

Macquarie Point Multipurpose Stadium

Noise Assessment Supplementary Report

31-Jan-2025

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Noise Assessment Supplementary Report

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1.0 Introduction

AECOM prepared a Noise and Vibration Assessment Report in 2024¹ on behalf of the Macquarie Point Development Corporation (MPDC) in support of a development application for the Macquarie Point Multipurpose Stadium, Project of State Significance (PoSS).

The purpose of this supplementary report is to address the comments from the Tasmania Planning Commission (TPC) following the review of the PoSS Noise and Vibration Assessment report.

The main matters addressed in this report are:

- Additional noise monitoring on site, focusing on noise due to local traffic and the operations of the port.
- A high-level construction noise assessment based on the preliminary program.
- Comparison of the existing noise environment to the predicted noise levels from the Stadium construction and operation.
- Update the noise model to include vertical noise maps (i.e. noise levels at each floor of a building) of the predicted levels at nearby sensitive receptors.

1.1 Tasmanian Planning Commission Comments

The Tasmanian Planning Commission (TPC) has provided the following comments following the submission of the PoSS noise and vibration assessment report. This report presents a response to each of the matters raised by TPC, with reference to the relevant report section given in Table 1.

Table 1 TPC Comment

Ref No.	Matters Raised	How comments are addressed and relevant sections in the Report
B.6.1	Further analysis and evidence would assist to understand the effects of proposed uses on existing uses in the vicinity of the project site and proposed management and programming regimes relating to the proposed uses and their effects on surrounding uses (including effects relating to traffic, parking, noise and pedestrian movement) (section 7.0 of the Guidelines).	- Additional monitoring has been conducted to understand the existing noise environment, particularly the operation of the Macquarie Wharves, including the departure and arrival of cruise ships. - In the absence of measured helicopter noise from the Royal Hobart Hospital, a noise model has been constructed to understand the noise impact from the operation of the emergency helicopter to nearby receptors. - Provided additional commentary and analysis comparing the potential noise from the operation of the Stadium with the existing noise environment in the precinct. - A high-level construction noise assessment has been based on the preliminary construction program. Relevant Report Sections: - Section 2.1 - Section 2.5 - Section 3.4
B.7.5	Reports relating to noise should consider noise levels at all levels of multistorey buildings and include an analysis of whether receivers on the Eastern Shore should be	- Clarified that predicted operational noise levels in the PoSS report have considered multistorey buildings, and the presented levels represent the worst-case for each receptor. - Included additional sensitive receptors in the suburbs of Rosnyand Bellerive across Ross Bay.

¹ Macquarie Point Multipurpose Stadium Noise and Vibration Assessment Report dated 21 August 2024

Ref No.	Matters Raised	How comments are addressed and relevant sections in the Report
	considered in the assessment (section 8.4 of the Guidelines).	- Conducted additional noise modelling to include noise levels on multistorey building façades. Relevant Report Sections: - Section 2.1 (Table 3) - Section 3.1 (Table 9) - Appendix A - Appendix B

1.2 Limitations and Clarifications

This supplementary report is to be read in conjunction with the Macquarie Point Multipurpose Stadium Noise and Vibration Assessment Report dated 21 August 2024 prepared as part of the PoSS submission.

The predicted noise levels for music concerts, PA system, game sirens and in-bowl crowd presented in this Supplementary Noise Assessment Report differ slightly from the PoSS Report. This is due to design development and refinement of the Stadium facade resulting in smaller openings compared to the Stadium model used in the PoSS Report. This reduction in facade opening has resulted in lower noise level emissions of up to 2dB. At this stage of the project, the façade design is not expected to change significantly. Therefore, further changes to the predicted noise levels are not anticipated.

2.0 Existing Noise environment

The Project Site is approximately 10 hectares of former industrial rail yard, located between the Royal Hobart Regatta grounds and the Macquarie Wharves in Hobart.

Significant noise-generating operations, including freight handling activities (TasRail and Toll Transport), Boral's concrete batching plant and the Hobart Cold Storage Centre, have ceased operation on the Project Site since 2009.

Table 2 summarises the existing noise environment in the vicinity of the Site.

Table 2 Existing Noise Environment

Location	Description
North of the Site	Potential future developments include public ferry services and a storage/display centre for historic trams. The Huon Quays site has been closed and may be developed commercially. The existing Domain slipway facility will continue boat maintenance. The parcel of land adjacent to the Domain boat ramp may be subject to future residential developments. The Royal Hobart Regatta Grounds, including the Cenotaph, is adjacent to the north. It is crucial to ensure the operation of the Stadium does not impact the events at the Cenotaph, such as the Dawn Service, Last Post Ceremony or any other memorial services.
Southeast of the Site	The Macquarie Wharves makes up the majority of the land to the southeast and takes in both passenger cruise ships and commercial cargo operations. A parcel of the land includes a water treatment plant, owned and operated by TasWater. The plant is scheduled for decommissioning by the end of 2025.
West of the Site	Davey Street and Tasman Highway bound the Site to the west. There are a number of noise sensitive receptors beyond these roads, including Baha'l Centre of Learning, ABC Broadcast Centre and residential apartments.
South of the Site	The majority of the noise sensitive receptors are located to the south of the Site, including residential apartments, hotels, and the School of Creative Arts. Federation Concert Hall is also a significant sensitive receptor located to the southwest of the Site at the corner of Davey Street and Evans Street.

AECOM has previously conducted attended noise measurements surrounding the Site. However, previous measurements were conducted outside of cruise ship season. As a result, additional long-term noise monitoring, as well as supplementary attended measurements, were undertaken in January 2025 in order to capture the noise from the port activities.

2.1 Nearest Noise Sensitive Receptors

The noise sensitive receptors surrounding the Stadium remain largely unchanged from the PoSS assessment, with the exception of the addition of residential receptors in the suburbs of Rosny and Bellerive across Ross Bay to the east of the Stadium. The receptors are included following comments from the TPC for completeness.

The table below presents the nearest noise sensitive receptors surrounding the Project Site.

Table 3 Noise Sensitive Receptor Locations

Receptor Reference	Location Description	Approximate Distance to the Stadium ¹
R1	Sullivans Cove Apartments	40 metres to the south
R2	Zero Davey Boutique Apartments	40 metres to the south
R3	University of Tasmania School of Creative Arts and Media	70 metres to the south
R4	MACq 01 Hotel	115 metres to the south
R5	IXL, Henry Jones Hotel	80 metres to the south
R6	Federation Concert Hall (Tasmanian Symphony Orchestra)	40 metres to the southwest
R7	Hotel Grand Chancellor	110 metres to the southwest
R8	7 Macquarie Street apartments	70 metres to the west
R9	The Old Woolstore Apartment Hotel	110 metres to the west
R10	Baha'i Centre of Learning	150 metres to the west
R11	ABC Broadcast Centre	230 metres to the west
R12	The land parcel adjacent to Domain Boat Ramp, potential future residential development	180 metres to the north
R13	Royal Hobart Regatta Grounds (The Cenotaph)	90 metres to the north
R14	One Collins Apartment	200 metres to the west
R15	Royal Hobart Hospital	320 metres to the west
R16	Residential Apartments (1 Creswells Row)	250 metres to the southwest
R17	Residential Apartments (1-9 Ragged Lane)	180 metres to the west
R18	Residential Apartments (1-15 Terminus Row)	220 metres to the southwest
R19	Residential Dwellings in the suburb of Rosny	1300 metres to the east
R20	Residential Dwellings in the suburb of Bellerive	2000 metres to the east

Note 1: The distance to the receptor is measured from the outer edge of the Stadium.

Figure 1 and Figure 2 overleaf provides an overview of the Project Site and identifies the nearest noise sensitive receptors.

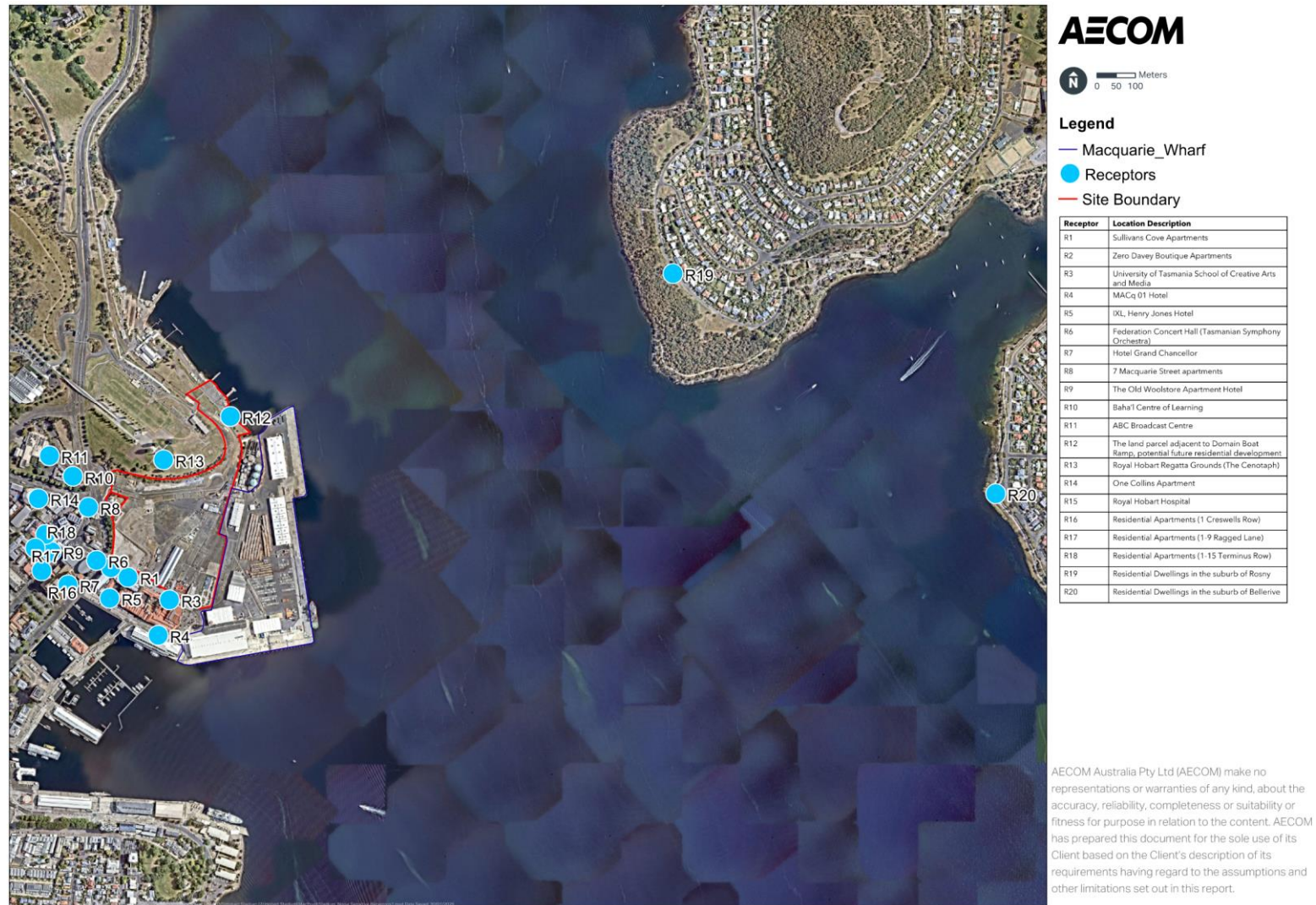


Figure 1: Overall Site Map



Figure 2: Site Map (Macquarie Point)

2.2 Noise Measurement Durations and Locations

Unattended noise monitors were placed on site at two locations between 21st January 2025 and 28th January 2025.

Supplementary attended measurements were conducted on the 21st January 2025.

For clarity, noise measurements were previously conducted in June 2025 as part of the PoSS submission. Refer to the PoSS Noise and Vibration Assessment Report for details.

The measurement locations are shown in Figure 3 overleaf.

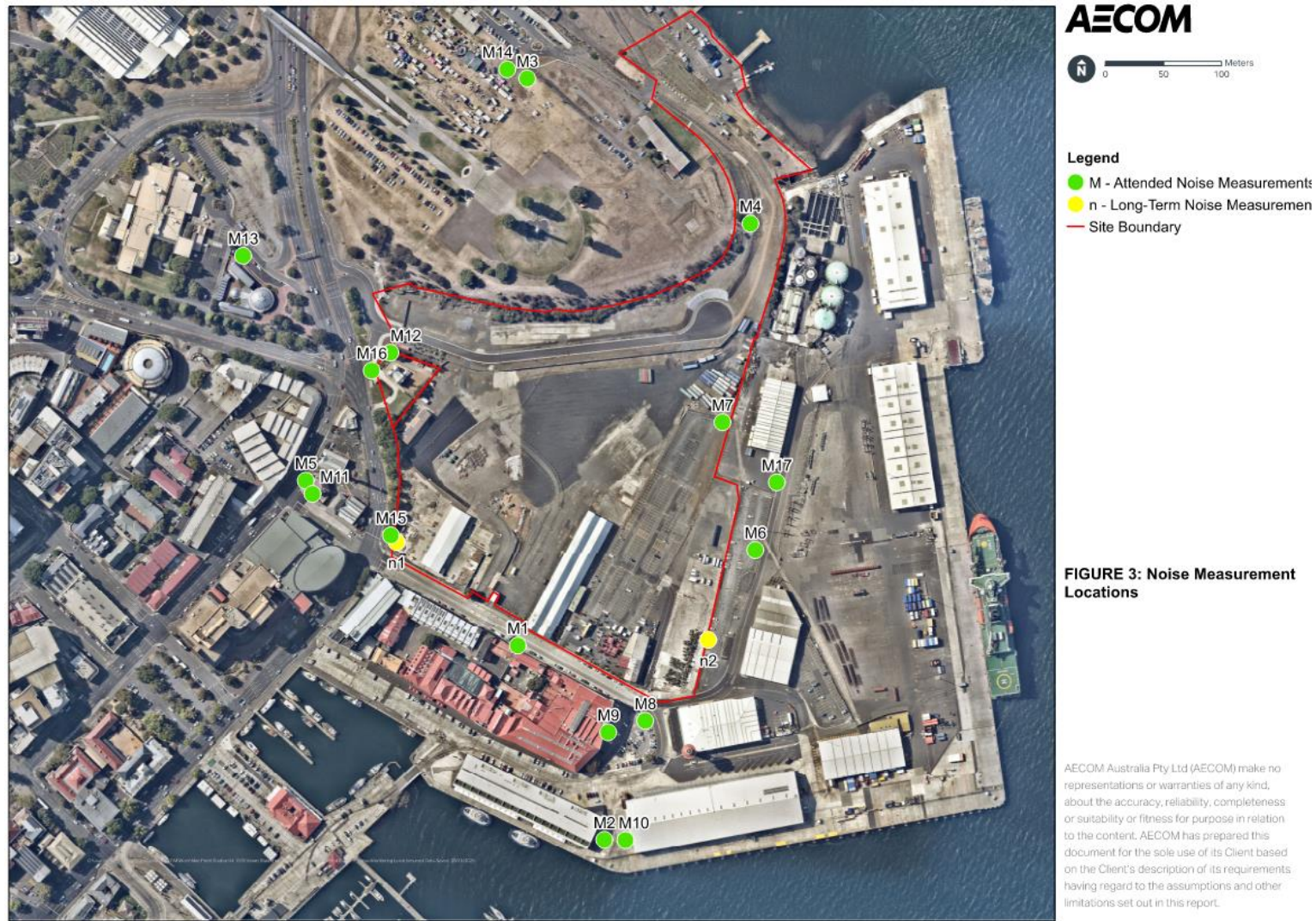


Figure 3: Noise Measurement Locations

2.3 Attended Noise Measurements

The specifications and details of the instrumentation used to conduct the attended measurements are presented in Table 4. All instrumentation has been laboratory calibrated and was calibrated for on-site use.

Table 4 Instrumentation (Attended Noise Measurements)

Instrument	Model	Serial Number
Sound Level Meter	Rion NL52	1010744
Sound Level Meter	B&K 2270	3029627

The measured noise levels are presented in Table 5.

Table 5 Attended Noise Measurement Results

ID	Measured Noise Levels, dB	Details
M1	L _{Aeq} : 50 L _{A90} : 45	- Location: Evans Street - Observations: Dominated by Davey Street Traffic. Distant traffic audible. - Date: 12/06/2024 22:22 - Duration: 10 minutes
M2	L _{Aeq} : 48 L _{A90} : 44	- Location: The Story Bar - Observations: Dominated by Seagulls - Date: 12/06/2024 22:49 - Duration: 10 minutes
M3	L _{Aeq} : 44 L _{A90} : 40	- Location: Domain Boat Ramp - Observations: Dominated by Tasman Highway Traffic. Hum from port building services just audible. - Date: 12/06/2024 23:18 - Duration: 10 minutes
M4	L _{Aeq} : 47 L _{A90} : 45	- Location: Water Treatment Plant - Note: This will be decommissioned as part of the Project - Observations: Dominated by water treatment plant noise - Date: 12/06/2024 23:30 - Duration: 10 minutes
M5	L _{Aeq} : 61 L _{A90} : 48	- Location: Corner Evans Street and Macquarie Street - Observations: Dominated by traffic on Macquarie Street - Date: 12/06/2024 23:44 - Duration: 10 minutes
M6	L _{Aeq} : 58 L _{A90} : 51	- Location: TasPorts Car Park - Observations: Dominated by excavator moving timber in port. Seagulls and distant traffic audible. - Date: 13/06/2024 09:10 - Duration: 5 minutes
M7	L _{Aeq} : 56 L _{A90} : 52	- Location: Macquarie Point Car Park - Observations: Dominated by excavator moving timber in port, Macquarie Point Construction and Seagulls. - Date: 13/06/2024 09:45 - Duration: 5 minutes
M8	L _{Aeq} : 59 L _{A90} : 48	- Location: Hunter Street Car Park - Observations: Dominated by Hunter / Evans Street traffic and Macquarie Point construction. Excavator moving timber in port just audible. - Date: 13/06/2024 10:00 - Duration: 5 minutes
M9	L _{Aeq} : 55 L _{A90} : 48	- Location: UTAS School of Creative Arts Façade - Observations: Dominated by UTAS loading dock activity and Hunter / Evans Street traffic. - Date: 13/06/2024 10:07

ID	Measured Noise Levels, dB	Details
		Duration: 5 minutes
M10	LAeq: 51 LA90: 47	- Location: The Story Bar - Observations: Dominated by Hunter Street traffic. Distant traffic audible. - Date: 13/06/2024 10:13 - Duration: 10 minutes
M11	LAeq: 71 LA90: 64	- Location: Corner Evans Street and Macquarie Street - Observations: Dominated by traffic on Macquarie Street. Macquarie Point construction (rock breaker) audible. - Date: 13/06/2024 10:35 - Duration: 10 minutes
M12	LAeq: 65 LA90: 58	- Location: Royal Engineers Building - Observations: Dominated by Davey and Macquarie Street traffic. Macquarie Point construction not audible - Date: 13/06/2024 11:10 - Duration: 10 minutes
M13	LAeq: 58 LA90: 53	- Location: Baha'l Learning Centre Car Park - Observations: Dominated by Tasman Highway traffic. - Date: 13/06/2024 11:27 - Duration: 10 minutes
M14	LAeq: 52 LA90: 49	- Location: Domain Boat Ramp - Observations: Dominated by Tasman Highway traffic. - Date: 13/06/2024 12:01 - Duration: 10 minutes
M15	LAeq: 67 LA90: 60 LAmax: 80	- Location: Corner of Evans Street and Davey Street - Observations: Dominated by Davey Street Traffic - Date: 28/01/2025 10:10 - Duration: 15 minutes
M16	LAeq: 63 LA90: 55 LAmax: 85	- Location: Corner of Davey Street and Brooker Avenue outside of the Royal Engineering Building - Observations: Dominated by Davey Street Traffic - Date: 28/01/2025 10:35 - Duration: 15 minutes
M17	LAeq: 68 LA90: 62 LAmax: 84	- Location: East boundary of the Site - Observations: Dominated by activities on dock (truck passbys) and bird noise - Date: 28/01/2025 11:04 - Duration: 15 minutes

2.4 Unattended Noise Measurements

Two unattended noise monitors were deployed on site in January 2025 at the locations indicated in Figure 3.

The specifications of the monitors are detailed in Table 6 below. All monitors have been laboratory calibrated and were calibrated in the field before and after the measurement period, no significant drift in calibration level was observed.

Weather conditions during the survey were generally acceptable with the exception of the 22nd January 2025, when there was a brief period of 1mm rainfall. The affected data has been excluded.

Table 6 Instrumentation (Unattended noise monitoring)

Instrument	Model	Serial Number
Sound Level Meter	Rion NL52	01010779
Sound Level Meter	Rion NL52	00410186

The measurement results are presented in Table 7. In addition, brief explanations of the noise descriptors used in the measurements are provided below.

- L_{Aeq} - The 'A'-weighted Equivalent Continuous Sound Pressure Level, commonly referred to as the average Sound Pressure Level recorded for all noise events over a given time period.
- L_{A90} - The value of 'A'-weighted Sound Pressure Level which is exceeded for 90 percent of the measurement period. L_{A90} Sound Pressure Levels are commonly used to represent background noise levels.
- L_{Amax} - The maximum 'A'-weighted Sound Pressure Level measured during a given time period. The L_{Amax} would typically represent the maximum noise level occurring during short term events such as a truck passing, sirens or foghorns. L_{Amax} is a relevant descriptor in determining the likelihood of sleep disturbance and general annoyance.

Table 7 Long-term Noise Monitoring Results

Location	Period	Measured Noise Levels		
		L_{Aeq} , 1hr dB	L_{A90} , 1hr dB	L_{Amax} dB
Corner of Evans Street and Davey Street (n1)	Day (7am to 6pm)	66	58	73 - 91
	Evening (6pm to 10pm)	64	54	71 - 91
	Night (10pm to 7am)	61	42	64 - 87
Southeast corner of the Site (n2)	Day (7am to 6pm)	55	47	62 - 82
	Evening (6pm to 10pm)	53	46	60 - 79
	Night (10pm to 7am)	51	43	55 - 80

2.5 Observations

The following observations were made during the noise surveys conducted in January 2025.

West and Southwest of the Site

Based on the monitoring results and on site observations, the general noise environment to the south and southeast of the Stadium is dominated by traffic noise from the Tasman Highway, Davey Street and Macquarie Street. Davey Street and Macquarie Street are the main thoroughfares through Hobart CBD, carrying a large volume of vehicles and heavy trucks throughout the day. As evidenced by the measured noise levels at Monitor Location n1, the ambient noise levels (L_{eq}) remain relatively consistent through day, evening and night. While the high maximum noise levels (L_{max}) are driven by heavy truck passbys.

South and East of the Site

The noise environment in these areas is driven by the activities on the dock, including plant machinery operating in the timber yard, trucks on Hunter Street and Evans Street, bird noise and cruise ships arriving and departing Macquarie Wharf. The measured upper range of the maximum noise levels (L_{max}) in Table 7 are primarily caused by truck passbys and cruise ship horns.

Cruise Ships

It was noted during the observations of the cruise ships that the departing and arriving of the ships do not generate significant noise over the ambient level. However, the loudest aspect of the cruise ships is the foghorn (measured at 79dB(A) L_{max} at monitor location n2) which lasts for around 5 seconds, and is clearly audible.

North of the Site

There is no significant noise source on the site of the Stadium. The ambient noise environment is dominated by traffic along Tasman Highway.

2.6 Helicopter Noise from Royal Hobart Hospital

Emergency helicopter noise is a regular occurrence in Hobart CBD following the completion of the Royal Hobart Hospital. It forms a part of the existing acoustic ambience in the area. In order to understand the helicopter noise impact on the surroundings, this additional assessment has been undertaken.

An emergency helipad is located on the roof of Building K at the Royal Hobart Hospital (RHH), at an elevation of approximately 65 metres above ground level. No helicopter operation was recorded during the attended and long-term noise measurements as helicopter movements are infrequent and generally unscheduled. As such, a helicopter noise model has been constructed to determine the noise impact on the surrounding areas. AECOM was involved in the design of the RHH, including assessing the helicopter noise impact, and the information regarding the helipad has been obtained from AECOM's previous work on RHH.

2.6.1 Approach / Take-off

It has been advised that the approach of helicopters to the RHH Helipad will typically be from the southeast, and take-off will typically be toward the northwest.

2.6.2 Type of Helicopter

It has been advised that the helicopters using the helipads may include BK117-B2, Bell 412EP, and AW139.

The Bell 412EP type helicopter is noted to be the loudest of the three helicopters under consideration for both approach and take-off. Therefore, the noise assessment has been based on a Bell 412EP helicopter to represent the worst-case scenario.

Measurements undertaken by AECOM of the Bell 412EP helicopter have been used to derive the source noise levels for this assessment, which are presented in Table 8.

Table 8 Sound Power Level of Bell 412EP Helicopter

Event	Sound Power Level dB							Overall dB(A)
	63	125	250	500	1k	2k	4k	
Approach	146	141	135	139	137	134	128	141
Take-off	143	141	132	136	134	131	125	138

2.6.3 Predicted Helicopter Noise Levels

Based on the above, the predicted L_{max} helicopter noise levels are presented in Figure 4.

The areas directly under the helicopter flight would experience noise levels between 85-94 dB L_{Amax} . The areas to the northeast and southwest of the flight path would experience noise levels between 78-90 dB L_{Amax} .



Figure 4: Predicted RHH Helicopter Noise

3.0 Comparison of Existing and Future Noise Environment

The following sections provide a comparison between the existing noise environment and the predicted noise levels following the development of the stadium.

3.1 Noise due to Stadium operations

The PoSS noise assessment provides detailed noise modelling and results of the Stadium operations. Through the course of subsequent design phases, there has been refinement to the Stadium facade, including reduction of facade openings, which has resulted in a reduction of noise emission levels. The results of the noise modelling for the updated Stadium model and its operations are presented in Table 9.

Additional modelling has been undertaken for the residential receptors in Rosny and Bellerive. Noise contours for operational noise associated with the Stadium have been provided in Appendix A.

The noise model has considered all habitable levels of the noise sensitive receptors and the presented noise levels are for the worst-case for each receptor. An additional set of façade noise maps has been provided in Appendix B, which illustrate how the predicted levels change with height.

Table 9: Predicted Environmental Noise Levels

Receptors	Predicted Noise Levels (External)									
	Concerts L _{eq} , dB(A) ²	PA System L _{eq} , dB(A)	Sirens L _{max} , dB(A)	Crowd Noise (In Bowl) L _{eq} , dB(A)	Patrons Arriving / Departing L _{eq} , dB(A)	Patrons at F&B L _{eq} , dB(A)	Bus Plaza L _{eq} , dB(A)	Permanent Building Services L _{eq} , dB(A)	Temporary Generators L _{eq} , dB(A)	Loading Dock and Waste Collections L _{eq} , dB(A)
R1	58 – 76	56	67	53	47	39	Negligible	31	Negligible	32
R2	54 – 73	53	64	49	41	40	Negligible	31	Negligible	22
R3	63 – 81	65	76	61	40	44	Negligible	38	37	28
R4	57 – 75	56	67	52	34	38	Negligible	25	31	23
R5	57 – 74	55	66	51	30	36	Negligible	27	26	21
R6	53 – 73	53	63	48	36	39	Negligible	30	Negligible	23
R7	61 – 78	59	71	55	31	35	Negligible	22	Negligible	20
R8	57 – 74	54	65	50	33	41	Negligible	27	Negligible	28
R9	53 – 71	50	61	46	26	36	Negligible	23	Negligible	Negligible
R10	55 – 73	53	64	49	31	42	Negligible	22	Negligible	26
R11	55 – 72	52	63	48	27	40	Negligible	Negligible	Negligible	20
R12	53 – 71	44	54	39	Negligible	31	33	Negligible	Negligible	Negligible
R13	62 – 78	58	68	54	30	51	29	Negligible	Negligible	35
R14	55 – 73	54	67	51	28	38	Negligible	20	Negligible	24
R15	56 – 74	54	67	50	25	33	Negligible	Negligible	Negligible	Negligible
R16	49 – 67	45	56	41	25	33	Negligible	21	Negligible	Negligible
R17	53 – 71	49	60	45	26	35	Negligible	Negligible	Negligible	22
R18	53 – 71	49	60	45	25	34	Negligible	21	Negligible	20
R19	46 – 64	46	58	42	Negligible	28	Negligible	Negligible	Negligible	Negligible
R20	43 – 61	43	56	38	Negligible	23	Negligible	Negligible	Negligible	Negligible

Comparison to Existing Noise Environment										
Comments	Music noise from rock concerts (worst case) would be audible over the existing ambient level and be the dominant noise source in the vicinity of the Stadium during concerts. Music levels would be less noticeable for mid-intensity concerts (pop, RnB) due to high existing traffic noise levels.	Noise from the PA system would likely be just noticeable for receptors adjacent to the Stadium. The use of PA system is intermittent in nature. The continuous traffic noise would likely still be the dominant noise source.	Sirens would be clearly audible over the existing ambient noise levels. However, it is comparable to a cruise ship's foghorn during departure and arrival. With cruise ships, multiple arrivals and departures would occur throughout the week. The game sirens would only occur on game days.	It would likely be just noticeable for receptors adjacent to the Stadium. The continuous traffic noise is expected to still be the dominant noise source.	The predicted levels are below the measured existing ambient noise levels. They are unlikely to be noticeable for the majority of the receptors except the apartments directly across Evans Street.	Patron noise will be limited to the Southern Plaza and is unlikely to be noticeable for the majority of the receptors.	The predicted levels are significantly lower than the existing ambient levels. Unlikely to be noticeable and be further mitigated through practical management controls.	Unlikely to be noticeable over the existing ambient noise levels. Noise mitigations to the services plant will be designed and implemented.	Unlikely to be noticeable over the existing ambient noise levels. Practical management controls and mitigation can be implemented as necessary.	The loading dock is located internally within the Stadium. Noise levels from trucks on public roads are unlikely to be noticeable over existing ambient levels.

Note:

1. Where results are noted as negligible, it indicates that the predicted level is less than 20 dB(A), which is not noticeable above background noise
2. Concert music noise levels are presented as a range, representing a potential worst-case scenario for a rock concert and mid-intensity concerts with lower music levels.
3. Operations from the bus plaza, permanent building services, temporary generators, loading dock and waste collections are predicted to comply with the TAS EPA Noise environment indicator levels with noise controls designed accordingly.

Comparing the predicted RHH helicopter noise levels with the potential Stadium operation noise levels, the helicopter noise would still be the dominant noise source during flyby events.

The predicted helicopter noise levels are more than 10dB higher than the predicted worst-case concert noise levels.

4.0 Construction Noise Assessment

The following sections provide a high-level assessment of potential noise due to the construction of the Stadium.

4.1 Applicable Guidelines

MPDC has previously engaged Hanson Associates to prepare a Construction Noise and Vibration Management Plan (CNVMP), ref R02 dated 10 October 2024. The CNVMP utilises the NSW Department of Environment and Climate Change Interim Construction Noise Guideline (ICNG) 2009.

The ICNG provides guidance on how a quantitative assessment should be conducted and provides construction noise management levels (NML) for various receptors.

Table 10 sets out the management level for noise at residences and how they are to be applied. Table 11 provides management levels for other sensitive land uses.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).

As a guide, the difference between the internal and external noise levels is typically 10 dB with windows open for adequate ventilation.

Table 10 ICNG Noise Management Levels (Residences)

Time of day	Management level L_{Aeq} (15min)	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. - The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. - Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Table 11 ICNG Noise Management Levels (Other Sensitive Uses)

Land Use	Management Level, $L_{Aeq}(15min)$ (applies when properties are being used)
Classrooms at schools and other education institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

4.2 Noise Management Levels

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories. The external noise levels should be assessed at the most-affected occupied point of the premises:

- industrial premises: 75 dB $L_{Aeq}(15 min)$
- offices, retail outlets: 70 dB $L_{Aeq}(15 min)$
- other businesses that may be very sensitive to noise are discussed below.

The CNVMP has undertaken a separate body of work to identify the specific sensitivities of operations critical to the Tasmanian Symphony Orchestra (TSO).

The performance, recording and rehearsal spaces in the TSO facilities have been identified as having a heightened sensitivity to noise that is not suitably reflected by the broad noise management level guidance in the ICNG.

Project-specific NMLs for these spaces have been derived from baseline noise monitoring conducted within those spaces (refer to AEN Advisory and Design Services Report R01 dated June 2024).

Project NMLs for various receptors have been derived based on previous noise monitoring conducted on site by MPDC. They are summarised in Table 12.

Table 12 Project Noise Management Levels

Receptor Type	NML, dB $L_{Aeq}(15min)$
Residential	
Residences in the suburb of Glebe	55 (external)
Evans Street (Zero Davey Apartments, the Sullivans Cove Apartments and the IXL Apartments)	62 (external)
Hotel Grand Chancellor	61 (external)
Henry Jones Art Hotel	55 (external)

Receptor Type	NML, dB L _{Aeq} (15min)
Other sensitive land uses	
Classrooms at schools and other educational institutions: UTAS School of Creative Arts and Media	45 (internal)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation): Cenotaph	60 (external)
Industrial Premises: TasPorts Macquarie Wharf	75 (external)
Offices, Retails Outlets: All Davey Street, Hunter Street, Evans Street commercial premises, including TSO general office Evans Street South Side mixed residential / commercial	70 (external)
Project Specific High Sensitivity Receivers¹	
Federation Hall (music concert / rehearsal)	dBLA _{max} 30 (internal)
Federation Hall (conference, HGC functions), TSO Studio, ABC audio mastering room	30 (internal)

Note 1: the TSO spaces are included here for completeness but are not included in this high-level assessment, they will be addressed in a separate report.

4.3 Noise Modelling Methodology

The following sections describe the methodology adopted to model the potential noise impact from the construction of the proposed Stadium.

4.3.1 Noise Model

Modelling was conducted using SoundPlan Version 8.2 environmental noise modelling software, which implements the CONCAWE prediction methodology. The CONCAWE method was chosen to enable the worst-case meteorological conditions noted in Modelling Inputs, Assumptions and Limitations be applied to the prediction model.

The following propagation effects were included in the noise model:

- Attenuation of noise with distance, including geometrical spreading and air absorption
- Reflections from buildings and other acoustically-reflective structures
- Barrier effects due to obstructions between noise sources and residential receptors
- Ground absorption
- Local topographical changes
- Meteorological conditions

4.3.2 Modelling Inputs, Assumptions and Limitations

The inputs and assumptions used in the acoustic model are detailed in Table 13.

Table 13 Noise Modelling Inputs and Limitations

Inputs	Comment
Inputs	The following inputs were included in the noise model: • Construction program provided by MPDC • Possible roof erection sequence dated 16 Dec 2024 • Macquarie Point Stadium Construction Management Plan August 2024 Based on the above, construction fleets, works locations and noise levels were developed by AECOM.

Inputs	Comment
Topography	A mixture of supplied survey and internet sourced data was used to determine the topography of the assessment area: - Survey: 306246 D01 R0 Macquarie Point (MGA2020 GRID).dwg - Elvis - Elevation and Depth (elevation.fsdf.org.au)
Receptor Locations	Noise sensitive buildings were identified via Nearmap and Google Earth aerial studies of the project site, and via a site visit on 13 June 2024. The predicted noise level for each receptor was calculated at a height of 1.5 metres above each habitable level, and one metre from the centre of the most exposed façade.
Ground absorption	Ground absorption has been assumed as follows: - An absorption coefficient of 0.0 (hard ground) has been assumed for residential and built-up areas. - An absorption coefficient of 0.5 (medium soft ground) has been assumed for parks. - An absorption coefficient of 0.0 (hard ground) has been assumed for water surface
Rounding	Noise levels are rounded to the nearest whole number.
Meteorological Conditions	Worst-case meteorological conditions have been assumed for the assessment: - Pasquil stability class F - Wind speed of 3m/s blowing directly from sources to receivers This represents a worst-case scenario for the acoustic modelling in which the noise is carried by the wind from the source to the receptor direction constantly. Increasing the wind speed above 3m/s in the noise model would not change the predicted results. Based on the historical data for the Hobart climate, this condition could be experienced more than 50% of the time throughout the day. However, it should be noted that in reality only receptors in the downwind direction are affected, whilst the assessment assumes all receptors are affected regardless of wind directions.
Building data	The building data has been provided by AECOM GIS team, the data is based on the existing Lidar of the area.

4.3.3 Modelling Scenarios

The Project proposes a construction period for the Stadium of up to 42 months between the hours of 7am to 6pm Monday to Friday and 8am to 3pm Saturday.

Table 14 presents the indicative construction program for the Project.

Table 14 Stadium Indicative Construction Activity Schedule

Stage	Construction Month													
	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	27-30	30-33	33-36	36-39	39-42
Bulk Excavation														
Piling														
Substructure														
Roof Structure														
Stand Construction														
Façade and Fitout														
Ground Playing Areas														

The construction equipment and associated noise levels for each construction stage are shown in Table 15. The equipment noise levels were based on the following references:

- AECOM Database for fixed and mobile plant,
- AS2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*,
- BS 5228-1:2014 *Code of practice for noise and vibration control on construction and open sites - Part 1: Noise*, and
- Manufacturer specifications.

The highest sound power level noted in the table is not a sum of all plant identified within each phase, as not all plant would be located on-site at the same time and not all plant would be located within the same area at all times.

Table 15 Equipment Sound Power Levels for Construction Stages

Plant Type	Model / Detail	Quantity	Noise Level, L _{WA} dB	Highest Noise Level for Stage, L _{WA} dB
Bulk Excavation				
Excavator	20T	1	113	121 ¹
Excavator with Rock Breaker	20T	1	121	
Dump Truck	-	2	106	
Water cart	-	1	93	
Piling				
Bored Piling Rig	-	2	111	113
Excavator	20T	1	113	
Concrete Pump	-	1	106	
Concrete Agitator	-	1	103	
Substructure				
Excavator	20T	1	113	113
Backhoe	-	1	96	
Skid Steer Loader	-	1	107	
Concrete Pump	-	1	109	
Concrete Agitator	-	1	109	
Dump Truck	-	1	106	
Roof Structure				
Tower Crane	300T	4	106	106
Welding Equipment	-	2	93	
Hand tools	-	4	93	
Angle Grinder	-	2	102	
Stand Construction				

Plant Type	Model / Detail	Quantity	Noise Level, L _{WA} dB	Highest Noise Level for Stage, L _{WA} dB
Tower Crane	300T	4	106	110 ¹
Hand tools	-	4	93	
Impact drill	-	2	106	
Concrete Saw	-	1	110	
Power Trowel	-	1	97	
Concrete Pump	-	1	106	
Concrete Agitator		1	106	
Façade and Fitout				
Mobile Crane	-	2	109	109
Hand tools	-	4	93	
Impact Drill	-	2	106	
Angle grinder	-	2	102	
Ground Playing Areas				
Excavator	20T	2	113	113
Roller	-	2	113	
Dump Truck	-	2	106	
Hand Tools	-	2	93	

Note 1: In accordance with TfNSW Construction Noise and Vibration Guideline, the overall SWL has been increased by 5 dBA to account for special audible characteristics from rock breaking and concrete sawing.

The following worst-case construction noise scenarios have been developed based on the proposed construction program and equipment. The scenarios take into account the potential overlapping of construction stages and the cumulative impacts of the construction activities.

Table 16 Modelled Construction Scenarios

Construction Scenario (CS)	Included Stages
CS1	Bulk Excavation Piling
CS2	Piling Substructure Stand Construction
CS3	Roof Structure Stand Construction Façade and Fitout
CS4	Roof Structure Façade and Fitout
CS5	Façade and Fitout Ground Playing Areas

For each scenario, construction works were modelled as occurring across the expected work area such that the highest predicted noise level for works in any location in the modelled work area could be determined for each noise-sensitive location.

For Construction Scenario 5, it is assumed that the stadium envelope will provide a barrier effect from construction works to surrounding receptors. As such, the built form has been included in the noise model.

4.4 Noise Modelling Results

Table 18 presents predicted noise levels and compares them to the Noise Management Levels (NML) for the identified receptors.

In addition, noise levels have been rated in accordance with Table 9 of the Transport for NSW *Construction Noise and Vibration Guideline* (CNVG). Whilst the CNVG is not specifically referenced in the CNVMP, it provides a good reference in regard to the likely noise impact on the receptors.

Noise level ratings are based on the predicted noise levels relative to the NMLs, as follows.

Table 17 Noise Level Ratings

Font Colour	Description	Noise Level
	Noticeable	At NML
	Clearly Audible	10 dB above NML
	Moderately Intrusive	10-20 dB above NML
	Highly Intrusive	More than 20 dB above NML
	Highly Noise Affected	> 75 dB(A)

If the predicted noise levels are not coloured, the predicted levels are below NML.

Table 18 Indicative Noise Levels from Construction Scenarios

Ref	Receptor	NML dB(A)	CS1	CS2	CS3	CS4	CS5
Residential Receptors							
R1	Sullivans Cove Apartments	62	87	74	74	68	54
R2	Zero Davey Boutique Apartments	62	83	74	70	64	52
R4	MACq 01 Hotel	55	68	66	47	41	37
R5	IXL, Henry Jones Hotel	55	64	63	49	45	43
R7	Hotel Grand Chancellor	61	72	61	61	55	54
R8	7 Macquarie Street apartments	61	75	56	63	57	45
R9	The Old Woolstore Apartment Hotel	61	66	55	55	51	39
R14	One Collins Apartment	61 ¹	68	53	57	51	47

Ref	Receptor	NML dB(A)	CS1	CS2	CS3	CS4	CS5
R16	Residential Apartments (1 Creswells Row)	61 ¹	67	43	46	40	36
R17	Tramway on Collins Apartments (1-9 Ragged Lane)	61 ¹	55	43	43	37	36
R18	Residential Apartments (1-15 Terminus Row)	61 ¹	50	39	39	33	36
Non-residential Receptors²							
R3	University of Tasmania School of Creative Arts and Media	45 (Internal)	89	69	74	68	52
R6	Federation Concert Hall (Tasmanian Symphony Orchestra) ³	30 (internal)	79	63	67	61	50
R10	Baha'i Centre of Learning	45 (Internal)	71	55	59	53	44
R11	ABC Broadcast Centre	30 (Internal)	68	54	56	50	43
R13	Royal Hobart Regatta Grounds (The Cenotaph)	60	73	53	62	56	57
R15	Royal Hobart Hospital	45 (Internal)	66	53	55	49	54
Comparison to Existing Noise Environment							
Comments			This is expected to be the loudest stage of construction due to rock breaking, which could last up to a month. The noise environment would be highly impacted during this stage of the construction.	The receptors adjacent to the Stadium will be the most impacted due to the works associated with the substructure and stand. Receptors further away would receive lower noise impact due to shielding from buildings in front.	These stages involve up to four cranes operating. The noise is expected to travel further due to the source height. However, noise levels are not expected to exceed ambient levels significantly except for receptors directly adjacent to the Stadium. The noise impact at this stage of construction is limited to local areas surrounding the Stadium.		The building structure and façade would provide significant noise attenuation for internal construction works. As such, noise levels during this stage are not expected to be noticeable over the existing ambient levels.

Note 1: NMLs for these receptors have not been included in the CNVMP. They are based on NML of the nearest receptor (Hotel Grand Chancellor).

Note 2: For non-residential receptors with an internal NML, additional assessment of the building façade performance should be conducted by the contractor to determine the actual noise impacts on internal spaces.

Note 3: A separate assessment will be undertaken to address the construction noise impact to internal spaces of the TSO.

4.5 Mitigation Measures

The CNVMP provides guidelines on potential noise mitigation, monitoring procedures, community engagement and a complaints procedure.

In addition, the Managing Contractor for the Project is expected to develop a comprehensive Construction Noise and Vibration Management Plan (CNVMP) specific to the construction methodology and program of works for the Stadium.

The CNVMP shall include appropriate protocols for managing construction noise and vibration. The following mitigation measures are recommended to be adopted by the contractor:

- Community notification and engagement
- Project specific noise management measures
- Site inductions and behavioural practices
- Scheduling and respite of works
- Selection of quieter construction methods or equipment
- Non-tonal reversing alarms
- Noise monitoring and model verification
- Noise barriers

Based on the predicted levels presented in Table 18 and guidance provided in the CVNMP and TfNSW Construction Noise & Vibration Guideline, the following indicative noise mitigation measures have been developed. These are to be used as a guide, and should be reviewed and expanded during the development of the comprehensive CNVMP.

Table 19 Indicative Noise Management Measures for Construction

Working Hours	Construction Scenario	Included Stages	Periodic Notification	Verification Noise Monitoring	Specific Notification
			Receptors > 20 dB(A) above NML	Receptors > 10-20 dB(A) above NML	Receptors > 75 dB(A)
Standard Hours Monday-Friday 7am-6pm Saturday 8am-3pm	CS1	Bulk Excavation Piling	R1, R2, R4, R6, R7, R8	R1, R2, R4, R6, R7, R8	R1, R2, R3, R6
	CS2	Piling Substructure Stand Construction	R1, R2, R4, R6	R1, R2, R4, R6	Nil
	CS3	Roof Structure Stand Construction Façade and Fitout	R1, R6	R1, R6	Nil
	CS4	Roof Structure Façade and Fitout	R6	R6	Nil
	CS5	Façade and Fitout Ground Playing Areas	R6	R6	Nil

Table 20 presents indicative actions that may be undertaken for the identified receptors based on the suggested management measures provided in Table 19.

Table 20 Indicative Actions under each Noise Management Measure

Action	Management Measures
Periodic Notification	A notification is produced and distributed to stakeholders via letterbox drop or distributed to the Project postal and/or email mailing lists. Periodic notifications provide an overview of current and upcoming work across the Project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g., traffic changes or noisy works) can assist in reducing the impact on stakeholders. The approval conditions for projects specify requirements for notification to sensitive receivers where work may impact them.
Verification monitoring	Verification monitoring of noise during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended logging or operator attended surveys (i.e., for specific periods of construction noise). Verification must be undertaken by a suitably qualified, trained and experienced personnel using appropriate equipment and methodology, with reference to AS1055. The purpose of monitoring is to confirm that: • Construction noise from the Project is consistent with the predictions in the noise assessment. • Mitigation and management of construction noise is appropriate for receivers affected by the work. • Where noise monitoring finds the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required.
Specific Notification	Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. In addition to Specific Notifications and letters communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing. • Letters may be letterbox dropped, hand distributed or emailed. • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs. • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the Project. • Specific notifications are used to support periodic notifications, or to advertise unscheduled or high impact work and must be approved by authority prior to implementation/distribution. Where impacts have already been captured in a Periodic Notification, a Specific Notification may not be required

The noise management measures provided in Table 20 should be supported by implementing all feasible and reasonable practices to reduce construction noise impacts.

Table 21 provides guidance on standard noise mitigation measures developed from guidance provided in the CVNMP and the TfNSW Construction Noise & Vibration Guideline.

Table 21 Standard Noise Mitigation Measures for Construction

Action	Mitigation Measures
Implementation of any Project specific mitigation measures required.	In addition to the measures set out in this table, any Project specific mitigation measures identified in the comprehensive CNVMP or approval or licence conditions must be implemented.
Stakeholder engagement	Periodic notification (monthly letterbox drop/email and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. In addition to periodic notification, the following strategies may be adopted on a case-by-case basis: • Project-specific website • Project info line • Construction response line • Email distribution list • Web-based surveys • Social media • Community and stakeholder meetings
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics should be scheduled during less sensitive time periods.
Construction respite period	Noise with special audible characteristics (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise mitigation measures. • Relevant licence and approval conditions. • Permissible hours of work. • Any limitations on noise generating activities with special audible characteristics. • Location of nearest sensitive receivers. • Construction employee parking areas. • Designated loading/unloading areas and procedures. • Site opening/closing times (including deliveries). • Environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.
Plan worksites and activities to minimise noise	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Use quieter construction methods where feasible and reasonable. For example, when piling is required, use of bored piles rather than impact-driven piles will minimise noise impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise benefits.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work, including delivery vehicles.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur <i>as far as possible</i> from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever

Action	Mitigation Measures
	possible.
Construction related traffic	Schedule vehicle movements during less sensitive times and route them away from sensitive receptors. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.
Silencers on mobile plant	Where possible reduce noise from mobile plant through additional fittings including: • Residential grade mufflers • Damped hammers such as 'City' Model Rammer Hammers • Air Parking brake engagement is silenced.
Prefabrication of materials off-site	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.
Engine compression brakes	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.
Shield Stationary Noise Sources such as pumps, compressors, fans, etc.	Stationary noise sources should be enclosed or shielded wherever possible.

5.0 Summary

This report, prepared by AECOM for the Macquarie Point Development Corporation, serves as a supplementary assessment to the AECOM PoSS Noise and Vibration Assessment to address matters raised by the Tasmania Planning Commission (TPC). It provides additional analysis of the existing noise environment, potential noise impacts from stadium operations, and a high-level construction noise assessment.

The TPC comments are addressed in this report as follows:

- TPC comment 26: *Further analysis and evidence would assist to understand the effects of proposed uses on existing uses in the vicinity of the project site and proposed management and programming regimes relating to the proposed uses and their effects on surrounding uses (including effects relating to traffic, parking, noise and pedestrian movement) (section 7.0 of the Guidelines).*
 - Additional monitoring has been conducted to understand the existing noise environment, particularly the operation of the Macquarie Wharves, including the departure and arrival of cruise ships.
 - In the absence of measured helicopter noise from the Royal Hobart Hospital, a noise model has been constructed to understand the existing noise impact from the operation of the emergency helicopter to nearby receptors.
 - Provided additional commentary and analysis comparing the potential noise from the operation of the Stadium with the existing noise environment in the precinct.
 - A high-level construction noise assessment has been based on the preliminary construction program.
- TPC Comment 33: *Reports relating to noise should consider noise levels at all levels of multistorey buildings and include an analysis of whether receivers on the Eastern Shore should be considered in the assessment (section 8.4 of the Guidelines).*
 - Clarified that predicted operational noise levels in the PoSS report have considered multistorey buildings, and the presented levels represent the worst-case for each receptor.
 - Included additional sensitive receptors in the suburb of Rosny and Bellerive across Ross Bay.
 - Conducted additional noise modelling to include noise levels on multistorey building façades.

6.0 References

1. EPA Tasmania, Environment Protection Policy (Noise) 2009
2. EPA Tasmania, Noise Measurement Procedures Manual (NMPM), Second Edition, July 2008
3. Macquarie Point Development Corporation, Construction Noise and Vibration Management Plan, R02, 10 October 2024
4. NSW Department of Environment & Climate Change Interim Construction Noise Guideline, July 2009
5. Transport for NSW Construction Noise and Vibration Guideline, September 2023
6. Stadiums Tasmania, Macquarie Point Stadium, User Brief, Initial Draft April 2024
7. Tasmanian Government, Environmental Management and Pollution Control (Miscellaneous Noise) Regulations 2016
8. Tasmanian Government, Environmental Management and Pollution Control Act 1994
9. Tasmanian Planning Commission, Guidelines for the Project of State Significance, 16 February 2024

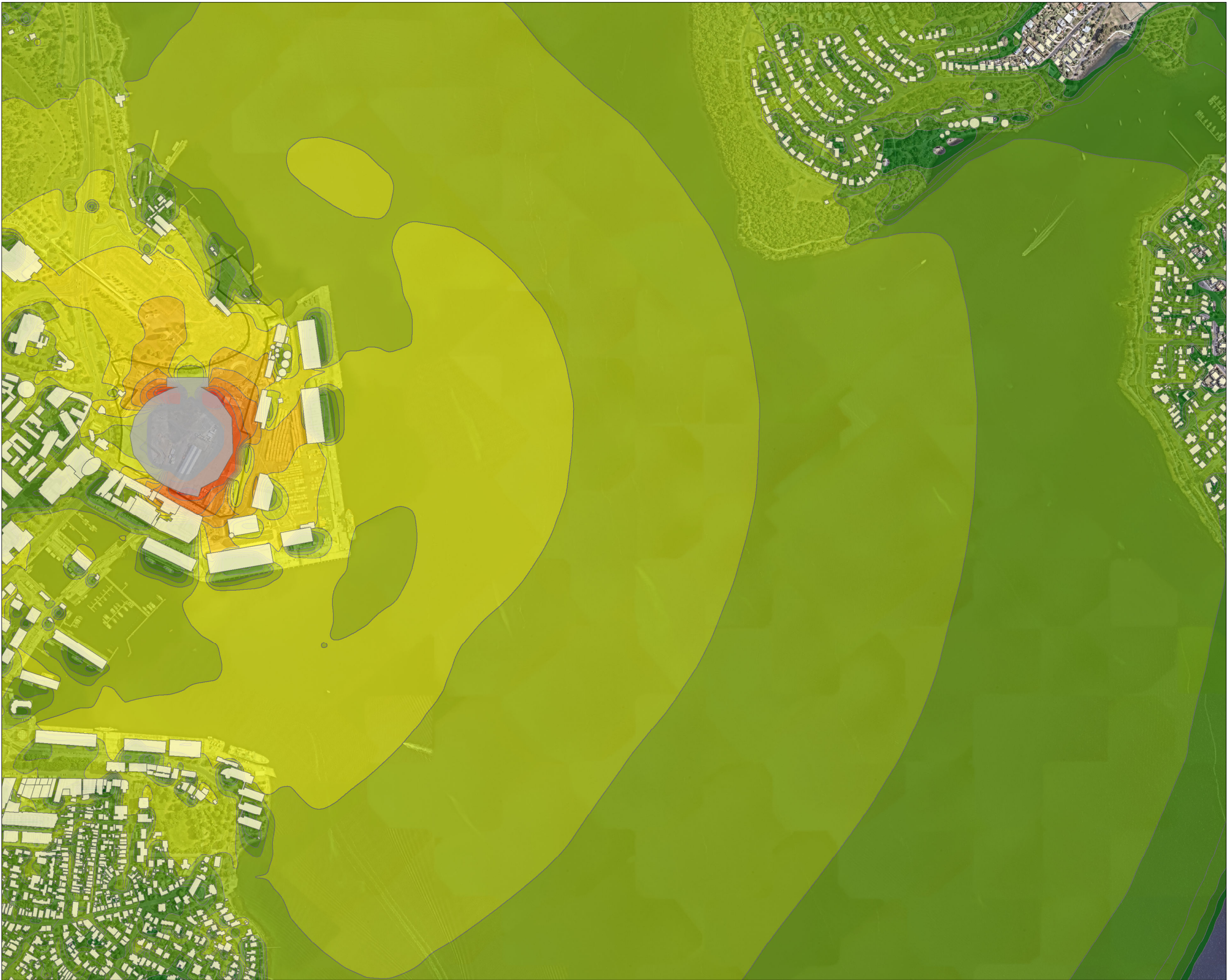
Glossary

Term	Definition																				
'A' Weighted	Frequency filter designed to adjust the absolute sound pressure levels to correspond to the subjective response of the human ear. The A-weighting filter emphasises frequencies in the speech range (between 1 kHz and 4 kHz) which the human ear is most sensitive to.																				
Ambient noise	The A-weighted equivalent continuous sound pressure level LAeq, is typically the descriptor used to describe ambient noise.																				
Decibel [dB]	The measurement unit of sound.																				
Decibel scale	A three decibel increase in the sound pressure level corresponds to a doubling in sound energy. An increase or decrease of three decibels is typically considered to be the smallest change in sound level that a listener can detect. A change of five decibels, however, is clearly noticeable. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. This increase is typically perceived to sound twice as loud. The table below shows the sound pressure level that would be typically experienced when exposed to different sources: <table> <tr> <td>0 dB</td><td>Threshold of human hearing</td></tr> <tr> <td>40 dB</td><td>Whisper in a library</td></tr> <tr> <td>50 dB</td><td>Open office space</td></tr> <tr> <td>60 dB</td><td>Normal conversation</td></tr> <tr> <td>70 dB</td><td>Inside a car on a freeway</td></tr> <tr> <td>80 dB</td><td>Outboard motor</td></tr> <tr> <td>90 dB</td><td>Heavy truck pass-by</td></tr> <tr> <td>100 dB</td><td>Pneumatic hammer</td></tr> <tr> <td>110 dB</td><td>Rock concert</td></tr> <tr> <td>120 dB</td><td>747 take off at 250 metres</td></tr> </table>	0 dB	Threshold of human hearing	40 dB	Whisper in a library	50 dB	Open office space	60 dB	Normal conversation	70 dB	Inside a car on a freeway	80 dB	Outboard motor	90 dB	Heavy truck pass-by	100 dB	Pneumatic hammer	110 dB	Rock concert	120 dB	747 take off at 250 metres
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80 dB	Outboard motor																				
90 dB	Heavy truck pass-by																				
100 dB	Pneumatic hammer																				
110 dB	Rock concert																				
120 dB	747 take off at 250 metres																				
LA90 (Background level)	The value of 'A'-weighted Sound Pressure Level which is exceeded for 90 percent of the time during a given measurement period. LA90 Sound Pressure Levels are commonly used to represent background noise levels. [Unit: dB]																				
LAeq	The 'A'-weighted Equivalent Continuous Sound Pressure Level which is the constant Sound Pressure Level that, for a given duration, would be equivalent in sound energy to the time-varying Sound Pressure Level measured over the same duration. LAeq Sound Pressure Levels are commonly referred to as the average Sound Pressure Level. [Unit: dB]																				
LAmix	The maximum 'A'-weighted Sound Pressure Level measured during a given time period. The LAmix would typically represent the maximum noise level occurring during short noise events such as a noisy truck passing. LAmix is a relevant descriptor in determining the likelihood of sleep disturbance and general annoyance.																				
Frequency [f]	Frequency is measured in Hertz (Hz). The frequency corresponds to the pitch of the sound: a high frequency to a high-pitched sound and a low frequency to a low-pitched sound.																				

Term	Definition
Octave band	The International Standards Organisation has agreed upon preferred frequency bands for sound measurement and the octave band is the widest band for frequency analysis. The upper frequency limit is approximately twice the lower frequency limit and each band is identified by its band centre frequency. Typical Octave Band frequencies for environmental noise assessments are: 31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz.
Sensitive receptor	Areas where the occupants, buildings or land use are potentially susceptible to the adverse effects of exposure to noise and vibration.
Sound Power Level	The sound power level (L_w) is a measure of the total acoustic energy emitted by a source. It is expressed in decibels (dB) and is a logarithmic measure of the sound power (P) relative to a reference sound power (P_0), typically set at 10^{-12} watts.
Sound Pressure Level	A measure of the magnitude of a sound wave (Unit: Decibels). Mathematically, it is twenty times the logarithm to the base ten of the ratio of the root mean square sound pressure at a point in a sound field, to the reference sound pressure; where sound pressure is defined as the alternating component of the pressure (Pa) at the point, and the reference sound pressure is 2×10^{-5} Pa.
Tonality	Noise is subjectively more annoying when it has a tonal component (a perceptible hum or whine). Tonality can be determined by subjective assessment or from one-third octave band analysis of the noise. Where a noise is tonal, an adjustment is made to allow for the additional annoyance caused by the tone.
Impulsive noise	Impulsive noise refers to short bursts of sound characterised by a sudden onset and a rapid decay, typically lasting less than one second. These sounds are often high in intensity and can be startling or disruptive due to their abrupt nature. Impulsive noises are generally distinct and easily recognisable from continuous or steady-state noises.
Intermittent noise	Intermittent noise is a type of sound that occurs at irregular intervals, characterised by periods of silence or significantly lower noise levels between louder noise events. Unlike continuous noise, which maintains a steady level over time, intermittent noise fluctuates, making it more variable and sometimes more disturbing.

Appendix A

Noise Contours for operational noise
associated with the Stadium



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

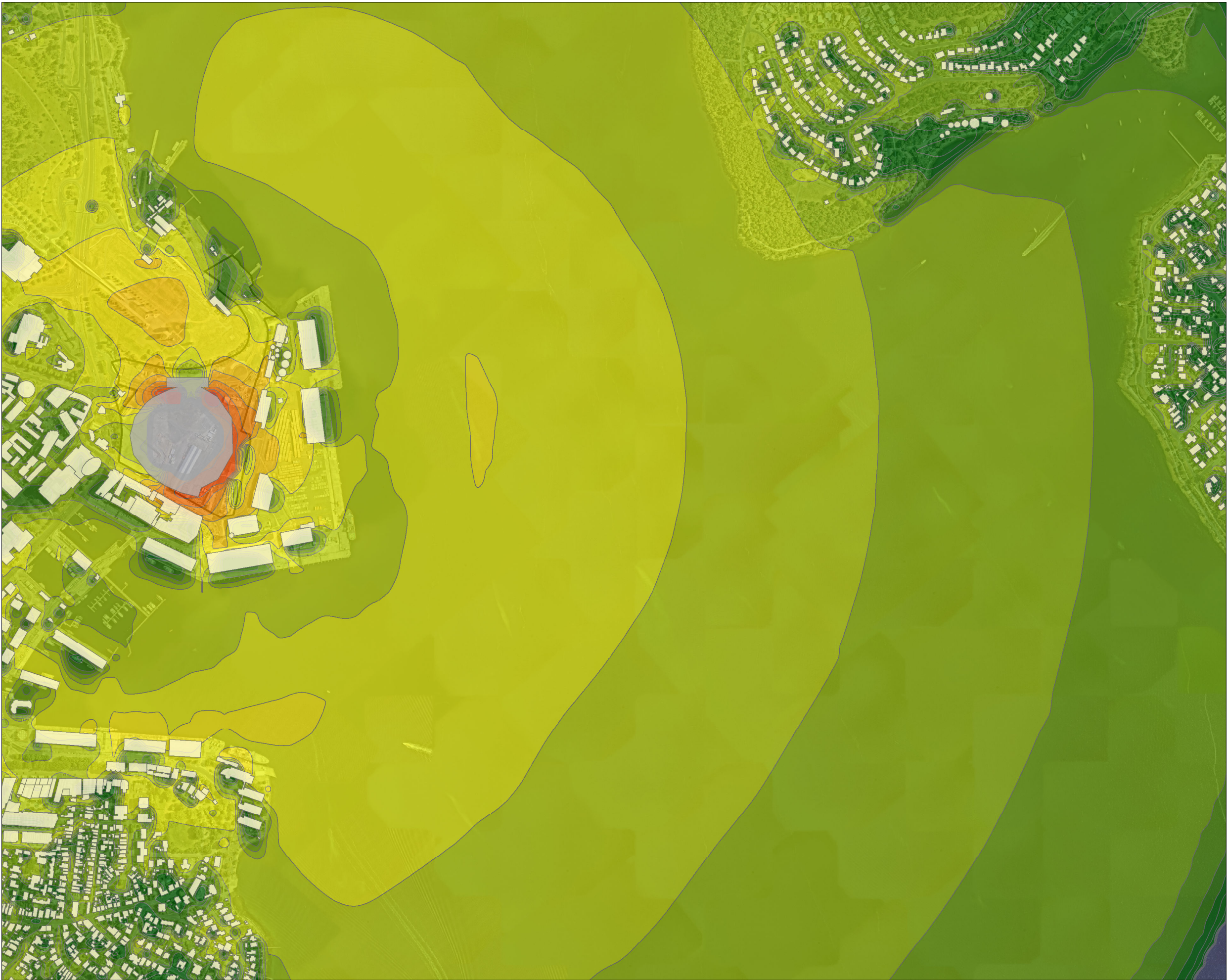
Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

PA Noise Contours

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Legend

-  MacPoint Stadium
-  Surrounding Buildings
-  Site Boundary

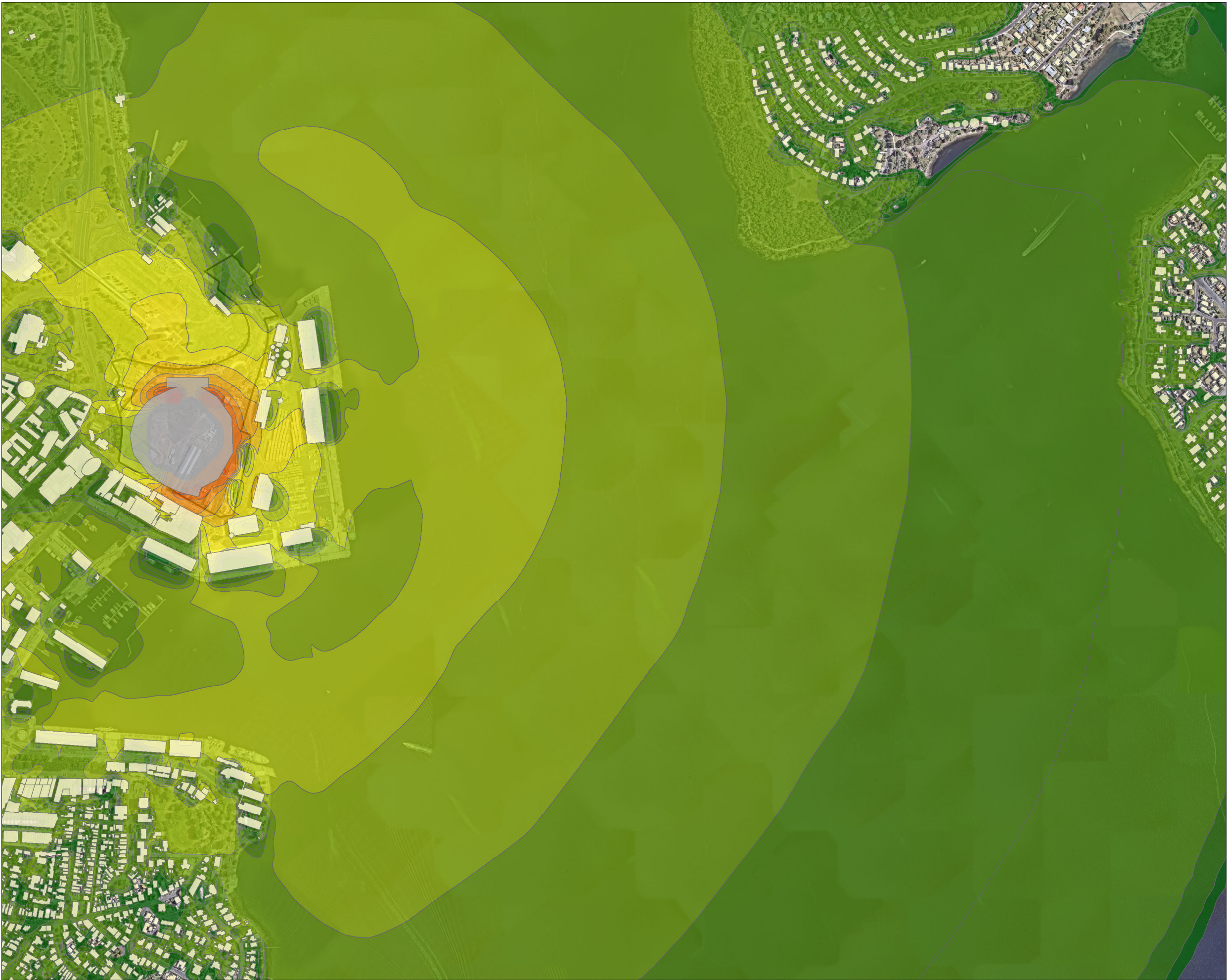
Predicted Noise Levels, Lmax dB(A)

-  < 45
-  45 - 48
-  48 - 51
-  51 - 54
-  54 - 57
-  57 - 60
-  60 - 63
-  63 - 66
-  66 - 69
-  69 - 72
-  72 - 75
-  75 - 78
-  78 - 81
-  > 81

Noise contours have been calculated at 2m above ground.

Siren Noise Contours

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

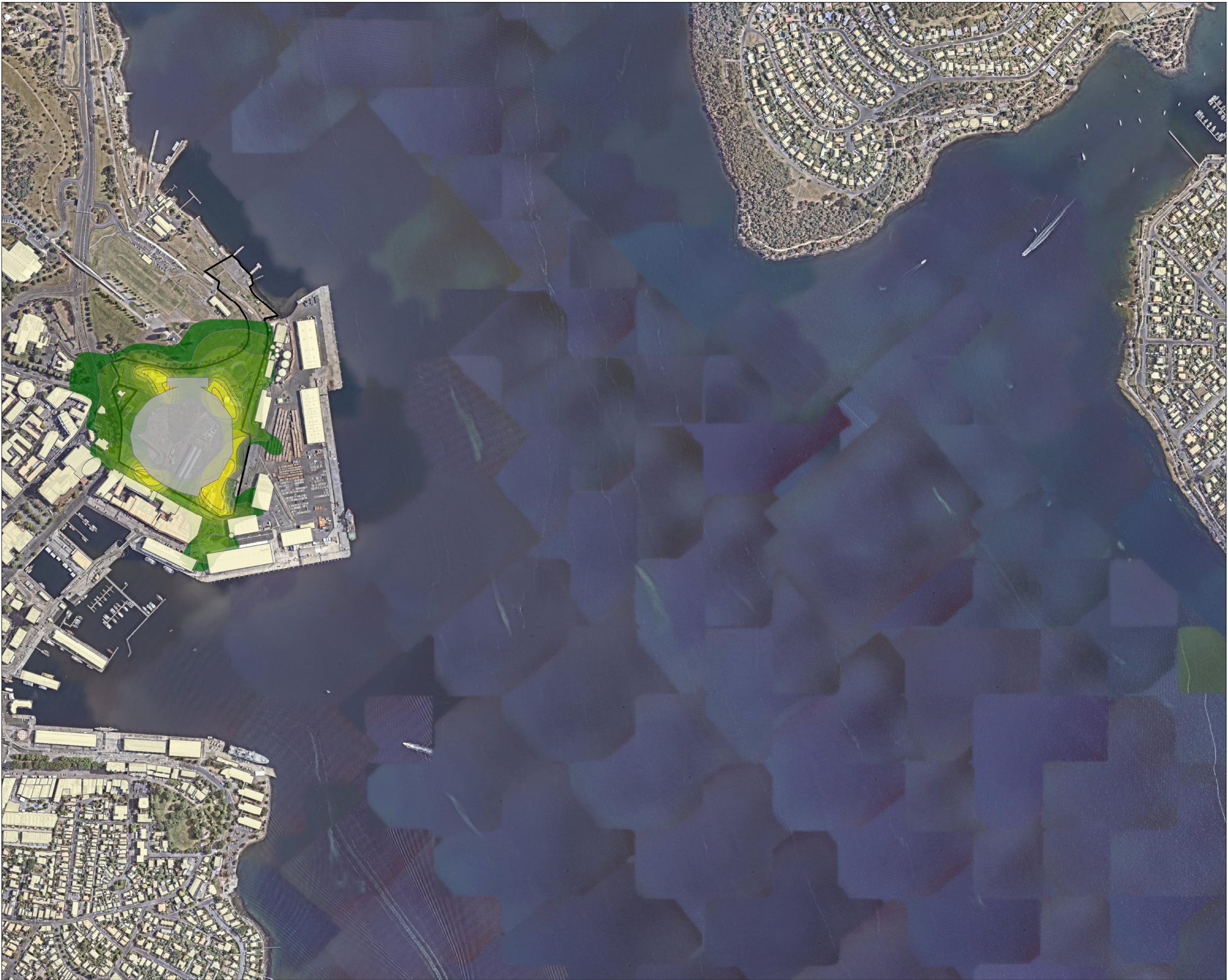
Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

Crowds Noise Contours

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

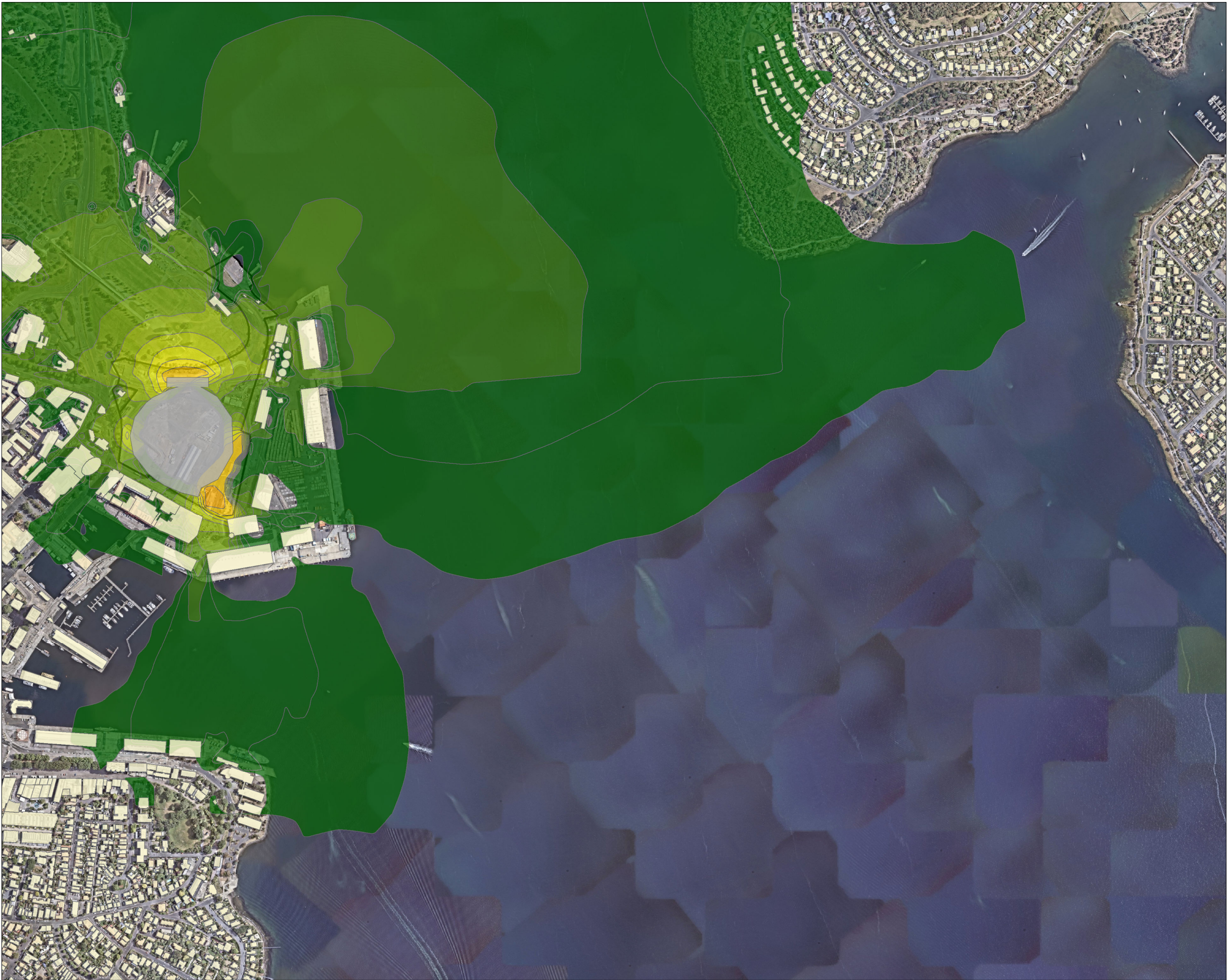
Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

**Patrons Arriving/Departing
Noise Contours**

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

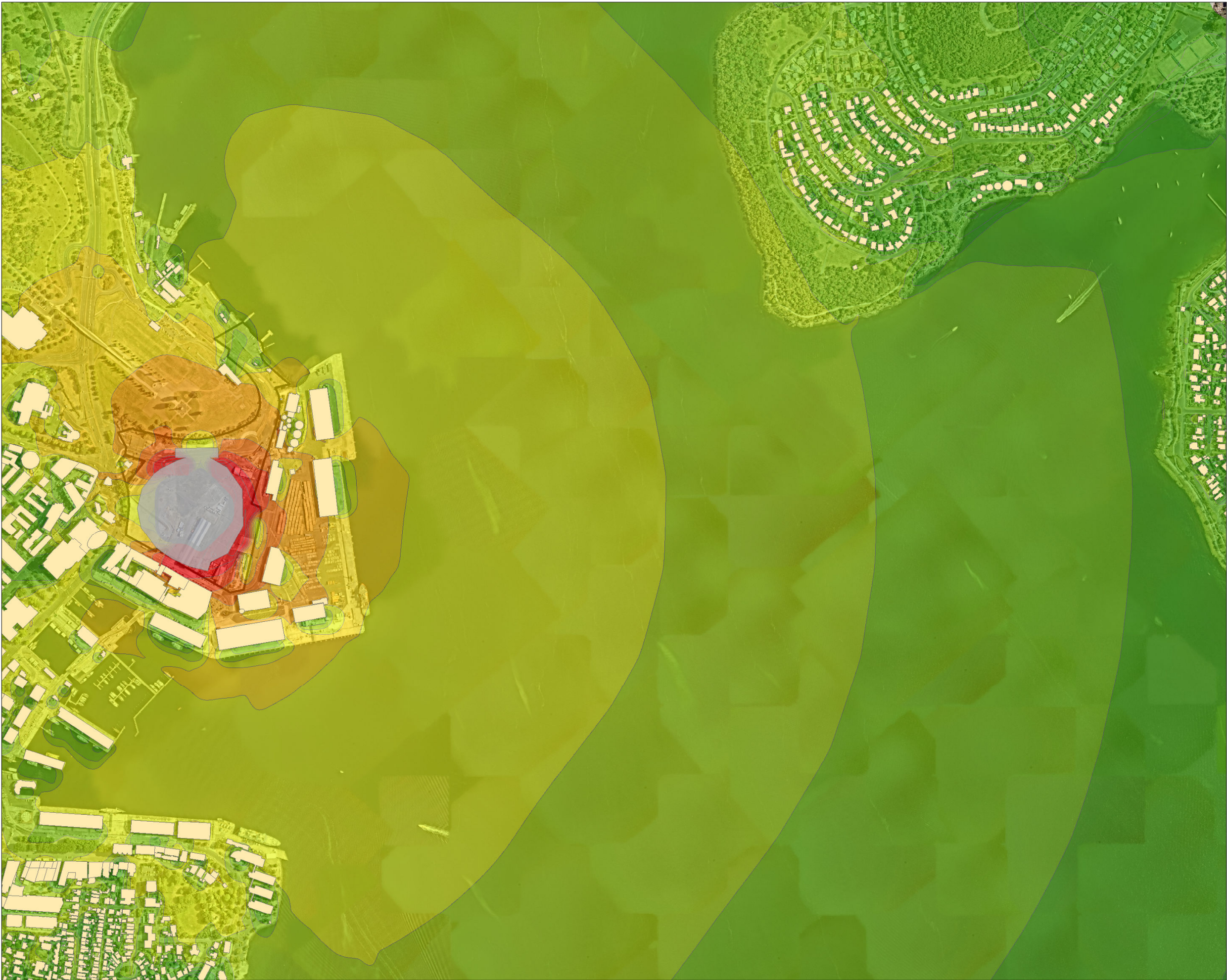
Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

**Patrons Outdoor Entertainment
Noise Contours**

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Legend

-  MacPoint Stadium
-  Surrounding Buildings
-  Site Boundary

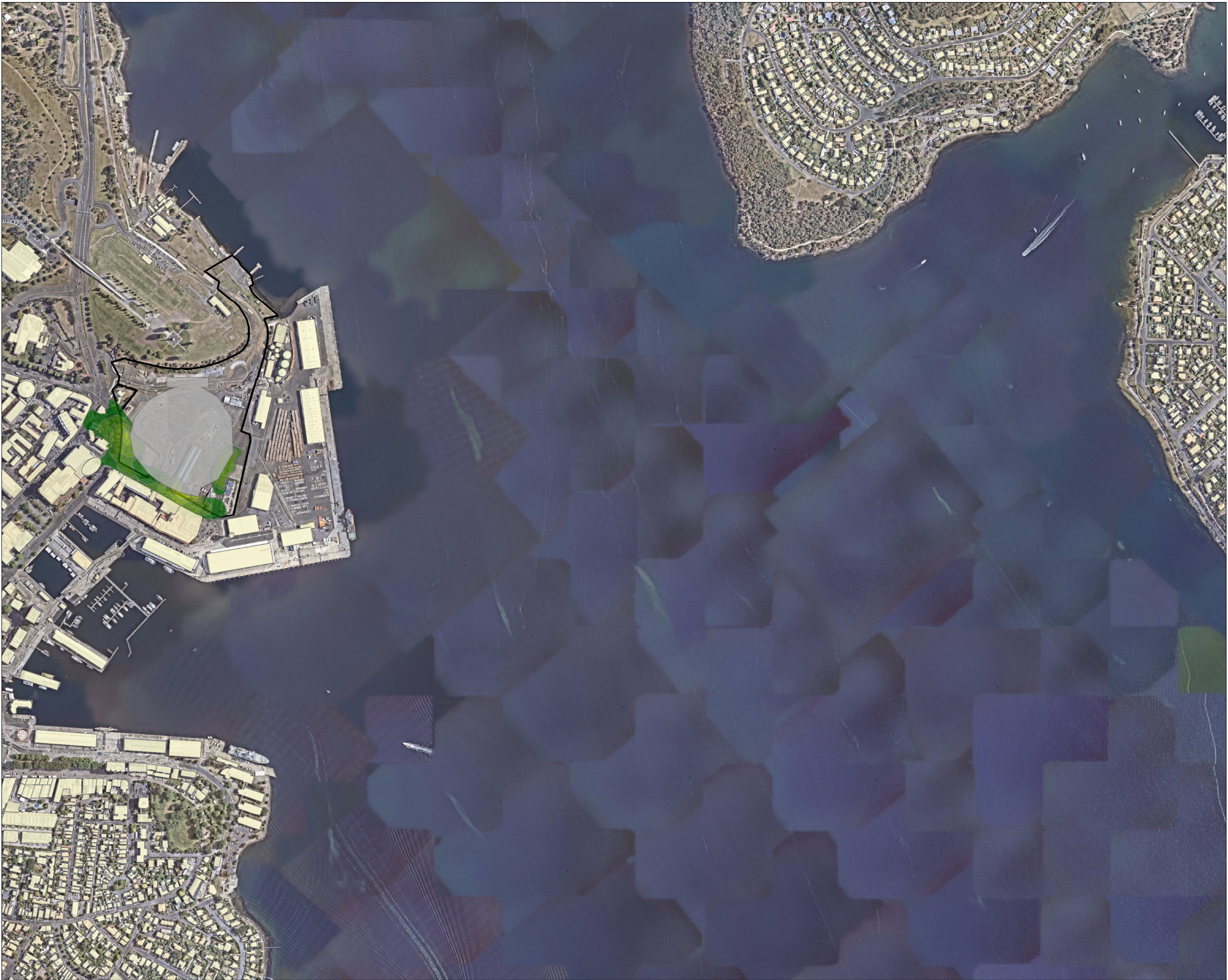
Predicted Noise Levels, Leq dB(A)

-  <57
-  57 - 60
-  60 - 63
-  63 - 66
-  66 - 69
-  69 - 72
-  72 - 75
-  75 - 78
-  78 - 81
-  > 81

Noise contours have been calculated at 2m above ground.

**Music Concert Noise Contours
(Potential worst-case scenario)**

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

Mechanical Noise Contours

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

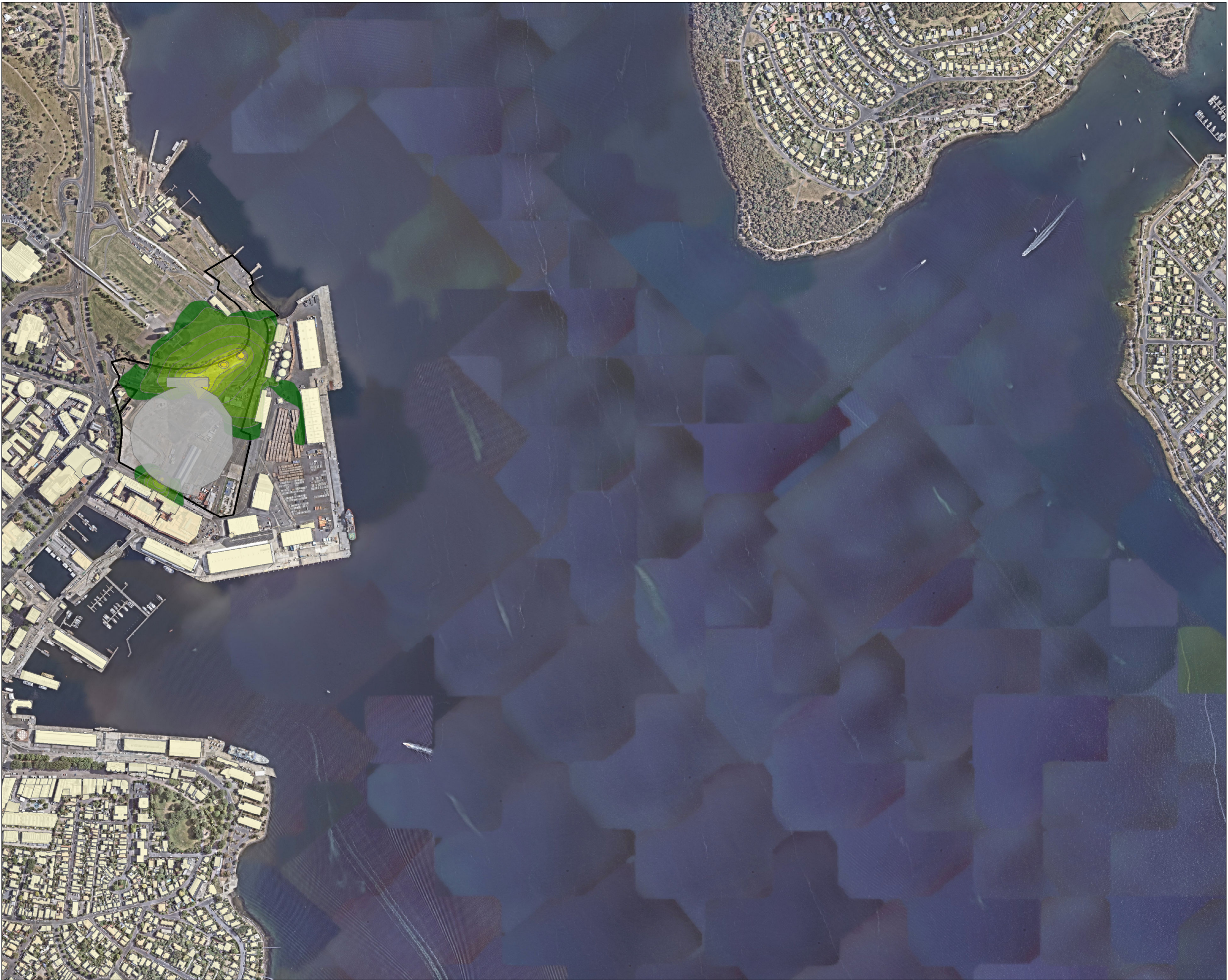
Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

Bus Hub Noise Contours

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

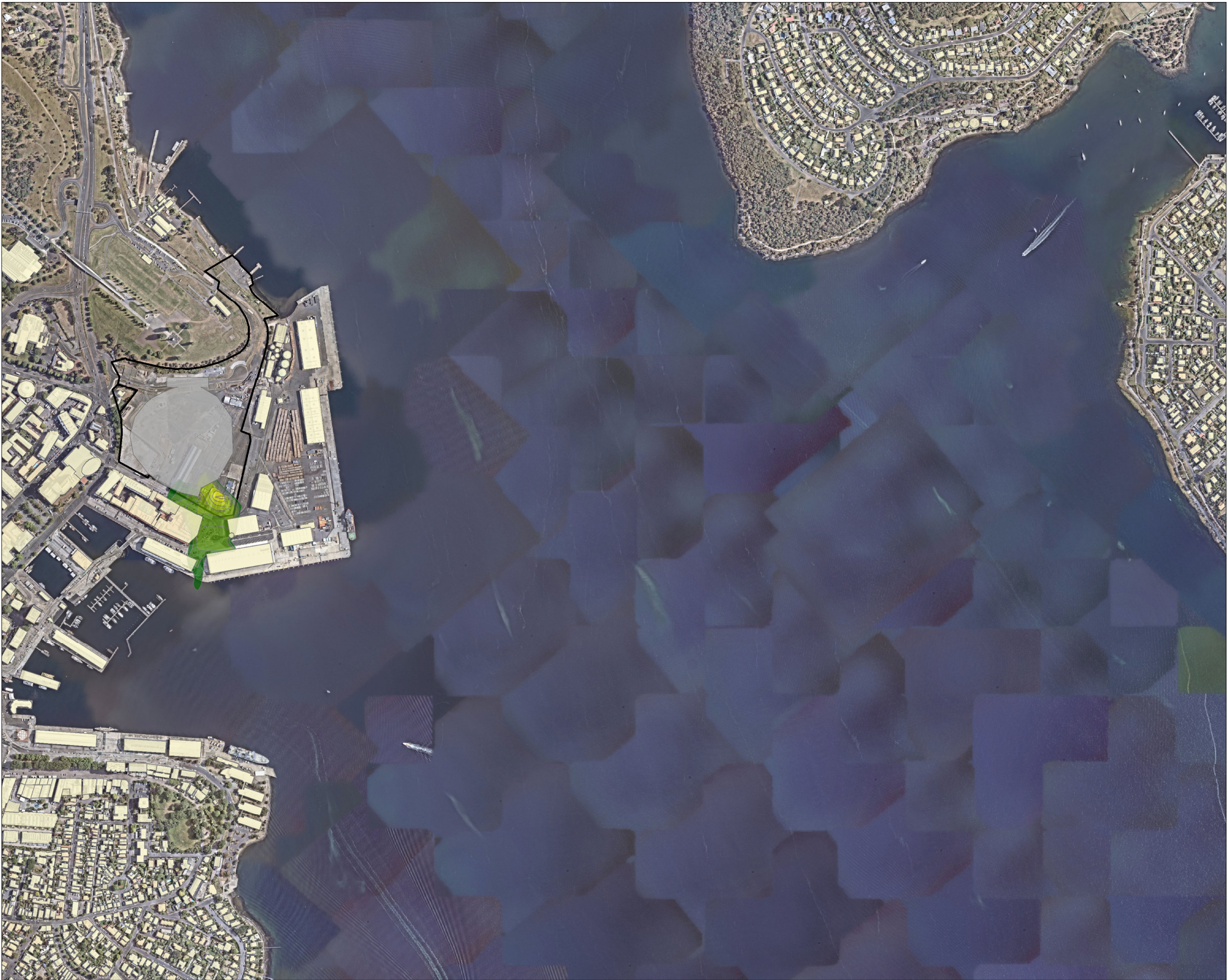
Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

Loading Dock Noise Contours

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

Predicted Noise Levels, Leq dB(A)

- < 30
- 30 - 33
- 33 - 39
- 39 - 42
- 42 - 45
- 45 - 48
- 48 - 51
- 51 - 54
- 54 - 57
- 57 - 60
- 60 - 63
- 63 - 66
- 66 - 69
- > 69

Noise contours have been calculated at 2m above ground.

Temp Gensets Noise Contours

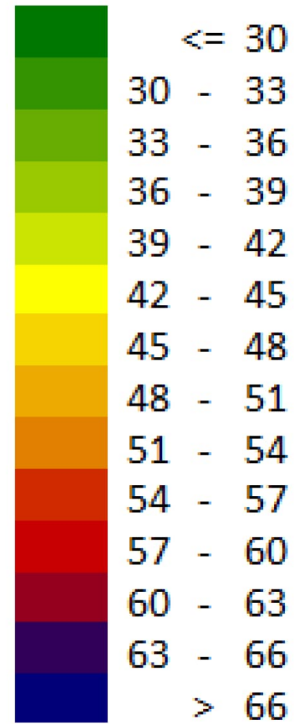
AECOM Australia Pty Ltd (AECOM) make no representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content. AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report.

Appendix B

Facade Noise Maps for operational
noise associated with the Stadium

Legend
MacPoint Stadium

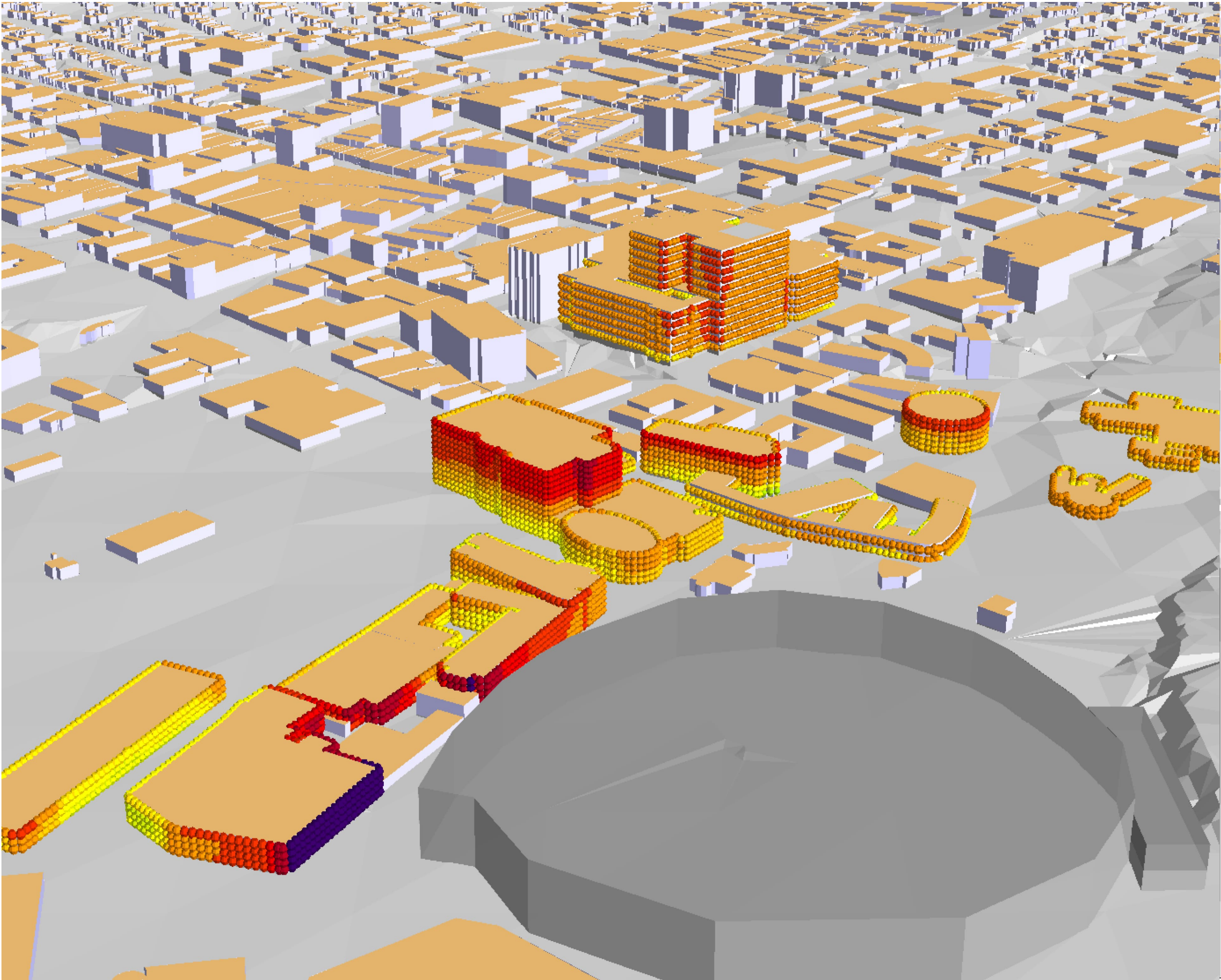
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

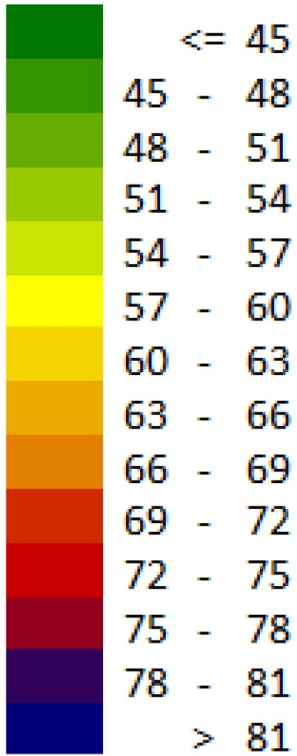
PA Noise Contours

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Legend
MacPoint Stadium

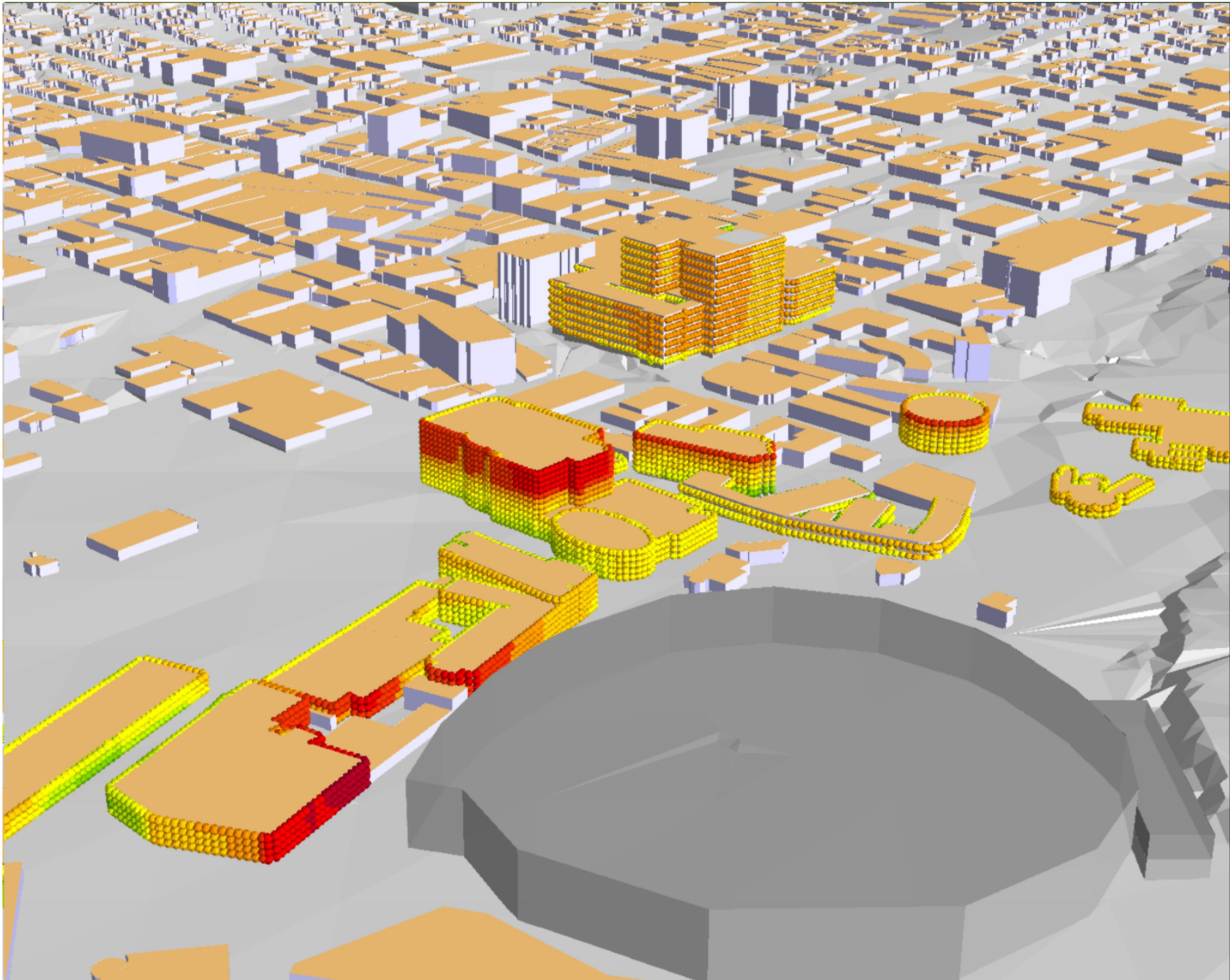
Predicted Noise Levels, Lmax dB(A)



The facade noise map is looking towards east of the Stadium

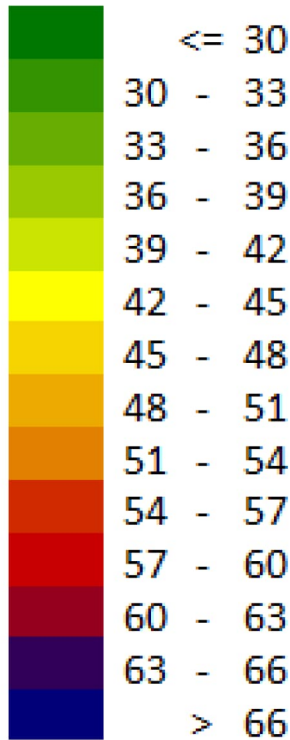
Siren Noise Contours

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Legend
MacPoint Stadium

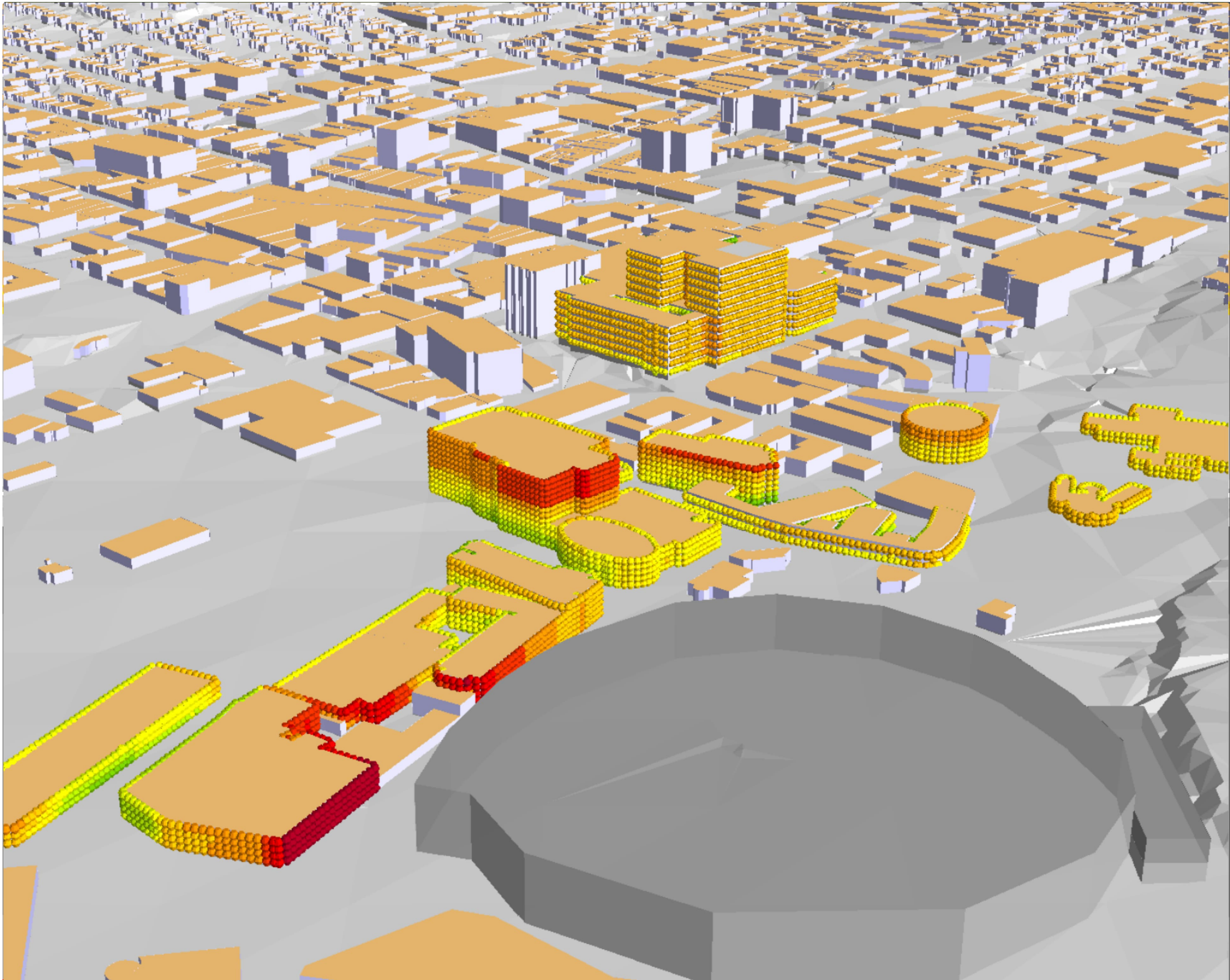
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

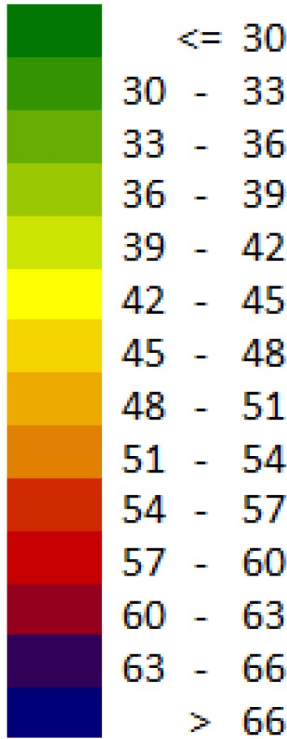
Crowds Noise Contours

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Legend
MacPoint Stadium

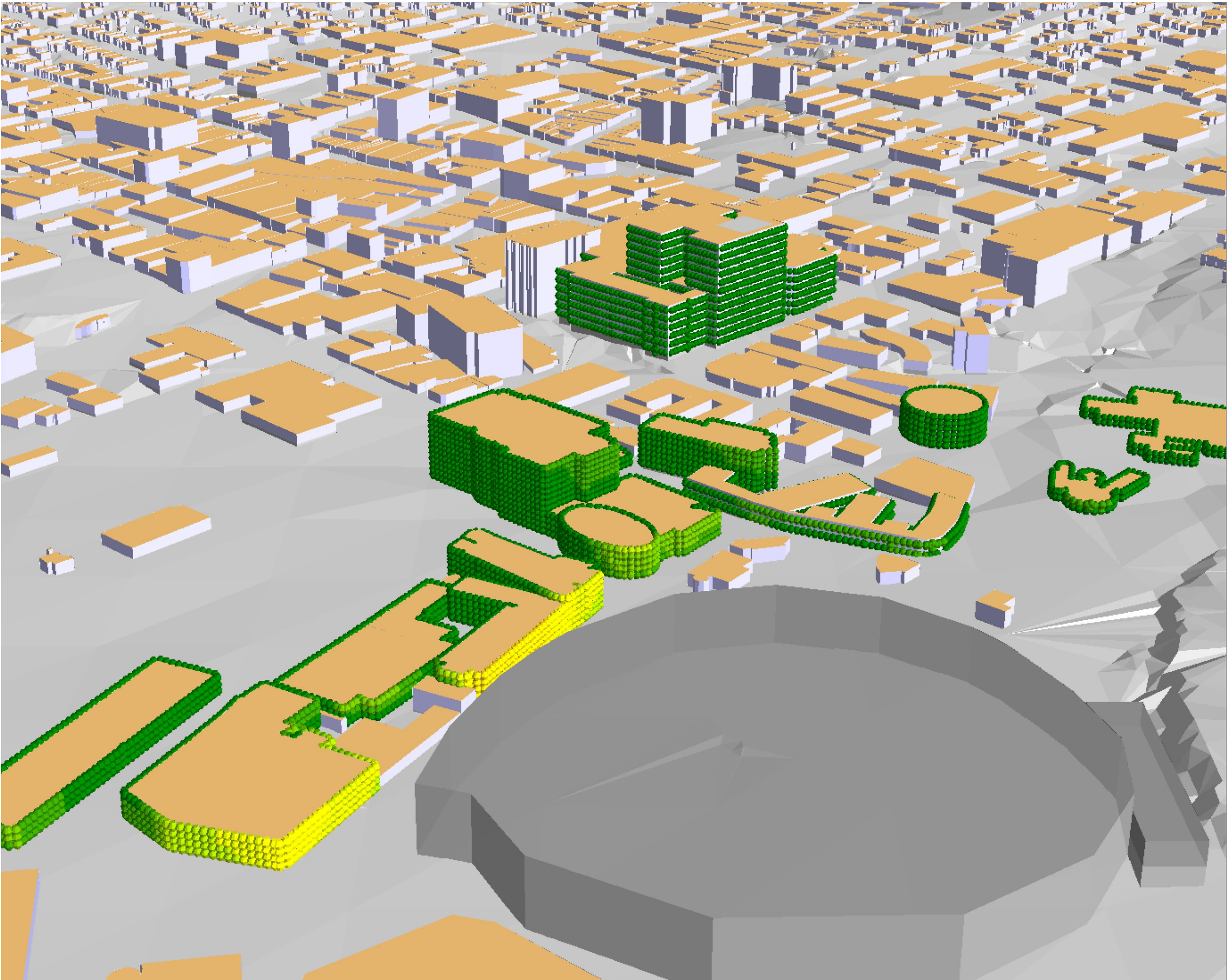
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

Patrons Arriving/Departing Noise Contours

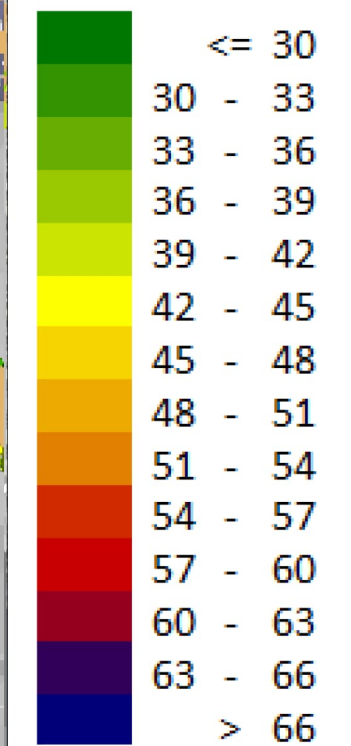
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Legend

MacPoint Stadium

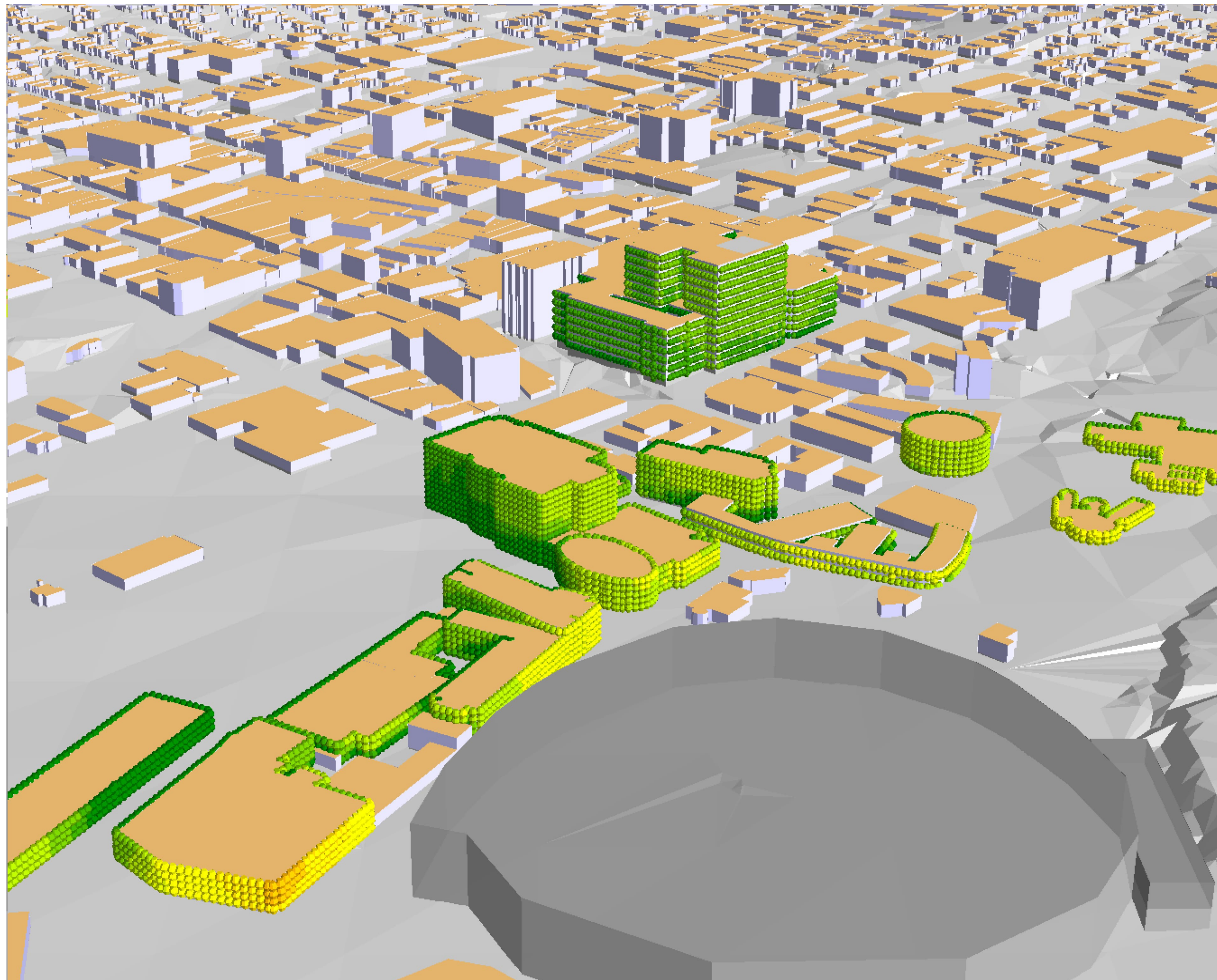
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

Patrons Outdoor Entertainment Noise Contours

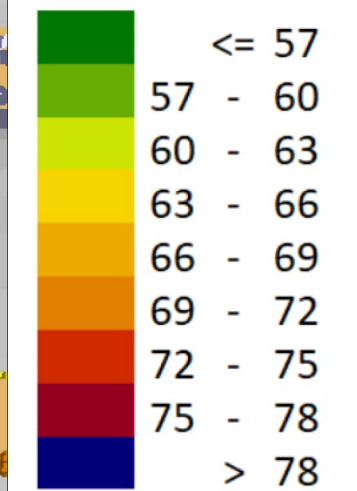
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Legend

MacPoint Stadium

Predicted Noise Levels, Leq dB(A)



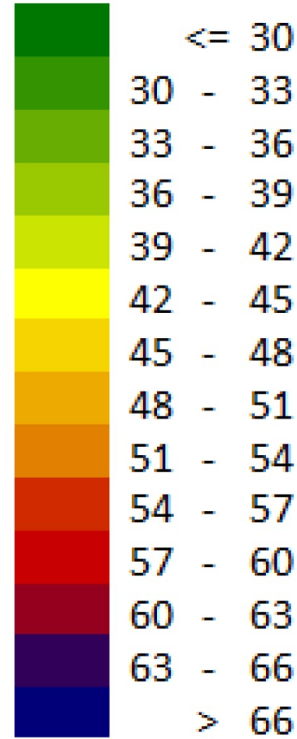
The facade noise map is looking towards east of the Stadium

Music Concert Noise Contours (Potential worst-case scenario)

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Legend
MacPoint Stadium

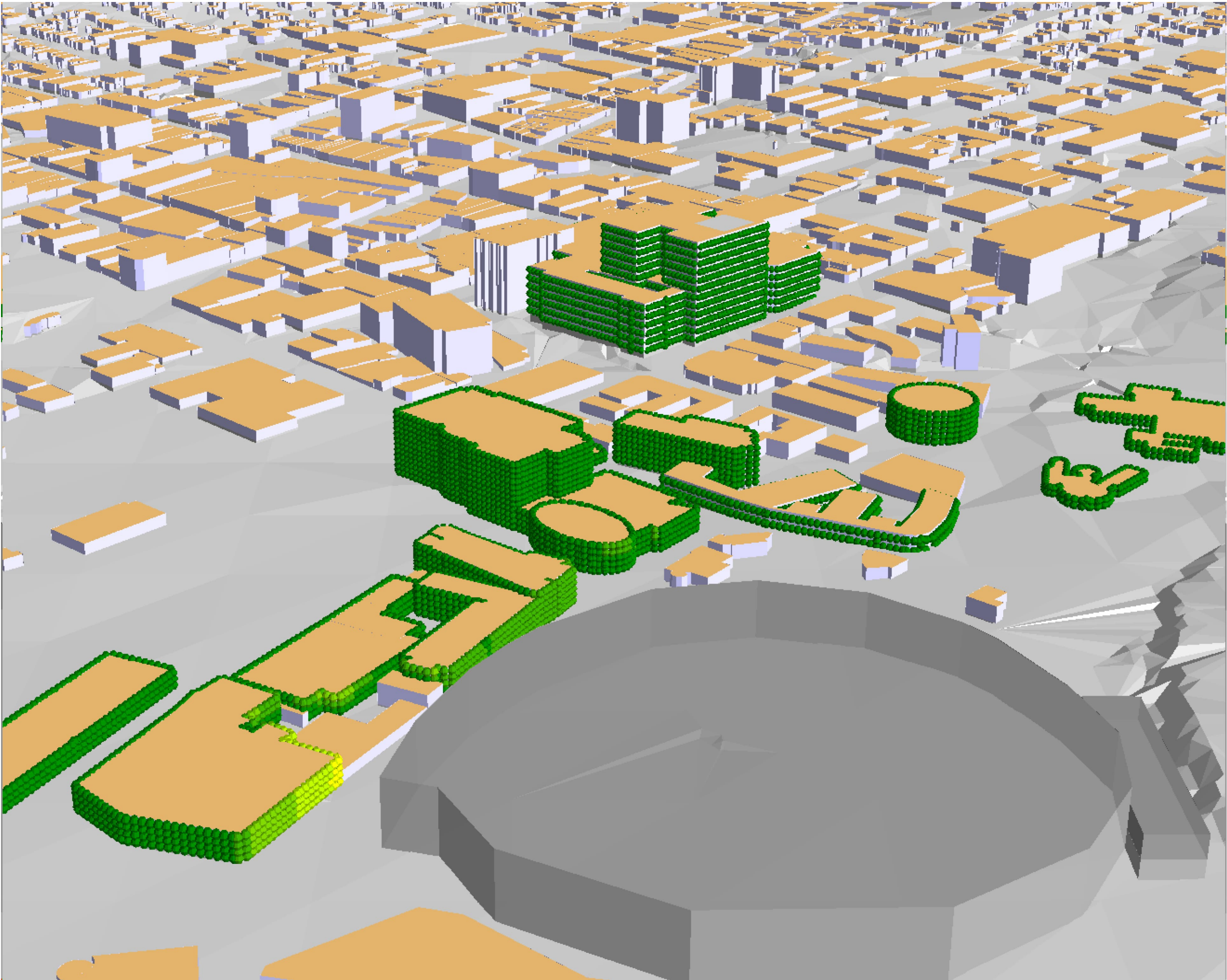
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

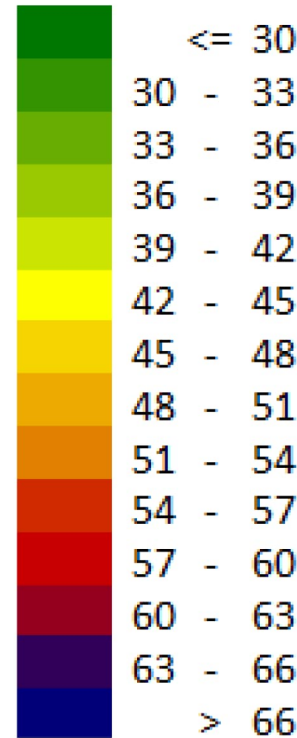
Mechanical Noise Contours

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Legend
MacPoint Stadium

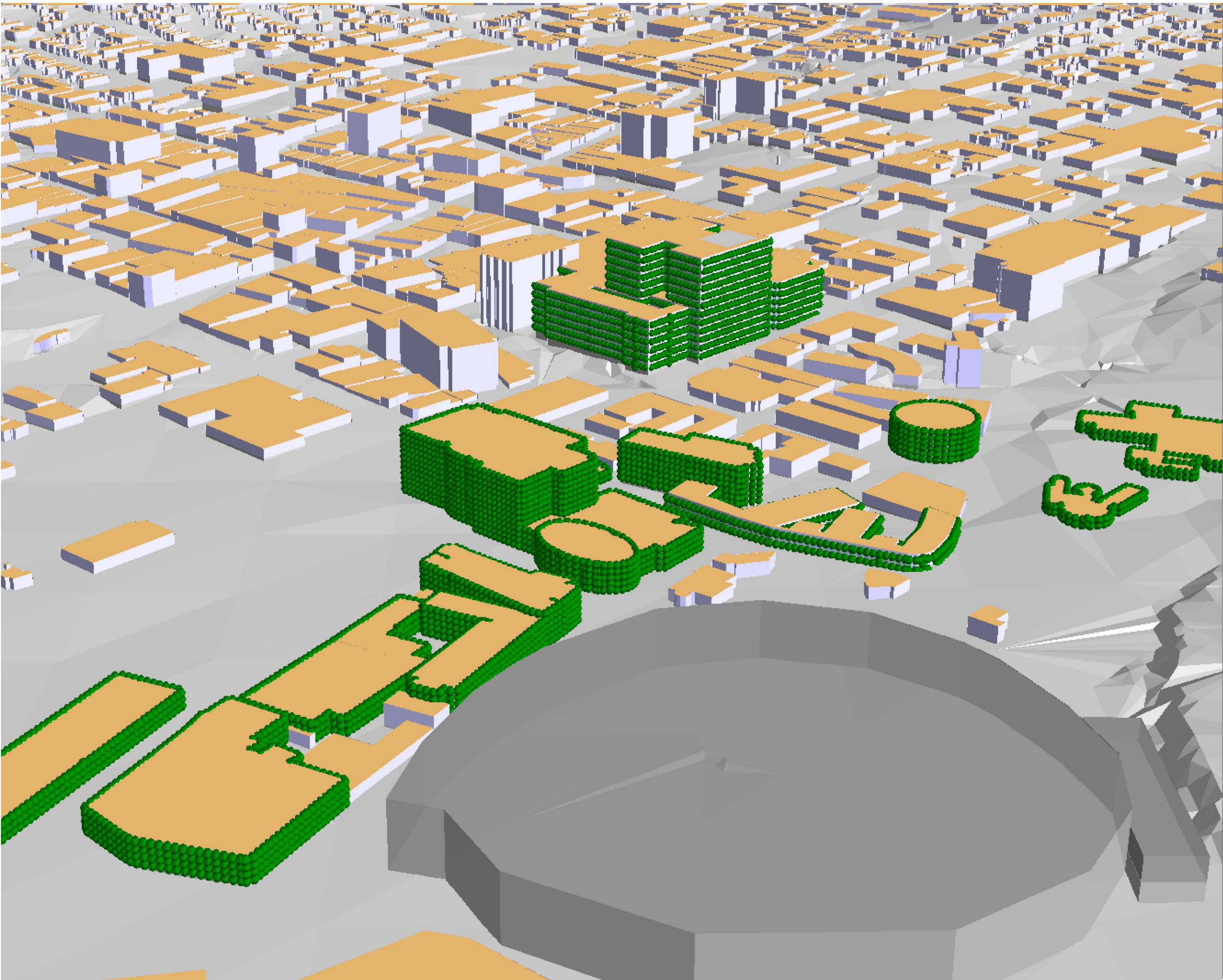
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

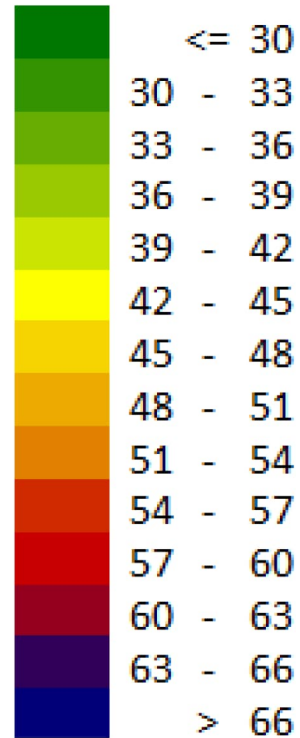
Bus Hub Noise Contours

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Legend
MacPoint Stadium

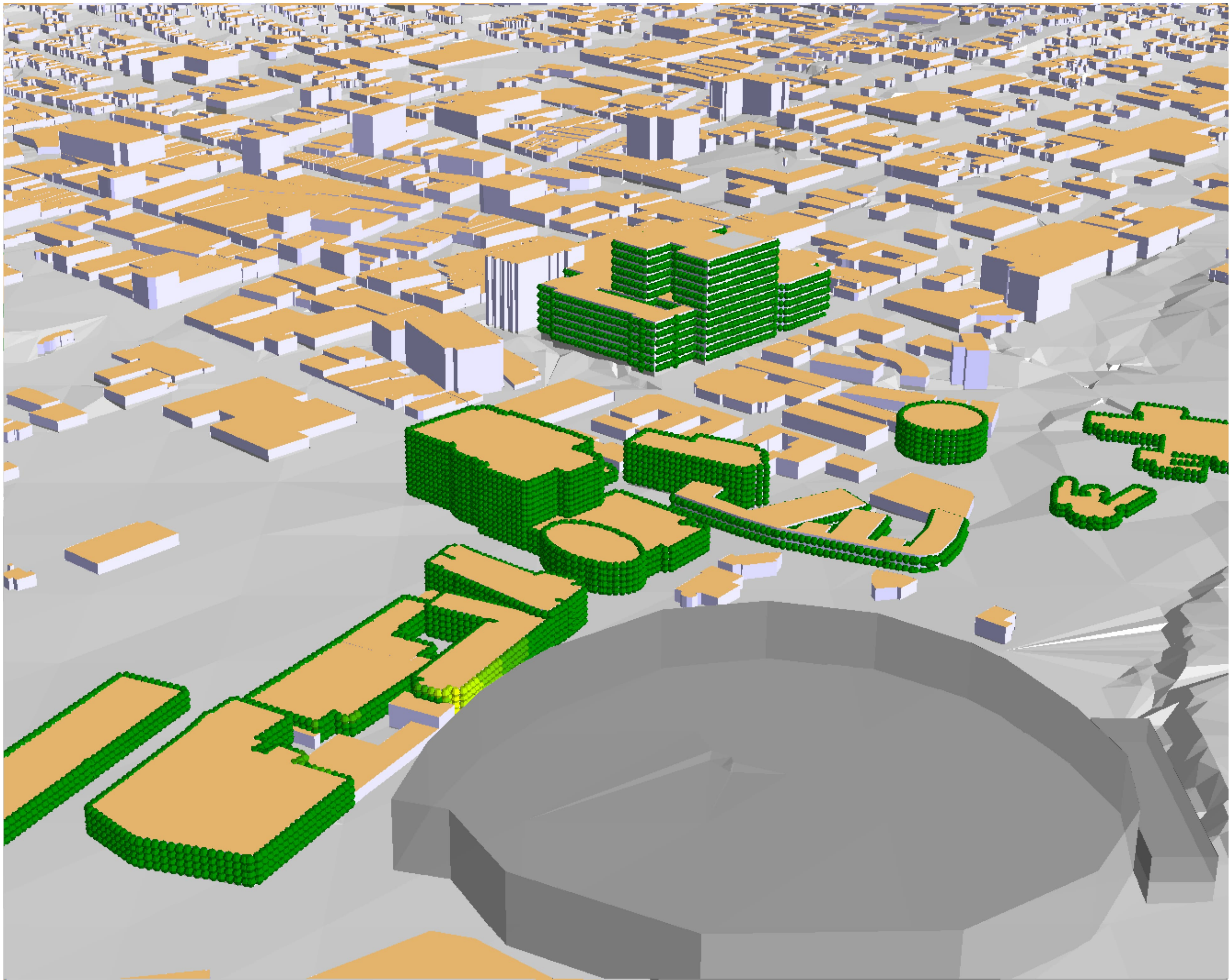
Predicted Noise Levels, Leq dB(A)



The facade noise map is looking towards east of the Stadium

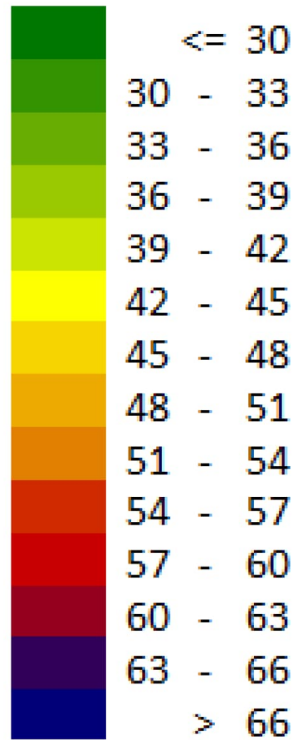
Loading Dock Noise Contours

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Legend
MacPoint Stadium

Predicted Noise Levels, Leq dB(A)



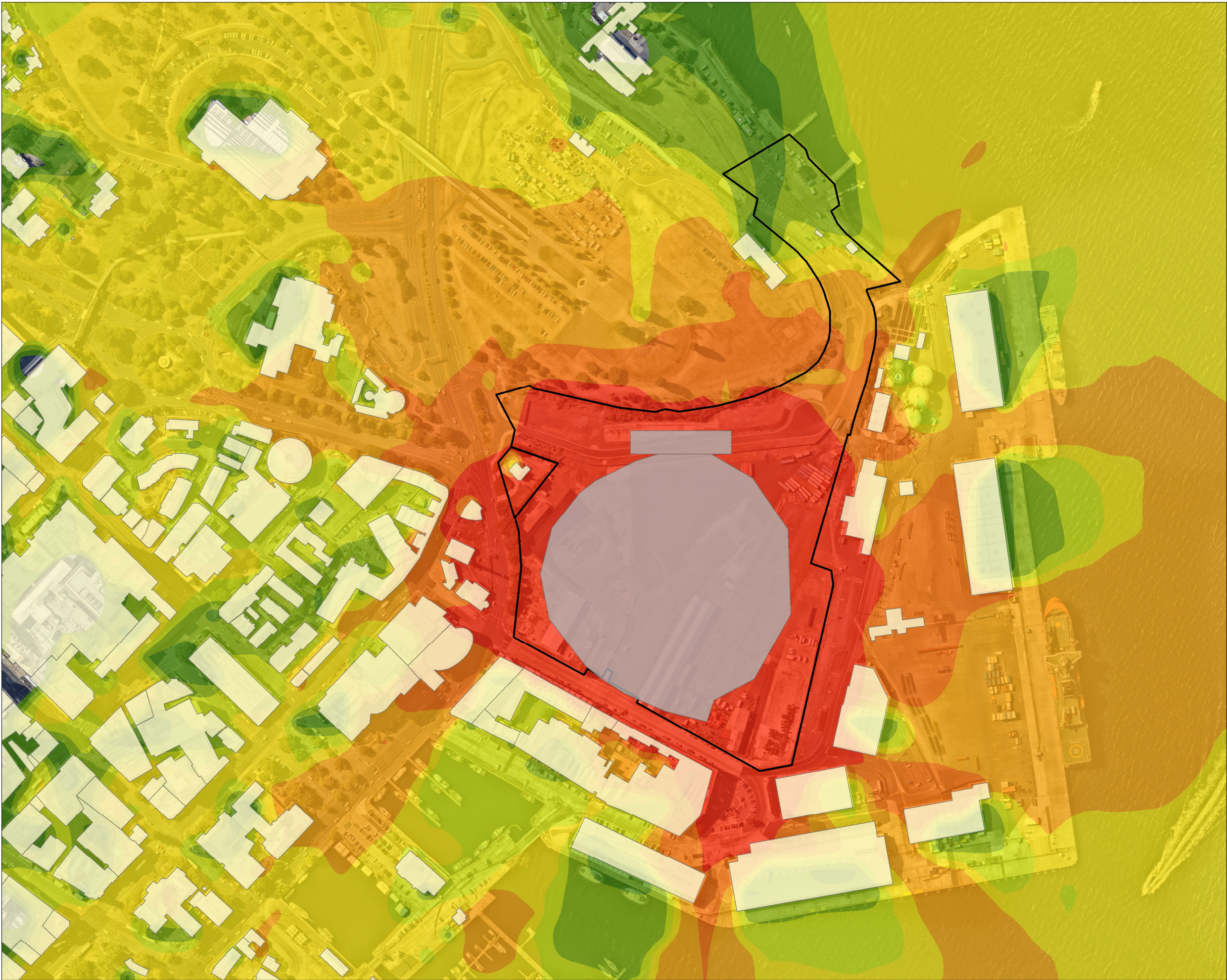
The facade noise map is looking towards east of the Stadium

Temp Gensets Noise Contours

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Appendix C

Noise Contours for construction noise
associated with the Stadium



AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

Predicted Noise Levels, L_{eq} dB(A)

- < 45 dB(A)
- 45 to 50 dB(A)
- 50 to 55 dB(A)
- 55 to 60 dB(A)
- 60 to 65 dB(A)
- 65 to 70 dB(A)
- 70 to 75 dB(A)
- > 75 dB(A)

Noise contours have been calculated at 2m above ground.

**Construction Noise Contours
Construction Scenario 1 (CS1)**

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

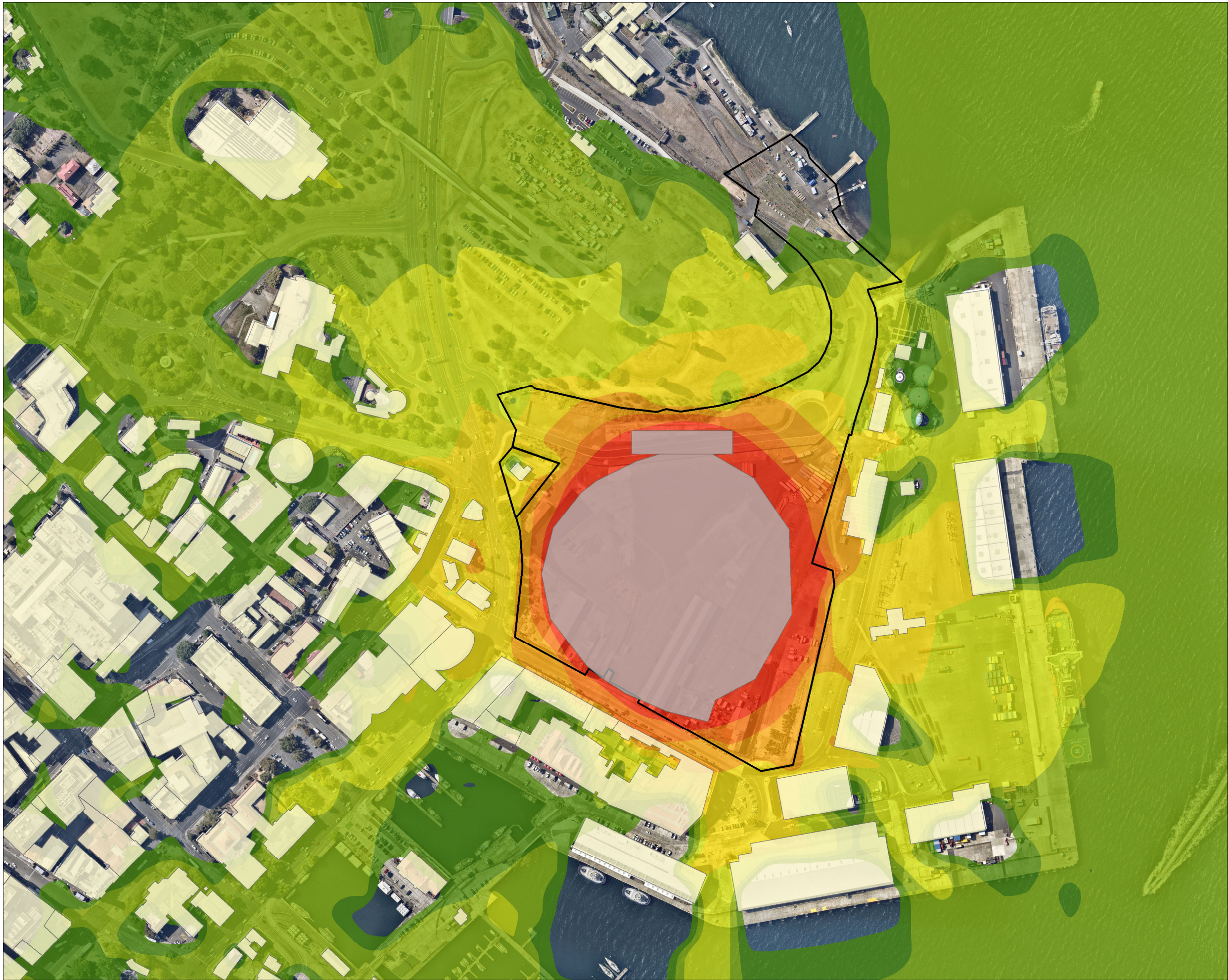
Predicted Noise Levels, L_{eq} dB(A)

- < 45 dB(A)
- 45 to 50 dB(A)
- 50 to 55 dB(A)
- 55 to 60 dB(A)
- 60 to 65 dB(A)
- 65 to 70 dB(A)
- 70 to 75 dB(A)
- > 75 dB(A)

Noise contours have been calculated at 2m above ground.

Construction Noise Contours Construction Scenario 2 (CS2)

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

Predicted Noise Levels, L_{eq} dB(A)

- < 45 dB(A)
- 45 to 50 dB(A)
- 50 to 55 dB(A)
- 55 to 60 dB(A)
- 60 to 65 dB(A)
- 65 to 70 dB(A)
- 70 to 75 dB(A)
- > 75 dB(A)

Noise contours have been calculated at 2m above ground.

Construction Noise Contours Construction Scenario 3 (CS3)

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

Predicted Noise Levels, L_{eq} dB(A)

- < 45 dB(A)
- 45 to 50 dB(A)
- 50 to 55 dB(A)
- 55 to 60 dB(A)
- 60 to 65 dB(A)
- 65 to 70 dB(A)
- 70 to 75 dB(A)
- > 75 dB(A)

Noise contours have been calculated at 2m above ground.

**Construction Noise Contours
Construction Scenario 4 (CS4)**

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AECOM



Legend

- MacPoint Stadium
- Surrounding Buildings
- Site Boundary

Predicted Noise Levels, L_{eq} dB(A)

- < 45 dB(A)
- 45 to 50 dB(A)
- 50 to 55 dB(A)
- 55 to 60 dB(A)
- 60 to 65 dB(A)
- 65 to 70 dB(A)
- 70 to 75 dB(A)
- > 75 dB(A)

Noise contours have been calculated at 2m above ground.

**Construction Noise Contours
Construction Scenario 5 (CS5)**

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