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8. LAND CONTAMINATION

8.1 Introduction

8.1.1.1 Section 8 of the EIA Report presents potential land contamination implications associated with the Project. Land contamination implications were assessed in accordance with Section 3.4.8 and Appendix G of the EIA SB (No. ESB-340/2021).

8.2 Environmental Legislations, Standards and Guidelines

8.2.1.1 Relevant environmental legislation guidelines and standards relating to land contamination include:

(a) Section 3 (Potential Contaminated Land Issues) of Annex 19 “Guidelines for Assessment of Impact on Sites of Cultural Heritage and Other Impacts” of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

(b) Guidance Note for Contaminated Land Assessment and Remediation (Guidance Note)

This Guidance Note sets out the requirements for the proper assessment and management of potentially contaminated sites such as oil installations (e.g. oil depots, petrol filling stations), gas works, power plants, shipyards / boatyards, chemical manufacturing / processing plants, steel mills / metal workshops, car repairing / dismantling workshops and scrap yards. In addition, this Guidance Note provides guidelines on how site assessments should be conducted and analysed and suggests practical remedial measures that can be adopted for the remediation of contaminated sites.

(c) Practice Guide for Investigation and Remediation of Contaminated Land (Practice Guide)

This guide outlines typical investigation methods and remediation strategies for the range of potential contaminants typically encountered in Hong Kong.

(d) Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management (Guidance Manual)

This Guidance Manual introduces the risk-based approach in land contamination assessment and provides details for the comparison of soil and groundwater data under Risk-Based Remediation Goals (RBRGs) for 54 chemicals of concern (COCs) commonly found in Hong Kong. The RBRGs were derived to suit Hong Kong conditions by following the international practice of adopting a risk-based methodology for contaminated land assessment and remediation; and were designed to protect the health of people who could potentially be exposed to land impacted by chemicals under four broad post restoration land use categories. The RBRGs also serve as the remediation targets where remediation is necessary.

8.3 Assessment Methodology

8.3.1.1 Land contamination assessment was undertaken in accordance with the EIAO-TM, Guidance Note, Practice Guide and Guidance Manual, and the requirements stated in Section 3.4.8 and Appendix G of the EIA Study Brief.

8.3.1.2 The following tasks were undertaken to identify any potentially contaminated areas for the purpose of land contamination assessment:

(a) Desktop review of site history; and

(b) Site reconnaissance to identify the potentially contaminated sites.

8.3.1.3 For the desktop review, the following information was reviewed:

(a) Topographic maps and relevant aerial photographs (Lands Department);

- (b) Revised Recommended Outline Development Plan;
- (c) Hong Kong Geological Survey maps;
- (d) Geospatial Data accessed via the Public Sector Information Portal (data.gov.hk),
- (e) Records of dangerous goods and chemical spillage/leakage incidents (Fire Services Department)
- (f) Chemical waste producer register and chemical spillage/leakage incidents (Environmental Protection Department),
- (g) Relevant EIA reports and Project Profiles (<https://www.epd.gov.hk/eia/>)

8.3.1.4 Potentially contaminated sites were identified from the desktop review and site reconnaissance. Potentially contaminated sites are presented in the Contamination Assessment Plan (CAP) in Appendix 8.1.

8.3.1.5 With reference to the Preliminary Feasibility Study on Developing the New Territories North and the Geochemical Atlas of Hong Kong published by the Geotechnical Engineering Office Civil Engineering Department in 1999; natural occurrences of medium to high levels of arsenic, antimony and lead exist over broad areas of the northern New Territories. The Preliminary Feasibility Study indicates the highest levels of arsenic are recorded in the Lok Ma Chau (117- 492 ppm) and Ngau Tam Mei (118-922 ppm) areas. The Geochemical Atlas indicates that strong arsenic anomalies are influenced by anthropogenic contamination superimposed on a high natural background level.

8.3.1.6 As mapped information in the Geochemical Atlas of Hong Kong is based on concentrations interpolated from stream sediment sampling rather than soil sampling, a separate assessment as to whether high levels of arsenic exist in soils within the Project area and any associated works area was undertaken. The Health Impact Assessment relating to arsenic in soil is provided in Appendix 8.2.

8.4 Description of Environment

8.4.1.1 The Project occupies approximately 610ha. and is located to the west of Kwu Tung North and Fanling North New Development Areas (NDAs), Fanling and Sheung Shui New Towns and to the northeast of Yuen Long and Tin Shui Wai New Towns. It is based on the Project boundary in the Revised Recommended Outline Development Plan (RODP). The location plan of the Project is provided in Figure 2.1.

8.5 Identification of Potential Land Contamination Concern

8.5.1 Review of Historical Land Uses

8.5.1.1 The development history of the Project area was reviewed using aerial photographs covering the period 1963 – 2022. Potentially contaminated sites were identified on the current land use topographic map with the data is superimposed on selected aerial photography as presented as in Appendix A of Appendix 8.1. Historical land use within the Project area is summarised in **Table 8-1**.

Table 8-1 Historical Land Use within the Project Area

Year	Historical Land Uses
1963	<ul style="list-style-type: none"> The majority of the Project area comprised natural terrain, rural residential areas, fishponds and agricultural land. Castle Peak Road is identified.
1973	<ul style="list-style-type: none"> No significant change in land use in comparison with 1963.
1982	<ul style="list-style-type: none"> No significant change in land use in comparison with 1963 and 1973 except some land formation in the western portion (near Hop Shing Wai)
1993	<ul style="list-style-type: none"> San Sham Road, San Tin Highway, San Tin Interchange and Lok Ma Chau Control Point are identified. Industrial activities (mostly open storage and container/trailer yards) were observed in the western and northern portions along Castle Peak Road and San Sham Road, and in the southern portion along Kwu Tung Road. A few more fishponds observed in the northern portion.
2002	<ul style="list-style-type: none"> Lok Ma Chau Control Point under expansion. The extent of industrial activities along Castle Peak Road and Kwu Tung Road increased
2006	<ul style="list-style-type: none"> Lok Ma Chau Spur Line was observed. Land use in the Project area similar to land use observed in the 2002 although the footprint of industrial activities increased.
2010	<ul style="list-style-type: none"> Some open storage and container/trailer yards were replaced by warehousing/logistic centres.
2014	<ul style="list-style-type: none"> Industrial activities (recycling yards, warehouses) increasingly observed in the southern portion near San Tin Barracks
2017	<ul style="list-style-type: none"> No significant change in land use in comparison to 2014.
2020	<ul style="list-style-type: none"> No significant change in land use in comparison to 2017.
2022	<ul style="list-style-type: none"> No significant change in land use in comparison to 2020.

8.5.2 Site Geology

- 8.5.2.1 Ground investigation (GI) works have been completed within the Project area for a variety of projects. Based on the existing GI records, fill deposits beneath developed areas vary in thickness from 1 m and 5 m. Much of the Project area is covered by terraced alluvium except for some areas in the northwest and southwest where outcrops of in-situ materials are exposed. The alluvium underlying the fill, marine deposits or pond deposits are variable in terms of their composition and typically described as soft to stiff sandy/silty clay and clayey silt, and loose to very dense sand and gravel with cobbles. The thickness of alluvium encountered within the Project area typically varies from 0.3 m to over 24 m. A layer of in-situ soil, predominately saprolite and in places Grade IV rock is located between the alluvium and rockhead. The predominant unit of the saprolite is Grade V materials derived from weathered rock. The thickness of saprolite varies from less than 1 m to over 115 m.
- 8.5.2.2 Based on the existing GI records the general geological sequence of the soil strata is described in the following **Table 8-2**.

Table 8-2 Description of Soil Strata

Stratum	Typical Descriptions	Approximate Strata Thickness (m)*
Fill	<ul style="list-style-type: none"> Consists of various materials including SILT, SAND with gravel, cobbles and in places clayey portions and locally with boulders Absent in undeveloped areas and natural hillsides 	0.4 to 14.5
Pond deposits (PD)	<ul style="list-style-type: none"> Anticipated in current and former ponds. Drillholes recording PD are mainly located at the Northern Project area DN and locally in the Southern Project area Where encountered, PD are generally soft to firm locally stiff silty CLAY/ clayey SILT, in places sandy or gravelly and with organic matter 	0.5 to 5.5
Estuarine deposits (ED)	<ul style="list-style-type: none"> Drillholes recording ED are generally located in the Northern part of the Project area Where encountered, ED are typically soft to firm locally stiff, slightly sandy to sandy silty CLAY in places with organic matter, sandy pockets or shell fragments locally 	0.5 to 9.1
Marine Deposits (MD)	<ul style="list-style-type: none"> Drillholes recording MD are generally located in the Northern part of the Project area Where encountered, it is generally overlain by fill, PD and/or ED, typically as very soft to firm locally stiff CLAY / silty CLAY in places with sandy portions, with shell fragments Lacustrine deposits, up to about 3.5m thick, is recorded locally at the ST Interchange area as soft CLAY / SAND 	0.5 to 15.5
Alluvial Deposits	<ul style="list-style-type: none"> Alluvium and terraced alluvium are anticipated at the original alluvial plains at the Southern Project area and the Northern Project area Where encountered, alluvium is generally highly variable and typically as soft to very stiff slightly sandy to sandy silty CLAY/ clayey SILT or loose to very dense silty/ clayey SAND, occasionally with gravelly and cobbly portions 	0.35 to over 56
Colluvium (COLL)	<ul style="list-style-type: none"> Anticipated at the foot of hillslopes within or near the eastern, southern and locally the western (near Hop Shing Wai) boundaries of the Project area. Where encountered, it is generally as firm slightly sandy to sandy SILT or silty SAND in places clayey, with gravels and occasionally cobbles and boulders 	0.4 to 23.1
In-situ Material above Rockhead	<ul style="list-style-type: none"> in-situ grade V materials are generally extremely weak to very weak in strength. Grade IV is generally very weak to moderately weak. Residual Soil (grade VI) material generally as firm to stiff slightly sandy to sandy clayey SILT is recorded locally at the Project area. Corestones and rocks not meeting the criteria of bedrock are recorded above the bedrock in the in-situ materials 	0.21 to 76.32

Note: * where encountered;

San Tin / Lok Ma Chau Development Node Setting

- 8.5.2.3 Based on a review of topographic survey plans, the Project area consists of low flat flood plains surrounded by natural terrain in the north, south and west. About 65% of the Project area is low-lying with gentle slope gradient less than 5°. The highest point in the vicinity is at about 250 mPD on the natural terrain at Yuen Tau Shan.
- 8.5.2.4 The existing ground levels of the Project area vary generally from approximately +2 mPD to +119 mPD with majority of the areas vary between +5 mPD and +15 mPD. The areas with existing ground levels lower than +6 mPD are generally located at the eastern part of the Project area and commonly along water courses. The areas with ground levels higher than 15 mPD are mainly located at the northwest and southeast of the Project area although local small hills with ground level over +15 mPD are also found at other parts of the Project area.
- 8.5.2.5 Groundwater level monitoring records from standpipes and piezometers in Geotechnical Assessment and Site Investigation Reports in the Project area were reviewed. Records show that the groundwater levels are generally shallow at about 2 m below the ground surface in flat land. No groundwater monitoring records were reviewed for natural terrain within the Project area.

8.5.3 Information from Government Departments

- 8.5.3.1 The EPD and Fire Services Department (FSD) were contacted for
- (a) records of any spillage / leakage of chemicals.
 - (b) records of Dangerous Goods (DG).
 - (c) records of Chemical Waste Producer(s) (CWPs); and
 - (d) records of reported incidents within the Project area.
- 8.5.3.2 EPD and FSD's replies on the request are attached at Appendix C and Appendix D of **Appendix 8.1**. The information is summarised below.

Environmental Protection Department

- 8.5.3.3 Based on EPD replies dated 15 March, 28 June 2022, 11 April 2023 and 31 May 2023 regarding requests for chemical spillage/ leakage information; EPD has no record of any chemical spillage / leakage within the Project area. EPD Environmental Compliance Division, Territorial Control Office, Chemical Waste and WEEE (Licensing and Control Support) Section was visited in March and April 2022 and April 2023 to review CWP records; 114 CWPs with a site address / land lot / identified occupant name were identified within the Project area.

Fire Services Department

- 8.5.3.4 Based on FSD replies dated 8 December 2021 and 22 August 2022, no DG licence records are identified within the Project area. Two events of petroleum spillage events have been recorded by FSD. The remaining incidents are minor (vegetation and rubbish fire, No.1 & No. 2 alarm fire, vehicle fire, car accident and late call) individual events and potential land contamination is not anticipated as a result of these incidents.
- 8.5.3.5 Since the two petroleum leakage incidents occurred on the paved road carriageway with run-off collected by the drainage system, these incidental releases of petroleum did not encroach any of the surveyed sites and as the spillages were appropriately cleaned up, land contamination at the incident spots is not anticipated. Further site investigation at the two incident spots is not proposed.

8.5.4 Site Reconnaissance

8.5.4.1 Site visit with a reconnaissance of accessible areas was undertaken in April – June 2022 and April 2023 to confirm as far as practicable current land uses within the Project area. Drone reconnaissance of the Project area was undertaken with video and photographs taken to identify current land use.

8.5.5 Site Appraisal

8.5.5.1 Based on the results of desktop review, drone reconnaissance and site visits, 500 surveyed sites were identified for further study, however, the majority of sites are privately occupied and inaccessible for site walkover. Given these constraints, information is limited to observations from peripheral locations during the reconnaissance. A summary of these surveyed site is provided in **Table 8-3**. The location of surveyed site is provided in **Figure 8.1 – 8.4**.

8.5.5.2 The majority of sites were inaccessible for detailed reconnaissance, detailed reconnaissance was only carried out for the following sites.

- E034
- E068
- S201
- S202
- S301
- S302
- W101
- W102
- W103
- W104
- W105

8.6 Identification of Potentially Contaminated Sites

8.6.1.1 A total of 500 sites were surveyed as summarised in **Table 8-3**.

Table 8-3 Summary of Surveyed Site

Description	Number of Sites
Potentially Contaminated Sites	195
Site required further appraisal	106
Site not to be Developed	2
Non-Contaminated Sites	197
TOTAL	500

8.6.1.2 Based on the site appraisal, the following land uses with the potential to cause land contamination issues were identified:

- Open area storage, container storage and warehouse.
- Construction equipment storage / equipment depot and vehicle / repair maintenance workshops.
- Factories.
- Recycling facilities.
- Fueling facilities.

8.6.1.3 Various classifications were assigned to the surveyed sites. Detailed assessment of surveyed sites is provided in Appendix 8.1.

Potentially Contaminated Sites

8.6.1.4 195 potentially contaminated sites were identified. Identified land uses include container storage, equipment/machinery storage; recycling facilities, vehicle repair/maintenance workshops, diesel refuelling, waste dumping ground, metal workshops etc. Figures 8.5 – 8.8 presents the locations of the potentially contaminated sites.

8.6.1.5 Detail site reconnaissance was carried out for 9 of the 195 potentially contaminated sites. The nine (9) sites (S201, S202, S301, S302, W101, W102, W103, W104 and W105) were identified as possible vehicle maintenance workshops and/or open storage where operations have potential to result in land contamination. All nine sites were vacant and fenced at the time of site visit. Figure 8.9 presents the locations of these sites.

8.6.1.6 The proposed sampling and testing plan for the nine accessible sites is presented in Section 6 of Appendix 8.1.

Site Requiring Further Appraisal

8.6.1.7 106 sites are assessed to have been used for warehousing or are occupied by inaccessible buildings (pump houses, substations etc). As the nature of operations within these buildings is not certain, site inspection is necessary to further appraise the potential for land contamination issues within these sites.

- 8.6.1.8 For these sites, the presence and degree of contamination would greatly depend on the types of goods stored within these warehouses. For example, warehouses that stored general household goods (e.g., furniture and toys) are unlikely to cause contamination to the underlying soil and groundwater. Re-appraisal of these sites will be required at a later stage of development to (i) assess the nature of these warehouses, site conditions and the historical usage, (ii) confirm the necessity for site investigation works and, if required, (iii) formulate the sampling and testing strategies.

Site not to be Developed

- 8.6.1.9 Sites E021 and S203 are not anticipated to be redeveloped therefore further land contamination potential is not necessary. The existing Chau Tau Ventilation Building (Site E021) and Mai Po Substation (Site S203) will be retained including the structures and facilities.

Non-Contaminated Sites

- 8.6.1.10 197 surveyed sites assessed to have low land contamination potential include logistics warehousing and farms. Detailed reconnaissance was conducted for two (2) of the 197 sites, namely E034 and E068. Potential land contamination is not typically associated with activities undertaken within these types of facilities. Machinery/vehicle maintenance is not anticipated on these sites.

8.7 Proposed Site Investigation Plan

- 8.7.1.1 Detail site reconnaissance was carried out for 9 of 195 potentially contaminated sites (Sites S201, S202, S301, S302, W101, W102, W103, W104 and W105). Site investigation (SI) is recommended to be carried out to determine the presence, nature and quantities of soil/groundwater contamination within the sites. The sampling and testing plan for each site has been determined based on the recommendations given in Section 2.4.1 of EPD's Practice Guide and detailed in Section 6 of Appendix 8.1.
- 8.7.1.2 Access has not yet granted by the Lands Department due to objections from villagers relating to the Simplified Temporary Land Allocation (STLA) application, therefore site investigation for the nine (9) sites was unable to instigated during the course of the EIA.
- 8.7.1.3 These nine (9) potentially contaminated sites have been fenced off by the Lands Department and are unlikely to be privately re-occupied. The Project Proponent shall carry out site investigation and sampling works in accordance with the sampling plan proposed in Appendix 8.1 at a later stage.
- 8.7.1.4 For the other potentially contaminated sites that were inaccessible for detailed site walkover, the actual sampling and testing plan can only be determined when access for detailed site walkover is granted. However, the recommended minimum number of sampling locations for each of the concerned sites, taking into consideration the area of the potentially contaminated sites and adopting the regular grid sampling strategy in Section 2.4.1 of EPD's Practice Guide, has been provided in Appendix H of the CAP in Appendix 8.1. Extra sampling locations may be required after site walkover(s) are conducted, if additional potential sources of contamination (or 'hotspots') are identified within the concerned sites. The final sampling and testing plan, considering the aforementioned regular grid sampling strategy and any hotspots identified following the site walkover will be reported in supplementary CAP(s) at the later stage of the Project.

8.8 Prediction and Evaluation of Environmental Impacts

8.8.1 COCs and Possible Remediation Methods for Potentially Contaminating Land Uses

8.8.1.1 With reference to the possible contaminants, remediation methods previously implemented in Hong Kong are presented in **Table 8-4**. If land contamination is identified, the actual remediation method shall be proposed in the Remediation Action Plan (RAP) for EPD endorsement. Remedial options are not limited to the remediation method listed in **Table 8-4**.

Table 8-4 Possible Remediation Methods for Potentially Contaminating Land Uses

Identified Potentially Contaminating Land Uses	Potentially Contaminating Activities	COCs ⁽¹⁾	Possible Remediation Methods ⁽²⁾
Open area storage, container storage and warehouse	Loading, unloading and storage of goods, fuel storage and transfer, maintenance of equipment and vehicles.	Metals (full list), PCRs, VOCs and SVOCs.	Biopiling, Cement Solidification / Stabilisation, Permeable Reactive Barriers
Construction equipment storage / equipment depot and vehicle / repair maintenance workshops	Release of oils, fuels and lubricants from vehicles, vehicle and equipment maintenance and refuelling. Use of chemicals and solvents in maintenance activities. Motor vehicle painting and storage and disposal of wastes.	Metals (e.g. chromium, copper, lead, manganese, nickel, zinc), PCRs, VOCs (e.g. acetone, BTEX, MTBE, and trichloroethene) and PAHs.	Biopiling, Cement Solidification / Stabilisation, Permeable Reactive Barriers
Factories	Release of oils, fuels and lubricants from mechanical machinery, equipment maintenance and refuelling. Use of chemicals and solvents in maintenance activities.	Metals (full list), PCRs, VOCs and SVOCs.	Biopiling, Cement Solidification / Stabilisation, Permeable Reactive Barriers
Recycling facilities	Storage and processing of waste materials, storage and transfer of chemicals and fuels. Storage and disposal of wastes.	Metals (full list), PCRs, VOCs, SVOCs and PCBs.	Biopiling, Cement Solidification / Stabilisation, Permeable Reactive Barriers, Thermal Desorption / Incineration
Fuelling facilities (diesel)	Leaks from pipework, tanks and offset fill pipes. Spills during customer refuelling, filling underground storage tanks and over filling of portable containers.	PCRs, VOCs (BTEX) and PAHs.	Biopiling, Cement Solidification / Stabilisation, Permeable Reactive Barriers

Identified Potentially Contaminating Land Uses	Potentially Contaminating Activities	COCs ⁽¹⁾	Possible Remediation Methods ⁽²⁾
<p>Note: (1) Metals include antimony, arsenic, barium, cadmium, chromium III, chromium VI, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, tin and zinc.</p> <p>Petroleum carbon ranges (PCRs) include C6 – C8, C9 – C16 and C17 – C35.</p> <p>Volatile organic chemicals (VOCs) include BTEX (benzene, toluene, ethylbenzene, and total xylenes), MTBE (methyl tert-butyl ether), acetone, bromodichloromethane, 2-butanone, chloroform, methylene – chloride, styrene, tetrachloroethene, and trichloroethene.</p> <p>Semi-volatile organic chemicals (SVOCs) include polyaromatic hydrocarbons (PAHs) (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene and pyrene), bis-(2-ethylhexyl)phthalate, hexachlorobenzene, and phenol.</p> <p>PCBs – Polychlorinated biphenyls.</p>			

8.8.2 Surmountability of Potential Land Contamination Issues

8.8.2.1 Contamination issues are not insurmountable in view of the following factors:

- The sizes of the potential contaminated sites are relatively small.
- The extent of any contamination is expected to be localised rather than widespread.
- Remediation methods available in the market are well established with local remediation experience sufficient to deal with the nature of the possible contaminants.

8.8.2.2 Land contamination issues within those sites/areas identified as potentially contaminated are considered not insurmountable due to the following factors:

Anticipated localised contamination from current operation scale

8.8.2.3 Based on the site appraisal, more than half of the potentially contaminated sites are used for open storage, container storage and warehousing. Land used for warehousing of non-contaminating goods such as furniture or toys is unlikely to present any land contamination potential. For container storage and open storage, a large portion of their areas are typically used for goods storage with possibly smaller portion for potentially contaminating activities such as vehicle / equipment maintenance area and the associated chemical handling/storage. If the main types of goods stored on-site are not potential sources of contamination, land contamination, if indeed present, for these land types would likely be localised.

8.8.2.4 In addition, the potentially contaminated sites are not large-scale polluting installations / facilities such as oil depots and power plants. Therefore, the contamination extent, if any, caused by the operations of the identified potentially contaminated sites is anticipated to be localised.

Chemicals of Concern (COC) identified are readily treatable using established physical, chemical and biological techniques

8.8.2.5 Based on the site appraisal, the potential COCs identified with the potential to be present include metals, VOCs, SVOCs, PCRs and PCBs. Remediation methods that have been demonstrated to effectively treat the aforementioned soil and groundwater contaminants include biological treatment and physical / chemical treatment.

Local remediation experience is sufficient to deal with the nature of the possible contaminants

8.8.2.6 Soil contaminated with the abovementioned COCs had successfully been remediated in Hong Kong using proven remediation techniques. Notable local remediation projects include the followings:

- Decommissioning of Kai Tak Airport North Apron;
- Decontamination works at the Cheoy Lee Shipyard;
- Reclamation works at North Tsing Yi Shipyard site; and
- Decommissioning of Kwai Chung Incinerator.

8.8.3 Recommendation of Further Works

8.8.3.1 The area within the Project boundary will remain in operation and potential exists for a change in land use or operations prior to development. It is recommended to re-appraise the whole area within the Project boundary. If there are land use changes which pose a potential for land contamination, this information should be reported in Supplementary CAP(s).

Potentially Contaminated Sites

8.8.3.2 The sites identified as potentially contaminated remain in operation therefore potential exists for a change in land use or operations prior to development. As the majority of these sites were inaccessible at the time of reporting, proper assessment of site conditions / identification of hotspots and formulation of sampling and testing plan(s) is not practical within the CAP (Appendix 8.1).

8.8.3.3 Prior to development of these sites, the Project Proponent should appoint a consultant to re-appraise these sites and update the findings (e.g. locations of hotspots) and sampling and testing requirements presented in the CAP. Supplementary CAP(s), incorporating the findings of the site re-appraisal and the updated sampling and testing strategy, should be prepared and submitted to EPD for approval prior to conducting any SI works.

8.8.3.4 SI works should be implemented according to the supplementary CAP(s). CAR(s) detailing the findings and, if contaminated soil and/or groundwater is identified, RAP(s), should be prepared and submitted to EPD for approval. Any contaminated soil and groundwater should be treated according to EPD's approved RAP(s) and RR(s) should be submitted to EPD for agreement after completion of the remediation works. No development works shall commence prior to EPD's agreement of the RR.

8.8.3.5 For the nine (9) sites (namely S201, S202, S301, S302, W101, W102, W103, W104 and W105) where detailed site reconnaissance was carried out, these sites have been fenced off by the Lands Department and are unlikely to be privately re-occupied. The Project Proponent shall carry out site investigation and sampling works in accordance with the sampling plan proposed in Section 6 of Appendix 8.1 at a later stage.

8.8.3.6 CAR(s) shall be compiled following receipt of site investigation results. The CAR(s) shall detail the methodology used during soil boring / well installation and soil and groundwater sampling, details of field observations and interpretation of laboratory testing results. The CAR(s) should be compiled according to the Practice Guide and submitted to EPD for approval.

- 8.8.3.7 Should results / field observations indicate that contamination is above the site-specific adopted thresholds; remediation will be required to render a particular site safe for future use. RAP(s) will be developed in conjunction with the CAR. The expected content of a RAP is defined in the Section 4.2 of the Practice Guide. RAP(s) shall be submitted to and approved by the EPD prior to the implementation of remedial actions.
- 8.8.3.8 Following implementation of remediation, RR(s) will be compiled following the completion of remedial works. The RR(s) shall consist of the background information, remediation methods, programme and the interpretation of remediation results. RR(s) demonstrate the clean-up is adequate and, will be submitted to EPD for approval prior to the commencement of any development works within the sites.

Sites Requiring Further Appraisal

- 8.8.3.9 A requirement of any site investigation within some of the surveyed sites (primarily those sites occupied by warehousing) remains unconfirmed in the CAP (Appendix 8.1). For these sites, the presence and degree of contamination would greatly depend on the types of goods stored within these warehouses. For example, warehouses that stored general household goods (e.g., furniture and toys) are unlikely to cause contamination to the underlying soil and groundwater.
- 8.8.3.10 Re-appraisal within these sites is required at the later stage (once the land is resumed or access granted) to (i) assess the nature of these warehouses, site conditions and the historical usage, (ii) assess the need for site investigation and, where required, (iii) formulate sampling and testing strategies.
- 8.8.3.11 If the findings of re-appraisal suggest a reasonable potential for land contamination that warrants site investigation, supplementary CAP(s), incorporating the re-appraisal findings and the updated sampling and testing strategy, should be prepared and submitted to EPD for approval prior to conducting any SI works.
- 8.8.3.12 SI works should be implemented according to the supplementary CAP(s). CAR(s) and, if contaminated soil and/or groundwater identified, RAP(s) should be prepared and submitted to EPD for approval. Any contaminated soil and groundwater should be treated according to EPD's approved RAP(s) with RR(s) submitted to EPD for agreement of completion of the remediation works. No development works shall be commenced prior to EPD's agreement of the RR.

Sites not to be Developed

- 8.8.3.13 In the event of a change to the Project plan wherein these sites will be developed, re-appraisal will be required to assess the potential land contamination status at such time that the site become accessible.
- 8.8.3.14 If potential land contamination is confirmed after site re-appraisal and site investigation is deemed necessary, Supplementary CAP(s), incorporating the findings of the site re-appraisal and the updated sampling and testing strategy, should be prepared and submitted to EPD for approval prior to conducting any SI works.
- 8.8.3.15 SI works should then be carried out according to the supplementary CAP(s). CAR(s) and, if contaminated soil and/or groundwater identified, RAP(s) should be prepared and submitted to EPD for approval. Any contaminated soil and groundwater should be treated according to EPD's approved RAP(s) and RR(s) should be submitted to EPD for agreement after completion of the remediation works. No development works shall be commenced prior to EPD's agreement of the RR.

Non-Contaminated Sites

- 8.8.3.16 Similarly, as the development will only commence in phases from 2024, it is possible that the land uses of the non-contaminated sites could change to contaminated land types. Hence, after the sites are handed over to the PP for development, the PP's appointed consultant should also revisit these sites to assess the latest land uses and site conditions as well as to ascertain the initial evaluation and recommendation reported in this CAP. If any of these sites are found to have potential land contamination issues, the PP's appointed consultant should also prepare and submit supplementary CAP(s), which incorporate the findings of the site re-appraisal (e.g. locations of hotspots) and the sampling and testing strategy, to EPD for approval prior to conducting any SI works.

8.9 Evaluation of Residual Impacts

- 8.9.1.1 Referring to **Section 8.8.2**, all land contamination issues are surmountable if the recommended further works in **Section 8.8.3** are followed and contaminated soil and groundwater (if any) is properly treated using appropriate remediation methods and according to EPD's approved RAP. However, any localised soil/groundwater contamination within these sites, if left untreated, could potentially pose health risks to existing or future occupants.
- 8.9.1.2 By implementing the recommended further works under this Project, the actual contaminated site(s) within the Project boundary would be located and any contaminated soil and groundwater would be identified and treated. The recommended further works would not only minimise the health risks to the future occupants arising from the exposure of the contaminated soil and/or groundwater, it would also provide the opportunity to treat the contaminated soil / groundwater using proven remediation techniques for reuse as useful materials (such as backfilling materials); thereby minimising the amount of waste disposing into the already depleting landfills in Hong Kong and achieving a more sustainable development.
- 8.9.1.3 Furthermore, the Project would allow the conversion of the contaminated site(s) into land that are safe for more optimal development (e.g. residential development).

8.10 Environmental Monitoring and Audit

- 8.10.1.1 Remediation works, if necessary, would be carried out based on the recommended further works outlined in **Section 8.8.3**. Mitigation measures as recommended in the future EPD approved RAP should be implemented during the remediation works. The EM&A requirements should be carried out in the form of regular site inspection to ensure the recommended mitigation measures are properly implemented.

8.11 Environmental Acceptability of Schedule 2 Designated Projects

- 8.11.1.1 This Project is a Schedule 3 Designated Project under the EIAO, whilst there will be 7 Schedule 2 DPs. The details of these Schedule 2 DPs are presented in **Section 1.5** (i.e. **Table 1.1**) and **Section 2.4.4**, and the locations of these Schedule 2 DPs are shown in Figure 1.2.

8.11.1.2 The identified potentially contaminated sites are grouped under each Schedule 2 DP and the findings are summarised in Appendix 8.3. As the land contamination potential of the sites listed in Appendix 8.3 have been assessed under this EIA Study, the land contamination issue within these sites are considered surmountable (refer to **Section 8.8.2** for details). Prior to the commencement of construction of each Schedule 2 DP, the recommended further works under this EIA Study (including site re-appraisal, SI works and if required, remediation works (refer to **Section 8.8.3** for details)) will be carried out for the concerned sites listed in Appendix 8.3. Any soil / groundwater contamination would be identified and properly treated prior to the development of the concerned sites. No residual land contamination impacts are anticipated, it is considered environmentally acceptable if the recommended further works in **Section 8.8.3** were followed.

8.12 Health Risk Assessment for Arsenic-Containing Soil

8.12.1.1 The EIA Study Brief (ESB-340/2021) Clause 3.4.8 requires assessment of whether high levels of arsenic exist within the Project area. If high levels of naturally occurring arsenic are identified within the Project area and any associated works area, a Health Impact Assessment (HIA) shall be conducted based on established international practices. As high levels of arsenic is identified during ground investigation works, a HIA report is provided in **Appendix 8.2** for the health impact assessment on arsenic.

8.12.2 Findings on Ground Investigation

8.12.2.1 With reference to available ground investigation results, samples from the soil profile within 21 boreholes have been analysed for arsenic. The average arsenic content is 130mg/kg and maximum detection at 1,140 mg/kg. The arsenic content in soil in the Project area is assessed to be naturally occurring and not as a result of anthropogenic contamination. It is considered that the arsenic soil concentrations in the Project Area and NENT EIA (Kwu Tung North) are similar.

8.12.3 Soil Screening Level

8.12.3.1 Based on the Health Impact Assessment for the Ingestion Pathway detailed in Section 3.2 of Appendix 8.2 with reference to NENT EIA Report, a risk based arsenic threshold is calculated as 571 mg/kg.

8.12.4 Proposed Mitigation Measures

8.12.4.1 During construction of the Project, the Contractor shall follow all requirements under the Factories and Industrial Undertaking Ordinance (F&IUO) and its subsidiary regulations. Control measures shall be proposed in a safety plan which shall be fully implemented by the Contractor.

8.12.4.2 During operation of the Project, provided further arsenic assessment and treatment (if required) of high arsenic containing soil (HAC soil) will be implemented, arsenic content in the top 4-8 m of the development will be determined. In case of exceedance on soil screening level, the HAC soil will be treated accordingly by cement solidification/stabilisation (S/S). Treated materials may be backfilled in-situ or ex-situ. A 4m – 8m thick free/treated arsenic zone will be provided underneath further development. This 4m – 8m thick free/treated arsenic zone will provide effective barrier for future users/residents during operation phase and therefore, no mitigation measures is required during operation phase.

8.12.5 Treatment Approach

- 8.12.5.1 HAC soil is proposed to be treated by Cement S/S and followed by in-situ or ex-situ as backfilling.
- 8.12.5.2 Further arsenic assessment should be carried out during site formation and during construction of foundation. The Government will treat the HAC soil in the shallow region before land allocation or land lease. The treatment depth will depend on the future land use in **Revised** RODP. Subsequent Developer/Works Departments will treat HAC soil in deep regions for excavations required for basements, piles and utilities. Detail treatment approach is provided in Section 5 of Appendix 8.2.

8.13 Conclusion

- 8.13.1.1 This land contamination assessment examined the potential contaminative land use within the Project boundary and their potential impacts to future land use.
- 8.13.1.2 Based on the findings from desktop review (e.g. review of historical aerial photos and relevant information from EPD and FSD), drone reconnaissance and site surveys, 500 potentially contaminated sites have been identified.
- 8.13.1.3 For potentially contaminated sites, findings of the desktop review and site surveys as well as the proposed soil and groundwater sampling and testing strategy are presented in the CAP in Appendix 8.1.
- 8.13.1.4 The majority of 195 potentially contaminated sites were inaccessible for detailed reconnaissance at the time of reporting. As the identified potentially contaminated sites are still in operation and the development will only commence in phases from 2024, potential exists for changes in land use or the nature of operations prior to development within both the potentially contaminated site and other surveyed sites.
- 8.13.1.5 Detail site reconnaissance was carried out for 9 of 195 potentially contaminated sites (Sites S201, S202, S301, S302, W101, W102, W103, W104 and W105). Access has not been granted by the Lands Department due to objections from villagers relating to the STLA application. The Project Proponent shall carry out site investigation and sampling works in accordance with the CAP (Appendix 8.1).
- 8.13.1.6 Further works, including site re-appraisal, SI works as well as submission of supplementary CAP(s) and CAR(s) for EPD's endorsement are recommended to be carried out after the sites are handed over to PP for development. If contaminated soil and/or groundwater were identified, remediation should be carried out according to EPD approved RAP(s) and RR(s) should be submitted to EPD for agreement after completion of the remediation works. No development works shall commence prior to EPD agreement of the RR. The further works would need to follow EPD's Guidance Manual, Guidance Note and Practice Guide and according to **Section 8.8.3**.
- 8.13.1.7 Based on the findings of the assessment 195 potentially contaminated sites are identified from land uses including container storage, equipment/machinery storage; recycling facilities, vehicle repair/maintenance workshops, diesel refuelling facilities, waste dumping grounds, metal workshops, etc.
- 8.13.1.8 At all sites, contamination (if any) is anticipated to be localised as the types of operations are not large-scale polluting installations / facilities, such as oil depots and power plants, where the nature of those operations has greater potential to result in widespread contamination.

- 8.13.1.9 COCs with potential to be present at potentially contaminated sites include metals, VOCs, SVOCs, PCRs and PCBs. These COCs are treatable using established physical, chemical and biological techniques and have been successfully remediated using proven remediation techniques in Hong Kong. By implementing the recommended works, contaminated soil and groundwater within the Project boundary would be identified and treated.
- 8.13.1.10 Recommended further works would not only mitigate health risk to future occupants, the works would also demonstrate sustainable reuse of treated soils as useful materials (such as backfill); thereby minimising the amount of waste disposed to landfill.
- 8.13.1.11 Furthermore, the Project would allow the conversion of the contaminated site(s) into land that are safe for more optimal development (e.g. residential development).
- 8.13.1.12 High levels of naturally occurring arsenic in soil is confirmed by ground investigation works. Health Impact Assessment has calculated a risk based arsenic threshold of 571 mg/kg which acts as a remedial threshold concentration. Further arsenic assessment and a detailed treatment approach has been proposed based on the Revised RODP.
- 8.13.1.13 Further arsenic assessment should be carried out during site formation and during construction of foundation. The Project Proponent will treat the high arsenic containing soil in the shallow region before land allocation or land lease to ensure no adverse health impact to future occupants. The treatment depth will depend on the future land use. Subsequent Developer/Works Departments will treat HAC soil in deep regions for excavations required for basements, piles and utilities.