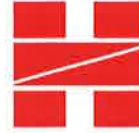


Keppel Seghers







吉寶西格斯 - 振華聯營公司
KEPPEL SEGHERS - ZHEN HUA JOINT VENTURE

DETAILED PLAN ON DEEP CEMENT MIXING

(Clause 2.6A, Further Environmental Permit No. FEP-01/429/2012/A)

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- 1 Monitoring Stations for DCM works (Baseline and Regular DCM Monitoring)
- 2 Monitoring Station Arrangement for Initial Intensive DCM Monitoring

1 INTRODUCTION

1.1 Background

The Government of Hong Kong SAR will develop the Integrated Waste Management Facilities (IWMF) Phase 1 (hereafter “the Project”) with incineration to achieve substantial bulk reduction of unavoidable municipal solid waste (MSW) and to recover energy from the incineration process. The IWMF will be on an artificial island to be formed by reclamation at the south-western coast of Shek Kwu Chau. Keppel Seghers – Zhen Hua Joint Venture (KSZHJV) was awarded the contract under Contract No. EP/SP/66/12 Integrated Waste Management Facilities Phase 1 to construct and operate the Project.

An environmental impact assessment (EIA) study for the Project have been conducted and the EIA Report was approved under the Environmental Impact Assessment Ordinance on 17 January 2012. An Environmental Permit (EP) (EP No.: EP-429/2012) was granted to EPD on 19 January 2012 for the construction and operation of the Project. Subsequently, the EP was amended (EP No.: EP-429/2012/A) and a further EP (FEP) (EP No.: FEP-01/429/2012/A) was granted to the Keppel Seghers – Zhen Hua Joint Venture (KSZHJV) on 27 December 2017.

Pursuant to Clause 2.6A of the FEP, a detailed plan on deep cement mixing for the Project shall be developed and deposited with the Director of Environmental Protection.

1.2 Purpose & Scope

The project requires the reclamation, construction of seawall and breakwater of about 12.4ha and construction of berth of about 1.9ha. Ground treatment works are required before the construction of seawall and breakwater and reclamation. Deep cement mixing will be used to reinforce the marine mud in situ.

As specified in Condition 2.6A of the FEP:

“If Deep Cement Mixing (DCM) is used, at least 1 month before the commencement of DCM works of the Project, deposit 3 hard copies and 1 electronic copy of a detailed plan (the Plan) containing at least a layout arrangement and monitoring programme on DCM during the construction shall be deposited with the Director. The Plan shall provide details of mitigation measures (including sand blanket laying and silt curtain deployment) to be implemented to avoid adverse water quality impact, and the water quality monitoring programme (including monitoring locations, frequency and event / action plan) for DCM process including the sand blanket laying

works.”

This Detailed Plan on Deep Cement Mixing has been prepared in accordance with the FEP requirements and details the requirements. In particular, this Plan covers the following:

- Silt Curtain Arrangement for DCM works
- Water quality monitoring programme for DCM works
- Water quality monitoring locations, parameters and equipment
- Arrangements for initial intensive DCM monitoring and regular DCM monitoring
- Event and Action Plan
- Mitigation Measures to be implemented as part of the DCM process

2 OVERVIEW OF DEEP CEMENT MIXING WORKS

Prior to the DCM work, Static Loading test and DCM site trial shall be conducted first. The purpose of static loading test is to find out the data for stability checking for future detailed design and the purpose of DCM site trial is to find out the optimum mixing ratio of cement with marine sediment. Cage typed silt curtain will be deployed during laying sand blankets, laying Grade 200 or above rock and operating of deep cement mixing. According to the approved EIA report, the fine content of rock (Grade 200 or Grade 400) is negligible. A brief programme showing the tentative commencement and completion dates of the DCM works are enclosed in **Appendix A**.

Static Loading Test

The construction sequences for Static Loading Test are summarized as follows:

1. Laying Geotextile at seabed;
2. Laying of sand blankets with at least 2m thickness on top of geotextile, cage type silt curtain-Type 1 shall be deployed while laying sand blanket;
3. Laying Grade 200 or above rock on top of sand blanket to form a rubble mound, cage type silt curtain – Type 1 shall also be deployed while laying of Grade 200 or above rock; and
4. Placing concrete blocks on top of rubble mound to form a platform to install the survey monitoring equipment.

DCM Site Trial

1. Carrying out site investigation to determine the property, grading, chemical composition of the sediment;
2. Obtaining sediment samples for laboratory investigation to produce design mix of cement slurry;

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3. Placing of sand blanket, with at least 2m thickness, to cover the seabed at the area where DCM would be carried out, cage type silt curtain – Type 1 shall be deployed while laying sand blanket;
4. Positioning of marine DCM barge;
5. Cage Type silt curtain – Type 2 and Type 3 shall be deployed prior to commencing DCM works;
6. Inserting piling pile of mixing treatment equipment into the soft layer at the designated level;
7. Pulling up of piling pipe together with the injection of cement slurry and mixing of soft material by the agitator;
8. Monitor, control, review and adjust the cement slurry content during mixing; and
9. Repositioning of the marine DCM barge and repeat the mixing procedure until the required pattern of strengthened material is formed.

The construction sequences for DCM are similar as DCM site trials are summarized as follows:

1. Carrying out site investigation to determine the property, grading, chemical composition of the sediment;
2. Obtaining sediment samples for laboratory investigation to produce design mix of cement slurry;
3. Placing of sand blanket, with at least 2m thickness, to cover the seabed at the area where DCM would be carried out, cage type silt curtain – Type 1 shall be deployed while laying sand blanket;
4. Positioning of marine DCM barge;
5. Cage Type silt curtain – Type 2 and Type 3 shall be deployed prior to commencing DCM works;
6. Inserting piling pile of mixing treatment equipment into the soft layer at the designated level;
7. Pulling up of piling pipe together with the injection of cement slurry and mixing of soft material by the agitator;
8. Monitor, control, review and adjust the cement slurry content during mixing;
9. Repositioning of the marine DCM barge and repeat the mixing procedure until the required pattern of strengthened material is formed;
10. Coring of DCM samples to ensure that DCM clusters acquired sufficient strength;
11. The top level of DCM clusters shall be leveled by using grab to facilitate the installation of Caisson in later stage. Cage type silt curtain – Type 1 shall be deployed while levelling the top level of DCM clusters; and
12. Lay Grade 200 or above rock on top of DCM clusters.

Laying of sand blanket and rock shall be carried out by a bottom dumping method to prevent

localized overloading of the seabed and potential instability as well as minimizing loss of fines when placing the sand. The proposed method would allow sand and rock to be discharged to a point near the seabed where current dispersion would be low.

Tentative design cross section for the seawall is attached in **Appendix B**. Reference photographs of different types of DCM barges and DCM layout arrangement are shown in **Appendix C**. Prior to commencement of DCM works, various trials for equipment testing and calibration will be conducted at individual DCM barge.

2.1 Environmental Concerns related to DCM

With reference to the Supporting Document for Application for Variation of the Environmental Permit (EP-429/2012) dated September 2016, the key environmental concerns and the associated evaluation of the Key Environmental Concerns are summarized as below table.

Key Environmental Concerns	Evaluation of the Key Environmental Concern
Release of suspended solids (SS) due to DCM activities	<p>(1) A blanket of sand would be placed on top of the sediment layer prior to DCM treatment to avoid sediment disturbance and to contain any release of cement slurry and potential suspension; and the depth of sand blanket shall be at least 2m and</p> <p>(2) Silt Curtains would be deployed to minimize dispersion of SS to the surrounding marine water body.</p> <p>(3) Provision of silt curtain in the vicinity of coral colonies.</p>
Potential risk of contaminant release during ground treatment via DCM	<p>(1) The potential release of sediment bound contaminants during DCM treatment would not be an issue of concern as the marine sediment at the Project site is not contaminated, which is involved only Type 1 material.</p>
Rise in water temperature associated with the exothermic process of in-situ cement mixing	<p>(1) Rise in water temperature is not considered to be significant as the major contact area is along the longitudinal surface of the cement-mud mixing column, thus heat dissipation would largely occur within the mud layer immediately surrounding the DCM column, which is beneath the seabed. While there would be minor heat dissipation through the upper ends of DCM columns, the heat will be absorbed by the sand blanket that will be placed on top of the seabed prior to ground</p>

Key Environmental Concerns	Evaluation of the Key Environmental Concern
	improvement works. Therefore, any residual heat transfer to the water column above the sand blanket will be minimal, and potential impacts on water temperature from the DCM process would be negligible.
Disturbance to marine mammals during DCM activities (e.g. due to underwater noise)	(1) According to the results of the site trials for the Expansion of Hong Kong International Airport into a Three-Runway System, the DCM work is relatively quiet compared to other marine construction techniques, and the underwater noise generated was typically below 200Hz which is a frequency of low sensitivity of Finless Porpoises. According to Goold and Jefferson (2002)*, Finless Porpoises use narrowband and high frequency ultrasonic pulses with peak energy of 142kHz. The underwater noise generated by the DCM ground treatment is well below the acoustic range of Finless Porpoises. Therefore, no unacceptable acoustic disturbance to marine mammals from DCM works and no additional mitigation measures required.

* Goold, J. C. & Jefferson, T. A. (2002). Acoustic signals from free-ranging finless porpoises (*Neophocaena phocaenoides*) in the waters around Hong Kong. Raffles Bulletin of Zoology, Supplement 10: 131 – 139.

3 SILT CURTAIN DESIGN FOR DEEP CEMENT MIXING WORKS

3.1 Floating Type Silt Curtain

All floating silt curtains shall comprise at least the following components:

- Silt Curtain fabric
- Flotation
- Ballast chain
- Seams and Joints
- Anchors
- Warning lights / marker buoys

Silt Curtain Fabric

For silt curtains, the fabric material shall comprise a geotextile such as woven polypropylene or reinforced polyvinyl chloride (PVC) membrane. Impermeable fabrics are not recommended due to

the excessive pressure that would be induced on the curtain due to tidal conditions, hence the fabric shall have a suitably low permeability that allows water to pass through under pressure, but will retain suspended solids. The fabric including seams and connecting parts shall have adequate tensile strength to withstand the pressures induced by the wind, wave and sea current conditions at the location to be deployed.

Floatation

The floatation device shall comprise flexible and buoyant units contained within a floatation sleeve or collar that is attached to the silt curtain. The buoyancy of the floatation units shall be adequate to support the full weight of the curtain including the pressure weight induced by tidal currents acting on the silt curtain surface. A freeboard of at least 10cm shall be maintained above the water surface at all times.

Ballast Chain

The ballast chain (or load lines) shall comprise a steel chain that is incorporated into the bottom hem of the silt curtain. The chain shall be sufficiently weighted to hold the curtain in a vertical position. Connecting devices from the load lines to connecting joints of the silt curtain shall be able to develop the full breaking strength of the chain.

Seams and Joints

Seams of the silt curtain fabric shall be heat sealed and shall develop the full strength of the fabric. Jointing devices such as ropes, chains and shackles shall be made of materials with adequate strength and shall not limit the full strength of the silt curtain fabric.

Anchors

Anchors shall comprise either dig type (e.g. stakes, grappling hook, plow or fluke-type) or weight type (e.g. concrete blocks) with adequate hold / weight to retain the silt curtain in the same position relative to the seabed without interfering with the action of the silt curtain. Lateral anchors (one on either side of the silt curtain) shall be attached to a floating anchor buoy via an anchor line, which connects to the top of the silt curtain. Anchor spacing should be between 15 to 30 m apart. For areas with faster current velocity, closer spacing shall be adopted as necessary to stabilize the silt curtain.

Warning Lights / Marker Buoys

To warn other marine vessels not to approach or run into the silt curtains, yellow marker buoys fitted with yellow flashing lights shall be used to indicate the position of the anchors and silt curtain system. The buoys and lights shall be located on both sides of the silt curtain at regular

intervals (no more than 60m apart) along the entire length of silt curtain.

Silt Curtain Depth

The depth (vertical length from the water's surface to the bottom) of the silt curtain shall be sized to the water depth at the location of deployment. The base of the silt curtain skirt shall be anchored to within 30cm of the seabed even during high tides, hence adequate depth of silt curtain shall be allowed in the total silt curtain depth to cater for tidal changes. Given that the tidal range at the Project area can reach >2m, the base of the silt curtain may be affected by deposition of sediment during low tides. Design of the silt curtain shall take into account the potential additional drag pressure on the silt curtain due to sediment deposition at low tide.

Two layers of double floating type silt curtain shall be installed in the vicinity of coral colonies during the marine work construction period.

The typical section and layout plan of the proposed floating type silt curtain is attached in **Appendix D**. Specification of the proposed geotextile for the silt curtain is attached in **Appendix E**.

3.2 Cage Type Silt Curtain – Type 1

Cage type silt curtain – Type 1 shall mainly comprise the geotextile fabric with ballast chain / weight, a metal frame and associated connectors to affix the silt curtain to the frame. The frame shall be made of non-corrosive metal and properly designed to achieve structural integrity of the silt curtain.

The geotextile fabric shall be mounted and/or affixed to all four sides of the frame using seamed joints with sufficient overlap to prevent leakage of suspended solids. The silt curtain shall contain a roll up mechanism to enable the geotextile fabric to be rolled up when not in use. The design of the mechanism must enable the geotextile fabric to remain attached to the sides of the frame during roll up and roll down (i.e. prevent billowing of the fabric away from the cage frame).

Both the length of the frame and the geotextile fabric shall be measured and cut to fit the water depths at the location of deployment. The exact length shall be flexible to cater for changes in tidal level.

Cage type silt curtain – Type 1 shall be used by vessels laying sand blanket and laying rock and dredging by using a closed grab method. Laying of sand blanket and Grade 200 or above rock

shall be carried out by a bottom dumping method to prevent localized overloading of the seabed and potential instability as well as minimizing loss of fines when placing the sand. The proposed method would allow sand and rock to be discharged to a point near the seabed where current dispersion would be low. In addition, dredging works shall be carried out by closed grab dredger, each of grab size of not more than 2m³.

The typical section of the different cage type silt curtains are attached in **Appendix F**. Specification of the proposed geotextile is attached in **Appendix E**.

3.3 Cage Type Silt Curtain – Type 2

Cage type silt curtain – Type 2 shall mainly comprise the geotextile fabric with ballast chain / weight. Metal rods and associated connectors to affix the silt curtain to the electric winches installed at the boundary of DCM barge. The metal rods shall be made of non-corrosive metal and properly designed to achieve structural integrity of the silt curtain.

The geotextile fabric shall be mounted and/or affixed to all four sides of the DCM barges using seamed joints with sufficient overlap to prevent leakage of suspended solids. The silt curtain shall contain a roll up mechanism, by electric winch, to enable the geotextile fabric to be rolled up when not in use. The design of the mechanism must enable the geotextile fabric to remain attached to the sides of the DCM barge during roll up and roll down (i.e. prevent billowing of the fabric away from the DCM barge).

Both the length of the frame and the geotextile fabric shall be measured and cut to fit the water depths at the location of deployment. The exact length shall be flexible to cater for changes in tidal level.

Cage type silt curtain – Type 2 shall be used by DCM barge as a secondary layer of silt curtain while conducting DCM works.

The typical section of the different cage type silt curtains are attached in **Appendix F**. Specification of the proposed geotextile is attached in **Appendix E**.

3.4 Cage Type Silt Curtain – Type 3

Cage type silt curtain – Type 3 shall comprise of several layers of hollow boxes made up of metal plates. The total length of hollow box can be adjusted by using telescopic method. Electric

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winches shall be used to move the hollow box upward or downward so as to reach the seabed. The metal plates shall be made of non-corrosive metal and properly designed to achieve structural integrity of the silt curtain.

Cage type silt curtain – Type 3 shall be used by DCM barge in the vicinity of drilling rod as a primary layer of silt curtain while conducting DCM works.

The typical section of the different cage type silt curtains are attached in **Appendix F**.

3.5 Cage Type Silt Curtain – Type 4

Cage type silt curtain – Type 4 shall mainly comprise the geotextile fabric with ballast chain / weight, a metal frame and associated connectors to affix the silt curtain to the frame. The frame shall be made of non-corrosive metal and properly designed to achieve structural integrity of the silt curtain.

Double layers geotextile fabric shall be mounted and/or affixed to all four sides of the frame using seamed joints with sufficient overlap to prevent leakage of suspended solids. The silt curtain shall contain a roll up mechanism to enable the geotextile fabric to be rolled up when not in use. The design of the mechanism must enable the geotextile fabric to remain attached to the sides of the frame during roll up and roll down (i.e. prevent billowing of the fabric away from the cage frame).

Both the length of the frame and the geotextile fabric shall be measured and cut to fit the water depths at the location of deployment. The exact length shall be flexible to cater for changes in tidal level.

Cage type silt curtain – Type 4 shall be used by spreader pontoon / pelican barge / sand pumping barge while conducting reclamation by using sand pumping pipe. Reclamation shall be carried out by a bottom dumping method to prevent localized overloading of the seabed and potential instability as well as minimizing loss of fines when placing the sand. The proposed method would allow sand to be discharged to a point near the seabed where current dispersion would be low.

The typical section of the different cage type silt curtains are attached in **Appendix F**. Specification of the proposed geotextile is attached in **Appendix E**.

4 SILT CURTAIN INSTALLATION

Silt curtains shall be installed completely before commencement of sand blanket laying works and Deep Cement Mixing Works. Prior to installation of silt curtains, the KSZHJV shall undertake a thorough check for defects and / or damages particularly in the silt curtain fabric, at the seams, and at the jointing / connector locations. Any defects and / or damages shall be rectified before commencing installation.

Floating Type Silt Curtain

The furled floating silt curtains shall be launched into the sea by derrick / crane boats / seawalls and floated into position. Anchors shall be carefully lowered to the seabed at the specified intervals. Care shall be taken to ensure that lateral anchor points are in the correct positions prior to attaching the anchor lines / anchor buoy to the silt curtain. After attaching the silt curtain to the anchors and before unfurling the silt curtains, a check shall be conducted on the 'lay' of the curtain to confirm the positioning and slack allowances are correct. Where necessary, final adjustments should be made to the anchors, before the furling lines are released to allow the silt curtain skirt to drop. Where base anchors are also required, connection of the anchor lines to the silt curtain shall be done by divers after unfurling the silt curtain.

Cage Type Silt Curtains

The assembled cage frame shall be securely attached to the section of the construction vessel involved in the marine works (e.g. around the grab of the grab dredger). The rolled up silt curtains attached to the cage frame should be lowered to seabed level after the frame position has been fixed and the vessel is in the correct location for the marine works.

5 SILT CURTAIN MAINTENANCE

On board supervisors will be assigned to check the condition of the silt curtain before commencement of works every day. An inspection checklist will be prepared and filled in by the site supervisors. All checklists will be kept on site for record purpose. The sample of Silt Curtain Inspection Checklist is attached in **Appendix G**.

For the tentative arrangement of silt curtain under adverse weather, the silt curtain will not be temporary removed. However, related works will be suspended immediately if silt curtain is found any damage. The damaged silt curtain shall be lifted up from water by grab dredger / derrick barge. Double line sew a new piece of geotextile to the existing geotextile to cover the damaged area. The overlapping length shall be at least 300mm. The marine works involving the requirement for

using of silt curtain shall only be commenced after the damaged silt curtain is repaired.

Refuse around the silt curtains will be collected at regular intervals on a daily basis so that water behind the silt curtains will be kept free from floating debris.

Sufficient spare geotextiles will be kept on site for replacing of damaged silt curtains. The spare geotextiles shall be covered with tarpaulin sheets to avoid direct contact with water and sunlight.

6 SILT CURTAIN REMOVAL / REPOSITIONING

Prior to removal of silt curtains, all marine works for which the silt curtains are deployed shall be stopped and visual inspection of the water quality within the area protected by silt curtains shall be conducted to confirm no sediment plume remaining within the works area before commencing silt curtain removal.

Floating Type Silt Curtain

Floating silt curtains shall be removed by detaching the chain connecting the silt curtain to the anchors, before rolling up and lifting the silt curtains and marker buoys / lights onto derrick / crane boats. Care should be taken to protect the silt curtain skirt from damage as it is dragged from the water. The remaining anchors shall be individually connected to the crane by divers and carefully lifted off the seabed for recovery onto the boats to minimize disturbance to the seabed.

Cage Type Silt Curtains

For cage type silt curtains, the silt curtains shall be rolled up and either securely wrapped to the top of the frame or detached from the frame completely before the cage frame is lifted and removed or re-positioned as required. Re-installation where required, shall follow the procedures specified in **Section 4**.

7 WATER QUALITY MONITORING REQUIREMENTS

7.1 Scope of Water Quality Monitoring for DCM Works

Type of DCM Monitoring

The monitoring requirements for DCM activities are divided into the following three types:

- Baseline Monitoring – to obtain baseline water quality prior to the commencement of DCM works of the projects
- Initial Intensive DCM Monitoring – to undertake in-depth monitoring of a specific group of

DCM rigs for a minimum duration to ascertain the environmental acceptability of the DCM works

- Regular DCM Monitoring – to maintain regular monitoring on DCM activities for the duration of DCM works and provide a mechanism for re-initiation of intensive DCM monitoring when necessary

Water Quality Parameters to be Monitored

For each type of monitoring related to DCM works, the water quality parameters to be monitored are summarized in **Table 1**.

Table 1 – Water Quality Parameters

Water Quality Parameters	Baseline Monitoring	Initial DCM Monitoring	Intensive DCM Monitoring	Regular DCM Monitoring
Dissolved Oxygen (DO)	x	x		x
pH	x	x		x
Temperature	x	x		x
Turbidity	x	x		x
Suspended Solids (SS)	x	x		x
Total Alkalinity	x	x		x
Water depth	x	x		x
Current Velocity and direction	x	x		x

x – Parameters to be tested

7.2 Monitoring Equipment and Procedures

Monitoring of DO, pH, temperature, turbidity as well as water depth, current velocity and direction should be measured in-situ whereas SS and Total Alkalinity should be sampled and then determined by laboratory. The equipment required for each type of monitoring are specified below.

Data record sheets shall be completed for each monitoring location. Sample data record sheets based on the one presented in the “EM&A Guideline for Development Projects in Hong Kong” are shown in **Appendix H**.

In-situ Monitoring

- Dissolved Oxygen Measuring Equipment – the instrument should be portable and weatherproof using a DC power source. It should be capable of measuring a dissolved

oxygen level in the range of 0-20mg/L and 0-200% saturation.

- pH Measuring Equipment – a portable pH meter capable of measuring a range between 0.0 and 14.0 should be provided to measure pH under the specified conditions according to the Standard Methods, APHA.
- Temperature Measuring Equipment – the instrument should be portable and weatherproof using a DC power source. It should be capable of measuring a temperature of 0-45 degree Celsius with a capability of measuring to ± 0.1 degree Celsius.
- Turbidity Measuring Equipment – the instrument should be portable and weatherproof using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000NTU.
- Total Alkalinity – a digital titrator should be provided to measure the amount of sulphuric acid used in determination of total alkalinity
- Positioning Device – a hand held or boat fixed type differential Global Positioning System (dGPS) with way point bearing indication or other equivalent instrument of similar accuracy should be provided and used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements
- Water Depth Detector – a portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. The unit would either be handheld or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.
- Current Meter – a portable, electronic current meter such as Valeport 108 MKIII current meter or product having equivalent functions and / or performance should be used for measuring current velocity and direction.

Calibration of In-situ Instruments

All in-situ monitoring instrument should be checked, calibrated and certified by a laboratory accredited under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or other international accreditation scheme that is HOKLAS-equivalent before use, and subsequently re-calibrated at three monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use.

For the on-site calibration of field equipment, the BS 1427:2009, Guide to on-site test methods for the analysis of waters should be observed.

Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment should also be made available so that monitoring can proceed uninterrupted

even when some equipment is under maintenance, calibration etc.

Water Samples for Laboratory Testing

Collection of Water Samples

Water samples for all monitoring parameters should be collected, stored, preserved and analysis according to the Standard Methods, APHA 22nd ed. and/or other methods as agreed by the EPD.

A water sampler comprises a transparent PVC cylinder, with a capacity of not less than two litres, and could be effectively sealed with latex cups at both ends should be used. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth. Kahlsico Water Sampler or a similar instrument approved by the ET and SO should be used.

Water samples should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4 °C without being frozen), delivered to the laboratory within 24 hours of collection.

Laboratory Measurement / Analysis

Analysis of Total Alkalinity and SS should be carried out in a HOKLAS accredited laboratory (or other international accredited laboratory that is HOKLAS-equivalent). Sufficient water samples should be collected at the monitoring stations for carrying out the laboratory determination. The laboratory determination work should start within 24 hours after receipt of the water samples. The analysis should follow the standard methods summarised in **Table 2**.

Table 2: Laboratory analysis for SS, nutrient and heavy metals

Parameters	Instrumentation	Analytical Method	Reporting Limit
Suspended Solids (SS)	Analytical Balance	APHA 2540D	1 mg/L
Total Alkalinity	Titration	APHA 2320	0.01 mg/L

Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis should be kept by the laboratory for three months in case repeat analysis is required.

8 BASELINE MONITORING

8.1 Purpose

The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the DCM works of the project. These baseline conditions shall be established by measuring DO, pH, temperature, turbidity, SS, total alkalinity, current velocity and direction at designated monitoring stations. Current velocity, direction and total alkalinity are required to be measured specific for DCM works, while other parameters are same as the ones required by baseline marine water quality monitoring for both dry season (monitored between 26 February 2018 and 26 March 2018) and wet season (monitored between 13 August 2018 and 7 September 2018). Baseline monitoring of current velocity, direction and total alkalinity for DCM works will be conducted before the commencement of DCM works.

8.2 Timing

Baseline Water Quality Monitoring for DCM works shall be conducted prior to the commencement of the DCM works of the project.

8.3 Monitoring Locations

Baseline water quality for the DCM works will be measured at the monitoring stations as listed in **Table 3** and illustrated in **Figure 1**. The locations of these DCM monitoring stations will be the same as those for the IWMF's marine water quality monitoring stations during construction stage. DO, pH, temperature, turbidity, SS, total alkalinity, current velocity and direction are measured at all the DCM monitoring stations.

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Table 3 – Proposed Monitoring Stations for DCM Works (for Baseline Monitoring and Regular DCM Monitoring)

Station	Description	Easting	Northing	DCM Parameters	Other Parameters
B1	Beach – Cheung Sha Lower	813342	810316	Total	DO, pH, Temperature, Turbidity, SS
B2	Beach – Pui O	815340	811025	Alkalinity,	
B3	Beach – Yi Long Wan	817210	808395	Current	
B4	Beach – Tai Long Wan	817784	808682	Velocity and direction	
H1	Horseshoe Crab – Shek Kwu Chau	816477	806953		
C1	Control Station	810850	806288		
C1A	Control Station (latest)	812823	806300		
C2	Control Station	819421	808053		
C2A	Control Station (latest)	818869	806808		
F1	Cheung Sha Wan Fish Culture Zone	818631	810966		
F1A	Cheung Sha Wan Fish Culture Zone (latest)	819109	810924		
S1	Submarine Cable Landing Site	814245	810335		
S2	Submarine Cable	815076	807747		
S2A	Submarine Cable (latest)	814808	808515		
S3	Submarine Cable Landing Site	816420	805621		
CR1	Coral	817144	805597		
CR2	Coral	816512	805882		
M1	Tung Wan	821572	807799		

Notes:

1. Baseline Monitoring of those parameters as stated in “other parameters” have been conducted between 26 Feb 18 to 26 Mar 18 and between 13 Aug 2018 to 7 Sept 2018 as part of the baseline marine water quality monitoring.
2. Due to fishermen’s requests and safety concern, there were changes of monitoring locations for C1, C2, F1 and S2. Regular monitoring shall refer to the latest coordinates of C1A, C2A, F1A and S2A.

8.4 Monitoring Procedures

The measurements will be taken three days per week, at mid-flood and mid-ebb tides, for a period of four weeks prior to the commencement of DCM works of the project. The interval between two sets of monitoring will be not less than 36 hours.

Samples will be taken at three depths (at 1m below surface, at mid-depth, and at 1m above bottom) for locations with water depth >6m. For locations with water depth between 3m and 6m, two depths (surface and bottom) were taken. Locations with water depth < 3m, only surface depth will be taken. Duplicate water samples will be taken and analysed.

There will be no DCM construction activities in the vicinity of the stations during the baseline monitoring.

8.5 Reporting

Baseline Monitoring Report for DCM works shall follow the relevant reporting requirements as specified in the EM&A Manual. The Baseline Monitoring Report for DCM works shall be certified by ET leader and verified by the IEC.

9 INITIAL INTENSIVE DCM MONITORING

9.1 Purpose

The purpose of the initial intensive DCM monitoring is to demonstrate the environmental acceptability of DCM works. The initial intensive DCM monitoring would be conducted at an early stage during DCM activities to reaffirm environmental acceptability of DCM works.

9.2 Timing

The monitoring should be conducted within 3 months of commencement of actual DCM works, during three DCM rigs operated concurrently.

The initial intensive DCM monitoring programme will be conducted for a period of at least four weeks to ensure that the criteria for various parameters are complied with. The actual duration of the initial intensive DCM monitoring may extend beyond four weeks should there be any exceedances in water quality action and limit levels.

9.3 Monitoring Locations

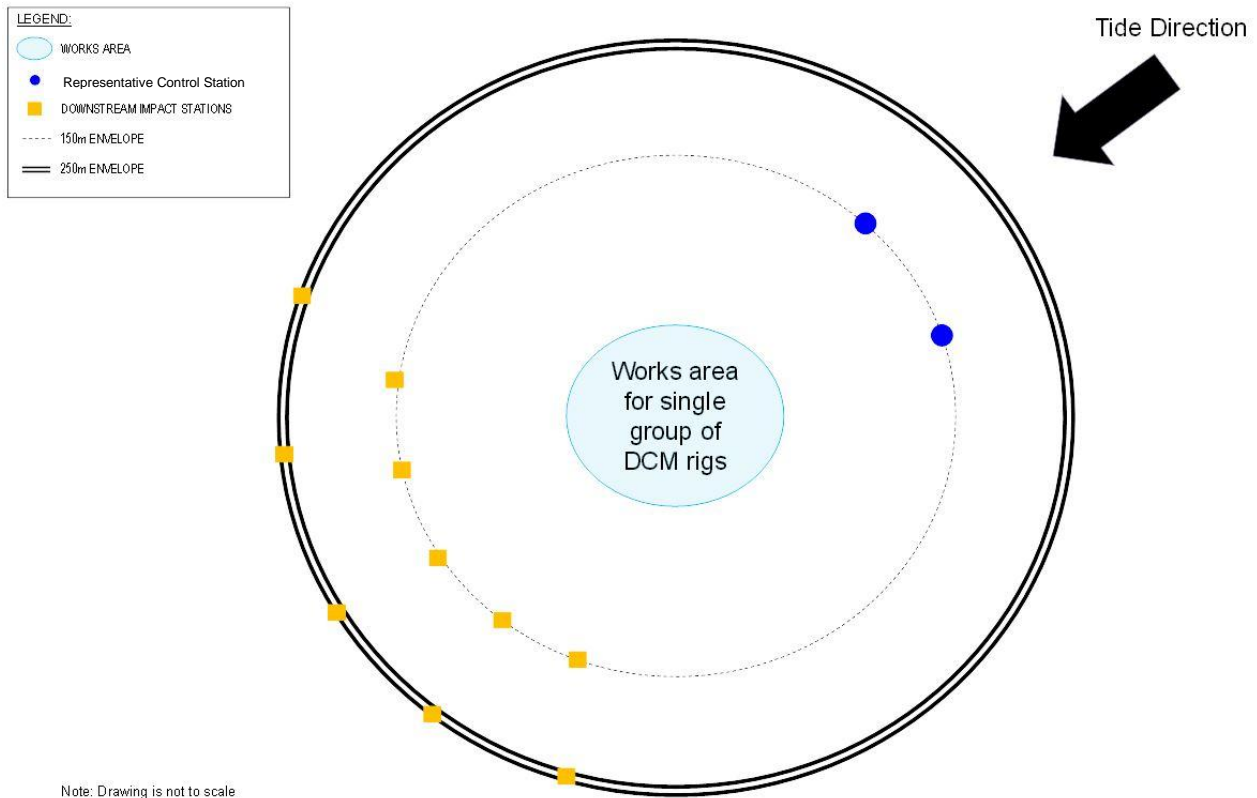
For initial intensive DCM monitoring, mobile impact monitoring stations shall be located within fixed distances from the DCM group works area to obtain water quality information in the immediate upstream and downstream area. The indicative location for initial intensive DCM works is shown in **Appendix C**.

A total of 12 nos. monitoring stations will be deployed with the following arrangement:

- Two monitoring stations upstream and at 150 m envelope of DCM group works area (Representative Control stations).
- Five monitoring stations downstream and at 150 m envelope of DCM group works area (Impact 1 stations).
- Five monitoring stations downstream and at 250 m envelope of DCM group works area (Impact 2 stations).
- Monitoring stations should be at least 50 m apart;
- Downstream monitoring stations should be perpendicular to the tidal direction.

The monitoring station arrangement is illustrated in **Figure 2**. DO, pH, temperature, turbidity, SS, total alkalinity, current velocity and direction should be measured at all stations.

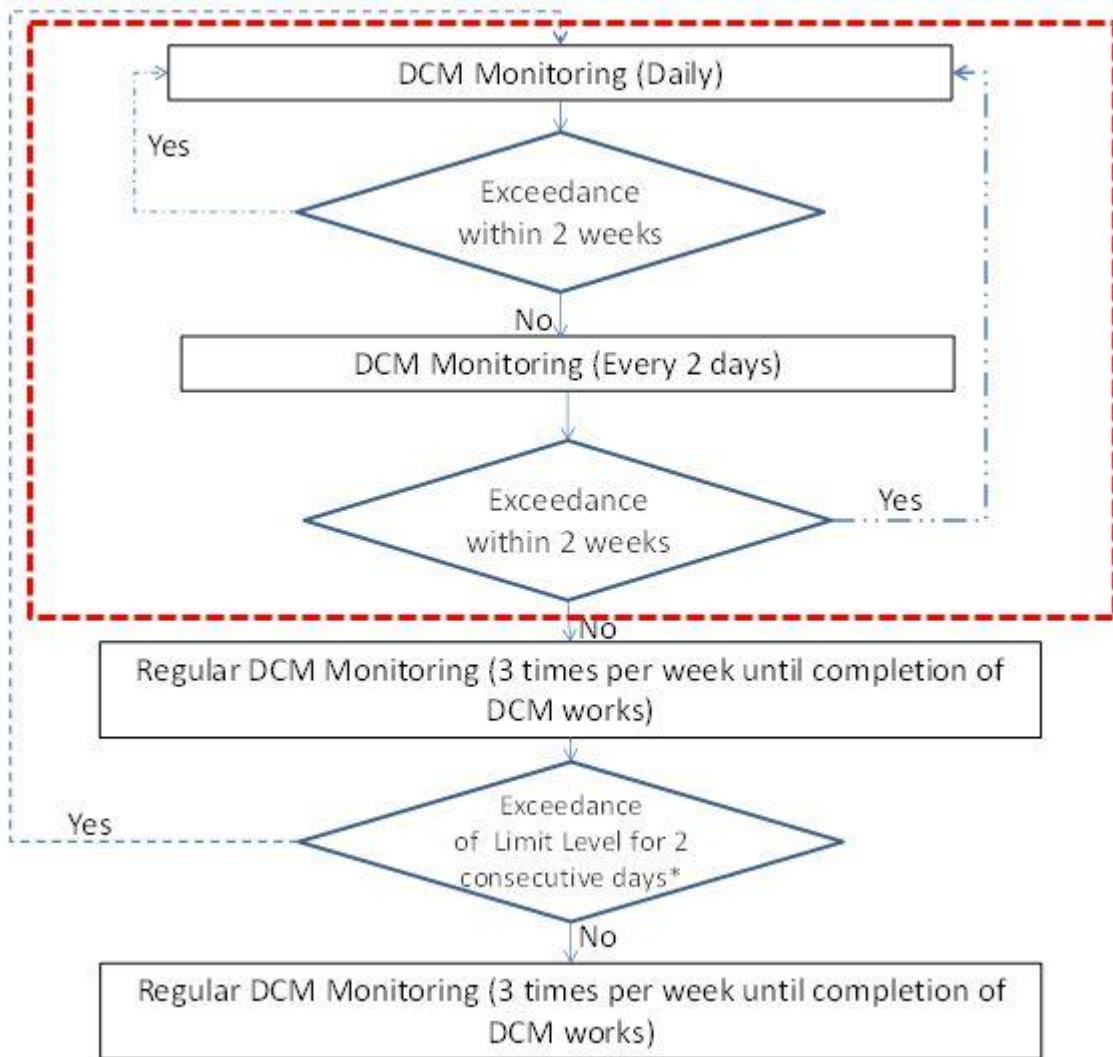
Figure 2 - Monitoring Station Arrangement for Initial Intensive DCM Monitoring



9.4 Monitoring Frequency and Duration

Monitoring frequency and duration is linked to a feedback loop mechanism that enables re-initiation / continuation of intensive DCM monitoring should there be any exceedances in water quality action and limit levels. The feedback loop mechanism for DCM Monitoring is shown in **Chart 1**. The part covering intensive DCM monitoring is highlighted within the red dotted lines.

Chart 1: Flow Chart for DCM Specific Monitoring Parameters (Intensive)



*Exceedances refer to total alkalinity and temperature only. These should be confirmed by ET and verified by IEC as project-related.

As illustrated in **Chart 1**, if no exceedance is recorded within the first two weeks, then the monitoring frequency can be reduced to every two days. If no exceedance is recorded after another two weeks, the intensive DCM monitoring will be terminated and DCM monitoring will continue as part of the regular DCM monitoring presented in **Section 10**.

9.5 Monitoring Procedures

Monitoring shall be conducted at mid-flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides. Samples should be taken at three depths

(at 1m below surface, at mid-depth, and at 1m above bottom) for locations with water depth >6m. For locations with water depth between 3m and 6m, two depths (surface and bottom) should be taken. Locations with water depth <3m, only surface depth should be taken.

Two consecutive measurements of DO, pH, temperature (°C) turbidity (NTU), and current velocity and direction should be taken in-situ according to the stated sampling method. Water samples for SS (mg/L) and Total Alkalinity (mg/L) should be collected at the same depths. Duplicate water samples should be taken and analysed.

9.6 Action and Limit Levels

The action and limit (AL) levels for DCM-specific water quality parameters during intensive DCM monitoring are defined in **Table 4**.

Table 4 - Action and Limit Levels for DCM-specific Water Quality Parameters (Intensive DCM Monitoring)

Parameters	Action Level	Limit Level
Temperature in °C	1.8°C above the temperature recorded at representative control station at the same tide of the same day	2°C above the temperature recorded at representative control station at the same tide of the same day
Total Alkalinity in mg/L	95 percentile of baseline data or 120% of representative control station at the same tide of the same day, whichever is higher	99 percentile of baseline data or 130% of representative control station at the same tide of the same day, whichever is higher

Notes:

1. Non-compliance of water quality results when monitoring results is higher than the limits.
2. Depth-averaged results are used unless specified otherwise.
3. Baseline data to be adopted in the Intensive DCM monitoring are specified in the Baseline Monitoring Report for DCM works.
4. Representative control station refers to average of the two representative control stations results, unless the difference between the two representative control stations results is >25%, in which case the higher (for SS and Turbidity) and lower (for DO) of the two shall apply.

For other parameters (DO, turbidity and SS), Action and Limit levels are defined in **Table 5**.

Table 5 - Action and Limit Levels for Other Water Quality Parameters (Intensive DCM Monitoring)

Parameters	Action Level	Limit Level
DO in mg/L (Surface and middle)	80% of representative control station at the same tide of the same day or 4mg/L, whichever is lower.	70% of representative control station at the same tide of the same day or 4mg/L, whichever is lower
DO in mg/L (Bottom)	80% of representative control station at the same tide of the same day or 2 mg/L, whichever is lower	70% of representative control station at the same tide of the same day or 2mg/L, whichever is lower
Suspended Solids (SS) in mg/L	120% of representative control station at the same tide of the same day	130% of representative control station at the same tide of the same day
Turbidity in NTU		

Notes:

1. For DO, non-compliance of water quality results when monitoring results are lower than the limits.
2. Depth-averaged results are used unless specified otherwise
3. For SS and Turbidity, non-compliance of water quality results when monitoring results are higher than the limits.
4. Baseline data to be adopted in the Intensive DCM monitoring are specified in the Baseline Monitoring Report for DCM works.
5. Representative control station refers to average of the two representative control stations results, unless the difference between the two representative control stations results is >25%, in which case the higher (for SS and Turbidity) and lower (for DO) of the two shall apply.

9.7 Event and Action Plan

The actions in accordance with the Event and Action Plan in **Table 6** should be carried out if the water quality assessment criteria are exceeded at the impact monitoring stations.

Table 6 - Event and Action Plan for DCM Process during Intensive DCM Monitoring

Event	Action			
	Environmental Team (ET)	Independent Environmental Checker (IEC)	Supervising Officer (SO)	KSZHJV
Action level being exceeded by one sampling day	1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and KSZHJV; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC and KSZHJV; 6. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1 . (applies to DCM-specific parameters only)	1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures.	1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures.	1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET and IEC and propose mitigation measures.

Event	Action			
	Environmental Team (ET)	Independent Environmental Checker (IEC)	Supervising Officer (SO)	KSZHJV
<p>Action Level being exceeded by more than two consecutive sampling days</p>	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and KSZHJV; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC and KSZHJV; 6. Ensure mitigation measures are implemented; 7. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM- specific parameters only) 	<ol style="list-style-type: none"> 1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET and IEC and propose mitigation measures to IEC and SO within 3 working days; 7. Implement the agreed mitigation measures. 8. As directed by SO, to slow down all or part of the construction activities.

Event	Action			
	Environmental Team (ET)	Independent Environmental Checker (IEC)	Supervising Officer (SO)	KSZHJV
Limit Level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, KSZHJV and EPD; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC, SO and KSZHJV; 6. Ensure mitigation measures are implemented; 7. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM- specific parameters only) 	<ol style="list-style-type: none"> 1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC, ET and KSZHJV on the proposed mitigation measures; 2. Request KSZHJV to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET, IEC and SO and propose mitigation measures to IEC and SO within three working days; 7. Implement the agreed mitigation measures.

Event	Action			
	Environmental Team (ET)	Independent Environmental Checker (IEC)	Supervising Officer (SO)	KSZHJV
Limit Level being exceeded by more than one consecutive sampling days	<ol style="list-style-type: none"> Repeat in-situ measurement to confirm findings; Identify reasons for non-compliance and sources of impact; Inform IEC, KSZHJV and EPD; Check monitoring data, all plant, equipment and KSZHJV's working methods; Discuss mitigation measures with IEC, SO and KSZHJV; Ensure mitigation measures are implemented; If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM- specific parameters only) 	<ol style="list-style-type: none"> Discuss with ET and KSZHJV on the mitigation measures; Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> Discuss with IEC, ET and KSZHJV on the proposed mitigation measures; Request KSZHJV to critically review the working methods; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures; Consider and instruct, if necessary, the KSZHJV to slow down or to stop all or part of the construction activities until no exceedance of limit level. 	<ol style="list-style-type: none"> Inform SO and confirm receipt of ET's notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Provide report of the status and condition of plant, equipment and mitigation measures to ET; Consider changes of working methods; Discuss with ET, IEC and SO and propose mitigation measures to IEC and SO within three working days; Implement the agreed mitigation measures; As directed by SO, to stop all or part of the construction activities.

Notes:

DCM- specific parameters refers to Total Alkalinity, temperature only

9.8 Reporting

Findings from the initial intensive DCM monitoring will be used to review the monitoring requirements for all parameters for regular DCM monitoring. For any re-initiated intensive DCM monitoring, these shall be reported as part of the relevant Monthly EM&A Report and the subsequent Quarterly EM&A Report. The reporting requirements shall follow the relevant requirements specified in the EM&A Manual.

10 REGULAR DCM MONITORING

10.1 Purpose

The purpose of the regular DCM monitoring is to maintain a check on the environmental acceptability of DCM works throughout the duration of DCM works, and to provide a mechanism for re-initiation of intensive DCM monitoring in the event of exceedances in water quality limits arising from the DCM activities.

10.2 Timing

During and after the DCM field trial, early regular DCM monitoring will be conducted to maintain a check on the early DCM works until initial intensive DCM monitoring commences. After completion of the initial intensive DCM monitoring, the regular DCM monitoring will continue for the remaining duration of the DCM works. Exact timing of commencement of the regular DCM monitoring programme is subject to the date of commencement of DCM works, and the date of completion of initial intensive DCM monitoring.

Regular DCM monitoring would be temporarily halted whenever intensive DCM monitoring is re-initiated, and would re-commence once the intensive DCM monitoring process has been completed with no further exceedances detected.

Regular DCM monitoring shall continue for another 4 week period after the completion of DCM works in order to confirm there are no impacts on water aspect at nearby water sensitive receivers.

10.3 Parameters for Regular DCM Monitoring

During regular DCM monitoring, DO, pH, temperature, turbidity, SS, total alkalinity and current velocity and direction will be monitored.

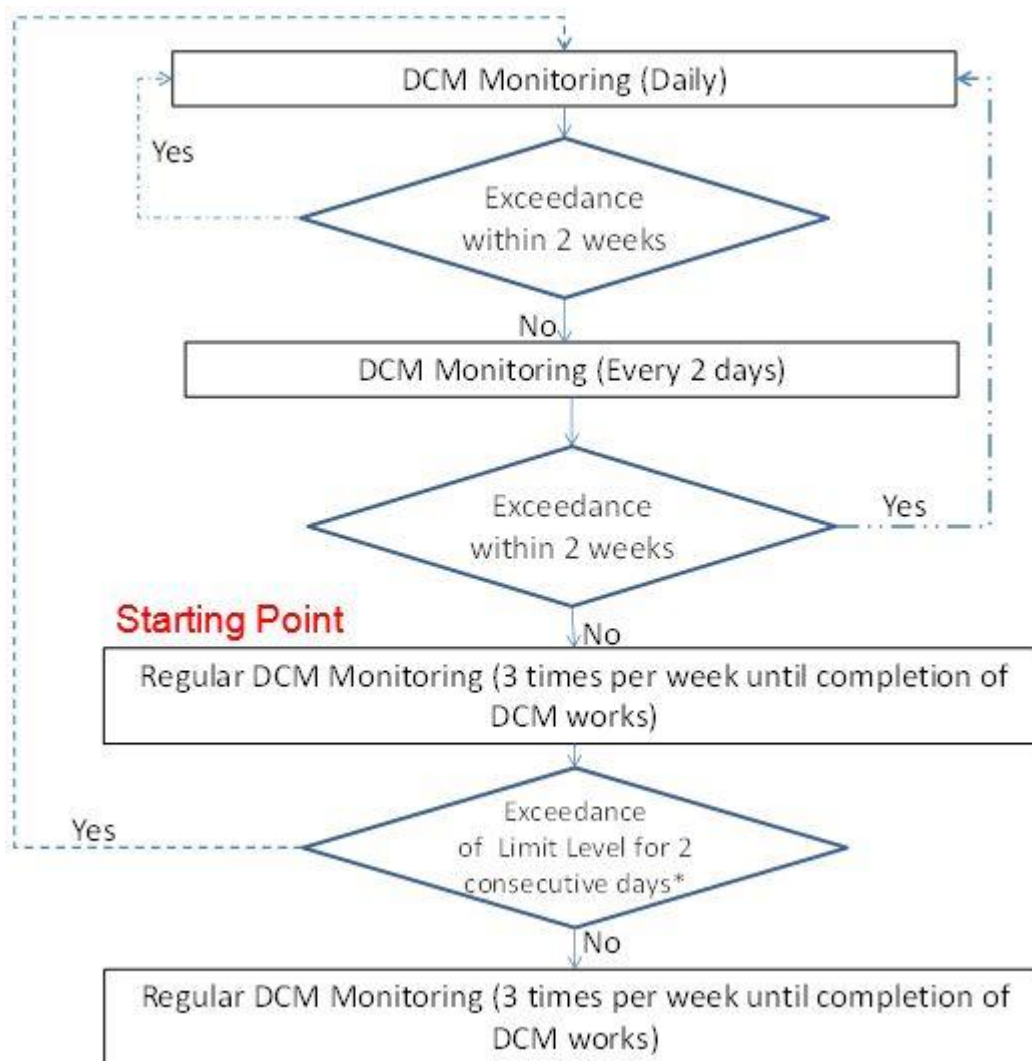
10.4 Monitoring Locations

Due to fishermen's request and safety concern, there were changes of monitoring locations for C1, C2, F1 and S2. Regular DCM Monitoring for water quality for the DCM works was measured at the latest coordinates of monitoring stations as listed in **Table 3** and illustrated in **Figure 1**. The locations of these DCM monitoring stations are the same as those for the IWWMF's marine water quality monitoring stations during construction stage. DO, pH, temperature, turbidity, SS, total alkalinity, current velocity and direction are measured at all the DCM monitoring stations.

10.5 Monitoring Frequency and Duration

Monitoring frequency and duration is linked to a feedback loop mechanism that enables the regular DCM monitoring to be changed to intensive DCM monitoring should there be any exceedances in water quality limit levels for the DCM-specific parameters. The feedback loop mechanism for DCM Monitoring is shown in **Chart 2**.

Chart 2 - Flow Chart for DCM Specific Monitoring Parameters (Regular DCM Monitoring)



*Exceedances refer to total alkalinity and temperature only. These should be confirmed by ET and verified by IEC as project-related.

As illustrated in **Chart 2**, regular DCM monitoring of three times per week will continue for the duration of DCM works unless there is any exceedance of the limit levels for total alkalinity for two consecutive sampling days and such exceedance is confirmed by the ET (with verification by the IEC) to be a result of the DCM works. If such instances arise, intensive DCM monitoring will be re-initiated as shown in **Chart 1** and will follow the procedures described in **Section 9**. Regular DCM monitoring will only resume once the intensive DCM monitoring process has been completed with no further exceedances detected.

Regular DCM monitoring shall continue for another 4 week period after the completion of DCM works in order to confirm there are no impacts on water aspect at nearby water sensitive receivers.

10.6 Monitoring Procedures

Monitoring shall be conducted at mid-flood (within ± 1.75 hour of the predicted time) and mid-ebb (within ± 1.75 hour of the predicted time) tides. Samples should be taken at three depths (at 1m below surface, at mid-depth, and at 1m above bottom) for locations with water depth $>6m$. For locations with water depth between 3m and 6m, two depths (surface and bottom) should be taken. Locations with water depth $<3m$, only surface depth should be taken.

Two consecutive measurements of DO, pH, temperature ($^{\circ}C$) turbidity (NTU), current velocity and direction should be taken in-situ according to the stated sampling method. Water samples for SS (mg/L) and Total Alkalinity (mg/L) measurements should be collected at the same depths. Duplicate water samples should be taken and analysed.

10.7 Action and Limit Levels

The action and limit levels for DCM-specific water quality parameters and the other water quality parameters during regular DCM water quality are tabulated in **Table 7** and **Table 8**.

Table 7 - Action and Limit Levels for DCM-specific Water Quality Parameters (Regular DCM Monitoring)

Parameters	Action Level	Limit Level
Total Alkalinity in mg/L	95 percentile of baseline data or 120% of upstream control station at the same tide of the same day, whichever is higher	99 percentile of baseline data or 130% of upstream control station at the same tide of the same day, whichever is higher

Notes:

1. Non-compliance of water quality results when monitoring results is higher than the limits.
2. Depth-averaged are used unless specified otherwise
3. Baseline data to be adopted in the Regular DCM monitoring are specified in the Baseline Monitoring Report for DCM works.
4. With reference to Plate 5b.8 of the approved EIA report EIA-201/2011, the upstream control station shall be C2 during flood tide and C1 during ebb tide.

For other parameters (DO, turbidity and SS), Action and Limit levels are defined in **Table 8**.

Table 8 - Action and Limit Levels for Other Water Quality Parameters (Regular DCM Monitoring)

Parameters	Action Level	Limit Level
DO in mg/L	≤ 5 percentile of baseline data	≤ 4mg/L
Suspended Solids (SS) in mg/L	95 percentile of baseline data or 120% of upstream control station at the same tide at the same day, whichever is higher	99 percentile of baseline data or 130% of upstream control station at the same tide of the same day, whichever is higher
Turbidity in NTU	95 percentile of baseline data or 120% of upstream control station at the same tide at the same day, whichever is higher	99 percentile of baseline data or 130% of upstream control station at the same tide of the same day, whichever is higher

Notes:

1. For DO, non-compliance of water quality results when monitoring results are lower than the limits.
2. Depth-averaged results are used unless specified otherwise
3. For SS and Turbidity, non-compliance of water quality results when monitoring results are higher than the limits.
4. Baseline data to be adopted in the Regular DCM monitoring are specified in the Baseline Monitoring Report for DCM works.
5. With reference to Plate 5b.8 of the approved EIA report EIA-201/2011, the upstream control station shall be C2 during flood tide and C1 during ebb tide.

10.8 Event and Action Plan

The actions in accordance with the Event and Action Plan in **Table 9** should be carried out if the water quality assessment criteria are exceeded at the impact monitoring stations.

Table 9 - Event and Action Plan for DCM Process during Regular DCM Monitoring

Event	Action			
	ET	IEC	SO	KSZHJV
Action level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and KSZHJV; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC and KSZHJV; 6. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM-specific parameters only) 	<ol style="list-style-type: none"> 1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET and IEC and propose mitigation measures.

Event	Action			
	ET	IEC	SO	KSZHJV
<p>Action Level being exceeded by more than two consecutive sampling days</p>	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC and KSZHJV; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC and KSZHJV; 6. Ensure mitigation measures are implemented; 7. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM-specific parameters only) 	<ol style="list-style-type: none"> 1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET and IEC and propose mitigation measures to IEC and SO within 3 working days; 7. Implement the agreed mitigation measures. 8. As directed by SO, to slow down all or part of the construction activities.

Event	Action			
	ET	IEC	SO	KSZHJV
Limit Level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, Contractor and EPD; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC, SO and KSZHJV; 6. Ensure mitigation measures are implemented; 7. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM-specific parameters only) 	<ol style="list-style-type: none"> 1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC, ET and KSZHJV on the proposed mitigation measures; 2. Request KSZHJV to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET, IEC and SO and propose mitigation measures to IEC and SO within three working days; 7. Implement the agreed mitigation measures.

Event	Action			
	ET	IEC	SO	KSZHJV
Limit Level being exceeded by more than one consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify reasons for non-compliance and sources of impact; 3. Inform IEC, KSZHJV and EPD; 4. Check monitoring data, all plant, equipment and KSZHJV's working methods; 5. Discuss mitigation measures with IEC, SO and KSZHJV; 6. Ensure mitigation measures are implemented; 7. If not already undertaking daily monitoring, increase monitoring frequency in accordance with Chart 1. (applies to DCM-specific parameters only) 	<ol style="list-style-type: none"> 1. Discuss with ET and KSZHJV on the mitigation measures; 2. Review proposals on mitigation measures submitted by KSZHJV and advise SO accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC, ET and KSZHJV on the proposed mitigation measures; 2. Request KSZHJV to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures; 5. Consider and instruct, if necessary, the KSZHJV to slow down or to stop all or part of the construction activities until no exceedance of limit level. 	<ol style="list-style-type: none"> 1. Inform SO and confirm receipt of ET's notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Provide report of the status and condition of plant, equipment and mitigation measures to ET; 5. Consider changes of working methods; 6. Discuss with ET, IEC and SO and propose mitigation measures to IEC and SO within three working days; 7. Implement the agreed mitigation measures; 8. As directed by SO, to stop all or part of the construction activities.

Notes:

DCM- specific parameter refers to Total Alkalinity only

10.9 Reporting

Findings from the regular DCM monitoring shall be reported as part of the Monthly and Quarterly EM&A Report. The reporting requirements shall follow the relevant requirements specified in the EM&A Manual.

11 MITIGATION MEASURES FOR DCM

11.1 General

Mitigation Measures for the IWMF Project have been specified in the approved EIA report and Supporting Document for Application for Variation of the Environmental Permit (EP-429/2012). By using DCM for ground treatment, it can construct the seawall and breakwater by using precast concrete structures. The key mitigation measures listed in this Section are thus restricted to those that are recommended for ensuring the DCM process and activities themselves do not cause adverse water quality impact and disturbance to marine mammals. The Implementation schedule for DCM works is attached in **Appendix I**.

11.2 Mitigation Measures for Water Aspect

Mitigation measures recommended for protecting water quality due to DCM activities include the following:

- No DCM works should be carried out within 100m to the nearest non-translocatable coral colony / colonies;
- Silt curtains should be employed to enclose the DCM field trial and any DCM work to minimize the potential impacts on water aspects; and
- A sand blanket with at least 2m thickness shall be placed on top of the marine deposit using tremie pipes / garb by using bottom dumping method prior to the DCM ground treatment to avoid sediment disturbance and minimize sediment loss.

11.3 Mitigation / Precautionary Measures for Ecology Aspect

Mitigation / precautionary measures recommended for protecting marine mammals due to DCM activities include the following:

- Implementation of marine mammal exclusion zone;
- Deployment of silt curtains is required for laying sand blanket, laying rock and during DCM works in preventing indirect ecological impacts to marine ecological resources nearby.



Contract No. EP/SP/66/12
Integrated Waste Management Facilities, Phase 1

Appendix A

Construction Programme

Activity ID	Activity Name	Remaining Duration	Start	Finish	2018												2019												2020												2021												2022												2023												2024												2025																						
					N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J	A	S	O	N	D	N	D	J	F	M	A	M	J	J
EP_SP_66_12-WP-2-M0	Programme for Design and Construction Works	2835	22-Nov-17 A	26-Aug-25																																																																																																											
EP_SP_66_12-WP-2-M0.01	Key Dates	2496	22-Nov-17	21-Sep-24																																																																																																											
EP_SP_66_12-WP-2-M0.02	Contract Preliminaries	2807	19-Dec-17	26-Aug-25																																																																																																											
EP_SP_66_12-WP-2-M0.03	Licence/Permit Applications	2252	15-Dec-17	13-Feb-24																																																																																																											
EP_SP_66_12-WP-2-M0.04	General Submissions	1320	22-Nov-17	03-Jul-21																																																																																																											
EP_SP_66_12-WP-2-M0.05	Design Submissions	1724	22-Nov-17 A	11-Aug-22																																																																																																											
EP_SP_66_12-WP-2-M0.06	Procurement of Major Equipment	1903	13-Sep-18	28-Nov-23																																																																																																											
EP_SP_66_12-WP-2-M0.07	Environmental Works	1708	05-Jan-18	09-Sep-22																																																																																																											
EP_SP_66_12-WP-2-M0.08	Maritime Works	1277	29-Dec-17	27-Jun-21																																																																																																											
EP_SP_66_12-WP-2-M0.08.3	Submissions	196	29-Dec-17	12-Jul-18																																																																																																											
EP_SP_66_12-WP-2-M0.08.1	Marine Construction	1265	10-Jan-18	27-Jun-21																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.1	Phase I - Construction of Perimeter Seawalls	740	10-Jan-18	19-Jan-20																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.1.3	Marine Works Preparations	274	10-Jan-18	10-Oct-18																																																																																																											
08-0900	Carry out hydrographic survey	14	10-Jan-18	23-Jan-18																																																																																																											
08-1005	Ground Investigation for DCM Design	180	13-Feb-18	11-Aug-18																																																																																																											
08-1010	Mobilization of DCM Barge for Load Test	30	14-May-18	12-Jun-18																																																																																																											
08-1020	Mobilization of Remaining DCM Barge for Construction	30	11-Sep-18	10-Oct-18																																																																																																											
08-1340(2)	Sediment Sample collection and testing Dumping Permit Application	21	05-Sep-18*	25-Sep-18																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.1.1	Seawall and Berth at DCM Area	676	15-Mar-18	19-Jan-20																																																																																																											
08-1030	DCM Mix Trial (incl. Bench-scale testing and Lab Tests)	106	15-Mar-18	28-Jun-18																																																																																																											
08-1040	DCM Pre-construction Site Trial and testing	43	29-Jun-18	10-Aug-18																																																																																																											
08-1050	Static Load Test Preparation	31	11-Aug-18	10-Sep-18																																																																																																											
08-1060	Carry out static loading test	22	11-Sep-18	02-Oct-18																																																																																																											
08-1065(2)	Static load test report submission	8	03-Oct-18	10-Oct-18																																																																																																											
08-1070	Geotextile Laying	60	11-Aug-18	09-Oct-18																																																																																																											
08-1075(2)	Sand Blanket Laying	60	11-Aug-18	09-Oct-18																																																																																																											
08-1080	DCM Injection Works (575,000m3, approx 6300 nr.)	120	11-Oct-18	07-Feb-19																																																																																																											
08-1090	DCM Final Completion Tests	180	10-Nov-18	08-May-19																																																																																																											
08-1100	Rubble Mound Laying (100,000m3 approx. @550m3/d)	180	09-Jan-19	07-Jul-19																																																																																																											
08-1105(1)	Prefabrication for Caisson	282	24-Nov-18	01-Sep-19																																																																																																											
08-1110	Caisson Laying (Total 50nrs, @2 nrs/week)	182	24-Mar-19	21-Sep-19																																																																																																											
08-1120	Wave Wall Construction	120	22-Sep-19	19-Jan-20																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.1.2	Seawall at Dredging Area	295	25-Dec-18	15-Oct-19																																																																																																											
08-1130	Dredging Works (26,000m3 @ 285m3/d avg. to comply EP Conditions 2.18)	110	25-Dec-18	13-Apr-19																																																																																																											
08-1140	Lay Rock & Sand Fill	50	15-Mar-19	03-May-19																																																																																																											
08-1150	Place Rubble Mound (35,000m3 approx., @550m3/d)	88	30-Mar-19	25-Jun-19																																																																																																											
08-1155(2)	Fabrication and delivery of Precast Seawall Blocks (12,000nr. approx)	90	15-Mar-19	12-Jun-19																																																																																																											
08-1160	Lay Concrete Block Walls (300m length approx. @4m/d)	80	29-Apr-19	17-Jul-19																																																																																																											
08-1170	In situ Concrete Wall Construction	90	18-Jul-19	15-Oct-19																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.2	Phase II - Reclamation, Breakwater and Berth Construction	999	03-Oct-18	27-Jun-21																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.2.1	Reclamation	999	03-Oct-18	27-Jun-21																																																																																																											
08-1180	Geotextile Laying	100	03-Oct-18	10-Jan-19																																																																																																											
08-1185(2)	Sand Blanket Laying	100	03-Oct-18	10-Jan-19																																																																																																											
08-1190	Install Vertical Band Drain by Barge	160	10-Feb-19	19-Jul-19																																																																																																											
08-1200	Reclamation fill up to +2.5mPD	375	22-Sep-19	30-Sep-20																																																																																																											
08-1210	Reclamation fill from +2.5 to Formation Level	120	03-Jul-20	30-Oct-20																																																																																																											
08-1220	Lay Surcharge	80	11-Sep-20	29-Nov-20																																																																																																											
08-1230	Surcharge Period	180	30-Nov-20	28-May-21																																																																																																											
08-1240	Remove Surcharge	85	04-Apr-21	27-Jun-21																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.2.2	Breakwater	583	02-Sep-19	06-Apr-21																																																																																																											
08-1250	Geotextile and Sand Blanket Laying	45	22-Sep-19	05-Nov-19																																																																																																											
08-1260	DCM Injection Works (290,000m3, approx 3200 nr.)	65	06-Nov-19	09-Jan-20																																																																																																											
08-1270	DCM Final Completion Test	71	05-Jan-20	15-Mar-20																																																																																																											
08-1280	Rubble Mound Laying (100,000m3 approx. @550m3/d)	188	05-Mar-20	08-Sep-20																																																																																																											
08-1285(1)	Prefabrication for Caisson	411	02-Sep-19	16-Oct-20																																																																																																											
08-1290	Caisson Laying (Total 43nrs, @2 nrs/week)	150	11-Jul-20	07-Dec-20																																																																																																											
08-1300	Wave Wall Construction	120	08-Dec-20	06-Apr-21																																																																																																											
EP_SP_66_12-WP-2-M0.08.1.2.3	Seawall and Berth at Marine Access	150	03-Jul-20	29-Nov-20																																																																																																											
08-1310(2)	Prefabrication for Caisson (4nrs)	90	03-Jul-20	30-Sep-20																																																																																																											
08-1320(2)	Caisson Laying (4nrs)	30	01-Oct-20	30-Oct-20																																																																																																											
08-1330(2)	Wave Wall Construction	30	31-Oct-20	29-Nov-20																																																																																																											
EP_SP_66_12-WP-2-M0.09	Foundation Works	397	12-Apr-21	13-May-22																																																																																																											
EP_SP_66_12-WP-2-M0.09.0	Site Investigation and Preliminary Pile	46	12-Apr-21	27-May-21																																																																																																											
EP_SP_66_12-WP-2-M0.09.1	Administration Bld Foundation	138	25-Nov-21	11-Apr-22																																																																																																											
EP_SP_66_12-WP-2-M0.09.2	Waste Bunker & Tipping Hall Bld Foundation	203	13-May-21	01-Dec-21																																																																																																											
EP_SP_66_12-WP-2-M0.09.3	Boiler & Flue Gas Bld Foundation	331	12-Apr-21	08-Mar-22																																																																																																											
EP_SP_66_12-WP-2-M0.09.4	ACC Area Foundation	129	20-Sep-21	26-Jan-22																																																																																																											
EP_SP_66_12-WP-2-M0.09.5	Turbine Hall Bld Foundation	142	28-Jun-21	16-Nov-21																																																																																																											
EP_SP_66_12-WP-2-M0.09.6	Air Compressor Bld Foundation	28	17-Nov-21	14-Dec-21																																																																																																											

Programme for Design and Construction Works
Summary Programme

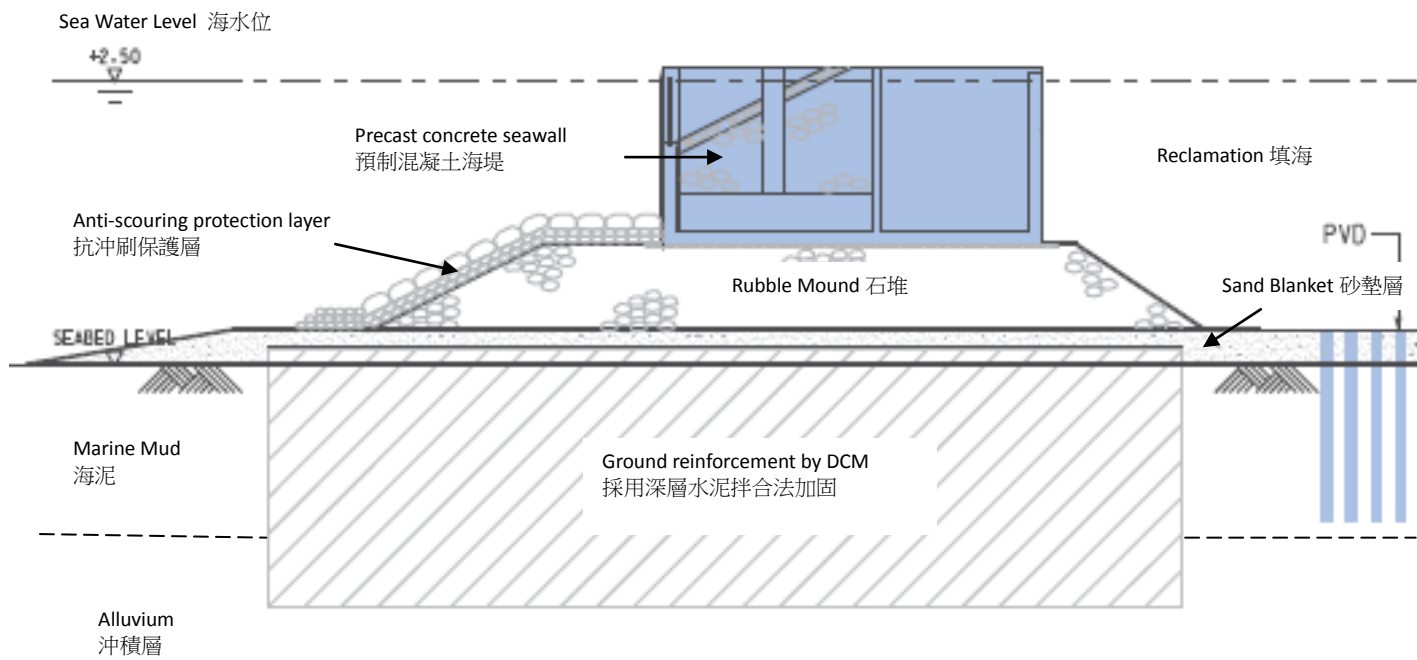
Date	Revision	Checked	Approved
04-Dec-17	Rev.0 - 1st Issue		
16-Jul-18	Rev.1 - Revised to SO's comments		
03-Sep-18	Rev.2 - Revised to SO's comments		



Contract No. EP/SP/66/12
Integrated Waste Management Facilities, Phase 1

Appendix B

Tentative Design Cross Section for the Seawall



With Deep Cement Mixing (DCM) Ground Reinforcement
採用深層水泥拌合法加固

Appendix C

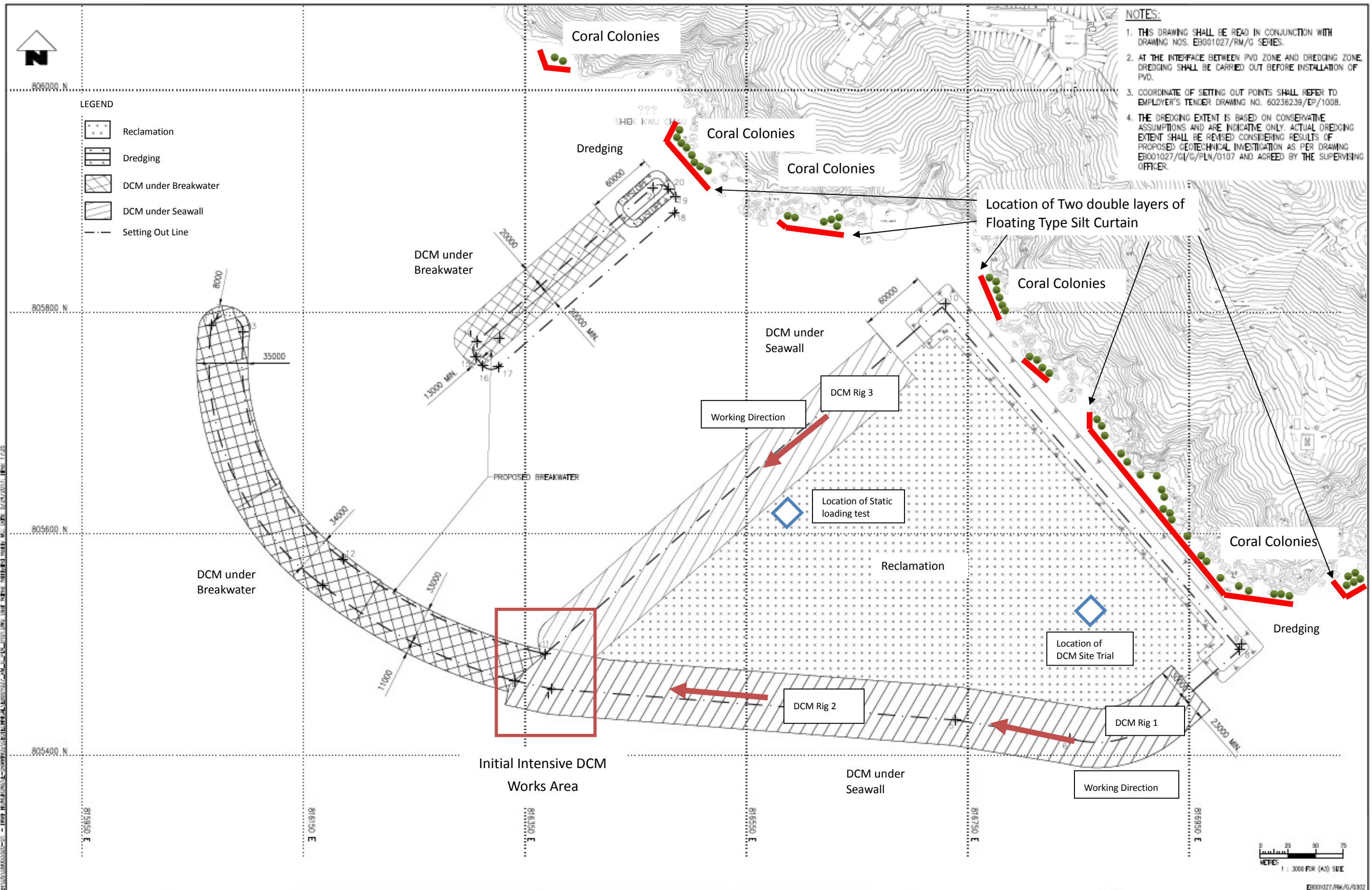
Photographs and Layout Arrangement of Different Types of DCM Rigs

Single-rig Type DCM



Multiple-rig Type DCM



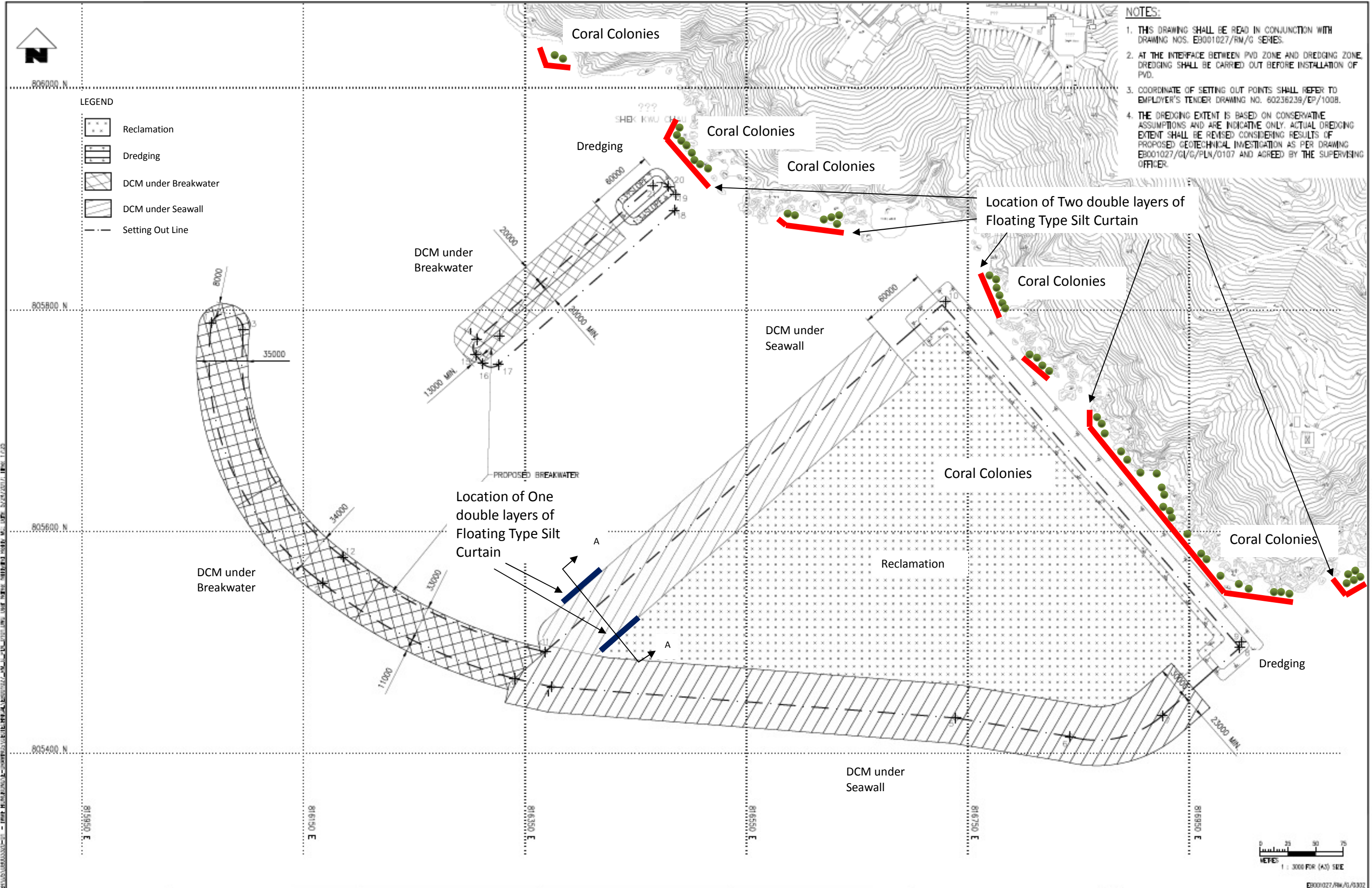


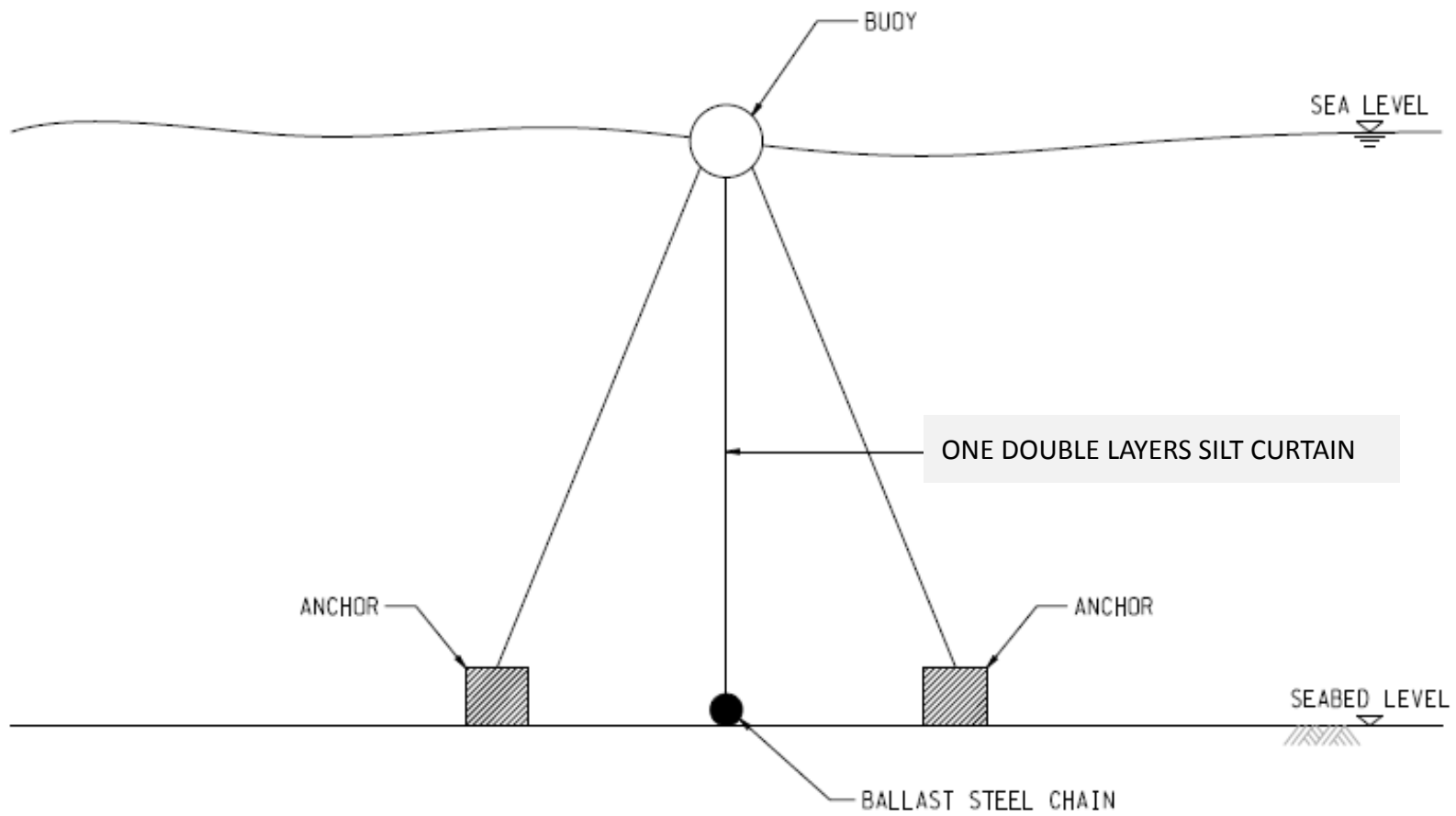


Contract No. EP/SP/66/12
Integrated Waste Management Facilities, Phase 1

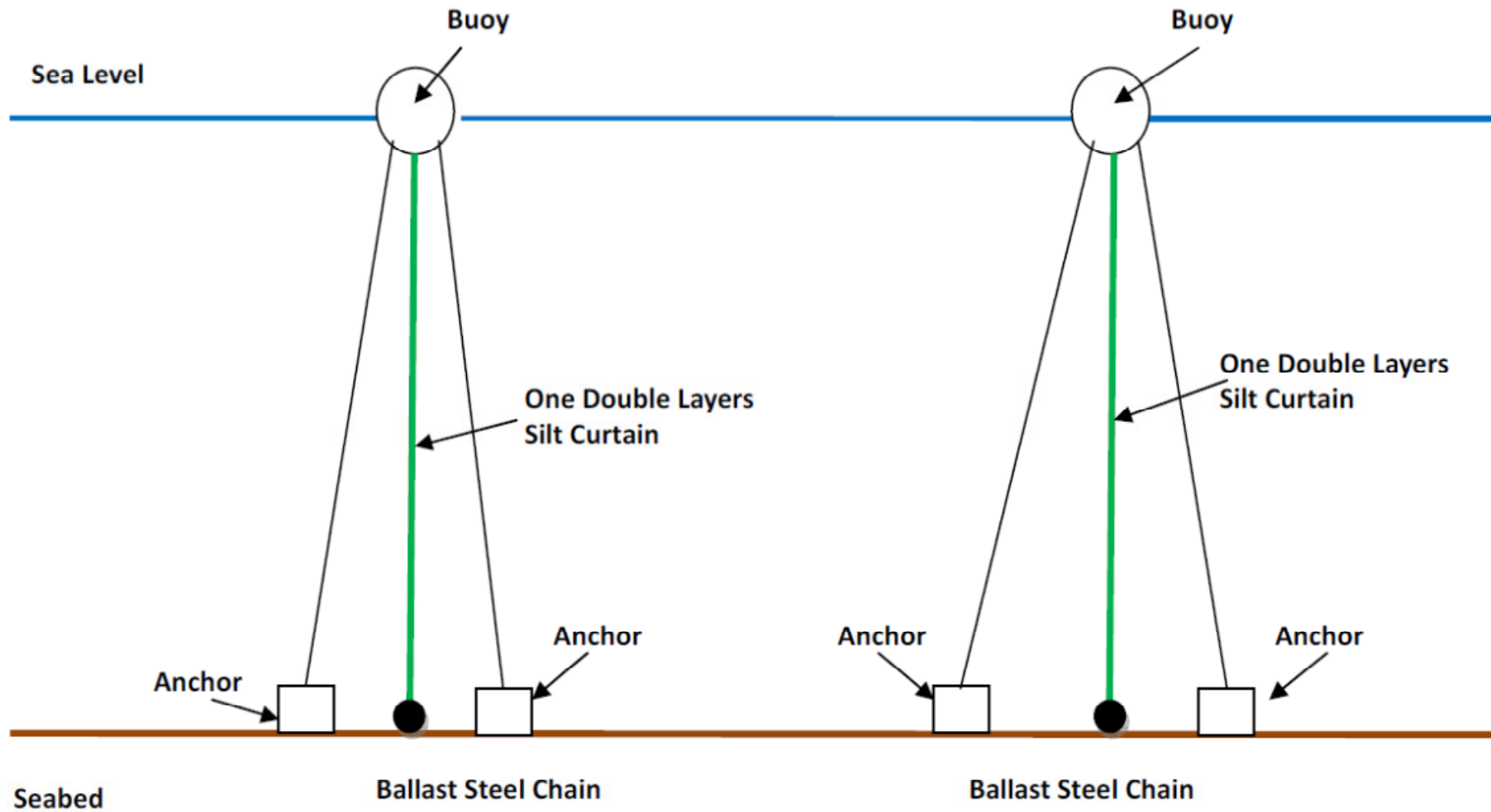
Appendix D

Typical Section and Layout Plan of Floating Type Silt Curtains





Typical Section of One double layers of Floating Type Silt Curtain



Typical Section of Two double layers of Floating Type Silt Curtain



Contract No. EP/SP/66/12
Integrated Waste Management Facilities, Phase 1

Appendix E

Specification of the Proposed Geotextile



SG WOVEN GEOTEXTILES

we under^{cover} the world

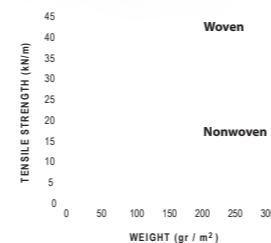
A TOTAL RANGE OF GEOTEXTILES

Headquarters:
BONAR TECHNICAL FABRICS NV/SA
 Industriestraat 39
 B-9240 Zele
 BELGIUM
 T.: +32 (0) 52 457 487
 F.: + 32 (0) 52 457 495
 E-MAIL: geotextiles@bonartf.com

For UK and Ireland:
BONAR YARNS & FABRICS Ltd
 St. Salvador Street
 Dundee Scotland
 DD3 7EU
 T.: +44 (0)1382 346102
 F.: +44 (0)1382 229238
 E-MAIL: geotextiles@bonaryarns.com

website: www.bonartf.com

bontec
 woven and nonwoven geotextiles



SEPARATION



REINFORCEMENT



Other geotextiles available within the Bontec range include Highflow, High strength Wovens and Thermally Bonded & Needle-punched Nonwovens

Visit us at our website:
www.bonartf.com

For UK and Ireland: **BONAR YARNS & FABRICS Ltd**
 St. Salvador Street | Dundee | Scotland | DD3 7EU
 T.: +44 (0)1382 346102 | F.: +44 (0)1382 229238
 E-MAIL: geotextiles@bonaryarns.com

SG Woven Geotextiles PRODUCT PROFILE

“An exciting range of Standard Grade geotextiles that offer the perfect solution to your Separation requirements. With tensile strengths ranging from 10 to 300 kN/m you can be certain that an SG fabric will be available with the performance that you are looking for.”

DAILY SEPARATION, SOIL STRENGTHENING OR GROUND REINFORCEMENT?

Bontec SG woven geotextiles are manufactured from polypropylene tapes & yarns, and exhibit an excellent chemical resistance to commonly encountered acids and alkalis at ambient temperatures. Available in a lightweight range with products from 80 to 200g/m², and a heavyweight range from 200 to 800g/m².

Bontec SG facts include:

Tensile strengths up to 300 kN per metre (kN/m) width
 CBR Puncture Strengths ranging from 1.800 N to 12.500 N

SG Mechanical Properties that offer maximum strength at minimal cost and ensure the products survivability both against installation damage and in the longer term.

Lightweight woven geotextiles typically offer greater mechanical strengths per unit weight than comparable nonwoven grades. This makes lightweight woven geotextiles the ideal choice for separation

Waterflows normal to the plane that are generally several times more than that required by design

A range of consistent opening sizes suited for use in soils ranging from clay to coarse granular fill.

SG hydraulic properties that are suited to the demands of everyday separators.

Available ex-stock in 4.5m and 5.25m wide rolls or other widths to order

Typical applications for SG woven geotextiles include:

As a general purpose separator for use under site access roads and areas of hardstanding.

As a separation and strengthening layer under new roadways, car parks, industrial units etc.

As an erosion control layer under heavy rock armour in coastal defence projects. For any separation application where there exists a need to prevent the intermixing of soft foundation soils with good clean granular fill.

SG Woven Geotextiles have been manufactured as a cost effective solution to your soil separation and stabilisation applications. They are manufactured from highly durable polypropylene polymer and have a long life expectancy when used in permanent structures.

For further product information, be it a technical data sheet or to discuss your project with one of our in-house geotextile experts please do not hesitate to contact one of our offices listed below.

Headquarters: **BONAR TECHNICAL FABRICS NV/SA**
 Industriestraat 39 | B-9240 Zele | BELGIUM
 T.: +32 (0) 52 457 487 | F.: + 32 (0) 52 457 495
 E-MAIL: geotextiles@bonartf.com

Bontec® SG 110/110

Standard Grade Woven Geotextiles

Technical data sheet

Product description

Polymer	Density	Melting Point	Construction
100% Polypropylene	0,91 kg/dm ³	165 °C	Tapes

Properties

Mechanical Properties	Standard	Performance	Tolerance
Tensile strength - MD	EN ISO 10319	110 kN/m	-9,9 kN/m
Tensile strength - XD	EN ISO 10319	110 kN/m	-9,9 kN/m
Elongation at break - MD	EN ISO 10319	10 %	+/-2,3 %
Elongation at break - XD	EN ISO 10319	7 %	+/-1,6 %
Static puncture resistance (CBR)	EN ISO 12236	12,5 kN	-2,5 kN
Dynamic perforation resistance (cone drop)	EN ISO 13433	10 mm	+2,0 mm

Hydraulic Properties	Standard	Performance	Tolerance
Water permeability normal to the plane (Vlh50)	EN ISO 11058	25x10 ⁻³ m/s	-8x10 ⁻³ m/s
Waterflow in the plane @20 kPa	EN ISO 12958	-	-
Characteristic Opening Size (O90)	EN ISO 12956	230 µm	+/-69,0 µm

Physical Properties	Standard	Performance	Tolerance
Thickness under 2 kPa	EN ISO 9863-1	1,53 mm	+/-0,31 mm
Weight	EN ISO 9864	464 g/m ²	+/-46,4 g/m ²
Length x width		100 x 525 m	
Roll Diameter		-	

Durability	Standard	Performance	
Predicted minimal durability in years in natural soils with 4 < pH < 9 and soil temperatures < 25°C	Annex B	25,0	

The Quality Management System of Bonar has been approved to the ISO 9001 Quality Management System Standard. Certificates are available on request.



The information set forth in this data sheet reflects the best knowledge at the time of publication. The document is subject to change pursuant to new developments and findings. The same reservation applies to the properties of the products described. No liability is undertaken for results obtained by usage of the products and information.

SILT PROTECTOR (오탁방지막)

SILT PROTECTOR의 물성 및 상세도



SILT PROTECTOR의 용도

- 매립 공사시 해수중에 발생하는 토사, 세립토(SILT)의 확산방지
- 해상 공사의 주변 양식장, 청정수역, 해수욕장 피해 방지
- 항로 준설, 해상 정비 지역 주위의 오탁 확산 방지
- 항만, 호안 공사시 인근지역의 오탁 방지



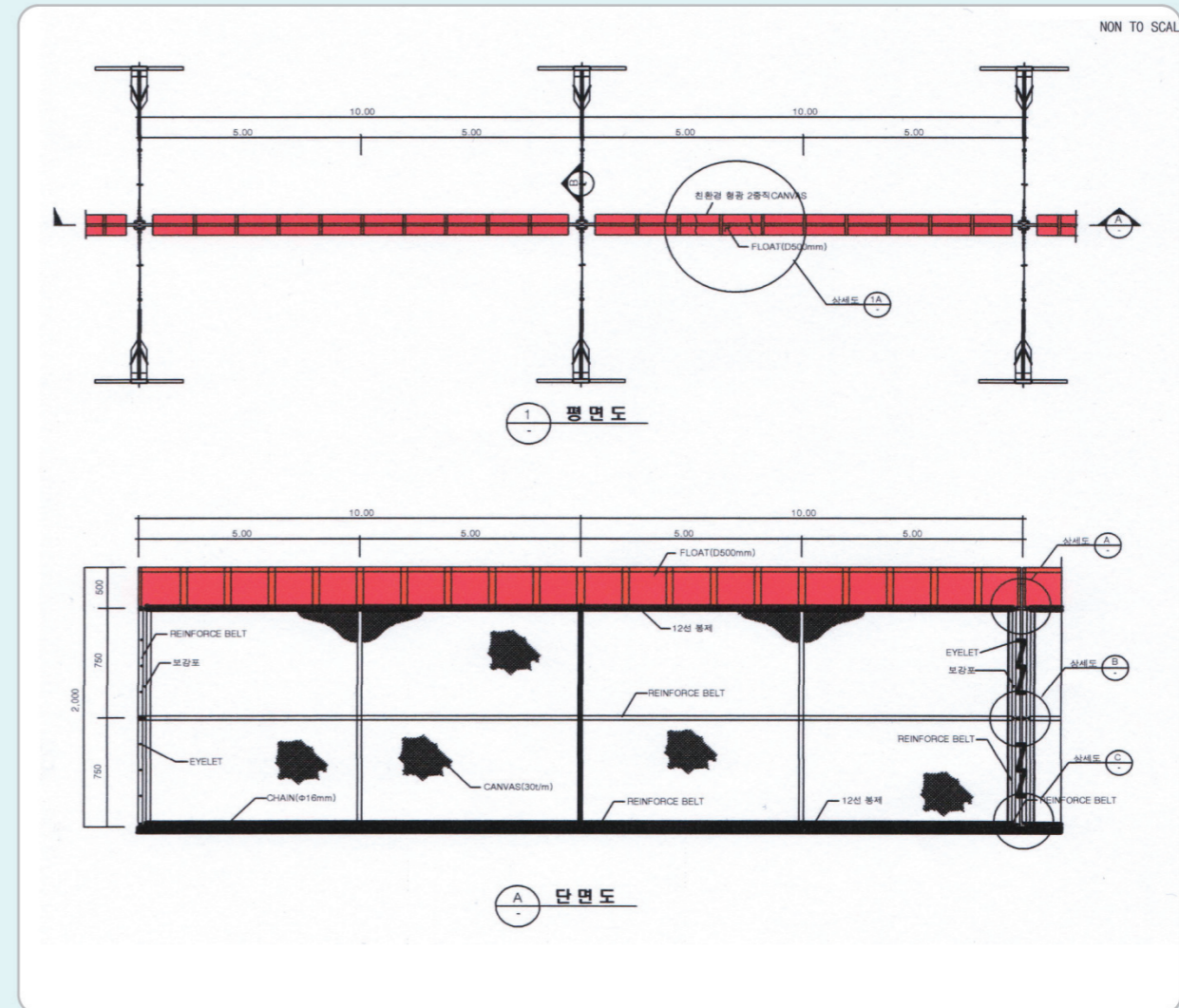
SILT PROTECTOR의 특징 및 효과

- 조립, 설치, 철거가 용이하고 취급이 간편하다.
- 고강도의 다양한 막체를 생산하여 해상 조건에 따른 막체 선정이 자유롭다.
- 파랑에 대한 순응성이 양호하며 FLOAT 파손시 부분 교체, 보수가 용이하다.
- 오탁수의 침강 촉진과 확산 방지가 탁월하다.
- 현장의 해상 및 기상 조건 등에 따라 CANVAS부의 강도와 FLOAT부의 부력에 맞춰 다양한 제품의 공급이 가능하다.

SILT PROTECTOR

구분	단위	JYS 10	JYS 15	JYS 20	JYS 25	JYS 30	JYS 32	시험방법	
재질	-	폴리에스터						KS K 0210-1	
중량	g/m ²	300	400	600	700	900	1000	KS K ISO 9864	
인장 강도	kN/m이상	100	150	200	250	300	320	KS K ISO 10319 광폭스트립법	
인장 신도	%	10~30						10~40	KS K ISO 10319 광폭스트립법
인열 강도	N, 이상/ (Kgf 이상)	1000 (100)	1500 (150)	2000 (200)	2500 (250)	3000 (300)	3200 (320)	KS K 0796	
투수 계수	cm/sec	$\alpha \times 10^{-2} \sim 10^{-4}$ ($\alpha : 1.0 \sim 9.9$)						KS K ISO 11058	
치수변화율	%	±0.2% 이하						KS K ISO 7771	

SILT PROTECTOR 상세도

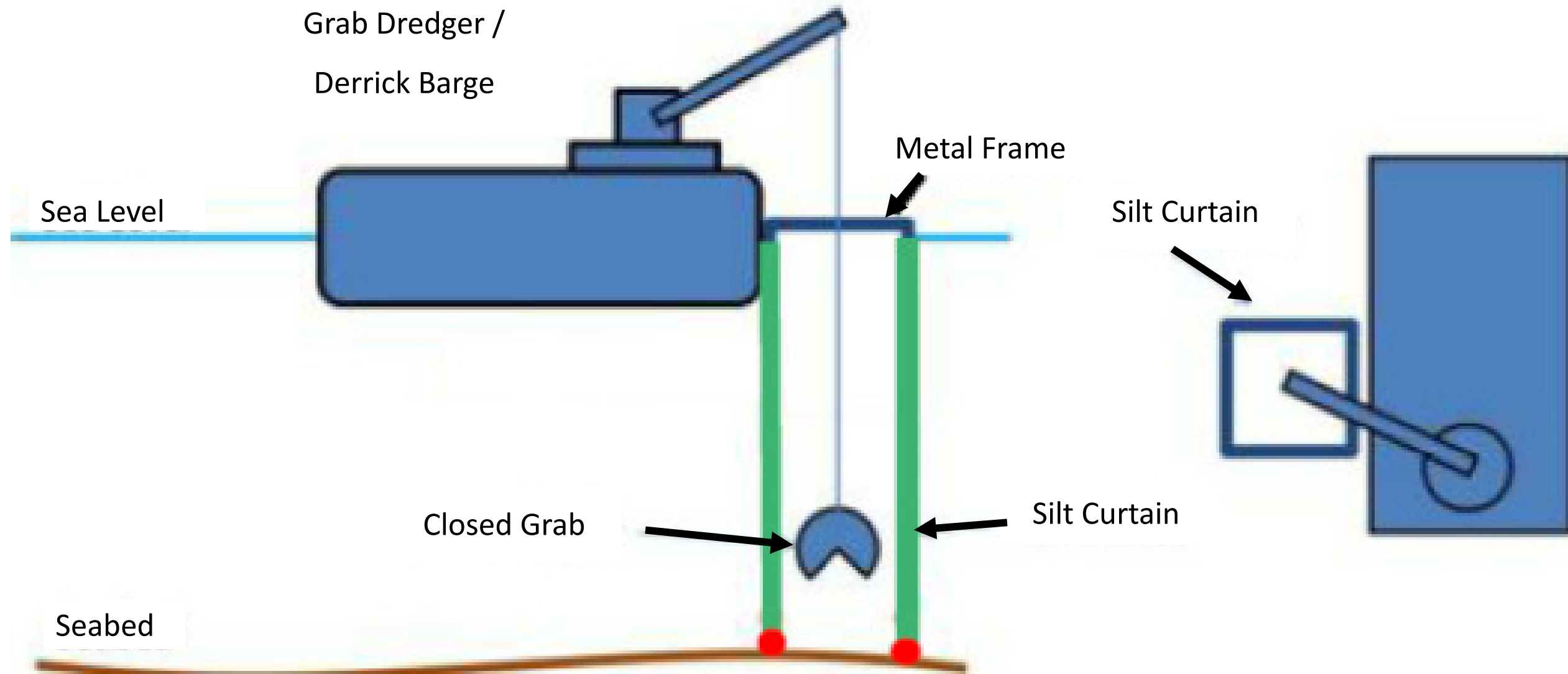


Appendix F

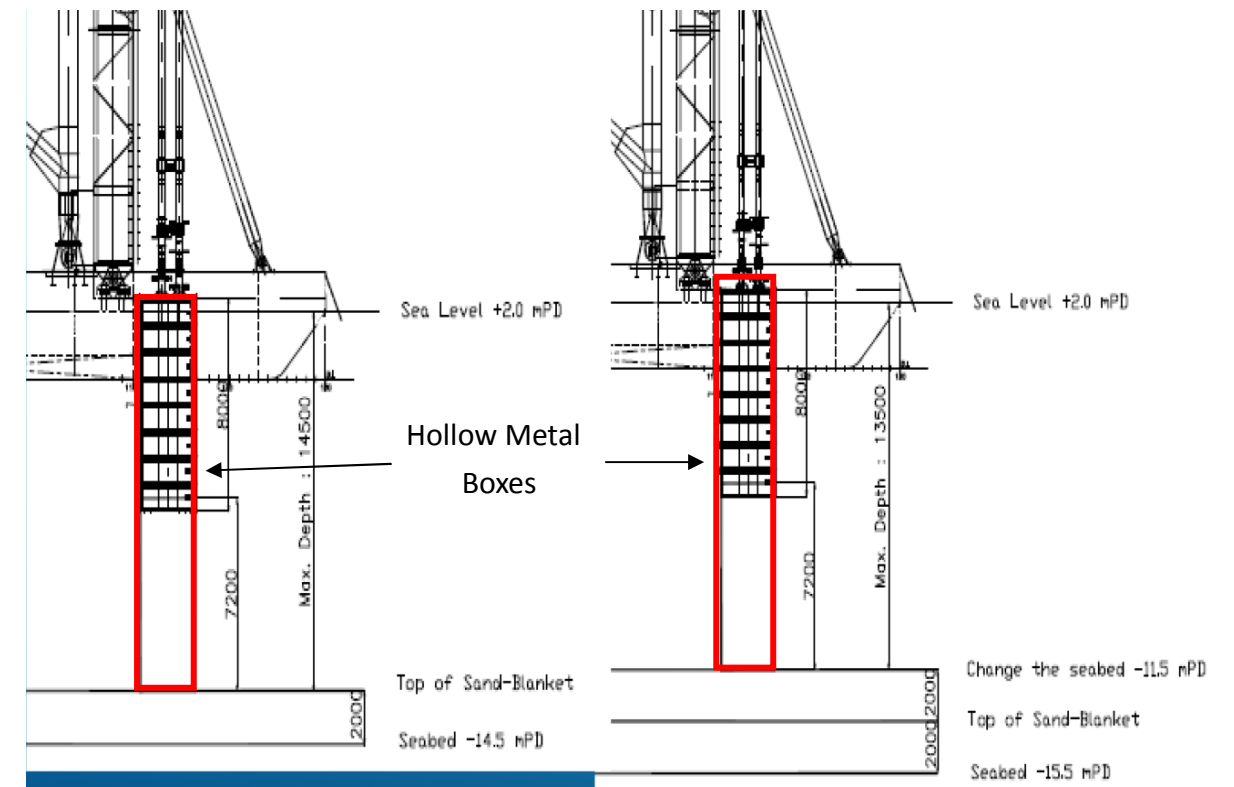
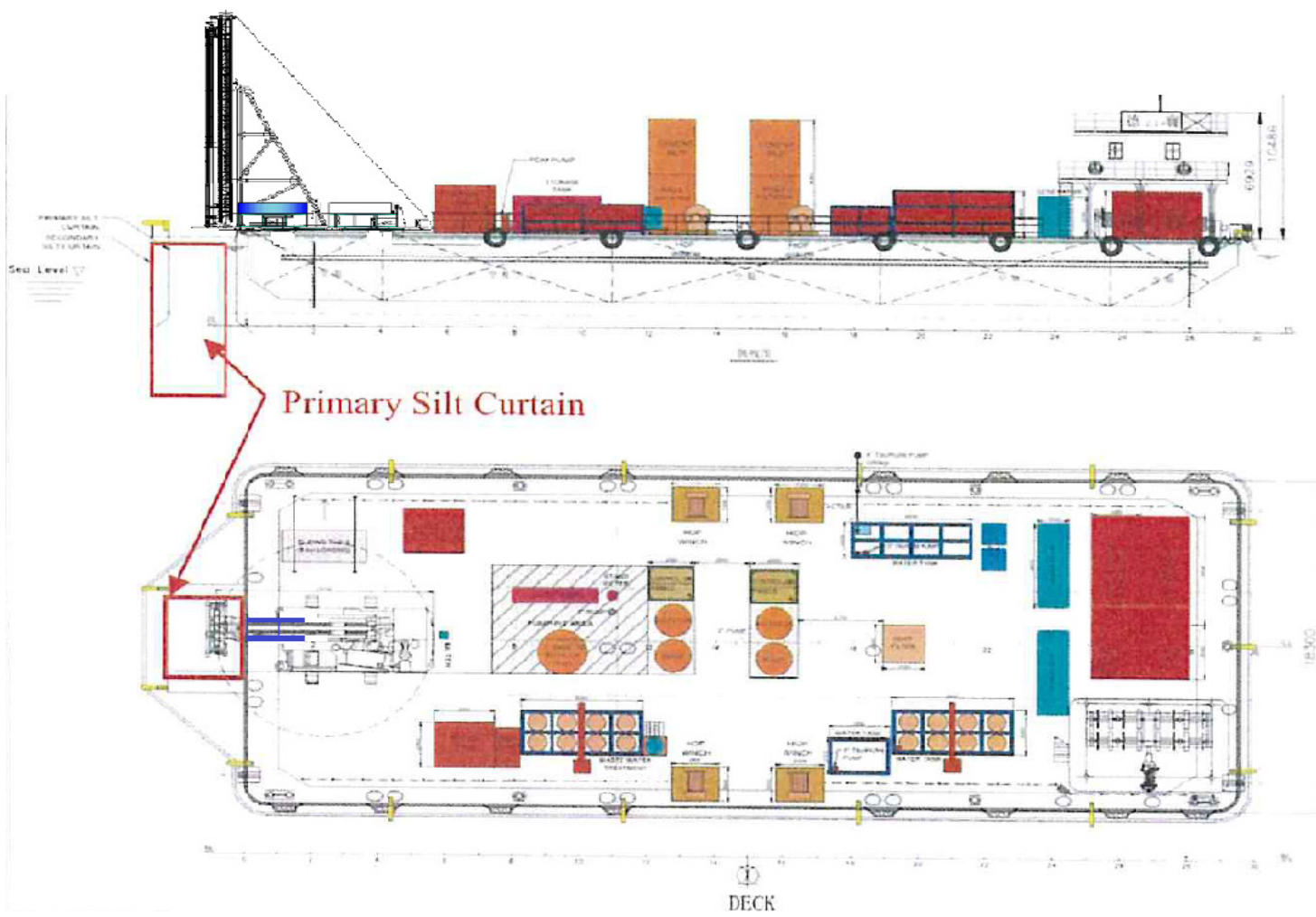
Typical Section of Different Cage Type Silt Curtain

Section View

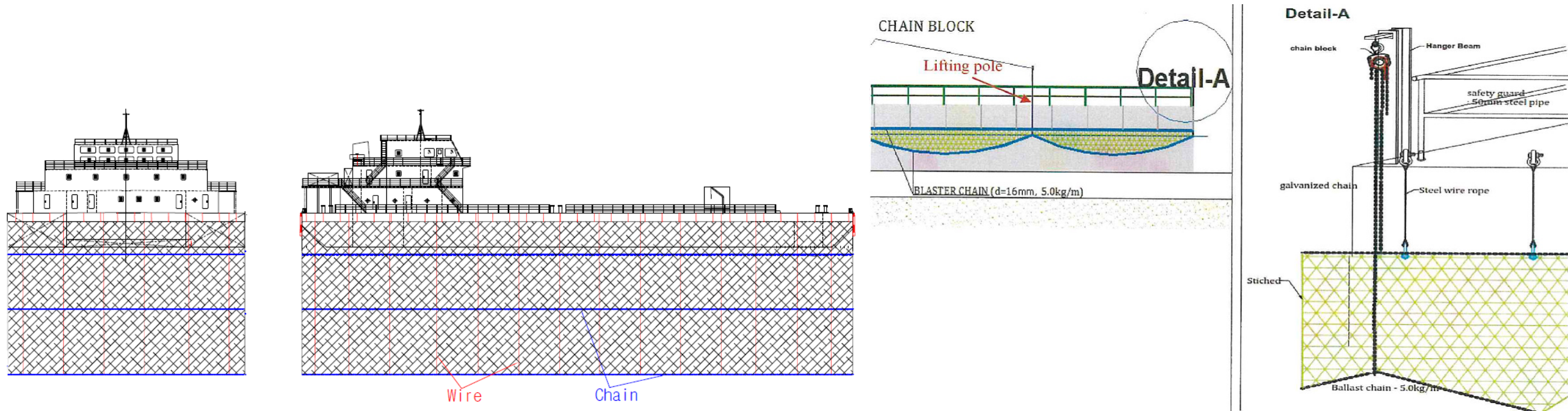
Plan View



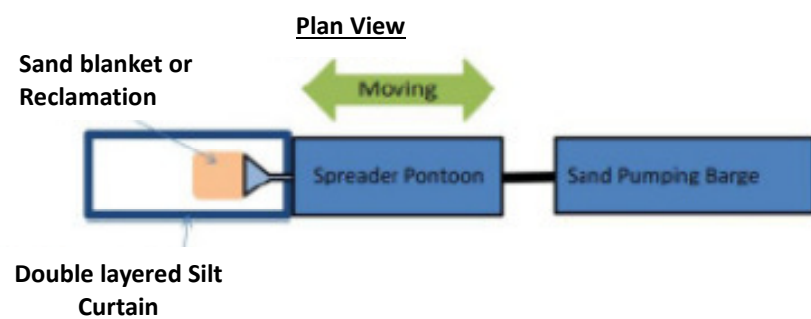
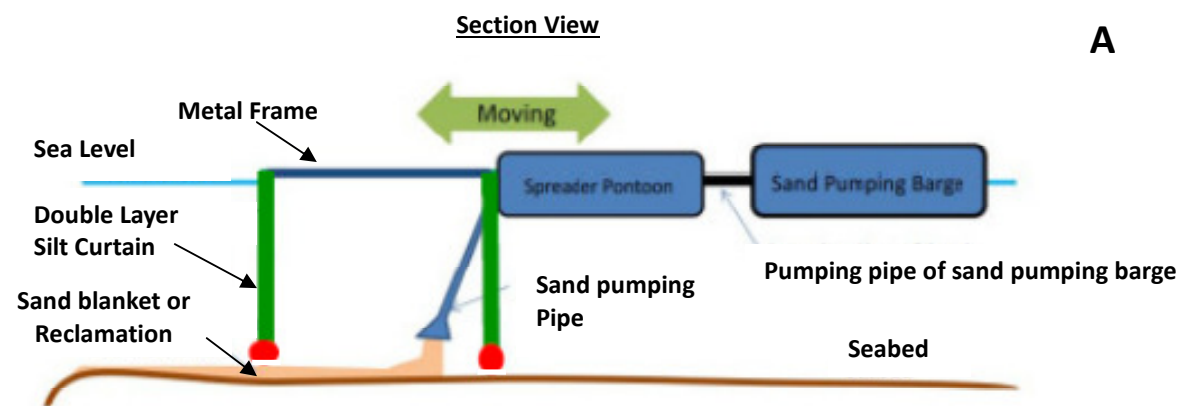
Typical Section of Cage Type Silt Curtain – Type 1 (for Close Grab)



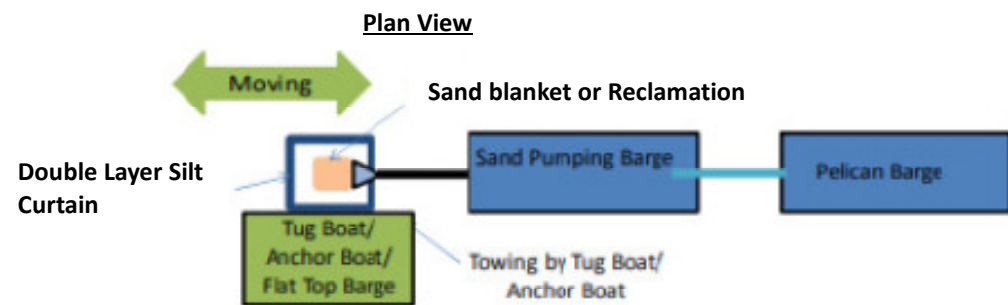
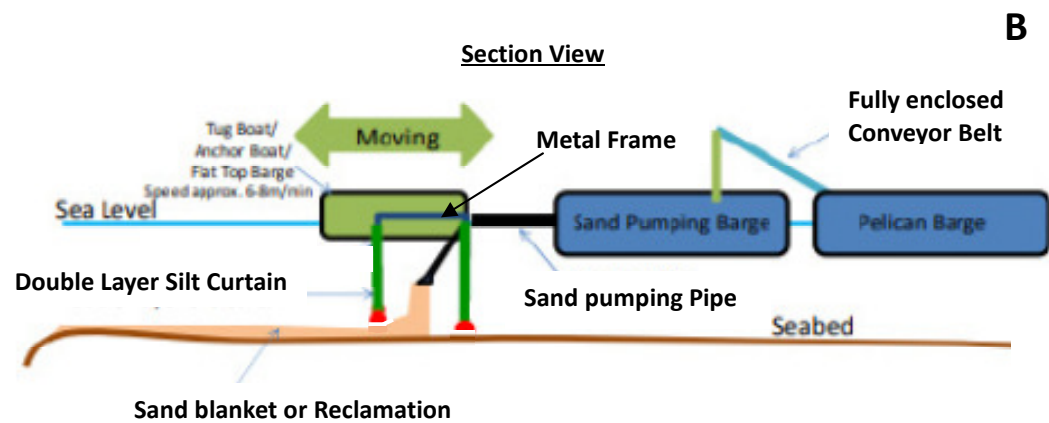
Typical Section of Cage Type Silt Curtain – Type 3 (for DCM Operation – Primary Layer Silt Curtain)



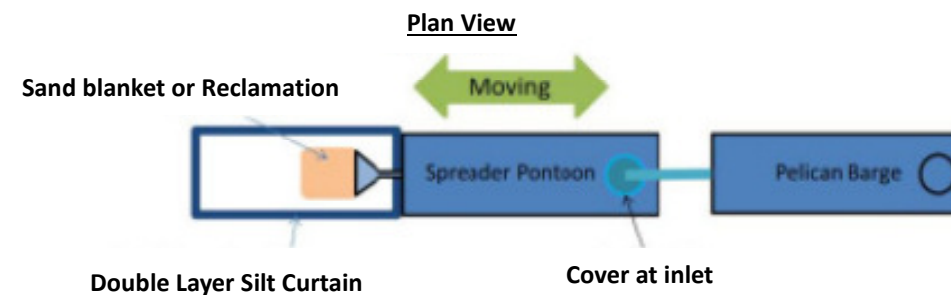
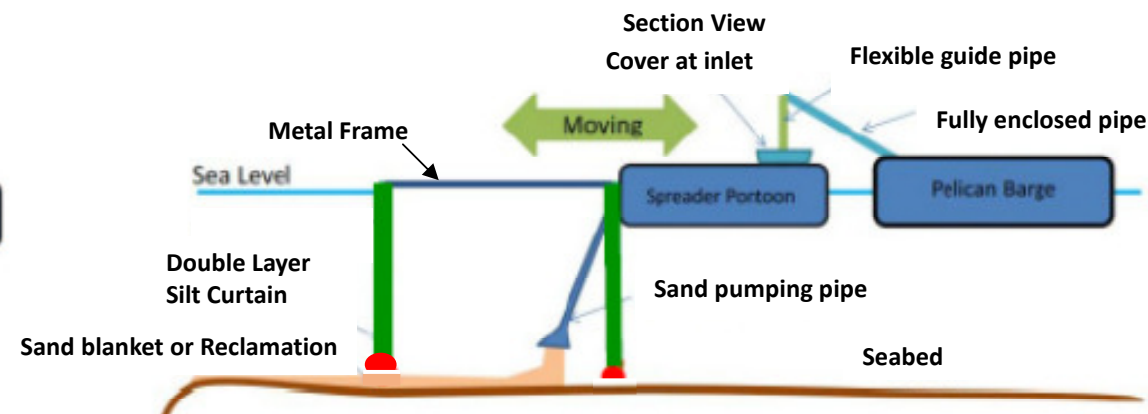
Typical Section of Cage Type Silt Curtain – Type 2 (for DCM Operation – Secondary Layer Silt Curtain)



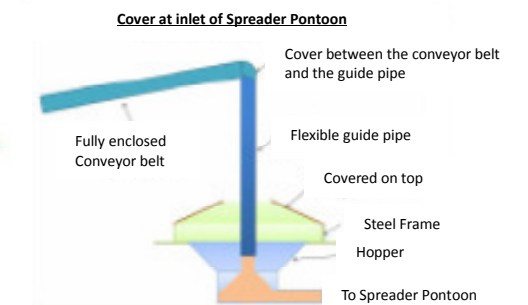
A



B



C



Typical Section of Cage Type Silt Curtain – Type 4 (for Spreader Pontoon and sand pumping barge using sand pumping pipe)



Contract No. EP/SP/66/12
Integrated Waste Management Facilities, Phase 1

Appendix G

Silt Curtain Inspection Checklist

Contract No.: EP/SP/66/12
 Project Title: Integrated Waste Management Facilities, Phase 1

Client: Environmental Protection Department
 Consultant: AECOM
 Main Contractor: Keppel Seghers – Zhen Hua Joint Venture

Silt Curtain Daily Inspection Checklist

Silt Curtain ID: _____
 Location: _____
 Inspection Date and Time: _____

Item	Description	Condition		Immediate Action Required?*		Target Rectification Date	Remarks
		Yes	No	Yes	No		
1	No any floating debris / refuse within silt screen / curtain?						
2	Supporting frame / buoys in good condition?						
3	Tying rope in good condition?						
4	Geotextile intact and in good condition?						
5	Sinkers in good condition?						
6	No any obstruction to water flow between geotextile?						

Checked by: _____
 On behalf of KSZHJV

Noted by: _____
 On behalf of AECOM

*Note: For silt curtain with defects which need to be rectified immediately, related marine works have to be stopped until rectification works are completed to the satisfaction of the Supervising Officer

Contract No.: EP/SP/66/12
 Project Title: Integrated Waste Management Facilities, Phase 1

Client: Environmental Protection Department
 Consultant: AECOM
 Main Contractor: Keppel Seghers – Zhen Hua Joint Venture

Diver Inspection Checklist for Silt Curtain

Silt Curtain ID: _____
 Location: _____
 Inspection Date and Time: _____

Item	Description	Condition		Immediate Action Required?*		Target Rectification Date	Remarks
		Yes	No	Yes	No		
Part A - Geotextile							
1	Curtain remains intact and without gap						
2	Curtain in upright position						
3	Curtain has no loose / flapping parts						
4	Curtain is securely attached at joints						
5	Curtain fittings (e.g. chains, bands, plates, joint connectors etc.) are intact and in position						
6	Curtain extends to within 30cm from seabed level (for floating type)						
7	Curtain hem is not weighted down by sediment deposition						

Item	Description	Condition		Immediate Action Required?*		Target Rectification Date	Remarks
		Yes	No	Yes	No		
Part B - Ancillary Components							
1	Anchors are undamaged and positions are correct						
2	Anchor lines are properly attached to the buoys / connectors of the silt curtain						
3	No parts are detached from the silt curtain						

Checked by: _____
On behalf of KSZHJV

Noted by: _____
On behalf of AECOM

*Note: For silt curtain with defects which need to be rectified immediately, related marine works have to be stopped until rectification works are completed to the satisfaction of the Supervising Officer



Contract No. EP/SP/66/12
Integrated Waste Management Facilities, Phase 1

Appendix H

Sample Record Sheet

DCM Water Quality Monitoring Data Record Sheet

Location			
Date			
Start Time (hh:mm)			
Weather			
Sea Conditions			
Tidal Mode			
Current Velocity			
Current Direction			
Water Depth (m)			
Monitoring Results		1 st reading	2 nd reading or Duplicate
Dissolved Oxygen	mg/L		
Dissolved Oxygen Saturation	%		
pH			
Turbidity	NTU		
Temperature	° C		
Total Alkalinity	mg/L		
Suspended Solids	mg/L		
Observed construction activities	<100m from location		
	>100m from location		
Other Observations			

Name & Designation

Signature

Date

Recorded by: _____

Checked by: _____



Contract No. EP/SP/66/12

Integrated Waste Management Facilities, Phase 1

Appendix I

Implementation Schedule

Implementation Schedule for DCM Works

Supporting Document for Application of VEP Ref. No. / EIA Ref	Current Plan Ref. No.	Environmental Protection Measures / Mitigation Measures	Location / Timing	Implementation Agent	Implementation Stages*			
					Des	C	O	Dec
3.2.2.3 – 3.2.2.9	2 – 6, Appendix D	<p><u>Measures to reduce Possible Sediment and Contaminant Release from DCM</u></p> <ul style="list-style-type: none"> Using of bottom dumping method for laying sand blanket Sand blanket shall be at least 2m thickness placed on top of the marine sediment prior to the DCM treatment No DCM works shall be carried out within 100m to the nearest non-translocatable coral colony / colonies Silt curtain should be employed to enclose DCM field trial and any DCM work Two layers of double floating type silt curtain shall be installed in the vicinity of coral colonies 	IWMF Site	KSZHJV		√		
7b.8.3.16 – 7b.8.3.30 (EIA Ref.)	11	<p><u>Monitored exclusion zones</u></p> <ul style="list-style-type: none"> During the installation / re-installation / relocation process of floating type silt curtains, in order to avoid accidental entrance and entrapment of marine mammals within the silt curtains, a monitored exclusion zone of 250m radius from silt curtain 	IWMF	KSZHJV		√		

		<p>should be implemented. The exclusion zone should be closely monitored by an experienced marine mammal observer at least 30 minutes before the start of installation / re-installation / relocation process. If a marine mammal is noted within the exclusion zone, all marine works should stop immediately and remain idle for 30 minutes, or until the exclusion zone is free from marine mammals.</p> <ul style="list-style-type: none"> • The experienced marine mammal observer should be well trained to detect marine mammals. Binoculars should be used to search the exclusion zone from an elevated platform with unobstructed visibility. The observer should also be independent from the project proponent and has the power to call-off construction activities. • In addition, as marine mammals cannot be effectively monitored within the proposed monitored exclusion zone at night, or during adverse weather conditions (i.e. Beaufort 5 or above, visibility of 300 meters or below), marine works should be avoided under weather conditions with low visibility. 						
4.3.3.1	2 – 6, Appendix D	<p><u>Measures on prevent deterioration on water aspect</u></p> <ul style="list-style-type: none"> • Deployment of silt curtains is required for laying sand blanket, laying rock and during DCM works 	IWMF	KSZHJV		√		

Note: * - Des – Design; C – Construction; O – Operation; Dec - Decommissioning

Figure 1

Monitoring Stations for DCM Works (Baseline and Regular DCM Monitoring)

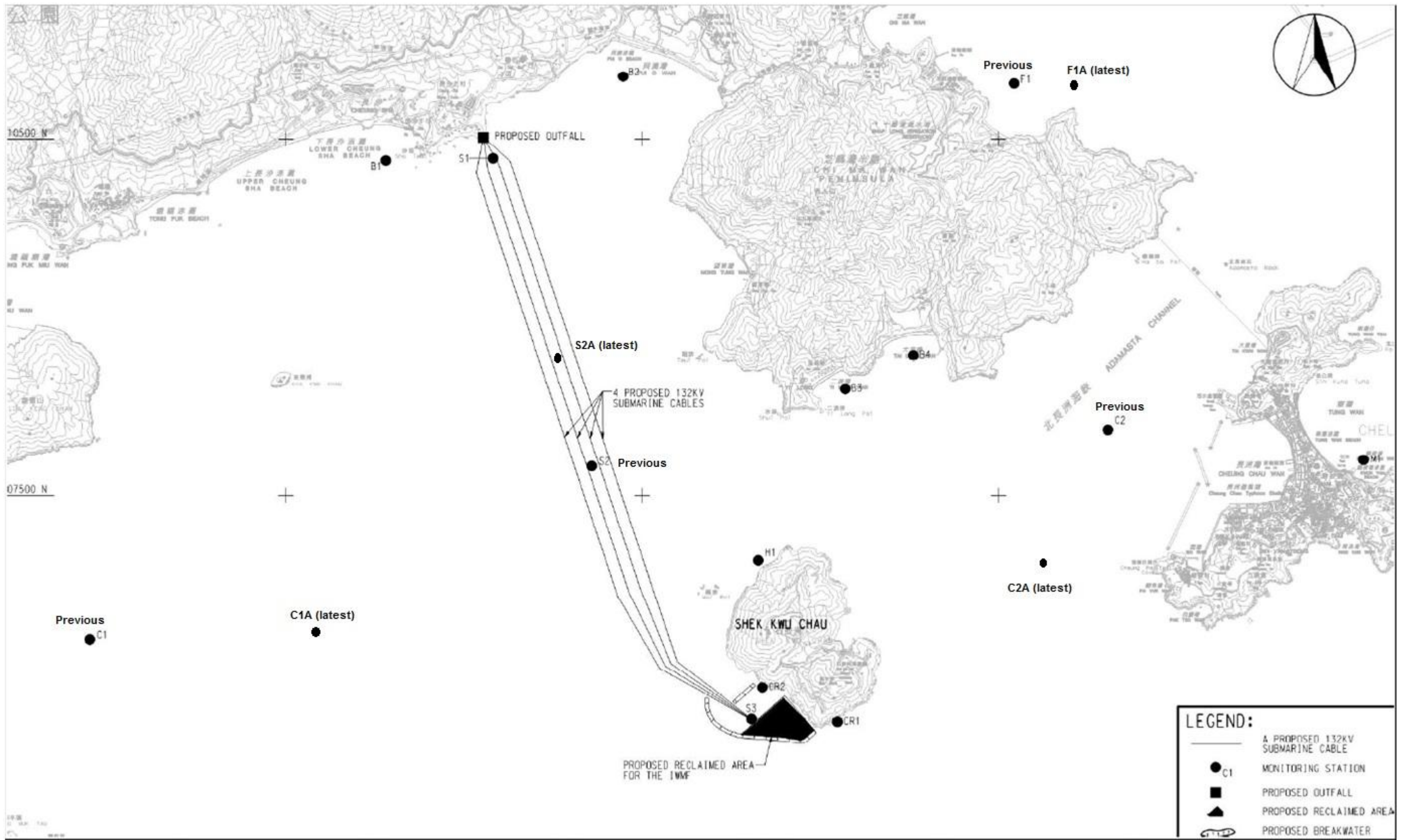


Figure 1 Monitoring Stations for DCM Works (Baseline and Regular Monitoring)

Figure 2

Monitoring Station Arrangement for Initial Intensive DCM Monitoring

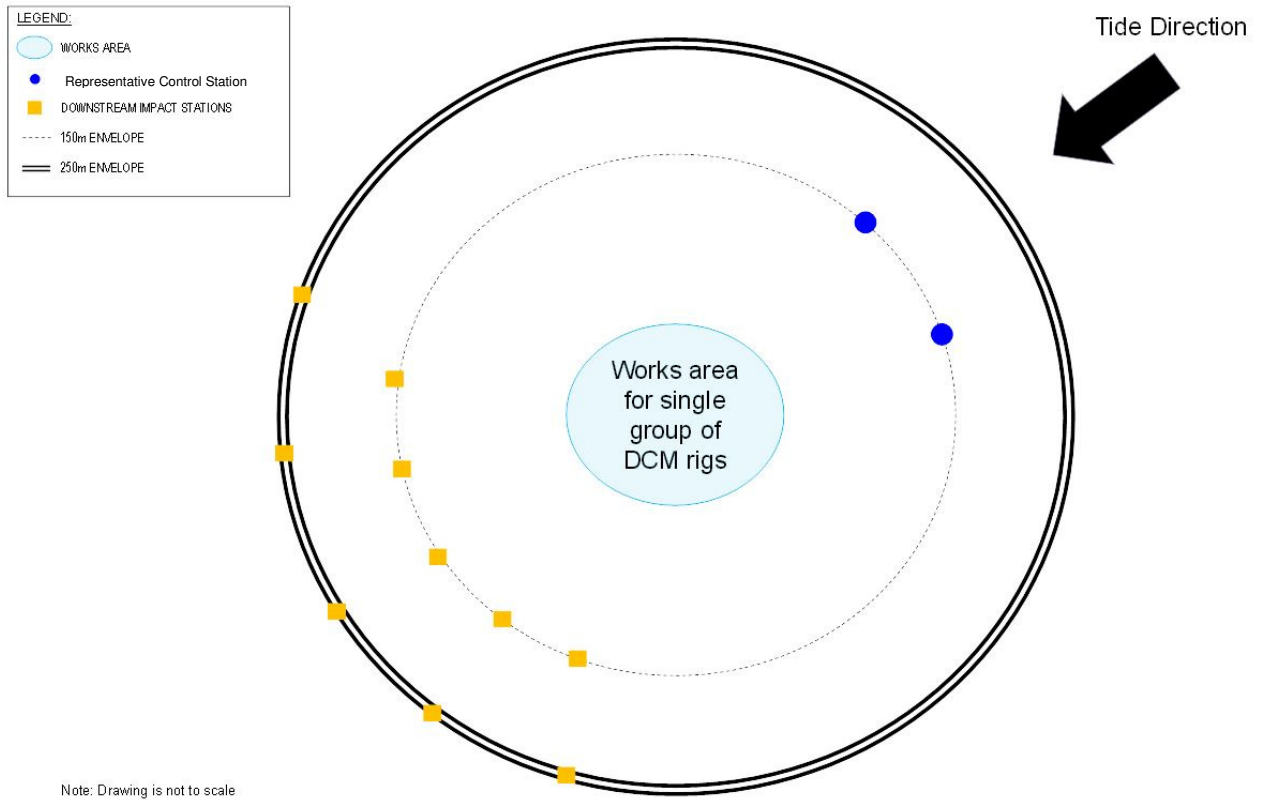


Figure 2 Monitoring Station Arrangement for Initial Intensive DCM Monitoring