

**The proposal of Further Development on Treatment Level / Details  
and the Reuse Mode for Marine Sediment has been reviewed and  
certified by  
the Environmental Team Leader (ETL)  
In accordance with S10.5.1.7 of EIA Report and  
Condition 1.9 of EP-489/2014.**

**Certified by:**

A handwritten signature in black ink, appearing to read 'Terence Kong', written in a cursive style.

---

Terence Kong

Environmental Team Leader (ETL)  
Mott MacDonald Hong Kong Limited

Date

17 January 2020



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By Email

Airport Authority Hong Kong  
HKIA Tower, 1 Sky Plaza Road  
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Lantau, Hong Kong

Attn: Mr. Lawrence Tsui, Principal Manager

17 January 2020

Dear Sir,

**Contract No. 3102**  
**3RS Independent Environmental Checker Consultancy Services**

**The Proposal of Further Development on Treatment Level / Details and the Reuse Mode for Marine Sediment**

Reference is made to the submission of the Proposal of Further Development on Treatment Level / Details and the Reuse Mode for Marine Sediment mentioned in Section 10.5.1.7 of the Environmental Impact Assessment Report and Section 4.1 of the Waste Management Plan. The proposal was certified by the ET Leader on 17 January 2020.

We would like to inform you that we have no adverse comment on the captioned proposal. Therefore we write to verify the captioned submission in accordance with the requirement stipulated in Condition 1.9 of EP-489/2014.

Should you have any query, please feel free to contact the undersigned at 3922 9376.

Yours faithfully,  
AECOM Asia Co. Ltd.

Jackel Law  
Independent Environmental Checker

# **Expansion of Hong Kong International Airport into a Three-Runway System**

## **FURTHER DEVELOPMENT ON TREATMENT LEVEL / DETAILS AND THE REUSE MODE FOR MARINE SEDIMENT**

### **1. Background**

All land formation works under the 3RS Project are carried out by non-dredge methods as described in the approved 3RS EIA Report (S10.4.1.23 refers) and EP condition 2.31(i). Apart from land formation works, the approved 3RS EIA Report also described a number of construction activities that involve excavation of marine sediment (S10.4.1.25 refers) which include but not limited to:

- Diversion of the submarine 11kV cable – the field joint area;
- Foundation piling works within the proposed land formation area (after land formation);
- Piling works for the marine sections of the new approach lights required at either end of the proposed third runway;
- Piling works for the proposed Hong Kong International Airport Approach Area (HKIAAA) beacons;
- Basement work for the proposed T2 expansion; and
- Excavation works for the proposed APM depot.

It should be noted that the submarine 11kV cable diversion work was completed in May 2017 and no marine sediment was generated from the works.

For marine sediment to be generated from 3RS Project, it is proposed to adopt the following criteria for the reuse of marine sediment:

### **2. Review of On-site Reuse Criteria of Excavated Marine Sediment**

As described in the approved 3RS EIA Report (S10.4.1.36 and S10.5.1.7 refer), the handling of excavated marine sediment is summarized as follows:

- Treatment by cement mixing and stabilization;
- The treated sediment will be tested against certain relevant treatment criteria, including Risk Based Remediation Goals (RBRGs), Toxicity Characteristics Leaching Procedure (TCLP), and Unconfined Compressive Strength (UCS) before reuse; and
- On-site reuse of treated sediment as backfilling materials.

Also described in S10.5.1.7 of the approved 3RS EIA Report, the treatment level / details and the reuse mode of the excavated sediment is subject to further development during the detailed design stage. In this regard, a detailed review of the EIA requirements, RBRGs, TCLP and relevant technical circulars is conducted by AAHK, ET and IEC on the on-site reuse criteria of excavated sediment under the 3RS Project.

The nine heavy metals contaminants listed in *PNAP ADV-21 Management Framework for Disposal of Dredged/Excavated Sediment* (April 2007), namely Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Zinc, Silver and Copper were identified as the contaminants of concern for the excavated sediment under the 3RS Project during the EIA Stage as disposal of marine sediment was anticipated, and these nine heavy metals are the common contaminants present in marine sediment and required to be tested for classification of sediment in accordance with *PNAP ADV-21* for marine disposal. Among these nine heavy metals, the proposed reuse criteria for eight of them (namely Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Zinc and Copper) are the TCLP limits recommended in Table 10.20 of the approved 3RS EIA Report (which was referring to EPD's *Practice Guide for Investigation and Remediation of Contaminated Land* (hereafter referred to as *Practice Guide*)).

## 2.1 Reclaimed Land Area with Ground Improvement Works by Deep Cement Mixing

As the marine sediment generated from the areas with ground improvement works of the 3RS Project is already treated in-situ with cement by deep cement mixing, and the concerned sediment materials are to be excavated on newly formed lands and re-use on land without disposal at sea, it is considered more appropriate to have the excavated materials tested against RBRGs. Therefore, as an alternative to the testing arrangement presented in the 3RS EIA Report, it is proposed to adopt the assessment approach provided in the *Practice Guide*. The quality of excavated marine sediment will be assessed against the most stringent RBRG limits (for Rural Residential Land Use) for eight heavy metals including Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Zinc and Copper as list in **Table 1**. This approach would allow early assessment of the site before excavation and planning ahead on the logistics of marine sediment treatment arrangements, i.e. size of treatment area/facility and stockpiling area for air curing, based on the volume of marine sediment that required to be treated as the contamination level of concerned metals can be determined at the early stage.

**Table 1 Proposed RBRGs for Testing Marine Sediment**

Chemical	RBRGs for Soil – Rural Residential (mg/kg)
Arsenic	21.8
Cadmium	72.8
Chromium III	10000
Chromium VI	218
Lead	255
Mercury	6.52
Nickel	1460
Zinc	10000
Copper	2910

Silver is excluded from the above table because it is not considered as a contaminant of concern for reuse of treated sediment for 3RS Project. Having reviewed the marine sediment testing results provided in the EIA Report, there was only one sampling location, AV11, with an exceedance in the Upper Chemical Exceedance Level (UCEL) of 2 mg/kg, and three sampling locations, namely TC7A, TC9A and TC16A, exceeded the Lower Chemical Exceedance Level (LCEL) of 1 mg/kg. The location of AV11 is at the eastern corner of the proposed third runway and TC7A is outside the footprint of the proposed Third Runway Concourse (TRC). No marine sediment will be excavated from these two locations. Although, the silver concentrations of the marine sediment sample at TC9A and TC16A were above LCEL, they were below the UCEL. From the hazards point of view, metallic silver is considered to be with low toxic risk through dermal contact, ingestion and inhalation of silver compounds<sup>1</sup>. In addition, there is no RBRG limit for silver in soil and groundwater under the Guidance Manual for Use of RBRGs for Contaminated Land Management. Therefore, silver should not be a key concern in land contamination in Hong Kong. In addition, as cement stabilization would immobilize metal contamination, it is anticipated that the silver content of treated sediment materials in the DCM treated area would be significantly stabilized after treatment and would not cause any land contamination on the environment.

Following the approach, if an exceedance in RBRGs is found for a particular heavy metal, the sediment which has been already treated with cement by DCM, depending on conditions, will undergo further cement stabilization or other suitable treatment if necessary, before testing against the TCLP limit for the concerned heavy metal (with RBRG exceedance) as provided in Table 4.6 of the *Practice Guide*.

The total area of reclaimed land is about 650 hectare. Within the reclamation area, a substantial portion of the area has now been treated with Deep Cement Mixing (DCM) as part of the ground improvement works (**Figure 1**). Site investigation works will be undertaken before the actual marine sediment

<sup>1</sup> Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66:2008 Volume 1, Environment Agency, UK

excavation work to determine the presence and extent of contamination on site and the treatment target where applicable for the reuse of marine sediment. The area with marine sediment to be excavated is estimated to be 410,000 m<sup>2</sup>. With reference to the *Practice Guide*, a sampling grid size of 100 m x 100 m will be adopted for locating sampling points for areas where marine sediment to be excavated is over 90,000 m<sup>2</sup>. A sampling point will be located within each sampling grid. The thickness of marine sediment is estimated to range from about 15 – 30 m and varies over the reclamation area. The DCM method is to slowly inject and mix cement slurry into the marine mud using mixing blades. After DCM process, the vertical distribution of contaminants of the DCM materials if any will be homogeneous. In this regard, it is proposed to have three-tier sampling strategy depending on the depth of marine sediment to be excavated. One marine sediment sample will be taken if the depth of marine sediment to be excavated is less than or equal to 3 m. If the depth of marine sediment to be excavated is less than or equal to 6 m, a sample will be taken from the depth of 0 – 3 m, and 3 – 6 m. If the marine sediment to be excavated is more than 6 m, a sample will be taken from three different depths including one in the depth of 0 – 3 m, 3 – 6 m, and 6 m to the bottom of the marine sediment to be excavated. The actual sampling depth will be determined by the AAHK's engineer on-site during the sampling works.

If the testing results are below the RBRG limits, no further treatment will be required for the marine sediment materials excavated from the sampling grid. As the excavation areas have been treated with DCM for the marine sediment layers under ground improvement work, the excavated sediment materials from original marine sediment layers have been undergone in-situ cement solidification and stabilization. In general, if there is RBRG exceedance in a particular heavy metal at a certain sampling depth, subsequently during work stage, excavated sediment material from such sampling depth of the concerned sampling grid which has been already treated with cement by DCM, depending on conditions, will undergo further cement stabilization or other suitable treatment if necessary, before testing against the concerned heavy metal (metal parameter exceeded RBRG) for TCLP with limits as provided in **Table 2** (Table 4.6 of the *Practice Guide*) before reuse. Only excavated sediment materials from such sampling depth with exceedance of RBRG will be handled and tested against the concerned heavy metal for TCLP and UCS within the concerned sampling grid. The UCS will be defined based on respective engineering requirements.

**Table 2 Universal Treatment Standards for On-site Reuse of Sediment Treated by Cement Mixing and Stabilization**

Parameters <sup>(1)(2)</sup>	TCLP Limit (mg/L)
Arsenic	5
Cadmium	0.11
Total Chromium	0.6
Lead	0.75
Mercury	0.025
Nickel	11
Zinc	4.3

Note:

- (1) Universal Treatment Standard – US 40 CFR 268.48
- (2) For copper, it must be reduced by at least 90% in mobility for copper through cement stabilization/solidification remedial treatment. The reduction of mobility of copper (leachable metals contaminant) should be confirmed through TCLP tests (i.e. to carry out TCLP test for the untreated sediment and for the sediment after treatment and to compare the concentrations of copper in the leachates).

The testing frequency for TCLP will be the same as that described in the approved 3RS EIA Report (S10.5.1.14 refers), i.e. one sample per 50 m<sup>3</sup> for the first 1,000 m<sup>3</sup> batch of excavated sediment materials. Provided that the samples meet the TCLP limit(s), the subsequent testing frequency will be reduced to be at least two samples per 10,000 m<sup>3</sup> batch. In the event that the required level is not achieved, the concerned whole batch should be crushed and the material would be further handled and treated as necessary. The testing frequency should be revised to one sample per 50 m<sup>3</sup> batch (with two further samples kept for contingency) and treated samples should be taken for laboratory testing.

Once the concerned heavy metal complies with the particular TCLP limit, the previous sampling frequency of at least two samples per 10,000 m<sup>3</sup> batch should be resumed.

Tentative sampling grids of 100 m x 100 m for the area where marine sediment is to be excavated from the newly reclaimed land are shown in **Appendix A**. One sampling location will be located in each sampling grid and the exact sampling location together with the sampling grids will be finalised at a later stage when engineering details are confirmed.

According to the EIA Report, there is only one sample (at a depth of 2.90 – 3.90 m from TC9A) with high molecular weight PAH exceeding the LCEL. No exceedance in PAH was found at nearby sampling locations. TC9A is located at the footprint of the western portion of TRC where marine sediment will be excavated. Therefore, during the construction phase, it is proposed to use TC9A as the centre of the sampling grid of 100 m x 100 m as shown in **Figure 2** and take samples at the location of TC9A for testing against the most stringent RBRGs (Rural Residential) for metals (as listed in **Table 1**) and semi-volatile organic compounds (SVOCs) as provided in Table 2.1 of the *Guidance Manual for Use of Risk-Based Remediation Goals for Contaminated Land Management*. The sampling depths are the same as those proposed above. If the testing results are below the RBRG limits for metals, no further treatment will be required for the marine sediment excavated from the sampling grid. If there is a RBRG exceedance in any of metals, excavated sediment materials from such sampling depth of the concerned sampling grid which have been already treated with marine sediment by DCM, depending on conditions, will undergo further cement stabilization or other suitable treatment if necessary, before testing against the concerned heavy metal (metal parameter exceeded RBRG) for TCLP with limits as provided in **Table 2**. The treated sediment materials should be complied with the TCLP limit of the concerned metal(s) before reuse. The testing frequency for TCLP will be the same as that described in the approved 3RS EIA Report (S10.5.1.14 refers). According to S10.5.1.15 of the approved EIA Report, if there is an exceedance of the RBRGs in SVOCs, the marine sediment will require extra treatment such as air purging or bio-pile to achieve compliance with the RBRGs prior to on-site reuse. After formation of bio-pile, soil samples will be taken monthly at one sample per 20 m<sup>3</sup> for the analysis of pH, moisture content and the concerned SVOCs with exceedance. Soil sampling from bio-pile will be accomplished using the hand-driven sampler.

## 2.2 Existing Airport Island Areas and Approach Light Areas

For the marine sediment to be generated from the existing airport island and approach light areas, the excavated marine sediment will be treated with cement and tested against the TCLP limits as provided in **Table 2**. The testing frequency will be the same as that described in the approved 3RS EIA Report (S10.5.1.14 refers). The treated sediment will also be tested against relevant engineering requirements to confirm their suitability as backfilling material for respective areas of different future uses. The UCS will be tested and defined based on respective engineering requirements.

## 2.3 Areas for Reuse of Treated Sediment

The treated sediment will be reused within 3RS project area. The indicative areas where treated sediments will be reused are shown in **Figure 3**.

## **3. General Arrangement for the Proposed Cement Stabilization Treatment Method**

At this stage, two methods of cement stabilization treatment have been proposed by the Contractor. The first one is the pug-mill type mixing facility. The other method is to use a mechanical rota-blade fixed to driven mechanical plant for mixing cement and marine sediment. The marine sediment will be spread out over a large area in a relatively thin layer and the sand/cement stabilization mixed by driving over the area with the rota-blade. Pilot trial mixes will be carried out to select an appropriate treatment method.

Mitigation measures as recommended in S10.5.1.17 of the approved EIA Report will be implemented during excavation and treatment of the sediment:

- Cement mixing process should be enclosed in order to minimize odour/ dust emissions;
- The loading, unloading, handling, transfer or storage of treated and untreated sediment should be carried out in such a manner to prevent or minimize dust emissions;

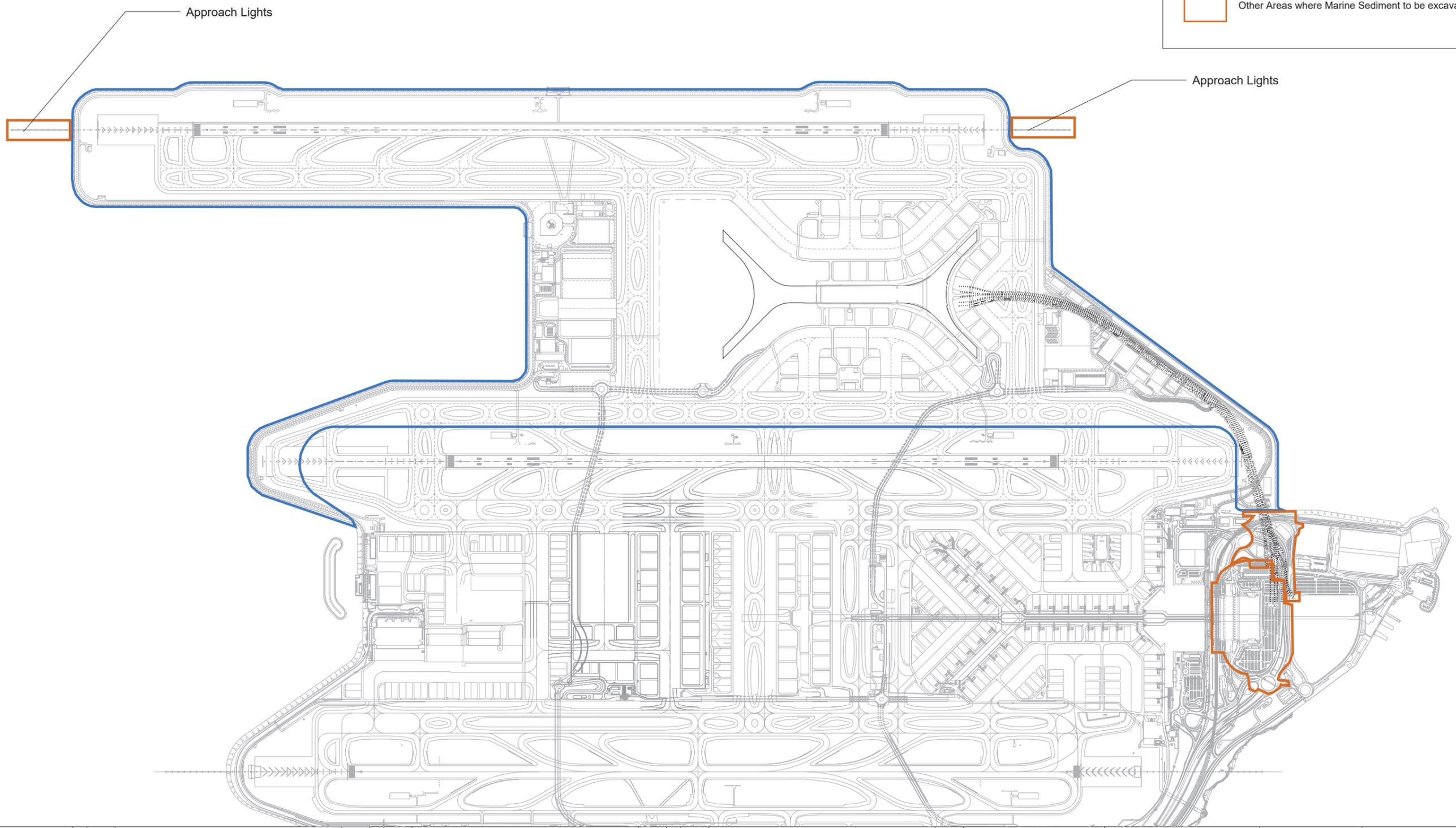
- All practical measures, including but not limited to speed control for vehicles, should be taken to minimize dust emission;
- Good housekeeping should be maintained at all times at the sediment treatment facility and storage area;
- Treated and untreated sediment should be clearly separated and stored separately; and
- Surface runoff from the enclosed area should be properly collected and stored separately, and then properly treated to levels in compliance with the relevant effluent standards as required by the Water Pollution Control Ordinance before final discharge.

As the works progress, if there is any changes on the arrangement of marine sediment sampling and treatment, the Contractor is required to submit a proposal to ET and IEC for agreement.

**Figure 1 – Areas of Marine Sediment to be Excavated on Reclaimed Land and Other Areas**

**LEGEND:**

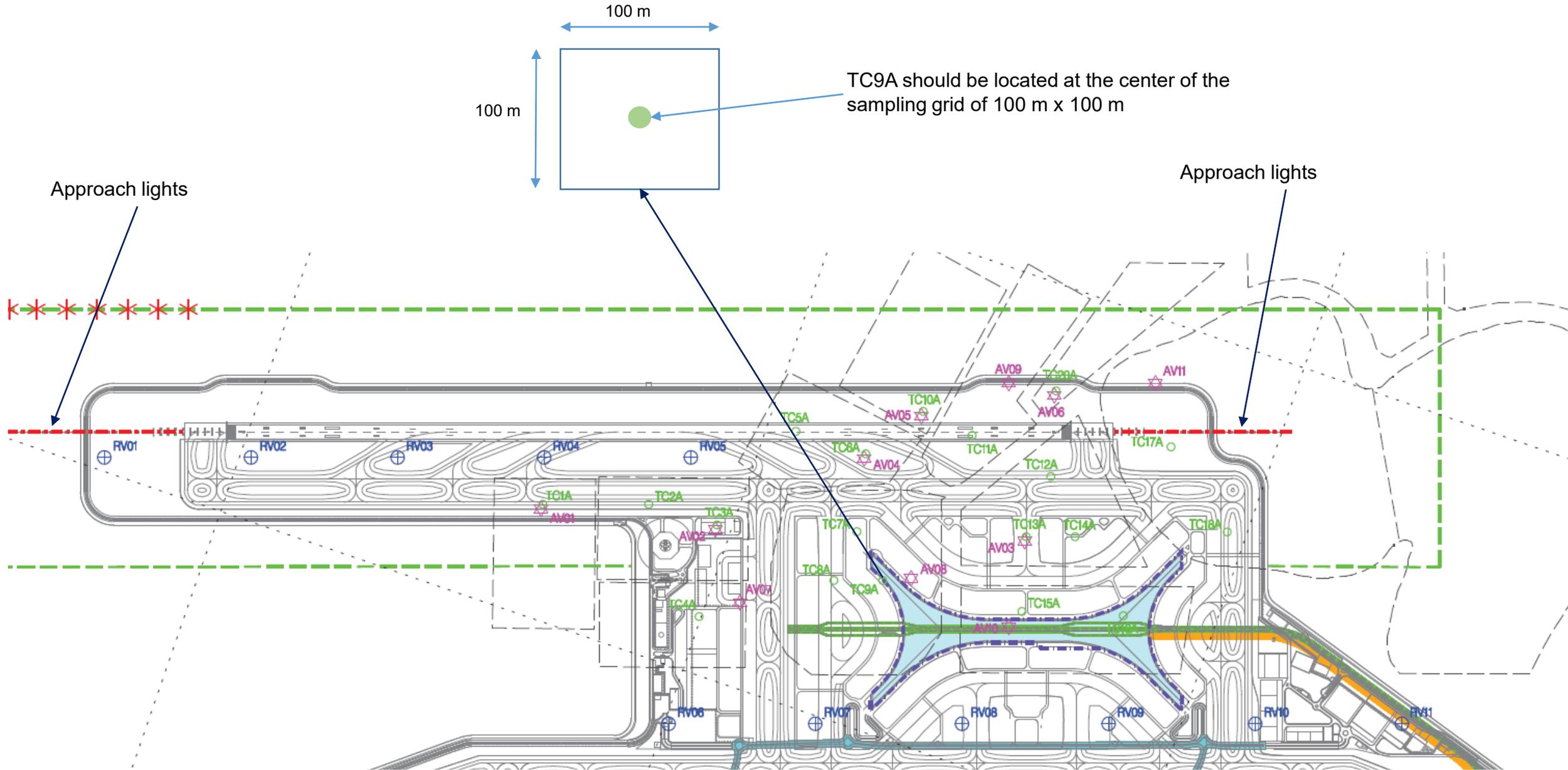
- Reclaimed Land Area with Ground Improvement Works (Deep Cement Mixing) where Marine Sediment to be excavated
- Other Areas where Marine Sediment to be excavated



<p>Notes:</p> <ol style="list-style-type: none"> <li>1. Measurements are based on metric system.</li> <li>2. All levels are in metres to Principal Datum (mPD) unless noted otherwise.</li> <li>3. Do not scale drawings.</li> <li>4. Figure dimensions are to be followed.</li> <li>5. Do not use for construction unless expressly permitted.</li> <li>6. The Contractor shall verify all conditions on the site &amp; notify the Employer's Representative of any variations from dimensions before construction.</li> </ol> <p>Copyright in this document and all proprietary rights in the information it contains belong to the AA. It is a condition of the supply of this document, in whatever form, that the recipient shall not, in whole or in part, nor disclose its contents without the written consent of the AA.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rev.</th> <th>Date</th> <th>Description</th> <th>Checked</th> <th>Rev.</th> <th>Date</th> <th>Description</th> <th>Checked</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>25/11/2019</td> <td>FIRST ISSUE</td> <td>T.WAN</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Rev.	Date	Description	Checked	Rev.	Date	Description	Checked	A	25/11/2019	FIRST ISSUE	T.WAN					<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Checked</th> <th>Rev.</th> <th>Date</th> <th>Description</th> <th>Checked</th> <th>Rev.</th> <th>Date</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Checked	Rev.	Date	Description	Checked	Rev.	Date	Description									<p>Signatures for Approval</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Drawn</td> <td>Date</td> <td>Design</td> <td>Date</td> </tr> <tr> <td>Checkers</td> <td>Date</td> <td>Per Date</td> <td>25/11/2019</td> </tr> <tr> <td>Design Supervisor</td> <td colspan="3">Date</td> </tr> <tr> <td>Authorized Representative</td> <td colspan="3">Date</td> </tr> </table>	Drawn	Date	Design	Date	Checkers	Date	Per Date	25/11/2019	Design Supervisor	Date			Authorized Representative	Date			<p>Key Plan</p>	<p>Hong Kong International Airport</p> <p>香港國際機場 HONG KONG INTERNATIONAL AIRPORT</p> <p>Airport Authority: HKA   Tower: 1 Sky   Kowloon Road, Hong Kong International Airport, Lantau, Hong Kong Tel: 852 2388 7711</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Scale</th> <th>Zone</th> <th>Drawing No.</th> <th>Design No.</th> <th>Location</th> <th>Check No.</th> <th>Page</th> <th>Number</th> <th>Revision</th> </tr> <tr> <td>1: 7000 (in A0)</td> <td>XXXX</td> <td>TRD/A3000/AA-XX/EV-SK/DR/000006</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>A</td> </tr> </table>	Scale	Zone	Drawing No.	Design No.	Location	Check No.	Page	Number	Revision	1: 7000 (in A0)	XXXX	TRD/A3000/AA-XX/EV-SK/DR/000006						A
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# Figure 2 - Sampling grid for TC9A



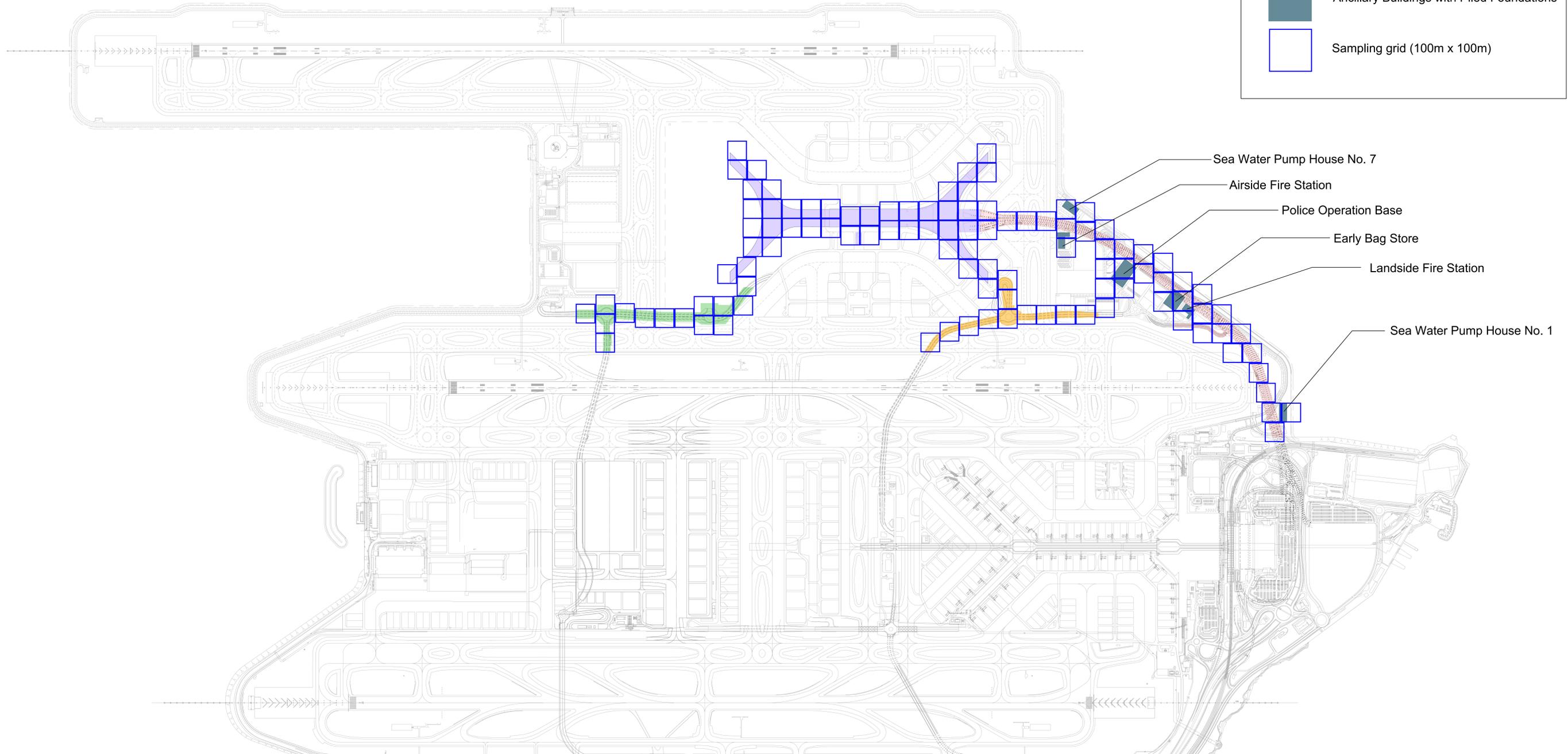


**Appendix A**  
**Tentative Sampling Grids for Piling**  
**/Excavation Areas on Reclaimed**  
**Land Area with Ground**  
**Improvement Works by DCM**

# Appendix A - Tentative Sampling Grids for Piling / Excavation Areas on Reclaimed Land Area with Ground Improvement Works by DCM

## LEGEND:

- Third Runway Concourse
- APM / BHS Tunnel
- Eastern Vehicular Tunnel
- Western Vehicular Tunnel
- Ancillary Buildings with Piled Foundations
- Sampling grid (100m x 100m)



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