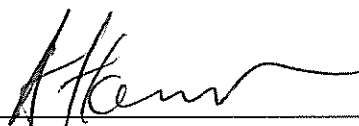


MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU –
SHENZHEN – HONG KONG EXPRESS RAIL LINK
(No. EP-349/2009/A)

Contamination Assessment Report &
Remediation Action Plan (Part 1) for
Mai Po Ventilation Building Works Area
(Revision C)

Verified by:



Position:

Independent Environmental Checker

Date:

15 November 2010

MTR Corporation Limited

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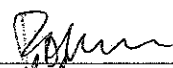
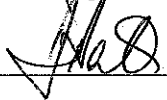
Position:

Date:

Glenn Frommes
Environmental Team Leader
12 NOV 2010

Gammon Construction Limited**Hong Kong Section of
Guangzhou-Shenzhen-Hong Kong
Express Rail Link****Supplementary Contamination Assessment
Report and Remediation Action Plan (Part I)
for Mai Po Ventilation Building Works Area**

November 2010

	Name	Signature
Prepared & Checked:	Catherine Po	
Reviewed & Approved:	David Paton	

Version: C

Date: 12 November 2010

The information contained in this report is, to the best of our knowledge, correct at the time of printing. The interpretation and recommendations in the report are based on our experience, using reasonable professional skill and judgment, and based upon the information that was available to us. These interpretations and recommendations are not necessarily relevant to any aspect outside the restricted requirements of our brief. This report has been prepared for the sole and specific use of our client and AECOM Environment accepts no responsibility for its use by others.

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Tel: (852) 2893 1551 Fax: (852) 2891 0305 www.aecom.com**Important Message****Rebranding as AECOM**

To better serve our clients, all Munsell AECOM operations in Hong Kong have been integrated into one operating entity and rebranded as AECOM. The ENSR Asia (HK) Limited operation is now part of AECOM Asia Co. Ltd.

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1. INTRODUCTION

- 1.1 AECOM Asia Company Limited (AECOM) was commissioned by Gammon Construction Limited (GCL) as the environmental consultant to undertake the supplementary land contamination assessment at Mai Po Ventilation Building Works Area under the Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL). The Hong Kong Section of the XRL will be a 26-km long underground rail line on a dedicated track that runs from the terminus located in West Kowloon to the boundary at Huanggang, as shown in **Figures NOL/ERL/300/C/XRL/ENS/M57/531-533**.
- 1.2 An Environmental Impact Assessment (EIA) for the Hong Kong Section of XRL was conducted and approved under the Environmental Impact Assessment Ordinance (EIAO) on 28 September 2009 (Register No. AEIAR-143/2009). An Environmental Permit (EP) No. EP-349/2009 was granted by the Director of Environmental Protection (DEP) on 16 October 2009. The EP (No. EP-349/2009) was then amended under application for Variation of an Environmental Permit No. VEP-323/2010 and has been replaced by Environmental Permit No. EP-349/2009/A on 27 September 2010.
- 1.3 During the time of EIA Study, some of the land lots/facilities within the development area were not fully surveyed and/or assessed due to site constraints. In this respect, the approved EIA specifies those inaccessible lots/facilities needed to be further assessed after land resumption and prior to the commencement of the constructions works at respective sites. Pursuant to new EP Condition 2.21, revised contamination assessment plans (CAPs) with updated sampling and testing schedule based on respective site condition, supplementary contamination assessment reports (CARs) and if contamination found, supplementary remediation action plans (RAPs) should be submitted to Environmental Protection Department (EPD) for approval prior to the commencement of works.
- 1.4 Table 9.8 of the approved EIA report provides a detailed summary for the initial findings for each potential site. According to the table, there are five sites (Site A, C, D and E and WSW) within Mai Po Ventilation Building Works Area (MPV) which require further site assessment. The location of MPV along the alignment and the general site layout plan has been shown in **Figures NOL/ERL/300/C/XRL/ENS/M57/531 and 534**. Given that Site WSW was encroached upon the Project Area of the Proposed Comprehensive Development at Wo Shang Wai, Yuen Long (WSW) EIA, Site WSW would be assessed / remediated in accordance with the Environmental Permit conditions (EP-311/2008) of that particular EIA by its own project proponent. A revised CAR/RAP for WSW Project Area was submitted by the WSW permit holder of EP-311/2008 and approved by the EPD in March 2010.
- 1.5 In regards of the tight construction schedule and different land resumption stage, site access could only be granted at Site A, western portion of Site C (i.e. Site C2) and Site E. Revised CAP (Part I) for MPV Works Area (rCAP) concerning the abovementioned accessible site (Subject Area) and Site WSW was therefore prepared and approved by EPD on 12 March 2010. The approved rCAP proposed a total of 20 boreholes for soil and groundwater sampling and testing within the Subject Area. In addition, a review of the WSW CAR/RAP has been conducted according to rCAP and it is confirmed that no contamination issue was found at Site WSW. As such, no remediation work is required to be completed prior to the commencement of works at MPV, of which Site WSW has been taken up by the permit holder of EP-349/2009 and is governed by EP-349/2009 during the construction of XRL. Based on the WSW CAR/RAP, the nearest contaminated sampling location within Wo Shang Wai Development, is located at approximately 40m from the southern boundary of MPV works area. With the localised nature of contamination at the nearest contaminated sampling location, the migration of contaminants from the contaminated borehole to Site WSW and MPV works area is not expected. This is further supported by documents provided by permit holder of EP-349/2009. The supporting document is attached in **Appendix F** for reference.
- 1.6 Given the tight project programme schedule, site investigation (SI) for land contamination assessment in the Subject Area was commenced on 14 October 2009 and completed on 7 November 2009. The SI works, including rotary drilling of boreholes, logging of ground materials, installation of groundwater monitoring wells and water level monitoring were all conducted by GCL

while laboratory analyses were carried out by ALS Technichem (HK) Pty Limited (ALS) under GCL appointment.

- 1.7 Based on the findings of the site investigation, one sample collected at 3.0m to 3.45m from sampling location E-02 was found to have bis-(2-Ethylhexyl)phthalate exceeding relevant RBRG levels. In order to ensure complete isolation of the contaminated area and setup of “no works” area for the commencement of phased construction works and to determine the most practical remediation option, additional sampling to delineate the extent of contamination was conducted on 25 May 2010. The sampling exercise was conducted by Penta-Ocean Construction Co. Ltd (Penta-Ocean) while laboratory analysis was carried out by ALS under Penta-Ocean’s appointment.
- 1.8 For the remaining part of Site C (i.e. Site C1) and Site D, separate supplementary CAP(s), CAR(s) and if necessary, supplementary RAP(s) will be prepared and submitted to EPD for approval when site access is granted.

Objectives

- 1.9 This supplementary CAR/RAP (supp. CAR/RAP) is prepared for Sites A, C2 and E of MPV. The objectives of this supp.CAR/RAP are to (i) summarize findings of the SI (including fieldworks and laboratory analyses) , (ii) determine the nature and extent of contamination based on the findings of the SI works conducted in the Subject Area and (iii) determine the contamination extent in advance for setting up “no works” area (**Section 3**). The remediation proposal of appropriate remediation actions for the identified contaminated area will also be provided in a Remediation Action Plan (RAP) (**Section 4**).
- 1.10 This supp.CAR/RAP is submitted to seek endorsement from the DEP in accordance with Condition 2.21 of the EP.

2. FINDINGS OF APPROVED REVISED CAP

2.1 According to the approved revised CAP, the potential land contaminative activities identified at the Subject Area are summarized in **Table 2.1**.

Table 2.1 Potential Source of Land Contamination Identified in the Subject Area

Contamination Site Concern	Potential Source of Land Contamination
Site A	- In the recent site inspection, the site was found to be vacant with some inert materials (mainly wooden racks and bags of plastic tape) discarded on the concrete paved ground. No apparent stains were observed on the ground surface. Sources of land contamination were not identified. - Potential land contamination concerns are based on observations made of the surroundings during site visits conducted in the course of EIA study. Suspected historical operation of the site included a recycling facility
Site C2	- In the recent site inspection, the site C2 was found to be vacant. Minor staining was noted on the asphalt paved ground however no other contaminative activities identified during site inspection. - Potential land contamination concerns are based on observations made of the surroundings in previous site visits conducted in the course of EIA study where suspected historical operation of the site included use as a container truck parking area with repair/ maintenance activities.
Site E	- In the recent site inspection, the site was found to be vacant with some inert materials (mainly consists of wooden racks, bricks, hoarding) discarded on the concrete paved ground. - Oil spillage was noted near the ex-paint booth increasing the likelihood for potential land contamination.

2.2 In light of the potential sources of land contamination identified within the Subject Area, a total of 20 boreholes were proposed in the approved rCAP. 12 boreholes were recommended in Site A, 3 boreholes in Site C2 and 5 boreholes in Site E. Detailed rationales for selecting sampling locations in the approved rCAP are provided in **Appendix A**.

3. CONTAMINATION ASSESSMENT REPORT

Sampling and Testing for Site Investigation

Site Investigation

Soil Boring and Sampling

- 3.1 The SI works at the Subject Area were carried out between 14 October 2009 to 7 November 2009. A total of 20 boreholes as proposed in the rCAP were constructed at Site A, C2 and E. The locations of the boreholes established are shown in **Figures NOL/ERL/300/C/XRL/ENS/M57/535-537**.
- 3.2 Soil samples were generally collected at approximately 0.5m, 1.5m, 3m, 4.5m and 6m below base of concrete (BBC) for all boreholes. Where an inspection pit was excavated, disturbed samples were collected at 0.5m and 1.5m and undisturbed samples were collected from all other depths. A total of 106 soil samples (including 6 duplicate samples) were collected for laboratory analysis. The entire SI process was supervised by the land contamination specialist of MTR. During the SI works, the soil sample collected at 6.00m BBC from C2-1 was found to be insufficient for laboratory testing due to an insufficient volume of sample recovered. Another soil sample was therefore collected at 6.45m BBC for laboratory testing purposes.
- 3.3 Before drilling/trial pit construction, the sampling equipment and any equipment in contact with the ground was decontaminated using laboratory-grade detergent and steam-cleaning/high-pressure hot water jetting prior to use at each sampling location.
- 3.4 Soil samples were properly labelled and stored in cool boxes at approximately 4°C until delivery to ALS for laboratory analysis. All the collected soil samples in the SI were analyzed in accordance with the analysis schedules detailed in the approved rCAP.

Strata Logging

- 3.5 Strata logging for boreholes was undertaken during the course of drilling and sampling by a qualified geologist. The logs included the general stratigraphic descriptions, depth of soil sampling, sample notation and level of groundwater (if encountered). The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics was also recorded. Soil boring logs are provided in **Appendix B**.

Groundwater Sampling

- 3.6 Groundwater was encountered in all boreholes. After completion of soil sampling, groundwater monitoring wells were installed at the 20 boreholes established. Details of groundwater monitoring wells are provided in **Appendix E**. Following installation, well development was carried out to ensure the well screen interval was in hydraulic communication with the monitored zone before being used for water quality sampling or water level measurements. Wells were bailed until the well was thoroughly flushed of standing water and well construction sediments, therefore, containing natural formation water. Adequate development was achieved when bailed water was relatively sediment-free and non-turbid. No measurable light non-aqueous phase liquids (LNAPLs) were encountered during the groundwater development, purging or sampling exercise at all sampling locations.
- 3.7 Prior to groundwater sampling, each monitoring well was purged until at least three well volumes of water had been removed or the well purged dry, to ensure fresh, representative groundwater samples were obtained. The water level in each well was allowed to recover to its pre-purged static water level prior to sample collection.

- 3.8 Immediate after collection, groundwater samples were transferred to new, clean, laboratory-prepared, “amber glass” type sample containers. Groundwater samples were placed in the glass jars with zero headspace and promptly sealed with a septum-lined cap. All samples were clearly labelled. Immediately following collection, samples were subsequently stored in cool box at about 4°C and delivered to analytical laboratory on the same day. All groundwater samples were analyzed in accordance with the analysis schedules detailed in the approved rCAP (**Appendix A**).

Assessment Criteria

Criteria for Soil and Groundwater Contamination

- 3.9 The assessment methodology is adopted in accordance with the *Guidance Note for Contaminated Land Assessment and Remediation* (Guidance Note 1), *Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management* (Guidance Manual) and *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops* (Guidance Note 2) issued by the EPD.
- 3.10 Interpretation of results has made reference to those Risk-based Remediation Goals (RBRGs) presented in *Table 2.1 and Table 2.2* as stipulated in the Guidance Manual.
- 3.11 The new RBRGs are developed based on a risk assessment approach to suit the local environmental conditions and community needs in Hong Kong. Decisions on contaminated soil and groundwater remediation are based on the nature and extent of the potential risks that are posed to human receptors as a result of exposure to chemicals in the soil and/or groundwater. RBRGs are developed for four different land use scenarios reflecting the typical physical settings in Hong Kong under which people could be exposed to contaminated soil and groundwater. A description of each land use scenario is as follows:
- Urban residential – Sites located in an urban area where main activities involve habitation by individuals. The typical physical setting is a high rise residential building situated in a housing estate that has amenity facilities such as landscaped yards and children’s playgrounds. The receptors are residents who stay indoors most of the time except for a short period each day, during which they are outdoors and have the chance of being in direct contact with soil at landscaping or play areas within the estate.
 - Rural residential – Sites located in a rural area where the main activities involve habitation by individuals. These sites typically have village-type houses or low rise residential blocks surrounded by open space. The receptors are rural residents who stay at home and spend some time each day outdoors on activities such as gardening or light sports. The degree of contact with the soil under the rural setting is more than that under the urban setting both in terms of the intensity and frequency of contact.
 - Industrial – Any site where activities involve manufacturing, chemical or petrochemical processing, storage of raw materials, transport operations, energy production or transmission, etc. Receptors include those at sites where part of the operation is carried out directly on land and the workers are more likely to be exposed to soil than those working in multi-storey factory buildings.
 - Public parks – Receptors include individuals and families who frequent parks and play areas where there is contact with soil present in lawns, walkways, gardens and play areas. Parks are considered to be predominantly hard covered with limited areas of predominantly landscaped soil. Furthermore, public parks are not considered to have buildings present on them.
- 3.12 In addition to the RBRGs, screening criteria (soil saturation limits, Csat, developed for Non-aqueous Phase Liquid [NAPL] in soil and water solubility limits for NAPL in groundwater) for the more mobile organic chemicals must be considered to determine whether a site requires further action.

- 3.13 As reviewed in the approved rCAP, the Subject Area will be occupied for railway facilities. According to the Guidance Manual, the corresponding RBRG land use for railway related facilities would be "Industrial". Relevant soil and groundwater RBRGs level for this land contamination assessment including soil saturation limit and solubility limit are presented in **Table 3.1**.

Table 3.1 Relevant RBRGs for Soil and Groundwater – Industrial

Chemical	Soil (mg/kg)		Groundwater (µg/L)	
	RBRGs for Industrial	Soil Saturation Limits	RBRGs for Industrial	Solubility Limits
VOCs				
Acetone	10,000	***	10,000,000	***
Benzene	9.21	336	54,000	1,750,000
Bromodichloromethane	2.85	1,030	26,200	6,740,000
2-Butanone	10,000	***	10,000,000	***
Chloroform	1.54	1,100	11,300	7,920,000
Ethylbenzene	8,240	138	10,000,000	169,000
Methyl tert-Butyl Ether	70.1	2,380	1,810,000	***
Methylene Chloride	13.9	921	224,000	***
Styrene	10,000	497	10,000,000	310,000
Tetrachloroethene	0.777	97.1	2,950	200,000
Toluene	10,000	235	10,000,000	526,000
Trichloroethene	5.68	488	14,200	1,100,000
Xylenes (Total)	1,230	150	1,570,000	175,000
SVOCs				
Acenaphthene	10,000	60.2	10,000,000	4,240
Acenaphthylene	10,000	19.8	10,000,000	3,930
Anthracene	10,000	2.56	10,000,000	43.4
Benzo(a)anthracene	91.8	NA	NA	NA
Benzo(a)pyrene	9.18	NA	NA	NA
Benzo(b)fluoranthene	17.8	NA	7,530	1.5
Benzo(g,h,i)perylene	10,000	NA	NA	NA
Benzo(k)fluoranthene	918	NA	NA	NA
bis-(2-Ethylhexyl)phthalate	91.8	NA	NA	NA
Chrysene	1,140	NA	812,000	1.6
Dibenzo(a,h)anthracene	9.18	NA	NA	NA
Fluoranthene	10,000	NA	10,000,000	206
Fluorene	10,000	54.7	10,000,000	1,980
Hexachlorobenzene	0.582	NA	695	6,200

Chemical	Soil (mg/kg)		Groundwater (µg/L)	
	RBRGs for Industrial	Soil Saturation Limits	RBRGs for Industrial	Solubility Limits
Indeno(1,2,3-cd)pyrene	91.8	NA	NA	NA
Naphthalene	453	125	862,000	31,000
Phenanthrene	10,000	28	10,000,000	1000
Phenol	10,000	7,260	NA	NA
Pyrene	10,000	NA	10,000,000	135
Metals				
Chromium III	10,000	NA	NA	NA
Chromium VI	1,960	NA	NA	NA
Copper	10,000	NA	NA	NA
Lead	2,290	NA	NA	NA
Zinc	10,000	NA	NA	NA
Petroleum Carbon Ranges				
C6 - C8	10,000	1000	1,150,000	5,230
C9 - C16	10,000	3000	9,980,000	2,800
C17 - C35	10,000	5000	178,000	2,800
PCB				
PCB	0.748	NA	5,110	31
Other Inorganic Compound				
Cyanide, Free	10,000	NA	NA	NA

Note: NA - Not Available

*** indicates that the Csat value/ solubility limit exceeds the 'ceiling limit' therefore the RBRG applies

Analytical Results and Interpretation

Field Records

- 3.14 The SI works were undertaken in accordance with the sampling plan detailed in the approved rCAP. During soil boring, slight petroleum hydrocarbon odours were noted from a soil sample recovered from 0.5m BBC from A-04. The soil sample collected was also noted to be unnaturally stained, however as reported by the land contamination specialist and GCL, no measurable LNAPL was observed at any of the sampling locations. A summary of field observation during soil boring and groundwater measurement were presented in **Appendix C**.

Laboratory Analytical Results

Results of Soil Analysis

- 3.15 A total of 106 soil samples (including 6 duplicate samples) were collected during SI for laboratory analysis. All laboratory analyses for soil and groundwater samples were conducted using Hong Kong Laboratory Accreditation Scheme (HOKLAS) testing methods by a HOKLAS accredited laboratory.

A summary table of the laboratory testing results with the laboratory reports and standard forms adopted from Guidance Manual for assessing the soil samples are presented in **Appendix D**.

- 3.16 Among these samples collected, one soil sample was found to have a bis-(2-Ethylhexyl)phthalate concentration exceeding the relevant RBRG level. **Table 3.2** summarizes the exceedance.

Table 3.2 Summary of Soil Samples Exceeding the RBRG Level

Sample I.D.	Depth (m BBC)	Contaminant	Relevant RBRG/Csat Level (mg/kg)		Concentration Detected (mg/kg)	Exceedance of RBRG/Csat?
			Csat	RBRG		
E-02	3.00-3.45	bis-(2-Ethylhexyl)phthalate	NA	91.8	134	>RBRG only

Note: NA = Not applicable.

- 3.17 The reported concentration of bis-(2-Ethylhexyl)phthalate exceeded the relevant RBRG level as detailed in **Table 3.2**, as such remediation of the concerned contaminant is required at E-02. For the sample collected at 0.5m from A-04 where stained soil and slight petroleum hydrocarbon odour were noted, there are no exceedances of the industrial RBRG levels. In addition, as confirmed by the land contamination specialist of MTR, no evidence of LNAPL was observed during soil boring at A-04 therefore remediation at A-04 is not considered necessary.

Results of Groundwater Analysis

- 3.18 A total of 23 groundwater samples (including 3 duplicate samples) were collected from the site. Depth to groundwater at each well location is presented in **Table 3.3** with groundwater monitoring well construction details provided in **Appendix E**. A summary table of the laboratory testing results with the laboratory reports and standard forms adopted from Guidance Manual for assessing groundwater samples are provided in **Appendix D**.

Table 3.3 Summary of Groundwater Levels

Sample I.D.	Groundwater Levels	
	Depth to Groundwater (m below ground)	mPD (m below HK Principal Datum)
A-01	1.03	+3.25
A-02	1.04	+3.34
A-03	1.32	+3.18
A-04	1.02	+3.23
A-05	2.28	+2.1
A-06	2.43	+2.07
A-07	0.92	+3.27
A-08	1.5	+2.85
A-09	1.77	+2.69
A-10	0.82	+3.21
A-11	0.9	+3.37
A-12	1.3	+3.2
C2-1	1.05	+2.36
C2-2	1.04	+2.45
C2-3	1.07	+2.61

Sample I.D.	Groundwater Levels	
	Depth to Groundwater (m below ground)	mPD (m below HK Principal Datum)
E-01	0.87	+3.75
E-02	0.83	+3.97
E-03	1.83	+2.87
E-04	1.59	+2.87
E-05	1.44	+2.74

3.19 Of the samples analyzed, concentrations of petroleum carbon fraction C₁₇-C₃₅ exceed the relevant solubility limit for 15 groundwater samples. **Table 3.4** summarizes the exceedances.

Table 3.4 Summary of Groundwater Samples Exceeding the RBRG Level/Solubility Limit

Sample I.D.	Contaminant	Relevant RBRG/Csol Level (µg/l)		Concentration (µg/l)	Exceedance of RBRG/Solubility Limit?
		Csol	RBRG		
Site A					
A-01	Petroleum Hydrocarbon (C ₁₇ -C ₃₅)	2800	178000	4400	> Solubility Limit only
A-01 (Duplicate)				5000	> Solubility Limit only
A-08				3600	> Solubility Limit only
A-09				3600	> Solubility Limit only
A-10				4100	> Solubility Limit only
A-11				3900	> Solubility Limit only
A-12				3800	> Solubility Limit only
Site C					
C2-1	Petroleum Hydrocarbon (C ₁₇ -C ₃₅)	2800	178000	5300	> Solubility Limit only
C2-1 (Duplicate)				4700	> Solubility Limit only
C2-3				4400	> Solubility Limit only
Site E					
E-01	Petroleum Hydrocarbon (C ₁₇ -C ₃₅)	2800	178000	5700	> Solubility Limit only
E-02				3300	> Solubility Limit only
E-03				3400	> Solubility Limit only
E-04				3800	> Solubility Limit only
E-05				6900	> Solubility Limit only

3.20 Based on the findings of site investigation and as confirmed by the land contamination specialist of MTR, no evidence of LNAPL was observed at any of the sampling locations. According to *Figure 3.3* of the Guidance Manual, no cleanup of groundwater is considered necessary at all sampling locations as chemical concentrations of all groundwater samples collected were below RBRG levels and no evidence of LNAPL was observed.

Results of QA/QC Analysis

- 3.21 QA/QC is the practice of ensuring that sample collection and analysis techniques provide precise and accurate information. This process is to ensure the levels of contamination measured in the environmental samples reflect the actual environmental levels and are not due to accidental contamination of the sample or sample container. In this land contamination assessment, a total of 6 sets of duplicate samples, field blank and equipment blank for soil and 3 sets of the above-mentioned QA/QC for groundwater were sampled and analyzed in accordance with the approved rCAP and summarized in the table below:

Table 3.5 Number of QA/QC Samples

Site	Number of QA/QC Samples*	
	Soil	Groundwater
A	3 sets	1 set
C2	1 sets	1 set
E	2 sets	1 set

Note:* Trip Blanks not included

- 3.22 In addition to the above, a total of 11 trip blanks samples were included in the sample shipment from the Subject Area to the laboratory. The laboratory results for QA/QC samples are presented in **Appendix D**.
- 3.23 Based on the findings of laboratory analysis, the QA/QC procedures for sample collection and preparation are considered to be acceptable as the analytical results for equipment blanks and field blanks recorded concentration below the method detection limits. The only exception is a zinc detection in one set of equipment blank samples collected during the soil sampling exercise. A potential source of cross contamination could be due to (1) incomplete equipment decontamination or 2) zinc contamination from the sample container. As reported by the site supervision personnel, all procedures were implemented in accordance with the requirements set in the approved CAP during sampling on site. However, the zinc concentrations detected in the blanks do not show strong co-relation with zinc concentrations identified in soil therefore the results are not expected to significant influence the this assessment and the QA/QC procedures for sample collection and preparation are therefore considered acceptable. Based on the results of field and laboratory QA/QC testing the analytical results is considered suitable for use in the assessment of the Site

3.24 In order to assess the sampling and laboratory reproducibility and precision, the relative percent difference (RPD) between primary and duplicate parameters was determined. The calculation, as presented in **Appendix D**, shows that all soil RPDs were within the acceptable range of 0- 50%. For groundwater samples, RPDs were not calculated for the majority of parameters as the concentrations of either primary or duplicate samples were below the limit of reporting. The exception is for petroleum carbon ranges C₉-C₁₆ and C₁₇-C₃₅ where one set of samples recorded a RPD for petroleum carbon range C₁₇-C₃₅ in exceedance of the acceptable range of 0-30%. This exceedance is not considered significant given the concentration in both primary and duplicate are low which likely resulted in an exaggerated percent difference.

Pre-remediation Assessment

Estimated Extent of Contamination

- 3.25 Based on analytical results of soil presented above, a bis-(2-Ethylhexyl)phthalate detection exceeding the adopted RBRG was identified between 3.0-3.45m at location E-02.. The area of land to be remediated is preliminarily defined as a 5m x 5m square centered at E-02 however, given the proximity of E-02 to the site boundary; the extent of excavation will adjusted accordingly. The validity of this approach will be confirmed by a comparison of analytical results from soils collected

from the excavation boundaries at mid-depths against the adopted screening criteria. If there are risk based exceedances at the excavation boundaries, the excavation will be incrementally extended until the samples collected at the excavation boundaries meet the remediation target value. In respect of the vertical distribution of contaminants, the depth of contamination is conservatively estimation to be 0.5m above and below a particular sampling depth where contamination is identified.

Additional Sampling

- 3.26 In order to more accurately delineate the extent of contamination, additional sampling was conducted on 25 May 2010 by Penta-Ocean. A total of four samples were collected at the boundary of the estimated contaminated areas shown in **Figure NOL/ERL/300/C/XRL/ENS/M57/539**. Soil samples were collected at depths shown in **Table 3.6**. Sampling and testing procedures as detailed in **Section 3.3** and **3.4** were followed.

Table 3.6 Details of Additional Samples Collected

Additional Sampling Location	Sampling Depth (m BBC)	Collection Date	Testing Parameters
E-02a	3.2m	25 May 2010	bis-(2-Ethylhexyl)phthalate
E-02b			
E-02c			
E-02d			

Pre-remediation Assessment Results

- 3.27 Of the four soil samples collected from the pre-remediation assessment works, no exceedance of relevant RBRG levels was identified. All sampling works were completed on 25 May 2010.
- 3.28 Based on the laboratory results from the pre-remediation works, the horizontal extent of contamination is delineated by the 4 additional samples as shown in **Figure NOL/ERL/300/C/XRL/ENS/M57/539**. The vertical extent of contamination will be confirmed by sampling soils from the base of the excavation. Given no exceedance of the industrial RBRG was identified in a sample taken from 4.5m-4.95m at E-02, the maximum vertical extent of contamination will be capped at 4.5m BBC. The estimated contaminated soil quantity based on the as-built additional sampling location is summarized in **Table 3.7**

Table 3.7 Estimated Soil Contamination Extent

Borehole ID	Depth with Contaminated Soil Found (m BBC)	Contaminant	Estimated Contamination Extent*		
			Vertical Extent (m BBC) (Thickness)	Horizontal Extent (m ²)	Volume (m ³)
E-02	3.0-3.45	bis-(2-Ethylhexyl)phthalate	2.5-3.95 (or to a maximum depth of 4.5m) (1.45m -2m thick)	17	34
Estimated Total Volume of Contamination=34m³					

*Note: The quantity of contaminated soil identified may be smaller subject to confirmatory tests at the bottom of the pit. The maximum depth would be capped at 4.5m BBC (i.e. of 2m thick) and therefore the maximum quantity of contaminated soil is expected to be of 34m³

Conclusions and Recommendations

- 3.29 According to the results of site investigation, a total of 106 soil samples and 23 groundwater samples (including duplicates) were collected, in which only 1 soil sample was found to have a bis-(2-Ethylhexyl)phthalate concentration exceeding the relevant RBRG level. No exceedances of RBRGs were identified in any groundwater samples collected. Based on site observation, no evidence of

LNAPL was observed at any of the groundwater monitoring locations, thus groundwater remediation is considered not necessary.

- 3.30 In accordance with the Guidance Note and Guidance Manual, remedial actions for soil are required and a Remediation Action Plan (RAP) is therefore presented in **Section 4** to identify the appropriate remediation actions for approximately 34m³ of bis-(2-Ethylhexyl)phthalate contaminated soil identified at sampling location E-02 at Site E of MPV.

4. REMEDIATION ACTION PLAN

Objective

- 4.1 This section presents possible remediation proposals and recommends appropriate remediation actions for the contaminated areas found.
- 4.2 The objectives of the remediation action plan (RAP) are as follows:
- (i) To propose remediation method(s) for the soil contamination
 - (ii) To propose a mean to confirm completed excavation of contaminated soil;
 - (iii) To provide guidelines regarding handling and/or disposal of contaminated soil

Potential Remediation Methods

- 4.3 Soil remediation options applicable to the contaminated area at Site E were addressed based on the followings criteria:
- nature and extent of the contamination;
 - soil characteristics;
 - cost effectiveness and time required for remediation;
 - environmental benefits and disbenefits; and
 - experience.

Soil Remediation

Nature of bis-(2-Ethylhexyl)phthalate

- 4.4 Bis-(2-ethylhexyl)phthalate, is an organic chemical commonly abbreviated as DEHP. It is an odourless colourless liquid with the formula $C_{26}H_{54}O_4$. The chemical is semi-volatile, with vapour pressure of only 1.32 mm Hg at 200°C (while vapour pressure of benzene is 100 mm Hg at 26.1 °C). It is insoluble in water but soluble in with mineral oil, hexane, and most organic solvents. It is widely used as a plasticizer in manufacturing of articles made of polyvinyl chloride (PVC) and also used as hydraulic fluid, dielectric fluid in capacitors and solvent in lightsticks. DEHP released to soil will neither evaporate nor leach into groundwater. DEHP has a strong tendency to adsorb to soil and sediments.

Suitable Soil Remediation Methods

- 4.5 A number of soil remediation technologies considered suitable for this nature of contaminant are selected for further examination. The applicability and limitations of the candidate treatment technologies are detailed in **Table 4.1** below.

Table 4.1 List of Possible Remedial Measures for Contaminated Soil

Remediation Option	Descriptions	Applicability and Environmental Benefits	Limitations and Environmental Dis-benefits
Biopiling	<i>Ex-situ</i> bioremediation method that bacteria grow in the piled contaminated soil and degrade the waste into harmless products.	- Effective to TPH and other wide range of organic contaminants with some successful local case studies, e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay, reclamation works at North Tsing Yi Shipyard site. - Most cost-effective for large volumes of contaminated soil - All materials and equipment are commercially available - Can be designed to be a closed system; vapour emissions can be controlled	- Labour-intensive; require considerable maintenance - Time-consuming and not cost-effective for treating small volume of soil. - Space required for biopile construction
Ex Situ Chemical Oxidation	<i>Ex-situ</i> chemical oxidation as a contaminant mass reduction technology. Chemical oxidants are directly applied in a controlled manner to excavated soils. Mixing optimizes intimate contact between soil and oxidant which promotes contaminant destruction or breaks down the chemical structure to enhance natural biodegradation processes.	- Effective to a broad range of soil and groundwater contaminants including Bis-(2-ethylhexyl)phthalate - Preparatory oxidants are available which leave behind very little residue, and which do not have a negative effect or interfere with efficient natural attenuation or enhanced bioremediation processes and do not detrimentally impact the quality of the groundwater - Rapid oxidation of target compounds	- Restricted access to the working site until completion of backfilling - Strong oxidizers require safe storage and handling by personnel specifically trained for handling and storage of hazardous materials. - Oxidizers must be stored away from combustible materials, reducing agents, acids, bases, and sources of heat
Soil Venting	<i>In situ</i> bioremediation method that uses indigenous bacteria to degrade contaminants. Activity of the bacteria is enhanced by inducing air flow (using extraction or injection wells) and, if necessary, by adding nutrients.	- Effective for reduction of semi volatile organic compounds (SVOCs) - Suitable for remediation in built up areas because wells can be placed between or below buildings - Applicable to large sites with widespread contamination - Uses readily available equipment; easy to install - Vapour emissions can be controlled but not to the extent of biopiling due to underground soil <i>in-situ</i> properties	- Effectiveness is limited by underground soil features e.g. soil moisture content, permeability, etc. - May induce possible air emission to the sensitive receivers, off-gas treatment required. - Require large space for the system development

Remediation Option	Descriptions	Applicability and Environmental Benefits	Limitations and Environmental Dis-benefits
Landfarming	<i>Ex-situ</i> bioremediation method that mixes the soil with bacteria involving the spread and exposure of contaminated soil to atmosphere	• Very effective in treating hydrocarbons • Simple to design and implement	• May induce possible dust and vapour emission to the sensitive receivers (surrounding factories and buildings) and relatively different to control • Require large flat space for the system development • Slow bioremediation rate and require long operation period (as long as 2 years) which may affect future development schedule
Natural Attenuation	<i>In-situ</i> bioremediation method which includes a variety of physical, chemical, or biological processes that, under favourable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. The <i>in-situ</i> processes include biodegradation, dispersion, dilution, sorption, volatilization, chemical or biological stabilisation, transformation, or destruction of contaminants.	• Applicable to non-halogenated VOCs/SVOCs and fuel hydrocarbons • Minimal technologies are required • No disturbance to on-going site operation • Can be adopted in inaccessible locations, e.g. below buildings. • No operations and maintenance requirements • No large scale excavation is required • Access to the site is mostly allowed	• Prevailing site conditions must be suitable to support the attenuation process • Extensive amounts of data must be collected and analyzed to determine contaminant plume behaviour • Not applicable when the plume is expanding • Intermediate degradation products may be more mobile and more toxic than the original contaminant • Contaminants may migrate before they are degraded • Routine monitoring is required • Time line for cleanup at the site is long (take over years) depending on optimal environmental / site conditions e.g. hydrogeology and geochemistry of the site

Remediation Option	Descriptions	Applicability and Environmental Benefits	Limitations and Environmental Dis-benefits
Excavation and Landfill Disposal	<i>Ex-situ</i> method whereby contaminants are removed by excavation of the contaminated soil and direct disposal to landfill	• Most simple and quickest way to dispose of large volume of contaminated soil • Contamination is removed definitely • Higher certainty of success • Wide experience in Hong Kong • Applicable to all waste or mixture that meet land disposal restriction treatment standards. • Common practice for shallow, highly-contaminated soils	• Pre-treatment may be required for contaminated soil to meet landfill disposal criteria • Landfill space limited and valuable • Indirect costs to the landfill management on monitoring and maintenance • Potential long-term liabilities to landfill • Need large volume of clean backfill materials • No access to the working site until completion of backfilling • Require approval from EPD and least desirable management option

Proposed Remediation Method

- 4.6 A maximum in ground volume of 34m³ of soil with bis-(2-Ethylhexyl)phthalate concentrations in excess of the industrial land use RBRG requires treatment.
- 4.7 Considering the quantity of soil, the experience of application in Hong Kong and the options appraisal of selected remediation techniques listed in **Table 4.1**; excavation followed by biopiling is identified as the most practical approach.
- 4.8 Biodegradation is a process which makes use of the biodegrading ability of naturally occurring or specifically added bacteria to break down the contaminants in the soil or to convert them into harmless substances. The organic nature of bis-(2-Ethylhexyl)phthalate renders this chemical suitable for biological degradation and biopiling methods have a successful track record in Hong Kong. Biopiling has been adopted as a soil remediation techniques at sites such as Former Kai Tak Airport, Choi Lee Shipyard and North Tsing Yi Shipyard.
- 4.9 Considering the site will be occupied as railway facilities, the remediation target for bis-(2-Ethylhexyl)phthalate is proposed to be the industrial landuse RBRG i.e. 91.8 mg/kg. Once remediation is completed the decontaminated soil will be suitable to remain in situ or if geotechnically unsuitable at this location, reused at other areas of the site; thus no offsite disposal or importation of clean backfill is required. Based on the quantity of contaminated soil identified and the existing contamination level (134mg/kg), it is estimated that approximately 3-12 months is required for treatment using a biopiling methods.

Outline Process

Excavation

- 4.10 Based on the findings of pre-remediation works, the contaminated area is delineated by the four additional sampling locations established (E-02a – E-02d). This area will be demarcated as an exclusion zone, fenced off and appropriately signed. No construction works will be conducted within this area until the removal of contaminated soil is completed.
- 4.11 Detailed design drawings for planned excavations in the indicated areas should be prepared by the Contractor. Factors such as excavation areas and depths, engineering properties and stability of the soils should be considered to ensure safe working conditions. The excavations should be designed in accordance with the geotechnical properties of the soils with appropriate safety factors as determined by the Engineer. The excavated areas should be set out by an appropriate qualified and licensed land surveyor. Proposed contaminated zones requiring excavation are shown in **Figure No. NOL/ERL/300/C/XRL/ENS/M57/539** and summarized in **Table 4.2**.

Table 4.2 Estimated Soil Excavation Extent

Zone of Excavation	Depth of Contaminated Soil (m BBC)	Contaminant	Estimated Excavation Extent*		
			Vertical (m BBC) (Thickness)	Horizontal (m ²)	Volume (m ³)
E-02	3.0-3.45	bis-(2-Ethylhexyl)phthalate	2.5-3.95 (or to a maximum depth of 4.5m) (1.45m -2m thick)	17	34
Estimated Total Volume of Contamination= 34m³					

*Note: The quantity of contaminated soil requiring excavation maybe smaller subject to confirmatory tests at the base of the pit. The maximum depth would be capped at 4.5m BBC (i.e. of 2m thick) and therefore the maximum quantity of contaminated soil for excavation is expected to be of 34m³.

- 4.12 During the remediation process, the excavation sequence would be as follows:

- At each location as set out by the surveyor, the contaminated soil would be excavated and transferred to a lined treatment area for homogenization. Free product (if encountered) during excavation should be recovered and drummed properly and collected by licensed chemical waste collector for proper handling and treatment.
- Following excavation and prior to backfilling, confirmatory sampling and analyses should be carried out at the base of the excavation, to confirm that all the contaminated soil has been removed. Soil samples should be collected for laboratory analysis of the defined contaminant (bis-(2-Ethylhexyl)phthalate). If the analytical results exceed the relevant RBRG level(s), additional soil should be excavated (in 0.5m increments vertically). Additional samples should be collected and analysed until all confirmation samples are below the relevant RBRG. If the analytical results are below the relevant RBRG, removal of contaminated soil should be considered complete and the open excavations then backfilled with suitable imported or reworked site materials.

Closure Assessment for Excavation

- 4.13 The purpose of the closure assessment is to confirm that all contaminated soils have been excavated from the contaminated areas identified.
- 4.14 In addition to the findings from the additional samples taken from each sidewall of the excavation, one confirmatory sample should be collected from the pit base. Proposed locations for confirmatory sampling are shown in **Figure Nos. NOL/ERL/300/C/XRL/ENS/M57/539**. In all cases, if there are any visible indications of potential contamination (e.g. stain, odour) in the contaminated zone (i.e. Zone E-02), additional samples should be collected.
- 4.15 Although the contaminant strongly sorbs to soil particles, it has very low water solubility and is not expected to leach, however, to mitigate the risk of cross contaminating unimpacted ground, spoil generated during excavation works should be placed on an impermeable surface within the soil treatment area.
- 4.16 All construction activities should be carried out by persons appropriately trained in health and safety and appropriated personal protective equipment should be used by the persons engaged in decontamination activities. The following guidelines of health and safety should be strictly followed by all site personnel working on the contaminated area(s) at all times:
- Temporary fencing or warning ribbons will be provided to the boundary of excavation, slope crest and temporarily stockpiled areas. Where necessary, the exposed areas should be temporarily covered with impermeable sheeting during heavy rainstorm.
 - Workers are required to wear appropriate protective clothing and safety equipment.
 - Smoking, eating, drinking is strictly prohibited.
 - Relevant occupational health and safety regulations and guidelines during excavation should be observed.
- 4.17 The excavation and confirmatory sampling works should be supervised by a Land Contamination Specialist. Subsequent construction activities could only be carried out after closure assessment for excavation at the contaminated zone is completed as agreed by the Land Contamination Specialist.
- 4.18 The essential steps of biopiling are outlined in the following paragraphs:

Biopiling

- 4.19 Biopiling is a commonly accepted ex-situ bioremediation method for the restoration of sites contaminated with biodegradable organic contaminants. By using microorganisms to degrade contaminants in soil, biopile(s) transform hazardous / toxic materials into harmless elements such as

water, carbon dioxide, and other innocuous products. The essential steps of biopiling are outlined in the following paragraphs:

Biopile Formation

- 4.20 The formation of a biopile should be created in a longitudinal direction. Uniform starting concentrations will facilitate the control of the bioremediation and optimize cleanup times (as decontamination will not be controlled by patches of soil with high initial concentrations). Compaction of the biopile by excavation machinery shall be avoided in order maintain a uniform soil density within the biopile. Bulking agents are not usually added as these may affect the geotechnical properties of the soil and be difficult to compact during backfilling. The biopile should be covered by impermeable sheeting to avoid fugitive emissions of dust from the biopile affecting the surrounding environment. Adequate turning should be undertaken during biopile formation and operation to maximize air circulation and enhance aerobic conditions for optimal microbial growth.
- 4.21 Impermeable sheeting shall be placed at the base of the biopile. As discussed in **Section 4.4**, bis-(2-ethylhexyl)phthalate has strong tendency to adsorb to soils does not leach, therefore whilst leachate control system is not required a simple temporary bund will be maintained around the stockpile to prevent migration of any surface runoff during wetting, if necessary.

Biopile Operation

- 4.22 Based on the limited volume of soil requiring treatment, the residual concentrations identified and semi-volatile nature of bis-(2-ethylhexyl)phthalate with its strong tendency to absorb to soil, the "evaporation" or volatilization of bis-(2-Ethylhexyl)phthalate contamination through mechanical induction of air is expected to be extremely low. An active aeration system is therefore not required within the biopile. The soil will be mechanically turned using a standard excavator bucket in order to introduce sufficient air for bacterial growth.
- 4.23 In addition to the above, moisture would be periodically added to the soil to maintain the moisture content within 10-20%. Regular progress monitoring of the soil conditions should be conducted to ascertain these conditions have been maintained.

Biopile Cleanup Progress Monitoring

- 4.24 The objective of the operation progress monitoring is twofold: i) to maintain the progress of contaminant cleanup, and ii) to ensure suitable conditions of the soil to support microbial growth. Progress monitoring would involve periodic soil sampling, and physical parameter monitoring.
- 4.25 It is proposed to undertake soil sampling monthly for the analysis of moisture content. However subject to actual remedial progress this frequency may be amended. Analyses for bis-(2-Ethylhexyl)phthalate for soil samples shall be conducted at least once every 3 months or higher frequency. Monitoring should continue until the cleanup targets are achieved. Once the cleanup targets for a location have been achieved, soil sampling at that particular location may discontinue. Progress of soil monitoring results will also indicate when the biopile decontamination process stops.

Biopile Closure Assessment

- 4.26 Biopile closure assessment should be conducted to ensure that the soil contaminant levels in the biopile are meeting the cleanup target for bis-(2-Ethylhexyl)phthalate.
- 4.27 The sampling frequency is proposed to be one sample per 10 m³ for biopile closure assessment considering the small volume of contaminated soil identified.
- 4.28 All soil samples shall be analyzed for bis-(2-Ethylhexyl)phthalate. The laboratory results are considered satisfactory when the levels of bis-(2-Ethylhexyl)phthalate meet the cleanup target

(industrial RBRG) using method USEPA Method 8270 (or equivalent). Industrial RBRG limit is selected as the future land uses of the areas would be railway development. Such acceptance testing shall be conducted for each 10 m³ of soil treated by biopiling.

- 4.29 Upon treatment by biopiling, the decontaminated soil shall be used as filling material or re-use on site with reference to the landuse scenario in the RBRG.

Demarcated “No Works” Area

- 4.30 In addition to the demarcated contaminated zone set around E-02, “no works” area will be set at Sites C1 and D and also set up along the eastern boundary of Site A, C and E to reduce the chance of contaminant migration from Sites C1 and D where land contamination assessment has not yet been conducted due to difficulties in gaining access for a site visit and inspection. No construction works will be allowed within the “no works” area demarcated along the eastern boundary of Sites A, C and E until the land contamination assessment was completed within Sites C1 and D and the samples collected at locations near Sites A, C2 and E indicated no exceedance of relevant RBRG levels. For Site C1 and D, construction works will not be allowed upon the submission and agreement of CAP, CAR/RAP from EPD. The demarcated “no works” areas are shown in **Figure Nos. NOL/ERL/300/C/XRL/ENS/M57/540**. Fencing and warning signs will be provided at the boundary of this Area to preclude working within these areas.

Remediation Report

- 4.31 Due to tight programme schedule, construction activities are required to be carried out after closure assessment of excavation at demarcated contaminated zone set around E-02. A Technical Note summarizing the findings should therefore be prepared by Land Contamination Specialist to confirm that all the contaminated soil has been removed at contaminated zone for treatment. All relevant information, including details of closure assessment, sampling results and photographs should be included in this technical note and submit to EPD for endorsement. Upon completion of soil remediation, a Remediation Report (RR) should be prepared by the Land Contamination Specialist to report on the remediation process and demonstrate that contaminated materials are all handled and treated to meet the relevant standards. All relevant information, including details of closure assessment, sampling results photographs and the quantity of treated soil and the final backfill site of treated soil should be included in the RR. The technical note will also be included in the RR for completeness.
- 4.32 In addition, no construction works should be conducted along the eastern boundary of Site A, C2 and E, where the areas are defined as “no works” area, until the land contamination assessment was completed within Sites C1 and D and the samples collected at locations near Site A, C2 and E indicated no exceedance of relevant RBRG levels. For Sites C1 and D, construction works should only be permitted upon approval of revised CAR and if needed, RAP.

Mitigation Measures and Safety Measures

- 4.33 In order to minimise the potentially adverse environmental impacts arising from the handling of potentially contaminated materials, the following environmental mitigation measures are proposed during the course of the site remediation:
- Excavation profiles must be properly designed and executed.
 - Stockpiles shall be sited on impermeable surfacing within the treatment area and covered to reduce dust emission. If this is not practicable, regular watering shall be applied.
 - Speed control for the trucks carrying contaminated materials should be enforced.

- Vehicle wheel and body washing facilities at the site's exist points shall be established and used.

4.34 In order to minimise the potentially adverse environmental impacts arising from the handling of potentially contaminated materials during the course of site remediation, the Occupational Safety and Health Ordinance (OSHO) (Chapter 509) and its subsidiary regulations shall be followed by all site personnel working on the site at all times. In addition, the following basic health and safety measures should be implemented as far as possible:

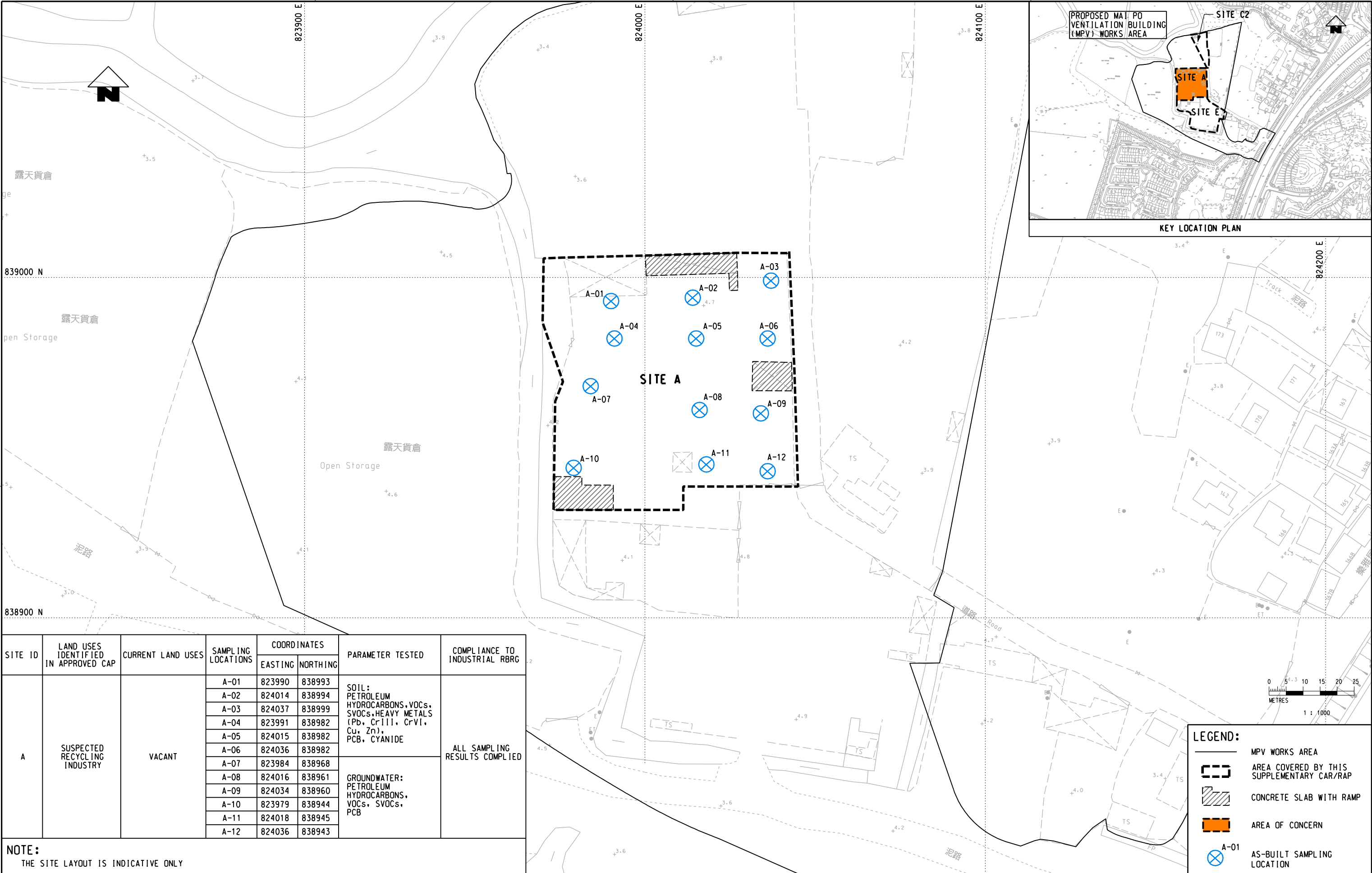
- Set up a list of safety measures for site workers;
- Provide written information and training on safety for site workers;
- Keep a log-book and plan showing the contaminated zones and clean zones;
- Maintain a hygienic working environment;
- Avoid dust generation;
- Provide face and respiratory protection gear to site workers;
- Provide personal protective clothing (e.g. chemical resistant jackboot, liquid tight gloves) to site workers; and
- Provide first aid training and materials to site workers.

5. CONCLUSION

- 5.1 Based on the findings of site investigation conducted in the period of October to November 2009, only 1 out of the 106 soil samples collected at Site A, C2 and E was found to have bis-(2-Ethylhexyl)phthalate exceeding the relevant RBRG level. No exceedances of the groundwater RBRG were identified.
- 5.2 To delineate the contaminated area, additional sampling was conducted in May 2010; the analytical results indicate no exceedance of the relevant RBRG, therefore confirming the extent of contamination. However, the vertical extent of contamination cannot be confirmed prior to excavation. Confirmatory testing will be conducted at the base of the excavation to determine the vertical extent of contamination and to ensure complete removal of contaminated soil during excavation. The volume of contaminated soil required remediation is estimated to be approximately 34m³.
- 5.3 Considering the contaminant is organic and biodegradable in nature, *biopiling* is considered the most suitable remediation method for the contaminated soil. The remediation target for the contaminated soil is proposed to be the RBRG (industrial) for the post-restoration land use associated with railway development.
- 5.4 A Technical Note and a Remediation Report should be submitted for EPD's approval upon completion of excavation works and the remediation works respectively. Appropriate environmental mitigation measures have been proposed to minimize the potential environmental impacts of the remediation activities. Health and safety measures should be followed to minimize safety hazard posed to site workers.
- 5.5 For the remaining part of Site C (i.e. Site C1) and Site D, separate supplementary CAP(s), CAR(s) and if necessary, supplementary RAP(s) will be prepared and submitted to EPD for approval when site access is permissible. No construction works should be conducted along the eastern boundary of Sites A, C2 and E, where the areas are defined as "no-works" area until the land contamination

assessment was completed within Sites C1 and D and the samples collected at locations near Site A, C2 and E indicated no exceedance of relevant RBRG levels. For Sites C1 and D, construction works should only be permitted upon approval of the Revised CAP, CAR and, if needed RAP.

PLOT DRW: \\mtr\mtr\p1\DRIVER\WINDOWS\3 COLOR\p1\155834 2010-3-18 155834.dgn
MODELNAME: PROJECTS\GO4070\DRAWINGS\NOL\ERL_300_C_XRL\ENS\M57_535A.dgn
FILENAME:

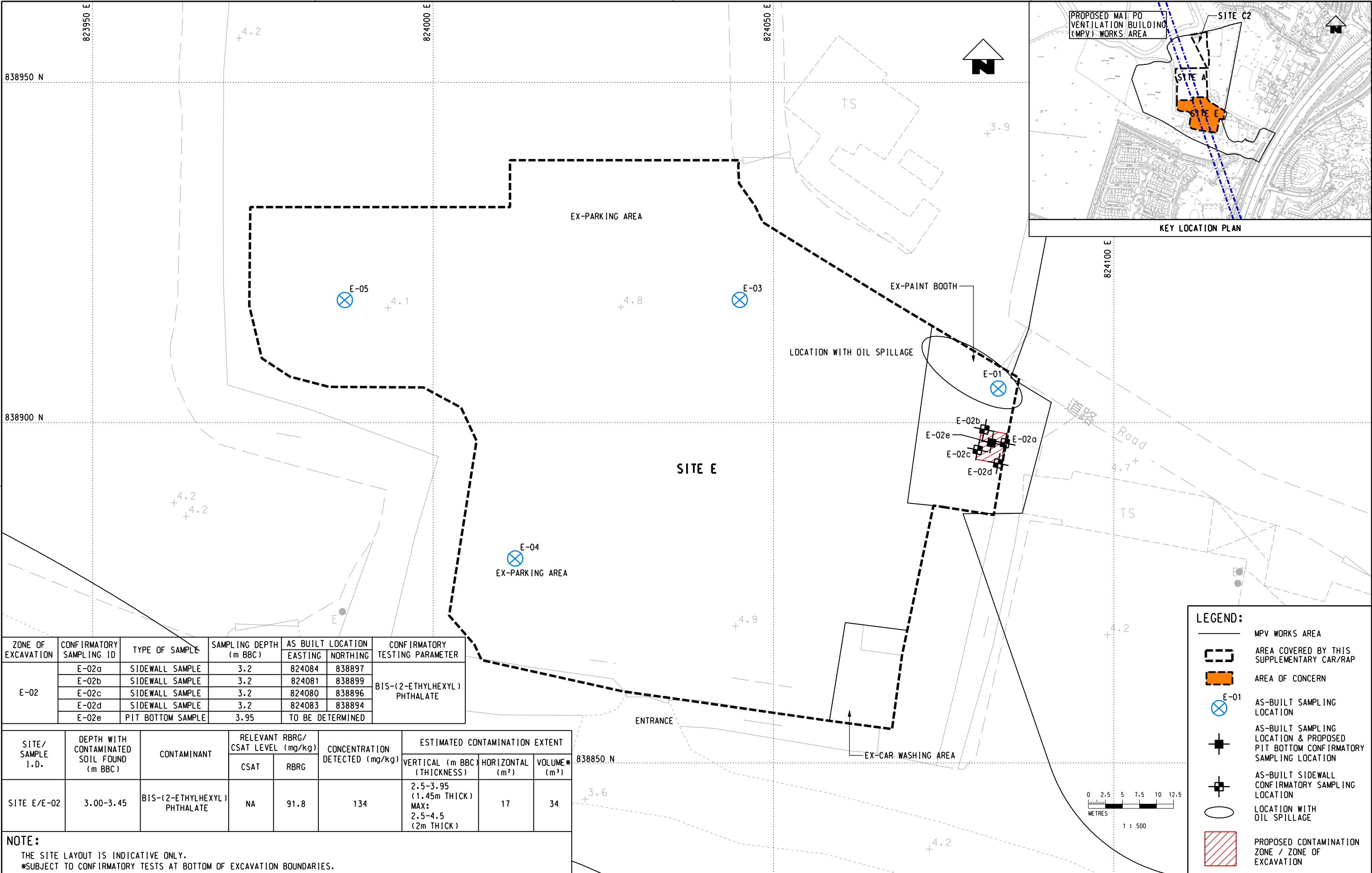


SITE ID	LAND USES IDENTIFIED IN APPROVED CAP	CURRENT LAND USES	SAMPLING LOCATIONS	COORDINATES		PARAMETER TESTED	COMPLIANCE TO INDUSTRIAL RBRG
				EASTING	NORTHING		
A	SUSPECTED RECYCLING INDUSTRY	VACANT	A-01	823990	838993	SOIL: PETROLEUM HYDROCARBONS, VOCs, SVOCs, HEAVY METALS (Pb, CrIII, CrVI, Cu, Zn), PCB, CYANIDE	ALL SAMPLING RESULTS COMPLIED
			A-02	824014	838994		
			A-03	824037	838999		
			A-04	823991	838982		
			A-05	824015	838982		
			A-06	824036	838982		
			A-07	823984	838968	GROUNDWATER: PETROLEUM HYDROCARBONS, VOCs, SVOCs, PCB	
			A-08	824016	838961		
			A-09	824034	838960		
			A-10	823979	838944		
			A-11	824018	838945		
			A-12	824036	838943		

NOTE:
THE SITE LAYOUT IS INDICATIVE ONLY

REV	DESCRIPTION				BY	DATE	APPROVED	REV	DESCRIPTION				BY	DATE	APPROVED				
DRAWN		YJP		DESIGNED		TWF		CHECKED		KCC		APPROVED		PL		DATE		06/JAN./2010	
DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.		COPYRIGHT © 2008 MTR CORPORATION LIMITED. ALL RIGHTS RESERVED.		REPRODUCTION OF THIS DRAWING / DOCUMENT IS OWNED BY THE MTR CORPORATION LIMITED OF HONG KONG. NO REPRODUCTION OF THE DRAWING / DOCUMENT OR ANY PART BY WHATEVER MEANS IS PERMITTED WITHOUT THE PRIOR WRITTEN CONSENT OF THE MTR CORPORATION LIMITED.		ORIGINATOR		EXPRESS RAIL LINK		AECOM		CADD REF.		NOL_ERL_300_C_XRL_ENS_M57_535A.dgn		TITLE		MTRC CONTRACT NO. 8202	
SCALE		1 : 1000 (A3)		FIGURE NO.		NOL/ERL/300/C/XRL/ENS/M57/535		REV.		A		SUPP. CAR/RAP (PART 1) FOR MPV WORKS AREA		AS-BUILT SAMPLING LOCATION					

PLOT DRW: \\mtr\mtr\p1\driver\windows\3\color\p1\2010-6-28 9:55:30
MODELNAME: NOL_ERL_300_C_XRL_ENS_M57_539A.dgn
FILENAME: NOL_ERL_300_C_XRL_ENS_M57_539A.dgn



ZONE OF EXCAVATION	CONFIRMATORY SAMPLING ID	TYPE OF SAMPLE	SAMPLING DEPTH (m BBC)	AS BUILT LOCATION		CONFIRMATORY TESTING PARAMETER
				EASTING	NORTHING	
E-02	E-02a	SIDEWALL SAMPLE	3.2	824084	838897	BIS-(2-ETHYLHEXYL) PHTHALATE
	E-02b	SIDEWALL SAMPLE	3.2	824081	838899	
	E-02c	SIDEWALL SAMPLE	3.2	824080	838896	
	E-02d	SIDEWALL SAMPLE	3.2	824083	838894	
	E-02e	PIT BOTTOM SAMPLE	3.95	TO BE DETERMINED		

SITE/ SAMPLE I.D.	DEPTH WITH CONTAMINATED SOIL FOUND (m BBC)	CONTAMINANT	RELEVANT RBRG/ CSAT LEVEL (mg/kg)		CONCENTRATION DETECTED (mg/kg)	ESTIMATED CONTAMINATION EXTENT		
			CSAT	RBRG		VERTICAL (m BBC) (THICKNESS)	HORIZONTAL (m ²)	VOLUME* (m ³)
SITE E/E-02	3.00-3.45	BIS-(2-ETHYLHEXYL) PHTHALATE	NA	91.8	134	2.5-3.95 (1.45m THICK) MAX: 2.5-4.5 (2m THICK)	17	34

NOTE:
THE SITE LAYOUT IS INDICATIVE ONLY.
*SUBJECT TO CONFIRMATORY TESTS AT BOTTOM OF EXCAVATION BOUNDARIES.

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	YJP
DESIGNED	TWF
CHECKED	KCC
APPROVED	PL
DATE	13/JAN./2010
DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE. (C) MTR CORPORATION LIMITED 2008. COPYRIGHT IN RESPECT OF THIS DRAWING / DOCUMENT IS OWNED BY THE MTR CORPORATION LIMITED OF HONG KONG. NO REPRODUCTION OF THE DRAWING / DOCUMENT OR ANY PART BY WHATEVER MEANS IS PERMITTED WITHOUT THE PRIOR WRITTEN CONSENT OF THE MTR CORPORATION LIMITED.	



EXPRESS RAIL LINK

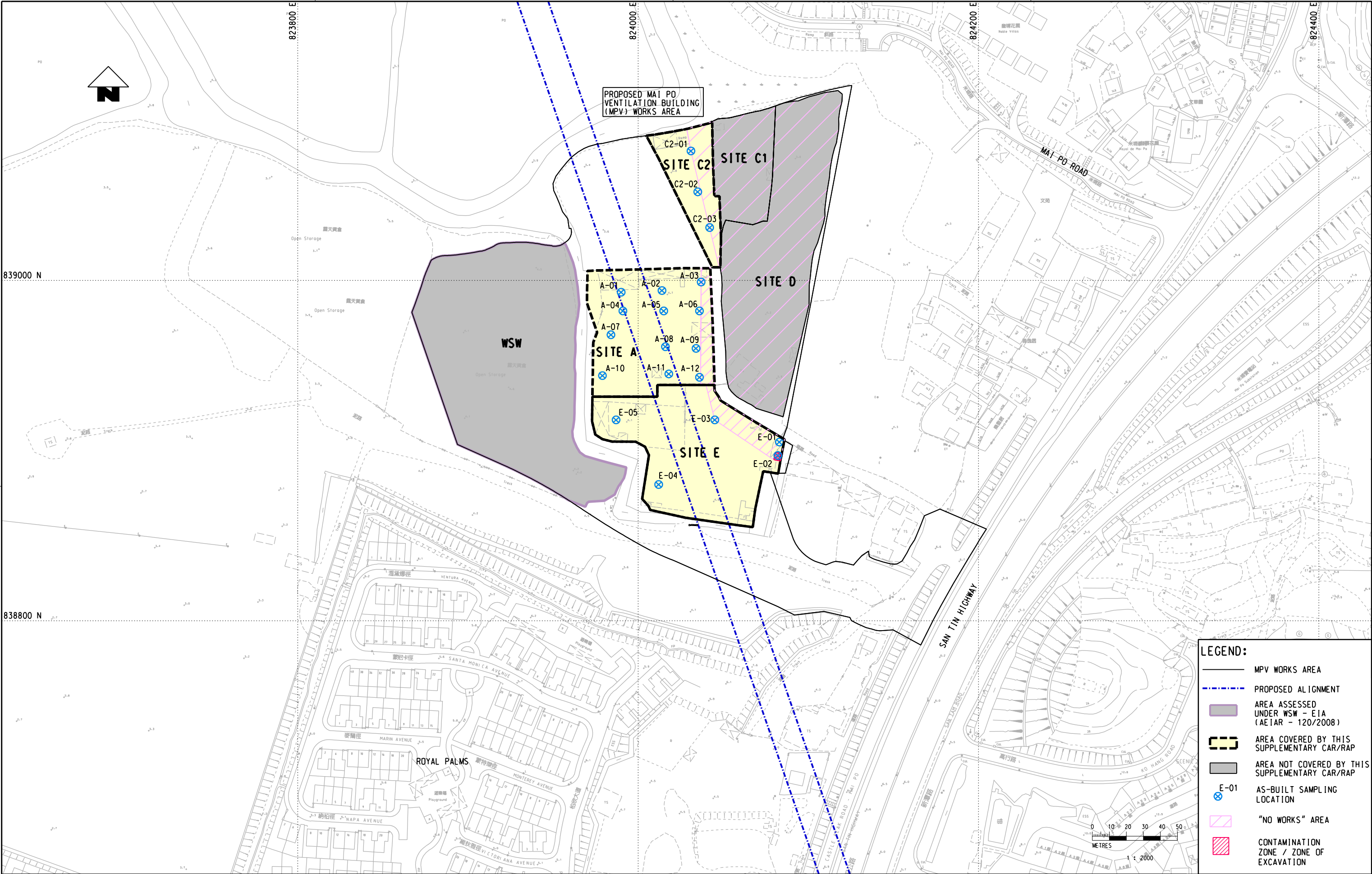


ORIGINATOR

CADD REF. NOL_ERL_300_C_XRL_ENS_M57_539A.dgn

TITLE MTRC CONTRACT NO. 8202 SUPP. CAR/RAP (PART 1) FOR MPV WORKS AREA EXTENT OF CONTAMINATION AND CONFIRMATORY SAMPLING LOCATIONS		
SCALE 1 : 500 (A3)	FIGURE NO. NOL/ERL/300/C/XRL/ENS/M57/539	REV. A

Plot Drw: R:\stnset\mtr\plot\driver\windows\3 colour.dgn 154832 2010-6-24
Model Name: Default
File Name: p:\projects\300\300 drawings\300\ens\m57_540a.dgn



LEGEND:

- MPV WORKS AREA
- PROPOSED ALIGNMENT
- AREA ASSESSED UNDER WSW - EIA (AEIAR - 120/2008)
- AREA COVERED BY THIS SUPPLEMENTARY CAR/RAP
- AREA NOT COVERED BY THIS SUPPLEMENTARY CAR/RAP
- AS-BUILT SAMPLING LOCATION
- "NO WORKS" AREA
- CONTAMINATION ZONE / ZONE OF EXCAVATION

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