7 Noise Impact Assessment

7.1 Introduction

This section presents an assessment of the potential noise impacts associated with the proposed improvement dredging works at Lamma Power Station navigation channel. Representative Noise Sensitive Receivers (NSRs) have been identified and assessed in accordance with Annexes 5 and 13 of Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) as well as the technical requirements stipulated in Clause 3.4.6 and Appendix E of the EIA Study Brief (ESB-282/2014). Restrictions on the dredging activities have been made, where necessary, to protect the NSRs and to ensure that the legislative criteria and guidelines can be satisfied.

7.2 Environmental Legislation, Standards, Guidelines and Criteria

7.2.1 Construction Phase

Control over the generation of construction noise from Designated Projects (DPs) under Environmental Impact Assessment Ordinance (EIAO) in Hong Kong is governed by the EIAO and the Noise Control Ordinance (NCO). The NCO is to provide statutory controls for carrying out construction work using powered mechanical equipment and prescribed construction works during the restricted hours. The noise standards for daytime construction activities are in according to Table 1B of EIAO-TM for construction noise of DPs. The Technical Memorandums (TMs) applicable to the control of noise from construction activities of proposed construction works are:

- TM on Environmental Impact Assessment Process (EIAO-TM)
- TM on Noise from Construction Work other than Percussive Piling (GW-TM).

These TMs prescribe the maximum permitted noise levels for the use of Powered Mechanical Equipment (PME) and certain construction activities and processes, according to the type of equipment or activity, the perceived noise climate of the area, and the working hours of equipment operation and usage.

7.2.1.1 General Construction Activities during Non-Restricted Hours

Noise impact arising from general construction activities other than percussive piling during the daytime period (07:00-19:00 hours of any day not being a Sunday or general holiday) would be assessed against the noise standards tabulated in **Table 7-1** below.

Table 7-1: Noise Standards for Daytime Construction Activities

Noise Sensitive Uses	0700 to 1900 hours on any day not being a Sunday or general holiday, Leq (30 mins), dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostel	
Educational institution including kindergarten, nurseries and all others where unaided voice communication is required	70 65 during examination period

Notes:
(i) The above noise standards apply to uses, which rely on opened windows for ventilation.
(ii) The above standards shall be viewed as the maximum permissible noise levels assessed at 1 m from the external facade.

7.2.1.2 General Construction Activities during Restricted Hours

Noise impacts arising from general construction activities (excluding percussive piling) conducted during restricted hours (19:00-07:00 hours on any day and anytime on Sunday or general holiday) and percussive piling during anytime are governed by the NCO.

For carrying out of any general construction activities involving the use of any Powered Mechanical Equipment (PME) within the restricted hours, a Construction Noise Permit (CNP) issued by the Authority must be obtained under the NCO. The noise criteria and the assessment procedures for issuing a CNP are specified in GW-TM published under the NCO.

The Acceptable Noise Levels (ANLs) for the NSRs are determined with consideration of the Area Sensitivity Rating (ASR), which is defined in GW-TM. As no significant changes of the NSRs in surrounding environment were identified, the assumption of ASR "A" in 2003 approved EIA remains valid. The relevant ANLs are given in **Table 7-2** below:

Table 7-2: Acceptable Noise Level for Construction Noise during Restricted Hours

Time Period	ANL, Leq(5 min), dB(A) ASR A
All days during the evening (1900 to 2300 hours), and general holidays including Sundays during day-time and evening (0700 to 1900 hours)	60
All days during the night-time (2300 to 0700 hours)	45

Regardless of any description or assessment made in this section, in assessing a filed application for a CNP the Authority will be guided by the relevant Technical Memoranda. The Authority will consider all the factors affecting their decision taking contemporary situations/ conditions into account. Nothing in this study shall pre-empt the Authority in making their decisions, and there is no guarantee that a CNP will be issued. If a CNP is to be issued, the Authority may include any conditions they consider appropriate and such conditions are to be followed while the works covered by the CNP are being carried out. Failing to do so may lead to cancellation of the CNP and prosecution action under the NCO.

According to the construction programme, the proposed construction works would be carried out 24 hours per day and 7 days per week, and it would be the Contractor's responsibility to ensure compliance with the NCO and the relevant TMs. The Contractor will be required to submit a CNP application to obtain a CNP from the Noise Control Authority and abide by any conditions stipulated, should any be issued.

7.2.2 Operation Phase

Some operation dredging for the improvement work to maintain the required depth within the navigation channel will be required. The noise criteria for the construction phase are also applicable to the future operation dredging during operational phase of this Project.

7.3 Description of the Environment

7.3.1 Study Area

The Study Area for the noise impact assessment should generally include areas within 300 m from the boundary of the Project and the works of the Project as shown in **Figure 7.1**.

7.3.2 Baseline Conditions

The major works area is located on the western side of Lamma Island. Scattered village houses / school along the west coast of Lamma Island would potentially be affected by the dredging works.

7.3.3 Noise Sensitive Receivers

Noise Sensitive Receivers (NSRs) have been identified in accordance with Annexes 5 and 13 of the EIAO-TM. The NSRs have included existing, planned / committed noise sensitive developments and relevant uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department.

No NSRs are identified within the Study Area. For the purpose of noise assessment, the first layer of houses / school of each village located close to the site boundary have been selected as assessment points / identified representative NSRs for prediction of the noise impact levels.

According to the Outline Zoning Plans (S/I-LI/11 – Lamma Island), the noise assessment area mainly comprises zoning of Village Type Development, Green Belt and Other Specified Uses. Existing NSRs in the residential zones located close to the site boundary have been identified and selected as representative NSRs. No planned NSR is identified in this Study. The identified representative NSRs are slightly different from that of the Project Profile since the nearest assessment points of the cluster of NSRs has been selected as representative NSRs in this study.

A summary of all selected representative NSRs for assessment is tabulated in **Table 7-3**. Locations of representative NSRs are shown in **Figure 7.1**.

Table 7-3: Representative Noise Sensitive Receivers Identified for the Assessment

NSR ID	Description	Existing / Planned	Type of Use	No. of Storeys (Sensitive use only)	Shortest Horizontal Distance from NSR to Project Boundary (approximate, m)
N1	Village House No.20, Ko Long	Existing	Residential	3	808
N2	Northern Lamma School	Existing	Educational	1	1256
N3	Village House No.21, Wang Long	Existing	Residential	3	1213
N4	Concerto Inn, Hung Shing Ye	Existing	Residential	3	1793
N5	YMCA Lamma Island Youth Hostel	Existing	Residential	2	2264
N6	Village House No.6, Lo So Shing	Existing	Residential	1	2002

Notes:
(i) Since the North Lamma Clinic has been installed with sealed glazing and provided with air-conditioning, the use does not rely on opened windows for ventilation and adverse noise impact is not expected. As a result, no assessment point is proposed for the North Lamma Clinic under the noise impact assessment.

7.4 Identification of Noise Emission Sources

7.4.1 Construction Phase Noise Impact

Operations of dredgers during the Channel improvement will be the major noise sources related to this Project. According to the 2003 approved EIA report (Register No.: AEIAR-069/2003), two options of dredging equipment were studied, viz., Trailer Suction Hopper Dredger (TSHD) or grab dredgers with tug boats. The types of dredgers that may be adopted for this Project are subject to the consideration of alternative options evaluation. However, reference from the approved EIA report has been made in this stage and the Powered Mechanical Equipment (PME) specifications are shown as **Table 7-4** below.

Table 7-4: PME Adopted in Previous Approved EIA Study

PME	Identification Code	SWL, dB(A)	Reference
Option 1 – TSHD			
TSHD	--	111	Approved EIA Reports [i]
Option 2 – Grab Dredgers			
Dredger, grab	CNP 063	112 [ii]	GW-TM
Tug boat	CNP 221		GW-TM

Notes:
(i) Approved EIA reports include "1,800 MW Gas-fired Power Station at Lamma Extension" (Register No.: AEIAR-010/1999) and "Lamma Power Station Navigation Channel Improvement" (Register No.: AEIAR-069/2003).
(ii) Since the tug boat is only used for moving the dump barge and it will not operate simultaneously with the corresponding grab dredger, at any time either one dredger grab or one tug boat will be operated for a pair of dredger grab and tug boat. As the sound power level of a tug boat is less than that of a grab dredger, the noisiest scenario will be operating of one grab dredger (i.e. SWL 112 dB(A)) for a pair of dredger grab and tug boat.

For the ground-borne construction noise issue from the operations of dredgers, since the horizontal distance between the proposed dredging works area and the nearest NSR (i.e. NSR N1) is at least 808 m,

the considerable distance will fully screen out the dredging vibration. Therefore, no ground-borne noise impact during the construction phase of the Project is anticipated.

The additional marine traffic flow induced by the Project (e.g. dredger and tug boat) is expected to be insignificant. With the considerable distance (i.e. at least 808 m) between the proposed dredging works area and the NSRs, potential marine traffic noise impact induced by the additional dredging vessels to the NSRs is not anticipated.

7.4.2 Operation Phase Noise Impact

During operation phase, operation dredging will be required periodically to maintain the required depth of the Channel. The potential noise impact associated with this recurring operation dredging is the same as that for construction phase. No other fixed noise source is anticipated.

Aside from the aforementioned, no other potential impact due to recurring operation dredging is anticipated given that the nature of the operation phase noise impact will be the same as that for construction phase.

7.4.3 Concurrent Projects

Concurrent projects in the vicinity with potential for cumulative noise impacts have been identified. Where sufficient information is available, the relevant activities of these concurrent projects have been incorporated as part of the cumulative noise impact assessment. A summary of the identified concurrent projects for consideration of cumulative impacts is presented in **Table 7-5**.

Table 7-5: Summary of Potential Concurrent Projects for Cumulative Noise Impact Assessment

Concurrent Project	Project Status	Relevant Construction Works	Reference Information for Cumulative Impact Assessment
Development of a 100MW Offshore Wind Farm in Hong Kong	In planning stage – no updated construction programme available	Marine piling and scour protection for wind farm Dredging and seawall removal / reinstatement for the submarine cable	Distance from Project boundary over 1,500m – not assessed for cumulative impacts
Planning and Engineering Study on Future Land Use at Ex-Lamma Quarry Area at Sok Kwu Wan, Lamma Island - Feasibility Study	Construction works are planned to commence in 2019 for completion in 2024. The programme is subject to change at a later stage.	Construction of tourist and recreational facilities accompanied by housing developments, public pier, refuse transfer station / piers, submarine sewage outfall, sewage treatment works, etc., and modification works to existing seawall.	Distance from Project boundary over 1,050m – not assessed for cumulative impacts
1,800 MW Gas-fired Power Station at Lamma Extension	Programme scheduled from early 2016 to end 2019	Construction of Unit L10	AEIAR-010/1999

Based on the latest information provided by the Hongkong Electric Company Limited, the construction of Unit L10 under the 1,800 MW Gas-fired Power Station at Lamma Extension Project is scheduled from early 2016 to end 2019. The cumulative construction noise impact associated with such construction works has been assessed in construction noise impact assessment. The plant inventory during the foundation & substructure, superstructure, structural steelwork and E&M erection phases of the Unit L10 in the approved "1,800 MW Gas-fired Power Station at Lamma Extension" EIA report (Register No.: AEIAR-010/1999) has been adopted for the assessment of cumulative construction noise impact.

7.5 Noise Impact Assessment Methodology

The adopted approach to assess the noise impact is in line with the Guidance Note titled "Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance" (GN 9/2010).

In addition, the assessment of construction noise impact is based on standard acoustic principles, and the guidelines given in GW-TM issued under the NCO where appropriate. The general approach is summarised below:

i. Obtain the construction schedules / programmes together with typical project-specific equipment type for each work stage from the relevant Engineering Design Consultants

ii. Obtain from GW-TM, the Sound Power Level (SWL) for each PME assumed in the equipment inventory

iii. Select representative NSRs for the construction noise impact assessment

iv. Calculate the optimum quantity of plants as well as the unmitigated Predicted Noise Level (PNL) and correct it for facade reflection to obtain the Corrected Noise Level (CNL) at any NSRs

v. If necessary, re-select typical project-specific silenced equipment and calculate the mitigated noise impact

vi. Compare the mitigated CNL with the noise standards to determine acceptability and the need for further mitigation.

The calculation methodology is estimated with the following standard Equation 3-1:

$$SPL = SWL - DC + FC \qquad \textit{Equation 3-1}$$

where

SPL:	Sound Pressure Level in dB(A)
SWL:	Sound Power Level in dB(A)
DC:	Distance Attenuation in dB(A) = 20 log D + 8 [where D is the distance in metres]
FC:	Façade Correction in dB(A) = +3 dB(A)

7.5.1 Dredging Working Zones

The major construction activity involved in this Project is the dredging of marine mud. Since no other potential noise source from this project is expected, the dredging works are identified as the representative phase of construction in this study. As shown in **Figure 7.1**, the navigation channel is divided into four

working zones, namely Zone 1 to 4. The optimum quantity of construction plants for each dredging method (e.g. TSHD / grab dredger) to meet the relevant construction noise criteria during non-restricted hours and restricted hours have been determined.

Notional source positions of PME groups at each working zone have been based on the assessment approach stated in GW-TM. Accordingly to GW-TM, if the construction site is large such that the notional source position would be greater than 50 m from the point on the site boundary nearest to the NSR the position shall be taken to be a point 50 m from that point on the site boundary measured along the line between the approximate geographical centre of the site and the point on the site boundary nearest to the NSR. If the dredging works area is large, a simple conservative approach of the site boundary nearest to the NSR plus 50m is adopted.

7.6 Construction Noise Impact Assessment

7.6.1 Noise Impact during Normal Working Hours (i.e. Non-Restricted Hours)

The optimum quantity of construction plants for each dredging method to meet the construction noise criteria and the predicted noise levels at the NSRs during normal working hours are shown in **Appendix 7.1** and summarised in **Table 7-6** below:

Table 7-6: Construction Noise Impact during Normal Working Hours

NSR ID	Type of Use	Predicted Noise Level dB(A)	Cumulative Noise Level dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?
Option 1 – TSHD, Optimum quantity: 60 pcs of TSHD at each Zone 1, 2, 3, 4					
N1	Residential	67	68	75	No
N2	Educational	65	65	70/65	No
N3	Residential	65	66	75	No
N4	Residential	64	65	75	No
N5	Residential	62	63	75	No
N6	Residential	63	64	75	No
Option 2 – Grab Dredgers, Optimum quantity: 48 pcs of Dredger, grab and 48 pcs of Tug boat at each Zone 1, 2, 3, 4					
N1	Residential	67	68	75	No
N2	Educational	65	65	70/65	No
N3	Residential	65	66	75	No
N4	Residential	64	65	75	No
N5	Residential	62	63	75	No
N6	Residential	63	64	75	No

The predicted results indicate that the construction noise impact of dredging activities with the optimum quantity of construction plants from this Project including the cumulative impact from concurrent project would comply with the construction noise criterion during the non-restricted hours at all representative NSRs. Therefore, adverse construction noise impact is not anticipated and hence mitigation measure is not required during the non-restricted hours.

7.6.2 Noise Impact during Evening and Holiday Day-time Periods

The optimum quantity of construction plants for each dredging method to meet the construction noise criteria and the predicted noise levels at the NSRs during the evening and holiday day-time periods are shown in **Appendix 7.1** and summarised in **Table 7-7** below:

Table 7-7: Construction Noise Impact during Evening and Holiday Day-time Periods

NSR ID	Type of Use	Predicted Noise Level* dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?
Option 1 – TSHD, Optimum quantity: 12 pcs of TSHD at each Zone 1, 2, 3, 4				
N1	Residential	60	60	No
N2	Educational	58	60	No
N3	Residential	58	60	No
N4	Residential	57	60	No
N5	Residential	55	60	No
N6	Residential	56	60	No
Option 2 – Grab Dredgers, Optimum quantity: 10 pcs of Dredger, grab and 10 pcs of Tug boat at each Zone 1, 2, 3, 4				
N1	Residential	60	60	No
N2	Educational	58	60	No
N3	Residential	58	60	No
N4	Residential	57	60	No
N5	Residential	55	60	No
N6	Residential	56	60	No

Notes:
(*) No construction noise impact from concurrent project. According to the approved EIA report "1,800 MW Gas-fired Power Station at Lamma Extension" (Register No.: AEIAR-010/1999), the foundation & substructure, superstructure, structural steelwork and E&M erection phases of the construction works of the Lamma Extension Project would be conducted during day-time period (i.e. 12 hours / day) only.

The predicted results indicate that the construction noise impact of dredging activities with the optimum quantity of construction plants from this Project would comply with the construction noise criterion during the evening and holiday day-time periods at all representative NSRs. Therefore, adverse construction noise impact is not anticipated and hence mitigation measure is not required during the evening and holiday day-time periods.

7.6.3 Noise Impact during Night-time Period

The optimum quantity of construction plants for each dredging method to meet the construction noise criteria and the predicted noise levels at the NSRs during the night-time period are shown in **Appendix 7.1** and summarized in **Table 7-8** below:

Table 7-8: Construction Noise Impact during Night-time Period

NSR ID	Type of Use	Predicted Noise Level* dB(A)	Noise Criteria dB(A)	Exceedance of Noise Criteria?
Option 1 – TSHD, Optimum quantity: 1 pc of TSHD at each Zone 2'#, 3, 4				
N1	Residential	44	45	No
N2^	Educational	42	45	No
N3	Residential	44	45	No
N4	Residential	44	45	No
N5	Residential	43	45	No
N6	Residential	44	45	No
Option 2 – Grab Dredgers, Optimum quantity: 1 pc of Dredger, grab and 1 pc of Tug boat at each Zone 2'#, 3, 4				
N1	Residential	45	45	No
N2^	Educational	43	45	No
N3	Residential	45	45	No
N4	Residential	45	45	No
N5	Residential	44	45	No
N6	Residential	45	45	No

Notes:

(*) No construction noise impact from concurrent project. According to the approved EIA report "1,800 MW Gas-fired Power Station at Lamma Extension" (Register No.: AEIAR-010/1999), the foundation & substructure, superstructure, structural steelwork and E&M erection phases of the construction works of the Lamma Extension Project would be conducted during day-time period (i.e. 12 hours / day) only.

(^) The operation hours of the Northern Lamma School would be from 7am to 11pm, i.e. not operated during night-time, as the school is closed during night-time. The predicted noise level is for reference only.

(#) Dredging working Zone 2' has been adopted in both options.

The predicted results indicate that the construction noise impact of dredging activities with the optimum quantity of construction plants from this Project would comply with the construction noise criterion during the night-time period at all representative NSRs. Therefore, adverse construction noise impact is not anticipated and hence mitigation measure is not required during the night-time period.

As the construction noise impact levels at the representative NSR are predicted to comply with the noise criteria during restricted hours, it is considered that it is feasible for the construction works being carried out in the restricted hours. However, regardless of the assessment results, in assessing a filed application for a CNP the Authority will be guided by the relevant Technical Memoranda. The Authority will consider all the factors affecting their decision taking contemporary situations/ conditions into account. Nothing in this EIA report shall pre-empt the Authority in making their decisions, and there is no guarantee that a CNP will be issued.

7.7 Operation Phase Noise Impact Assessment

As stated in **Section 7.4.2**, operation dredging will be required periodically to maintain the required depth of the Channel. The assumption that the quantity of dredgers and tug boats involved in the operation

dredging would be the same as that for the construction dredging in this Project during normal working hours. This indicated that the noise levels will comply with the noise criterion during the non-restricted hours. The Contractor will be required to submit a CNP application and obtain a CNP from the Noise Control Authority, and abide by any conditions stated if operation dredging is needed during restricted hours.

7.8 Mitigation Measures

As the predicted construction noise impacts at the NSRs would be in compliance with the relevant noise criteria, no mitigation measure is required for dredging during non-restricted and restricted hours provided that the quantity of construction plant not more than the optimum quantity as shown in **Table 7-6** to **Table 7-8**. However, the operation conditions specified in the CNP should be strictly followed for restricted hours.

7.9 Evaluation of Residual Impacts

No exceedance of the noise criteria was predicted at the representative NSRs, hence, no residual impact is anticipated.

7.10 Environmental Monitoring and Audit Requirements

No existing or planned NSR has been identified within 300 m from the works areas. The predicted construction noise levels at the NSRs located nearest to the works areas are complied with the noise criterion during the non-restricted hours. As such, noise will not be an issue and monitoring at the NSRs is not considered necessary during non-restricted hours. However, a daily log book should be maintained to record the number and type of plants deployed for auditing purpose.

Noise monitoring during restricted hours should be subject to the CNP requirements by EPD. Applicable permits under NCO should also be obtained by the Contractor.

7.11 Conclusion

The construction noise impact assessment has been conducted based on the best available information (taking into account other concurrent projects). With the optimum quantity of construction plants, the construction noise levels at all NSRs are predicted to comply with the relevant noise criteria. Adverse construction noise impacts are therefore not anticipated in this project.

The proposed construction has been assessed on a 24 hours per day basis. As the construction noise impact levels at the representative NSRs are predicted to comply with the noise criteria during restricted hours, it is considered feasible for the construction works to be undertaken during restricted hours. In case of any construction activities during restricted hours, it will be the Contractor's responsibility to ensure compliance with the NCO and the relevant TMs. The Contractor will also be required to submit a CNP application and obtain a CNP from the Noise Control Authority.

Same plant inventory has been assumed for the operation dredging as that for the construction dredging in this Project, the noise levels at the representative NSRs during operation dredging are expected to be no worse than during the construction phase and will comply with the construction noise criteria.