MOTT MACDONALD

Agreement No. CE 59/2020 (EP) Environmental Monitoring and Audit for Disposal Facility to the East of Sha Chau (2021-2026) – Investigation

Quarterly EM&A Report for
Contaminated Mud Pits to the East of Sha Chau
– April to June 2022

August 2022

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Mott MacDonald Hong Kong Limited
registered in Hong Kong no. 236497

土木工程拓展署
Civil Engineering and Development Department

MOTT MACDONALD

Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau

Environmental Certification Sheet

Environmental Permit No. EP-312/2008/A

Reference Document /Plan

Document/~~Plan~~ to be ~~Certified~~/ Verified:	Quarterly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – April to June 2022
Date of Report:	4 August 2022
Date prepared by ET:	4 August 2022
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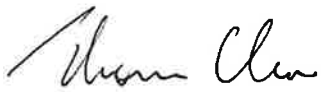
Reference EP Condition

Environmental Permit Condition:

Condition 3.1 of EP-312/2008/A:
The EM&A programme shall be implemented in accordance with the procedures and requirements as set out in the EM&A Manual. Any changes to the programme shall be justified by the ET leader and verified by the Independent Auditor as conforming to the information and requirements contained in the EM&A Manual before submission to the Director for approval.

ET Certification

I hereby certify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-312/2008/A.

Ir Thomas Chan,
Environmental Team Leader (ETL):  Date: 4 August 2022

IA Verification

I hereby verify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-312/2008/A.

Dr Wang Wen Xiong,
Independent Auditor (IA):  Date: 4 August 2022

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Impact Water Quality Monitoring during Dredging Operations, Water Column Profiling, Routine Water Quality Monitoring, Pit Specific Sediment Chemistry, and Cumulative Impact Sediment Chemistry were carried out for the Contaminated Mud Pits (CMPs) to the East of Sha Chau (ESC) during the quarterly reporting period of April to June 2022. This report presents the results of these monitoring activities to identify whether the disposal and capping operations at ESC CMP V are causing any unacceptable impact(s) to the surrounding aquatic environment or to those marine organisms that utilize these habitats.

Water Quality Monitoring for ESC CMPs

Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc – April to June 2022

Dredging activities for ESC CMP Vc were conducted between 1 April and 12 June 2022 and Impact Water Quality Monitoring during Dredging Operations for ESC CMP Vc was conducted three times per week during the reporting period between 1 April and 13 June 2022. Monitoring results showed that level of Dissolved Oxygen (DO) complied with the Action and Limit Levels at all stations. Levels of Turbidity and Suspended Solids (SS) mostly complied with the Action and Limit Levels. The results indicated that the dredging operations at ESC CMP Vc did not appear to cause any unacceptable deterioration in water quality during this quarterly period.

Water Column Profiling of ESC CMP Vb – April to June 2022

Results indicated that levels of Salinity, pH, DO and SS complied with the Water Quality Objectives (WQOs) at both Upstream and Downstream stations. Levels of DO, Turbidity and SS also complied with the Action and Limit Levels at all stations.

Overall, the results indicated that the mud disposal operation at ESC CMP Vb did not appear to cause any unacceptable impact in water quality during this reporting period.

Routine Water Quality Monitoring of ESC CMPs – April to June 2022

Results of Routine Water Quality Monitoring conducted in April, May and June 2022 showed that the levels of DO, SS and pH complied with the WQOs at all stations. Levels of Salinity also complied with the WQO at most stations. Levels of DO, Turbidity and SS complied with the Action and Limit Levels at all stations. From the monitoring results and statistical analysis, there were no trends indicating any increase in the concentrations of contaminants with proximity to the pit or with time. Thus, it appears that mud disposal operations at ESC CMPs have not caused any unacceptable impact in water quality during the reporting period.

Sediment Quality Monitoring for ESC CMPs

Pit Specific Sediment Chemistry of ESC CMP Vb – April to June 2022

Monitoring results showed that the concentrations of most inorganic contaminants were below the Lower Chemical Exceedance Levels (LCELs) at most monitoring stations. Statistical analysis indicated that there did not appear any trend of increasing sediment contaminants' concentrations with proximity to the pit or with time. Thus, it appears that mud disposal operation at ESC CMP Vb have not caused any unacceptable impact in sediment quality during the reporting period.

Cumulative Impact Sediment Chemistry of ESC CMPs – June 2022

Monitoring results showed that the concentrations of most inorganic contaminants were below the LCELs at most monitoring stations. Statistical analysis indicated that there did not appear to be any significant trend of increasing concentrations of contaminants with proximity to the pit or

with time. Thus, it appears that mud disposal operation at ESC CMP Vb have not caused any unacceptable impact in sediment quality during the reporting period.

Sediment Toxicity Tests of ESC CMPs – March 2022

Statistical analysis showed either no significant differences between Impact and Reference stations, or no project related trend in the toxicity tests of all the tested marine benthos. There did not appear to be any evidence of unacceptable impacts to sediment toxicity due to the mud disposal operations at ESC CMPs.

行政摘要

在 2022 年 4 月至 6 月的季度報告期內，環境小組在沙洲以東海泥卸置設施進行了挖掘期間水質監察、水層質量監察、例行水質監察、指定污泥坑沉積物化學監察及沉積物化學累積性影響監察。本報告詳述以上的環境監察結果，從而分析在沙洲以東海泥卸置設施 CMP V 的卸置及覆蓋作業有否對鄰近水體環境及利用這水體為棲身地的海洋生物造成不可接受的環境影響。

沙洲以東海泥卸置設施 (ESC CMPs)之水質監察

沙洲以東海泥卸置設施(ESC CMP Vc)挖掘期間水質監察 – 2022 年 4 月至 6 月

沙洲以東海泥卸置設施(ESC CMP Vc)的挖掘活動在 2022 年 4 月 1 日至 6 月 12 日期間進行，而水質監察則在 4 月 1 日至 6 月 13 日期間每星期進行 3 次。監察結果顯示，所有監測站的溶解氧含量符合行動及極限水平。另外，大部份監測站的混濁度及懸浮固體含量均符合行動及極限水平。總體而言，沒有證據顯示在報告期內沙洲以東海泥挖掘活動對周邊水體環境產生任何不可接受的水質影響。

水層質量監察 – 2022 年 4 月至 6 月

監察結果顯示上游及下游監測站的鹽度、酸鹼值、溶解氧及懸浮固體含量均符合海水水質指標。上游及下游監測站的溶解氧含量、混濁度及懸浮固體含量也符合行動及極限水平。總體而言，水層質量監察結果表明報告期內沙洲以東海泥卸置設施 CMP Vb 的污泥卸置活動沒有引致任何不可接受的水質影響。

例行水質監察 – 2022 年 4 月至 6 月

2022 年 4 月至 6 月的例行水質監察結果顯示，所有監測站的溶解氧濃度、懸浮固體含量及酸鹼值均符合海水水質指標。另外，大部分監測站的鹽度均符合海水水質指標。所有監測站的溶解氧含量、混濁度及懸浮固體含量也符合行動及極限水平。從監察數據和統計結果顯示，海水的污染物濃度沒有因越接近泥坑而趨向增加，亦沒有隨著時間而增加。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對周邊水體環境產生任何不可接受的水質影響。

沙洲以東海泥卸置設施 (ESC CMPs)之沉積物監察

指定污泥坑沉積物化學監察 – 2022 年 4 月至 6 月

監察結果顯示，大部分監測站的無機污染物含量均大致低於化學物質低量值。從統計結果顯示，沉積物的污染物濃度沒有因越接近泥坑而趨向增加，亦沒有隨著時間而增加。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對沉積物質素造成任何不可接受的影響。

沉積物化學累積性影響監察 – 2022 年 6 月

監察結果顯示，大部分監測站的無機污染物含量均大致低於化學物質低量值。從統計結果顯示，沉積物的污染物濃度沒有因越接近泥坑而趨向增加，亦沒有隨著時間而增加。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對沉積物質素造成任何不可接受的影響。

沙洲以東污泥坑之沉積物毒性測試 – 2022 年 3 月

統計結果顯示，所有已測試的海洋底棲生物在受影響監測站及參考監測站的沉積物毒性測試沒有明顯分別，且在沉積物毒性測試中亦沒有偵測到與項目相關的趨勢。總體而言，沒有證據顯示在報告期內沙洲以東海泥卸置運作對沉積物毒性造成任何不可接受的影響。

1 Introduction

1.1 Project Description

The Civil Engineering and Development Department (CEDD) is managing a number of marine disposal facilities in Hong Kong waters, including the Contaminated Mud Pits (CMPs) to the East of Sha Chau (ESC) for the disposal of contaminated sediment, and various open-sea disposal grounds located to the South of Cheung Chau (SCC), East of Tung Lung Chau (ETLC) and East of Ninepins (ENP) for the disposal of uncontaminated sediment.

Environmental Permits (EPs) (Ref. No. EP-312/2008/A) was issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for the Project – "Disposal of Contaminated Sediment – Dredging, Management and Capping of Sediment Disposal Facility at Sha Chau".

Under the requirements of the EP, EM&A programmes which encompass water and sediment chemistry, fisheries assessment, tissue and whole body analysis, sediment toxicity and benthic recolonisation studies as set out in the EM&A Manuals are required to be implemented. EM&A programmes have been continuously carried out during the operation of the CMPs at ESC. A review of the collection and analysis of such environmental data from the monitoring programme demonstrated that there had not been any adverse environmental impacts resulting from disposal activities.[1,2] The current programme will assess the impacts resulting from dredging, disposal and capping operations of CMP V.

A proposal on the change of number of sample replication of water quality and sediment monitoring as well as combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes have been effective for the EM&A activities since December 2020.

The present EM&A programme under Agreement No. CE 59/2020 (EP) ("the Study") covers the dredging, disposal and capping operations of the ESC CMP V (see **Appendix A** for the EM&A programme.)

1.2 Activities Conducted during the Reporting Period

Detailed works schedule for ESC CMP V is shown in **Table 1.1**. During the reporting period of April to June 2022, the following works were undertaken at the CMPs:

- Dredging of accumulated natural deposits at ESC CMP Vc;
- Disposal of contaminated mud at ESC CMP Vb; and
- Capping operations at ESC CMP Vd.

Table 1.1: Works Schedule for ESC CMP V

Pit	Operation	2021												2022												2023												2024												2025												2026		
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
ESC CMP V	Dredging																																																																
	Disposal																																																														
	Capping																																																														

The record for dredging of accumulated natural deposits at ESC CMP Vc during the reporting period is presented in **Appendix B1**. The records for contaminated mud disposal at ESC CMP

[1] ERM (2013) Final Report. Submitted under Agreement No. CE 4/2009 (EP) Environmental Monitoring and Audit for Contaminated Mud Pit at East Sha Chau. For CEDD.

[2] ERM (2017) Final Report. Submitted under Agreement No. CE 23/2012 (EP) Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012 – 2017). For CEDD.

Vb and capping operation at ESC CMP Vd during the reporting period are presented in **Appendix B2** and **B3**, respectively.

1.3 Objectives of the Monitoring and Audit Programme

The objectives of the EM&A programme are as follows:

1. To monitor and report on the environmental impacts of the dredging operations associated with the construction of the disposal pits at CMP V;
2. To monitor and report on the environmental impacts due to capping operations of the exhausted pits at CMP V;
3. To monitor and report on the environmental impacts of the disposal of contaminated marine sediments in the active pits at CMP V and specifically to determine:
   a. changes/trends caused by disposal activities in the concentrations of contaminants in sediments adjacent to the pits;
   b. changes/trends caused by disposal activities in the concentrations of contaminants in tissues of demersal marine life adjacent to and remote from the pits;
   c. impacts on water quality and benthic ecology caused by the disposal activities; and
   d. the risks to human health and dolphin of eating seafood taken in the marine area around the active pits.
4. To monitor and report on the environmental impacts of the disposal operation at CMP V and specifically to determine whether the methods of disposal are effective in minimising the risks of unacceptable environmental impacts.
5. To monitor and report on the benthic recolonisation of the capped pits at CMP V and specifically to determine the difference in infauna between the capped pits and adjacent sites.
6. To assess the impact of a major storm (Typhoon Signal No. 8 or above) on the containment of any uncapped or partially capped pits at CMP V.
7. To design and continually review the operation and monitoring programme and:
   a. to make recommendations for changes to the operation that will rectify any unacceptable environmental impacts; and
   b. to make recommendations for changes to the monitoring programme that will improve the ability to cost effectively detect environmental changes caused by the disposal activities.
8. To establish numerical decision criteria for defining impacts for each monitoring component.
9. To provide supervision on the field works and laboratory works to be carried out by contractors/laboratories.

1.4 Purpose of this Report

The purpose of this *Quarterly EM&A Report for Contaminated Mud Pits to the East of Sha Chau – April to June 2022* is to provide information regarding the findings in the reporting period of April to June 2022 (from 1 April to 30 June 2022) on the environmental impacts resulting from dredging operation at ESC CMP Vc, backfilling operation at ESC CMP Vb and capping operation at ESC CMP Vd. Although the EM&A programme has been conducted since 1997, this report presents the analytical and statistical results of the quarterly reporting period. Results from previous monitoring will be presented and discussed in the Annual Review Report. Readers are referred to the Monthly EM&A Reports for this Study for graphical and tabular presentations of the monitoring results.

The objectives of this report are to:

- Confirm that all activities, tests, analyses, assessments etc. have been carried out as stated in the Updated EM&A Manual[3]; and
- Report on any trend resulting from dredging, backfilling and capping operations at the CMPs.

[3] ERM (2017) Updated Environmental Monitoring and Audit (EM&A) Manual. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2017-2020) – Investigation. Agreement No. CE 63/2016(EP). Submitted to EPD in July 2017.

2 Summary of EM&A Programme

2.1 EM&A Tasks

Six key elements were designed for the EM&A Programme for assessing whether key environmental parameters are being affected by dredging, backfilling and capping operations at the CMPs. Key tasks are as follows:

- Sediment Quality Monitoring;
- Sediment Toxicity Testing;
- Trawling & Tissue/Whole Body Contaminant Testing;
- Water Quality Monitoring;
- Human Health and Ecological Risk Assessment; and
- Benthic Recolonisation.

2.2 EM&A Sampling and Analysis

Details regarding the methodologies for the field sampling and laboratory analysis of the monitoring tasks listed in **Section 2.1** are presented in the Updated EM&A Manual as well as in the following sampling and laboratory analysis contracts:

- Contract No. CV/2017/04 Sediment Disposal Facilities to the East of Sha Chau and East of Tung Lung Chau – Sampling (2018-2022); and
- Contract No. CV/2017/05 Sediment Disposal Facilities to the East of Sha Chau and East of Tung Lung Chau – Testing (2018-2022).

Lam Geotechnics Limited and Wellab Limited (hereinafter known as “Contractors”) were responsible for sampling under Contract No. CV/2017/04 and laboratory analysis under Contract No. CV/2017/05, respectively, during the reporting period.

3 Summary of Monitoring and Audit Activities

3.1 Sampling and Laboratory Analysis

Schedules of the EM&A programme are presented in **Appendix A**. The sampling, *in-situ* measurements and analysis of samples were conducted in accordance with the Updated EM&A Manual during this reporting period. The sampling conducted as well as the monitoring results received from the Contractors for this reporting period are shown in **Table 3.1**.

Table 3.1: Samplings Conducted and Monitoring Results Received from the Contractors for the Reporting Period

Key Task	Date of Sampling and *In-Situ* Measurement	Date of Results Received from the Contractors
ESC CMPs		
Impact Monitoring for Dredging of ESC CMP Vc	1, 4, 6, 8, 11, 13, 15, 19, 21, 23 & 25 Apr 2022	28 Apr 2022
	2, 4, 6, 9, 13, 16, 18, 20, 23, 25, 27 & 30 May 2022	1 Jun 2022
	2, 4, 6, 8, 10, 13 June 2022	29 Jun 2022
Water Column Profiling of ESC CMP Vb	20 Apr 2022	28 Apr 2022
	19 May 2022	1 Jun 2022
	7 Jun 2022	29 Jun 2022
Routine Water Quality Monitoring of ESC CMPs	14 Apr 2022	28 Apr 2022
	12 May 2022	1 Jun 2022
	9 Jun 2022	29 Jun 2022
Pit Specific Sediment Chemistry of ESC CMP Vb	7 Apr 2022	28 Apr 2022
	5 May 2022	1 Jun 2022
	1 June 2022	29 Jun 2022
Cumulative Impact Sediment Chemistry of ESC CMPs	16 Jun 2022	11 Jul 2022
Sediment Toxicity Test of ESC CMPs*	24 Mar 2022	17 May 2022

* The results of the sediment toxicity test conducted in the last reporting period were released in May 2022, and thus is presented in this quarterly report.

The monitoring results of the above environmental monitoring components for ESC CMPs have been presented in the respective Monthly EM&A Reports. The statistical analysis of these environmental monitoring components, where applicable, are presented in the following sections to report any trends caused by disposal activities at ESC CMPs during the reporting period. It should be noted that statistical analysis was not conducted for Water Column Profiling for ESC CMP Vb as the monitoring stations were mobile depending on the location of backfilling operation during the monitoring event. In addition, there was no action / limit level exceedances for the level of DO for the impact water quality monitoring during dredging operation of ESC CMP Vc, with the levels of Turbidity and SS mostly complied with the Action and Limit Levels conducted in April, May and June 2022. The results indicated that the dredging operations at ESC CMP Vc did not appear to have any unacceptable deterioration in water quality due to the dredging operation.

4 Summary of Monitoring Results and Statistical Analysis for ESC CMPs

4.1 Impact Water Quality Monitoring during Dredging Operations of ESC CMP Vc

Dredging activities for ESC CMP Vc were conducted between 1 April and 12 June 2022 and Impact Water Quality Monitoring during Dredging Operations for ESC CMP Vc was conducted three times per week during the reporting period between 1 April and 13 June 2022 as presented in **Table 3.1**. During each survey day, monitoring was conducted during both mid-ebb and mid-flood tides at two Reference (Upstream) stations and five Impact (Downstream) stations around the dredging operations at ESC CMP Vc. Monitoring was also conducted at one Sensitive Receiver station situated in Ma Wan. A total of eight (8) stations were monitored and locations of the sampling stations are shown in **Figure 4.1**. The dredged volume during the reporting period is detailed in Table B1 of **Appendix B**. The monitoring results indicated that level of DO complied with the Action and Limit Levels at all stations. Levels of Turbidity and SS generally complied with the Action and Limit Levels at most stations.

Overall, the results indicated that the dredging operations at ESC CMP Vc did not appear to cause any unacceptable deterioration in water quality during this quarterly period.

4.2 Water Column Profiling of ESC CMP Vb

Water Column Profiling for ESC CMP Vc was conducted once every month from April to June 2022 as presented in **Table 3.1**. A total of two (2) stations were sampled, one located 100 m Upstream and one located 100 m Downstream of the disposal area. The monitoring results indicated that levels of Salinity, pH, DO and SS complied with the WQOs at both Upstream and Downstream stations in April, May and June 2022. Levels of DO, Turbidity and SS also complied with the Action and Limit Levels at all stations during the reporting period.

Overall, the results indicated that the mud disposal operation at ESC CMP Vb did not appear to cause any unacceptable deterioration in water quality during this reporting period.

4.3 Routine Water Quality Monitoring of ESC CMPs

4.3.1 Background

Routine Water Quality Monitoring for ESC CMPs was conducted once every month from April to June 2022 as presented in **Table 3.1**. A total of sixteen (16) stations were sampled during ebb tide in April, May and June 2022 with locations of the monitoring stations presented in **Figure 4.2**. The disposal and capping volumes during the reporting period are detailed in **Appendix B2 and B3**, respectively. The monitoring results showed that levels of DO, SS and pH complied with the WQOs at all stations. The levels of DO, Turbidity and SS complied with the Action and Limit Levels at all stations during the reporting period.

4.3.2 Summary of Statistical Analysis

The aim of the statistical analysis is to reveal any trends of increasing concentration of contaminants with proximity to the pit or with time. Data obtained during this reporting period were statistically compared with data obtained since monitoring began at CMP V in February 2012. For most parameters, only low concentrations were measured from February 2012 to June 2022 and some parameters have majority of their recorded values below the limit of reporting. Statistical

analysis was performed on parameters for which at least 60% of data were above the limit of reporting since monitoring of CMP V began in February 2012. Improvements have been made to the statistical analysis whereby the spatio-temporal differences in in-situ parameters, dissolved metal, inorganic and organic contaminant contents were tested by two-factor Analysis of Variance (ANOVA) separately for ebb tide and flood tide. Area and Period were treated as fixed factors under investigation.

Should spatial trend of potential concern (i.e. increasing contaminant concentration with proximity to the pit) be detected by ANOVA and subsequent SNK post-hoc tests, further evaluation would be conducted to evaluate if the mud disposal activities were causing consistent and adverse impact to the water body. If potential concern was detected by SNK results for consecutive reporting months, linear regression analyses would be performed to examine the temporal change of contaminant levels in each area over the concerned months in consideration of tidal effects. Further analysis may also include assessing the concentration variation between stations. Details regarding the statistical analysis results are presented in **Appendix C**.

4.3.3 In-Situ Measurements

Dissolved Oxygen (DO)

DO levels varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of decreasing concentrations of DO with proximity to the pit. DO levels were generally the highest at Intermediate and Impact stations, thus there was no significant project related impact.

Turbidity

Turbidity levels varied significantly with sampling periods and areas during ebb tide and flood tide. During ebb tide, the relationship between turbidity levels and proximity to the pit (i.e. Area) indicated a significant overall spatial trend due to historic data from past reporting quarters. No potential project related spatial trend were detected within this reporting quarter. During flood tide, there was no consistent spatial trend of increasing concentrations of turbidity with proximity to the pit, where the turbidity levels were generally the highest at Impact stations.

4.3.4 Metals and Metalloid

The majority of dissolved metals had high percentage of their values below the limit of reporting (i.e. > 60% of values were below the limit of reporting during February 2012 to June 2022). Copper, Nickel and Zinc were the exceptions, and all varied significantly over sampling periods and area as indicated by results of the ANOVA tests (**Appendix C**), but without any consistent project related spatial trends for both ebb and flood tide. The concentrations of Copper and Nickel were the highest at Reference stations; while the concentrations of Zinc were the highest at Ma Wan station.

4.3.5 Inorganic Contaminants

Ammonia Nitrogen (NH_3-N)

NH_3-N concentrations varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of increasing concentrations of NH_3-N with proximity to the pit. Concentrations of NH_3-N were generally similar at all stations and slightly higher at Ma Wan station, thus there was no significant project related impact.

Total Inorganic Nitrogen (TIN)

TIN concentrations varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of increasing concentrations of TIN with proximity to

the pit. Concentrations of TIN were generally the highest at Reference and Impact stations, thus there was no significant project related impact.

5-Day Biochemical Oxygen Demand (BOD_5)

Levels of BOD_5 varied significantly with sampling periods and areas during ebb tide and flood tide. There was no consistent spatial trend of increasing concentrations of BOD_5 with proximity to the pit. Levels of BOD_5 were generally similar across all stations and higher at Reference and Ma Wan stations.

Suspended Solids (SS)

SS levels varied significantly with sampling periods and areas during ebb tide and flood tide. During ebb tide, the relationship between SS levels and proximity to the pit (i.e. Area) indicated a significant overall spatial trend, but no potential project related spatial trend was detected in this reporting period, thus there was no evidence showing consistent project related impact. During flood tide, there was no consistent spatial trend of increasing SS levels with proximity to the pit, where SS levels were generally the highest at Reference stations.

4.3.6 Conclusions

Overall, results of statistical analyses for the water quality data did not appear to provide any evidence of unacceptable water quality impacts caused by the mud disposal and capping operations at CMP V of the ESC area.

4.4 Pit Specific Sediment Chemistry of ESC CMP Vb

4.4.1 Background

Pit Specific Sediment Chemistry of ESC CMP Vb was conducted once every month from April to June 2022 as presented in **Table 3.1**. A total of six (6) monitoring stations for ESC CMP Vb were sampled in each monitoring event and the monitoring locations are shown in **Figure 4.3**. The monitoring results showed that the concentrations of most inorganic contaminants were below the Lower Chemical Exceedance Levels (LCELs) at most stations from April to June 2022, except for Copper, Silver and Arsenic. The concentration of Copper was higher than the LCEL at Active-Pit station ESC-NPCA in April 2022. The concentration of Silver was higher than the LCEL at Active-Pit station ESC-NPCA in April 2022. The concentrations of Arsenic were higher than the LCEL at Pit-Edge station ESC-NECA and Active-Pit station ESC-NPCB in April 2022; at Near-Pit station ESC-NNCA, Pit-Edge station ESC-NECA and Active-Pit station ESC-NPCA in May 2022; and at Near-Pit station ESC-NNCA, Pit-Edge stations ESC-NECA & ESC-NECB and Active-Pit stations ESC-NPCA & ESC-NPCB in June 2022.

4.4.2 Summary of Statistical Analysis

Statistical analysis was performed for data obtained from Pit Specific Sediment Chemistry of ESC CMP Vb since February 2020. Improved statistical tests were run to examine the difference in contaminant concentrations between Active-Pit, Pit-Edge and Near-Pit stations and between sampling periods. ANOVA was employed as the statistical test, with Period, Area, and Direction as fixed factors.

Should temporal trend of potential concern (i.e. increasing contaminant concentration with proximity to the pit) be detected by ANOVA and subsequent SNK post-hoc tests for consecutive reporting months, further evaluation would be conducted to evaluate if the mud disposal activities were causing consistent and adverse impact to the sediment quality. Linear regression analyses would be performed to examine the temporal change of contaminant levels in each area over the concerned months. Detailed results of statistical analysis are presented in **Appendix C**.

Metals and Metalloids

There were significant spatial and temporal variations in the concentrations of all metal and metalloid contaminants (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver and Zinc). The relationship between contaminant levels and proximity to the pit (i.e. Area) was not significant for Cadmium, Copper, Lead, Mercury, Silver and Zinc. Subsequent linear regression analysis was conducted for Arsenic (ebb tide direction), Chromium (flood tide direction) and Nickel (flood tide direction). For Arsenic (ebb tide direction), the contaminant concentration returned to a lower level in April 2022 than that in March 2022, and the potential project related spatial trend was not detected in May 2022. Therefore, there is no evidence indicating consistent project related impact over time. For Chromium (flood tide direction) and Nickel (flood tide direction), although the overall contaminant concentration in May 2022 were higher than April 2022, the potential project related spatial trend was not detected in June 2022. Therefore, there was no consistent spatial trend of increasing contaminant concentrations with proximity to the pit over time.

Organic Contaminants

Concentrations of majority of organic contaminants were below their limits of reporting. Statistical analyses were only performed for contaminants for which 60% of data were over their limits of reporting.

In this reporting period, only Total Organic Carbon (TOC) concentrations were statistically analysed. Levels of TOC varied significantly with sampling periods and areas, but the overall project related spatial trend was not significant. As no potential project related spatial trend were detected for the reporting months, there is no evidence indicating unacceptable project-related impact over time.

4.4.3 Conclusions

From the results of the above statistical analyses, there did not appear to be any significant trend of increasing sediment contaminants' concentrations with proximity to the pit or with time. Therefore, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vb.

4.5 Cumulative Impact Sediment Chemistry of ESC CMPs

4.5.1 Background

Cumulative Impact Sediment Chemistry of ESC CMPs was conducted in June 2022 as presented in **Table 3.1**. A total of nine (9) monitoring stations were sampled and the monitoring locations are shown in **Figure 4.4**. The monitoring results showed that the concentrations of most inorganic contaminants were below the LCELs at most monitoring stations in June 2022, except the concentrations of Arsenic which were higher than the LCEL at Near-field station ESC-RNB1, Mid-field station ESC-RMA and Far-field station ESC-RFB.

4.5.2 Summary of Statistical Analysis

Data obtained during this reporting period were statistically compared with previous data obtained since monitoring began for ESC CMPs in June 2016. Improved statistical tests were run to examine the difference in contaminant concentrations amongst Near-Field, Mid-Field, Far-Field stations. ANOVA was employed as the statistical test, with Area and Station as fixed factors.

Should spatial trend of potential concern (i.e. increasing contaminant concentration with proximity to the pit) be detected by ANOVA and subsequent SNK post-hoc tests for a considerable period over the whole sampling period, further evaluation would be conducted to evaluate if the mud disposal activities were causing consistent and adverse cumulative impact to the sediment quality.

Regression analysis would be performed to examine the potential increase on the sediment contaminant concentration over time. Detailed results of statistical analysis are presented in **Appendix C**.

Metals and Metalloid

There were significant spatial variations in the concentrations of all metal and metalloid contaminants (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver and Zinc), but no consistent spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) was observed. In most cases, metal concentrations were the highest at Ma Wan or Mid-Field stations, thus there was no significant project related impact.

Organic Contaminants

Concentrations of the majority of organic contaminants were below their limits of reporting. Statistical analyses were only performed for contaminants for which 60% of data were over their limits of reporting.

In this reporting period, only TOC concentrations were statistically analysed. Levels of TOC varied significantly with sampling area and time, with generally higher concentrations recorded at Ma Wan station and Mid-field stations. There was no consistent spatial trend of increasing concentrations of TOC with proximity to the pit.

4.5.3 Conclusions

From the results of the above statistical analysis, there did not appear to be any significant trend of increasing sediment contaminants' concentrations with proximity to the pit or over time. Therefore, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vb during the reporting period.

4.6 Sediment Toxicity Tests – March 2022

Sediment Toxicity Tests were undertaken for sediments collected from the Impact (Near Pit), Reference and Ma Wan stations (see **Figure 4.5** for the sampling locations) in March 2022. Due to the logistic problem induced by the pandemic which adversely affecting the supply of international species adopted in testing programme of Sediment Toxicity Tests, as such, the tests originally scheduled in February 2022 were postponed to March 2022. The logistic problem persisted in March 2022 such that the supply of one of the species, namely burrowing amphipod *Leptocheirus plumulosus*, was still adversely affected. Therefore, there was no alternative but to carry out the tests in March 2022 using two international species (marine benthic polychaete *Neanthes arenaceodentata* and marine bivalve *Crassostrea gigas*) and two local species (barnacles *Balanus amphitrite* and shrimp *Penaeus vannaamei*) without burrowing amphipod *Leptocheirus plumulosus*.

Appropriate statistical test, i.e. ANOVA, was applied for comparing and determining the level of significance in the results of March 2022 between Impact and Reference Stations. When significant difference was detected then multiple comparison procedures would be used (e.g. Turkey's Test) to isolate where the differences is occurring.

Results of the Sediment Toxicity Tests in March 2022 showed that there were no significant differences between Impact and Reference stations in the toxicity tests for the growth rate for benthic polychaete. In detailed analysis, the potential project related spatial trend was not detected in the survival rate for marine bivalve and mortality rate for barnacles. Potential project related trend was detected for mortality rate for shrimp in March 2022, however, during our further investigation on the analysis results of the Cumulative Impact Monitoring of Sediment Quality. conducted in February 2022, no unacceptable project related impacts to sediment quality was

observed. It is also noted that variation on sediment grain size presence between treatment areas, therefore, it is hard to eliminate the effect of this physical factor on the mortality rate for shrimp. Therefore, there did not appear to be any evidence of unacceptable impacts to sediment toxicity due to the mud disposal operations at ESC CMP Vb. Detailed results of statistical analyses are presented in **Appendix C.**

5 Findings of the Field Events and Laboratory Tests and Analyses by the Independent Auditor

During the reporting period, the Independent Auditor (IA) conducted an inspection for Water Column Profiling on 20 April 2022 and a total of 2 stations were sampled. In situ and laboratory measurements were conducted. The IA was generally satisfied with the sample collection and confirmed that the requirements as stated in the EM&A Manual were implemented accordingly.

6 Future Key Issues

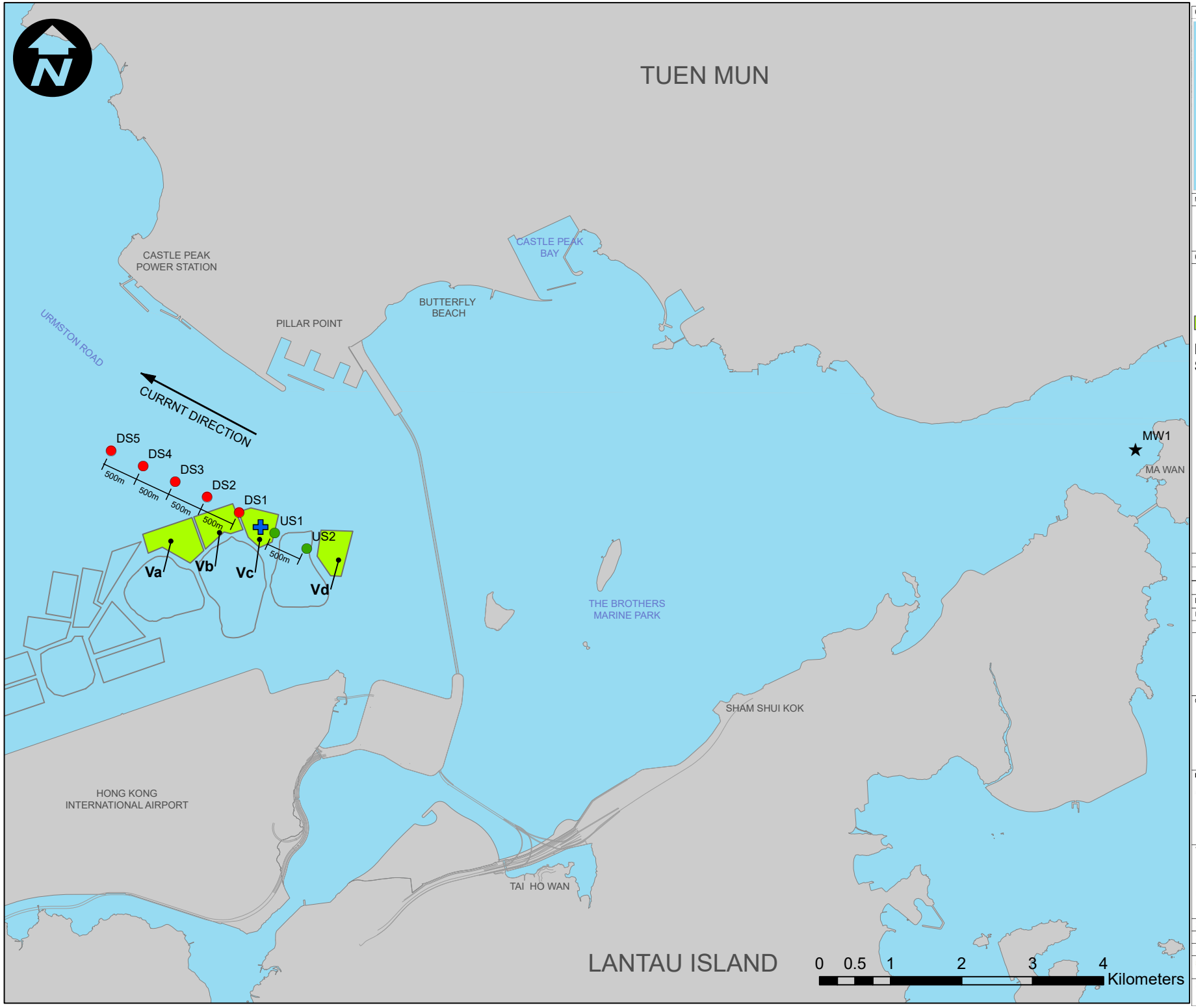
6.1 Activities Scheduled for the Next Reporting Period

The following monitoring activities will be conducted in the next quarterly reporting period of July to September 2022 for ESC CMPs including:

- Water Column Profiling of ESC CMP Vb in July, August and September 2022;
- Routine Water Quality Monitoring of ESC CMPs in July, August and September 2022;
- Pit Specific Sediment Chemistry of ESC CMP Vb in July, August and September 2022;
- Cumulative Impact Sediment Chemistry of ESC CMPs in August 2022;
- Sediment Toxicity Test of ESC CMPs in August 2022; and
- Demersal Trawling for ESC CMPs in August and September 2022.

The sampling schedule for ESC CMPs is presented in **Appendix A**.

Figures



Key Plan:

Notes:

Key to symbols:

LEGEND

ESC CMP V

INDICATIVE DREDGING IMPACT SAMPLING STATIONS

- POSITION OF DREDGING ACTIVITY
- DOWNSTEAM/ IMPACT STATION
- UPSTREAM/ REFERENCE STATION
- MA WAN STATION

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	AUG 2021	KN			

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Project

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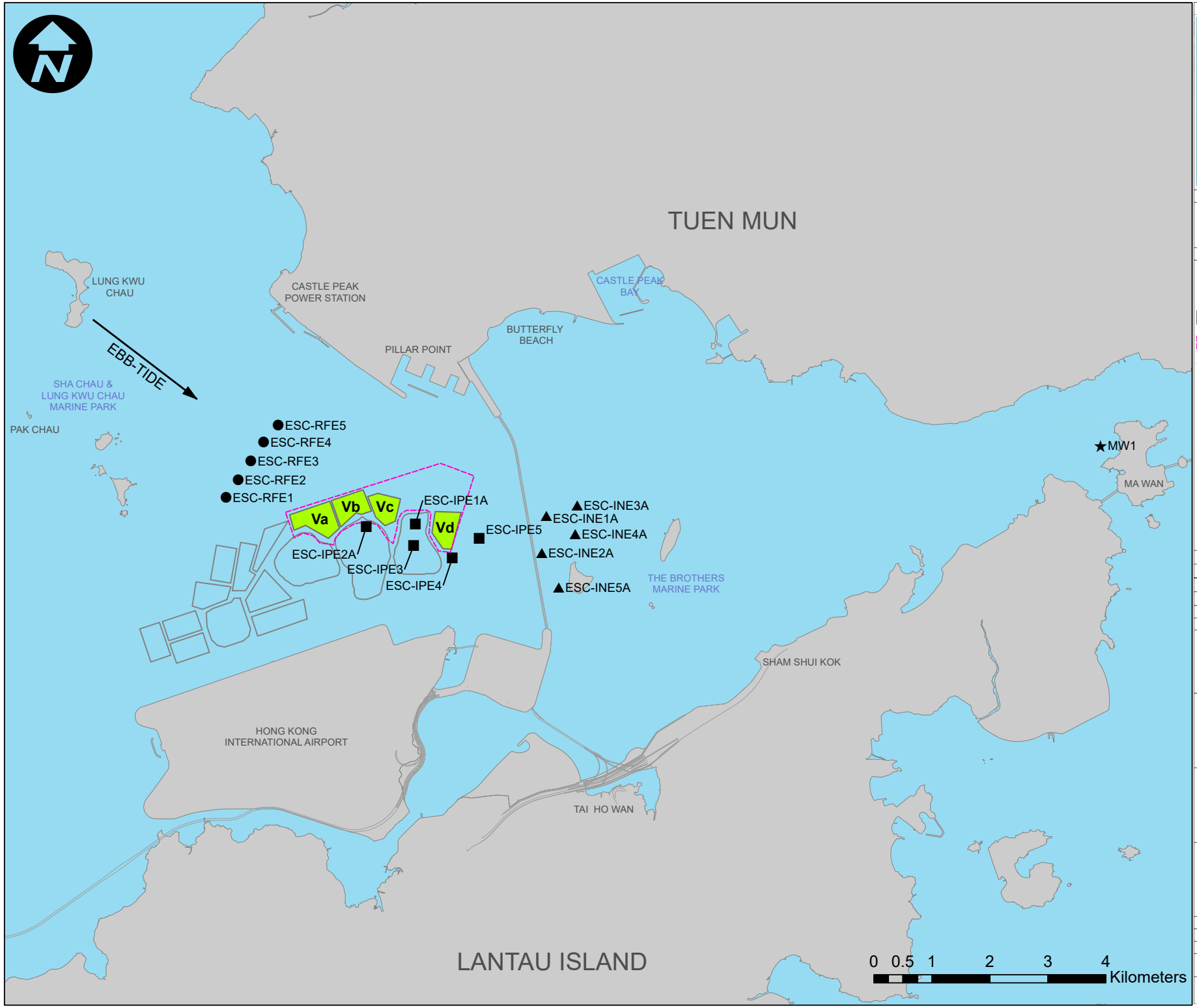
Title

INDICATIVE DREDGING IMPACT SAMPLING STATIONS FOR ESC CMPS

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.1



Key Plan:

Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1

WATER QUALITY SAMPLING STATIONS

- ■ IMPACT STATION
- ▲ INTERMEDIATE STATION
- ● REFERENCE STATION
- ★ MA WAN STATION

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P1	APR 2021	KN			

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Title

ROUTINE & CAPPING WATER QUALITY SAMPLING STATIONS (EBB-TIDE) FOR ESC CMPS

Designed			Eng check		
Drawn			Coordination		
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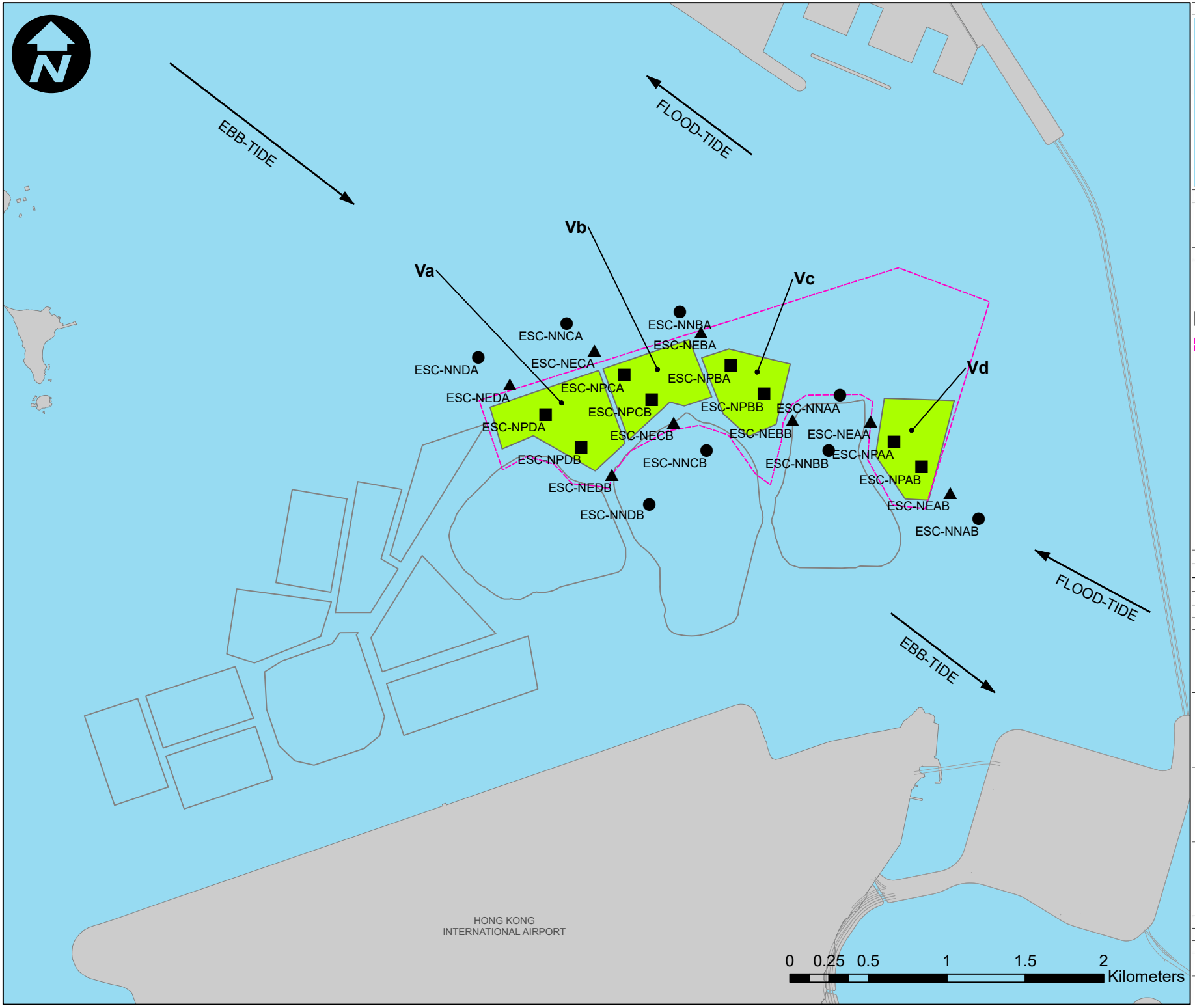
Drawing Number

FIGURE 4.2



Key Plan:

Notes:

Key to symbols:

LEGEND

ESC CMP V

ESC USABLE AREA 1

PIT SPECIFIC SEDIMENT MONITORING STATIONS

ACTIVE-PIT STATION

PIT-EDGE STATION

NEAR-PIT STATION

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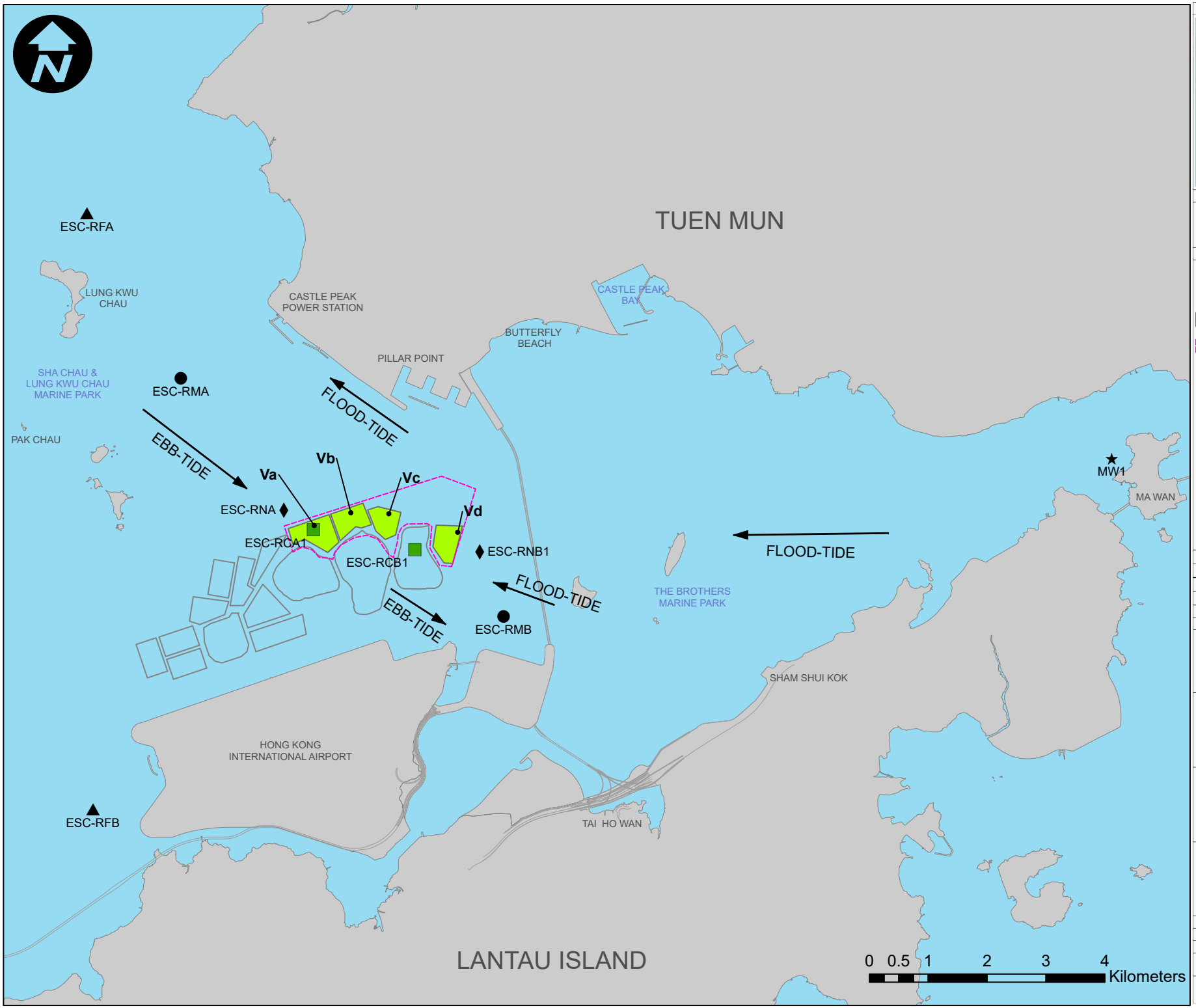
Title

PIT SPECIFIC SEDIMENT QUALITY MONITORING STATIONS FOR CMP V

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.3



Key Plan:

Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1

CUMULATIVE IMPACT SEDIMENT MONITORING STATIONS

- CAPPED PIT STATION
- NEAR-FIELD STATION
- MID-FIELD STATION
- FAR-FIELD STATION
- MA WAN STATION

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Title

CUMULATIVE IMPACTS SEDIMENT QUALITY MONITORING STATIONS FOR ESC CMPS

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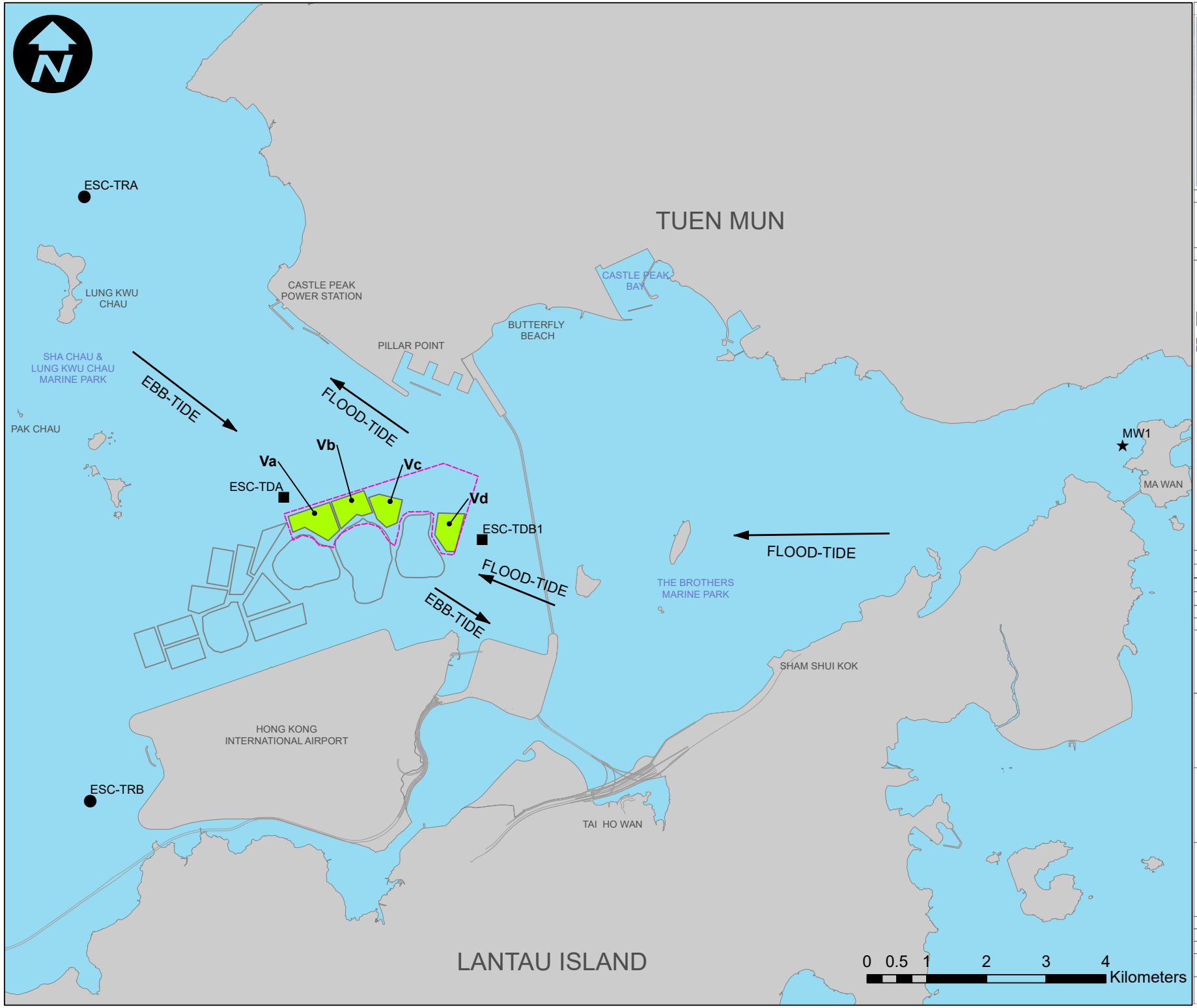
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.4



Key Plan:

Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1

SEDIMENT TOXICITY MONITORING STATIONS

- NEAR-FIELD STATION
- REFERENCE STATION
- MA WAN STATION

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Title

SEDIMENT TOXICITY MONITORING STATIONS FOR ESC CMPS

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Drawn			Coordination		
Dwg check			Approved		
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.5

Appendices

Appendix A. Sampling Schedule

East of Sha Chau CMPs
Environmental Monitoring and Audit Sampling Schedule
(January 2021 - March 2026)

Parameter / Station Type	Station ID	Frequency	2021												2022												2023												2024												2025												2026		
Pit Specific Sediment Chemistry *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Active-Pit																																																																		
	ESC-NPAA	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	ESC-NPAB	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Pit-Edge																																																																		
	ESC-NEAA	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	ESC-NEAB	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Near-Pit																																																																		
	ESC-NNAA	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	ESC-NNAB	Monthly	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Cumulative Impact Sediment Chemistry *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-field Stations																																																																		
	ESC-RNA	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RNB1	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Mid-field Stations																																																																		
	ESC-RMA	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RMB	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Capped Pit Stations																																																																		
	ESC-RCA1	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RCB1	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Far-field Stations																																																																		
	ESC-RFA	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
	ESC-RFB	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Ma Wan Station																																																																		
	MW1	4 times per year		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6				6		6	
Sediment Toxicity Tests			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-pit Stations																																																																		
	ESC-TDA	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
	ESC-TDB1	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
Reference Stations																																																																		
	ESC-TRA	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
	ESC-TRB	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
Ma Wan Station																																																																		
	MW1	2 times per year		5						5							5#					5						5						5						5						5						5						5						5	
Tissue / Whole Body Sampling			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-pit Stations																																																																		
	ESC-INA	2 times per year		*						*						*						*						*						*						*						*						*						*						*	
	ESC-INB	2 times per year		*						*						*						*						*						*						*						*						*						*						*	
Reference North																																																																		
	TNA	2 times per year		*						*						*						*						*						*						*						*						*						*						*	
	TNB	2 times per year		*						*						*						*						*						*						*						*						*						*						*	
Reference South																																																																		
	TSA	2 times per year		*						*						*						*						*						*						*						*						*						*						*	
	TSB	2 times per year		*						*						*						*						*						*						*						*						*						*						*	
Demersal Trawling			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Near-pit Stations																																																																		
	ESC-INA	4 times per year	5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	ESC-INB	4 times per year	5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Reference North																																																																		
	TNA	4 times per year	5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	TNB	4 times per year	5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Reference South																																																																		
	TSA	4 times per year	5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
	TSB	4 times per year	5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5					5	5	
Capping *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ebb Tide																																																																		
Impact Station Downcurrent																																																																		
	ESC-IPE1A	4 times per year *																																																																	
	ESC-IPE2A	4 times per year *																																																																	
	ESC-IPE3	4 times per year *																																																																	
	ESC-IPE4	4 times per year *																																																																	
	ESC-IPE5	4 times per year *																																																																	
Intermediate Station Downcurrent																																																																		
	ESC-INE1A	4 times per year *																																																																	
	ESC-INE2A	4 times per year *																																																																	
	ESC-INE3A	4 times per year *																																																																	
	ESC-INE4A	4 times per year *																																																																	
	ESC-INE5A	4 times per year *																																																																	
Reference Station Upcurrent																																																																		
	ESC-RFE1	4 times per year *																																																																	
	ESC-RFE2	4 times per year *																																																																	
	ESC-RFE3	4 times per year *																																																																	
	ESC-RFE4	4 times per year *																																																																	
	ESC-RFE5	4 times per year *																																																																	
Ma Wan Station																																																																		
	MW1	4 times per year *																																																																	
Flood Tide																																																																		
Impact Station Downcurrent																																																																		
	ESC-IPF1	4 times per year *																																																																	
	ESC-IPF2	4 times per year *																																																																	
	ESC-IPF3	4 times per year *																																																																	
Intermediate Station Downcurrent																																																																		
	ESC-INF1	4 times per year *																																																																	
	ESC-INF2	4 times per year *																																																																	
	ESC-INF3	4 times per year *																																																																	
Reference Station Upcurrent																																																																		
	ESC-RFF1A	4 times per year *																																																																	
	ESC-RFF2A	4 times per year *																																																																	
	ESC-RFF3	4 times per year *																																																																	
Ma Wan Station																																																																		
	MW1	4 times per year *																																																																	
Routine Water Quality Monitoring *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Ebb Tide																																																																		
Impact Station Downcurrent																																																																		
	ESC-IPE1A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE2A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE3	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE4	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPE5	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Intermediate Station Downcurrent																																																																		
	ESC-INE1A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE2A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE3A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE4A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INE5A	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Reference Station Upcurrent																																																																		
	ESC-RFE1	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE2	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE3	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE4	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFE5	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ma Wan Station																																																																		
	MW1	Monthly*				4	4	4		4		4	4			4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Flood Tide																																																																		
Impact Station Downcurrent																																																																		
	ESC-IPF1	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPF2	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-IPF3	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Intermediate Station Downcurrent																																																																		
	ESC-INF1	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INF2	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-INF3	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Reference Station Upcurrent																																																																		
	ESC-RFF1A	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFF2A	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ESC-RFF3	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ma Wan Station																																																																		
	MW1	Monthly*	4	4	4				4		4			4	4		4				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Water Column Profiling *			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Plume Stations																																																																		
	WCP1	Monthly*	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	WCP2	Monthly*	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Benthic Recoloinisation Studies			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Capped Stations at CMP V																																																																		
	ESCV-CPA	2 times per year																																																																	
	ESCV-CPB	2 times per year																																																																	
	ESCV-CPC	2 times per year																																																																	
	ESCV-CPD	2 times per year																																																																	
Reference Stations																																																																		
	RBA	2 times per year																																																																	
	RBB	2 times per year																																																																	
	RBC1	2 times per year																																																																	
Impact Monitoring for Dredging			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Upstream Stations																																																																		
	US1	3 times per week														2	2	2	2	2																																													
	US2	3 times per week														2	2	2	2	2																																													
Downstream Stations																																																																		
	DS1	3 times per week														2	2	2	2	2																																													
	DS2	3 times per week														2	2	2	2	2																																													
	DS3	3 times per week														2	2	2	2	2																																													
	DS4	3 times per week														2	2	2	2	2																																													
	DS5	3 times per week														2	2	2	2	2																																													
Ma Wan Station																																																																		
	MW1	3 times per week														2	2	2	2	2																																													

Notes:

(1) The number shown in each cell represents the numbers of replicates per monitoring station. The number shown in **green bolded text** represented monitoring works have been conducted before/ during the reporting period of this Monthly EM&A Report, while the number shown in black represent planned monitoring works after the reporting period of this Monthly EM&A Report.

(2) For the planned Routine Water Quality Monitoring (i.e. the numbers of replicates per monitoring station shown in black), the monitoring will be conducted at mid-ebb OR mid-flood tide. The yearly tidal selection of this monitoring will be based on a principle to obtain 6 months monitoring data at mid-ebb, and 6 months monitoring data at mid-flood.

(3) Impact Monitoring for Dredging will be scheduled when dredging operations commence.

(4) Benthic Recolonisation Studies for CMP V will be scheduled when capping operation for CMP V is completed.

Remarks:

* A proposal on the change of number of sample replication of water quality & sediment monitoring and combination of routine water quality monitoring and water quality monitoring during capping operation was submitted to EPD and agreed by EPD on 3 December 2020. The proposed changes have been implemented for the EM&A activities since December 2020. Water Quality Monitoring during Capping Operation and Routine Water Quality Monitoring are combined such that Routine Water Quality Monitoring have be conducted monthly starting in December 2020. The number of sampling replicates can be further reduced according to Sections 3 and 4, subject to the findings of the further data review.
# Due to the logistic problem induced by the pandemic which adversely affecting the supply of international species adopted in testing programme of Sediment Toxicity Tests, as such, Sediment Toxicity Tests of ESC CMPs originally scheduled in February 2022 were postponed to March 2022.

Appendix B. Dredging, Disposal and Capping Records

B1. Dredging Record at ESC CMP Vc

Date [1]	Daily Dredging Volume (m^3)	Weekly Dredging Volume (m^3) (From Saturday to Friday)
26 Mar 2022	1,300	16,250
27 Mar 2022	3,250	
28 Mar 2022	1,950	
29 Mar 2022	2,600	
30 Mar 2022	2,600	
31 Mar 2022	2,600	
1 Apr 2022	1,950	
2 Apr 2022	3,250	18,200
3 Apr 2022	1,950	
4 Apr 2022	3,250	
5 Apr 2022	1,950	
6 Apr 2022	3,250	
7 Apr 2022	1,950	
8 Apr 2022	2,600	
9 Apr 2022	3,250	22,750
10 Apr 2022	3,250	
11 Apr 2022	3,250	
12 Apr 2022	3,250	
13 Apr 2022	3,250	
14 Apr 2022	3,250	
15 Apr 2022	3,250	
16 Apr 2022	650	15,950
17 Apr 2022	1,950	
18 Apr 2022	2,950	
19 Apr 2022	2,600	
20 Apr 2022	3,250	
21 Apr 2022	2,600	
22 Apr 2022	1,950	
23 Apr 2022	1,300	4,550
24 Apr 2022	2,600	
25 Apr 2022	650	
26 Apr 2022	0	
27 Apr 2022	0	
28 Apr 2022	0	
29 Apr 2022	0	
30 Apr 2022	0	7,800
1 May 2022	650	
2 May 2022	0	
3 May 2022	650	
4 May 2022	1,300	
5 May 2022	1,950	
6 May 2022	3,250	

Date [1]	Daily Dredging Volume (m^3)	Weekly Dredging Volume (m^3) (From Saturday to Friday)
7 May 2022	0	650
8 May 2022	0	
9 May 2022	0	
10 May 2022	0	
11 May 2022	0	
12 May 2022	0	
13 May 2022	650	
14 May 2022	3,250	22,100
15 May 2022	3,250	
16 May 2022	2,600	
17 May 2022	3,250	
18 May 2022	3,250	
19 May 2022	3,250	
20 May 2022	3,250	
21 May 2022	3,250	14,300
22 May 2022	3,250	
23 May 2022	1,950	
24 May 2022	2,600	
25 May 2022	1,300	
26 May 2022	1,300	
27 May 2022	650	
28 May 2022	1,300	14,950
29 May 2022	2,600	
30 May 2022	3,250	
31 May 2022	1,300	
1 Jun 2022	3,250	
2 Jun 2022	1,300	
3 Jun 2022	1,950	
4 Jun 2022	2,600	14,950
5 Jun 2022	1,950	
6 Jun 2022	2,600	
7 Jun 2022	1,950	
8 Jun 2022	650	
9 Jun 2022	2,600	
10 Jun 2022	2,600	
11 Jun 2022	2,600	4,550
12 Jun 2022	1,950	
13 Jun 2022	0	
14 Jun 2022	0	
15 Jun 2022	0	
16 Jun 2022	0	
17 Jun 2022	0	

Note:

[1] Dredging works were completed on 12 Jun 2022.

B2. Disposal Record at ESC CMP Vb

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Apr 2022	0	724,822
2 Apr 2022	0	724,822
3 Apr 2022	0	724,822
4 Apr 2022	0	724,822
5 Apr 2022	1,200	726,022
6 Apr 2022	1,705	727,727
7 Apr 2022	1,800	729,527
8 Apr 2022	2,000	731,527
9 Apr 2022	343	731,870
10 Apr 2022	0	731,870
11 Apr 2022	0	731,870
12 Apr 2022	385	732,255
13 Apr 2022	0	732,255
14 Apr 2022	280	732,535
15 Apr 2022	0	732,535
16 Apr 2022	0	732,535
17 Apr 2022	0	732,535
18 Apr 2022	0	732,535
19 Apr 2022	0	732,535
20 Apr 2022	0	732,535
21 Apr 2022	378	732,913
22 Apr 2022	0	732,913
23 Apr 2022	780	733,693
24 Apr 2022	300	733,993
25 Apr 2022	500	734,493
26 Apr 2022	0	734,493
27 Apr 2022	0	734,493
28 Apr 2022	567	735,060
29 Apr 2022	0	735,060
30 Apr 2022	287	735,347
1 May 2022	0	735,347
2 May 2022	0	735,347
3 May 2022	0	735,347
4 May 2022	0	735,347
5 May 2022	308	735,655
6 May 2022	0	735,655
7 May 2022	800	736,455
8 May 2022	2,400	738,855
9 May 2022	2,400	741,255
10 May 2022	900	742,155
11 May 2022	0	742,155
12 May 2022	0	742,155
13 May 2022	0	742,155
14 May 2022	0	742,155
15 May 2022	0	742,155
16 May 2022	0	742,155
17 May 2022	0	742,155
18 May 2022	1,200	743,355
19 May 2022	600	743,955

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
20 May 2022	1,200	745,155
21 May 2022	400	745,555
22 May 2022	0	745,555
23 May 2022	0	745,555
24 May 2022	1,950	747,505
25 May 2022	1,300	748,805
26 May 2022	1,300	750,105
27 May 2022	650	750,755
28 May 2022	1,300	752,055
29 May 2022	2,600	754,655
30 May 2022	3,250	757,905
31 May 2022	1,300	759,205
1 Jun 2022	0	759,205
2 Jun 2022	0	759,205
3 Jun 2022	0	759,205
4 Jun 2022	0	759,205
5 Jun 2022	0	759,205
6 Jun 2022	0	759,205
7 Jun 2022	0	759,205
8 Jun 2022	0	759,205
9 Jun 2022	0	759,205
10 Jun 2022	0	759,205
11 Jun 2022	0	759,205
12 Jun 2022	0	759,205
13 Jun 2022	426	759,631
14 Jun 2022	420	760,051
15 Jun 2022	396	760,447
16 Jun 2022	411	760,858
17 Jun 2022	411	761,269
18 Jun 2022	410	761,679
19 Jun 2022	0	761,679
20 Jun 2022	410	762,089
21 Jun 2022	419	762,508
22 Jun 2022	0	762,508
23 Jun 2022	501	763,009
24 Jun 2022	646	763,655
25 Jun 2022	596	764,251
26 Jun 2022	0	764,251
27 Jun 2022	648	764,899
28 Jun 2022	658	765,557
29 Jun 2022	0	765,557
30 Jun 2022	418	765,975

B3. Capping Record at ESC CMP Vd

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Apr 2022	0	257,780
2 Apr 2022	0	257,780
3 Apr 2022	0	257,780
4 Apr 2022	0	257,780
5 Apr 2022	0	257,780
6 Apr 2022	0	257,780
7 Apr 2022	0	257,780
8 Apr 2022	0	257,780
9 Apr 2022	0	257,780
10 Apr 2022	0	257,780
11 Apr 2022	0	257,780
12 Apr 2022	0	257,780
13 Apr 2022	0	257,780
14 Apr 2022	0	257,780
15 Apr 2022	0	257,780
16 Apr 2022	0	257,780
17 Apr 2022	0	257,780
18 Apr 2022	0	257,780
19 Apr 2022	0	257,780
20 Apr 2022	0	257,780
21 Apr 2022	0	257,780
22 Apr 2022	0	257,780
23 Apr 2022	0	257,780
24 Apr 2022	0	257,780
25 Apr 2022	0	257,780
26 Apr 2022	0	257,780
27 Apr 2022	0	257,780
28 Apr 2022	0	257,780
29 Apr 2022	0	257,780
30 Apr 2022	0	257,780
1 May 2022	0	257,780
2 May 2022	0	257,780
3 May 2022	0	257,780
4 May 2022	0	257,780
5 May 2022	0	257,780
6 May 2022	0	257,780
7 May 2022	0	257,780
8 May 2022	0	257,780
9 May 2022	0	257,780
10 May 2022	0	257,780
11 May 2022	0	257,780
12 May 2022	0	257,780
13 May 2022	0	257,780
14 May 2022	0	257,780
15 May 2022	0	257,780
16 May 2022	0	257,780
17 May 2022	0	257,780
18 May 2022	0	257,780
19 May 2022	0	257,780

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
20 May 2022	0	257,780
21 May 2022	0	257,780
22 May 2022	0	257,780
23 May 2022	0	257,780
24 May 2022	0	257,780
25 May 2022	0	257,780
26 May 2022	0	257,780
27 May 2022	0	257,780
28 May 2022	0	257,780
29 May 2022	0	257,780
30 May 2022	0	257,780
31 May 2022	1,300	259,080
1 Jun 2022	3,250	262,330
2 Jun 2022	1,300	263,630
3 Jun 2022	1,950	265,580
4 Jun 2022	2,600	268,180
5 Jun 2022	1,950	270,130
6 Jun 2022	2,600	272,730
7 Jun 2022	1,950	274,680
8 Jun 2022	650	275,330
9 Jun 2022	2,600	277,930
10 Jun 2022	2,600	280,530
11 Jun 2022	2,600	283,130
12 Jun 2022	1,950	285,080
13 Jun 2022	0	285,080
14 Jun 2022	0	285,080
15 Jun 2022	0	285,080
16 Jun 2022	0	285,080
17 Jun 2022	0	285,080
18 Jun 2022	0	285,080
19 Jun 2022	0	285,080
20 Jun 2022	0	285,080
21 Jun 2022	0	285,080
22 Jun 2022	0	285,080
23 Jun 2022	0	285,080
24 Jun 2022	0	285,080
25 Jun 2022	0	285,080
26 Jun 2022	0	285,080
27 Jun 2022	0	285,080
28 Jun 2022	0	285,080
29 Jun 2022	0	285,080
30 Jun 2022	0	285,080

Appendix C. Statistical Analysis

Routine Water Quality Monitoring for ESC CMPs – Statistical Analysis up to June 2022

Dissolved Oxygen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	3168.45	34	366.04	**
Area	33.37	3	43.70	**
Period:Area	216.65	102	8.34	**
Residuals	1024.73	4025		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result[1]:

$$\left.\begin{array}{c}\text{Intermediate} = \text{Reference} \\ \text{Impact} > \text{Intermediate, Reference} \\ \text{Intermediate, Reference} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact < Intermediate < Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	4684.40	34	1328.12	**
Area	53.16	3	170.82	**
Period:Area	49.78	102	4.70	**
Residuals	260.90	2515		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Intermediate} = \text{Reference} \\ \text{Reference} = \text{Impact} \\ \text{Intermediate, Reference, Impact} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact < Intermediate < Reference) were detected for all months over the study period.

[1] The overall result represents the SNK tests on fixed factor Area.

Turbidity

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1804.32	34	272.41	**
Area	132.08	3	226.00	**
Period:Area	225.29	102	11.34	**
Residuals	784.11	4025		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  $\text{Impact} > \text{Intermediate} > \text{Reference} > \text{Ma Wan}\ \}$ ∴ potential overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2012, Aug 2012, Apr 2013, May 2016, Apr 2017, Apr 2020, Nov 2021
- No potential project related spatial trend detected for the reporting months.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	86835.32	34	125.37	**
Area	2205.78	3	36.09	**
Period:Area	11959.92	102	5.76	**
Residuals	51233.87	2515		

Note:

1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  $$\left.\begin{array}{c}\text{Impact} = \text{Reference}\\ \text{Reference} = \text{Intermediate}\\ \text{Impact} = \text{Intermediate}\\ \text{Impact, Reference, Intermediate} > \text{Ma Wan}\end{array}\right\}$$ ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Copper

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	3048.62	34	112.47	**
Area	39.18	3	16.38	**
Period:Area	473.26	102	5.82	**
Residuals	2949.69	3700		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Reference > Impact > Intermediate > Ma Wan } ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Aug 2020
- No potential project related spatial trend detected for the reporting months.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2198.62	34	194.74	**
Area	18.63	3	18.70	**
Period:Area	352.87	102	10.42	**
Residuals	790.31	2380		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Reference > Impact > Ma Wan > Intermediate} ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Feb 2012
- No potential project related spatial trend detected for the reporting months.

Nickel

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1070.07	34	147.86	**
Area	21.20	3	33.19	**
Period:Area	165.79	102	7.64	**
Residuals	787.55	3700		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{matrix}\text{Impact} = \text{Ma Wan} \\ \text{Reference} > \text{Impact, Ma Wan} > \text{Intermediate}\end{matrix}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	861.83	34	181.42	**
Area	3.60	3	8.58	**
Period:Area	148.69	102	10.43	**
Residuals	332.53	2380		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{matrix}\text{Ma Wan} = \text{Impact} \\ \text{Reference} > \text{Intermediate} > \text{Ma Wan , Impact}\end{matrix}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Zinc

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1589.48	34	151.76	**
Area	34.39	3	37.21	**
Period:Area	241.56	102	7.69	**
Residuals	1139.76	3700		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Ma Wan > Reference > Impact > Intermediate } ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2013, Jul 2016, Nov 2021
- No potential project related spatial trend were detected for the reporting months.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1301.60	34	141.95	**
Area	38.46	3	47.54	**
Period:Area	167.78	102	6.10	**
Residuals	641.84	2380		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Ma Wan > Reference > Intermediate > Impact } ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2016, Jan 2019
- No potential project related spatial trend were detected for the reporting months.

Ammonia Nitrogen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	899.61	34	339.15	**
Area	17.62	3	75.27	**
Period:Area	86.29	102	10.84	**
Residuals	288.66	3700		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  Ma Wa = Reference = Impact = Intermediate } ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	773.70	34	119.65	**
Area	6.43	3	11.27	**
Period:Area	61.37	102	3.16	**
Residuals	452.63	2380		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  Ma Wan = Reference = Intermediate = Impact } ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Total Inorganic Nitrogen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	448.42	34	434.45	**
Area	22.45	3	246.51	**
Period:Area	37.90	102	12.24	**
Residuals	112.32	3700		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Impact} = \text{Reference} \\ \text{Impact, Reference} > \text{Intermediate} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	643.32	34	356.69	**
Area	11.62	3	73.04	**
Period:Area	40.66	102	7.52	**
Residuals	126.25	2380		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Reference} = \text{Intermediate} \\ \text{Intermediate} = \text{Impact} \\ \text{Reference} = \text{Impact} \\ \text{Reference, Intermediate, Impact} > \text{Ma Wan}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

BOD_5

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	492.16	34	108.07	**
Area	14.85	3	36.97	**
Period:Area	188.75	102	13.82	**
Residuals	495.59	3700		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{c}\text{Reference} = \text{Ma Wan} \\ \text{Impact} = \text{Intermediate} \\ \text{Reference, Ma Wan} > \text{Impact, Imtermediate}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Impact > Intermediate > Reference) were detected for all months over the study period.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	569.38	34	169.19	**
Area	24.25	3	81.67	**
Period:Area	147.01	102	14.56	**
Residuals	235.57	2380		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\text{Ma Wan} > \text{Reference} > \text{Intermediate} > \text{Impact}\ \} \therefore \text{no overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Jan 2017
- No potential project related spatial trend were detected for the reporting months.

Suspended Solids

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	850.35	34	271.91	**
Area	42.88	3	155.38	**
Period:Area	130.88	102	13.95	**
Residuals	340.33	3700		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Impact > Intermediate > Reference > Ma Wan } ∴ potential overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Apr 2012, Aug 2012, May 2016, Jul 2017, Jul 2018, Apr 2020, May 2021
- No potential project related spatial trend were detected for the reporting months.

Flood Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	623.52	34	185.91	**
Area	13.61	3	45.98	**
Period:Area	117.00	102	11.63	**
Residuals	234.78	2380		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  Reference > Intermediate > Impact > Ma Wan } ∴ no overall significant project related impact.
- Months showing potential project related spatial trend (i.e. Impact > Intermediate > Reference):
  - Nov 2012, Jul 2013, Nov 2017, Aug 2018, Dec 2020, Sep 2021
- No potential project related spatial trend were detected for the reporting months.

Pit Specific Sediment Chemistry for ESC CMPs – Statistical Analysis up to June 2022

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	78.34	28	164.50	**
Area	8.36	2	245.80	**
Direction	6.46	1	380.02	**
Period:Area	16.08	56	16.88	**
Period:Direction	5.11	28	10.72	**
Area:Direction	6.64	2	195.30	**
Period:Area:Direction	15.41	56	16.18	**
Residuals	20.92	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

  $$\left.\begin{array}{l}\text{Pit Edge} > \text{Active Pit}\\ \text{Pit Edge} > \text{Near Pit}\\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction[2]
  - Flood Tide: Jun 2021, Aug 2021
  - Ebb Tide: Feb 2020, Sep 2020, Nov 2020, Jul 2021, Mar 2022, Apr 2022[3], Jun 2022
- Potential project related spatial trend was detected in two months for ebb tide direction over the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Mar-22	0.16	0.11	11.76	-0.21	N.S.
Apr-22	0.60	0.58	13.33	-0.78	**

Note: Linear regression analysis on spatial changes of contaminant concentrations in ebb tide direction for the two consecutive months with significant spatial trend.

[2] Direction: Stations located at downstream of the active pit during corresponding tide.

[3] Circled months represents consecutive months with significant spatial trend.

Cadmium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	76.28	28	24.94	**
Area	97.72	2	447.26	**
Direction	0.55	1	4.99	**
Period:Area	45.35	56	7.41	**
Period:Direction	25.40	28	8.30	**
Area:Direction	34.79	2	159.22	**
Period:Area:Direction	35.30	56	5.77	**
Residuals	134.38	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Pit Edge} \\ \text{Active Pit} > \text{Near Pit} \\ \text{Pit Edge} = \text{Near Pit}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit) were detected for all months over the study period.

Chromium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	15.91	28	38.32	**
Area	21.03	2	709.18	**
Direction	5.41	1	364.85	**
Period:Area	7.12	56	8.58	**
Period:Direction	3.39	28	8.18	**
Area:Direction	14.44	2	487.19	**
Period:Area:Direction	5.65	56	6.81	**
Residuals	18.23	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Pit Edge}\\ \text{Pit Edge} > \text{Near Pit}\\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{potential overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Feb 2020, Mar 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, July 2021, Aug 2021, Oct 2021, Nov 2021, Dec 2021, Apr 2022, May 2022
  - Ebb Tide: Apr 2020, Oct 2020, Nov 2020, May 2021, Oct 2021, Jan 2022, Feb 2022
- Potential project related spatial trend was detected in consecutive two months for flood tide direction over the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Apr-22	0.74	0.72	32.10	-2.18	**
May-22	0.68	0.66	33.76	-1.50	**

Note: Linear regression analysis on spatial changes of contaminant concentrations in flood tide direction for the two concerned reporting months.

Copper

Source	Type II Sum of Square	Df	F value	Significance Level
Period	29.75	28	29.52	**
Area	177.30	2	2463.23	**
Direction	16.05	1	446.02	**
Period:Area	25.27	56	12.54	**
Period:Direction	15.10	28	14.99	**
Area:Direction	46.16	2	641.26	**
Period:Area:Direction	31.43	56	15.59	**
Residuals	44.27	1230		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Near Pit}\\ \text{Near Pit} > \text{Pit Edge}\\ \text{Active Pit} > \text{Pit Edge}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Jul 2020, Oct 2020, May 2021
  - Ebb Tide: Jul 2020, Oct 2020, Sep 2021, Jan 2022, Feb 2022
- No potential project related spatial trend were detected for the reporting months.

Lead

Source	Type II Sum of Square	Df	F value	Significance Level
Period	14.32	28	14.75	**
Area	27.91	2	402.65	**
Direction	7.07	1	203.95	**
Period:Area	11.43	56	5.89	**
Period:Direction	4.45	28	4.59	**
Area:Direction	6.93	2	100.03	**
Period:Area:Direction	4.63	56	2.38	**
Residuals	42.62	1230		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Pit Edge}\\ \text{Pit Edge} > \text{Near Pit}\\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{Potential overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Jun 2020, Jul 2020, Aug 2020, Sep 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, Aug 2021, Oct 2021, Nov 2021, Dec 2021, Jan 2022, Feb 2022, Mar 2022
  - Ebb Tide: May 2020, Jul 2020, Mar 2021, May 2021, Jun 2021, Sep 2021, Oct 2021, Jan 2022, Feb 2022, Jun 2022
- Potential project related spatial trend was detected for one month in ebb tide direction over the reporting period.

Mercury

Source	Type II Sum of Square	Df	F value	Significance Level
Period	132.82	28	21.01	**
Area	113.11	2	250.45	**
Direction	65.89	1	291.77	**
Period:Area	65.28	56	5.16	**
Period:Direction	35.56	28	5.62	**
Area:Direction	89.82	2	198.87	**
Period:Area:Direction	31.95	56	2.53	**
Residuals	277.75	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Pit Edge} = \text{Near Pit} \\ \text{Active Pit} > \text{Pit Edge} \\ \text{Active Pit} > \text{Near Pit}\end{array}\right\} \therefore \text{no overall significant project related impact.}$$

- No potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit) were detected for all months over the study period.

Nickel

Source	Type II Sum of Square	Df	F value	Significance Level
Period	15.85	28	57.66	**
Area	21.32	2	1085.90	**
Direction	11.74	1	1196.38	**
Period:Area	8.20	56	14.92	**
Period:Direction	5.04	28	18.33	**
Area:Direction	18.18	2	925.92	**
Period:Area:Direction	6.77	56	12.32	**
Residuals	12.07	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

$$\left.\begin{array}{l}\text{Active Pit} > \text{Pit Edge}\\ \text{Active Pit} > \text{Near Pit}\\ \text{Pit Edge} > \text{Near Pit}\end{array}\right\} \therefore \text{Potential overall significant project related impact.}$$

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Feb 2020, Mar 2020, Oct 2020, Nov 2020, Dec 2020, Apr 2021, May 2021, Jun 2021, Jul 2021, Aug 2021, Oct 2021, Nov 2021, Dec 2021, Apr 2022, May 2022
  - Ebb Tide: Jun 2020, Jul 2020, Oct 2020, Jul 2021, Oct 2021, Jan 2022, Feb 2022
- Potential project related spatial trend was detected in consecutive two months for flood tide direction over the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Apr-22	0.70	0.68	18.42	-0.96	**
May-22	0.71	0.69	22.05	-1.09	**

Note: Linear regression analysis on spatial changes of contaminant concentrations in flood tide direction for the two concerning reporting months.

Silver

Source	Type II Sum of Square	Df	F value	Significance Level
Period	181.12	28	71.60	**
Area	308.13	2	1705.24	**
Direction	3.63	1	40.18	**
Period:Area	64.36	56	12.72	**
Period:Direction	33.60	28	13.28	**
Area:Direction	35.60	2	197.02	**
Period:Area:Direction	50.28	56	9.94	**
Residuals	111.13	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

  Active Pit > Near Pit
  Active Pit > Pit Edge
  Near Pit > Pit Edge
  ∴ no overall significant project related impact.

- No potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit) were detected for all months over the study period.

Zinc

Source	Type II Sum of Square	Df	F value	Significance Level
Period	15.75	28	48.24	**
Area	46.62	2	1998.53	**
Direction	3.06	1	262.73	**
Period:Area	12.68	56	19.41	**
Period:Direction	6.28	28	19.22	**
Area:Direction	8.01	2	343.51	**
Period:Area:Direction	7.09	56	10.86	**
Residuals	14.35	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

  Active Pit > Near Pit
  Active Pit > Pit Edge
  Near Pit > Pit Edge
  ∴ no overall significant project related impact.

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Jun 2020, Jul 2020, Oct 2020, Nov 2020, Apr 2021, May 2021, Feb 2022
  - Ebb Tide: Apr 2020, Jun 2020, Jul 2020, Oct 2020, Mar 2021, May 2021, Jun 2021, Sep 2021, Feb 2022, Jun 2022
- Potential project related spatial trend was detected for one month in ebb tide direction over the reporting period.

Total Organic Carbon

Source	Type II Sum of Square	Df	F value	Significance Level
Period	111.42	28	197.94	**
Area	67.83	2	1687.12	**
Direction	7.87	1	391.31	**
Period:Area	40.15	56	35.66	**
Period:Direction	14.16	28	25.15	**
Area:Direction	10.04	2	249.73	**
Period:Area:Direction	27.74	56	24.64	**
Residuals	24.73	1230		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:

  Active Pit > Near Pit
  Active Pit > Pit Edge
  Near Pit > Pit Edge
  } ∴ no overall significant project related impact.

- Months showing potential project related spatial trend (i.e. Active Pit > Pit Edge > Near Pit): Direction
  - Flood Tide: Feb 2020, Apr 2020, May 2020, Aug 2020, Oct 2020, May 2021, Jun 2021, Jul 2021, Sep 2021, Nov 2021, Feb 2022, Mar 2022
  - Ebb Tide: Jul 2020, Oct 2020, May 2021, Jun 2021, Oct 2021
- No potential project related spatial trend were detected for the reporting months.

Cumulative Sediment Chemistry for ESC CMPs – Statistical Analysis up to June 2022

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	68.67	24	149.06	**
Area	98.89	4	1288.02	**
Period:Area	65.70	96	35.65	**
Residuals	42.17	2197		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  - Mid-Field > Far-Field > Ma Wan > Near-Field > Capped-pit, ∴no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Cadmium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	70.65	24	25.29	**
Area	63.64	4	136.68	**
Period:Area	50.31	96	4.50	**
Residuals	255.73	2197		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  - Mid-Field = Far-Field = Ma Wan = Near-Field = Capped-pit, ∴no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Chromium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	5123.22	24	24.14	**
Area	74874.94	4	2117.22	**
Period:Area	17093.76	96	20.14	**
Residuals	19424.11	2197		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Copper

Source	Type II Sum of Square	Df	F value	Significance Level
Period	12154.78	24	16.83	**
Area	258603.17	4	2147.88	**
Period:Area	26902.64	96	9.31	**
Residuals	66129.17	2197		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Lead

Source	Type II Sum of Square	Df	F value	Significance Level
Period	30697.07	24	94.17	**
Area	73120.70	4	1345.83	**
Period:Area	19490.58	96	14.95	**
Residuals	29841.44	2197		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Mercury

Source	Type II Sum of Square	Df	F value	Significance Level
Period	418.44	24	38.60	**
Area	54.05	4	29.92	**
Period:Area	217.30	96	5.01	**
Residuals	992.35	2197		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan = Capped-pit = Mid-Field = Far-Field = Near-Field, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Nickel

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2244.47	24	22.04	**
Area	27439.17	4	1616.64	**
Period:Area	8953.87	96	21.98	**
Residuals	9322.37	2197		

Note:
1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Silver

Source	Type II Sum of Square	Df	F value	Significance Level
Period	173.13	24	44.34	**
Area	781.38	4	1200.69	**
Period:Area	83.18	96	5.33	**
Residuals	357.44	2197		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- Overall result:
  - Ma Wan > Mid-Field = Far-Field = Near-Field = Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Zinc

Source	Type II Sum of Square	Df	F value	Significance Level
Period	16.92	24	30.58	**
Area	142.06	4	1540.46	**
Period:Area	48.26	96	21.80	**
Residuals	50.65	2197		

Note:

1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  - Ma Wan > Far-Field > Mid-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Total Organic Carbon

Source	Type II Sum of Square	Df	F value	Significance Level
Period	1972029526	24	54.97	**
Area	3619637788	4	605.39	**
Period:Area	3813011415	96	26.57	**
Residuals	3283996296	2197		

Note:

1. Assume Gaussian distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:

- Overall result:
  - Ma Wan > Mid-Field > Far-Field > Near-Field > Capped-pit, ∴ no overall significant project related impact.
- No potential project related spatial trend (i.e. Capped-pit > Near-Field > Mid-Field > Far-Field) were detected for all months over the study period.

Sediment Toxicity for ESC CMPs – March 2022

Growth rate for benthic polychaete *Neanthes arenaceodentata*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	0.0697	2	2.8951	N.S.
Residuals	0.2649	22		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

Survival rate for marine bivalve *Crassostrea gigas*

Source	Type II Sum of Square	Df	F value	Significance Level
Area	0.0005	2	4.3550	**
Residuals	0.0013	22		

Note:
1. Assume Beta distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

SNK Results:
- $\left.\begin{array}{l}\text{Reference} = \text{Near Field}\\ \text{Near Field} = \text{Ma Wan}\\ \text{Reference} > \text{Ma Wan}\end{array}\right\}$ ∴ no overall significant project related impact.

Mortality rate for barnacles *Balanus Amphitrite*

Source	Df	F value	Significance Level
Area	2	10.477	**
Residuals	21		

Note:
1. Assume Beta distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

Post-hoc (Turkey's Tests) Results:
- Reference = Near-Field > Ma Wan ∴ no significant project related impact.

Mortality rate for shrimp *Penaeus vannaamei*

Source	Df	F value	Significance Level
Area	2	3.892	**
Residuals	21		

Note:
1. Assume Gamma distribution
2. N.S.: No significant difference; **: Significant difference (P-value < 0.05)

Post-hoc (Turkey's Tests) Results:
- $\left.\begin{array}{l}\text{Near Field} = \text{Ma Wan}\\ \text{Ma Wan} = \text{Reference}\\ \text{Near Field} > \text{Reference}\end{array}\right\}$ ∴ potential significant project related impact.