

**Land Contamination Study  
for the Extension of Public Golf Course  
at Kau Sai Chau, Sai Kung**

**Contamination Assessment Plan**

Reference : R420-5.05  
Client : China Harbour Engineering Company (Group)  
Prepared by : CH2M-IDC Hong Kong Limited  
Date : January 2006

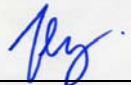
For and on behalf of CH2M-IDC Hong Kong Limited

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We confirm that this CAP has conformed to the information and recommendations contained in the EIA Report (Condition 2.4 of the Environmental Permit EP-224/2005).

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**LIST OF APPENDIX**

Appendix 1	Parameters, Assessment Guidelines and Analytical Results of the Preliminary Site Investigation during the EIA Stage
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**LIST OF ABBREVIATIONS**

Approved EIA Report	Environmental Impact Assessment Report on the Extension of Public Golf Course at Kau Sai Chau, Sai Kung, approved by the EPD in November 2005 (EIAO Register No. AEIAR-091/2005)
Assignment	Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung
BD	Buildings Department
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
CEDD	Civil Engineering and Development Department
CHEC	China Harbour Engineering Company (Group)
Client	China Harbour Engineering Company (Group)
COC	Chain-Of-Custody
Consultant	CH2M-IDC Hong Kong Limited
COP	Code of Practice
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance (Cap. 499)
EM&A	Environmental Monitoring and Audit
EP	Environmental Permit
EPD	Environmental Protection Department
ET	Environmental Team
FSD	Fire Services Department
GEO	Geotechnical Engineering Office
Guidance Notes	Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops, EPD (1999).
HKSAR	Hong Kong Special Administrative Region
HOKLAS	Hong Kong Laboratory Accreditation Scheme
IEC	Independent Environmental Checker
Laboratory	The HOKLAS accredited laboratory to be procured by the Consultant
LandsD	Lands Department
LNAPL	Light Non-Aqueous Phase Liquid
Main Contractor	China Harbour Engineering Company (Group)
MRA	Mutual Recognition Agreement
PlanD	Planning Department
PPE	Personal Protective Equipment
Project	Extension of Public Golf Course at Kau Sai Chau, Sai Kung
Project Team	All parties and organizations involved in the Project
ProPECC Note	Practice Note for Professional Persons – Contaminated Land Assessment and Remediation, EPD (1993)
QA/QC	Quality Assurance / Quality Control
RAP	Remediation Action Plan
SI	Site Investigation
SI Contractor	The contractor responsible for the site investigation works to be procured by the Consultant
Study Area	The area covered under the Project, i.e. Extension of Public Golf Course at Kau Sai Chau, Sai Kung

## 1. INTRODUCTION

### 1.1 Background Information

- 1.1.1 CH2M-IDC Hong Kong Limited (the Consultant) has been commissioned by the China Harbour Engineering Company (Group) (CHEC or the Client) to undertake the land contamination study for the Project “Extension of Public Golf Course at Kau Sai Chau, Sai Kung” (the Assignment). The concerned area of the Assignment (Study Area) is located at the eastern part of Kau Sai Chau Island, Sai Kung, immediately south and east of the existing golf course. Figure 1-1 shows the location of the Study Area.
- 1.1.2 The construction and operation of an 18 hole public golf course is the major component of the overall Project, apart from the construction and/or operation of other facilities such as a closed low flow drainage system, desalination facilities, and temporary barging point (construction phase only).
- 1.1.3 The Study Area is currently undeveloped, comprising scrubland and incised stream courses. It is reported that there are a number of locations within the Study Area where the former landuse as an artillery firing range has removed the thin surface vegetation that the resultant bare ground has led to surface soil erosion due to runoff. There has been no formal activity in this area since its cessation of use as an artillery firing range; while there has been no systematic checking and removal of unexploded ordnance.
- 1.1.4 As it is reported that the artillery firing range on Kau Sai Chau was used between the 1930’s and mid-1970’s, it is possible that such previous landuse might induce contamination to the soil and groundwater. The assessment of the potential environmental issues related to land contamination and the potential for the occurrence of soil contamination within the Study Area has been addressed in Section 11 of the recently approved Environmental Impact Assessment Report, EIAO Register No. AEIAR-091/2005 (the “Approved EIA Report”); and a preliminary Contamination Assessment Plan (CAP) was prepared as presented in Section 11.8 of the Approved EIA Report [Refer to Section 2 herein for further details].
- 1.1.5 As recommended in the Approved EIA Report, further land contamination assessment during the construction phase of the Project is required. In addition, the work related to land contamination is warranted as described in Condition 2.4 of the Project Environmental Permit (EP) No. EP-224/2005 and quoted as follows:

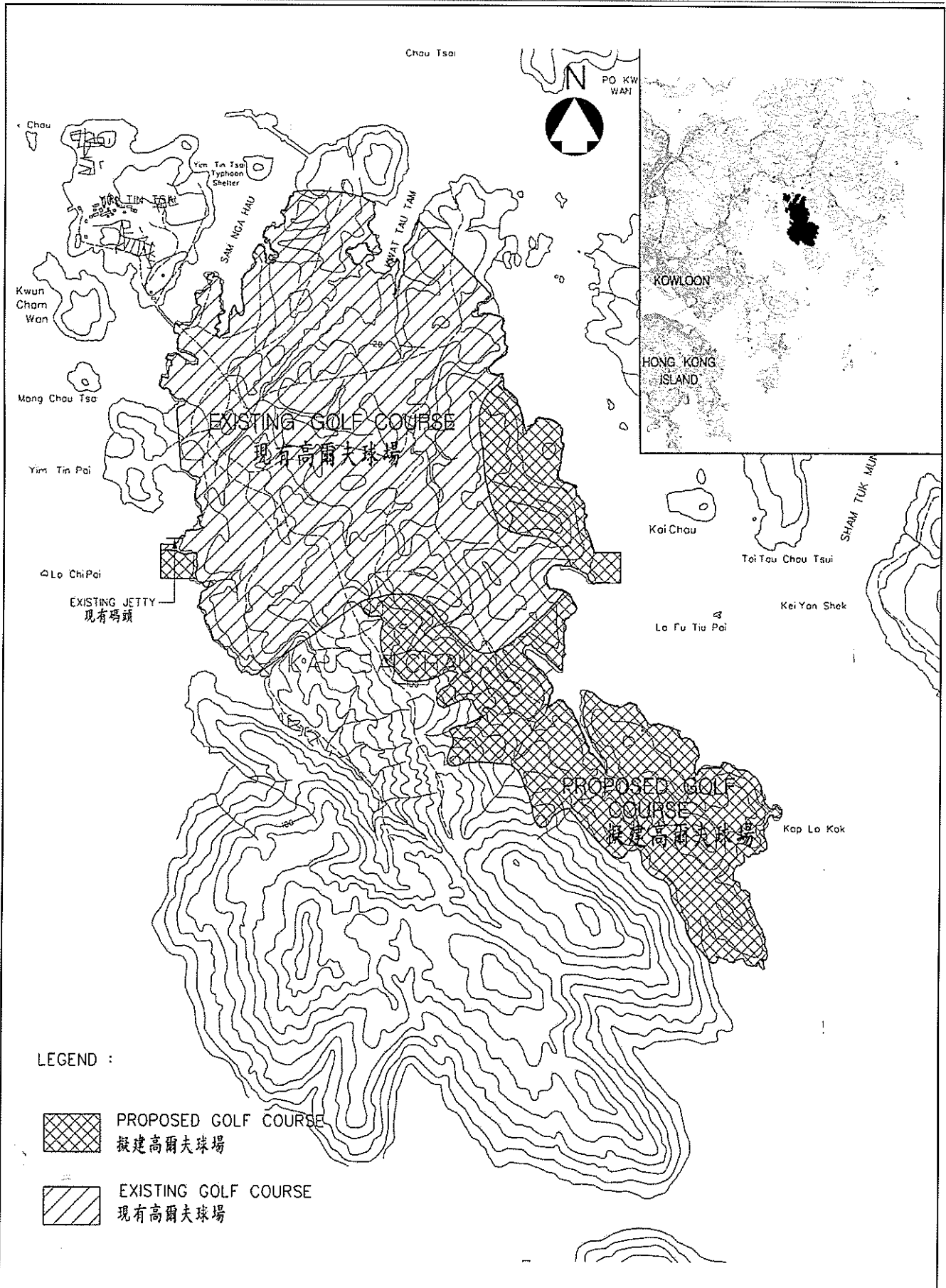
*The Permit Holder shall, at least one month before the commencement of construction at the potentially contaminated land as indicated in Figure 2, submit to the Director for approval 3 hard copies and one electronic copy of the Contamination Assessment Plan (CAP) with exact sampling locations and testing parameters. A site investigation shall be carried out in accordance with the approved CAP. If land contamination is confirmed by the site investigation, the Permit Holder shall submit to the Director for approval 3 hard copies and one electronic copy of a Remediation Action Plan (RAP) including a Contamination Assessment Report (CAR). All remediation actions in the approved RAP shall be fully and properly implemented. No work on the identified potentially contaminated sites shall be carried out unless and until the CAP and RAP submitted under this condition are approved by the Director. Before submission to the Director, all plans and reports shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the EIA Report.*

### 1.2 Objectives and Outline



- 1.2.1 The objectives of this Assignment are to:
- Specify the details and requirements of the further land contamination assessment arising from the former landuse as an artillery firing range; and
  - Propose the forthcoming tasks during the construction stage of this Assignment.

1.2.2 This CAP has been prepared following the guidance and steps outlined in the *Practice Note for Professional Persons – Contaminated Land Assessment and Remediation ProPECC PN3/94 (ProPECC Note)* and the *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops. (Guidance Notes)*, both published by the Environmental Protection Department (EPD) of the Government of HKSAR. This CAP is structured as follows:

- A description of the Project and the objectives of this Assignment as described in this Section 1;
- Review of the relevant reports and documents in Section 2;
- Site Investigation (SI) Plan for this Assignment in Section 3;
- Laboratory analytical requirements in Section 4; and
- Programme and the forthcoming tasks for this Assignment in Section 5.



LEGEND :

-  PROPOSED GOLF COURSE  
 擬建高爾夫球場
-  EXISTING GOLF COURSE  
 現有高爾夫球場

Source: Fig. 1.1 of the Approved EIA Report

<p>Title: Location of the Study Area for the Land Contamination Study on Kau Sai Chau</p>	<p><b>CH2M-IDC Hong Kong Limited</b></p>
<p>Project: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung - Contamination Assessment Plan</p>	<p>Scale: NTS Figure: 1-1</p>

## **2. REVIEW OF THE RELEVANT REPORTS**

### **2.1 Introduction**

2.1.1 This Section presents a review of available information related to this Assignment.

2.1.2 Information on the historic/current/proposed landuses, site environs, laboratory results of preliminary site investigation (SI), and proposed contamination investigation have been included in Section 11 and Appendices 11.1 to 11.3 of the Approved EIA Report. In addition, Figure 11.1 of the Approved EIA Report is an indicative location plan for the contamination investigation previously performed (as shown in Figure 2-1 of this CAP). The following paragraphs summarise the above-mentioned items, whereas Appendices 11.1 to 11.3 of the Approved EIA Report have been included in Appendix 1 of this CAP.

### **2.2 Currently Available Information**

#### Landuses

2.2.1 It is reported that during the EIA stage the following sources of information were collated and reviewed:

- Aerial photographs of Kau Sai Chau – reference numbers CN17350 (Year 1991), CN26878 (Year 2000) and CN26876 (Year 2000);
- HKSAR Government 1:5,000 Survey Maps (Ref No. 8-SW-D and 12-NW-B of Series HP5C) of Kau Sai Chau; and
- Archaeological survey summary of the Welch site on Kau Sai Chau by William Meacham<sup>1</sup>.

2.2.2 In addition, records and photographs during the site visits conducted during the EIA stage provide the existing environs of the Study Area. Gathering all available information, the following presents a chronology of the landuse within or near to the Study Area on Kau Sai Chau.

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<sup>1</sup> Available at <http://www.hku.hk/hkprehis/earliest.htm>

Table 2-1 Landuse Summary on Kau Sai Chau Island

Period / Year	Landuse / Description	Sources of Information
1936 to mid-1970's (except 1941 to 1945)	<ul style="list-style-type: none"> <li>▪ Landuse as artillery firing range by the British Forces (Army and Navy) for most of Kau Sai Chau.</li> <li>▪ Exact location of the range not known.</li> </ul>	Archaeological survey summary of the Welch site on Kau Sai Chau by William Meacham
1991	<ul style="list-style-type: none"> <li>▪ Rural area with small villages in both northern and southern parts of the Kau Sai Chau Island.</li> <li>▪ Landuses within the Study Area include village and farmland.</li> <li>▪ Certain eroded slopes observed oriented from the northwest direction to the centre of the island, possibly caused by the removal of vegetation from landuse as an artillery firing range.</li> <li>▪ Construction of the public golf course not yet commenced.</li> </ul>	Aerial photograph CN17350
2000	<ul style="list-style-type: none"> <li>▪ Public golf course already in place in the northern part of Kau Sai Chau Island.</li> <li>▪ A reservoir was built in the north of the island.</li> <li>▪ Certain eroded slopes recovered but others still exist in the centre of the island.</li> <li>▪ Village in the north removed while that in the south still exists.</li> </ul>	Aerial photographs CN26878 & CN26876
Up to July 2005	<ul style="list-style-type: none"> <li>▪ Unmanaged scrubland and incised stream courses.</li> <li>▪ Certain eroded slopes/areas.</li> </ul>	July 2005 site reconnaissance during the EIA stage.

Note: Information adopted from Section 11.5 and Section 11.6 of the Approved EIA Report.

### Site Environs

2.2.3 With reference to the site reconnaissance conducted during the EIA stage in July 2005, most of the Study Area was scrubland and incised stream courses, where plants are grown prosperously, except for certain eroded areas. There were a few streams flowing towards the coast.

### Preliminary SI and Laboratory Results

2.2.4 During the EIA stage, the sources of contaminants expected were bullets, gun powder, residues of exploded ordnance or some buried unexploded ordnance, due to the previous landuse on Kau Sai Chau as an artillery firing range. The target contaminants of concern were therefore heavy metals and sulphur. It is reported that sampling locations were randomly chosen within the Study Area, with focus on the eroded areas.

2.2.5 During the preliminary site investigation conducted on 12 July 2005, eight sampling locations (1 to 8) were identified within the Study Area as shown in Figure 2-1. Surface soil samples (soil of 5cm to 10cm below ground surface) were collected by means of shovel or hoe from seven out of the eight sampling locations, with the exception of Sampling Location 2 which was inaccessible during the preliminary SI.



2.2.6 As indicated in the ProPECC Note, the Conventional Dutch “ABC” List could be used as the criteria for assessing whether the soil has been contaminated or not. It has been generally adopted that soil contamination is evident if Dutch B criteria has been exceeded. Given this, a total of four exceedances in soil samples were identified in the Approved EIA Report (see Table 2-2 below).

Table 2-2 Summary of Soil Samples Exceeding Dutch B Level

Sampling Location	Parameter	Contaminant Concentration	Dutch B Criterion	Dutch C Criterion	Exceedance Level
3	Lead	240	150	600	> B and < C
6	Total sulphur	48	20	200	> B and < C
7	Total sulphur	20	20	200	≥ B and < C
8	Total sulphur	21	20	200	> B and < C

Note: Concentration and Dutch B/C Criteria are presented in mg/kg dry soil.

2.2.7 It has been indicated in the Approved EIA Report that the lead contamination is possibly a discrete exceedance at Sampling Location 3, while the exceedance of total sulphur at Sampling Locations 6 to 8 might have identified a contaminated spot, possibly due to the landuse of an artillery firing range. It has also been commented that sulphur contamination is not spatially continuous and is confined within the area near Sampling Locations 6 to 8.

#### Recommended Further Contamination Investigation

2.2.8 In the Approved EIA Report, it recommended that further SI for land contamination assessment should be undertaken prior to the commencement of any excavation works. Soil samples should be taken to determine the distribution of the contaminants. Table 2-3 below contains the required sampling locations and their justification as described in the Approved EIA Report.

2.2.9 It is recommended that soil sampling should be undertaken for the above-mentioned sampling locations. Sampling depths are recommended to be at 0.5m, 1.5m and 3.0m below the ground level, subject to sub-surface geological conditions of the locations. Where encountered, groundwater samples should also be collected at each of these sampling locations.

2.2.10 It was reported in the Approved EIA Report that there are no other historical land uses having potential land contamination except for the artillery firing range in the portions of the Study Area between the 1930’s and the 1970’s. Further review indicates that heavy metals and sulphur are the major potential contaminants that were typically used in firing ranges such as bullets, gun powder, residues of exploded or buried ordnance at that time<sup>2</sup>. The use of other toxic substances for artillery is very unlikely. Hence, the presence of other toxic organics is not expected. The potential contaminants associated with the artillery firing range would generally be heavy metals and sulphur as they are the only 2 parameters exceeding the respective Dutch B criterion; therefore these are selected as the parameters for further contamination investigation.

<sup>2</sup> Heavy metals are the major component of the metal casing for bombs. Gunpowder has three major components, they are potassium nitrate (oxidiser), charcoal (fuel) and sulphur (reducer). Potassium nitrate is a naturally occurring mineral source of nitrogen which is commonly used as fertiliser. For charcoal, it is a commonly found carbon compound and used as fuel, filter and absorbent. In addition, with reference to *Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair / Dismantling Workshops* and ProPECC PN 3/94, potassium nitrate and carbon are not classified as contaminants. Thus, potassium nitrate and charcoal (carbon) are not considered as potential contaminants. Heavy metal and sulphur are the major potential contaminants and being selected for testing.

Table 2-3 Justifications for Construction Phase Site Investigation

Sampling Location	Justification(s)
2	Preliminary site investigation could not be carried out during the EIA stage (accessibility problem).
3	A discrete hotspot of contamination (lead) was identified based on the results from the preliminary SI.
6	The area (eroded scar(s)) is potentially contaminated with sulphur as identified in the preliminary SI.
7	
8	

Note: Information adopted from Table 11.5 of the Approved EIA Report.

### 2.3 Review and Comments on the Preliminary Site Investigation

- 2.3.1 Section 11 of the Approved EIA Report provides valuable information as the basis for further investigation in order to determine the nature and extent of contamination within the Study Area. The Approved EIA Report adopted a hot-spot investigation approach with focus on eroded areas. The approach is considered acceptable given the vast but unknown extent of the previous landuse as an artillery firing range for several decades.
- 2.3.2 A suite of twelve heavy metals, as in Appendix IV of the ProPECC Note, as well as total sulphur have been analysed during the EIA stage for each of the sampling locations with Lead (Pb) and total sulphur being the identified contaminants of concern.
- 2.3.3 Based on the findings of the total sulphur exceedance at Sampling Locations 6 through 8, two out of three exceedances of the Dutch B criterion are only marginal. This is noted and will be considered during the assessment of land contamination.
- 2.3.4 Since the preliminary SI was conducted recently (July 2005) and the landuse of the site and its condition has not changed over the past several months, the Consultant considers that the findings arising from the preliminary SI contained in the Approved EIA report are still valid.
- 2.3.5 There has been no description of soil type of the obtained soil samples during the preliminary SI, and the general site geology and hydrogeology have not been fully identified. This information is to be obtained as far as possible through relevant party in the Project Team, presumably the geotechnical engineer, during the construction phase.
- 2.3.6 Apart from the information reviewed so far, the following HKSAR Government Departments have been enquired on the latest update on the availability of landuse status and records of land contamination and/or spillage for the Study Area, all dated 20 December 2005. The summary of correspondence is presented in Table 2-4 below.

Table 2-4 Enquiries and Responses on Land Contamination Related Records in the Study Area

Consultant's Letter Ref.	Department	Response Letter Ref.	Response Date	Summary
P261.05/0/0001	Management Group, FSD	Not yet received	N/A	N/A
P261.05/0/0002	Sai Kung District Office, LandsD	Not yet received	N/A	N/A
P261.05/0/0003	EPD	Not yet received	N/A	N/A
P261.05/0/0004	Support Division, BD	Not yet received	N/A	N/A
P261.05/0/0005	GEO, CEDD	Not yet received	N/A	N/A
P261.05/0/0006	PlanD	Not yet received	N/A	N/A
P261.05/0/0007	Explosive Ordinance Disposal Bureau, Hong Kong Police Force	Not yet received	N/A	N/A

## **2.4 Plan for Further Contamination Investigation**

- 2.4.1 Upon reviewing, acknowledging and adopting the land contamination assessment undertaken during the EIA stage of the Project, Section 3 and Section 4 herein present the plan and requirements of the proposed SI and laboratory analyses. These sections have adopted, where appropriate and applicable, the recommendations of the preliminary CAP outlined in Section 11.8 of the Approved EIA Report.



Source: Fig. 11.1 of the Approved EIA Report

Title: Preliminary Land Contamination Sampling Locations

CH2M-IDC Hong Kong Limited

Project: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung - Contamination Assessment Plan

Scale: NTS

Figure: 2-1

### 3. SITE INVESTIGATION PLAN

#### 3.1 Introduction

3.1.1 This Section presents the detailed requirements of the proposed site investigation for this Assignment.

#### 3.2 Sampling Strategy and Locations

3.2.1 A “hotspot” approach was adopted in the Approved EIA Report with reference to the identified previous landuses within the Study Area resulting in five follow-up sampling locations proposed as described in Table 2-3 herein.

3.2.2 There are some adjustments to the five proposed sampling locations as detailed in the EIA based on the following criteria:

- in the vicinity of the initial land contamination assessment locations (as detailed in the EIA Report);
- in an area of maximum excavation; and
- in the vicinity of the erosion scar, if such existed during initial land contamination assessment (note that there are no such features existing at Location 2 and Location 3).

3.2.3 The resulting five updated sampling locations and requirements are summarised in Table 3-1 and shown in the plan view on Figure 3-1.

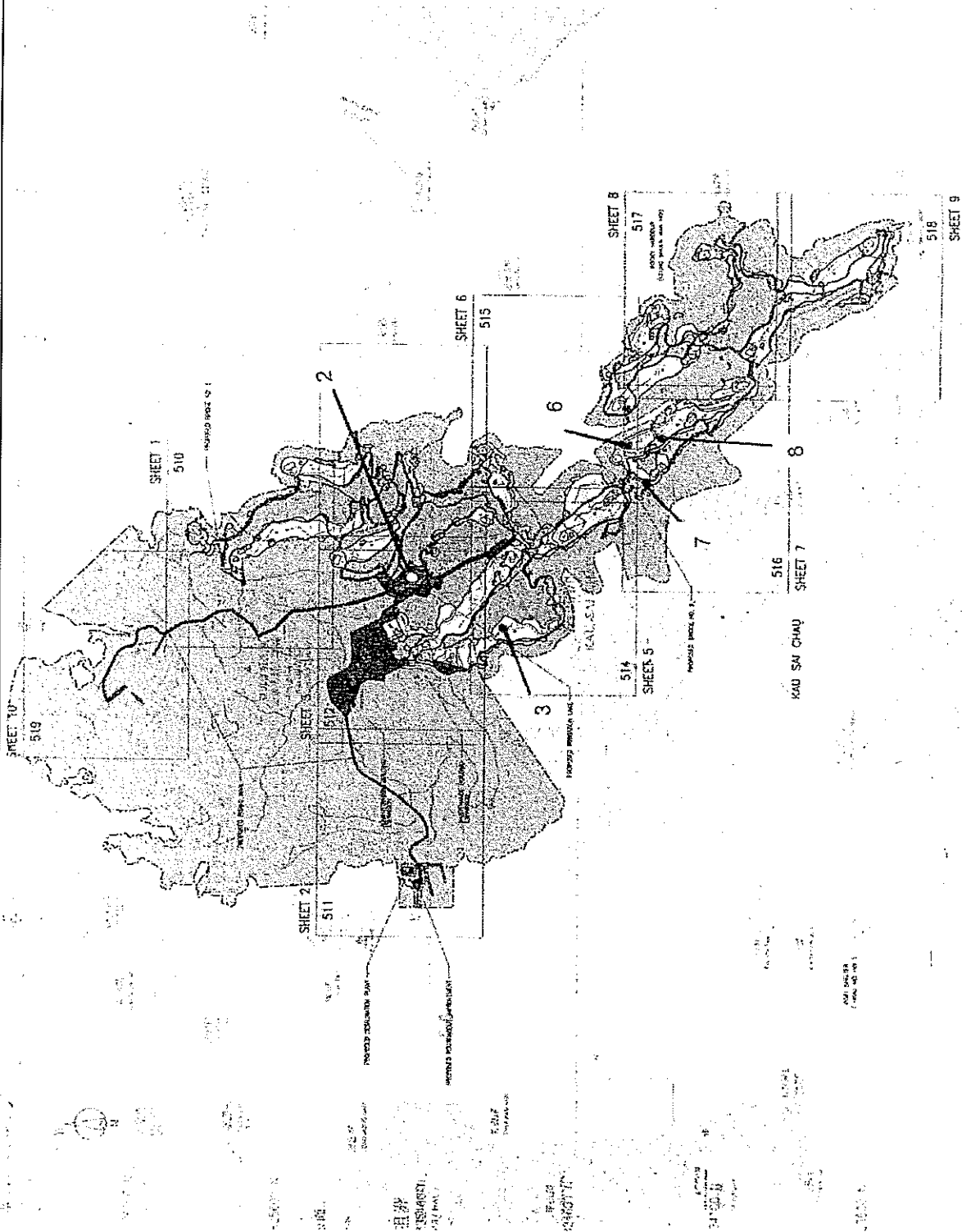
Table 3-1 Site Investigation Sampling Requirements for this Assignment

Sampling Location	Approximate Coordinates <sup>1</sup>	Target Contaminant(s)	Sampling Depths <sup>2</sup> (m below ground level)	Number of soil samples
2	N: 825 150 E: 850 520	Lead and Total Sulphur	0.5, 1.5, 3.0	3
3	N: 824 850 E: 850 350		0.5, 1.5, 3.0	3
6	N: 824 400 E: 850 960		0.5, 1.5, 3.0	3
7	N: 824 370 E: 850 850		0.5, 1.5, 3.0	3
8	N: 824 320 E: 851 000		0.5, 1.5, 3.0	3
<b>Total number of soil samples:</b>				<b>15</b>

Note:

1. Approximate coordinates determined by the Main Contractor in December 2005 and January 2006.
2. Subject to sub-surface geological conditions of the sampling locations at time of SI. Sampling will stop if bedrock or hardstanding is encountered.

3.2.4 The exact sampling locations and coordinates are to be determined on site, with reference to the existing site condition, topography and design of the golf course extension.



Title: Five Updated Sampling Locations for Detailed Contamination Assessment

Project: Land Contamination Study for the Extension of Public Golf Course at Kau Sai Chau, Sai Kung - Contamination Assessment Plan

CH2M-IDC Hong Kong Limited

Scale: NTS

Figure: 3-1

### 3.3 Soil Sampling Methodology

- 3.3.1 The fieldwork is proposed to be undertaken by a SI Contractor under direct management and supervision by the Consultant. It is proposed that inspection pit and hand auger sampling will be adopted for the soil sampling. All equipment in contact with the soil will be thoroughly decontaminated prior to use by cleansing with a laboratory-grade (non-phosphate) detergent and rinsed thoroughly by potable water. A clean area immediately adjacent to the sampling location will be established, using a plastic sheet or tarpaulin, on which all cleaned equipment will be placed.
- 3.3.2 For safety reasons, the Main Contractor (CHEC) will sweep at and in the vicinity of the sampling locations with a metal detector to check for the presence of unexploded ordnance prior to soil sampling works. If there is any metal scrap discovered under the ground during the course of SI, the SI Contractor is to cease work immediately until the identity is confirmed. For areas suspect of ordnance, the SI Contractor is to inform CHEC immediately for necessary notification to the Hong Kong Police Force for subsequent action.
- 3.3.3 Prior to any soil sampling works, vegetation and debris on and around the sampling location, if any, will be removed.
- 3.3.4 Inspection pit with nominal dimensions of 1.0m wide by 1.0m long and 1.0m deep will be constructed for inspection of sub-surface geological conditions immediately beneath the undisturbed ground surface or soil layer. During inspection pit excavation, sufficient quantity of soil sample per the advice of the appointed HOKLAS Laboratory will be obtained at 0.5m below ground level for laboratory analysis.
- 3.3.5 For each location beyond sampling depth of 1.0m below the undisturbed ground level or soil layer, boreholes are to be drilled manually by means of a hand auger and samples at 1.5m and 3.0m below ground level obtained. A groundwater sample will also be collected if groundwater is encountered during soil sampling (see Section 3.4 below).
- 3.3.6 The collected soil samples will be accompanied with the following information as a minimum:
- Sample identification number;
  - Date and location number where sample collected;
  - Soil sampling depth (m below ground level);
  - Volume and/or weight of soil sample;
  - Qualitative physical characteristics (clay, silt, sand, gravel, stone, cobble, colour, odour, moisture, etc.); and
  - Colour photograph and other pertinent information.
- 3.3.7 The as-constructed coordinates (i.e. Northings and Eastings according to HK1980 Grid) will be surveyed by the Main Contractor.

### 3.4 Groundwater Sampling Methodology

- 3.4.1 For each sampling location, a groundwater sample will be collected if encountered during soil sampling. The groundwater will be purged sufficiently to remove fine-grained materials and to collect freshly recharged representative samples. The purging exercise is considered adequate after removing five times the volume of groundwater within the borehole, using a WaTerra Pump or similar device.



- 3.4.2 During the purging exercise, the time for groundwater recharge to the original level is to be recorded by the SI Contractor as an indication of groundwater flow and velocity. The groundwater sampling location is then to be allowed to stabilise for at least 24 hours to permit groundwater to settle and to reach equilibrium.
- 3.4.3 The groundwater level (m below ground level) and thickness of any light non-aqueous phase liquid (LNAPL) floating on top of the groundwater is to be measured by the SI Contractor after 2 hours of purging and before the collection of groundwater samples.
- 3.4.4 When collecting the groundwater sample, a sufficient volume of groundwater per the advice of the appointed HOKLAS Laboratory is to be taken using WaTerra Pump or equivalent device and placed into containers to be provided by the Laboratory. Sampling of LNAPL, if present, will also be required to allow identification by the Laboratory.
- 3.4.5 The collected groundwater samples will be accompanied with the following information as a minimum:
- Sample identification number;
  - Location number where sample collected;
  - Groundwater level (m below ground level);
  - Date and time of groundwater sample collection;
  - Volume of groundwater sample;
  - Physical appearance (colour, odour, etc.); and
  - Colour photograph and other pertinent information.

### **3.5 Sample Handling Requirements**

- 3.5.1 All soil samples are to be taken by stainless steel spoon and placed into the containers provided by the Laboratory. The samples will be properly labelled and refrigerated on-site and during transit at or below 4°C but not frozen.
- 3.5.2 Similarly, all groundwater samples collected will be properly labelled, refrigerated on-site and during transit at or below 4°C but not frozen.
- 3.5.3 A chain-of-custody (COC) form, including the description of the sample containers, will be completed by the SI Contractor and counter-signed by the Consultant for all samples sent to the appointed HOKLAS Laboratory as part of the laboratory QA/QC requirements. All the collected samples will be sent to the appointed HOKLAS Laboratory on the same day of sample collection throughout the entire course of fieldwork, and the COC form is to always accompany the samples during the delivery.
- 3.5.4 All solid and liquid wastes and hazardous substances introduced by the SI Contractor (e.g. solvents, cleaners, etc.) will be handled and/or disposed of in full compliance with the applicable environmental Regulations, Ordinances, rules and Code of Practice (COP). As soon as the works are completed, the SI Contractor will clear all the debris, waste materials and equipment remaining, as may be generated during the course of SI works.
- 3.5.5 On completion of the fieldwork, the SI Contractor will as soon as practicable fill in and compact all inspection pits and boreholes using uncontaminated materials, level and reinstate the site as agreed by the Consultant and the Main Contractor.



### **3.6 Fieldwork Health and Safety Precautions**

3.6.1 The following measures are to be implemented to minimise risks to all field personnel during the SI stage:

- Sweep at and in the vicinity of the sampling locations with a metal detector to check for the presence of any unexploded ordnance prior to soil sampling works. If there is any metal scrap discovered under the ground during the course of SI, the SI Contractor is to cease work immediately until the identity is confirmed. For areas suspect of ordnance, the SI Contractor is to inform CHEC immediately for necessary notification to the Hong Kong Police Force for subsequent action;
- Minimise the exposure to any contaminated material by wearing appropriate clothing and personal protective equipment (PPE) such as gloves, goggles, protective coveralls and safety boots (when interacting directly with suspected contaminated material);
- Provide information to all workers on the potential hazards in the vicinity of sampling locations;
- Provide adequate hygiene and washing facilities; and
- Prohibit smoking or eating during activities with potential exposure to contaminated soil and/or groundwater.

## 4. LABORATORY ANALYTICAL REQUIREMENTS

### 4.1 Introduction

4.1.1 This Section presents the detailed requirements of the laboratory analyses for this Assignment.

### 4.2 Laboratory Testing Specifications

4.2.1 The samples collected during the fieldwork are to be tested by an appropriate laboratory with Hong Kong Laboratory Accreditation Scheme (HOKLAS) accreditation or its Mutual Recognition Agreement (MRA) accreditation bodies. The Laboratory is to conduct all the required analyses according to the internationally recognised standard methods (refer to Table 4-1).

4.2.2 The Laboratory is to provide containers of suitable material and size to the SI Contractor for containing samples for analyses. All these containers are to be pre-cleaned to guarantee their sterilisation and preservative contents. The Laboratory QA/QC programme is to include at least the following elements:

- Laboratory method blanks; and
- Batch duplicates.

4.2.3 The COC forms for the samples delivered from the field are to be endorsed by the Laboratory, with documentation of such faxed to the Consultant on a daily basis. This is performed to ensure all the samples collected from the field are safely delivered to the Laboratory for analysis.

### 4.3 Laboratory Testing Parameters

4.3.1 The parameters of laboratory analysis for the soil and groundwater (if any) samples from each of the site investigation locations are detailed in Table 4-1 below.

Table 4-1 Parameters of Laboratory Analysis for Site Investigation

Target Contaminant(s)	Reference Analytical Method <sup>1</sup>	Soil Reporting Limit <sup>2</sup> (mg/kg dry weight)	Groundwater Reporting Limit <sup>2</sup> (µg/L)
Lead (Pb)	Sample Preparation: Microwave digestion (USEPA 3051) Analysis: USEPA 6020A / ICPMS	15	5
Total Sulphur <sup>3</sup>	APHA 4500 USEPA 9215 USEPA 9035/9036/9038	2	10

Note:

1. Equivalent internationally recognised methods (with provision of the corresponding method statements) may also be used, subject to approval by EPD.
2. Reporting Limit refers to the minimum concentration that can be reported by the overall test procedures employed by the Laboratory. For a particular test, it refers to the overall precision that covers the proposed sample preparation and test methods, instruments and personnel employed and other elements as covered by the QA/QC system for such a test. The reporting limits are adopted to be 1/10 of the Dutch B standards as referred to in the EPD's ProPECC PN 3/94 for the respective contaminants.
3. Total sulphur is defined as the sum of soluble and insoluble sulphur.

## 5. PROGRAMME AND THE FORTHCOMING TASKS

### 5.1 Programme

- 5.1.1 The overall construction phase of the Project is scheduled from January 2006 to July 2007, and the land contamination issue is to be addressed prior to excavation works at and in the vicinity of the potentially contaminated locations (EP Condition 2.4 refers). Therefore, the Assignment is considered a high priority and is to be completed as soon as possible.
- 5.1.2 Careful programming, taking into consideration the time required for site investigation, laboratory testing and review/comment by various authorities, is to be allowed for efficient and timely completion of the Assignment.
- 5.1.3 It has been tentatively scheduled that the SI works will be carried out in mid February 2006 upon EPD's acceptance of the CAP. The CAR detailing the results of SI works and laboratory analysis will be subsequently prepared and submitted to ET and IEC tentatively in early March 2006 for certification/verification, prior to submission to EPD for review and approval.
- 5.1.4 The ET and IEC will be informed at least 3 days in advance of commencement of SI works, for their arrangement of necessary supervision and inspection of the works.
- 5.1.5 If contamination is identified, a Remediation Action Plan (RAP) will be developed.

### 5.2 The Forthcoming Tasks

- 5.2.1 Upon review and approval of this CAP by the EPD, the fieldwork and laboratory analyses are to be initiated; the expected date for such being mid of February 2006. As described in Section 3.3, the fieldwork will be supervised by the Consultant to ensure overall control of the quality.
- 5.2.2 Upon availability of the SI results, including field observations and laboratory analytical results, the Consultant will complete the land contamination assessment (i.e. results interpretation) to ascertain the nature and extent of contamination, if any. All the SI results will be presented in the Contamination Assessment Report (CAR), which will be certified and verified by the ET and IEC respectively, prior to submission to EPD for approval.

## 6. REFERENCES

- Approved Environmental Impact Assessment (EIA) Report and Environmental Monitoring & Audit (EM&A) Manual (EIAO Register No. AEIAR-091/2005) for the Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung.
- HKEPD (1993), Practice Note for Professional Persons – Contaminated Land Assessment and Remediation (“ProPECC PN 3/94”).
- HKEPD (1999), Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards, and Car Repair/Dismantling Workshops.
- Hong Kong's Earliest Site, available at <http://www.hku.hk/hkprehis/earliest.htm>
- USEPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, available at <http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm>
- American Public Health Association (1998), Standard Methods for the Examination of Water and Wastewater (20<sup>th</sup> Edition).

## **Appendix 1**

### **Parameters, Assessment Guidelines and Analytical Results of the Preliminary Site Investigation during the EIA Stage**

(Extracted from Appendices 11.1 to 11.3 of the Approved EIA Report)

## Appendix 11.1 – Detection Limit for Laboratory Analysis

### *Soil Samples*

	<b>Parameters</b>	<b>Dutch A Guideline</b>	<b>Detection Limit (mg/kg)</b>
1	<b><u>Heavy Metals</u></b>	-	-
	Chromium	100 mg/kg	1.0
	Cobalt	20 mg/kg	1.0
	Nickel	50 mg/kg	1.0
	Copper	50 mg/kg	1.0
	Zinc	200 mg/kg	2.5
	Asrenic	20 mg/kg	1.0
	Molybdenum	10 mg/kg	1.0
	Cadmium	1 mg/kg	1.0
	Tin	20 mg/kg	1.0
	Barium	200 mg/kg	1.0
	Mercury	0.5 mg/kg	1.0
	Lead	50 mg/kg	2.5
2	<b><u>Sulphur (Total)</u></b>	2 mg/kg	1.0

Remarks: Total sulphur is defined as the sum of soluble and insoluble sulphur.

### *Groundwater Samples*

	<b>Parameters</b>	<b>Dutch A Guideline</b>	<b>Detection Limit (µg/L)</b>
1	Lead	20 µg/L	10
2	<b><u>Sulphur (Total)</u></b>	10 µg/L	10

Remarks: Total sulphur is defined as the sum of soluble and insoluble sulphur.

## Dutch Guidelines and Laboratory Analytical Results for Contaminant Assessment of Soil

Contaminant	Unit	Dutch Guideline			LOR	Sampling Locations						
		A	B	C		1	3	4	5	6	7	8
<b>Metals</b>												
Arsenic	mg/kg	20	30	50	0.5	1.5	<0.5	2.9	<0.5	2.7	<0.5	<0.5
Barium	mg/kg	200	400	2000	0.5	3.4	26.0	7.5	3.9	7.8	7.6	7.2
Cadmium	mg/kg	1	5	20	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cobalt	mg/kg	20	50	300	0.5	1.5	0.5	0.5	<0.5	<0.5	0.6	0.6
Chromium	mg/kg	100	250	800	0.5	0.9	0.6	1.1	1.8	2.2	1.6	1.4
Copper	mg/kg	50	100	500	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Molybdenum	mg/kg	10	40	200	0.5	0.8	1.2	0.7	0.6	0.1	0.2	0.3
Nickel	mg/kg	50	100	500	0.5	<0.5	0.6	0.7	1.1	1.2	1.1	1.1
Lead	mg/kg	50	150	600	2.5	53	<b>240</b>	21	17	13	16	15
Tin	mg/kg	20	50	300	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	mg/kg	200	500	3000	2.5	19	20	18	30	25	27	26
Mercury	mg/kg	0.2	2	10	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
<b>Sulphur (Total)</b>	mg/kg	2	20	200	1.0	19	15	15	8	<b>48</b>	<b>20</b>	<b>21</b>

\* ***Bold and Italic*** indicates exceedances of Dutch B levels

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**TEST REPORT**

**APPLICANT:** Cinotech Consultants Limited  
1601-1610 Delta House,  
3 On Yiu Street,  
Shatin, N.T.

Laboratory No.:	01910-V1
Date of Issue:	2005-07-25
Date Received:	2005-07-12
Date Tested:	2005-07-13
Date Completed:	2005-07-18

**ATTN:** Mr. Henry Leung

Page: 1 of 3

**Sample Description :** 7 samples client said to be soil

Sample Code : 1) IA5003-1  
2) IA5003-3  
3) IA5003-4  
4) IA5003-5  
5) IA5003-6  
6) IA5003-7  
7) IA5003-8

Sampling Date: 2005-07-12

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**Tests Requested & Methodology:**

Item	Parameters	Ref. Method	LOR
1	Arsenic	In-house method WL/ENV/029	0.5mg/kg
2	Cadmium	In-house method WL/ENV/029	0.05mg/kg
3	Chromium	In-house method WL/ENV/029	0.5mg/kg
4	Copper	In-house method WL/ENV/029	<0.3mg/kg
5	Nickel	In-house method WL/ENV/029	0.5mg/kg
6	Lead	In-house method WL/ENV/029	2.5mg/kg
7	Zinc	In-house method WL/ENV/029	2.5mg/kg
8	Cobalt	In-house method WL/ENV/029	0.5mg/kg
9	Molybdenum	In-house method WL/ENV/029	0.5mg/kg
10	Tin	In-house method WL/ENV/029	0.5mg/kg
11	Barium	In-house method WL/ENV/029	0.5mg/kg
12	Mercury	In-house method WL/ENV/030	0.3mg/kg
13	Sulphur (Total)	In-house method for Total Sulphur in soil	1mg/kg

Remark: This report supersedes the one dated 2005/07/22 with certificate number 01910

\*\*\*\*\*

**PREPARED AND CHECKED BY:**

For and On Behalf of **WELLAB Ltd.**

  
**PATRICK TSE**  
Operation Manager

**WELLAB LTD.**

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**Results**

Parameters / Sample ID.	01910-1	01910-2
Arsenic, mg/kg	1.5	<0.5
Cadmium, mg/kg	<0.05	<0.05
Chromium, mg/kg	0.9	0.6
Copper, mg/kg	<0.3	<0.3
Nickel, mg/kg	<0.5	0.6
Lead, mg/kg	53	240
Zinc, mg/kg	19	20
Cobalt, mg/kg	1.5	0.5
Molybdenum, mg/kg	0.8	1.2
Tin, mg/kg	<0.5	<0.5
Barium, mg/kg	3.4	26
Mercury, mg/kg	<0.3	<0.3
Sulphur (Total) , mg/kg	19	15

Parameters / Sample ID.	01910-3	01910-4
Arsenic, mg/kg	2.9	<0.5
Cadmium, mg/kg	<0.05	<0.05
Chromium, mg/kg	1.1	1.8
Copper, mg/kg	<0.3	<0.3
Nickel, mg/kg	0.7	1.1
Lead, mg/kg	21	17
Zinc, mg/kg	18	30
Cobalt, mg/kg	0.5	<0.5
Molybdenum, mg/kg	0.7	0.6
Tin, mg/kg	<0.5	<0.5
Barium, mg/kg	7.5	3.9
Mercury, mg/kg	<0.3	<0.3
Sulphur (Total) , mg/kg	15	8

Remark: This report supersedes the one dated 2005/07/22 with certificate number 01910

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**Results**

Parameters / Sample ID.	01910-5	01910-6
Arsenic, mg/kg	2.7	<0.5
Cadmium, mg/kg	<0.05	<0.05
Chromium, mg/kg	2.2	1.6
Copper, mg/kg	<0.3	<0.3
Nickel, mg/kg	1.2	1.1
Lead, mg/kg	13	16
Zinc, mg/kg	25	27
Cobalt, mg/kg	<0.5	0.6
Molybdenum, mg/kg	<0.5	<0.5
Tin, mg/kg	<0.5	<0.5
Barium, mg/kg	7.8	7.6
Mercury, mg/kg	<0.3	<0.3
Sulphur (Total), mg/kg	48	20

Parameters / Sample ID.	01910-7
Arsenic, mg/kg	<0.5
Cadmium, mg/kg	<0.05
Chromium, mg/kg	1.4
Copper, mg/kg	<0.3
Nickel, mg/kg	1.1
Lead, mg/kg	15
Zinc, mg/kg	26
Cobalt, mg/kg	0.6
Molybdenum, mg/kg	<0.5
Tin, mg/kg	<0.5
Barium, mg/kg	7.2
Mercury, mg/kg	<0.3
Sulphur (Total), mg/kg	21

Remark: This report supersedes the one dated 2005/07/22 with certificate number 01910

\*\*\*\*\*END OF REPORT\*\*\*\*\*