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Opal St Clair
100 Explorers Way,
Saint Clair

Noise Impact Assessment

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Table of Contents

1 Introduction

Pulse White Noise Acoustics has been engaged to undertake the Noise Impact Assessment of the proposed Opal St Clair aged care facility located at 100 Explorers Way, Saint Clair.

The proposed project includes the following:

1. Ground floor including aged care rooms and associated common areas and administration areas.
2. First floor including aged care rooms and common areas.

This assessment includes the acoustic investigation into the potential for noise impacts from the operation of the completed project as well as potential noise impacts from existing noise sources within the vicinity of the site which predominantly includes traffic noise from the Western Motorway which is located to the north of the site.

The proposed development is detailed in the figure below.

Figure 1 – Proposed Development

1.1 Development Description

The Opal St Clair residential aged care facility is located at 100 Explorers way Saint Clair. The site is located to the south of the Western Motorway and includes existing residential receivers neighbouring the site to the east and west.

The site location is detailed in Figure 1 below.

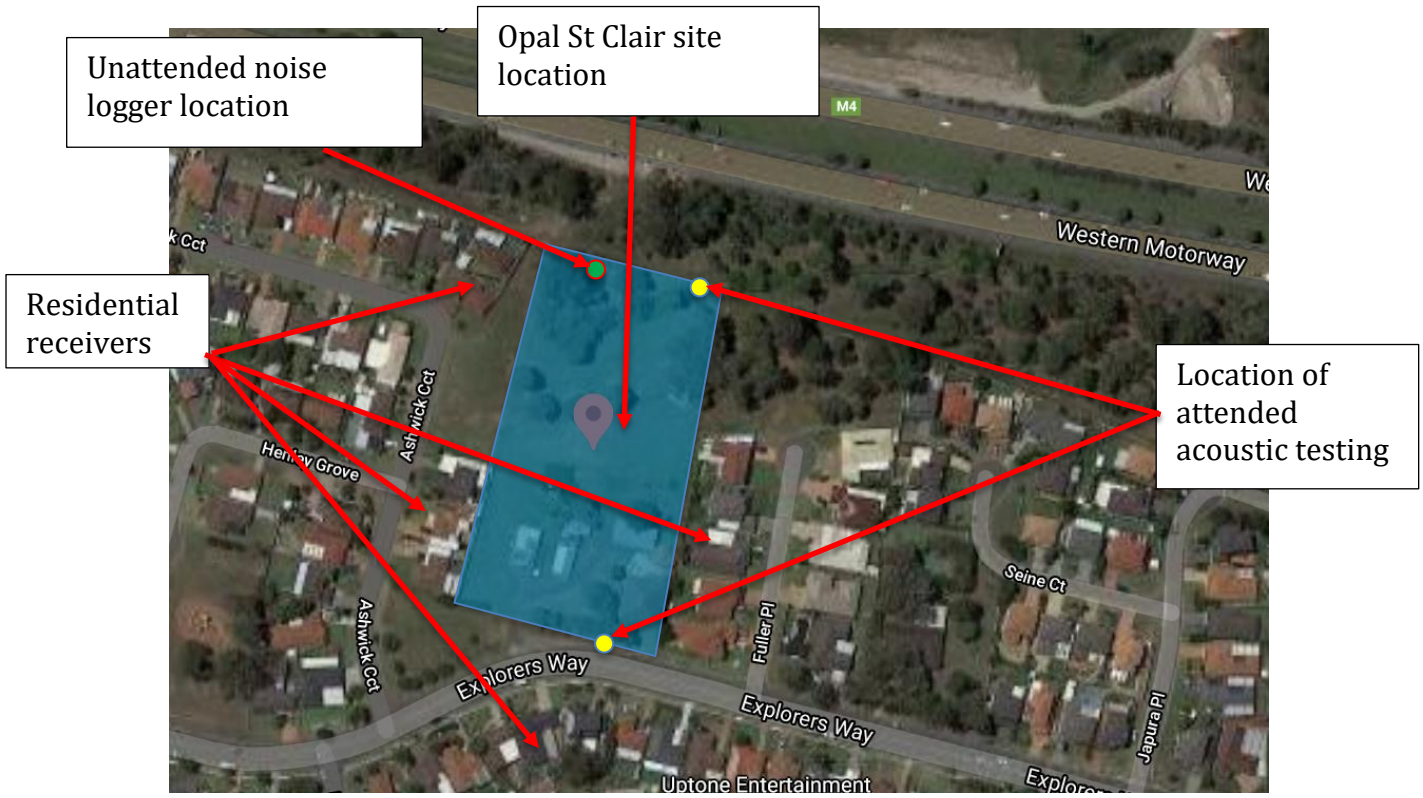


Figure 2 – Opal St Clair Site Location

2 Proposed Development

The proposed project is located at 100 Explorers Way, Saint Clair. The proposed development will include the following:

1. Ground floor including aged care rooms and associated common areas and administration areas.
2. First floor including aged care rooms and common areas.

The site is located within the Inner Penrith City Council local government area.

The site is located to the south of the Western Motorway which is defined as a busy road carrying over 40,000 Annual Average Daily Traffic (AADT) number as defined in Map 10 of the RTA's *Traffic Volume Maps for Noise Assessment for Buildings on Land Adjacent to Busy Roads*.

See the Figure below which includes the site location included on Map 10 as detailed above.

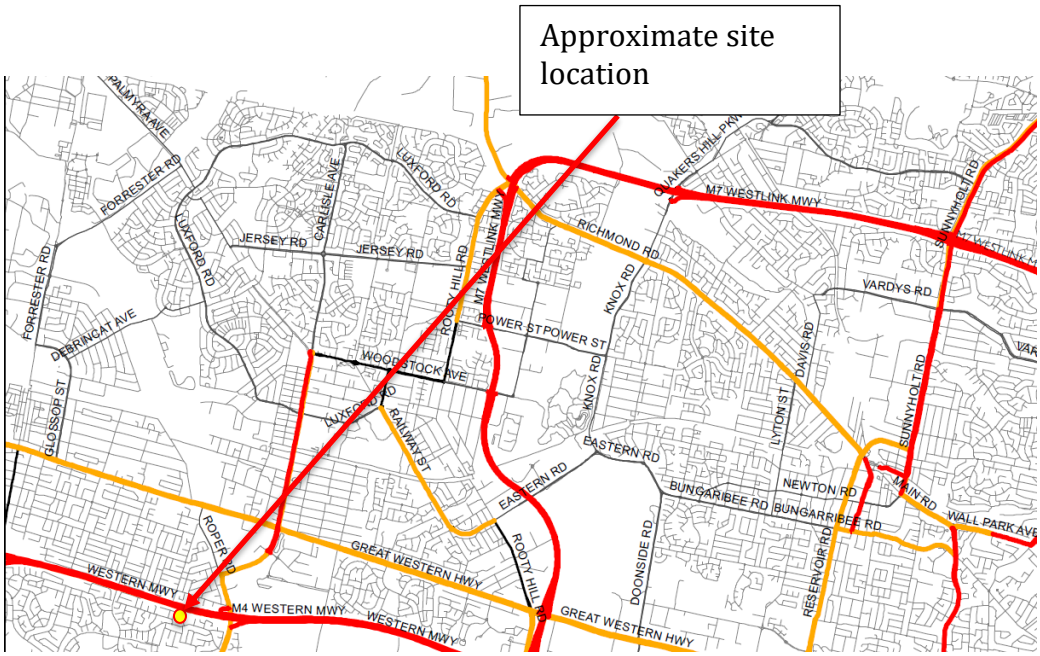


Figure 3 – Site Location of Map 10 of the RTA's *Traffic Volume Maps for Noise Assessment for Buildings on Land Adjacent to Busy Roads*

3 Existing Acoustic Environment

The Opal St Clair aged care facility site is located to the southern side of the Western Motorway within an area which includes residential dwellings. The site is located within an area which would be classified as a *Urban* area with existing noise from through traffic. The exiting noise levels at the site are predominantly as a result from traffic noise within the vicinity of the site from the Western Motorway (which includes high traffic flow volumes including use by heavy vehicles). Existing receivers within the vicinity of the site include residential receivers as detailed in Figure 2 above.

As part of this assessment an acoustic survey of the existing acoustic environment at the site was undertaken. The survey included attended noise level measurements at the site, during various times of the day on the 26th November, 2020 as well as long term unattended noise logging which was undertaken between the 19th and the 26th of November, 2020. During the testing periods there was no inclement weather periods.

Noise logging was undertaken using a Rion NL-42EX type noise monitor with serial number 00410151 and calibration with calibration number C19279. The noise logger was located to the rear of the site as detailed in Figure 1 above to obtain representative background noise levels. The logger was positioned such that it did not include façade corrects.

Attended noise level testing was conducted using a Bruel and Kjaer 2236C type meter. The meter was calibrated before and after testing and no significant drift was recorded.

3.1 Noise Survey Results

The attended and unattended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ($L_{90\,(t)}$) as well as the impact from traffic movements ($Leq_{(t)}$). The results of the acoustic survey are detailed in the tables below which have been used as the basis of this assessment.

Table 1 – Results of the Attended Noise Survey at the Site

Measurement Location	Time of Measurement	$L_{Aeq,\ 15min}$ dB(A)	$L_{A90,\ 15min}$ dB(A)	Comments
Attended noise measurement location, Northern Boundary	9.05am to 9.20am	69	59	Noise level at the site dominated by vehicle movements on the Western Motorway
Attended noise measurement location, Explorers Way	9.25am to 9.40am	54	51	

Table 2 – Results of the Noise Logging at the Site

Measurement Location	Time of Measurement	Maximum Repeatable $L_{Aeq,\ 15min}$ dB(A)	Representable Background noise Level (RBL) $L_{A90,\ 15min}$ dB(A)
Noise logger location, see figure 1 above	Day	68	60
	Evening	63	56
	Night	56	40

4 Internal Noise Level Criteria

Internal noise levels within the future residential occupancies have been based on the relevant noise levels of the following standards:

1. The Australian Standard AS2107:2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors.*
2. The Department of Planning *Development Near Rail Corridor and Busy Roads – Interim Guideline* (DNRCBR).

The required internal noise levels detailed within the standards are included in the sections below.

4.1 Australian Standard AS2107:2016

The Australian Standard AS2107:2016 *Acoustics - Recommended design sound levels and reverberation times for building interiors* recommended levels for various areas of a project. The recommended noise levels for residential dwellings near major roadways detailed within AS2107:2016 are detailed in the table below.

Table 3 – Recommended Internal Noise Levels AS2107:2016

Type of Occupancy/Activity	Design sound level maximum ($L_{Aeq,t}$)
Common areas (e.g. foyer, lift lobby)	50
Residential - Living areas	45
Residential - Sleeping areas (night time)	40
Toilets	55
Small retail areas	50
Note: The relevant time period (t) for all areas detailed is 15 minutes.	

4.2 Department of Planning Development Near Rail Corridor and Busy Roads – Interim Guideline

The DNRCBR includes the following requirements for the relevant design of internal areas of residential developments near busy roads, including the following:

> ***For Clauses 87 (Rail) and 102 (Road):***
> *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LA_{eq} levels are not exceeded:*
> - *in any bedroom in the building: 35dB(A) at any time 10pm–7am*
> - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.*

4.3 Project Internal Noise Level Criteria

The required levels for various areas of the project are detailed in the following table.

Table 4 - Design Recommended Internal Noise Levels

Type of Occupancy	Type of Occupancy/Activity	Design Internal Noise Level
Aged Care Facility	Common areas (e.g. foyer, lift lobby)	55 $L_{Aeq\ 24\ hour}$
	Residential (Aged Care Facility) - Living areas	40 $L_{Aeq\ 24\ hour}$
	Residential (Aged Care Facility) - Sleeping areas (night time)	35 $L_{Aeq\ 9\ hour}$[1]
	Dining and living areas	45 $L_{Aeq\ 24\ hour}$
	Toilets	55 $L_{Aeq\ 24\ hour}$
Note 1: The relevant time period for bedrooms include the period of 10pm to 7am		

5 Environmental Noise Intrusion Assessment

This section of the report details the assessment of environmental noise intrusion into the proposed development and the recommended acoustic treatments to ensure the recommended internal noise levels detailed in the Sections above (including traffic noise intrusion) are achieved.

Internal noise levels within the future areas of the development will result from the noise intrusion into the building through the external façade including glass, masonry and other façade elements. Typically, the acoustic performance of building elements including the relatively light weight elements of the building façade, including glass and/or plasterboard constructions, will be the determining factors in the resulting internal noise levels.

Calculations of internal noise levels have been undertaken based on the measured environmental noise levels at the site and the characteristics of the building, including window openings, buildings constructions and the like.

5.1 External Glass Elements

The recommended acoustic constructions to the buildings external façade glass elements are detailed in the table below to ensure the recommended internal noise levels detailed above are achieved, with the façade building openings closed.

Table 5 – External Glass Acoustic Requirements

Façade Orientation	Room Type	Recommended Glass Construction	Minimum Façade Acoustic Performance[1]
Northern Façade facing the Western Motorway	Aged Care Rooms	12.38mm Laminated	Rw 37
Eastern and Western facades of rooms within 25m of the northern property boundary	Aged Care Rooms	10.38mm Laminated	Rw 35
All remaining areas	Aged Care Rooms	6.38mm Laminated	Rw 30
	Living and Dining Common Areas	6.38mm Laminated	Rw 30
	Administration areas	6.38mm Laminated	Rw 30
	Common areas and lobbies	6.38mm Laminated	Rw 30
Note 1: *The acoustic performance of the external façade includes the installed glazing and frame including (but not limited to) the façade systems seals and frame. All external glazing systems are required to be installed using acoustic bulb seals.*			

The recommended glass constructions detailed in the table above include those required to ensure the acoustic requirements of the project are achieved. Thicker glazing may be required to achieve other project requirements such as structural, thermal, safety or other requirements and is to be advised by others.

5.2 External Building Elements

The proposed external building elements including masonry or concrete external walls and roof are acoustically acceptable without additional acoustic treatment.

Any light weight external pasteboard walls should be constructed from a construction with a minimum acoustic performance of Rw 50.

5.3 External Roof

The required external roof and ceiling constructions for the project are required to include the following:

1. Metal deck roofing and ceilings –
    a. Level 1 aged care rooms within 25m of the north boundary to include 2x 13mm plasterboard ceilings with 50mm thick, 14kg/m^2 insulation in the ceiling cavity.
    b. All other areas should include 1x 13mm plasterboard ceilings with 50mm thick, 14kg/m^2 insulation in the ceiling cavity.

5.4 External Opening and Penetrations

All openings and penetrations are required to be acoustically treated such that the performance of the building construction is not compromised. This may require lining of duck work behind mechanical service openings/grills, treatments to ventilation opening and the like.

5.5 Alternative Ventilation Requirements

The internal design sound levels detailed above are achieved with the external building openings closed.

As it is necessary for the windows and doors to remain closed to achieve compliance with specified internal noise levels an alternative method of providing outside air ventilation will be required to all units within the development.

The method of providing an alternative method of outside air ventilation is required to be provided in accordance with relevant regulations including the Building Code of Australia and AS1668.

The installation of the ventilation should not compromise the acoustic performance of the external building shell and is required to comply with the noise emission criteria detailed in the following section.

6 External Noise Emission Assessment

This section of the report details the relevant noise level criteria for noise emissions generated on the site once completed.

The relevant authority which provides the required noise level criteria for noise levels generated on the site includes the NSW Environmental Protection Authority's (EPA) Noise Policy for Industry (NPI).

6.1 NSW Environmental Protection Authority, Noise Policy for Industry

The NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI), previously Industrial Noise Policy, details noise criteria for the control of noise generated from the operation of developments and the potential for impact on surrounding receivers.

The NPfI includes both intrusive and amenity criteria which are summarised below.

1. Intrusive noise level criteria, The NPfI states the following:

   'The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the LAeq descriptor), measured over a 15minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.'

2. Amenity noise level criteria, The NPfI states the following:

   'To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.'

   Project amenity noise level for industrial developments = recommended amenity noise level (Table 2.2) minus 5 dB(A)

   Where the resultant project amenity noise level is 10 dB or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time.

The LAeq is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, this policy assumes that the LAeq,15min will be taken to be equal to the LAeq, period + 3 decibels (dB), unless robust evidence is provided for an alternative approach for the particular project being considered.

Project amenity noise level (ANL) is urban ANL (Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level (dB = decibel; dB[A] = decibel [A-weighted]; RBL = rating background noise level).

Noise level used in the assessment of noise emission from the site have been based on the noise level survey conducted at the site and detailed in this section of the report.

Consequently, the resulting noise level criteria are summarised in the table below. The criteria are nominated for the purpose of determining the operational noise limits for the operation of the site including mechanical plant associated with the development which can potentially affect noise sensitive receivers and operational noise levels from the future tenancies. For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. The calculated *Project Amenity Noise Level* includes either the Recommended Amenity Noise Level minus 5 dB(A) plus 3 dB(A) (for a 15minum period) or the measured existing Leq noise level – 10 dB if this is greater as determined by the NPfI.

Table 6 – External Noise Level Criteria in Accordance with the NSW NPfI

Location	Time of Day	Project Amenity Noise Level, $L_{Aeq, period}$ [1] (dBA)	Measured $L_{A90, 15\ min}$ (RBL) [2] (dBA)	Measured $L_{Aeq, period}$ Noise Level (dBA)	Intrusive $L_{Aeq, 15\ min}$ Criterion for New Sources (dBA)
Urban residences	Day	58	51	68	**56**
	Evening	**48**	51	63	56
	Night[4]	**43**	40	56	45

Note 1: Project Amenity Noise Levels corresponding to "Urban" areas, recommended noise levels.
Note 2: L_{A90} Background Noise or Rating Background Level including façade corrections
Note 3: Project Noise Trigger Levels are shown in bold
Note 4: Noise from the operation of residential condensers are to be inaudible within a neighbouring residential premises during night time hours

6.2 Noise Impact Assessment

An assessment of noise generated on the site has been undertaken on this section of the report. The assessment of noise levels generated on the site are summaries below:

1. Mechanical Services Equipment –Detailed selections of the proposed mechanical plant and equipment to be used on the site are not available at this time. All future plant and equipment are to be acoustically treated to ensure the noise levels at all surrounding receivers comply with noise emission criteria detailed within this report. Experience with similar projects indicated that it is both possible and practical to treat all mechanical equipment such that the relevant noise levels are achieved. Examples of the possible acoustic treatments to mechanical equipment includes the following:
    a. Supply and Exhaust Fans – location of fans within the building and treated using internally lined ductwork or acoustic silencers.
    b. General supply and exhaust fans – general exhaust and supply fans such as toilet, kitchen, lobby and other small mechanical fans can be acoustically treated using acoustic flex ducting or internal lined ducting.

    Details of the required mechanical services equipment and acoustic treatments to ensure the relevant noise level criteria is achieved will be provided as part of the CC submission of the project.

6.3 Waste and Garbage Removal Noise

Noise resulting from the removal of waste and garbage from the site, including garbage trucks and the like will be undertaken in accordance with council's waste management requirements, which generally includes collections of waste outside of night-time hours. That is no garbage vehicles will service the site between the hours of 10pm to 7am.

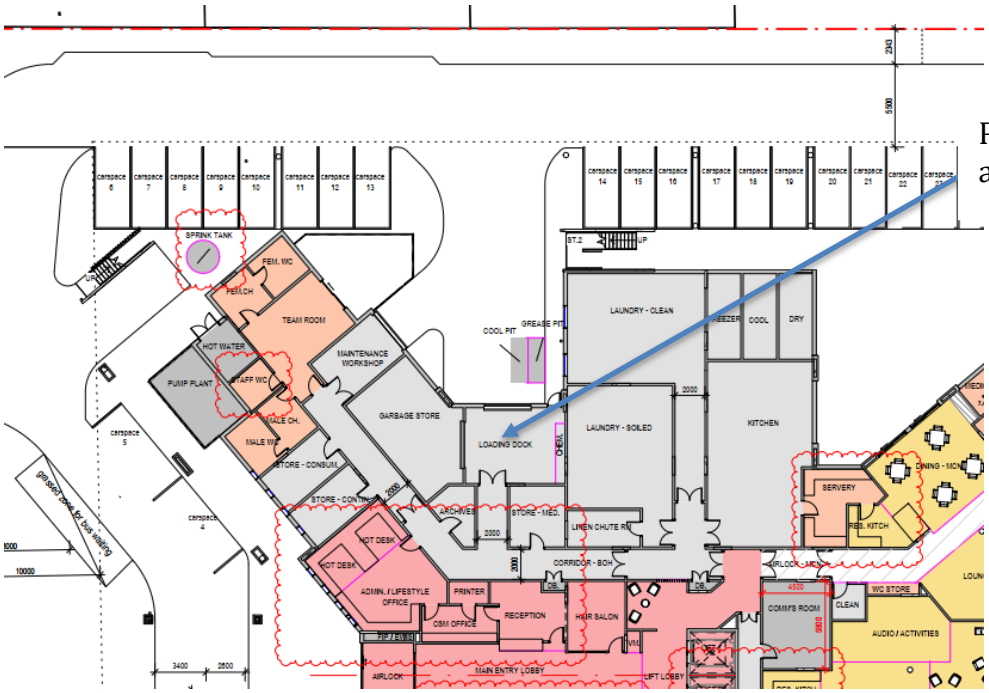
The location of the garbage collection area and storeroom is to the west of the site, as detailed in the figure below.

The proposed garbage storeroom is located in a position which will minimise noise resulting from both the storage of waste as well as the operation of waste collection vehicles.

Based on the location of the proposed garbage area, providing collections are undertaken in accordance with the relevant council waste collections polices noise resulting from the storage and collection of waste will be acoustically acceptable.

6.4 Loading Dock

The proposed development includes a loading dock which is located to the west of the site, as detailed in the figure below.



Proposed loading dock area

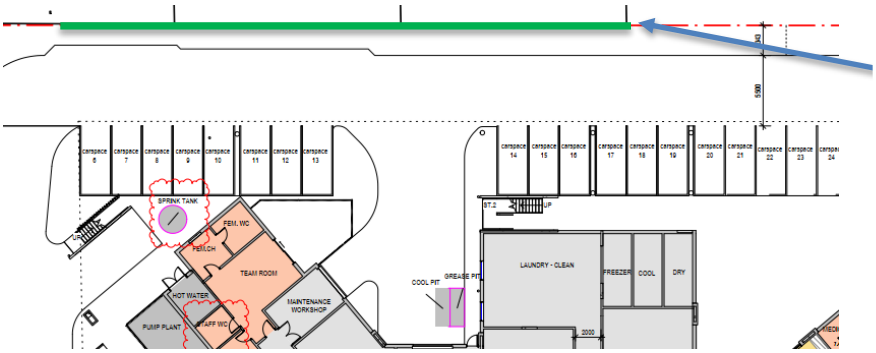
The loading dock will include the use for small vans and trucks servicing the site.

The use of large truck and semi reticulated trucks are not proposed to service the site.

Use of the loading dock will be limited to include arrival and departures of van and small trucks during daytime hours only.

Based on the proposed operational hours of the loading dock the resulting noise impact from the use of the loading dock will be acoustically acceptable and noise impacts to the surrounding receivers will comply with the noise emission criteria detailed in this report providing the following mitigations are included:

1. Install a solid lapped and capped timber fence (or similar) to the western boundary of the site. The fence should include a minimum height of 2.2m and should be located as detailed in the figure below.



Recommended location of the lapped and capped timber fence

A sample calculation for a 15 minute period when a small truck is accessing the loading dock is include below.

Table 7 – Noise Calculation to Neighbour, Small Truck Accessing the Loading Dock

Descriptor	Noise Level
Noise Source – Small Truck	95 dB(A) Sound Power Level
Distance Correction (10m)	-28
Correction for period of truck movement	-5
Barrier correction	-6
Resulting Noise at the Neighbouring Property	56 dB(A) $L_{eq\ (15\ min)}$
Project Daytime noise level criteria	56 dB(A) $L_{eq\ (15\ min)}$

6.5 Carparking Area

The proposed development includes carparking located to the west of the building, including 36 parking locations. The proposed car parking is detailed in the figure below.

As part of this assessment the potential for noise impacts from the use of the carparking including night time hours for the potential of sleep disturbance events to the neighbouring residential receivers has been undertaken.

6.5.1 Sleep Disturbance Criteria

This section of the report details the assessment for potential sleep disturbance from the use of the parking spaces and movement to and from the site during night-time hours including 10pm to 7am (as defined as nigh-time by the Environmental Protection Authority (EPA)).

The potential for a sleep disturbance events, including short term noise events, such as a vehicle entering or existing the site has been assessed in this section of the report based on the EPA's *Industrial Noise Policy for Industry* (NPfI) and the *NSW Road Noise Policy (RNP).*

The NPfI includes the following commentary regarding possible sleep awakening events:

> ***2.5 Maximum noise level event assessment***
>
> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.*
> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> - $L_{Aeq,15min}$ *40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - L_{AFmax} *52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *A detailed maximum noise level event assessment should be undertaken. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.*

The RNP includes the following comments regarding sleep disturbance:

> *From the research on sleep disturbance to date it can be concluded that:*
> - *maximum internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep*
> - *one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are*
>
> *not likely to affect health and wellbeing significantly.*

Based on the details included within the NPfI and the RNP in the event a noise level of 55 dB(A) L_{max} does not occur as a result of the use of the property from the use of the carpark then noise levels are *unlikely to awaken people from sleep* and compliance with the requirements of the NPfI and the RNP regarding sleep disturbance would be achieved.

6.5.2 Carpark Noise Impact Assessment

As part of this assessment the calculated noise levels resulting from the use of the proposed carpark on the site has been undertaken. The assessment has been undertaken using the following assumptions:

1. Windows of the neighbouring residential property are open during all periods including night-time periods.
2. The carpark can be used for the arrival, departure of cars at any time including the start-up of a car engine and the closing of doors.
3. The acoustic treatments and controls detailed in the *Discussion* below are included in the site.

Based on the above the assessment of noise from the use of the site including the start-up of a car engine and the closing of a car door has been undertaken. Details of the assessment are included in the table below.

Table 8 – Noise Calculation to Neighbour, Use of the Carpark

Descriptor	Noise Level	
Noise Source	70 dB(A) Lmax Engine Start Up	75 dB(A) Lmax ECar Door Closing
Correction for noise source (5m)	+27	+27
Distance Correction to Receiver (10m)	-28	-28
Barrier Correction for Boundary Fence	-6[1]	-6[1]
Correction for open window	-6[2]	-6[2]
Correction for Receiver Room	-5[3]	-5[3]
Resulting Noise Level within bedroom	47 dB(A) Lmax	52 dB(A) Lmax
unlikely to awaken people from sleep Noise Level	55 dB(A) Lmax	55 dB(A) Lmax

Note: 1 - Barrier correction includes calculation to worst affected window at the neighbouring receiver.

2 – Window correction for the open window includes revised correction for the window open based on the neighbouring property.

3 – The correction for the receiver room is based on a standard 3m x 3m x 2.6m bedroom including soft furnishings (such as a bed) as a room correction and a receiver location of 1.5m from the widow to a bed head.

Based on the results of the worst-case maximum noise level generated from the use of the proposed carpark on the site, including engine start-ups or closing of a car door, a noise level of 52 dB(A) Lmax could be generated within the neighbouring dwellings. The calculated noise level is complaint with the noise level detailed by the NPfI and the RNP which is unlikely to awaken people from sleep. Based on the resulting noise levels the resulting impacts from the use of the carpark is considered to be acoustically acceptable.

In addition to the above the following is also discussed:

- The assessment includes the noise levels for the potential to generate a sleep disturbance regardless of the number of events. It is unlikely that a large number of events or movements will occur during the quiet periods of night. In the event 1 or 2 movements where to occur in any given night the RNP notes that one or two noise events per night, with maximum internal noise levels of 65–70 dB(A), are not likely to affect health and wellbeing significantly. In the event an assessment using 65 dB(A) Lmax as the assessment criteria is undertaken noise levels within the neighbouring residential bedroom are 13 dB(A) below the equivalent sleep disturbance level.
- The assessment assumes that the neighbouring buildings bedroom window is open. In the event the window to the receiver is closed a future reduction of no less than 15 dB(A) for a standard 4mm glass would be expected.

7 Conclusion

This report details the Noise Impact Assessment of the proposed Opal St Clair aged care facility located at 100 Explorers Way, Saint Clair.

This report details the required acoustic constructions of the building's façade, including external windows, to ensure that the future internal noise levels comply with the relevant noise levels of the Australian Standard AS2107:2016 and the Department of Planning *Development Near Rail Corridors and Busy Roads – Interim Guideline* and the *Infrastructure SEPP.* Providing the recommended constructions detailed in this report are included in the construction of the project the required internal noise levels will be achieved.

External noise emissions from the site have been assessed and detailed in accordance with the NSW Environmental Protection Authorities Noise Policy for Industry. The future design and treatment of all building services associated with the project can be acoustically treated to ensure all noise emissions from the site comply with the EPA NPfI criteria. Details of the equipment and associated acoustic treatments will be provided as part of the CC submission of the project.

For any additional information please do not hesitate to contact the person below.

Regards

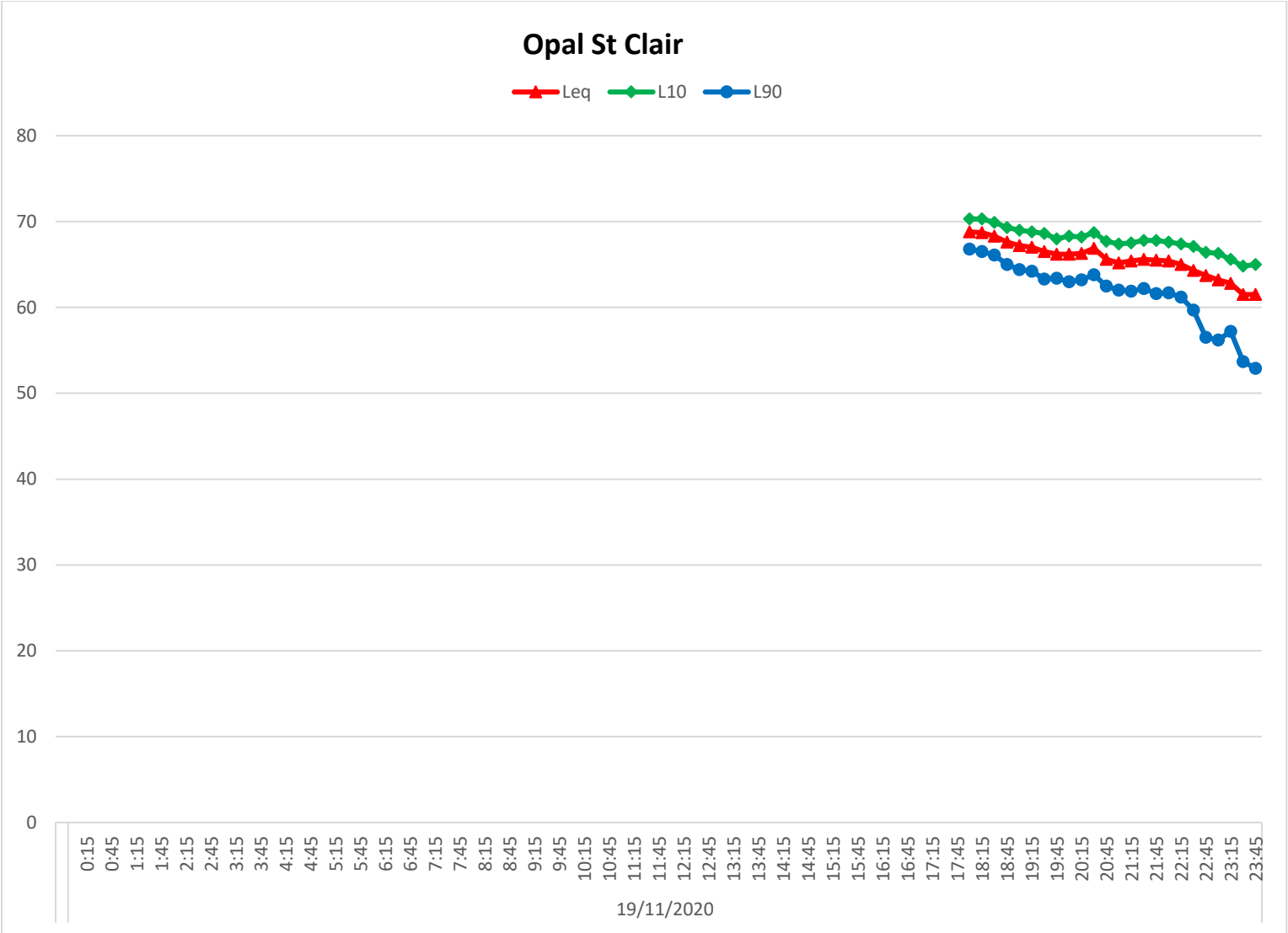
Ben White
Director
Pulse White Noise Acoustics

8 Appendix A – Glossary of Terms

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Background Sound Low	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L_{A90} value
Ctr	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
dB (A)	'A' Weighted overall sound pressure level

Noise Reduction	The difference in sound pressure level between any two areas. The term “noise reduction” does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
NR Noise Rating	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the “A” weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
R_W	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for Rw are defined in ISO 140-2:1991 “Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data”.
R'_W	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
Sound Isolation	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term “sound isolation” does not specify any grade or performance quality and requires the units to be specified for any contractual condition
Sound Pressure Level, L_P dB	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
Sound Power Level, L_W dB	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
Speech Privacy	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
Transmission Loss	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.

9 Appendix B – Noise Logging Results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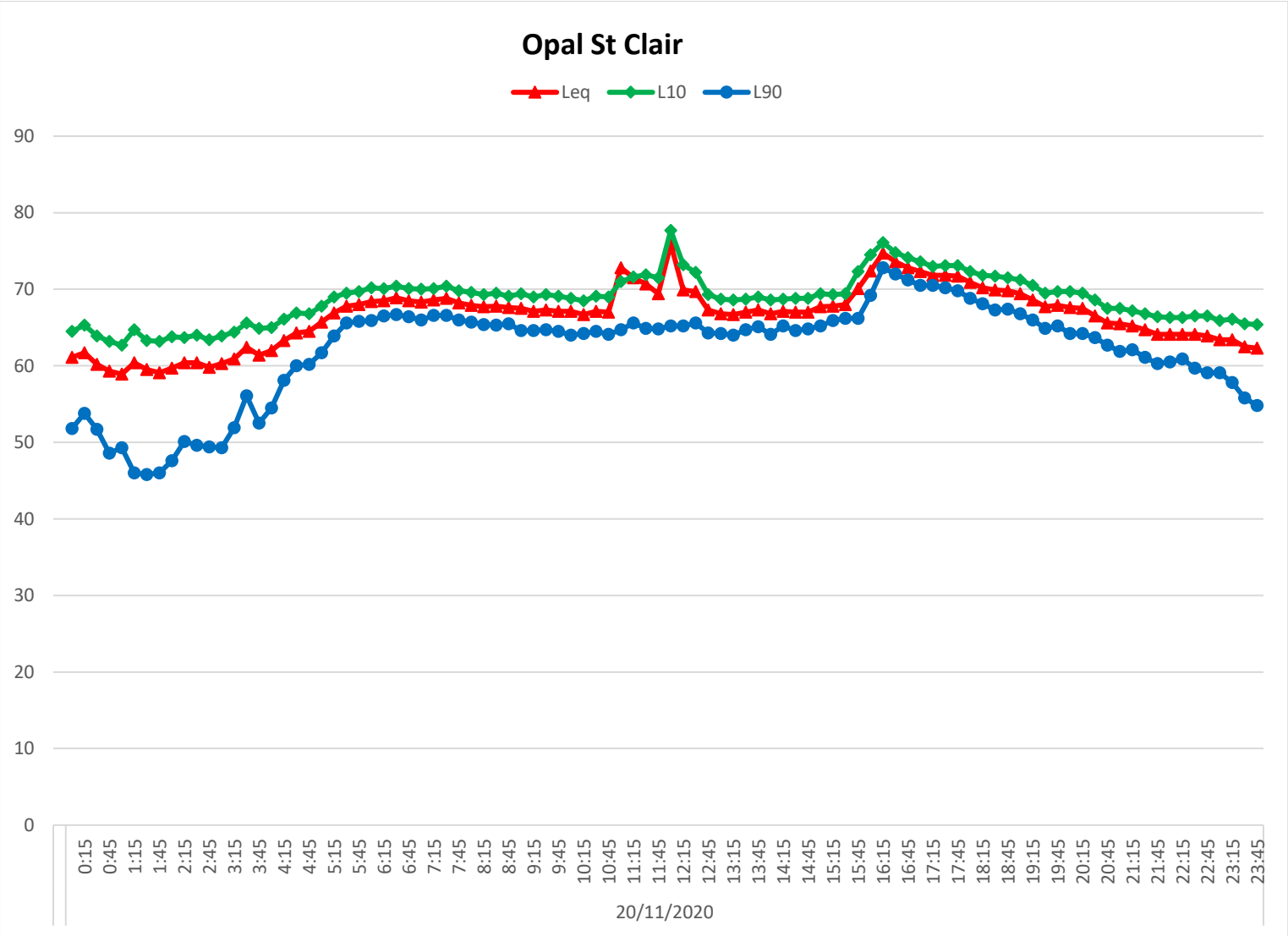
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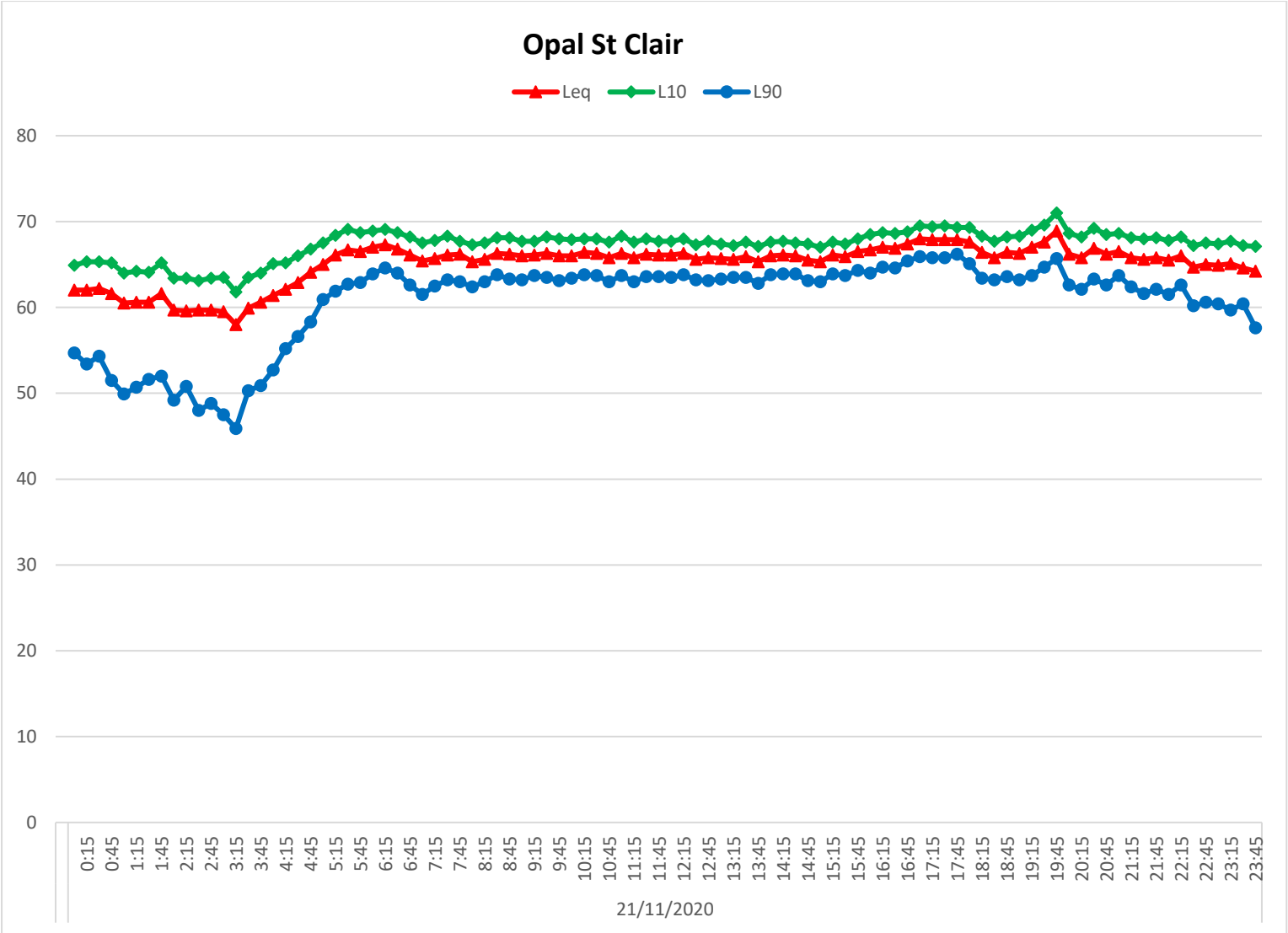
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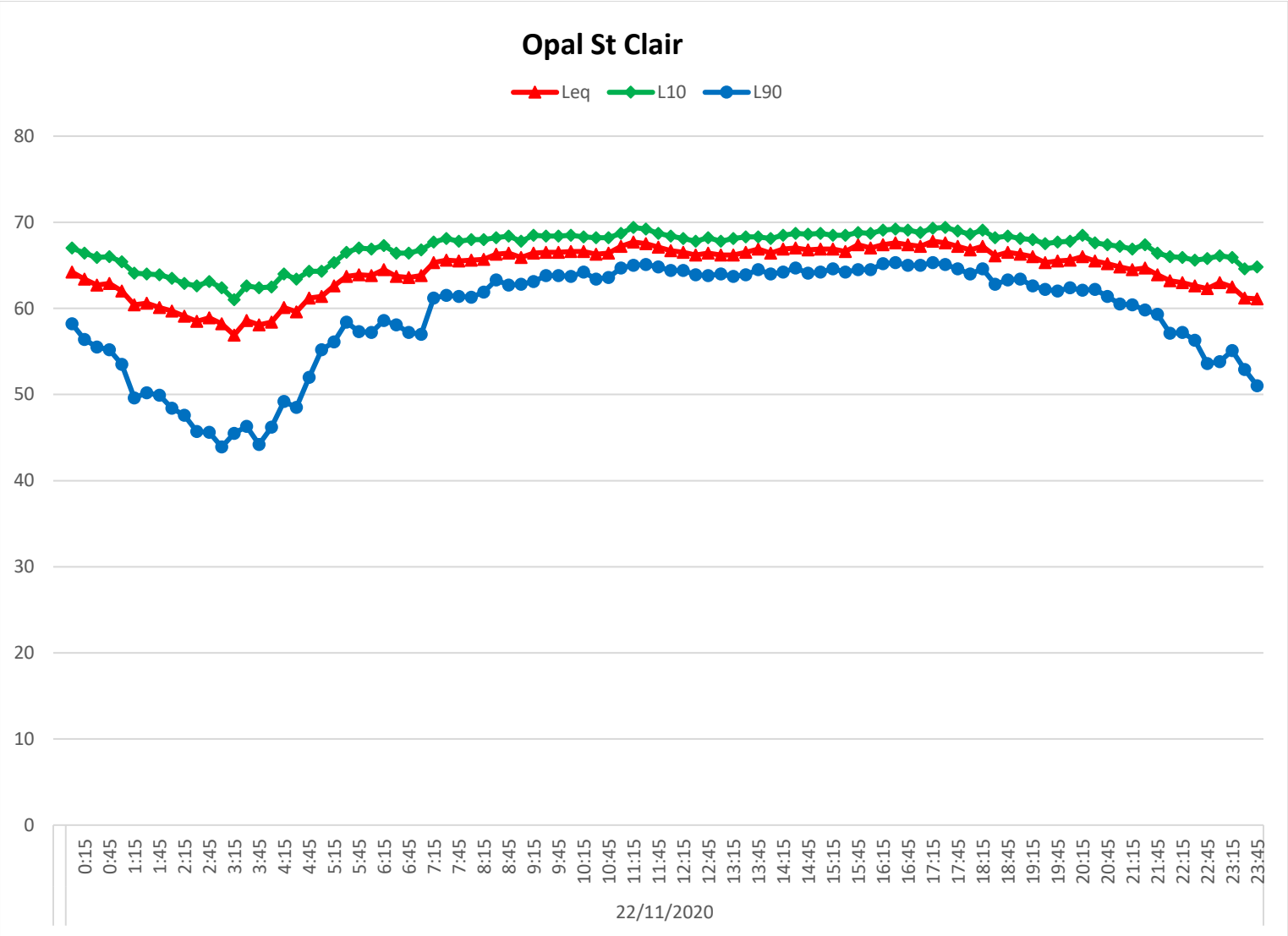
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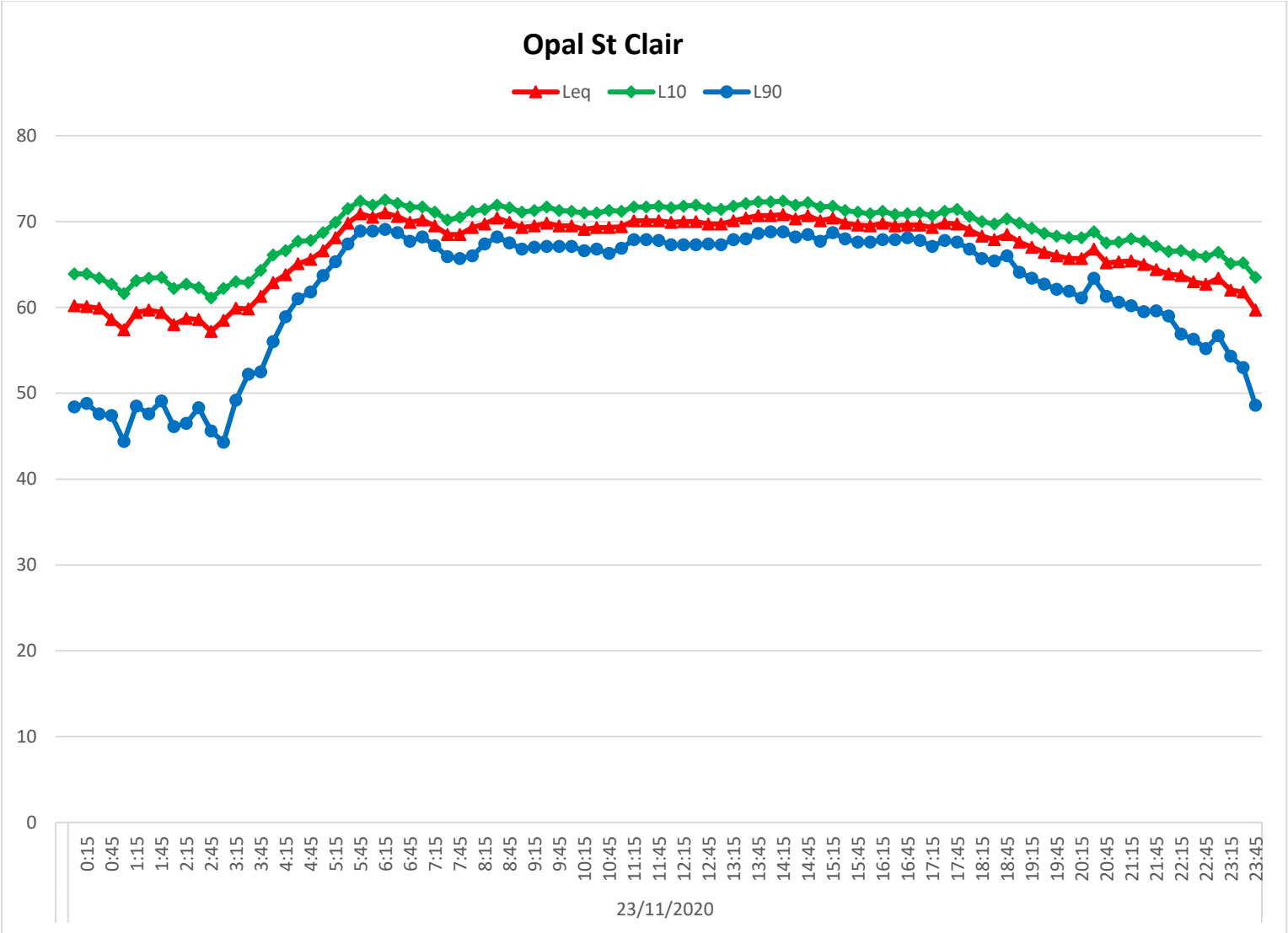
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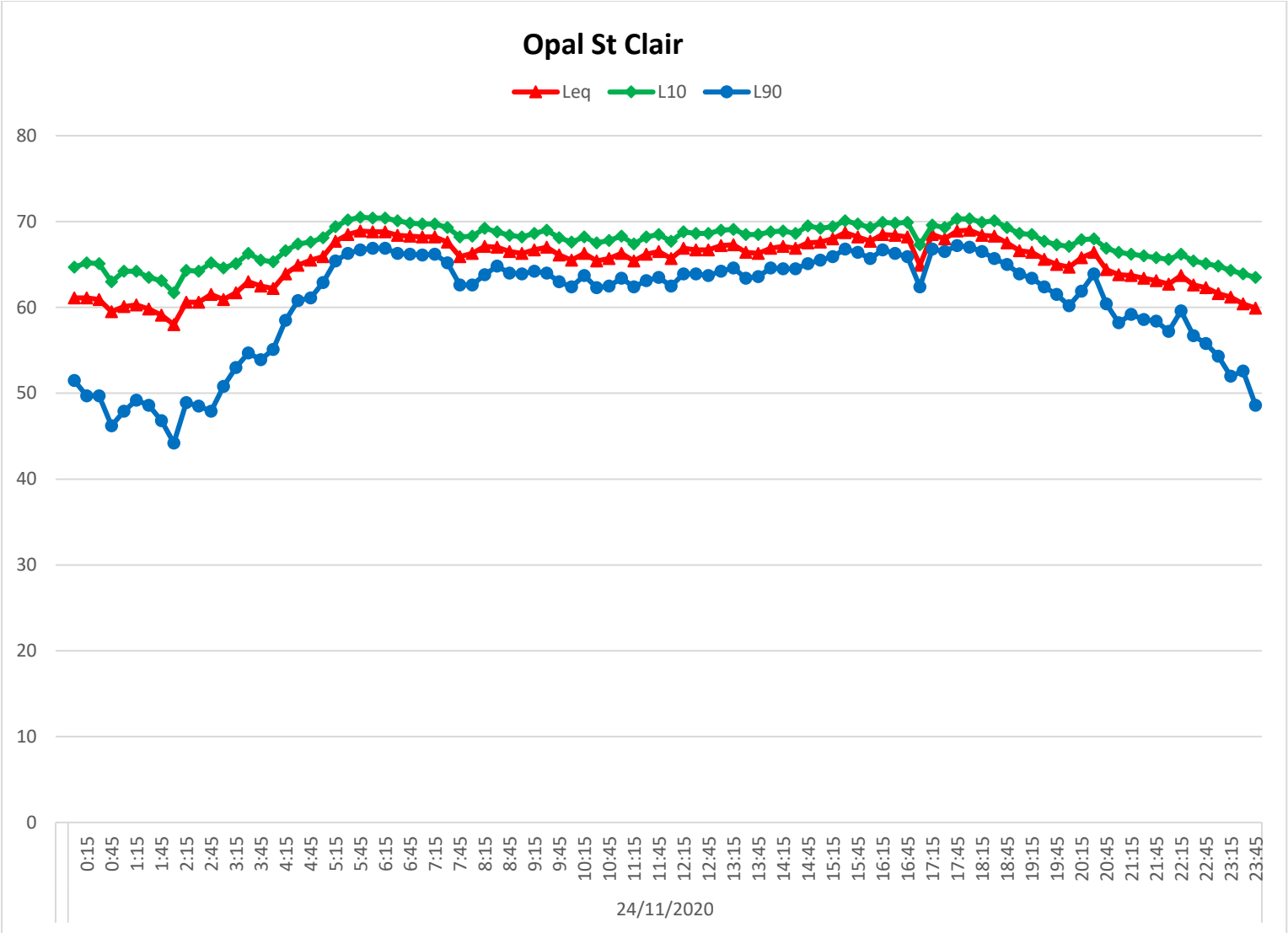
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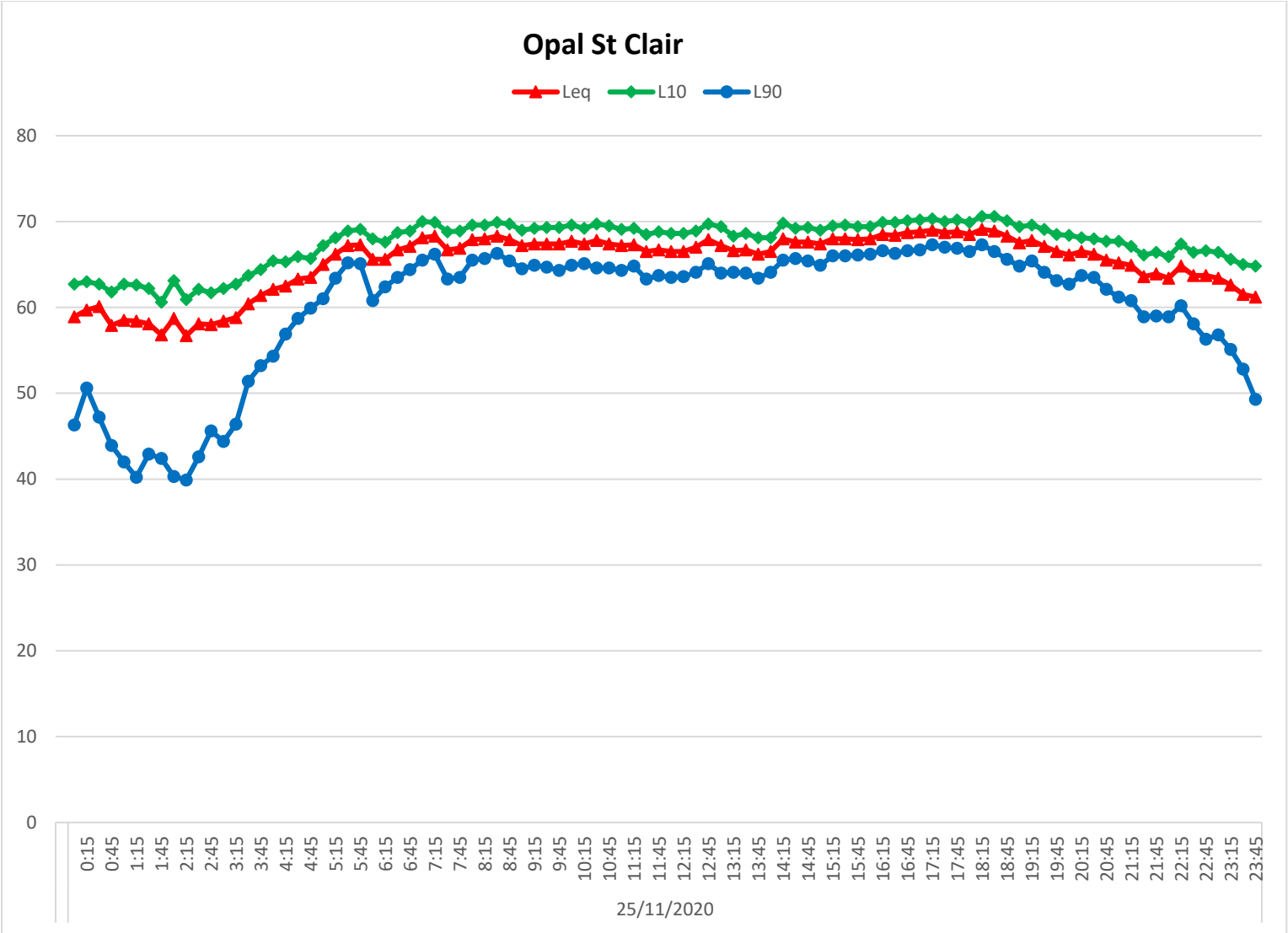
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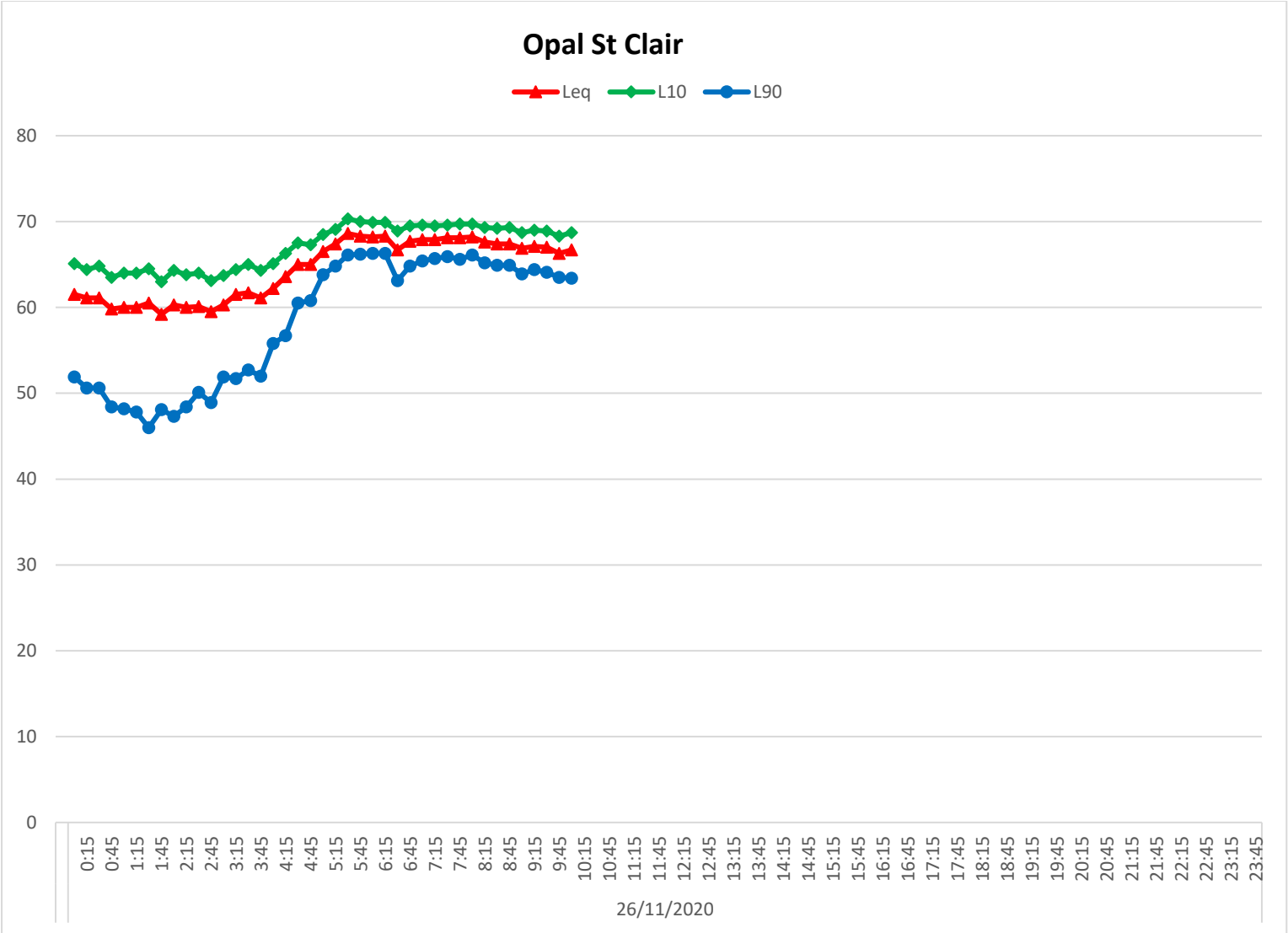
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