Appendix N:

Malcolm Hunt & Associates Maintenance Dredging and Disposal

Noise Effects Assessment Report

Assessment of Environmental Noise Effects

Maintenance Dredging and Disposal Project
Port Navigation Channel, Vessel Turning Basin & Wharves 4-8
Eastland Port, Gisborne

Prepared for:

Eastland Port

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1 Introduction

Eastland Port have commissioned Malcolm Hunt Associates to undertake an assessment of environmental noise effects associated with a project proposed by Eastland Port Limited referred to as the *Maintenance Dredging and Disposal Project: Port Navigation Channel, Vessel Turning Basin & Wharves 4-8* as set out within the application documents lodged with Gisborne District Council.

This assessment covers noise and vibration generated by dredging activities proposed for the port area and navigation channel to the port. This assessment focuses on noise effects due to the operation of various dredge types in order to identify the range of noise levels expected, given equipment likely to be used on the project. This report does not include noise from disposal activities. As described in the AEE, the sediment disposal site is located in 20 metres of water, at least 3 km from the nearest land. This site has previously been used to dispose of spoil in the past (e.g. around 88,000 m^3 of sediment following dredging in the turning basin and dredging around Wharf 6-8 authorised by a coastal permits issued by the Council in 2009). As this disposal of spoil appears to have not resulted in any known adverse noise effects, it is considered sediment disposal in the area proposed is a relatively benign activity, without any significant adverse noise effects to be reported on here.

This report focuses on noise from dredging to be carried out within the harbour and in terms of noise and vibration effects received on land (landward side of the CMA boundary) including at the closest residentially zoned sites. Maximum noise due to dredging within the surrounding environment, including at the Port Management Zone boundary have been predicted based on historical noise data and published results of dredge noise readings. The prediction results confirm noise effects will be generally confined in area, mainly affecting areas already affected by port activities and other urban sound sources.

Our assessment of noise effects is based on comparison with the permitted activity noise limits of the ***Tairāwhiti Resource Management Plan*** (TRMP) and relevant acoustic standards referred to within this document.

The overall assessment set out below indicates the proposed dredging can comply with the TRMP noise limits set except for possible minor breaches which may occur briefly owing to the close proximity of the prescribed assessment point (Port Management Area zone boundary) to the dredge (which will be a moving noise source). While a technical breach may occur, this is not due to elevated noise. Rather, this is due to the assessment location (Port Management Area zone boundary) lying temporarily quite close (only a metre or so) from where mobile dredging will occur within the turning basin. The noise limit applying at this point may be momentarily exceeded, however this noise will not be likely to generate adverse effects. This is because (1) the level of noise at source is quite modest, and (b) owing to the distances involved, the level of noise received at any sensitive receiver site will be relatively unaffected (if at all) by noise from dredging taking place at this time (or at any time during the dredging). The results below show that, apart from this technical (potential) breach, compliance is achieved at all noise-sensitive sites in the area for normal operation of the largest dredge likely to undertake the works.

It is concluded the proposed maintenance dredging noise will result in some noticeable noise occurring at the margins of the coastal marine area but will result in less than minor effects within noise-sensitive sites in the residential zone and within the nearby Commercial Amenity zone.

This assessment is based on development plans, specifications and site layout provided by Eastland Port Limited or its agents. Drawings and maps are schematic only and are not necessarily to scale.

2 Noise as an Environmental Effect

The environmental effects of land use activities are controlled through the provisions of the Resource Management Act 1991 (the RMA), the purpose of which includes the sustainable management of natural, and physical resources. Sustainable management includes avoiding, remedying, or mitigating adverse effects on the environment. The 'environment' involves people and communities and their ability to provide for their social and cultural well-being as well as for their health and safety.

Section 16 of the RMA places a general duty on all occupiers of land or the coastal marine area to adopt the best practicable option (BPO) to ensure noise emitted from any site does not exceed a reasonable level. What constitutes a "reasonable level" is not prescribed by the Act. The noise standards prescribed in the TRMP and the noise-related conditions of consent for the recently approved Wharf 6 & 7 project[1] have been used to establish reasonable levels of noise effects.

3 Dredging Noise

3.1 Past and Existing Activities

In terms of dredging noise effects, the Port area has experienced noise from Port dredging intermittently throughout its history. Various dredges have operated at Port Gisborne over the years. In 1916 records show two dredges operating at the Port being the *Maui* and the *John Townlee*. In 1924, the *Koura* dredge arrived. In 1936 one of *Koura*'s dumb barges was fitted with 2 x Prisetman grab cranes to undertake dredging in Gisborne. The *Koura* was scrapped in 1979. In 1981 the dredge the *Pukunui* arrived. This dredge was converted to suction dredge in 1983 / 84 and further upgraded in recent years. In 2012 the 55 metre long *Kawatiri* trailer suction dredge operated at Gisborne (which is normally based at Westport).

Dredging noise has occurred over the years at Port Gisborne in accordance with existing permits and consents. EPL has exercised coastal permits (other than the ones being replaced by this consent) to carry out dredging in the Port. We understand under Coastal Permits granted over the last 19 years, 75% of material being removed was done so utilising its Trailing Suction Hopper Dredge (TSHD) *Pukunui*, with dredging campaigns by higher productivity TSHDs (*New Era, Kawatiri, Brage R* and *Albatross*) in 2003, 2006, 2009, 2011, 2015, 2016 and 2017 (Eastland Port, 2019).

We understand the proposed maintenance dredging is expected to be largely carried out using a TSHD such as the *Pukunui*. Although if there are large inflows of sediment due to large storm events, a higher productivity TSHD or Cutter Suction Dredge (CSD) may be required to ensure the required port and channel depths can be maintained. Both types of existing dredges are described in detail below.

[1] While the grant of consent for the Wharf 6 & 7 project is currently the subject of two appeals to before the Environment Court, we understand neither appeal focusses on the noise effects of the proposal or the noise management conditions as granted.

3.2 Proposed Activity

The proposed dredging is described as maintenance dredging. The AEE notes that while the application is not limited to a specific dredging method or vessel, Eastland Port's *Pukunui* Trailer Suction Hopper Dredge (TSHD) is likely to be used for most of the maintenance dredging. The AEE notes that a larger TSHD, such as the *Albatross*, could be used if required (for example following storm events and larger than expected sediments inputs) and that a Back Hoe Dredger (BHD) or a Cutter Suction Dredger (CSD) maybe used in less accessible inner port areas.

The areas proposed for maintenance dredging are shown below in Figure 1.

Figure 1 Diagram indicating maintenance dredging area at the Port and the proposed Offshore Spoil Disposal Ground (ref. Fig 3 Eastland Port Dredging Project AEE dated Feb 2020).

As maintenance dredging, there are considered to be no associated noise effects associated with improving the port's handling capacity or increasing sizes of vessels using the port. Noise effects associated with increasing the capacity at the port such as the 'Twin Berth' project involving a new breakwater, Wharf 8, reclamation and dredging will be the subject of separate resource application packages expected to be lodged with the Council in 2020.

This report recommends a noise-related condition which ensures the granting of consent will result in no increase in port noise over levels already in place via Condition 40 (described below in Section 6) of existing consents granted in August 2018[2]. To this extent, noise from proposed dredging is proposed to be controlled to noise limits which already apply to a wide range of both dredging and non-dredging activities at the port. This

[2] Consents referred to as Wharves 6 & 7 , LU-2017-107936-00/CD-2017-107937-00/LL-2017-107938-00 and for the Slipway, LU-2017-107945-00/CD-2017-107944-00/DW-2017-107943-00/DL-2017-107942-00. Although we understand some aspects of these consents may be under appeal, we further understand this is not in relation to noise matters.

approach will severely any 'extra' noise attributable to the proposed dredging received within the port area and environs.

3.3 Proposed Dredges

As above, existing dredges *Pukunu*i and *Albatross* are "Trailing Suction Hopper Dredge" (TSHD) type dredges which appear likely to be used o0n the project. A "Cutter Suction Dredge" (CSD) type dredge is a possible alternative to a TSHD. Back hoe dredge (BHD) is also a common type of dredging activity undertaken in confined areas. All three dredge types are described as follows.

3.3.1 Cutter Suction Dredge(CSD)

CSD have a cutter head at the suction inlet which helps to loosen the sediment and take it to the suction mouth. CSDs suck up dredged spoil with the help of wear-resistant pump and then discharge it through a pipeline or a barge.

The following photograph shows a typical cutting head.

Photo 1: A CSD cutting head.

The diagram below indicates the range of noise sources typically found on CSD's. There are sounds associated with both the dredge and a support vessel.

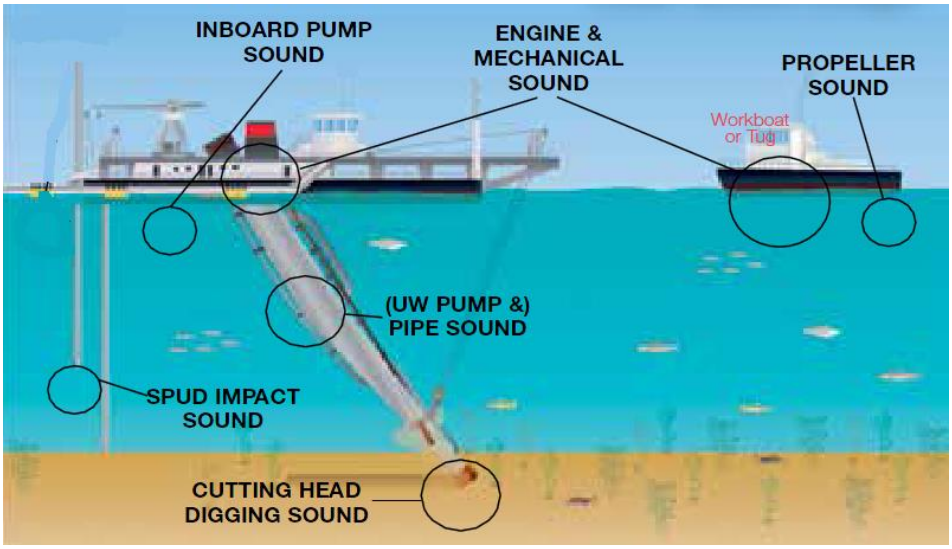

Figure 2 The range of noise sources associated with CSD dredging.

As no specific CSD has been identified to assist with maintenance dredging (if any), the sound levels assumed for this type of dredging has been based on published noise levels set out in a dredging noise report prepared for dredging Port Otago to cater for larger ships[3] sets out typical sound power levels for a CSD dredge. **Table 1** below sets out the Marshall Day CSD sound power levels and various setback distances (in metres) to equate with the given Leq(15 min) sound level (45 to 65 dBA).

Leq,15min dBA	Lw 110 dBA	Lw 112 dBA
45	590 metres	750 metres
50	330 metres	420 metres
55	190 metres	240 metres
60	100 metres	200 metres
65	56 meters	124 metres

Table 1 *Predicted Sound Level Dredge Sound Power Levels (Marshall Day 2009)*

The sound power level of Lw 112 dB has been used with the predictions below to estimate typical noise levels for a CSD dredge operating in the Gisborne Port.

3.3.2 Trailing Suction Hopper Dredge (TSHD)

In this type of dredge material is sucked into the vessel hopper using a drag head operating at the target depth. Material is pumped into the hopper with the water either overflowing across the deck on *Pukunui* and similar small dredgers, or through pipes on the *Albatross* and other larger vessels. Once the hopper has reached capacity it then is transported to the disposal ground.

Information on the two main dredges proposed to be used are set out in **Table 2**.

Vessel	Pukunui	Albatross
Length	30m	75m
Draft -Empty	1.2m	3.2m
Draft - Full	2.4m	3.8m
Hopper Volume	480m^3	1860m^3
Hopper Infilling Time	2 hours	2-5 hours
Travel Time to and from Disposal Site	2 hours	2 hours

Table 2: Gisborne Port Trailer Suction Hopper Dredge Information Source: MetOceans Report

The *Pukunui* is owned by Eastland Port and based permanently at the port. The *Albatross* is owned by Dutch Dredging and is a much larger vessel and has a much greater (almost four times) hopper capacity. We understand that while Eastland Port endeavor to undertake their own dredging, there is reliance on external dredging using other vessels when necessary.

.

[3] *Assessment of Noise Effects from Project Next Generation – Port Otago Dredging and Operation* REPORT NO.: 2009248A r04 Keith Ballagh, Marshall Day Acoustics.

Photo 2: Photograph of Pukunui Trailer Suction Hopper Dredge Maintenance Dredging Operation

Dredging would in the main be carried out by Trailer Suction Hopper Dredge (TSHD) such as the *Pukunui* TSHD. A larger suction dredge, such as the Albatross (also a Trailer Suction Hopper Dredge, TSHD shown below) may be used for some of the dredging operations mainly in the navigation channel.

Photo 3: Photograph of Albatross Trailer Suction Hopper Dredge (TSHD)

Trailer Suction Hopper dredges are self-loading/unloading. No noise readings are available of the *Pukunui* undertaking typical dredging. De Jong (2010)[4] identifies source levels from different activities associated with trailer dredges and covers vessels similar in size to the Albatross. The de Jong dredges are relevant as they are reported for dredges working in sand sediments similar to the fine mudstone sediments found in the Gisborne

[4] de Jong, C. A. F., Ainslie, M. A., Dreschler, J., Jansen, E., Heemskerk, E. & Groen, W. 2010. Noise of Trailing Suction Hopper Dredgers at Maasvlakte 2: Analysis of source levels and background noise – TNO-DV 2010 C335.

harbour .The levels of noise were reported by De Jong were around LAeq 108 dB at 1 metres (Lw 115 dB) with a sound spectrum dominant in the frequencies below 500 Hz, typical of large diesel engines and ship engines. The de Jong results showed that dredging itself did not produce louder sounds than those produced by the dredger during transit between the dredging and placement sites.

3.3.3 Back Hoe Dredger (BHD)

We are advised a Back Hoe Dredger (BHD) may be used in less accessible areas. Backhoe dredging operation involves removing seabed material using a backhoe arm with a bucket at the end mounted on a small barge, and the excavated material being dumped into a TSHD, like the *Pukunui* for transport to the disposal ground.

As with the TSHD operation the bucket loads being dumped into the hopper vessel contain sediment and water.

Photo 4 shows a photograph of BHD operations in the Wharf 7 and 8 area.

Photo 4: Photograph of Gisborne Port Back Hoe Dredging Operation

This is a "stationary" method whereby a 'back hoe' excavator mounted on a pontoon extracts sediment by the bucketload, and is unloaded into another barge or other vessel. Such generally barges are fitted with extended booms to provide increased reach to achieve the required dredging depth.

The primary noise source is the backhoe excavator itself. This sound source has been modelled as an excavator producing around 72 dBA when measured at 10 metres when working under load[5]. The excavator deposits excavated material into a barge moored temporarily alongside. Once the barge is fully loaded, it is removed from the side of the pontoon, replaced with an empty barge, and the full barge taken to the disposal site. We understand it is most likely that the barges will be unpowered split hopper or bottom dumping barges, manoeuvred using a tug.

[5] This is equivalent to a sound power level of SPW 112 dBA when determined using "*ISO 6395:2008 Earth-moving machinery — Determination of sound power level — Dynamic test conditions*".

4 Predicted Sound Levels

4.1 Methodology

The prediction methodology involved estimating expected noise levels based on the above sound power levels for the dredging noise at source. The sound levels at receiver locations have been modelled in accordance with *ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*. This standard sets out a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.

The method predicts the equivalent continuous A-weighted sound pressure levels (Leq) under meteorological conditions favourable to propagation from sources of known sound emission. Predicted LAeq noise levels are based on the dredge option likely undertake the works within the various dredging areas of:

- navigation channel
- wharves
- turning basin
- inner harbour

Dredge operations have been modelled as taking place within the full extent of the dredging area indicated in Figure 1 above. The prediction method adopts the standard 'inverse square' sound propagation principle with no specific screening by the built environment of natural terrain (which is a worse case. Sound propagation was calculated using ISO 9613-2:1996 *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation* adopting a correction for slightly enhanced propagation, as per Appendix B NZS6801:2008 (a more recent version of the 1991 version mentioned in the TRMP).

Sound power levels have been modelled in each octave band (63 Hz to 2 kHz) with source sound power (Lw) levels are equivalent to a dredging sound level of Lw 108 dBA at source within the inner port and Lw 118 dBA in the outer port and channel based on the dredge noise levels at source discussed above (Section 3.3.1 to 3.3.3).

4.2 Results

The noise prediction model delivers a cumulative sound level for FOUR selected receiver sites located on land in the local area (3 sites) and at the Port Management zone boundary (1 site) shown in **Figure 3** below. These are the considered representative of the most affected receiver sites likely to be affected by dredging noise.

Dredging sound is modelled as units LAeq(15 minutes). For the purposes of comparing prediction results with L_{10} noise limits found within some noise rules of the TRMP, the following conversion has been applied: $L_{10} = L_{eq} + 2.5$ dBA.

Predicted sound levels expected within the local area for maximum dredging noise are set out below in **Table 3**.

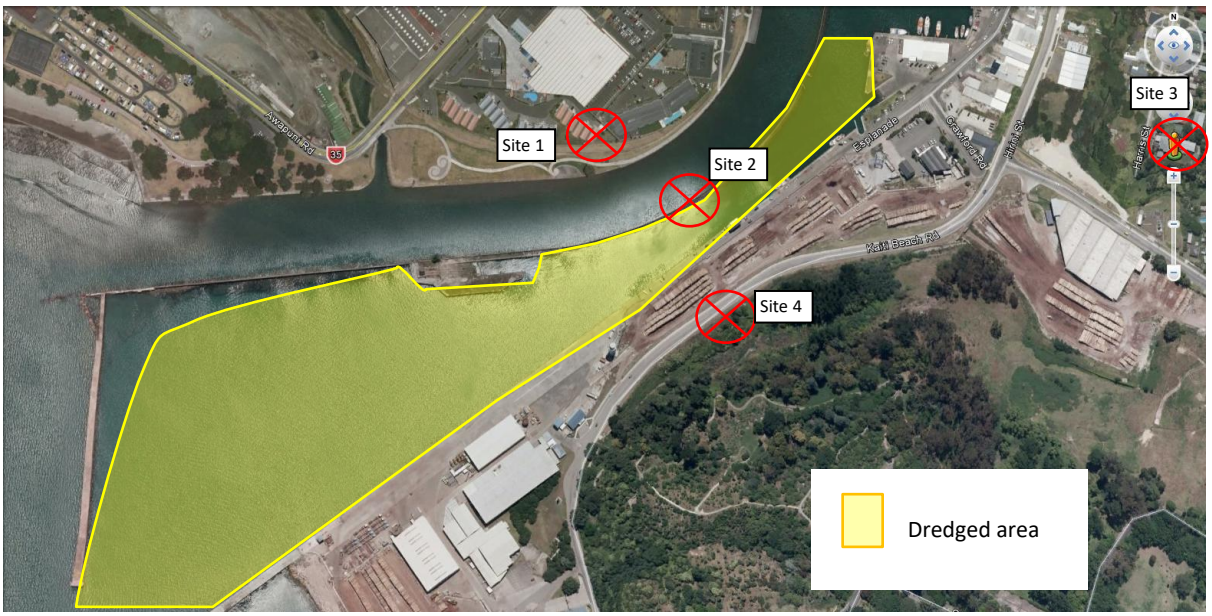

Figure 3 Assessment locations 1 to 4 where noise levels due to dredging have been reported. Also showing area within which dredging will take place.

No duration adjustment (downward) has been applied which means that if equipment were operated across all daytime 15 minute periods, the model will deliver an over-estimate Predicted sound levels for the relevant assessment locations shown above in **Figure 3** are set out in **Table 3** as follows;

	Predicted L_{A10}	Predicted L_{Aeq}
Site 1 – Closest occupied building in Amenity Commercial Zone	64 dB	62 dB
Site 2 – Closest Boundary Within CMA	76.6 dB	74.6 dB
Site 3 - Residential Zone, Closest residential Site	47.1 dB	45.1 dB
Site 4 – Closest Boundary To Heritage Reserve	64.7 dB	62.2 dB

Table 3 Predicted L_{Aeq} and L_{A10} sound levels at nearby assessment locations.

At the closest residential site L_{10} sound levels are expected to be received at levels no greater than the limits that apply to permitted (land-based) activities under the TRMP at Rule C11.2.15.1 'General Rules and Standards for Permitted Activities'. Sites within the Amenity Commercial area (e.g. Site 1) will receive noise not exceeding that permitted for normal port activities (70 dB under Rule C11.2.15.1C). An assessment of these received levels is assessed below in Section 7 below.

4.3 L_{max} Sound Levels

As per NZ Standards and the TRMP, noise rules applying during night time often apply limits on L_{10} and LAFMax sound levels. Although the proposed dredging is proposed as a daytime operation, the assessment of noise impacts is informed if L_{AFMax} sound levels are also taken into account. In this case the LAFMax sound levels are expected to be within 5 to 10 dBA of the predicted LAeq sound level. Adopting a worst case 10 dB conversion factor, expected range of L_{AFMax} sound levels for the above assessment locations are;

	Predicted LAFMax
Site 1 – Closest occupied building in Amenity Commercial Zone	70 dB
Site 2 – Closest Boundary With CMA	85 dB
Site 3 - Residential Zone, Closest residential Site	57 dB
Site 4 – Closest Boundary To Heritage Reserve	67 dB

Table 4 Predicted Lmax sound levels at nearby receiver locations.

Assessment of these levels is discussed below in Section 7 below.

5 Tairāwhiti Resource Management Plan

TRMP policies for noise management within the Port Management Area (that is, at or below mean high water springs) are set out at Section C11.2.13. Those provisions apply noise limits at the Port Management zone boundary which shown in **Figure 4** below (which includes the dredging and disposal area).

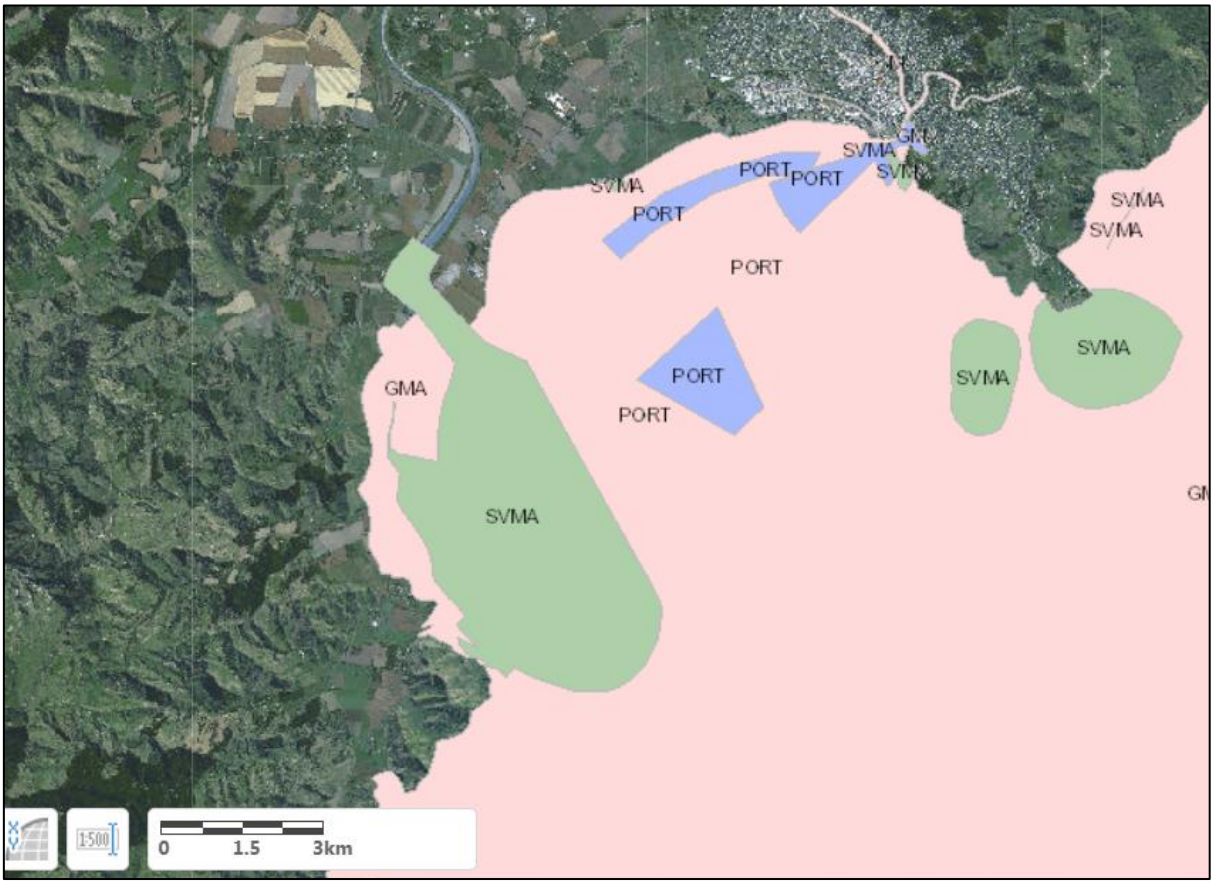

Figure 4 TRMP map showing the extent of the Port Management Area.

C11.2.15.8 A(1) of the TRMP sets out methods of assessment of noise which includes reference at (e) to NZS 6809:1999 " Acoustics – Port Noise Management and Land Use Planning".

In terms of appropriate NZ Standards for the measurement of assessment of noise from proposed dredging, it is noted the NZS 6809:1999 assessment method excludes noise from vessels not at berth (NZS6809:1999, section 3 'Definitions').

For this reason the recommended noise condition set out below refers to measurement and assessment of dredging noise using the following Standards, which outline appropriate alternative noise measurement and assessment methods, consistent with rule C11.2.15.8 A(1) of the TRMP:

- NZS6801:1991 "Measurement of Sound" and

- NZS 6802:1999 “Acoustics – Assessment of Environmental Sound”

Compliance with noise limits needs to follow the guidance regarding averaging of noise levels in accordance with rule C11.2.15.8 A(3) which sets out specific maximum sample periods to be employed in any averaging under the TRMP. In is noteworthy that the above predicted dredging noise levels (Tables 3 and 4) are not corrected (downwards) due to the effect of averaging of any kind. The results are therefore somewhat worst case for compliance assessment purposes.

The applicable TRMP Rule C11.2.16 (‘Rules for Noise in Coastal Environment’) applies to any activity that generates noise within the coastal marine area. These requirements are summarised as follows:

A. Standard A - L_{10} 70 dB and L_{AFMax} 70 dB limits to be complied with at the boundary of the Port Management Area;

B. Standard B – noise not resulting in the ‘long-term modification of the behaviour of aggregations of marine mammal or birds’; and

C. Standard C - noise from sirens and the like used for navigation and/or warning, is excluded from the above conditions.

Standards A, B and C apply to noise from dredging activities. Compliance with these requirements is assessed in Section 7 below. However, it is recommended alternative noise limits be adopted within recommended conditions of consent which are considered likely to be more effective if noise limits applied to protect sensitive receiver locations are applied at or near such receiver locations.

The noise limits recommended to be adopted in this report for the control of noise from dredging is based on noise received at the boundary with Amenity Commercial Zone, Residential General Zone or Inner City Residential Zone which are shown in the following diagram taken from the TRMP maps;

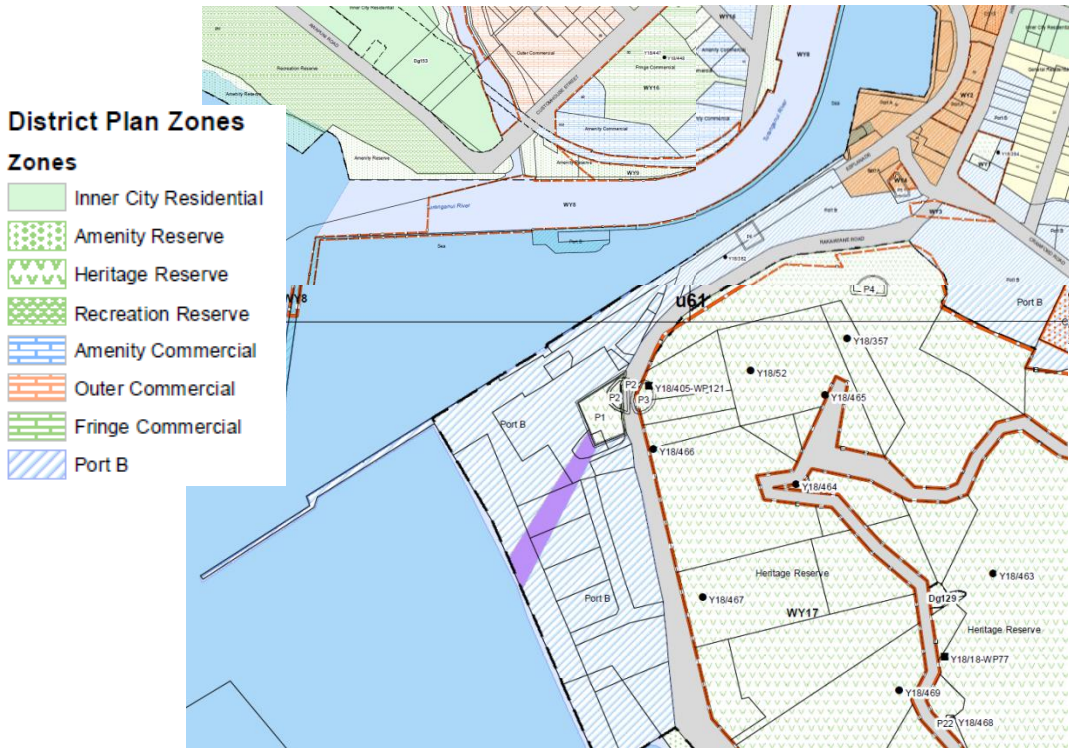

Figure 5: Relevant zoning of land in the vicinity of the proposed works

Regarding vibration effects, the TRMP sets out vibration limits within Rule C11.2.15.3 ‘Rules for Vibration’ which sets out both subjective assessment (not be ‘noticeably discernible’) or be measured to comply with specified

vibration limits at or within sites zoned Industrial, Port, Commercial, Suburban Commercial or Reserves (Table C11.11 of the TRMP). The allowable limit is 60 mm/s^2 which is a highly noticeable level of vibration.

6 Previous Dredging Consent Noise Limits

6.1 2015 Maintenance Dredging Consent

In 2015 consent was granted for maintenance dredging with details and noise limits imposed as follows;

CD-2015-106583-00, CD-2015-106584-00, CD-2015-106585-00,

CR-2015-106586-00, DA-2015-106587-00

Pursuant to Sections 104 and 104B of the Resource Management Act 1991, consent to Eastland Port Limited for maintenance dredging of the port navigation channel, vessel turning basin and Wharves 7 and 8 area at the Port of Gisborne, legally described as Lot 7 DP 7819, for a period of 5 years, subject to the following conditions and advice notes:

12. Limits on Noise Emissions

(a) The longer term average sound level (Ldn) from "essential port activities" within the Port Management zones shall not exceed 55dBA at any point outside the 55dBA noise contour nor 65dBA at any point outside the 65dBA noise contour.

(b) The noise emitted by maintenance dredging activities occurring between 10pm and 7am the following day shall comply with the following limits;

(i) The average sound level (L_{eq}) shall not exceed 60dBA when measured at any point on land beyond the 65dBA noise contour depicted within Appendix 28 of the Operative Gisborne Combined Regional Land & District Plan; and

(ii) The night time maximum sound level (L_{max}) shall not exceed 85dBA at any point on land beyond the 65dBA noise contour depicted within Appendix 28 of the Operative Gisborne Combined Regional Land & District Plan.

(c) The measurement and assessment of noise emissions shall be in accordance with NZS 6809:1999 Acoustics - Port Noise Management and Land Use Planning.

6.2 2018 Wharves 6 & 7 Consent

In August 2018 consents were granted for Wharves, LU-2017-107936-00/CD-2017-107937-00/LL-2017-107938-00 and for the Slipway, LU-2017-107945-00/CD-2017-107944-00/DW-2017-107943-00/DL-2017-107942-00.

Condition 40 applies under these consents to operational noise generated in the port;

40. Noise Emissions

Sound from all activities in the Tairawhiti Resource Management Plan Management Area excluding the rail bridge, Port A Management zone and area outside the breakwater must comply with the following noise limits when measured and assessed in accordance with NZS 6801 and NZS 6809.

At any point in the Amenity Reserve Zone outside the Port Inner Control Boundary (ii)At any point in the Heritage Reserve Zone more than 50m from the Port Management B Zone	65 dB L_{dn}
At any point in the Amenity Commercial Zone, Residential General Zone or Inner City Residential Zone	65 dB L_{dn} 60 dB $L_{Aeq(9h)}$ (2200h-0700h) 65 dB $L_{Aeq(15\ min)}$ (2200h-0700h) 85 dB L_{AFmax} (2200h-0700h)
At the permanent port noise monitoring location (Portside Hotel)	~~63~~ 64dB L_{dn} 60 dB $L_{Aeq(9h)}$ (2200h-0700h) 65 dB $L_{Aeq(15\ min)}$ (2200h-0700h) 85 dB L_{AFmax} (2200h-0700h)

The above consents both apply noise limits on the works based on contribution to cumulative daily port noise (Ldn) levels as well as night time and daytime LAeq levels measured over shorter periods.

In Section 8 below, we recommend a consent condition is imposed on the proposed maintenance dredging consents so that the consented works will be subject to a noise limit equivalent with that applying under an existing consents to operational port noise throughout the port. This will ensure the noise generated by maintenance dredging is no greater than activities well established in the port.

7 Assessment

7.1 TRMP Compliance

TRMP Rule C.11.2.16.1B applies noise limits to the boundary of the Port Management Area for all activities within the CMA and puts in place the following noise constraints:

- Standard A - average maximum noise (L10) and maximum noise (Lmax) levels measured at the boundary of the PMA and other specified management areas must not exceed L10 70 dB and LAFMax 70 dB limits measured at the boundary of the Port Management Area;

- Standard B – noise not resulting in the 'long-term modification of the behaviour of aggregations of marine mammal or birds';

Dealing with Standard A, predictions of maximum worse case dredging noise set out above (Tables 3 and 4) indicate the following maximum sound levels measured within this small part of the dredging area (turning basin) would result at Site 2 - the closest boundary of CMA and Port Management Area – in noise levels reaching;

L_{10} 77 dBA
LAFMax 85 dBA

This exceedance of the L10 70 dB limit by +7 dB and LAFMax +15 dB is not considered serious. This is because, if it occurs, it will occur for periods likely to be less than one day in duration. This is the worst case noise level, with dredging being undertaken by a dredge vessel larger than the existing *Pukunui* dredge. Normal operation of the existing dredge would be expected to meet the noise limits set out above in TRMP Rule C.11.2.16.1B.

In relation to the L_{AFMax} 70 dB of TRMP Rule C.11.2.16.1B, this limit appears to be set too low as it is inconsistent with NZ Standards and other relevant TRMP noise rules. The noise limits of Rule C11.2.15.1.C allow L10 levels at the port boundary to be received up to L10 75 dB with no applicable L_{AFMax} limit, yet Standard A above sets L_{AFMax} limit of 70 dB at a point in the middle of an operational port, at a non-noise sensitive boundary. In addition, the Wharves 6 & 7 consent allows up to L_{AFMax} 85 dB at a location closer to sensitive receiver sites. The general approach elsewhere in TRMP is to apply L_{AFMax} limits of 65 to 70 dB only at noise-sensitive residential sites as a sleep protection measure. Standard A appears to apply L_{AFMax} sound levels for an outdoor amenity control purpose which is not consistent with accepted practice for setting noise limits under recommended NZ Standards procedures which adopt L_{AFMax} as a 'single event' night time sleep control measure only.

Regarding Standard (B), this rule is based on not disturbing marine mammals or birds. As below (Section 7.3) adverse effects for sea birds or mammals would not be likely to disturbed according to some international recent research that has taken place with respect to effects on underwater animals. Although there is no definitive guidance on acceptable levels of noise effects, it is noted the 4Sight Ecology and Water Quality Report states that neither the port area nor the disposal ground are known to contain 'aggregations of marine mammals or birds' and that their behaviour would not be adversely affected either the dredging or disposal operations. On this basis compliance with Standard B is expected to be met.

Overall, proposed dredging operations will take place immediately adjacent to the Port Management Area which is likely to cause temporary and spatially confined non-compliance with the TRMP noise limits that apply along this boundary, even though the levels received at noise sensitive sites will generally fall within allowable limits for port-related activities.

7.2 Noise Impact On Land

The areas of land possibly affected by noise from dredging include (as a worse case) sites zoned Port, Commercial, and Suburban Commercial zones. **Tables 3** and **4** above set out the predicted maximum L10 and Lmax noise levels in the area due to the proposed dredging. This assessment has particularly focused on dredging sound levels received at sites 1 and 3 as these locations are used for residential purposes, with potential noise effects on occupiers.

Under the Section C11.2.15.1 ("General Noise Rules") the TRMP allows noise emitted by permitted activities ON LAND to emit noise up to the following noise limits within areas potentially affected by noise due to dredging.

The average maximum noise level (L10) as measured at or within the boundary of any industrial, port, commercial or Suburban Commercial zone shall not exceed the following limits:	***AVERAGE MAXIMUM NOISE LEVEL (L10) dBA at all times***
Industrial and Port	*75*
Commercial	*70*
Suburban Commercial	*65*

Thus, permitted activities are responsible (along with road vehicles) for a considerable amount of ambient noise found within the area surrounding the port (and the port itself).

Existing Wharves 6 & 7 consent (Section 3.2 above) refers to limits based on long term port noise measured over a 24 hour period of sound exposure (Ldn) which assesses noise levels over 24 hours for a period of 5 consecutive days. In addition, noise limits are specified as short term LAeq limits as well as single event L_{AFMax}) type limits which are also specified in the noise-related conditions of consent. To assess compliance under this long term standard, noise from port activity is being continuously measured by an automated noise monitor installed at Portside Apartments. These results are of interest in the current assessment.

Results of recent measurements of existing port noise levels experienced near the port (near Site 1) are set out below. These results are based on all sounds being included in the measurements, including non-port sounds. No dredging took place during these readings. The daily Ldn measured at Portside Apartments is also provided.

These reported levels are for all sound arriving at the microphone and therefore being measured, including any sounds due to vehicles on nearby streets or caused by the weather. There are times that due to high winds, stormy conditions considerably increase measured sound levels. The reported levels are therefore a 'worst case' assessment[6].

A summary of $L_{AFMa}x$ and Ldn sound levels measured during September, October, and November 2019 at a location near Site 1 (Figure 3) are presented as follows;

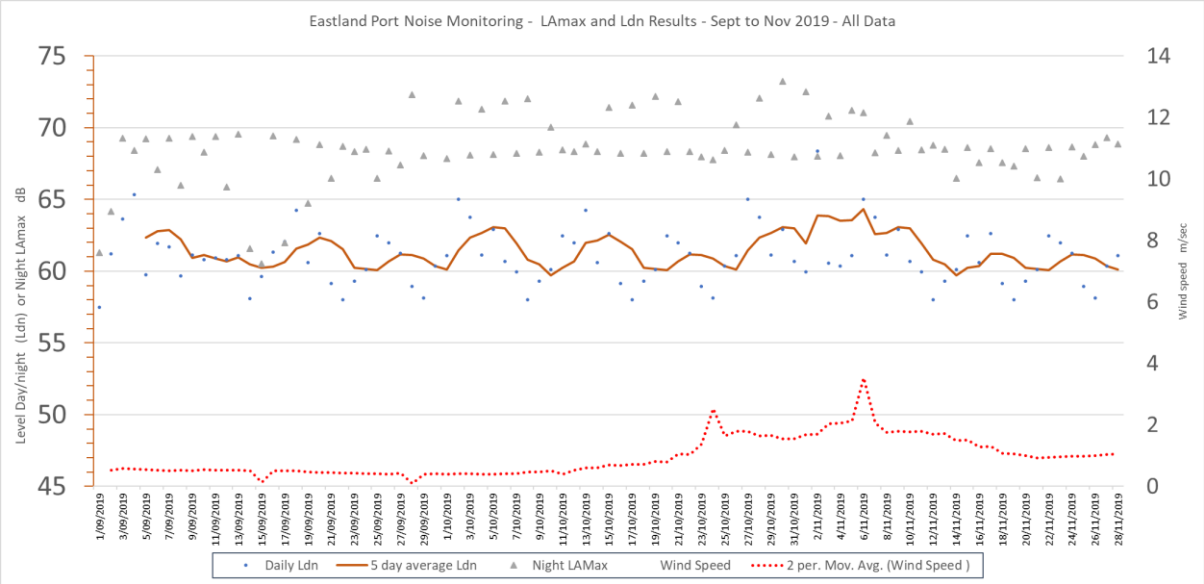

Figure 6 Results of measurements of LAFMax, LAeq and LA90 sound levels (and wind speed) as measured at the port noise monitoring location (Portside Apartments).

The following summaries port noise compliance based on these recorded levels, including considering the 'all in' nature of this noise monitoring at this location which lies near to Site 1 shown above in **Figure 3**;

- Long Term Average Sound Level (Ldn 65) not exceeded.
- Short term average sound levels (LAeq) at this location generally do not exceed 60dBA between 10pm and 7am
- The night time maximum sound level (Lmax) does not exceed 85dBA between the hours of 10pm and 7am.

The long term Ldn limits of the TRMP are complied with. Determining compliance with short-duration noise limits and Lmax limits is limited due to readings including both essential and non-essential port activities, as well as traffic noise and non-port background noise.

Tables 3 and 4 above confirm dredging noise received at or near this monitoring location (near Site1) would be received at a maximum of L_{Aeq} 64 dB and L_{AFMax} 70 dB. Figure 6 indicates such levels are within the range of noise levels already experienced in the area due to existing port activities and other related activities taking place in the area.

[6] To properly measure compliance with essential / non-essential activity noise limits the raw data needs to be matched with port company records to determine the relevant category of noise-making activity. As this has not been undertaken (the overall measured level of noise emission from the port has been used) the compliance assessment provided here remains provisional only.

In terms of noise received at Site 3 (residential zone) the TRMP sets out noise limits in Rule C11.2.15.1.B for noise generated by permitted activities in the area. The relevant limits are L_{10} 55 applying 7am to 6pm, L_{10} 45 dB 6pm to 10pm, and L_{10} 40 dB (and L_{AFMax} 70 dB) 10pm to 7am. Although Rule C11.2.15.1.B does not appear to apply to activities taking place within the CMA, Table 3 and 4 indicate dredging noise affecting any residentially zoned site would be below these daytime noise levels. See discussion below regarding night time.

7.2.1 Dredging Noise – Overall Assessment

Based on the predicted levels of dredging noise, dredging intermittency and being daytime based, it is considered dredging noise effects on land will not be unreasonable. Site 3 lies at the closest residentially zoned site is predicted to receive dredging sounds at or below the daytime and evening limits permitted under TRMP Section C11.2.15.1 for land-based permitted activities and is an acceptable level of environmental noise that will adequately protect health and amenity at residentially zoned sites.

Site 1 is a close-by location used for residential accommodation as apartments or hotels. At these locations our investigations confirm maximum dredging sound levels may reach L10 64 dBA when the dredge operates at its closest located to sites zoned Commercial Amenity under the TRMP**.**

The above assessment finds expected compliance with Rule C11.2.15.3 'Rules for Vibration' and permitted noise limits for normal port activities (70 dB under Rule C11.2.15.1C) will be complied with.

Sites within the Amenity Commercial area (e.g. Site 1) will receive noticeable noise at times however it is noted the TRMP provisions for this zone requires habitable rooms to be acoustically insulated to a reasonably high standard when constructed. Evidence at other port hearings established the closest affected apartments were built since the TRMP insulation requirements were enacted.

Our assessment is that, at these closest receiver sites, daytime dredging noise effects will be received at levels not significantly above levels found in the area regardless. It is noted buildings housing noise sensitive activities that meet the TRMP acoustic insulation standards will be sufficiently protected to ensure maximum noise from dredging in the main port and turning basin will not result in adverse noise annoyance for occupiers or visitors to these buildings. While the temporary noise due to the proposed dredging will be noticeable outdoors in this area, the sounds will not be inconsistent with daytime ambient sound levels received in the port and nearby areas.

7.2.2 Night Time Dredging Noise

As explained above, dredging activities have historically been daytime-based. We understand this is how the proposed maintenance dredging will proceed. Thus, although occurring infrequently, potential effects of dredging noise taking place between 10 pm and 7 am require assessment.

The above predictions of worst case dredge noise levels depict a level of L10 45 dBA being received at residentially zoned sites which adequately protects health and amenity during daytime according to NZS6802. During night time, this Standard recommends a L10 limit of 45 dBA, consistent with the Tairawhiti Resource management Plan (for residential sites adjacent to busy roads) and reflecting the general sensitivity to night time noise received in a residential setting. Although the closest residentially occupied site (Site 1) may, in theory, receive L10 64 dBA and LAFMax 70 dB, it is considered highly unlikely dredging would occur within this confined area at night.

Dredging is an intermittent but necessary undertaking at the port. If night time dredging is required, we understand this would only be when absolutely necessary. Mitigation of night time dredging noise could be via short periods of dredging noise with suitable gaps between. In this way, the more stringent LAeq(60 min) requirement could in fact be complied with if necessary. We are advised that any night dredging would more likely be along the navigation channel to the port not within the turning basin or inner port. Owing to the separation distances involved, there are no noise compliance issues for dredging located anywhere along the navigation channel.

Noise from night time dredging received at sensitive receiver sites will not be likely to generate adverse noise effects as the predicted dredge noise levels will be at or below the levels of noise from normal port activities allowable under the TRMP. In summary, noise limit conditions attached to the recently approved Wharf 6 & 7 consent (decisions dated 29 August 2018. LU-2017-107936-00/CD-2017-107937-00/LL-2017-107938-00) allow normal port activity up to the following limits;

At any point in the Amenity Commercial Zone, Residential General Zone or Inner City Residential Zone:

65 dB Ldn
60 dB LAeq(9h) (2200h-0700h)
65 dB LAeq(15 min) (2200h-0700h)
85 dB LAFmax (2200h-0700h)

In order to cater for the eventuality that dredging be required to be carried out after 10pm, we recommend a noise condition below in ***Section 8.0*** apply which sets a night time limit similar to the above limit for general port operations.

Monitoring of compliance with any consented noise limits can be achieved via the monitoring of port noise levels already required by Condition 41 of the Wharves 6 & 7 consent which requires a noise measurement system to continuously measure sound levels in the port to provide sufficient valid data for the Consent Holder to prepare reports regarding compliance with the limits applying under the consent. This system (which has installed and operating for several years at the Portside Apartments) can be utilised for conductoring monitoring of dredging noise levels. On this basis, no additional noise monitors are considered necessary.

The effect of this night time limit would impact of whether night time dredging could occur using the larger dredge types within the turning basin and other inner harbour areas during night time hours. The recommended night time noise limit allows for some activity to occur, for example dredging at locations more remote from occupied sites protected by the proposed noise condition.

We consider noise from dredging in the harbour and navigation channel undertaken to comply with the night time noise-related condition set out in Section 8 would result in noise effects on noise receivers that are no more than minor.

7.3 Underwater Noise

The effects of man-made underwater sounds on the marine environment have been the subject of much research in recent years. The World Organisation Of Dredging Associations (WODA) has investigated the issue. The effects on marine life have been assessed based on concentric rings of ‘effects’ including destruction of organisms in close proximity to active dredging, however these are mostly primitive genera such as snails and sea squirts. Obviously the species affected, and the degree of any effects of underwater noise would be specific to the site where dredging takes place, and the type of dredging undertaken.

There has been research into the effects of underwater noise on higher animals such as bony fishes or cetaceans. The WODA research[7] indicates that dredging sound has the potential to impact aquatic life however in terms of effects on higher animals most of these impacts would be limited and to communication disruption between animals due to masking or temporary alteration of behaviour patterns, however these matters are beyond our area of expertise.

7.4 Vibration

The RMA defines "noise" as including vibration. No specific investigations have been undertaken as no potential vibration effects. Potential vibration effects in the local area would not be likely given the scale and nature of the activity. The effects (if any) would be comparable to the effects expected when heavy vehicles traverse the local roading network and private land in the area. Vibration effects of the proposed dredging is therefore expected to fully comply with the limits set out within Rule C11.2.15.3 'Rules for Vibration' at or within sites zoned Industrial, Port, Commercial, Suburban Commercial or Reserves (Table C11.11 of the TRMP).

7.5 Overall Effects Assessment

Taking into account the above assessment, it is concluded that overall noise and vibration effects of the proposed dredging would not be significant as they can be assimilated into the environment without adverse effects. It appears compliance with a relevant TRMP noise rule cannot be achieved at all times when the dredge operates at locations close to the Port Management zone boundary, however this does not signal noise effects on the environment will be unacceptable.

Noise from dredging received by underwater organisms would not appear to cause any major effects, except for temporary navigation or communication effects. Most likely fish and other mobile marine creatures would move away from areas affected by appreciable underwater sounds from dredging. Once the dredging is completed, these creatures would be free to return to the affected location(s). It is difficult to see how this would represent anything other than a temporary nuisance to the affected organisms.

Noise effects on land have been primarily assessed based on the maximum expected dredging sound levels received at sites used for residential purposes. Noise from dredging received at the more distant residentially zoned sites during daytime are not likely to exceed L10 55 dBA which is an acceptable standard in terms of environmental health and amenity according to NZS6802:1991.

Regarding the hotel / apartments located near the port and closest to the dredging works, maximum expected noise levels received at these locations (Site 1) are not likely to exceed normal port operational noise and thus are not expected to give rise to any adverse effects.

For night time, dredging noise would only be noticeable in the area if there were no 'essential port activities' taking place. Even then, some noise is present due to non-essential port activities taking place in the port area. In order to mitigate potential noise effects of maintenance dredging where this is required to be undertaken after 10pm, a night time noise limit has been recommended below that is consistent with TRMP night time standards applying to noise from "essential port activities". These are the limits applying to normal ship loading taking place regularly within the port without any demonstrable adverse noise effects.

Outdoor noise from dredging may be detectable at these (and other) locations, however the effects of this noise would be less than minor in the context of day to day ambient conditions. Nearby urban receiving environments would be likely to already receive ambient sound levels greater than expected maximum dredging sound levels. It is therefore debateable whether there will be any detectable on shore noise effects of the proposed dredging

[7] *Technical Guidance on Underwater Sound*, WODA June 2013.

within nearby receiver environments.

8 Summary and Recommendation

Malcolm Hunt Associates have undertaken an assessment of environmental noise effects associated with the proposed *Maintenance Dredging and Disposal Project: Port Navigation Channel, Vessel Turning Basin & Wharves 4-8* involving dredging operations within the port navigation channel, vessel turning basin and Wharves 4 to 8 area at the Port of Gisborne, along with disposal of the spoil offshore at a the location indicated in the Application.

This assessment of environmental noise effects of proposed dredging operations has also covered aspects such as underwater noise, along with vibration.

Cumulative noise effects (ambient sounds including vehicle noise plus port activity noise plus dredging sounds) are considered not likely to be unreasonable or result in unacceptable noise effects on the local environment including residential receivers. The effects (if any) are considered consistent with outcomes anticipated by the TRMP in relation to noise from activities other than dredging undertaken in and around the port.

A limit on noise emission due to dredging has been recommended as a condition of consent (should consent be granted) that is consistent with that applying under an existing consent to operational port noise throughout the port. As explained in Section 5 above, the proposed condition differs slightly in terms of requiring measurement to be in accordance with NZS6801:1991 "Measurement of Sound" and assessment be in accordance with NZS 6802:1999 "Acoustics – Assessment of Environmental Sound". These two standards will ensure appropriate and applicable methods are adopted for the measurement and assessment of dredging noise.

The limits are set at levels which would provide protection against significant adverse noise effects, specifically by applying a lower noise limit for night time hours. Compliance with these requirements will ensure noise from proposed dredging will be no greater than activities well established in the port.

On the above basis we see no environmental noise-related reasons why consent cannot be granted under the Act for the proposed maintenance dredging activities provided the activity complies with the following condition aimed at controlling potential noise effects;

> *Noise emitted by dredging activities authorised by this consent shall comply with the following noise limits when measured at any point in the Amenity Commercial Zone, Residential General Zone or Inner City Residential Zone:*
>
> *(a) 65 dB Ldn*
> *(b) 60 dB LAeq(9h) (2200h-0700h)*
> *(c) 65 dB LAeq(15 min) (2200h-0700h)*
> *(d) 85 dB LAFmax (2200h-0700h)*
>
> *Measurements shall be in accordance with NZS6801:1991 "Measurement of Sound" and assessment shall be in accordance with NZS 6802:1999 "Acoustics – Assessment of Environmental Sound".*

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