

**Environmental Monitoring and Audit
 for Contaminated Mud Pits to the
 South of The Brothers and at East
 Sha Chau (2012-2017) – Investigation
 Agreement No. CE 23/2012(EP)**

**34th Monthly Progress Report for Contaminated
 Mud Pits to the South of The Brothers and at
 East Sha Chau – June 2015**

Revision 0

14 July 2015

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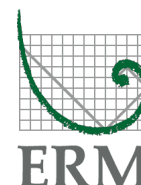
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| Client: Civil Engineering and Development Department (CEDD) | | Project No: 0175086 | | | |
| Summary: This document presents the 34 th monthly progress report for Contaminated Mud Pits at the South of The Brothers and at East Sha Chau. | | Date: 14 July 2015 | | | |
| | | Approved by:  | | | |
| | | Craig A. Reid Partner | | | |
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| | | | | | |
| v0 | 34 th Monthly Progress Report for ESC CMPs and SB CMPs | CY | JT | CAR | 14/7/15 |
| Revision | Description | By | Checked | Approved | Date |
| <p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p> <p>This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.</p> | | Distribution <input type="checkbox"/> Internal <input checked="" type="checkbox"/> Public <input type="checkbox"/> Confidential | | | |
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**Dredging, Management and Capping of Contaminated Sediment Disposal
Facility to the South of The Brothers**

**Environmental Certification Sheet
EP-427/2011/A**


Reference Document/Plan

| | |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Document/ Plan to be Certified/ Verified: | 34 th Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau - June 2015 |
| Date of Report: | 14 July 2015 |
| Date prepared by ET: | 14 July 2015 |
| Date received by IA: | 14 July 2015 |


Reference EP Condition

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Environmental Permit Condition: | Condition No.: 4.4 |
| 4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director. | |

ET Certification

| | |
|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| I hereby certify that the above referenced document/ plan complies with the above referenced condition of EP-427/2011/A | |
| Craig A. Reid, Environmental Team Leader: |  Date: 14/7/2015 |

IA Verification

| | |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| I hereby verify that the above referenced document/ plan complies with the above referenced condition of EP-427/2011/A | |
| Dr Wang Wen Xiong, Independent Auditor: |  Date: 14/7/2015 |

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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) - Investigation

34TH MONTHLY PROGRESS REPORT FOR JUNE 2015

1.1 BACKGROUND

1.1.1 Since early 1990s, contaminated sediment ⁽¹⁾ arising from various construction works (e.g. dredging and reclamation projects) in Hong Kong has been disposed of at a series of seabed pits at East of Sha Chau (ESC). In late 2008, a review indicated that the existing and planned facilities at ESC would not be able to meet the disposal demand after 2012. In order to meet this demand, the Hong Kong Special Administrative Region Government (HKSARG) decided to implement a new contained aquatic disposal (CAD) ⁽²⁾ facility at the South of The Brothers (SB CMPs) which had been under consideration for a number of years.

1.1.2 The environmental acceptability of the construction and operation of the Project had been confirmed by findings of the associated Environmental Impact Assessment (EIA) study completed in 2005 under *Agreement No. CE 12/2002(EP)* ⁽³⁾. The Director of Environmental Protection (DEP) approved this EIA report under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO)* in September 2005 (*EIA Register No.: AEIAR-089/2005*).

1.1.3 In accordance with the EIA recommendation, prior to commencement of construction works for the SB CMPs, the Civil Engineering and Development Department (CEDD) undertook a detailed review and update of the EIA findings for the SB site ⁽⁴⁾. Findings of the EIA review undertaken in 2009/2010 confirmed that the construction and operation of the SB site had been predicted to be environmentally acceptable.

- (1) According to the Management Framework of Dredged/ Excavated Sediment of ETWB TC(W) No. 34/2002, contaminated sediment in general shall mean those sediment requiring Type 2 – Confined Marine Disposal as determined according to this TC(W).
- (2) CAD options may involve use of excavated borrow pits, or may involve purpose-built excavated pits. CAD sites are those which involve filling a seabed pit with contaminated mud and capping it with uncontaminated material such that the original seabed level is restored and the contaminated material is isolated from the surrounding marine environment.⁷
- (3) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area (*Agreement No. CE 12/2002(EP)*)
- (4) Under the CEDD study *Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)*

1.1.4 *Environmental Permits (EPs) (EP-312/2008/A and EP-427/2011A) were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for ESC CMP V and on 23 December 2011 for SB CMPs, respectively. Under the requirements of the EPs, an Environmental Monitoring and Audit (EM&A) programme as set out in the EM&A Manuals ⁽¹⁾ ⁽²⁾ is required to be implemented for the CMPs.*

1.1.5 The present EM&A programme under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs as well as ESC CMPs. Detailed works schedule for both CMPs is shown in *Figure 1.1*. In June 2015, the following works were being undertaken at the CMPs:

- Capping operations at ESC CMPs;
- Capping operations at SB CMP 1; and
- Disposal of contaminated mud at SB CMP 2.

Figure 1.1 Works Schedule for ESC CMPs and SB CMPs

| Pit | Operation | 2012 | | | 2013 | | | | 2014 | | | | 2015 | | | | 2016 | | | | 2017 | | | | | | | | | |
|----------|-------------|------|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|---|---|---|---|---|---|
| | | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J |
| ESC CMP | Dredging | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Backfilling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Capping | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SB CMP 1 | Dredging | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Backfilling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Capping | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SB CMP 2 | Dredging | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Backfilling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Capping | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

1.2 REPORTING PERIOD

1.2.1 This 34th Monthly Progress Report covers the EM&A activities for the reporting month of June 2015.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

1.3.1 The following monitoring activity has been undertaken for ESC CMPs in June 2015:

- *Water Quality Monitoring during Capping of ESC CMPs* was undertaken on 2 June 2015.

(1) ERM (2012) Environmental Monitoring and Audit (EM&A) Manual. Final First Review. Environmental Monitoring and Audit for Contaminated Mud Pits to the South of the Brothers and at East Sha Chau (2012-2017) - Investigation. Agreement No. CE 23/2012(EP). Submitted to EPD in November 2012.

(2) ERM (2010) Environmental Monitoring and Audit (EM&A) Manual. Final Second Review. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) - Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in November 2010.

1.3.2 The following monitoring activities have been undertaken for SB CMPs in June 2015:

- *Pit Specific Sediment Chemistry* of CMP 2 was undertaken on 8 June 2015;
- *Cumulative Impact Specific Chemistry* of CMP 2 was undertaken 9 June 2015;
- *Water Quality Monitoring during Capping Operations* of CMP 1 was undertaken on 10 June 2015; and
- *Water Column Profiling* of CMP 2 was undertaken on 11 June 2015.

1.4 *DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS*

1.4.1 No outstanding sampling remained for June 2015. The following laboratory analyses were still in progress during the preparation of this monthly report and hence are not presented in this monthly report:

- Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry* of CMP 2 in June 2015; and
- Laboratory analyses of sediment samples collected for *Cumulative Impact Specific Chemistry* of CMP 2 in June 2015.

1.4.2 A summary of field activities conducted are presented in *Annex A*.

1.5 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR ESC CMPs

1.5.1 Brief discussion of the monitoring results of *Water Quality Monitoring during Capping of ESC CMPs* conducted on 2 June 2015 is presented below.

1.5.2 *Water Quality Monitoring during Capping – June 2015*

1.5.3 The monitoring results obtained during June 2015 sampling in the wet season have been assessed for compliance with the Water Quality Objectives (WQOs) through a review of the Environmental Protection Department (EPD) routine water quality monitoring data for the wet season period (April to October) of 2004 – 2013 from stations in the North Western Water Control Zone (WCZ), where ESC CMPs are located. For Salinity, the average value obtained from the Reference stations was used for the basis as the WQO. A total of sixteen (16) monitoring stations were sampled in June 2015 as shown in *Figure 1.2*. Graphical presentation of the monitoring results is provided in *Annex B*.

In-situ Measurements

1.5.4 Graphical presentation of the monitoring results is shown in *Figures 1-6 of Annex B*. Levels of Temperature, Dissolved Oxygen (DO), pH and Salinity at most stations in June 2015 complied with the WQO except Salinity at Ma Wan station. The higher Salinity recorded at Ma Wan station is likely to be caused by its greater separation distance from the Pearl River mouth, which is a key source of freshwater inputs in the area, when compared to the Reference stations. The turbidity complied with the Action and Limit levels at all stations in June 2015 (*Table C1 of Annex C*).

Laboratory Measurements for Suspended Solids (SS)

1.5.5 Concentrations of SS complied with the WQO at most stations except at Impact stations in June 2015 (*Figure 7 of Annex B*). However, the SS complied with the Action and Limit levels at all stations in June 2015 (*Table C1 of Annex C*). Further statistical analysis will be undertaken in the quarterly report to investigate whether the capping operations at ESC CMPs is causing any unacceptable deterioration in water quality of the area.

1.6 BRIEF DISCUSSION OF THE MONITORING RESULTS FOR SB CMPs

1.6.1 Brief discussion of the monitoring results of the following activities for SB CMPs is presented in this 34th *Monthly Progress Report*:

- Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry* of CMP 2 in May 2015;
- *Water Quality Monitoring during Capping Operations* of CMP 1 conducted on 10 June 2015; and

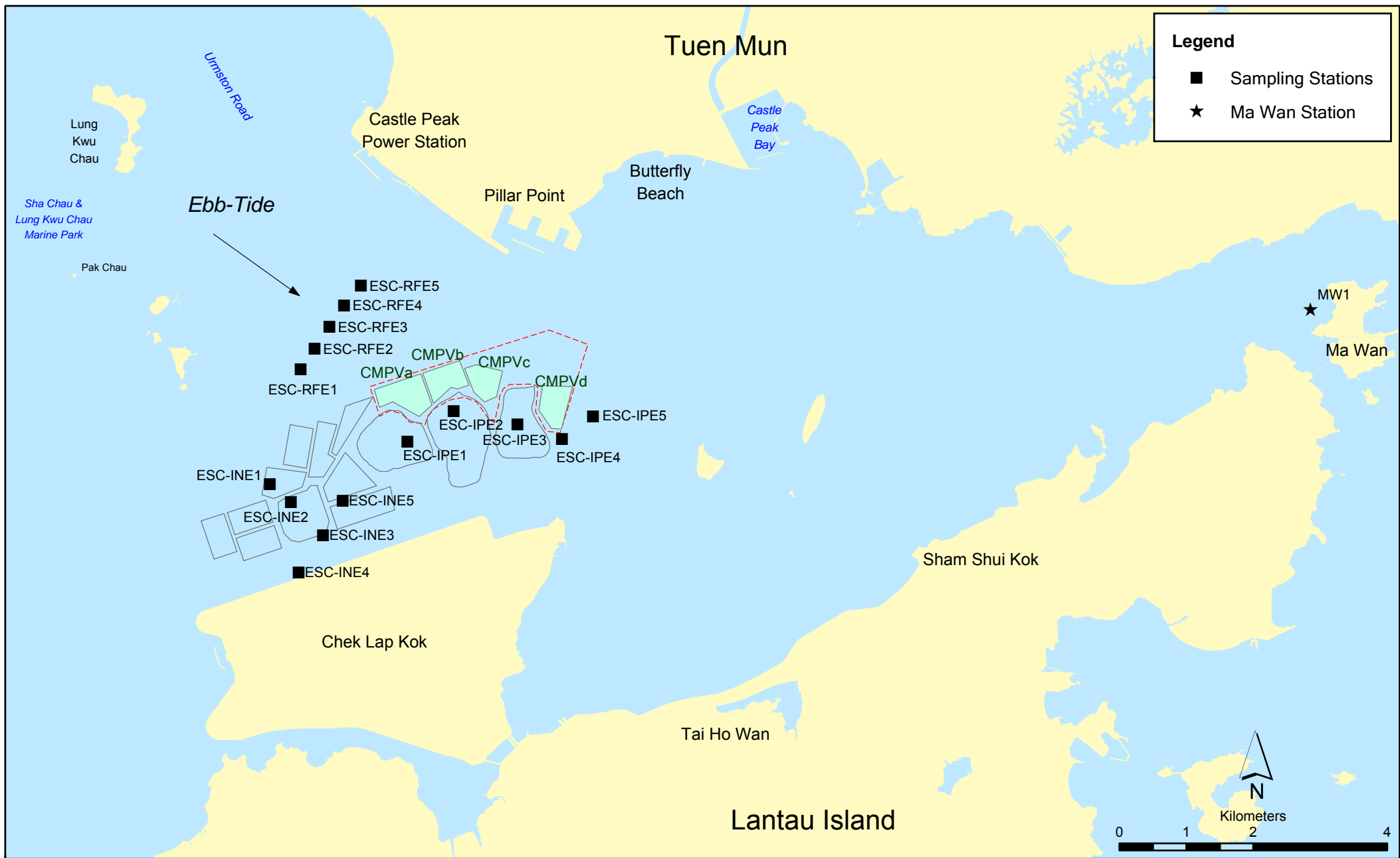


Figure 1.2

Routine & Capping Water Quality Sampling Stations (Ebb-Tide) for CMPV

- *Water Column Profiling* of CMP 2 undertaken on 11 June 2015.

1.6.2 ***Pit Specific Sediment Chemistry of CMP 2 – May 2015***

1.6.3 Monitoring locations for *Pit Specific Sediment Chemistry* for CMP 2 are shown in *Figure 1.3*. A total of six (6) monitoring stations were sampled in May 2015.

1.6.4 Zinc exceeded the Lower Chemical Exceedance Level (LCEL) at Active Pit station SB-NPBA while Nickel exceeded the Upper Chemical Exceedance Level (UCEL) at Active Pit station SB-NPBB. In addition, Copper and Silver exceeded the UCEL at Active Pit stations SB-NPBA and SB-NPBB in May 2015. The concentrations of other inorganic contaminants (Cadmium, Chromium, Mercury, Lead and Arsenic) were lower than the LCEL at all stations. As higher Copper, Nickel, Silver and Zinc concentrations were recorded within the Active Pit stations only which were receiving contaminated mud during the reporting month, there is no evidence indicating any dispersal of contaminants from the active pit.

1.6.5 For organic contaminants, the concentrations of Total Organic Carbon (TOC) were similar at most stations except lower values were recorded at Pit Edge station SB-NEBB and Near Pit station SB-NNBB (*Figure 10 of Annex B*). Tributyltin (TBT) concentrations were observed to be higher at Active Pit station SB-NPBA and Near Pit station SB-NNBB (*Figure 11 of Annex B*). Total dichlorodiphenyltrichloroethane (DDT), 4,4'-dichlorodiphenyldichloroethylene (DDE), Total Polychlorinated Biphenyls (PCBs), Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (MW PAHs) were below the limit of reporting at most stations (except High MW PAHs at Active Pit station SB-NPBA) in May 2015 (*Figure 12 of Annex B*).

1.6.6 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at CMP 2 in May 2015. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

1.6.7 ***Water Quality Monitoring during Capping Operations of CMP 1- June 2015***

1.6.8 The monitoring results obtained during June 2015 sampling in the wet season have been assessed for compliance with the WQOs (see *Section 1.5.3* for details). A total of fourteen (14) monitoring stations were sampled in June 2015 as shown in *Figure 1.4*. Graphical presentation of the monitoring results is provided in *Annex B*.

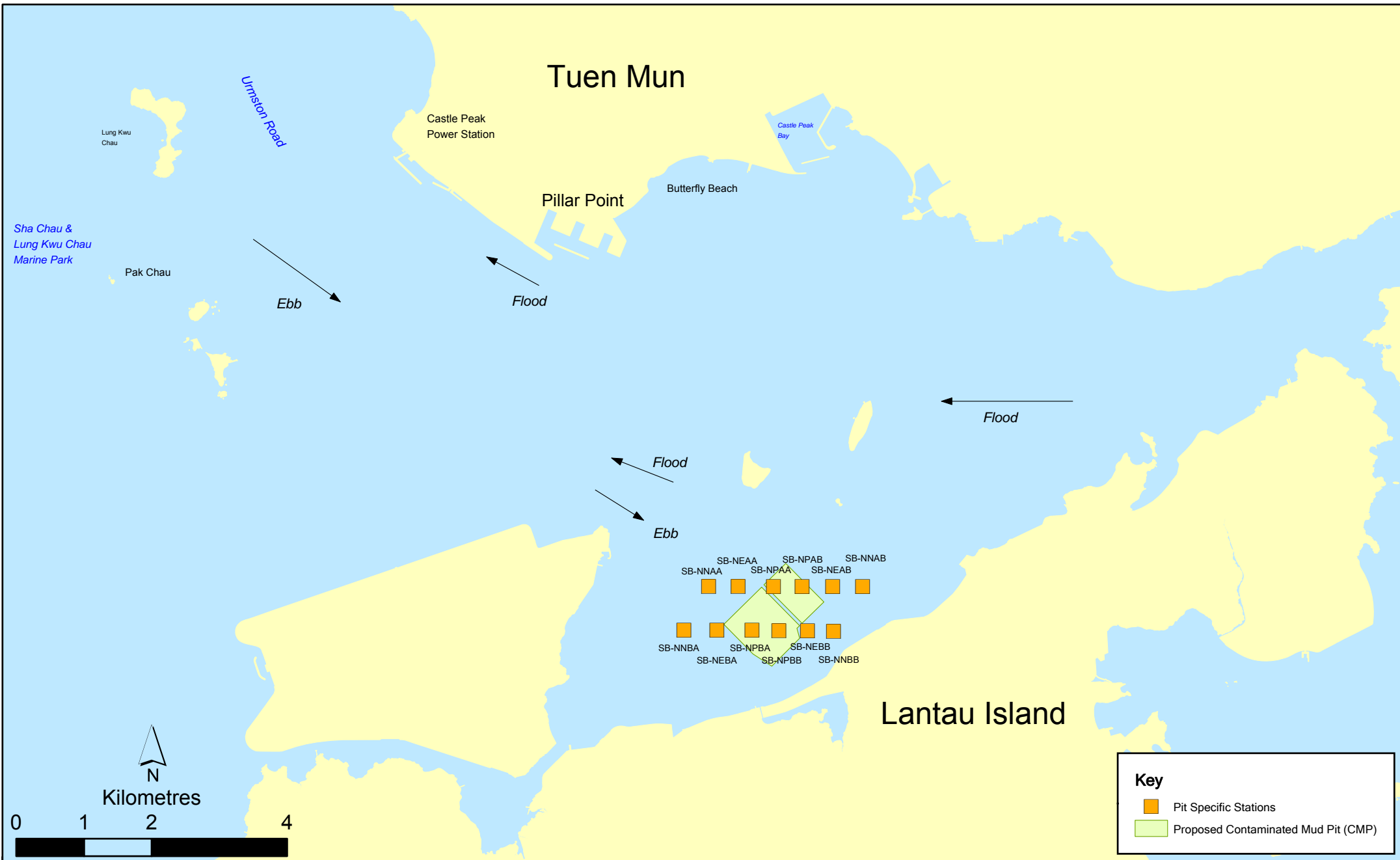


Figure 1.3

Pit Specific Sediment Quality Monitoring Stations for South Brothers Facility

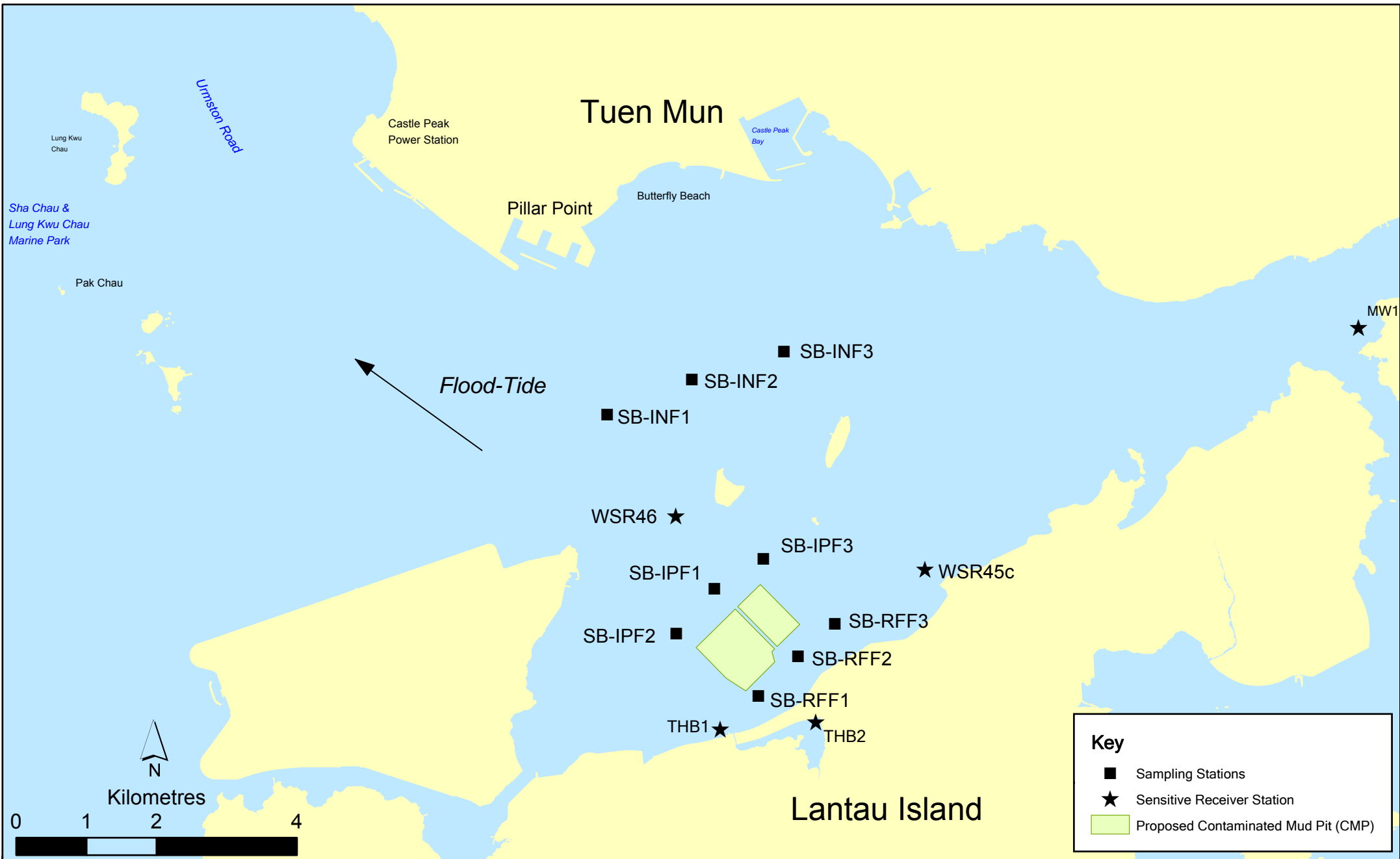


Figure 1.4

Routine & Capping Water Quality Sampling Stations (Flood-Tide) for South Brothers Facility

In-situ Measurements

- 1.6.9 Graphical presentation of the monitoring results is shown in *Figures 13-18 of Annex B*. Levels of pH at all stations in June 2015 complied with the WQO. Temperature and DO at most stations complied with the WQO except at Intermediate and Ma Wan stations. As Intermediate and Ma Wan stations are located further away from the CMP 1 and the Temperature and DO at the Impact stations complied with the WQO, it is considered that the non-compliance of DO and Temperature at these stations were possibly caused by the natural background variation in water quality of the area, but not from the capping operation of CMP 1.
- 1.6.10 Levels of Salinity exceeded the WQO at most stations except at Tai Ho Bay stations. The lower Salinities recorded at Tai Ho Bay and Reference stations are likely due to the close proximity of the nearby streams and Pearl River mouth, which release large amount of freshwater runoff in the area during flooding. The Salinities at other stations were above the WQO as they were located further away from the Tai Ho Bay and Reference stations which experienced less freshwater runoff from the nearby streams.

Laboratory Measurements

- 1.6.11 Concentrations of SS complied with the WQO (11.6 mg/L for wet season) at most stations in June 2015 except at Tai Ho Bay station 1 (*Figure 19 of Annex B*). However, SS at all stations complied with the Action and Limit Levels in June 2015 (*Table C2 of Annex C*).
- 1.6.12 For nutrients, concentrations of Ammonia (NH₃) were relatively similar amongst most stations except a slightly lower value was recorded at Reference and Tai Ho Bay stations (*Figures 20 of Annex B*). Concentrations of Biochemical Oxygen Demand (BOD₅) were similar at most stations except higher values were recorded at Tai Ho Bay stations in June 2015. Total Inorganic Nitrogen (TIN) at all stations exceeded the WQO of 0.5 mg/L in June 2015 (*Figure 22 of Annex B*). It should be noted that the North Western WCZ has historically experienced higher levels of TIN and the exceedances of TIN WQO at all stations are unlikely to be caused by the capping operation at CMP 1.
- 1.6.13 Since lower BOD₅ was recorded for both Impact and Reference stations, the higher concentration at Tai Ho Bay stations is likely due to the natural fluctuation of BOD₅ in the environment. Therefore, there is no evidence indicating any degradation of water quality due to the capping activities at CMP 1.
- 1.6.14 Statistical analysis will be undertaken and presented in the quarterly report to investigate whether the capping operations at CMP 1 is causing any unacceptable impacts in water quality of the area.

1.6.15 *Water Column Profiling of CMP 2 – June 2015*

1.6.16 *Water Column Profiling* was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 11 June 2015. The water quality monitoring results have been assessed for compliance with the WQOs as discussed in *Section 1.5.3*. The monitoring results were also compared with the Action and Limit Levels set in *Baseline Monitoring Report* (see *Table C2 of Annex C* for details).

In-situ Measurements

1.6.17 Analyses of results for June 2015 indicated that levels of Temperature, Salinity, DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table C3 of Annex C*). DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables C2 and C3 of Annex C*).

Laboratory Measurements for SS

1.6.18 Analyses of results for June 2015 indicated that the Suspended Solid (SS) levels at both Upstream and Downstream stations complied with the WQO. Both Upstream and Downstream stations also complied with the Action and Limit Levels (*Tables C2 and C3 of Annex C*).

1.6.19 Overall, the monitoring results indicated that the mud disposal operation at CMP 2 did not appear to cause any deterioration in water quality during this reporting period.

1.7 *ACTIVITIES SCHEDULED FOR THE NEXT MONTH*

1.7.1 The following monitoring activities will be conducted in the next monthly period of July 2015 for SB CMPs:

- *Pit Specific Sediment Chemistry of CMP 2;*
- *Demersal Trawling for CMP 2;*
- *Water Column Profiling of CMP 2; and*
- *Routine Water Quality Monitoring of CMP 2.*

1.7.2 No monitoring activity is scheduled to be conducted in the next monthly period of July 2015 for ESC CMPs.

1.7.3 The sampling schedule is presented in *Annex A*.

1.8 *STUDY PROGRAMME*

1.8.1 A summary of the Study programme is presented in *Annex D*.

Annex A

Sampling Schedule

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

| | | | 2012 | | | | | 2013 | | | | | 2014 | | | | | 2015 | | | | | 2016 | | | | | 2017 | | | | | | | | | | | | | | | | | | |
|-----------------------------------------|---------|------------------|------|---|---|---|---|------|---|---|---|---|------|---|---|---|---|------|---|---|---|---|------|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F |
| Capping Water Quality Monitoring | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ebb Tide | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Impact Stations Downcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPE1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPE2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPE3 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPE4 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPE5 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Intermediate Stations Downcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INE1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INE2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INE3 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INE4 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INE5 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reference Stations Upcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFE1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFE2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFE3 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFE4 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFE5 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sensitive Receiver Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MW1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | THB1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | THB2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | WSR45C | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | WSR46 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flood Tide | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Impact Stations Downcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPF1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPF2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-IPF3 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Intermediate Stations Downcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INF1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INF2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-INF3 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reference Stations Upcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFF1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFF2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFF3 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sensitive Receiver Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MW1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | THB1 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | THB2 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | WSR45C | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | WSR46 | 4 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Benthic Recolonisation Studies | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capped Contaminated Mud Pits | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-CPA | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-CPB | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reference Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | RBA | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | RBB | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | RBC | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Notes:
 "n*" = Number of replicates depends on parameters
 Naming of stations are tentative only and will be subjected to changes

Annex B

Graphical Presentations

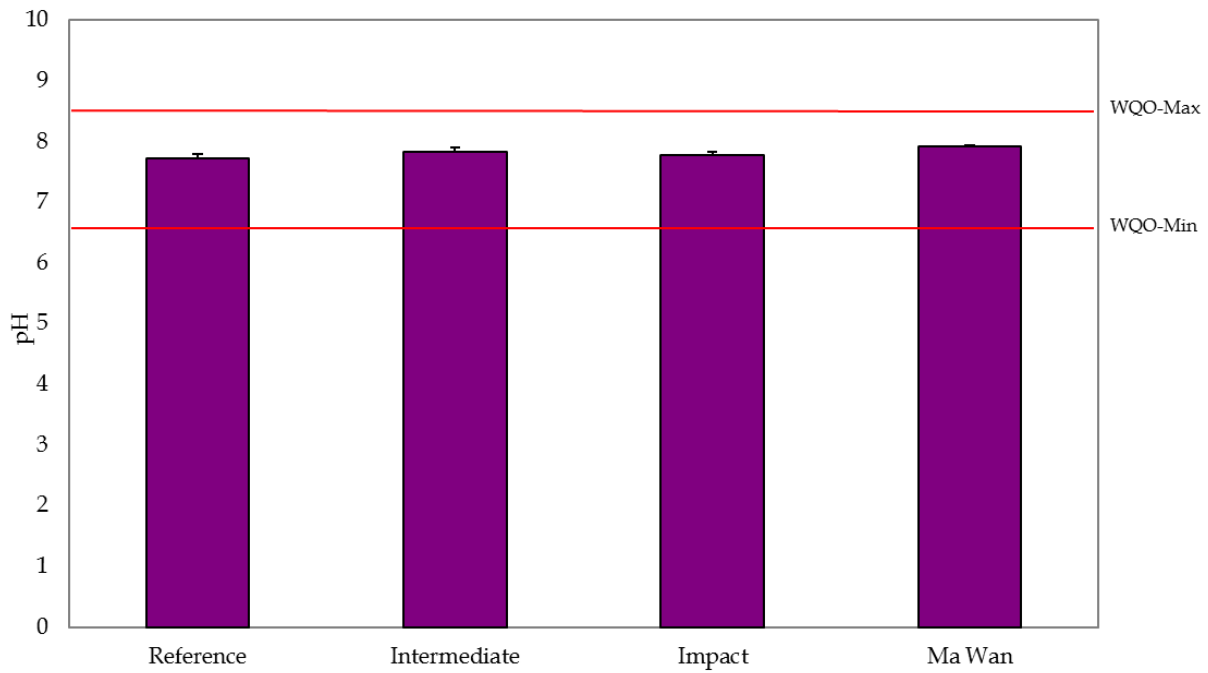


Figure 1: Levels of pH (mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

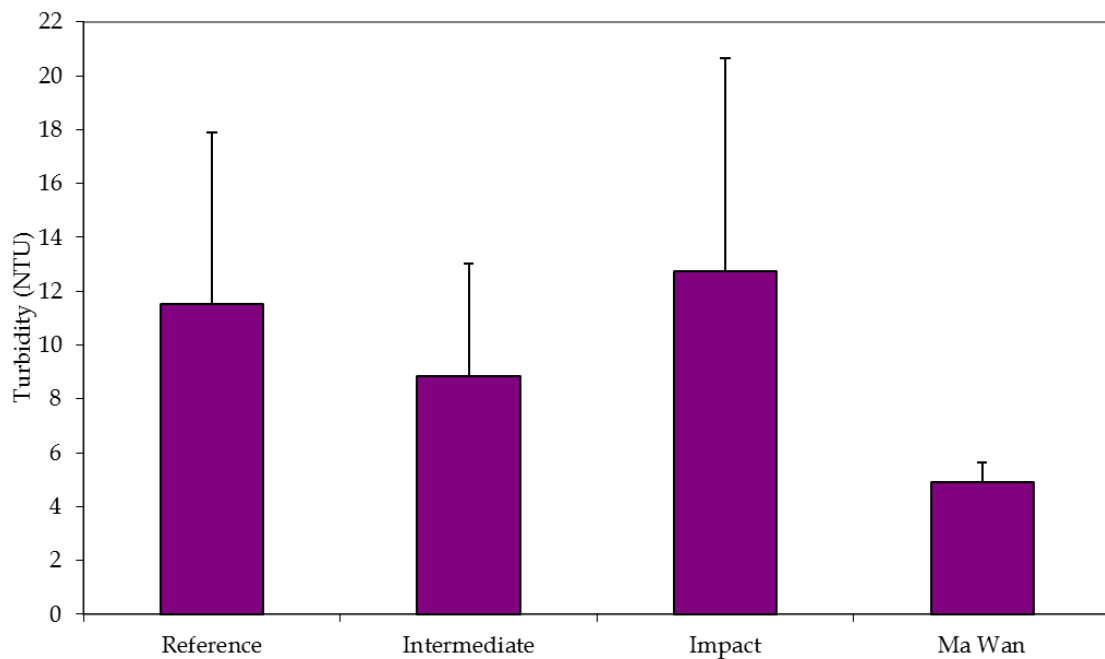


Figure 2: Levels of Turbidity (NTU; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

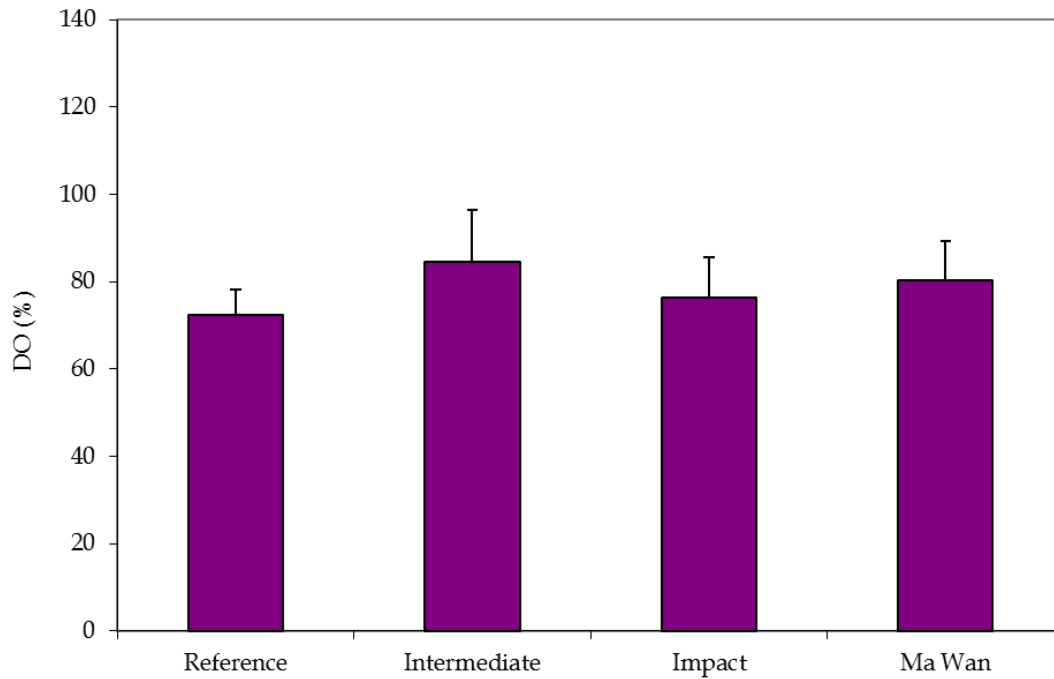


Figure 3: Levels of Dissolved Oxygen (% saturation; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

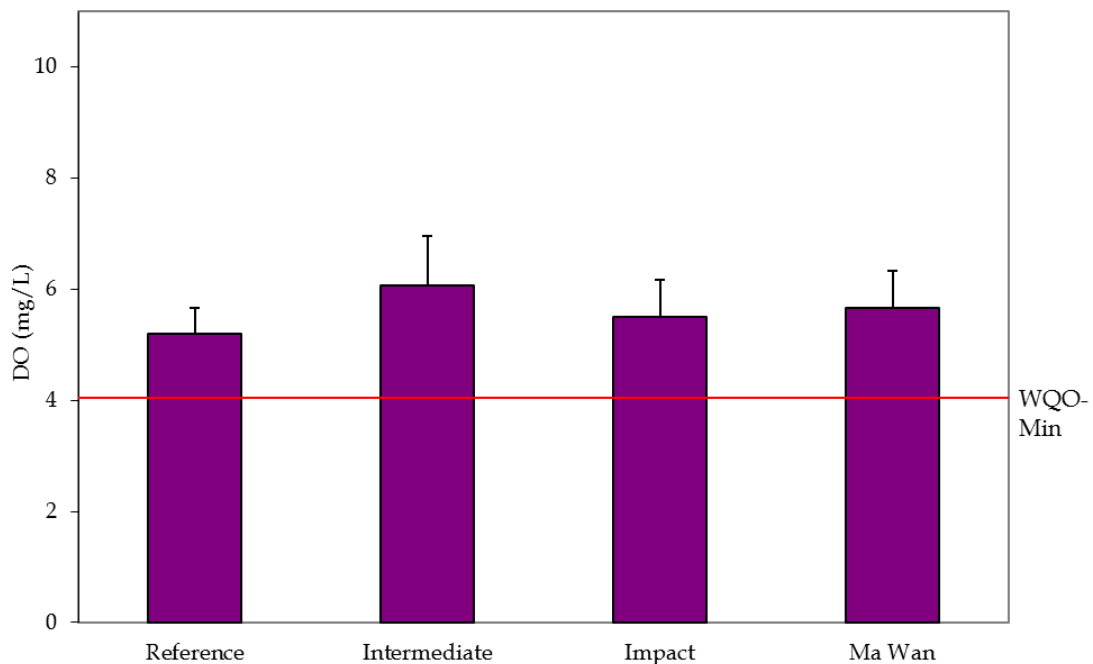


Figure 4: Levels of Dissolved Oxygen (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

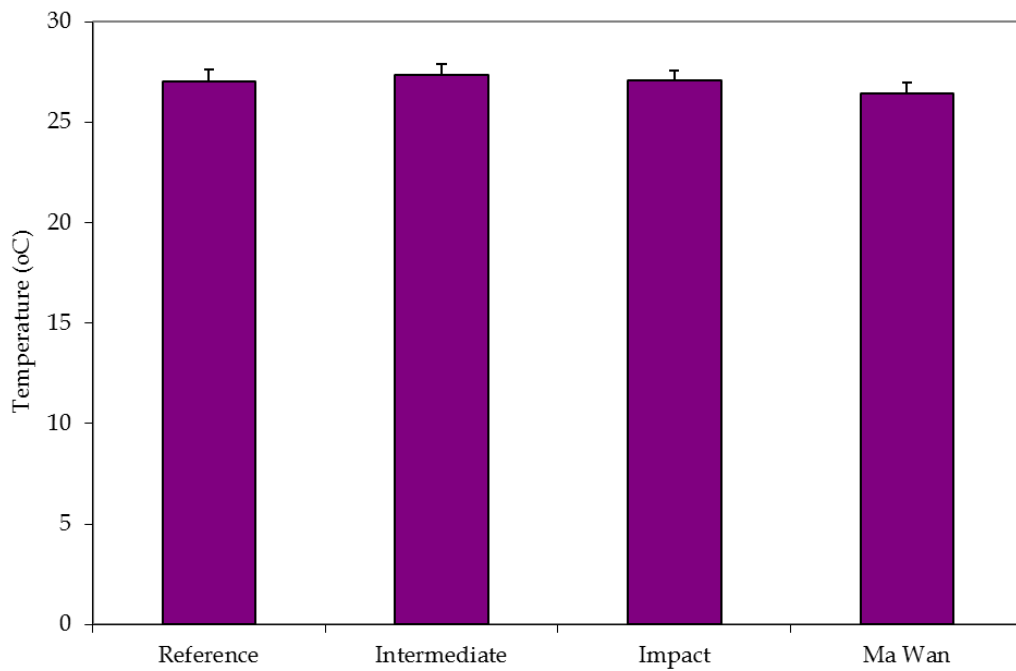


Figure 5: Levels of Temperature (°C; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

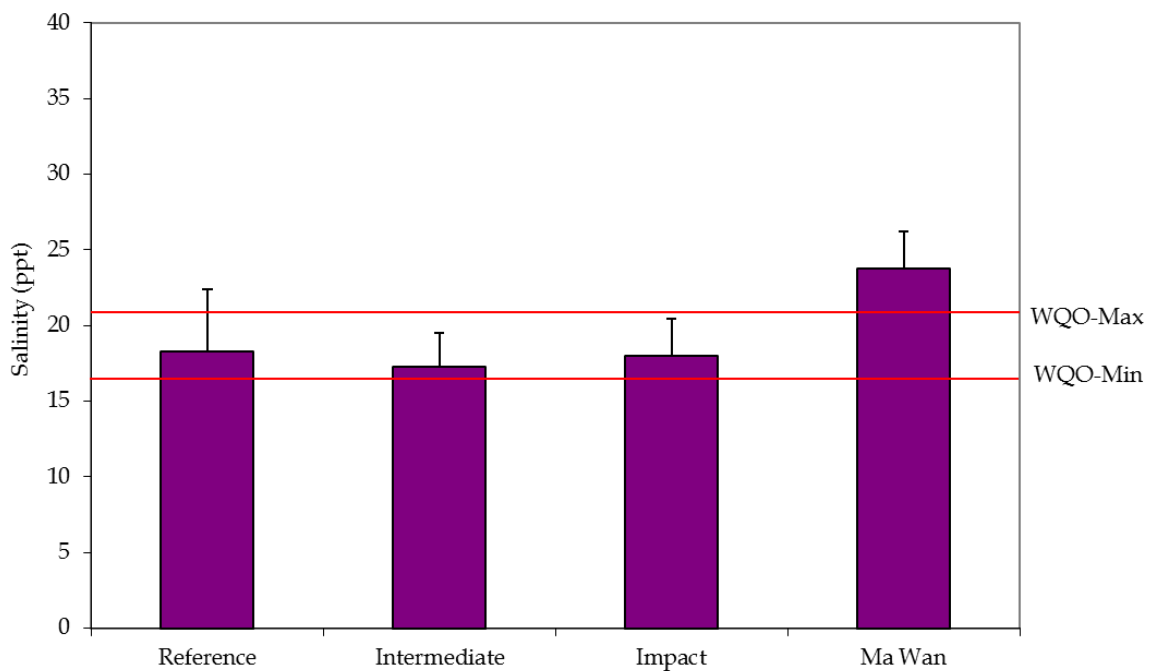


Figure 6: Levels of salinity (ppt; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

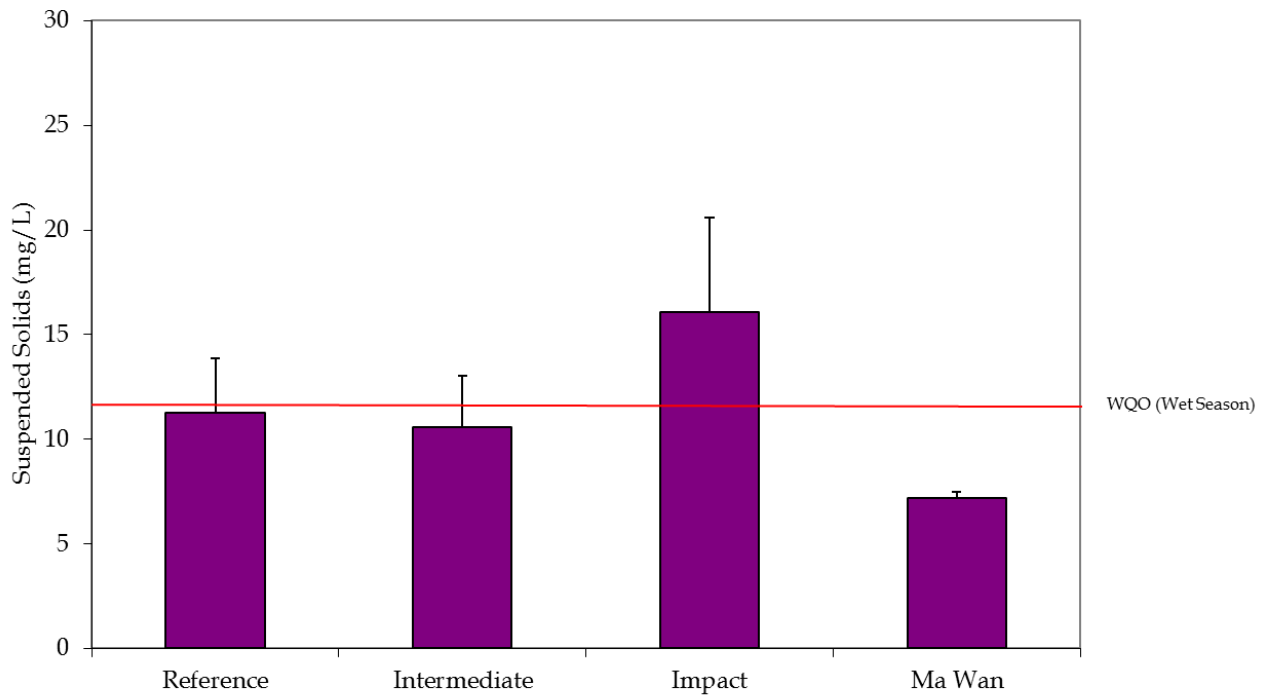


Figure 7: Levels of Suspended Solids (mg/L; mean +SD) recorded from Water Quality Monitoring during Capping of ESC CMPs in June 2015.

**Pit Specific Sediment Chemistry for Metal and Metalloid Contaminants at SB CMP 2
May 2015**

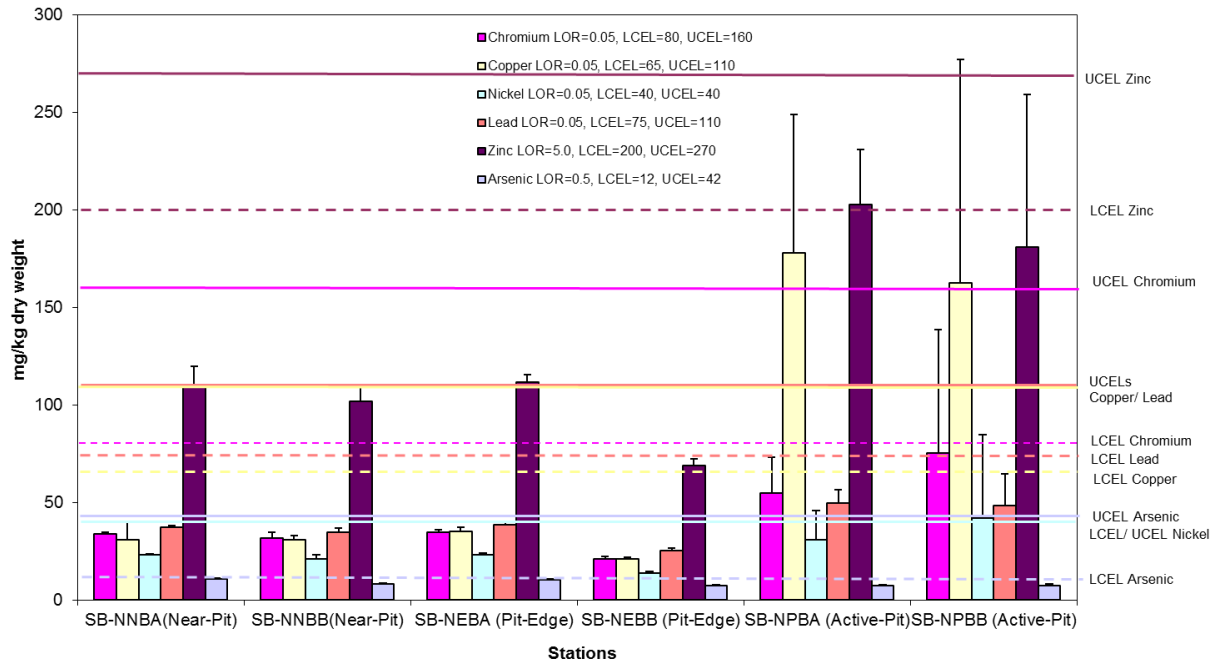


Figure 8: Concentration of Metals (Cr, Cu, Ni, Pb, Zn, As; mg/kg dry weight; mean +SD) in sediment samples collected from Pit Specific Sediment Chemistry Monitoring for CMP 2 in May 2015.

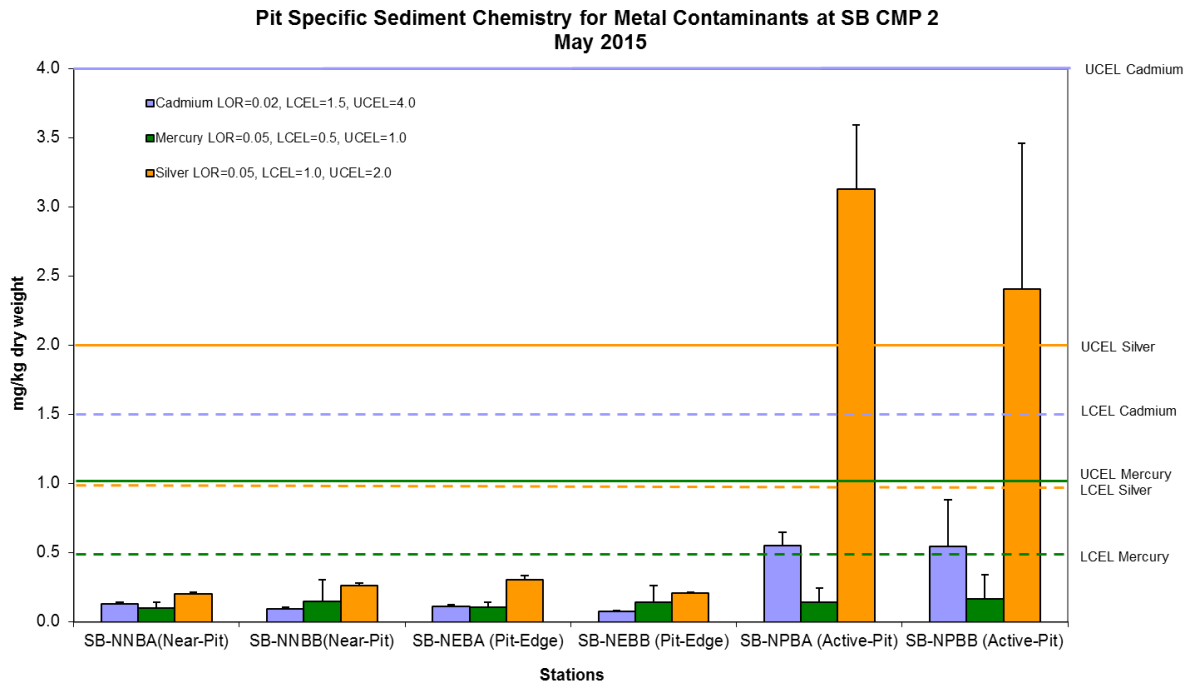


Figure 9: Concentration of Metals (Cd, Hg, Ag; mg/kg dry weight; mean +SD) in sediment samples collected from *Pit Specific Sediment Chemistry Monitoring* for CMP 2 in May 2015.

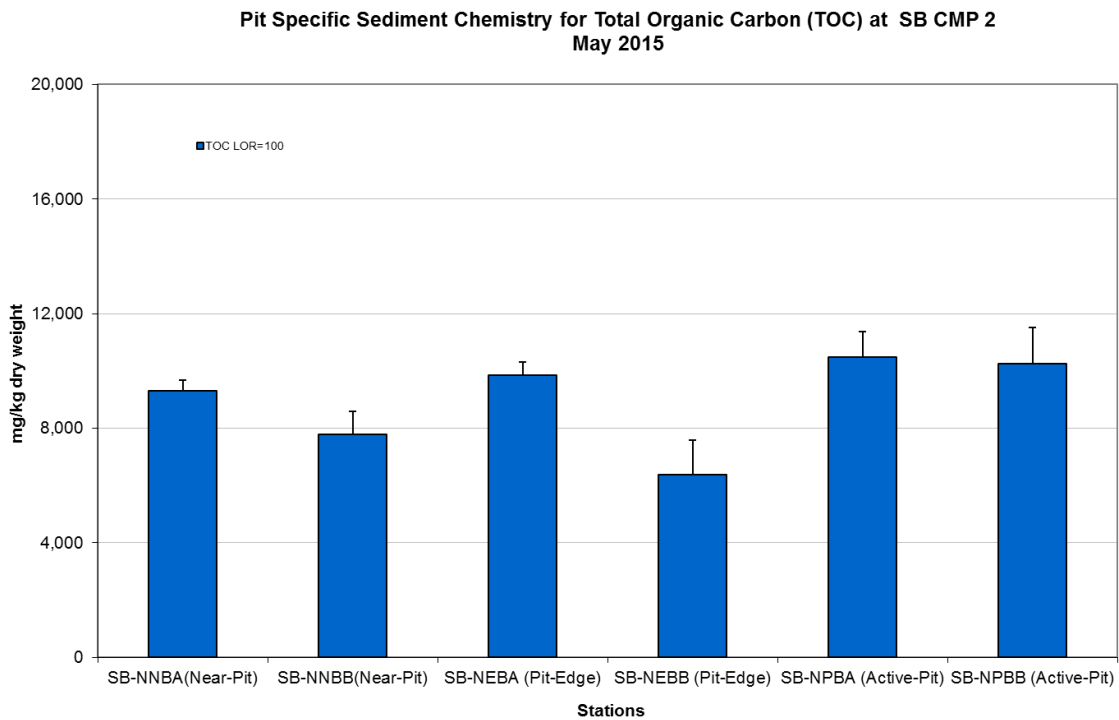


Figure 10: Concentration of Total Organic Carbon (mg/kg dry weight; mean +SD) in sediment samples collected from *Pit Specific Sediment Chemistry Monitoring* for CMP 2 in May 2015.

**Pit Specific Sediment Chemistry for Tributyltin (TBT) at SB CMP 2
May 2015**

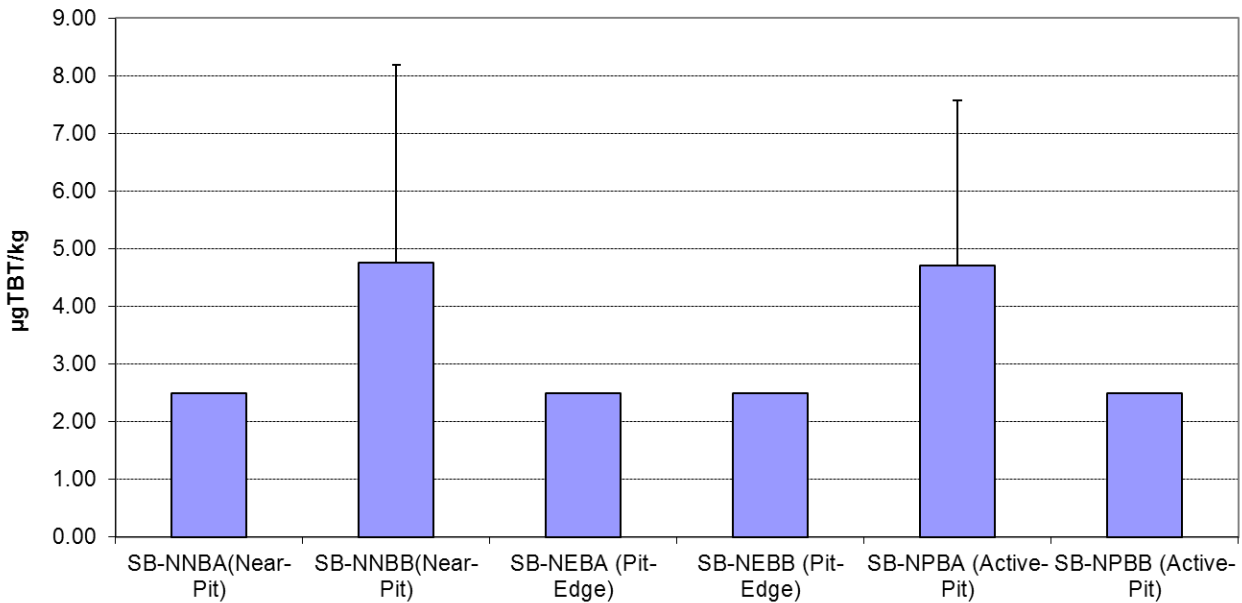


Figure 11: Concentration of Tributyltin ($\mu\text{g TBT/kg}$; mean +SD) in sediment samples collected from *Pit Specific Sediment Chemistry Monitoring* for CMP 2 in May 2015.

Pit Specific Sediment Chemistry for Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (PAHs) at CMP 2 in May 2015

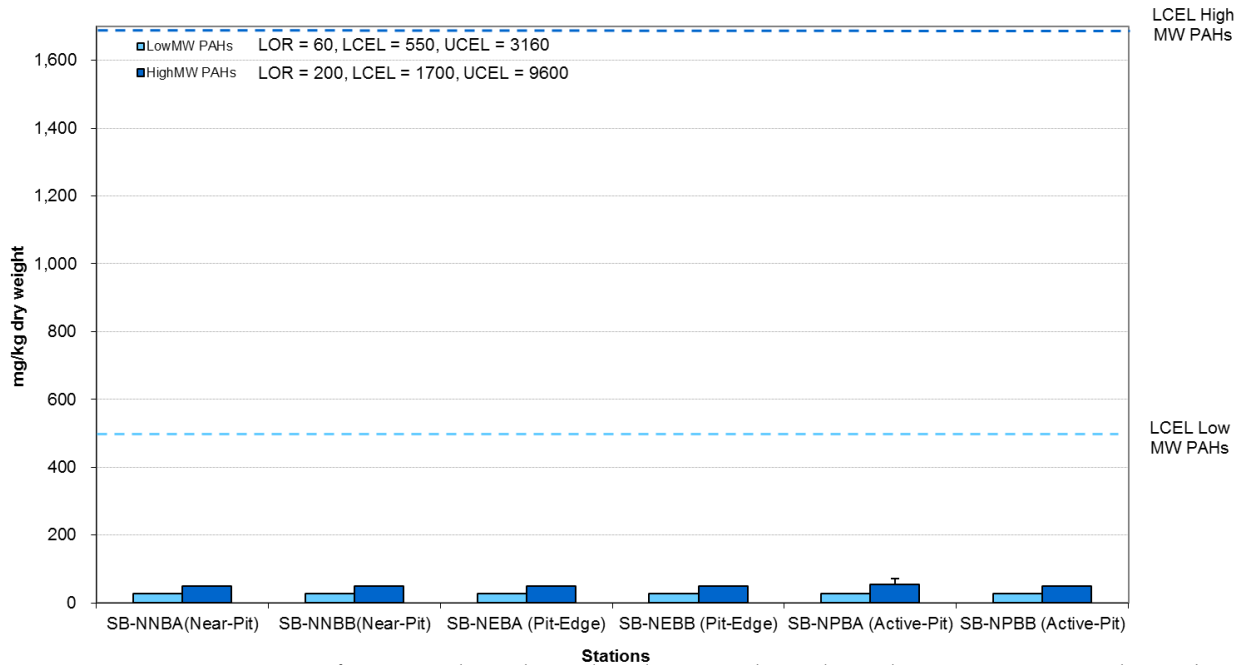


Figure 12: Concentration of Low and High Molecular Weight Polycyclic Aromatics Hydrocarbons (mg/kg dry weight ; mean +SD) in sediment samples collected from *Pit Specific Sediment Chemistry Monitoring* for CMP 2 in May 2015.

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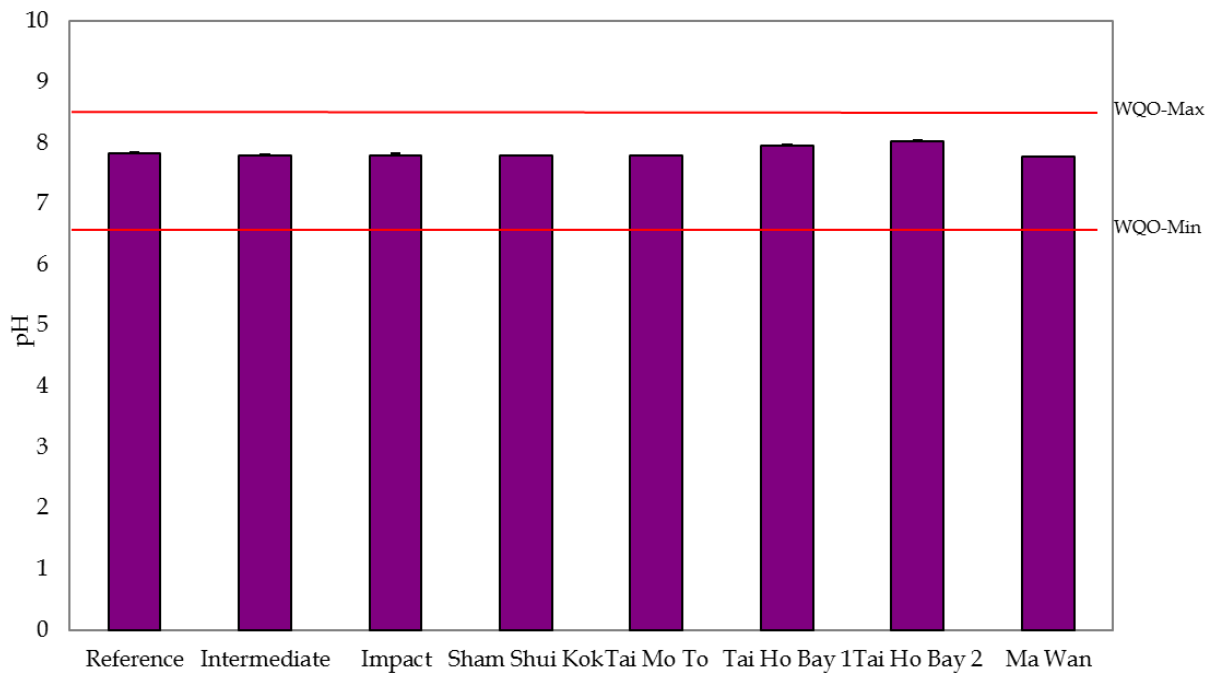


Figure 13: Level of pH (mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

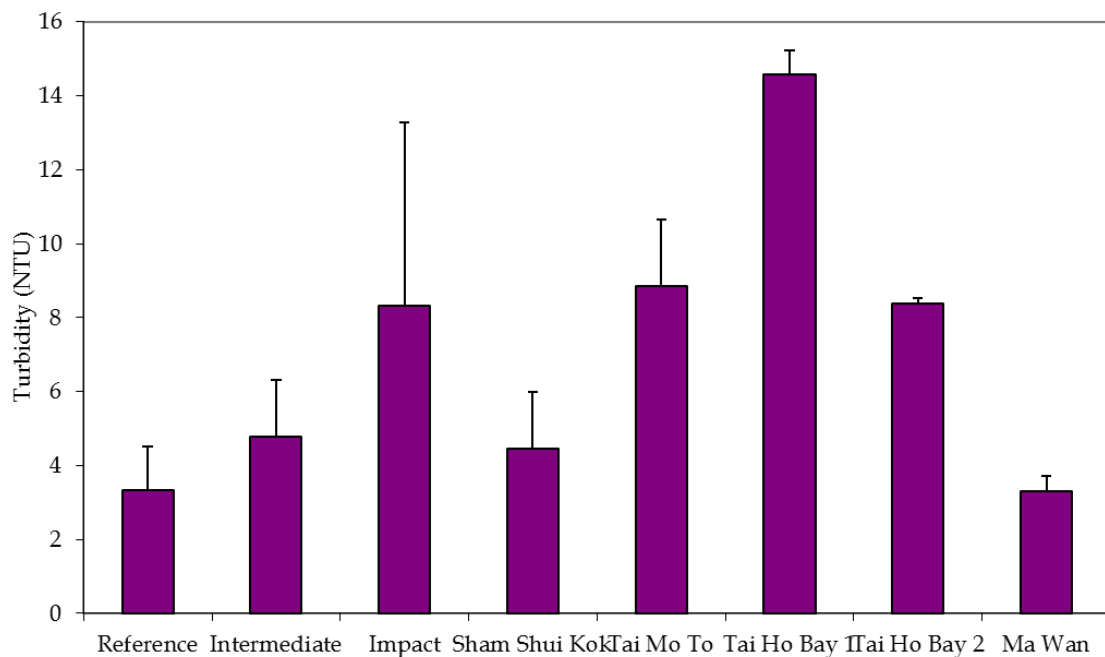


Figure 14: Level of Turbidity (NTU; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

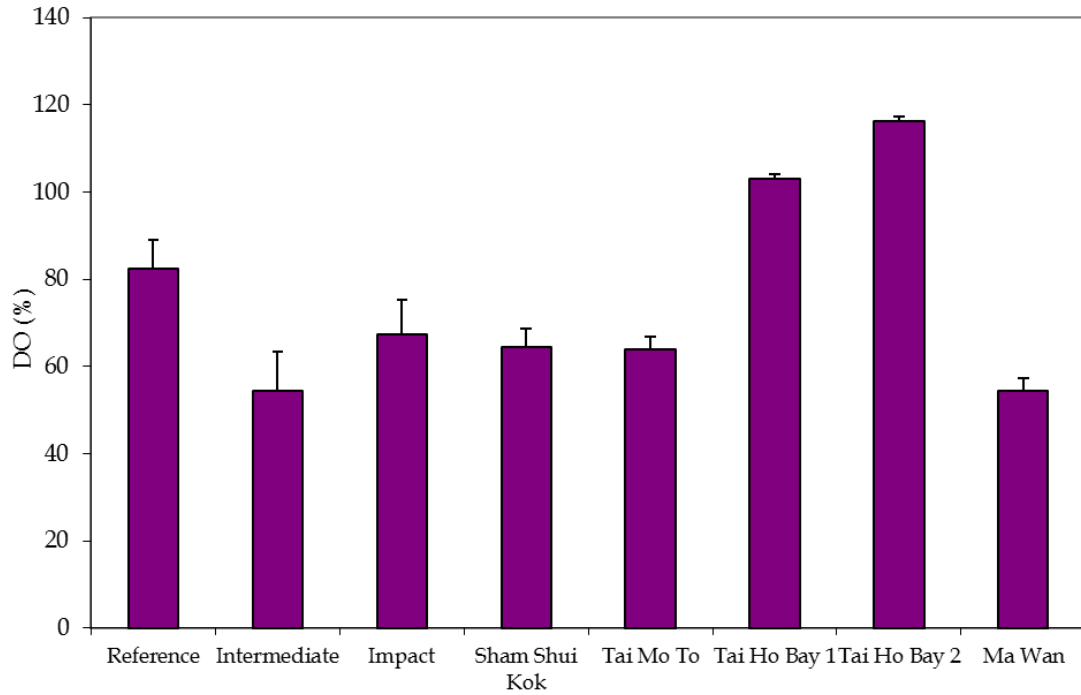


Figure 15: Level of Dissolved Oxygen (% saturation; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

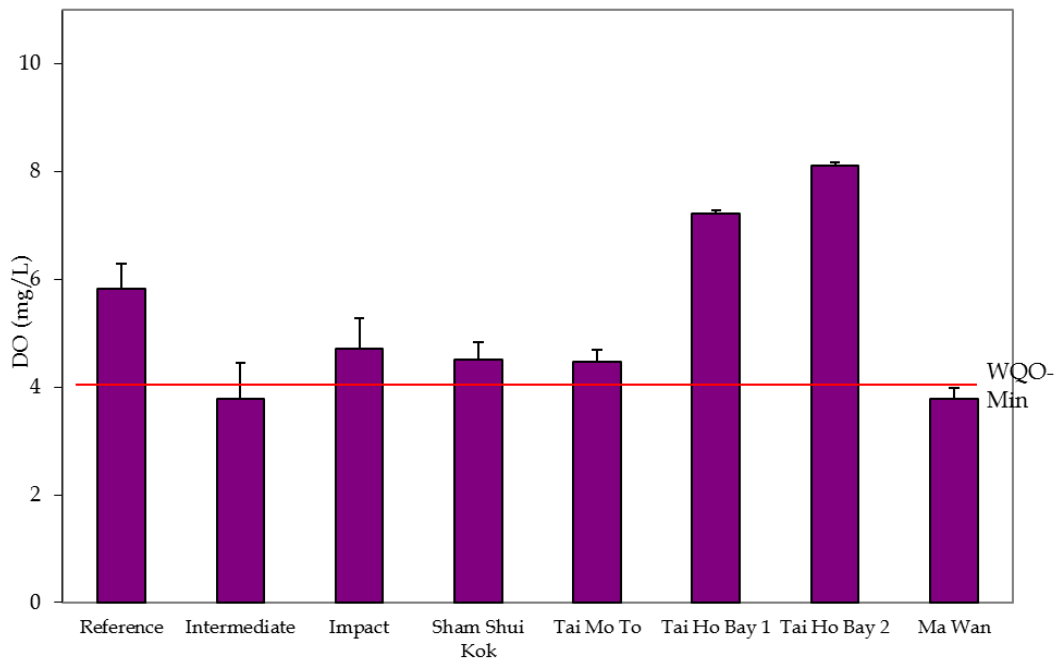


Figure 16: Level of Dissolved Oxygen (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

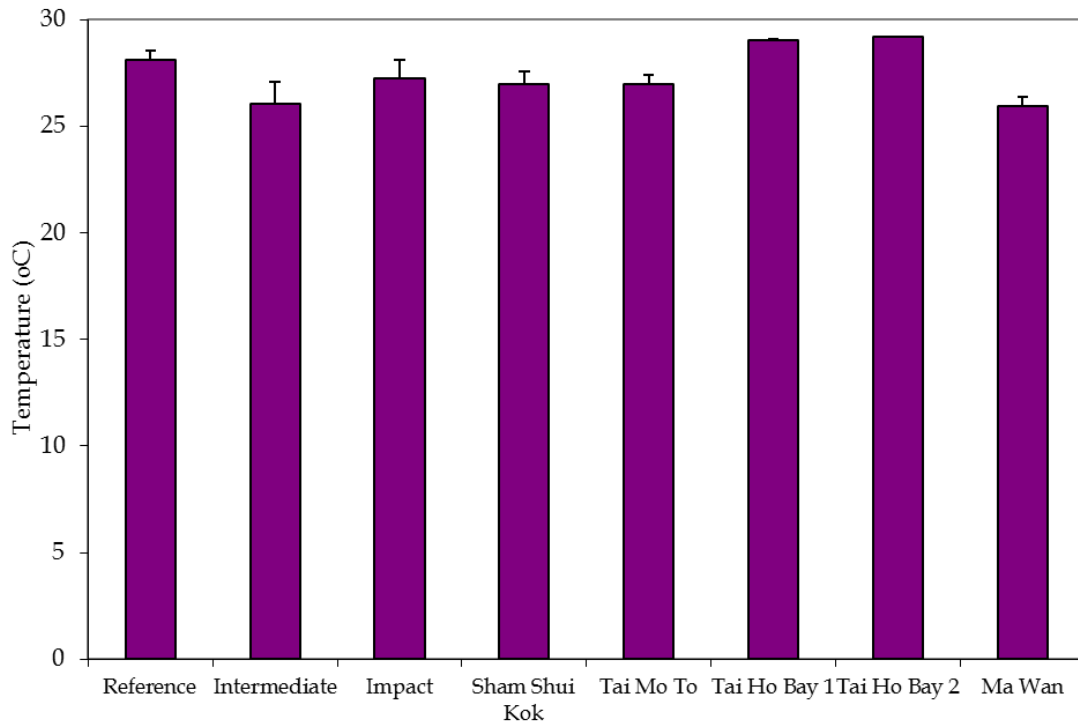


Figure 17: Level of Temperature (°C; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

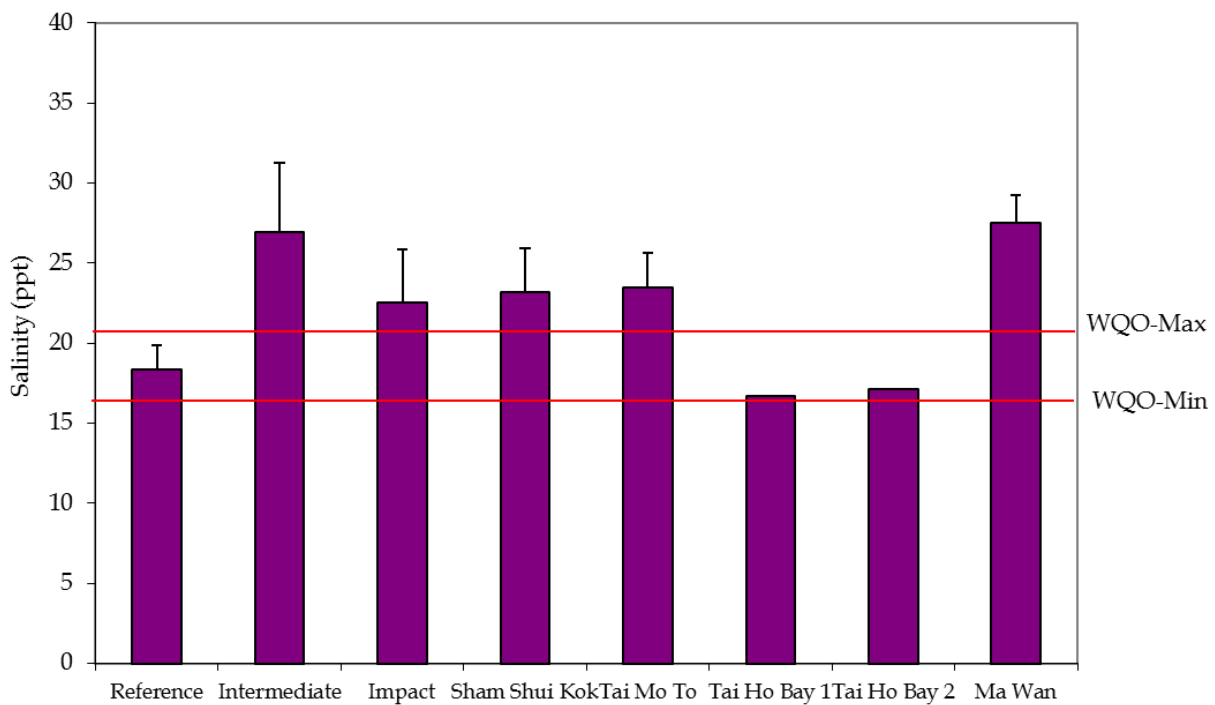


Figure 18: Level of Salinity (ppt; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

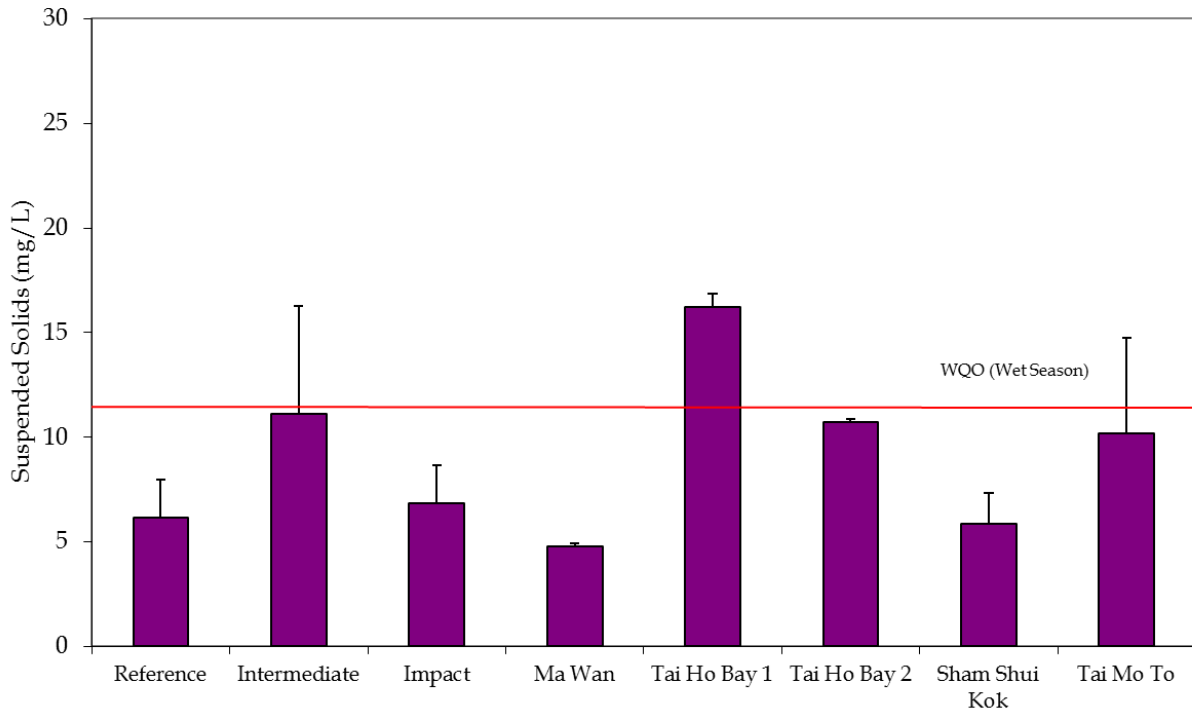


Figure 19: Level of Suspended Solids (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

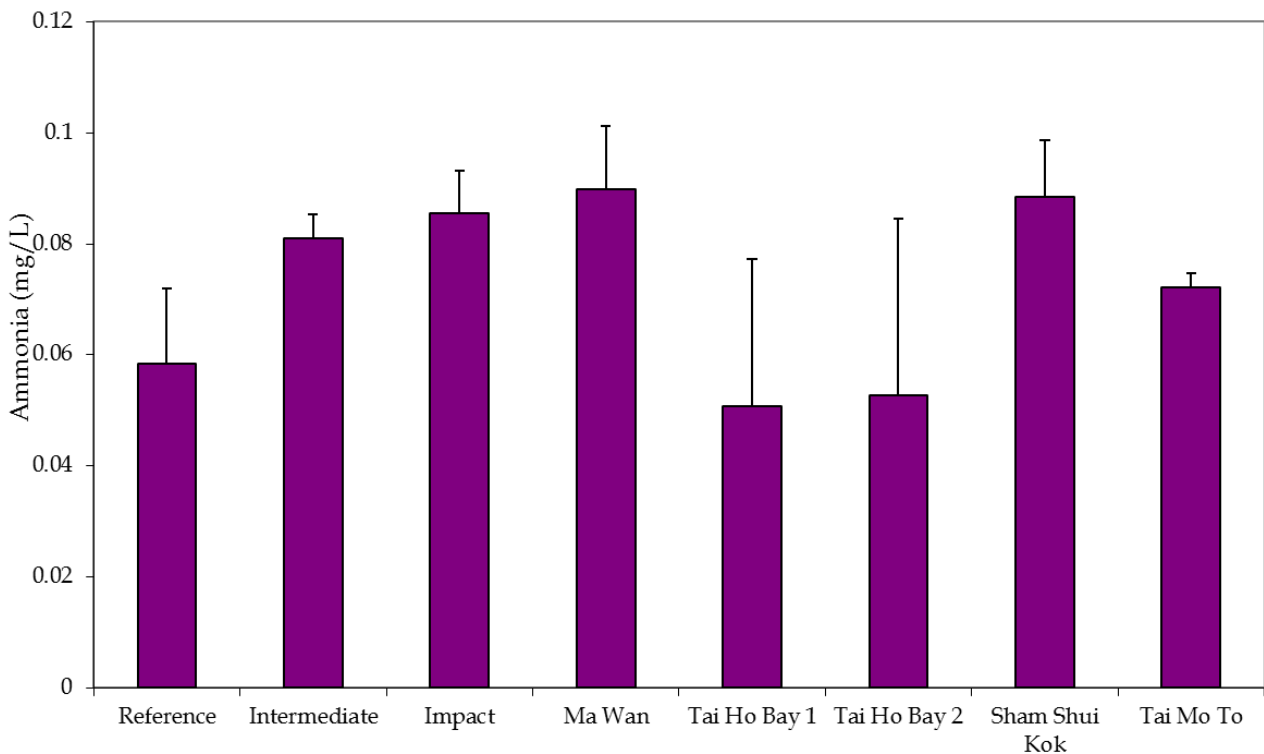


Figure 20: Level of Ammonia (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

Source: H:\Team\EM\GMS Projects\0175086 CEDD EM&A for South Brothers\02 Deliverable\07 CMP Monthly Report\34th (June 2015)

Date: 14/7/2015

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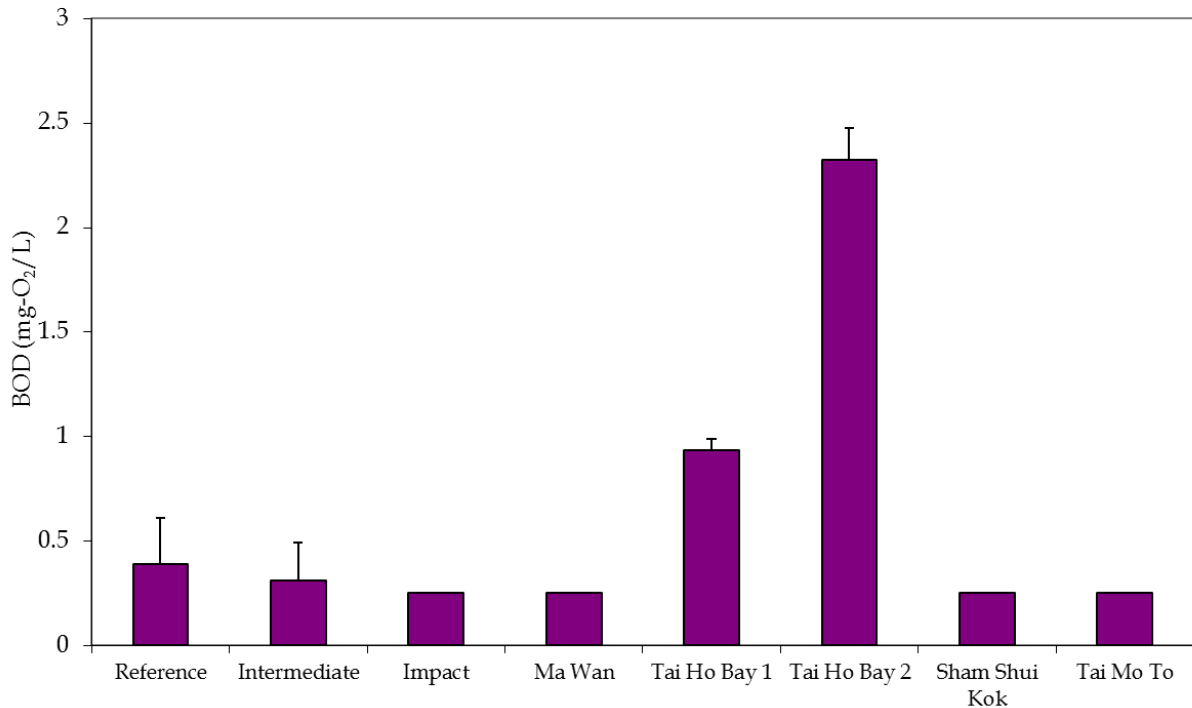


Figure 21: Level of BOD₅ (mg-O₂/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

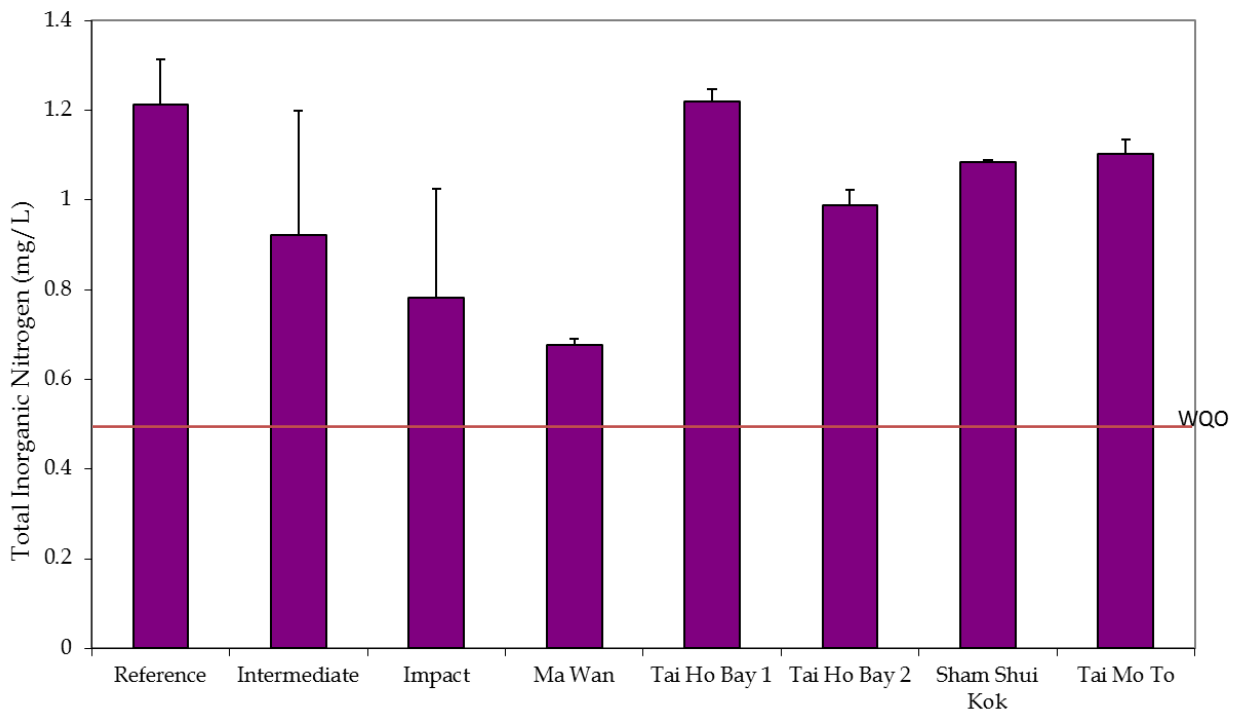


Figure 22: Level of TIN (mg/L; mean + SD) recorded from Water Quality Monitoring during Capping for SB CMP 1 in June 2015.

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Annex C

Water Quality Monitoring Results

Table C1 *Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities for ESC CMPV*

| Parameter | Action Level | Limit Level |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Dissolved Oxygen (DO) ⁽¹⁾ | | |
| Surface and Middle Depth Averaged ⁽²⁾ | 5%-ile of baseline data for surface and middle layer = 3.76 mg L ⁻¹ | 1%-ile of baseline data for surface and middle layer = 3.11 mg L ⁻¹ ⁽³⁾ |
| | and | and |
| | Significantly less than the reference stations mean DO (at the same tide of the same day) | Significantly less than the reference stations mean DO (at the same tide of the same day) |
| Bottom | 5%-ile of baseline data for bottom layers = 2.96 mg L ⁻¹ | The average of the impact station readings are <2 mg/L |
| | and | and |
| | Significantly less than the reference stations mean DO (at the same tide of the same day) | Significantly less than the reference stations mean DO (at the same tide of the same day) |
| Depth-averaged Suspended Solids (SS) ^{(4) (5)} | 95%-ile of baseline data for depth average = 37.88 mg L ⁻¹ | 99%-ile of baseline data for depth average = 61.92mg L ⁻¹ |
| | and | and |
| | 120% of control station's SS at the same tide of the same day | 130% of control station's SS at the same tide of the same day |
| Depth-averaged Turbidity (Tby) ^{(4) (5)} | 95%-ile of baseline data = 28.14 NTU | 99%-ile of baseline data = 38.32 NTU |
| | and | and |
| | 120% of control station's turbidity at the same tide of the same day | 130% of control station's turbidity at the same tide of the same day |

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L⁻¹, it is proposed to set the Limit Level at 3.11 mg L⁻¹ which is the first percentile of the baseline data.
- (4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table C2 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities for SB CMPs

| Parameter | Action Level | Limit Level |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dissolved Oxygen (DO) ⁽¹⁾ | <u>Surface and Mid-depth</u> ⁽²⁾ The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for surface and middle layer = 4.32 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day) | <u>Surface and Mid-depth</u> ⁽²⁾ The average of the impact, WSR 45C and WSR 46 station readings are < 4 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day) |
| | <u>Bottom</u> The average of the impact, WSR 45C and WSR 46 station readings are < 5%-ile of baseline data for bottom layers = 3.12 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day) | <u>Bottom</u> The average of the impact station, WSR 45C and WSR 46 readings are < 2 mg L⁻¹ and Significantly less than the reference stations mean DO (at the same tide of the same day) |
| Depth-averaged Suspended Solids (SS) ⁽³⁾⁽⁴⁾ | The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data for depth average = 21.60 mg L⁻¹ and 120% of control station's SS at the same tide of the same day | The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data for depth average = 40.10 mg L⁻¹ and 130% of control station's SS at the same tide of the same day |
| Depth-averaged Turbidity (Tby) ⁽³⁾⁽⁴⁾ | The average of the impact, WSR 45C and WSR 46 station readings are > 95%-ile of baseline data = 25.04 NTU and 120% of control station's Tby at the same tide of the same day | The average of the impact, WSR 45C and WSR 46 station readings are > 99%-ile of baseline data = 32.68 NTU and 130% of control station's Tby at the same tide of the same day |

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (4) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table C3 **Water Column Profiling Results for SB CMP 2 on 11 June 2015**

| Stations | Temp (°C) | Salinity (ppt) | Turbidity (NTU) | Dissolved Oxygen | | pH (mg L ⁻¹) | Suspended Solids (mg L ⁻¹) |
|-----------------------|--------------|------------------------------|--------------------|---------------------|-----------------------|-----------------------------|----------------------------------------------|
| | | | | (%) | (mg L ⁻¹) | (mg L ⁻¹) | |
| WCP 1 (Downstream) | 28.09 | 18.70 | 19.39 | 75.96 | 5.35 | 7.79 | 9.20 |
| WCP 2 (Upstream) | 28.17 | 18.67 | 4.64 | 80.20 | 5.64 | 7.83 | 7.15 |
| WQO (wet season) | N/A | 16.82- 20.54 [#] | N/A | N/A | >4 | 6.5-8.5 | 11.6 |

Note: [#]Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.
Cell shaded grey indicate value exceeding the WQO.

Annex D

Study Programme

