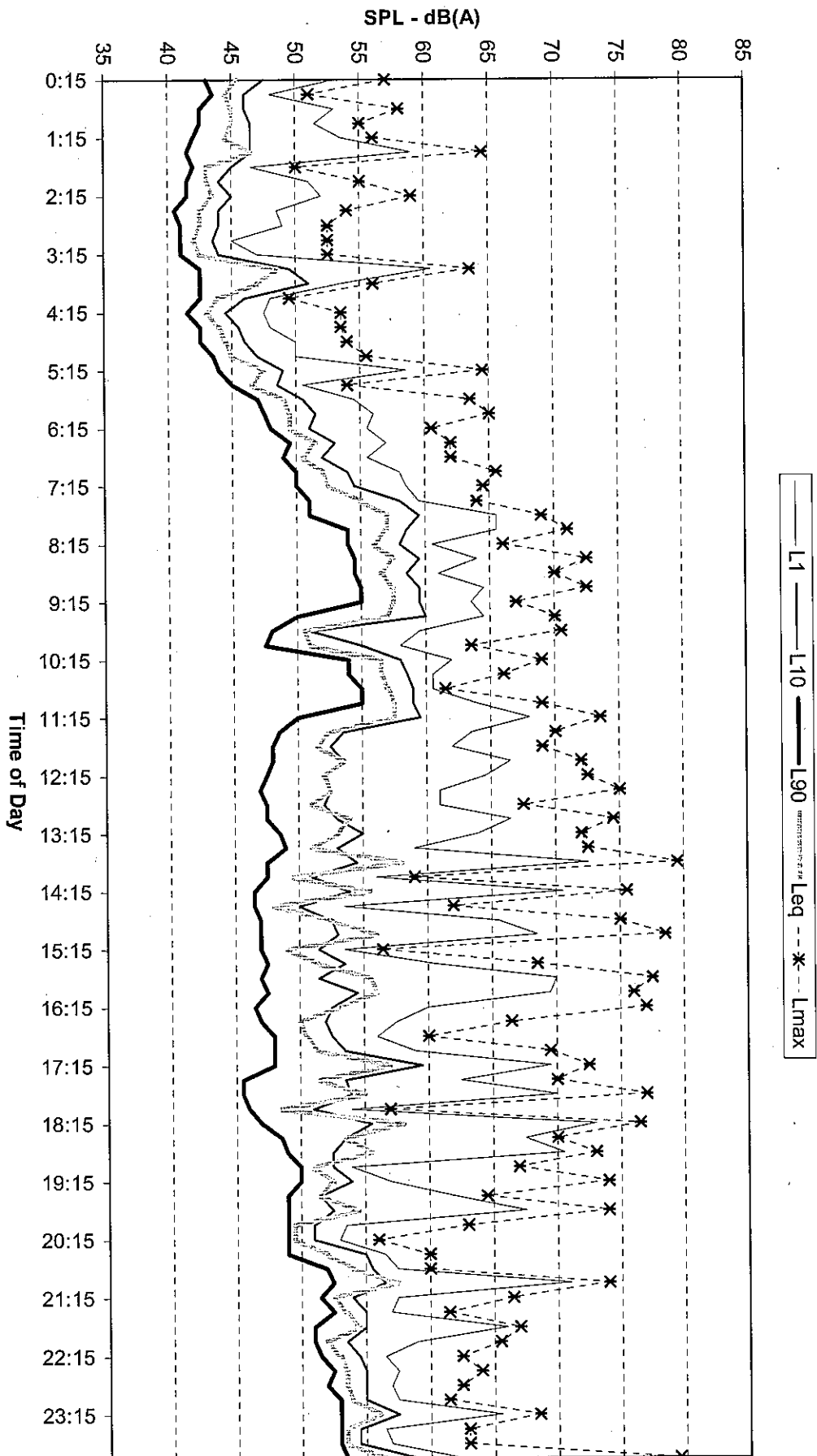
Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 7 April, 2003



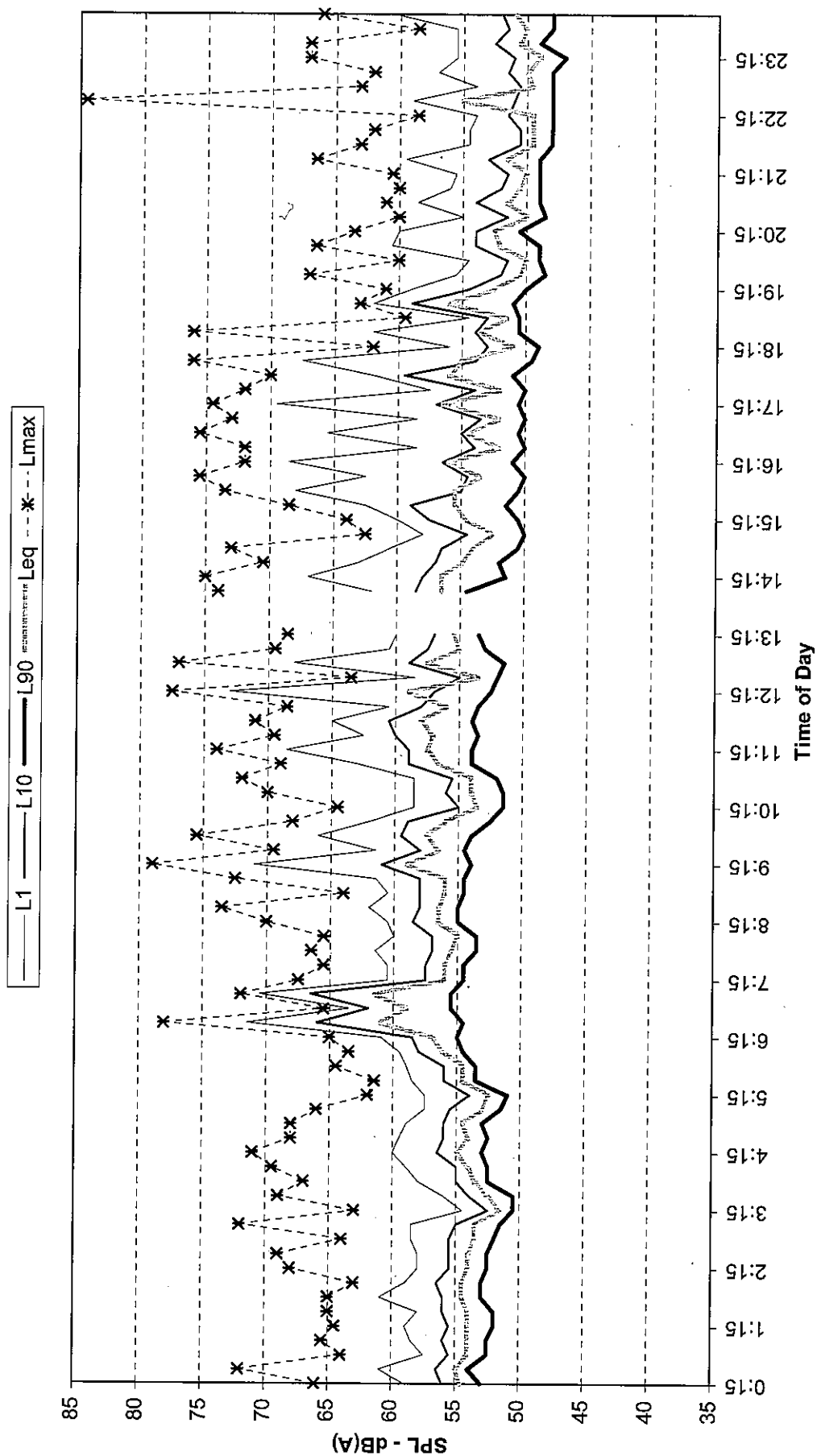
Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 8 April, 2003



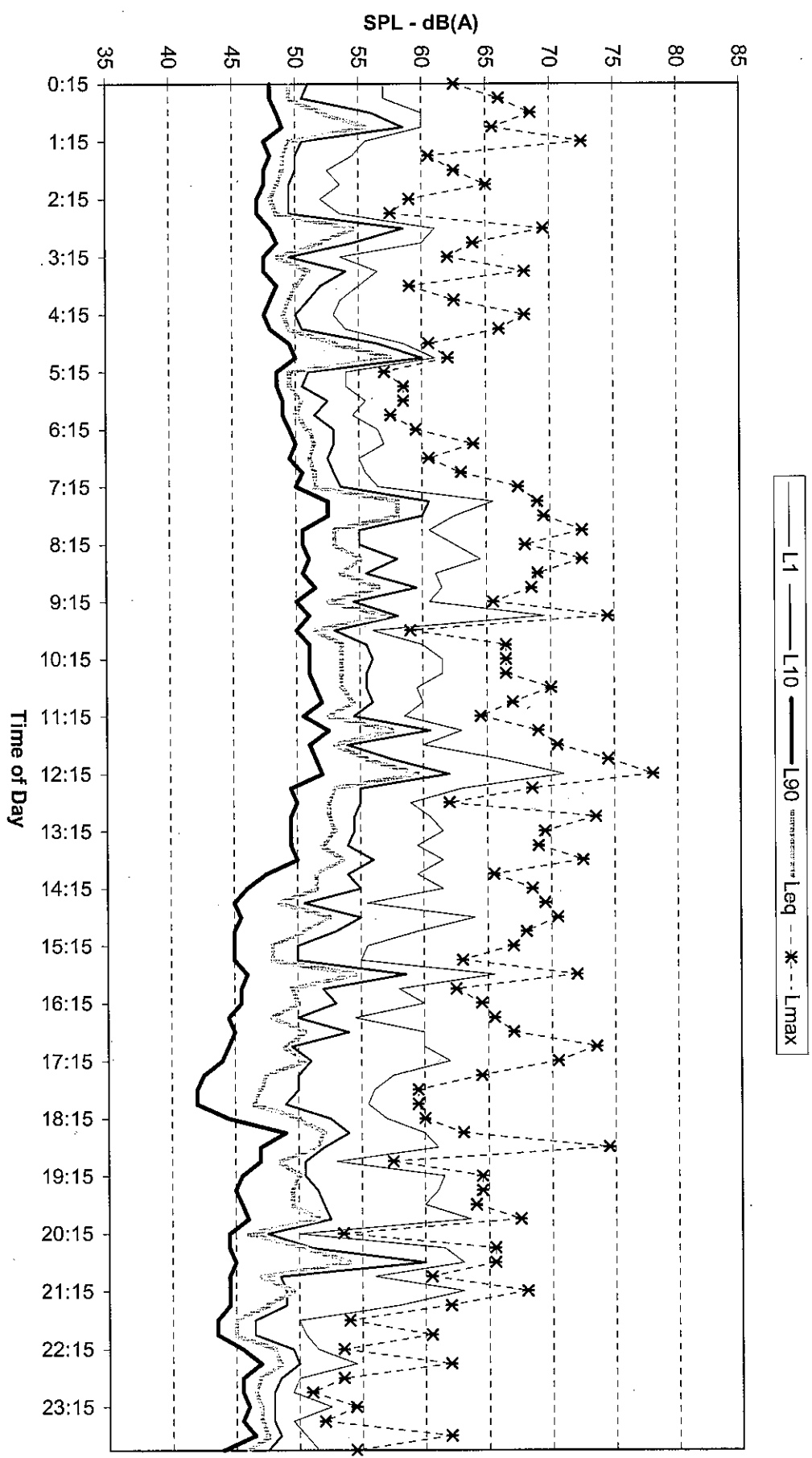
Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 9 April, 2003



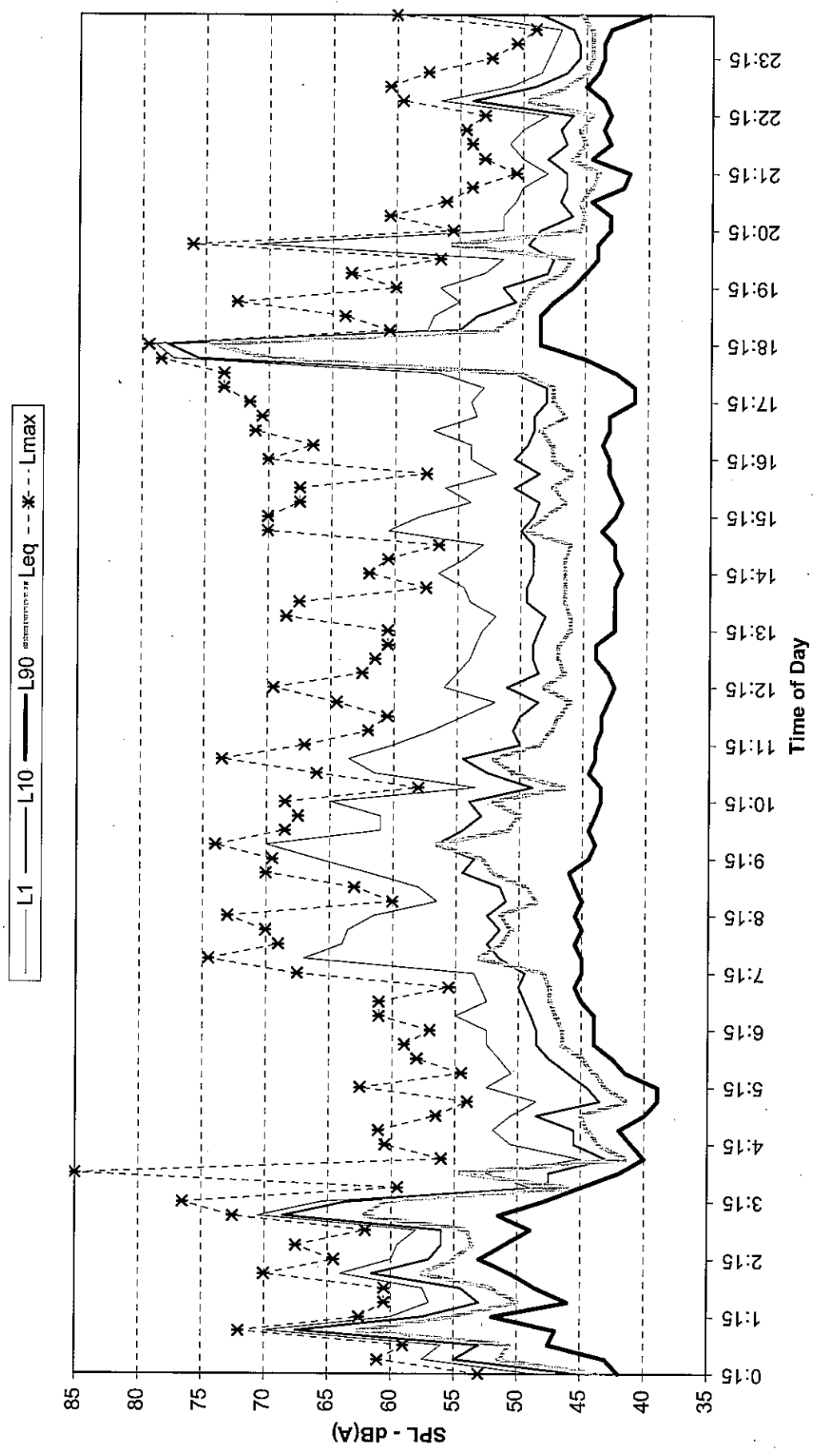
Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 10 April, 2003



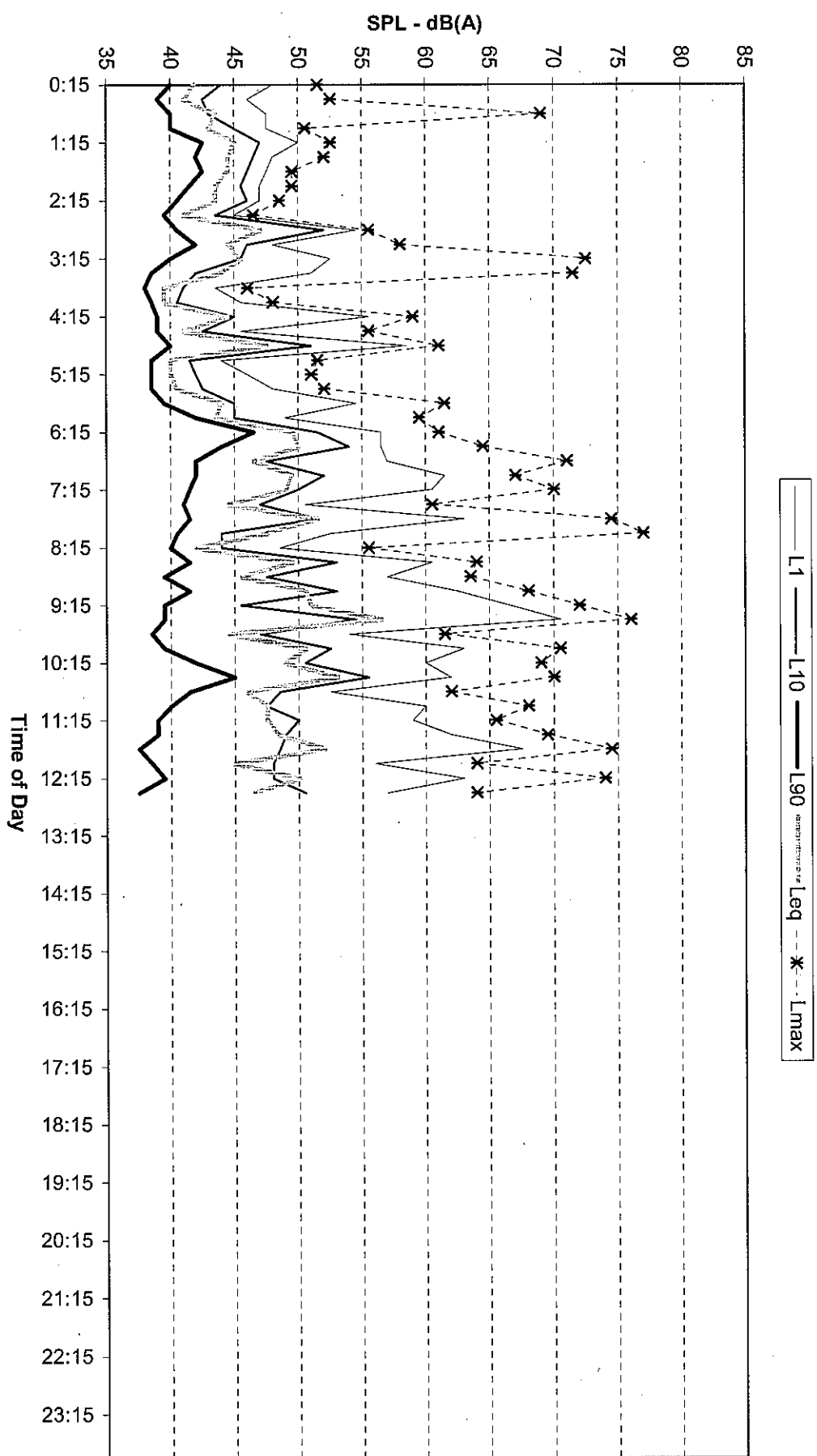
Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 11 April, 2003



Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 12 April, 2003



Recorded Statistical Noise Levels - Centre of Portside Wharf Site - 13 April, 2003



ATTACHMENT 4

SoundPLAN 6.5 Validation Model

— Road axis

— Emission line

— Surface

 Bridge

— Wall

Point receiver

Year 2003 Model Layout
Validation Point Location
Ground Level



Digitized by Google

Hamilton Portside Wharf Validation Model

Project description

Project title: Portside Wharf Development - Hamilton
Engineer: Travis Carberry
Customer: Multiplex Developments

Description:

Run description

Calculation type: Single Point Sound
Title: 2003 Validation
Run file: Portside.runx
Result number: 10
Calculation start: 1/05/2008 9:18:59 AM
Calculation end: 1/05/2008 9:19:00 AM
Calculation time: 00:00:094 [m:s:ms]
No. of points: 1
No. of calculated points: 1
Kernel version: 18/03/2008

Run parameters

Angle increment: 1.00 deg
Reflection depth: 0
Number of reflections: 3
Maximal search radius: 5000
Weighting: dB(A)

Standards:

Roads: Calculation of Road Traffic Noise (UK)
Emission according to: CRTN

Assessment: CRTN L10

Reflection of "own" facade is suppressed

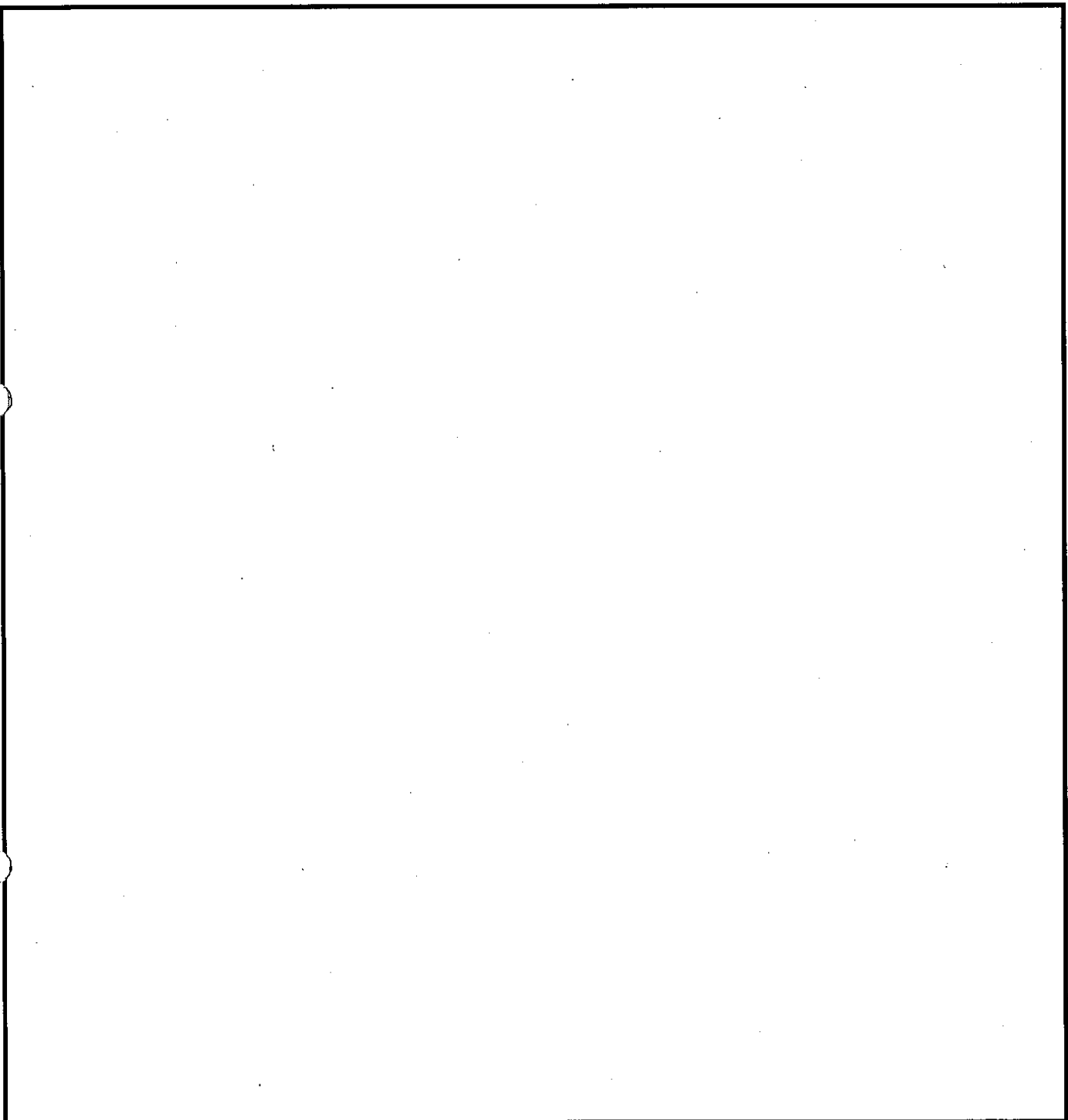
Geometry data

RDGM0001.dgm 2/08/2006 9:29:32 AM
Validation.sit 2/08/2006 4:08:42 PM
- contains:
Contours.geo 26/06/2007 9:40:44 AM
Datalogger.geo 2/08/2006 4:08:42 PM
Hercules St 2003.geo 2/08/2006 4:03:28 PM
Kingsford Smith Drv 2003.geo 2/08/2006 3:15:38 PM
Remora Rd 2003.geo 2/08/2006 4:03:28 PM

Hamilton Portside Wharf Validation Model

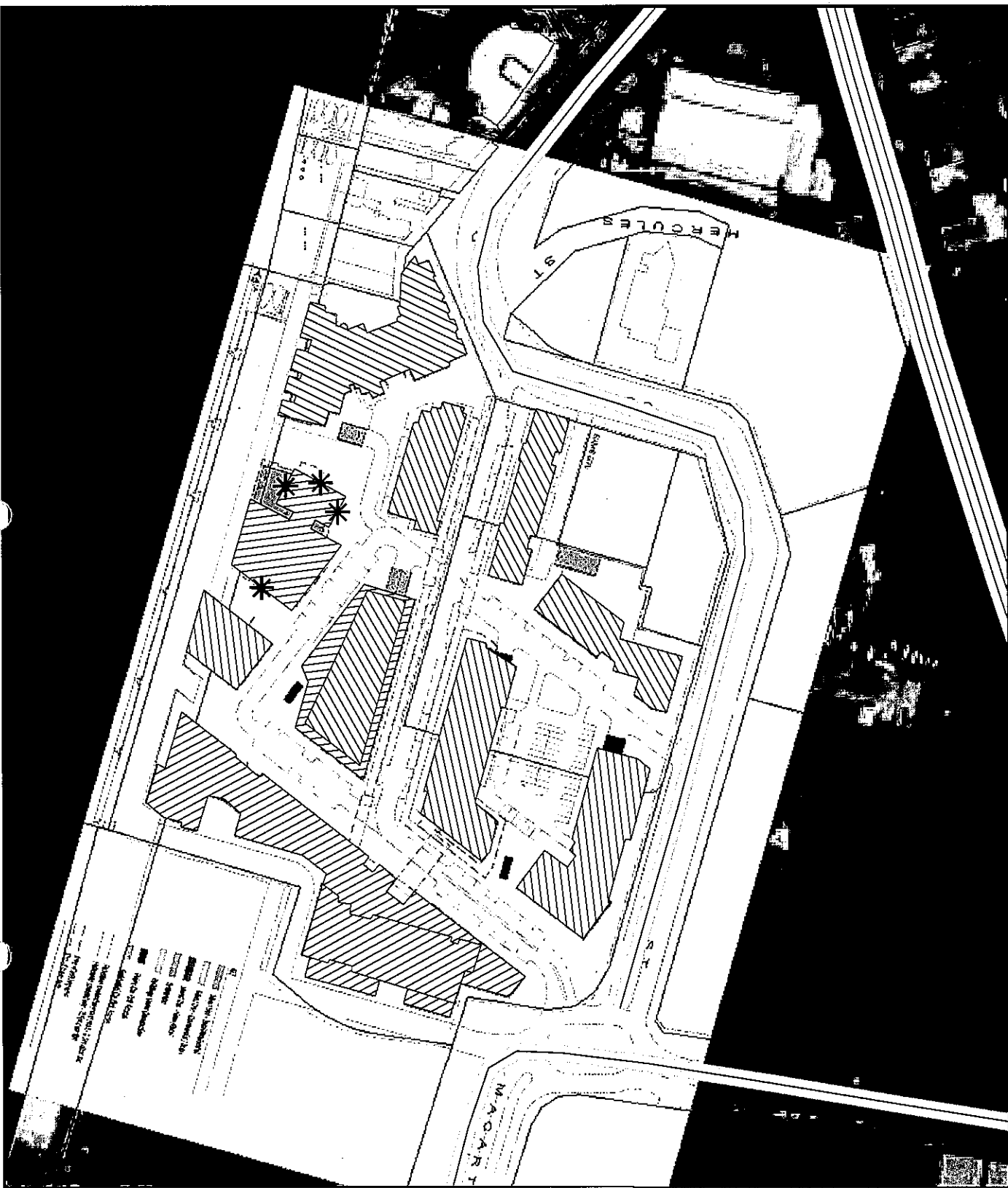
Receiver	Usage	Floor	Dir	L10(18h),lim	L10(1h),lim	dB(A)	dB(A)	L10(18h),diff	dB(A)

Datalogger	WA	EG				61.1			
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ATTACHMENT 5

Year 2018 SoundPLAN 6.5 Modelling



Signs and symbols

- Road axis
- Emission line
- Surface
- Bridge
- Wall
- Main building
- Point receiver
- Geometry bitmap

Hamilton 06-128
Portside Wharf
Year 2018 Model Layout
Building 2 DA
Receiver Point Locations
Levels 1 to 14

Portside Wharf Development - Hamilton - 2018 Receivers - B2 DA - 010508

Project description

Project title: Portside Wharf Development - Hamilton
Engineer: Travis Carberry
Customer: Multiplex Developments

Description:

Run description

Calculation type: Single Point Sound
Title: 2018 Receivers - B2 DA - 010508
Run file: Portside.runx
Result number: 300
Calculation start: 1/05/2008 9:35:06 AM
Calculation end: 1/05/2008 9:35:06 AM
Calculation time: 00:00:328 [m:s:ms]
No. of points: 4
No. of calculated points: 4
Kernel version: 18/03/2008

Run parameters

Angle increment: 1.00 deg
Reflection depth: 0
Number of reflections: 3
Maximal search radius: 5000
Weighting: dB(A)
Source side reflection precalculation enabled

Standards:

Roads: Calculation of Road Traffic Noise (UK)
Emission according to: CRTN

Assessment: CRTN L10

Reflection of "own" facade is suppressed

Geometry data

RDGM0001.dgm 2/08/2006 9:29:32 AM
B2 DA - 010508.sit 1/05/2008 9:35:02 AM
- contains:
Building 2 Receivers.geo 1/05/2008 9:34:36 AM
Building 2.geo 1/05/2008 9:34:36 AM
Building 4.geo 26/06/2007 9:40:44 AM
Contours.geo 26/06/2007 9:40:44 AM
Site Buildings.geo 24/10/2007 9:53:40 AM
Kingsford Smith Drv 2018.geo 1/05/2008 9:14:38 AM
Remora Rd 2018.geo 1/05/2008 9:14:38 AM
Hercules St 2018.geo 1/05/2008 9:16:10 AM

Portside Wharf Development - Hamilton Assessed receiver levels - 2018 Receivers - B2 DA - 010508

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Name	Usage	Floor	Dir	L10(18h),lm	L10(1h),lm	L10(1h),dB(A)	L10(18h),dB(A)	L10(1h),dB(A)
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Building 2 East	WA	1. Floor	SE			37.0	37.0	37.0
Building 2 East	WA	2. Floor	SE			37.2	37.5	37.2
Building 2 East	WA	3. Floor	SE			37.5	38.1	37.5
Building 2 East	WA	4. Floor	SE			39.5	42.4	39.5
Building 2 East	WA	5. Floor	SE			42.4	44.2	42.4
Building 2 East	WA	7. Floor	SE			44.2	44.5	44.2
Building 2 East	WA	8. Floor	SE			44.5	44.7	44.5
Building 2 East	WA	9. Floor	SE			44.7	44.8	44.7
Building 2 East	WA	10. Floor	SE			44.8	45.1	44.8
Building 2 East	WA	11. Floor	SE			45.1	45.5	45.1
Building 2 East	WA	12. Floor	SE			45.5	46.3	45.5
Building 2 East	WA	13. Floor	SE			46.3	48.5	46.3
Building 2 East	WA	14. Floor	SE					48.5

Building 2 North	WA	1. Floor	NE			52.2	52.8	52.2
Building 2 North	WA	2. Floor	NE			53.3	53.8	53.3
Building 2 North	WA	3. Floor	NE			53.8	54.3	53.8
Building 2 North	WA	5. Floor	NE			55.0	55.7	55.0
Building 2 North	WA	6. Floor	NE			55.7	56.9	55.7
Building 2 North	WA	8. Floor	NE			56.9	58.6	56.9
Building 2 North	WA	9. Floor	NE			58.6	61.2	58.6
Building 2 North	WA	10. Floor	NE			61.2	63.1	61.2
Building 2 North	WA	11. Floor	NE			63.1	64.0	63.1
Building 2 North	WA	12. Floor	NE			64.0	64.3	64.0
Building 2 North	WA	13. Floor	NE			64.3	64.7	64.3
Building 2 North	WA	14. Floor	NE					64.7

Building 2 South	WA	1. Floor	SW			37.3	37.3	37.3
Building 2 South	WA	2. Floor	SW			37.3	37.4	37.3
Building 2 South	WA	3. Floor	SW			37.4	37.5	37.4
Building 2 South	WA	4. Floor	SW			37.5	37.8	37.5
Building 2 South	WA	5. Floor	SW			37.8	38.2	37.8
Building 2 South	WA	6. Floor	SW			38.2	39.0	38.2
Building 2 South	WA	7. Floor	SW			39.0	40.1	39.0
Building 2 South	WA	8. Floor	SW			40.1	41.9	40.1
Building 2 South	WA	9. Floor	SW			41.9	44.0	41.9
Building 2 South	WA	10. Floor	SW			44.0	47.4	44.0
Building 2 South	WA	11. Floor	SW			47.4	51.5	47.4
Building 2 South	WA	12. Floor	SW			51.5	52.5	51.5
Building 2 South	WA	13. Floor	SW			52.5	53.5	52.5
Building 2 South	WA	14. Floor	SW					53.5

Building 2 West	WA	1. Floor	NW			50.1	50.7	50.1
Building 2 West	WA	2. Floor	NW			50.7	51.2	50.7
Building 2 West	WA	3. Floor	NW			51.2	51.8	51.2
Building 2 West	WA	4. Floor	NW			51.8	52.4	51.8
Building 2 West	WA	5. Floor	NW			52.4	53.0	52.4
Building 2 West	WA	6. Floor	NW			53.0	53.8	53.0
Building 2 West	WA	7. Floor	NW			53.8	55.0	53.8
Building 2 West	WA	8. Floor	NW			55.0	56.6	55.0
Building 2 West	WA	9. Floor	NW			56.6	59.4	56.6
Building 2 West	WA	10. Floor	NW			59.4	62.0	59.4
Building 2 West	WA	11. Floor	NW			62.0	63.2	62.0
Building 2 West	WA	12. Floor	NW			63.2	63.8	63.2
Building 2 West	WA	13. Floor	NW			63.8	64.6	63.8
Building 2 West	WA	14. Floor	NW					64.6

Max Winders and Associates Consulting Engineers and Environmental Scientists