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
– January to March 2022

May 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 – January to March 2022
Date of Report:	6 May 2022
Date prepared by ET:	6 May 2022
Date received by IA:	6 May 2022

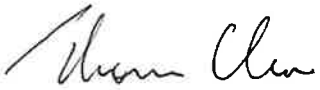
Reference EP Condition

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: 6 May 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: 6 May 2022

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Executive summary

Impact Water Quality Monitoring during Dredging Operations, Water Column Profiling, Routine Water Quality Monitoring, Pit Specific Sediment Chemistry, Cumulative Impact Sediment Chemistry, Sediment Toxicity Tests and Demersal Trawling were carried out for the Contaminated Mud Pits (CMPs) to the East of Sha Chau (ESC) during the quarterly reporting period of January to March 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 – February to March 2022

Dredging activities for ESC CMP Vc were conducted between 20 February and 31 March 2022 and Impact Water Quality Monitoring during Dredging Operations for ESC CMP Vc was conducted three times per week during the reporting period between 20 February and 31 March 2022. Monitoring results showed that levels of DO, Turbidity and SS complied with the Action and Limit Levels at all stations. 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 – January to March 2022

Results indicated that levels of Salinity, pH, Dissolved Oxygen (DO) and Suspended Solids (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 – January to March 2022

Results of Routine Water Quality Monitoring conducted in January, February and March 2022 showed that the levels of DO, Salinity and pH complied with the WQOs at all stations. Levels of SS 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 – January to March 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 – February 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

The analysis is in progress and the findings will be presented in next quarterly report.

Demersal Trawling for ESC CMPs – January and February 2022

During the sampling period in January and February 2022, the mean number of faunal species caught was generally lower at Impact stations. Biotic abundance, biomass, Catch per Unit Effort (CPUE) and Yield per Unit Effort (YPUE) were also generally lower at Impact stations ESC-INA and ESC-INB.

行政摘要

在 2022 年 1 月至 3 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、沉積物化學累積性影響監察、沉積物毒性測試及底棲漁業資源監察。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 2 月至 3 月

沙洲以東海泥卸置設施(ESC CMP Vc)的挖掘活動在 2022 年 2 月 20 日至 3 月 31 日期間進行，而水質監察則在 2 月 20 日至 3 月 31 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、混濁度及懸浮固體含量也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 1 月至 3 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 1 月至 3 月

2022 年 1 月至 3 月的例行水質監察結果顯示，所有監測站的溶解氧濃度、鹽度及酸鹼值均符合海水水質指標。另外，大部分監測站的懸浮固體含量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 1 月至 3 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 2 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

數據分析仍在進行中，其分析結果將於下一季度報告表述。

沙洲以東污泥坑之底棲漁業資源監察 – 2022 年 1 月和 2 月

監察結果顯示，2022 年 1 月和 2 月的底棲漁業資源在受影響監測站普遍錄得較低的品種數量。而在 2022 年 1 月及 2 月受影響監測站 ESC-INA 及 ESC-INB 的生物量、生物重量、單位努力漁獲量及單位努力生產量亦普遍錄得較低的數值。

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 January to March 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 – January to March 2022* is to provide information regarding the findings in the reporting period of January to March 2022 (from 1 January to 31 March 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	21 & 23 Feb 2022	3 Mar 2022
	14, 16, 18, 21, 23, 25, 28 & 30 Mar 2022	4 Apr 2022
Water Column Profiling of ESC CMP Vb	11 Jan 2022	26 Jan 2022
	8 Feb 2022	3 Mar 2022
	8 Mar 2022	4 Apr 2022
Routine Water Quality Monitoring of ESC CMPs	6 Jan 2022	26 Jan 2022
	15 Feb 2022	3 Mar 2022
	10 Mar 2022	4 Apr 2022
Pit Specific Sediment Chemistry of ESC CMP Vb	4 Jan 2022	26 Jan 2022
	8 Feb 2022	3 Mar 2022
	3 Mar 2022	4 Apr 2022
Cumulative Impact Sediment Chemistry of ESC CMPs	10 Feb 2022	3 Mar 2022
Sediment Toxicity Test of ESC CMPs	24 Mar 2022	NA (The analysis is in progress)
Demersal Trawling of ESC CMPs	12 & 13 Jan 2022	9 Feb 2022
	9 & 10 Feb 2022	8 Mar 2022

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 levels of Dissolved Oxygen (DO), Turbidity and Suspended Solids (SS) for the impact water quality monitoring during dredging operation of ESC CMP Vc conducted in February and March 2022 and thus there did not appear to have any unacceptable deterioration in water quality due to the dredging operation. Statistical analysis was also not conducted for Sediment Toxicity Test of ESC CMPs during this reporting period, details please refer to **Section 4.6**.

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 20 February and 31 March 2022 and Impact Water Quality Monitoring during Dredging Operations for ESC CMP Vc was conducted three times per week during the reporting period between 20 February and 31 March 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 levels of DO, Turbidity and SS complied with the Action and Limit Levels at all 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 January to March 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, Dissolved Oxygen (DO) and Suspended Solids (SS) complied with the Water Quality Objectives (WQOs) at both Upstream and Downstream stations in January, February and March 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 January to March 2022 as presented in **Table 3.1**. A total of ten (10) stations were sampled during flood tide in January and March 2022 with locations of the monitoring stations presented in **Figure 4.2**, while a total of sixteen (16) stations were sampled during ebb tide in February 2022 with locations of the monitoring stations presented in **Figure 4.3**. 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, Salinity and pH complied with the WQOs at all stations. The levels of DO and Turbidity complied with the Action and Limit Levels at all stations during the reporting period. It is noted that some SS levels in January 2022 were above the dry season WQO but in compliance with the Action and Limit Levels.

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 March 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 March 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 for consecutive reporting months, 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 January to March 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 4.4**. The monitoring results showed that the concentrations of most inorganic contaminants were below the Lower Chemical Exceedance Levels (LCELs) at most stations from January to March 2022, except for Copper, Zinc, Silver and Arsenic. The concentrations of Copper were higher than the LCEL and Upper Chemical Exceedance Level (UCEL) at Active-Pit station ESC-NPCB in February and March 2022, respectively. The concentration of Silver was higher than the LCEL at Active-Pit station ESC-NPCB in February and March 2022. The concentration of Zinc was higher than the LCEL at Active-Pit station ESC-NPCB in March 2022. The concentrations of Arsenic were higher than the LCEL at Pit-Edge station ESC-NECA and Active-Pit station ESC-NPCA in February and March 2022, and at Near-Pit station ESC-NNCA in March 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 Arsenic, Cadmium, Mercury, Silver and Zinc. Subsequent linear regression analysis was conducted for Chromium (ebb tide direction), Copper (ebb tide direction), Lead (flood tide and ebb tide directions) and Nickel (ebb tide direction). For Chromium (ebb tide direction), Copper (ebb tide direction), Lead (ebb tide direction) and Nickel (ebb tide direction), although the overall contaminant concentration in February 2022 were higher than January 2022, the potential project related spatial trend was not detected in March 2022. Therefore, there is no evidence indicating consistent or increasing project related impact over time. For Lead (flood tide direction), the overall concentration is in similar level from January 2022 to February 2022. Although a slight increase in concentration was experienced in March 2022, the overall concentration from January 2022 to March 2022 were remained in lower concentration levels than that in December 2021, and all the concentration levels were still well below the LCEL. Therefore, there was no unacceptable project-related impact to the sediment quality.

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. In detailed analysis, potential project related spatial trend was detected for consecutive two reporting months in flood tide direction. The concentration at the Near-Pit stations in March 2022 returned to a lower level compared to that in February 2022, indicating the dispersion of contaminant was well-maintained. Therefore, 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 February 2022 as presented in **Table 3.1**. A total of nine (9) monitoring stations were sampled and the monitoring locations are shown in **Figure 4.5**. The monitoring results showed that the concentrations of most inorganic contaminants were below the LCELs at most monitoring stations in February 2022, except the concentrations of Arsenic which were higher than the LCEL at Near-field station ESC-RNB1, Mid-field station ESC-RMA, Far-field stations ESC-RFA, ESC-RFB and Ma Wan station.

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 4.6** 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*.

The analysis of sediment samples is in progress and the findings will be presented in next quarterly report.

4.7 Demersal Trawling – January and February 2022

Fishery resources monitoring by demersal trawling was carried out at two (2) impact and four (4) reference stations (see **Figure 4.7** for locations) in January and February 2022. Monitoring results are presented in the following sections.

Abundance and Biomass

The average number of species collected in the period of January and February 2022 is presented in **Table 4.1**. Mean number of faunal species caught at Impact stations was generally lower than at Reference stations in January and February 2022.

Biotic abundance, Biomass, Catch per Unit Effort (CPUE) and Yield per Unit Effort (YPUE) were generally lower at Impact stations ESC-INA and ESC-INB in January and February 2022 (**Table 4.2**). Annual trend and statistical analyses will be conducted in the Annual EM&A Review Report to determine whether there is any significant difference that shows a considerable impact to fishery resources caused by the mud disposal operations at ESC CMP Vb.

Table 4.1: Summary of the Mean Number of Faunal Species Caught during Monitoring in January and February 2022

Mean Number of Faunal Species	Impact Stations		Reference Stations			
	ESC-INA	ESC-INB	TNA	TNB	TSA	TSB
Jan 2022	15.0	11.4	26.2	17.6	38.2	30.4
Feb 2022	10.8	8.6	12.8	18.6	33.2	28

Table 4.2: Summary of CPUE and YPUE during Monitoring in January and February 2022

Date	Station	Type of Station	No. of Individuals per Station	Total Biomass per Station (g)	Mean CPUE(1) per Tow (no./hr/net)	Mean YPUE(2) per Tow (g/hr/net)
Jan 2022	ESC-INA	Impact	458	4659.2	91.6	931.84
Jan 2022	ESC-INB	Impact	315	1890.0	63	378
Jan 2022	TNA	Reference	7507	90018.8	1501.4	18003.76
Jan 2022	TNB	Reference	2462	33448.0	492.4	6689.6
Jan 2022	TSA	Reference	2897	75054.5	579.4	15010.9
Jan 2022	TSB	Reference	1789	77963.5	357.8	15592.7
Feb 2022	ESC-INA	Impact	643	7580.4	128.6	1516.08
Feb 2022	ESC-INB	Impact	452	4838.3	90.4	967.66
Feb 2022	TNA	Reference	1048	22320.1	209.6	4464.02
Feb 2022	TNB	Reference	935	21520.1	187	4304.02
Feb 2022	TSA	Reference	2073	49640.1	414.6	9928.02
Feb 2022	TSB	Reference	1666	33246.2	333.2	6649.24

Notes:
(1) CPUE is calculated by dividing the number of individuals with the trawling time and number of nets (in hour and number of nets).
(2) YPUE is calculated by dividing the weight (g) of fish with trawling effort (in hour and number of nets).

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 Routine Water Quality Monitoring on 6 Jan 2022 and a total of 10 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. The IA suggested that several precautious steps should be followed, including 1) first rinse of bottles using site-collected waters when these sampled waters are filled to the bottles; 2) avoidance of any plastic ribbons which many contain Zn in their materials; 3) use of specific type of gloves, e.g., shoulder-length polyethylene or PVC type gloves are preferred.

6 Future Key Issues

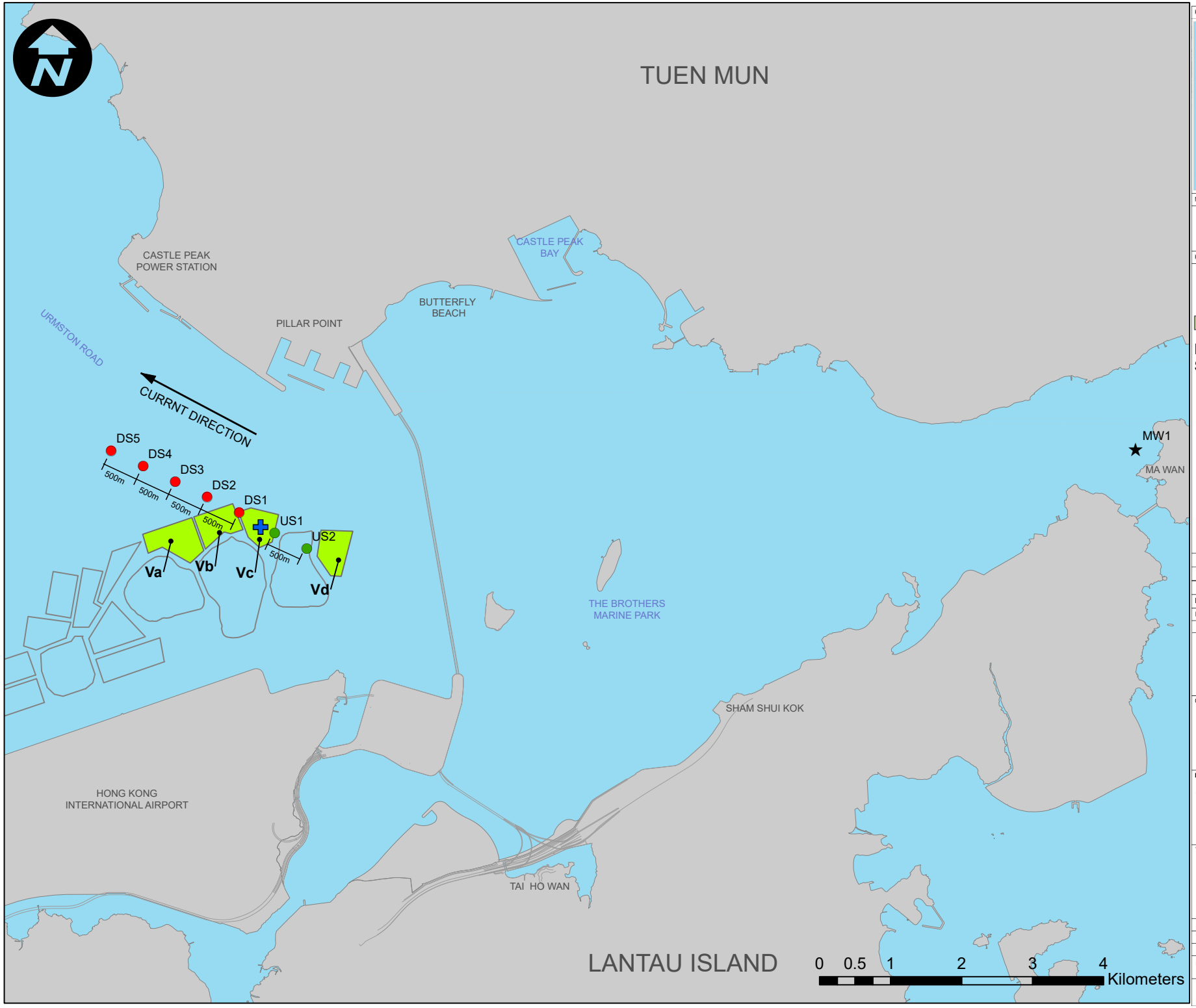
6.1 Activities Scheduled for the Next Reporting Period

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

- Water Column Profiling of ESC CMP Vb in April, May and June 2022;
- Routine Water Quality Monitoring of ESC CMPs in April, May and June 2022;
- Pit Specific Sediment Chemistry of ESC CMP Vb in April, May and June 2022;
- Cumulative Impact Sediment Chemistry of ESC CMPs in June 2022; and
- Water Quality Monitoring During Dredging of ESC CMP Vc in April, May and June 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

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P1	AUG 2021	KN			

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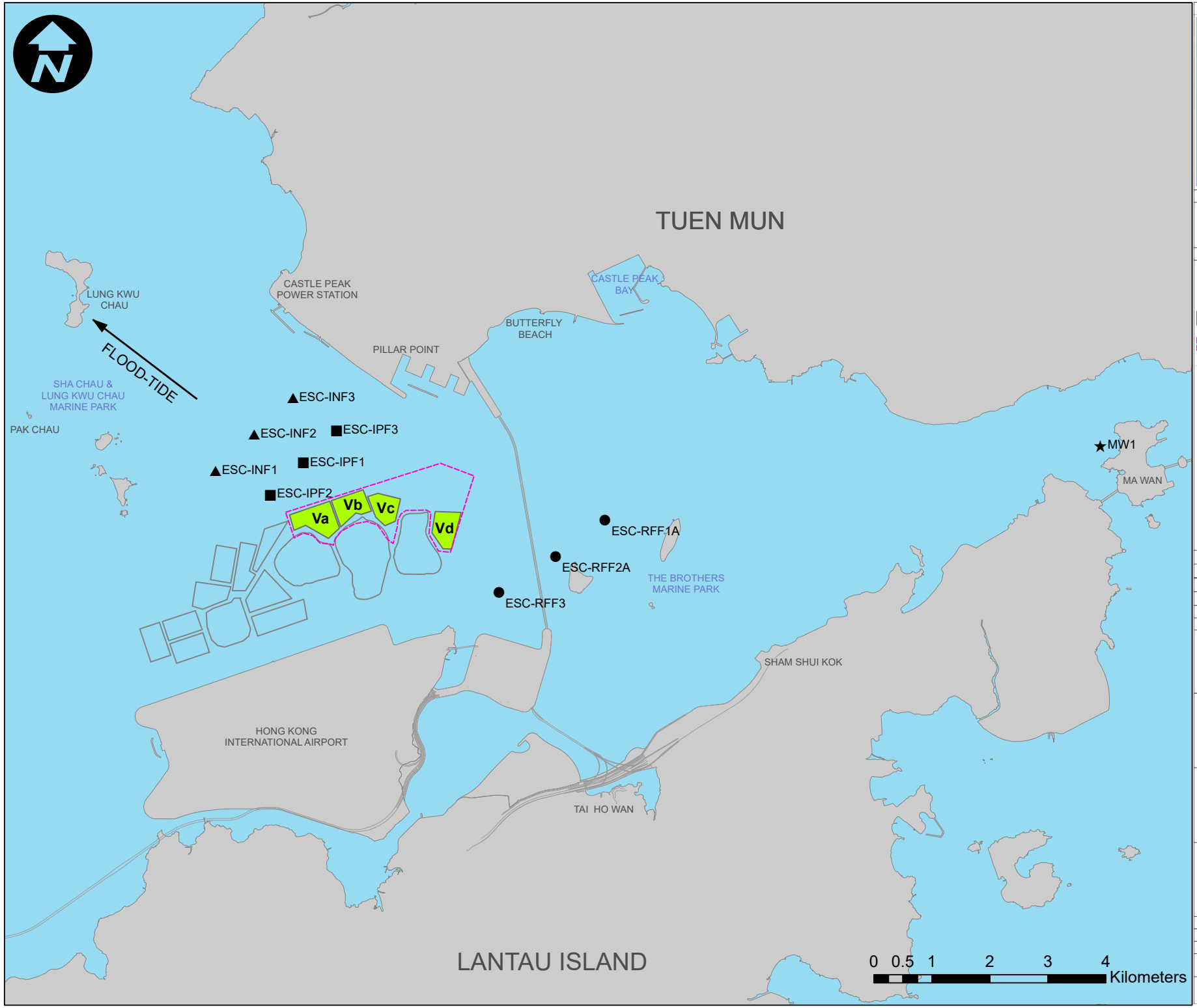
Title

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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Title

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

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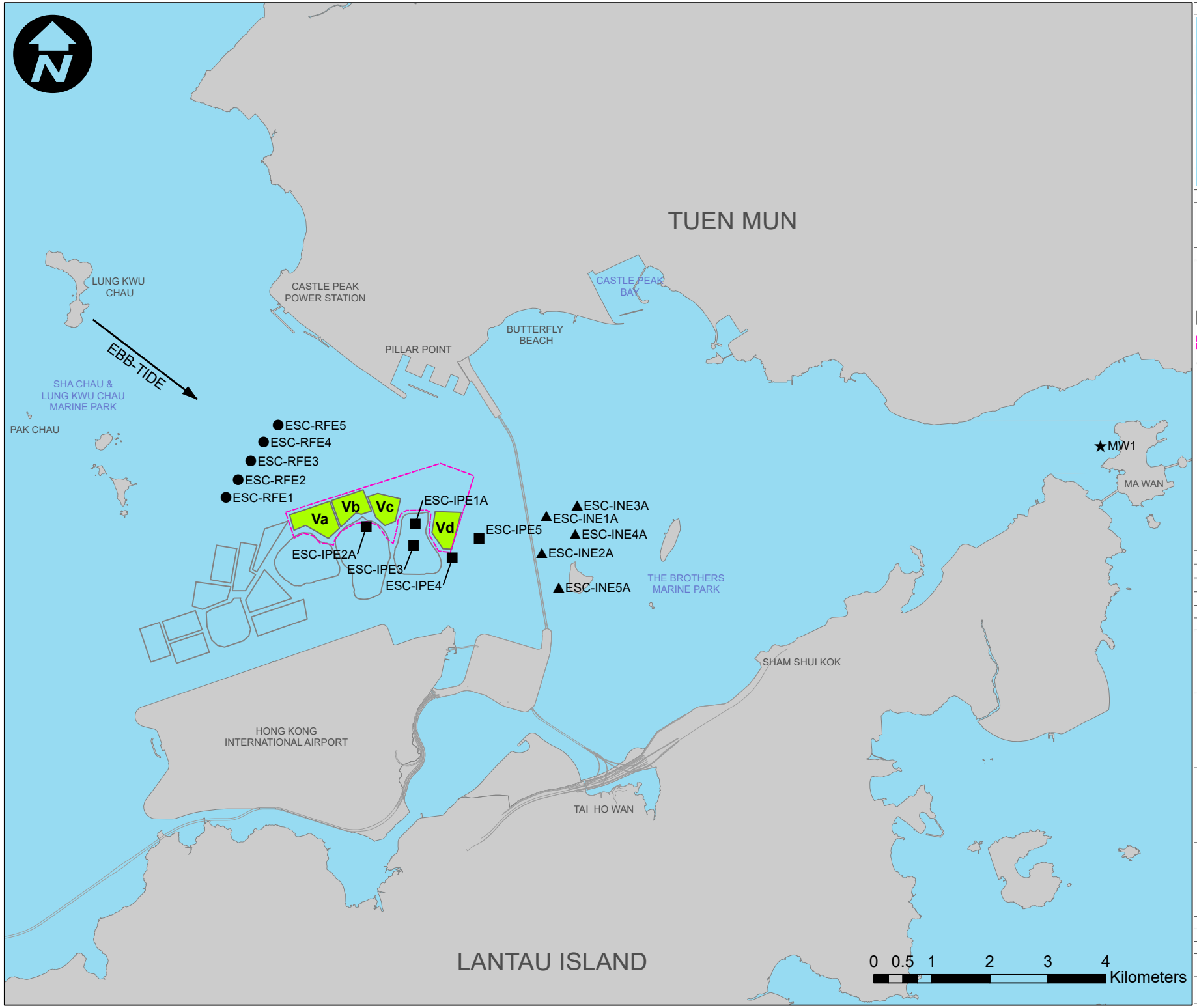
FIGURE 4.2



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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Title

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

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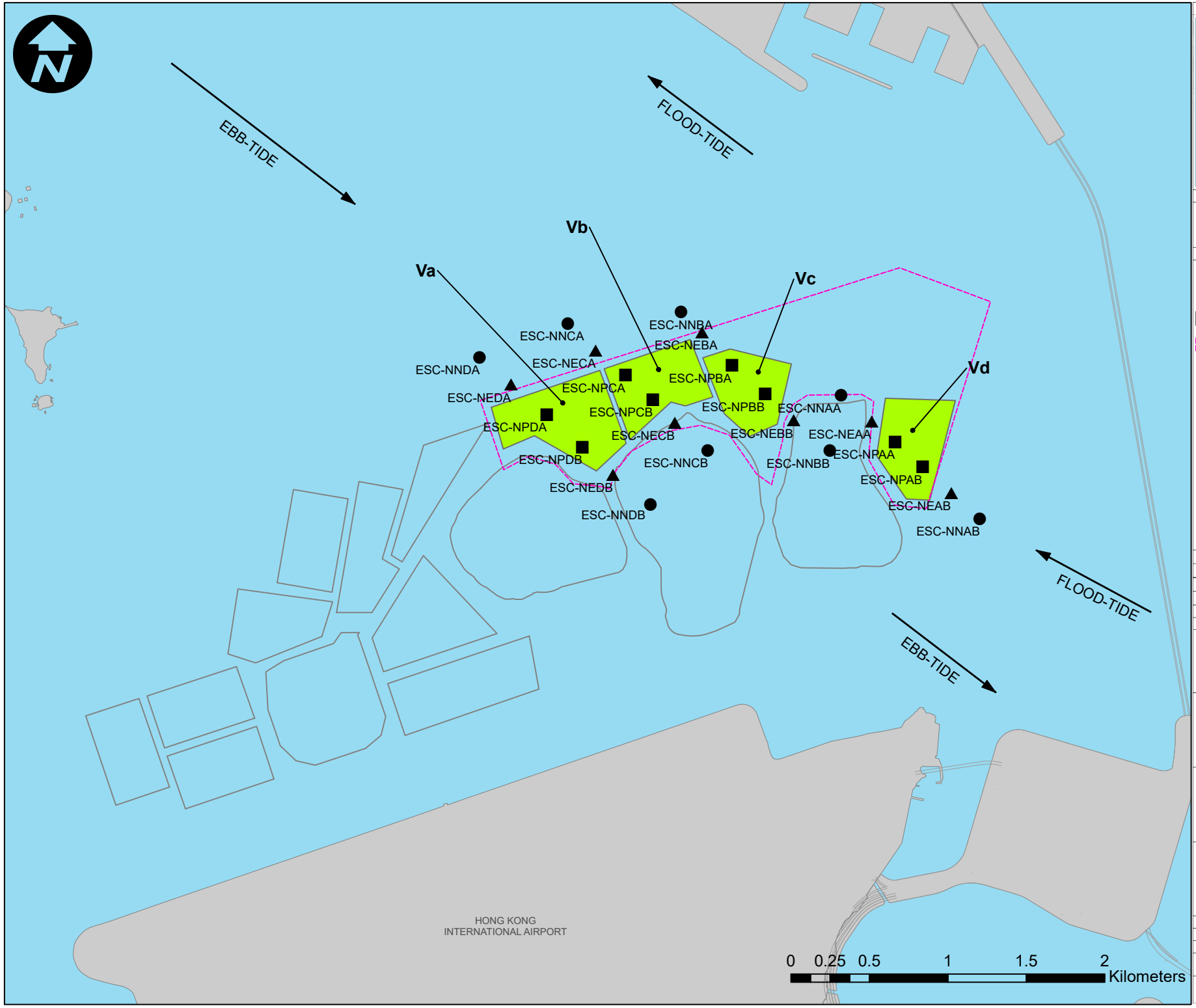
Drawing Number

FIGURE 4.3



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		
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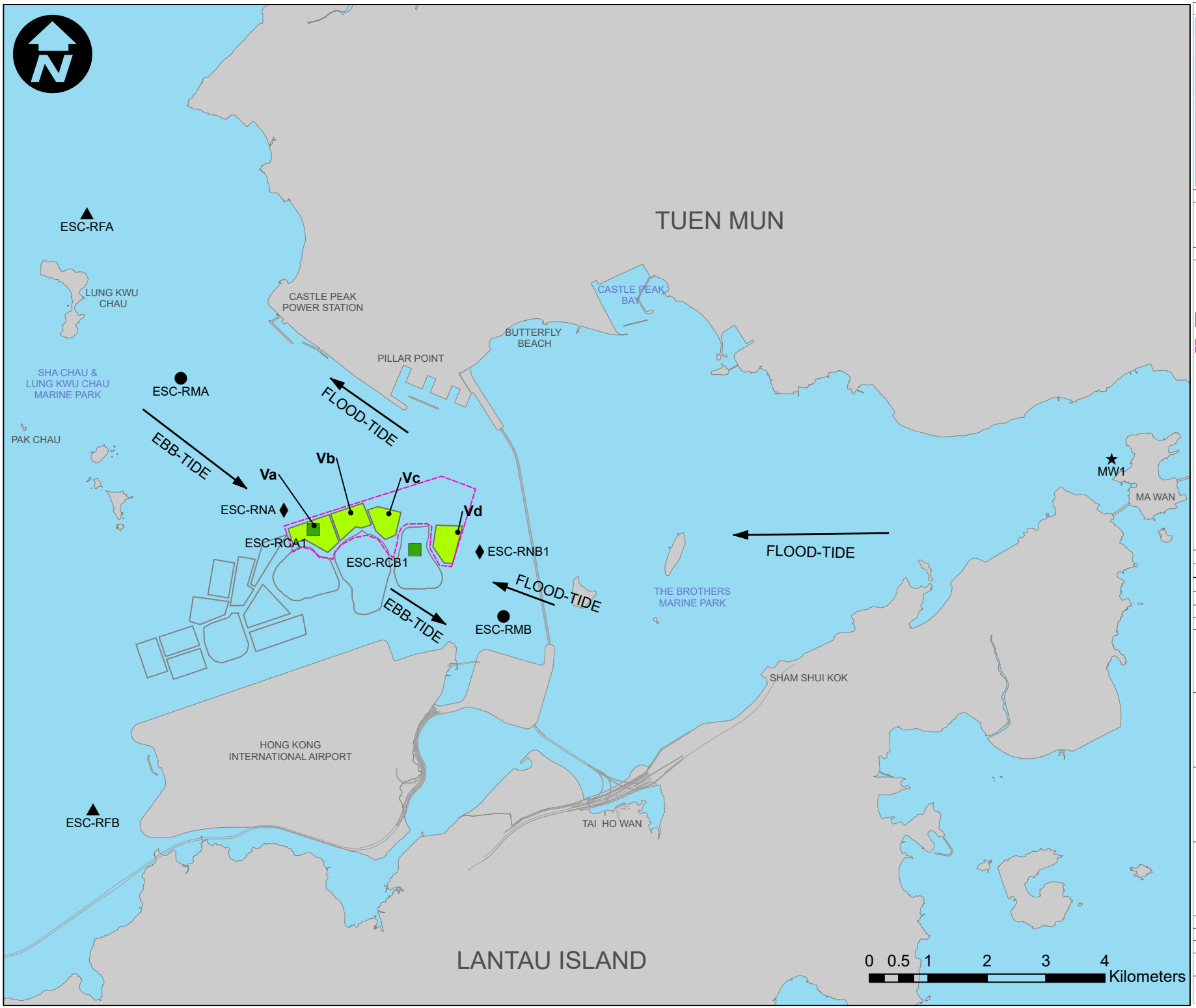
FIGURE 4.4



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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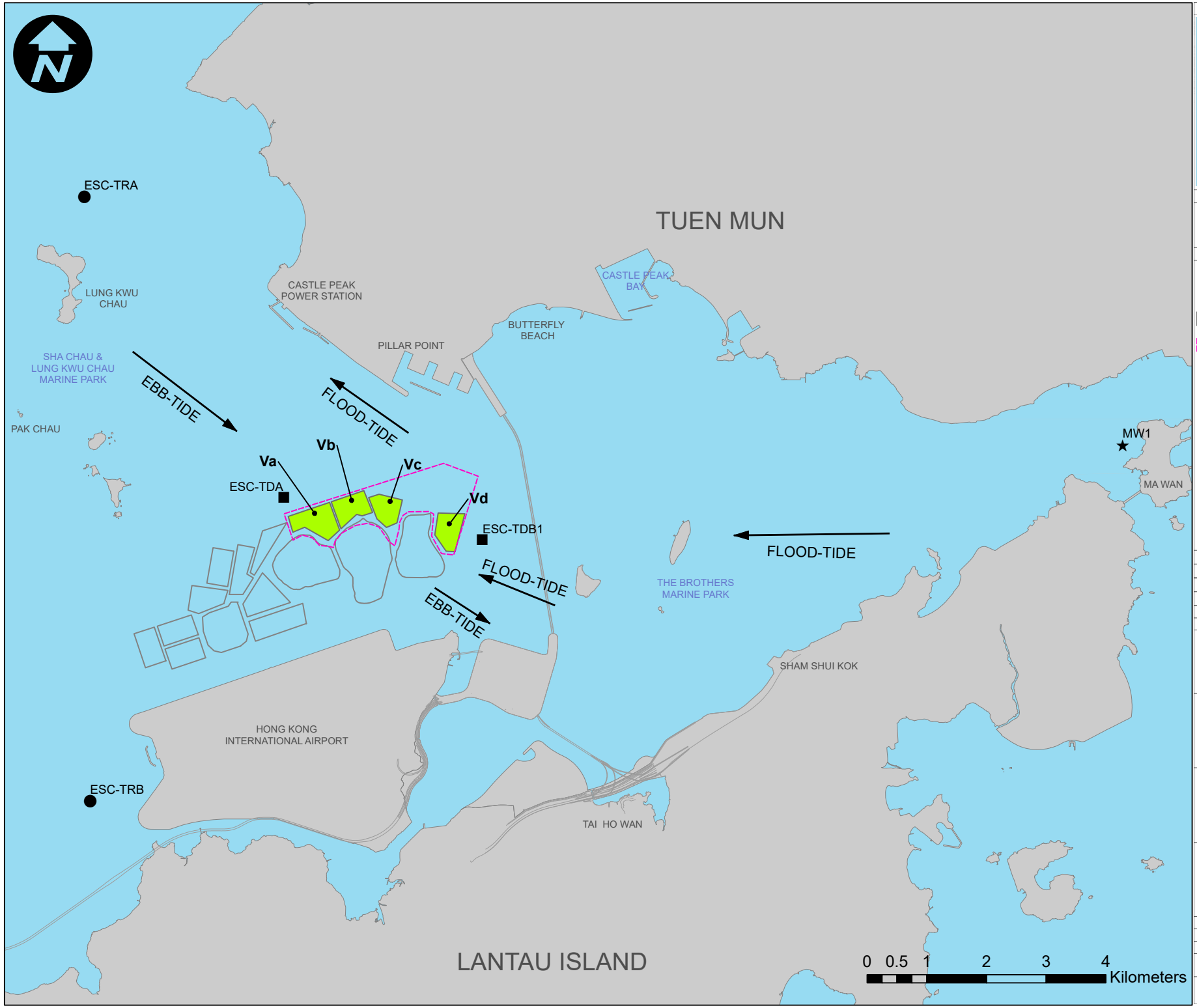
FIGURE 4.5



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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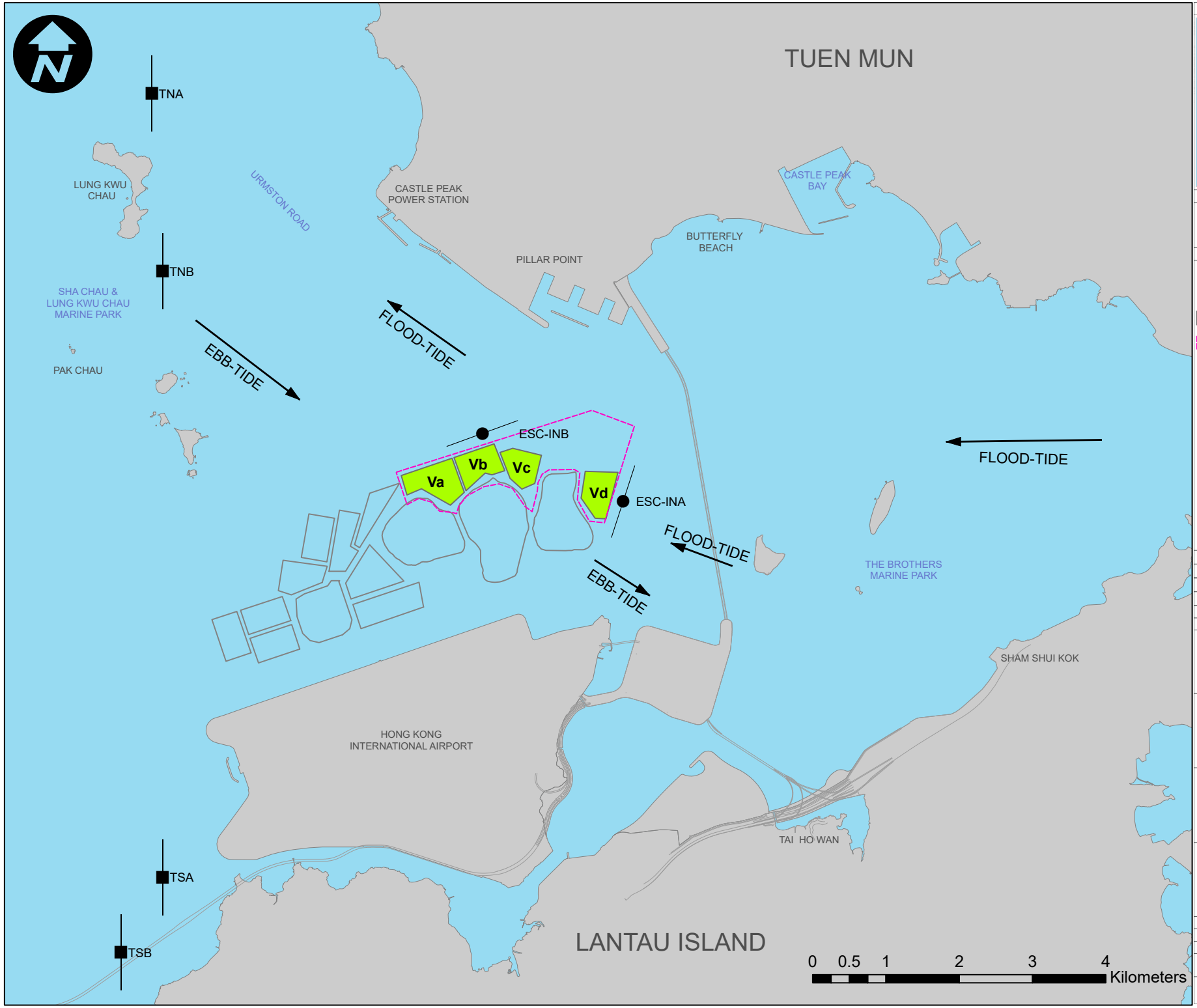
Scale at A3		Status		Rev	

Drawing Number

FIGURE 4.6



Key Plan:

Notes:

Key to symbols:

LEGEND

- ESC CMP V
- ESC USABLE AREA 1

DEMERSAL TRAWL SAMPLING STATIONS

- IMPACT TRAWL STATION
- REFERENCE TRAWL STATION

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ENVIRONMENTAL MONITORING AND AUDIT FOR DISPOSAL FACILITY TO THE EAST OF SHA CHAU (2021-2026) – INVESTIGATION**

Title

MARINE BIOTA MONITORING STATIONS FOR ESC CMPS

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
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Drawing Number

FIGURE 4.7

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	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	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	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	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	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	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	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	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	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	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][2]	Daily Dredging Volume (m^3)	Weekly Dredging Volume (m^3) (From Saturday to Friday)
19 Feb 2022	0	11,050
20 Feb 2022	1950	
21 Feb 2022	3250	
22 Feb 2022	1950	
23 Feb 2022	2600	
24 Feb 2022	1300	
25 Feb 2022	0	
26 Feb 2022	0	0
27 Feb 2022	0	
28 Feb 2022	0	
1 Mar 2022	0	
2 Mar 2022	0	
3 Mar 2022	0	
4 Mar 2022	0	
5 Mar 2022	0	0
6 Mar 2022	0	
7 Mar 2022	0	
8 Mar 2022	0	
9 Mar 2022	0	
10 Mar 2022	0	
11 Mar 2022	0	
12 Mar 2022	2,600	13,650
13 Mar 2022	2,600	
14 Mar 2022	1,300	
15 Mar 2022	1,950	
16 Mar 2022	2,600	
17 Mar 2022	2,600	
18 Mar 2022	0	
19 Mar 2022	0	1,950
20 Mar 2022	0	
21 Mar 2022	0	
22 Mar 2022	0	
23 Mar 2022	0	
24 Mar 2022	1,300	
25 Mar 2022	650	
26 Mar 2022	1,300	14,300
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	0	

Note:

[1] Mobilization work conducted on 19 Feb 2022 and dredging work commenced on 20 Feb 2022.

[2] With the development of pandemic situation in Hong Kong, the dredging operations were suspended after 24 Feb 2022 and resumed on 12 Mar 2022.

B2. Disposal Record at ESC CMP Vb

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Jan 2022	0	653,460
2 Jan 2022	0	653,460
3 Jan 2022	0	653,460
4 Jan 2022	1,879	655,339
5 Jan 2022	1,200	656,539
6 Jan 2022	1,970	658,509
7 Jan 2022	400	658,909
8 Jan 2022	1,678	660,587
9 Jan 2022	1,161	661,748
10 Jan 2022	800	662,548
11 Jan 2022	1,200	663,748
12 Jan 2022	1,600	665,348
13 Jan 2022	600	665,948
14 Jan 2022	1,014	666,962
15 Jan 2022	0	666,962
16 Jan 2022	1,200	668,162
17 Jan 2022	400	668,562
18 Jan 2022	630	669,192
19 Jan 2022	0	669,192
20 Jan 2022	647	669,839
21 Jan 2022	0	669,839
22 Jan 2022	0	669,839
23 Jan 2022	0	669,839
24 Jan 2022	0	669,839
25 Jan 2022	0	669,839
26 Jan 2022	0	669,839
27 Jan 2022	0	669,839
28 Jan 2022	0	669,839
29 Jan 2022	0	669,839
30 Jan 2022	0	669,839
31 Jan 2022	0	669,839
1 Feb 2022	0	669,839
2 Feb 2022	0	669,839
3 Feb 2022	0	669,839
4 Feb 2022	0	669,839
5 Feb 2022	0	669,839
6 Feb 2022	0	669,839
7 Feb 2022	400	670,239
8 Feb 2022	0	670,239
9 Feb 2022	0	670,239
10 Feb 2022	0	670,239
11 Feb 2022	0	670,239
12 Feb 2022	0	670,239
13 Feb 2022	0	670,239
14 Feb 2022	0	670,239
15 Feb 2022	845	671,084
16 Feb 2022	1,285	672,369
17 Feb 2022	780	673,149
18 Feb 2022	1,736	674,885

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
19 Feb 2022	1,933	676,818
20 Feb 2022	1,500	678,318
21 Feb 2022	2,364	680,682
22 Feb 2022	1,411	682,093
23 Feb 2022	2,329	684,422
24 Feb 2022	463	684,885
25 Feb 2022	0	684,885
26 Feb 2022	879	685,764
27 Feb 2022	0	685,764
28 Feb 2022	2,425	688,189
1 Mar 2022	0	688,189
2 Mar 2022	420	688,609
3 Mar 2022	2,000	690,609
4 Mar 2022	2,441	693,050
5 Mar 2022	1,200	694,250
6 Mar 2022	2,000	696,250
7 Mar 2022	2,385	698,635
8 Mar 2022	2,000	700,635
9 Mar 2022	1,662	702,297
10 Mar 2022	2,000	704,297
11 Mar 2022	400	704,697
12 Mar 2022	600	705,297
13 Mar 2022	400	705,697
14 Mar 2022	14	705,711
15 Mar 2022	0	705,711
16 Mar 2022	350	706,061
17 Mar 2022	500	706,561
18 Mar 2022	2,236	708,797
19 Mar 2022	800	709,597
20 Mar 2022	1,600	711,197
21 Mar 2022	2,150	713,347
22 Mar 2022	1,600	714,947
23 Mar 2022	1,811	716,758
24 Mar 2022	1,200	717,958
25 Mar 2022	1,964	719,922
26 Mar 2022	1,600	721,522
27 Mar 2022	800	722,322
28 Mar 2022	0	722,322
29 Mar 2022	1,000	723,322
30 Mar 2022	0	723,322
31 Mar 2022	1,500	724,822

B3. Capping Record at ESC CMP Vd

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
1 Jan 2022	0	217,480
2 Jan 2022	0	217,480
3 Jan 2022	0	217,480
4 Jan 2022	0	217,480
5 Jan 2022	0	217,480
6 Jan 2022	0	217,480
7 Jan 2022	0	217,480
8 Jan 2022	0	217,480
9 Jan 2022	0	217,480
10 Jan 2022	0	217,480
11 Jan 2022	0	217,480
12 Jan 2022	0	217,480
13 Jan 2022	0	217,480
14 Jan 2022	0	217,480
15 Jan 2022	0	217,480
16 Jan 2022	0	217,480
17 Jan 2022	0	217,480
18 Jan 2022	0	217,480
19 Jan 2022	0	217,480
20 Jan 2022	0	217,480
21 Jan 2022	0	217,480
22 Jan 2022	0	217,480
23 Jan 2022	0	217,480
24 Jan 2022	0	217,480
25 Jan 2022	0	217,480
26 Jan 2022	0	217,480
27 Jan 2022	0	217,480
28 Jan 2022	0	217,480
29 Jan 2022	0	217,480
30 Jan 2022	0	217,480
31 Jan 2022	0	217,480
1 Feb 2022	0	217,480
2 Feb 2022	0	217,480
3 Feb 2022	0	217,480
4 Feb 2022	0	217,480
5 Feb 2022	0	217,480
6 Feb 2022	0	217,480
7 Feb 2022	0	217,480
8 Feb 2022	0	217,480
9 Feb 2022	0	217,480
10 Feb 2022	0	217,480
11 Feb 2022	0	217,480
12 Feb 2022	0	217,480
13 Feb 2022	0	217,480
14 Feb 2022	0	217,480
15 Feb 2022	0	217,480
16 Feb 2022	0	217,480
17 Feb 2022	0	217,480
18 Feb 2022	0	217,480

Date	Daily Disposal Volume (m^3)	Accumulative Disposal Volume (m^3)
19 Feb 2022	0	217,480
20 Feb 2022	1,950	219,430
21 Feb 2022	3,250	222,680
22 Feb 2022	1,950	224,630
23 Feb 2022	2,600	227,230
24 Feb 2022	1,300	228,530
25 Feb 2022	0	228,530
26 Feb 2022	0	228,530
27 Feb 2022	0	228,530
28 Feb 2022	0	228,530
1 Mar 2022	0	228,530
2 Mar 2022	0	228,530
3 Mar 2022	0	228,530
4 Mar 2022	0	228,530
5 Mar 2022	0	228,530
6 Mar 2022	0	228,530
7 Mar 2022	0	228,530
8 Mar 2022	0	228,530
9 Mar 2022	0	228,530
10 Mar 2022	0	228,530
11 Mar 2022	0	228,530
12 Mar 2022	2,600	231,130
13 Mar 2022	2,600	233,730
14 Mar 2022	650	234,380
15 Mar 2022	1,950	236,330
16 Mar 2022	2,600	238,930
17 Mar 2022	2,600	241,530
18 Mar 2022	0	241,530
19 Mar 2022	0	241,530
20 Mar 2022	0	241,530
21 Mar 2022	0	241,530
22 Mar 2022	0	241,530
23 Mar 2022	0	241,530
24 Mar 2022	1,300	242,830
25 Mar 2022	650	243,480
26 Mar 2022	1,300	244,780
27 Mar 2022	3,250	248,030
28 Mar 2022	1,950	249,980
29 Mar 2022	2,600	252,580
30 Mar 2022	2,600	255,180
31 Mar 2022	2,600	257,780

Appendix C. Statistical Analysis

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

Dissolved Oxygen

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2526.29	31	319.29	**
Area	38.41	3	50.17	**
Period:Area	207.63	93	8.75	**
Residuals	919.11	3601		

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	1437.13	31	270.85	**
Area	97.48	3	189.84	**
Period:Area	207.19	93	13.02	**
Residuals	616.35	3601		

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

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

Copper

Ebb Tide

Source	Type II Sum of Square	Df	F value	Significance Level
Period	2985.77	31	115.11	**
Area	36.44	3	14.52	**
Period:Area	467.74	93	6.01	**
Residuals	2945.14	3520		

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	1061.95	31	153.94	**
Area	22.86	3	34.24	**
Period:Area	159.47	93	7.71	**
Residuals	783.32	3520		

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	1579.13	31	158.00	**
Area	38.36	3	39.66	**
Period:Area	235.09	93	7.84	**
Residuals	1134.85	3520		

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	897.16	31	360.53	**
Area	17.56	3	72.94	**
Period:Area	85.38	93	11.44	**
Residuals	282.56	3520		

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	428.64	30	468.00	**
Area	23.98	3	261.84	**
Period:Area	33.48	90	12.19	**
Residuals	103.68	3396		

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

SNK Results:
- Overall result:

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

- 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	446.47	31	102.90	**
Area	16.04	3	38.20	**
Period:Area	186.74	93	14.35	**
Residuals	492.67	3520		

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	790.47	31	275.19	**
Area	44.27	3	159.25	**
Period:Area	128.29	93	14.89	**
Residuals	326.16	3520		

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 March 2022

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	75.63	25	174.74	**
Area	8.65	2	249.85	**
Direction	5.34	1	308.53	**
Period:Area	15.42	50	17.82	**
Period:Direction	4.54	25	10.48	**
Area:Direction	5.85	2	169.08	**
Period:Area:Direction	15.10	50	17.45	**
Residuals	19.74	1140		

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
- Potential project related spatial trend was detected in one month for ebb tide direction over the reporting period.

Cadmium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	76.48	25	28.88	**
Area	94.73	2	447.12	**
Direction	0.53	1	5.04	**
Period:Area	39.41	50	7.44	**
Period:Direction	24.61	25	9.29	**
Area:Direction	33.08	2	156.13	**
Period:Area:Direction	29.20	50	5.51	**
Residuals	120.76	1140		

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.

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

Chromium

Source	Type II Sum of Square	Df	F value	Significance Level
Period	15.08	25	39.10	**
Area	18.12	2	587.24	**
Direction	4.41	1	285.65	**
Period:Area	6.52	50	8.45	**
Period:Direction	3.06	25	7.94	**
Area:Direction	13.87	2	449.32	**
Period:Area:Direction	5.44	50	7.05	**
Residuals	17.59	1140		

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[3]
  - 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 ebb tide direction over the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Jan-22	0.71	0.69	19.09	-1.04	**
Feb-22	0.75	0.73	32.26	-3.03	**

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

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

Copper

Source	Type II Sum of Square	Df	F value	Significance Level
Period	28.87	25	34.19	**
Area	164.83	2	2439.93	**
Direction	13.03	1	385.62	**
Period:Area	22.75	50	13.47	**
Period:Direction	13.82	25	16.36	**
Area:Direction	49.04	2	725.87	**
Period:Area:Direction	28.05	50	16.61	**
Residuals	38.51	1140		

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
- Potential project related spatial trend were detected in consecutive two months for ebb tide direction over the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Jan-22	0.66	0.64	21.44	-1.38	**
Feb-22	0.74	0.73	72.81	-13.40	**

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

Lead

Source	Type II Sum of Square	Df	F value	Significance Level
Period	13.85	25	16.18	**
Area	27.20	2	397.09	**
Direction	5.63	1	164.40	**
Period:Area	10.53	50	6.15	**
Period:Direction	3.89	25	4.54	**
Area:Direction	6.35	2	92.77	**
Period:Area:Direction	4.34	50	2.54	**
Residuals	39.04	1140		

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
- Potential project related spatial trend was detected for consecutive three months in flood tide direction and was detected in consecutive two months for ebb tide direction over the reporting period.

Regression Analysis Results:

Flood Tide:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Oct-21	0.71	0.69	35.16	-2.03	**
Nov-21	0.89	0.88	35.35	-1.94	**
Dec-21	0.60	0.57	40.78	-2.09	**
Jan-22	0.46	0.43	30.44	-0.88	**
Feb-22	0.49	0.46	31.98	-1.22	**
Mar-22	0.40	0.36	36.29	-1.19	**

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

Ebb Tide:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Jan-22	0.66	0.64	21.44	-1.38	**
Feb-22	0.74	0.73	72.81	-13.40	**

Note: Linear regression analysis on spatial changes of contaminant concentrations in ebb tide direction for the one concerned reporting month.

Mercury

Source	Type II Sum of Square	Df	F value	Significance Level
Period	132.33	25	21.90	**
Area	109.96	2	227.43	**
Direction	62.09	1	256.86	**
Period:Area	63.14	50	5.22	**
Period:Direction	34.93	25	5.78	**
Area:Direction	88.25	2	182.53	**
Period:Area:Direction	30.45	50	2.52	**
Residuals	275.59	1140		

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	14.38	25	57.78	**
Area	17.88	2	898.17	**
Direction	10.05	1	1009.99	**
Period:Area	7.11	50	14.28	**
Period:Direction	4.72	25	18.95	**
Area:Direction	16.76	2	841.52	**
Period:Area:Direction	6.44	50	12.95	**
Residuals	11.35	1140		

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
  - 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 ebb tide direction over the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Jan-22	0.73	0.71	12.91	-0.78	**
Feb-22	0.77	0.75	16.36	-1.13	**

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

Silver

Source	Type II Sum of Square	Df	F value	Significance Level
Period	157.45	25	65.77	**
Area	281.49	2	1469.81	**
Direction	2.64	1	27.59	**
Period:Area	58.47	50	12.21	**
Period:Direction	32.67	25	13.65	**
Area:Direction	38.58	2	201.43	**
Period:Area:Direction	41.47	50	8.66	**
Residuals	109.17	1140		

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	15.61	25	51.98	**
Area	41.73	2	1737.44	**
Direction	2.28	1	189.82	**
Period:Area	11.79	50	19.63	**
Period:Direction	5.89	25	19.60	**
Area:Direction	8.37	2	348.45	**
Period:Area:Direction	6.46	50	10.76	**
Residuals	13.69	1140		

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
- Potential project related spatial trend was detected in one month during the reporting period in both flood tide and ebb tide directions.

Total Organic Carbon

Source	Type II Sum of Square	Df	F value	Significance Level
Period	84.01	25	177.32	**
Area	49.61	2	1308.93	**
Direction	10.81	1	570.47	**
Period:Area	22.30	50	23.53	**
Period:Direction	9.51	25	20.07	**
Area:Direction	13.47	2	355.34	**
Period:Area:Direction	21.73	50	22.93	**
Residuals	21.60	1140		

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

SNK Results:

- Overall result:
  $\left.\begin{array}{l}\text{Active Pit} > \text{Near Pit}\\ \text{Active Pit} > \text{Pit Edge}\\ \text{Near Pit} > \text{Pit Edge}\end{array}\right\}$ ∴ 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
- Potential project related spatial trend was detected in consecutive two months in flood tide direction during the reporting period.

Regression Analysis Results:

Period	R Square	Adjusted R Square	Y-intercept	Slope	Significance Level
Feb-22	0.63	0.61	6072	-173.33	**
Mar-22	0.76	0.74	6900	-713.33	**

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

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

Arsenic

Source	Type II Sum of Square	Df	F value	Significance Level
Period	68.54	23	155.04	**
Area	95.58	4	1243.20	**
Period:Area	65.32	92	36.94	**
Residuals	41.29	2148		

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	55.55	23	20.45	**
Area	60.80	4	128.73	**
Period:Area	47.78	92	4.40	**
Residuals	253.63	2148		

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	5115.48	23	25.10	**
Area	72286.52	4	2039.41	**
Period:Area	16969.19	92	20.82	**
Residuals	19033.90	2148		

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	12154.76	23	17.66	**
Area	253784.41	4	2119.68	**
Period:Area	26695.01	92	9.69	**
Residuals	64293.88	2148		

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	30401.44	23	97.32	**
Area	71588.79	4	1317.73	**
Period:Area	19197.02	92	15.36	**
Residuals	29173.78	2148		

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	398.39	23	37.59	**
Area	58.72	4	31.86	**
Period:Area	209.05	92	4.93	**
Residuals	989.72	2148		

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	2236.06	23	22.91	**
Area	26458.24	4	1558.57	**
Period:Area	8897.49	92	22.79	**
Residuals	9116.07	2148		

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	168.18	23	44.66	**
Area	772.09	4	1178.98	**
Period:Area	78.80	92	5.23	**
Residuals	351.67	2148		

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	16.80	23	31.58	**
Area	139.43	4	1506.83	**
Period:Area	48.05	92	22.58	**
Residuals	49.69	2148		

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	1946192363	23	55.48	**
Area	3567783170	4	584.86	**
Period:Area	3796090385	92	27.06	**
Residuals	3275828796	2148		

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.