

Civil Engineering Department
The Government of the Hong Kong Special Administrative Region

Agreement No. CE 68/99

Infrastructure for Penny's Bay Development Engineering Design and Construction

**Decommissioning of Cheoy Lee Shipyard
At Penny's Bay**

EIA – Final Report

Executive Summary

February 2002

Maunsell Consultants Asia Ltd.
in association with
Maunsell Geotechnical Services Ltd
Maunsell Environmental Management Consultants Ltd

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1. INTRODUCTION

- 1.1 The decommissioning of the existing Cheoy Lee Shipyard (CLS) at Penny's Bay (the Project) involves the demolition of all buildings and structures, and where necessary, decontamination of site areas. The area cleared up will be used for the construction of infrastructures associated with Hong Kong Disneyland Phase 1, including the Penny's Bay Section of the Chok Ko Wan Link Road (CKWLR), Road P2, etc. The Project shall be on the critical path of the Hong Kong Disneyland Theme Park Project.
- 1.2 The Project proposes to decommission the existing CLS at Penny's Bay in order to make space available for the infrastructure construction in association with the Hong Kong Disneyland Phase 1 development. Key works of the Project comprise:
- (a) Demolition of the existing structures within CLS;
 - (b) Removal of abandoned equipment/ installation/ facilities and waste materials in CLS;
 - (c) Excavation of the contaminated soil in CLS and on-site treatment or transportation to the off-site treatment plants;
 - (d) Installation and operation of the on-site and off-site treatment plants;
 - (e) Decommissioning of the on-site and off-site treatment plants, site re-instatement and associated clean up work;
 - (f) Slope improving works behind the CLS;
 - (g) Filling of the CLS to a new formation level after decommissioning; and
 - (h) Implementation of appropriate mitigation measures as recommended in this EIA report to avoid/ minimise any adverse environmental impacts arising from the Project, so that the Project site would be made safe and free of hazards for the planned future use.
- 1.3 The Project consists of two Designated Projects (DPs), viz. item G.4 of Part I (a waste disposal facility, or waste disposal activity for refuse or chemical, industrial or special wastes) and item 17 of Part II (a facility for ship building or repairing more than 1 ha in size or with lifting capacity in excess of 20,000 tonnes) under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance. In compliance with the EIA Ordinance, environmental impacts due to the Project shall be comprehensively assessed and an Environmental Permit (EP) shall be obtained from the Director of Environmental Protection (DEP) prior to the Project commencement. In September 2000, the Project Proponent, Special Duties (Works) Division of Civil Engineering Department applied to the Environmental Protection Department for an EIA Study Brief with a Project Profile. An EIA Study Brief (No. ESB-062/2000) that purposes to guide the carrying out of the EIA study, was issued on 9 November 2000.
- 1.4 The EIA Report has been prepared in accordance with the requirements stipulated in the *Technical Memorandum on Environmental Impact Assessment Process*. This covers relevant project information, relevant legislation, existing environmental conditions, assessment criteria and methods, assessment findings and proposed mitigation measures.

- 1.5 A comparison of the options for decontamination works areas has been prepared taking into account of the key factors and constraints. The characteristics of particular importance are the size and availability of the site over the duration of the decontamination treatment period, the implications of any delays in the completion of the treatment affecting the infrastructure development, the distance from the shipyard and means of access, the suitability of existing facilities for access, the site constraints such as the presence of any sensitive receivers and the potential environmental effects from storage and treatment.
- 1.6 The review has determined that a suitable site at To Kau Wan is available for the expected duration of the proposed decontamination works. The site at To Kau Wan is 5.8ha and is adequate to accommodate all the treatment works on one site. The site is reasonably close to Penny's Bay and impacts arising from the land transportation of contaminated soils are expected to be minimal. Potential environmental impacts associated with the decontamination works are acceptable and can be mitigated as no sensitive land uses are located nearby. Accordingly, it is recommended that the site at To Kau Wan be used as the decontamination works site.

2. LAND CONTAMINATION

Soil Contamination

- 2.1 Based on the laboratory results of the site investigation, soil contamination is found in Area 1, Area 2 and Area 3 of CLS. The soil in Area 1 is predominantly contaminated with 'metals' and 'metals/TPH/SVOCs' whereas the soil in Area 3 is predominantly contaminated with 'metals' and 'dioxins/metals/TPH/SVOCs'. The soil in Area 2 is contaminated with 'metals', 'metals/TPH/SVOCs' and 'dioxins/metals/TPH/SVOCs'. (Please refer Figures 2.2 to 2.4 for Areas 1 to 3, respectively.)
- 2.2 The volumes of soils contaminated by different types of contaminants have been estimated based on the extensive laboratory results and are tabulated in Table 2.1 respectively.

Table 2.1 Estimated Volumes of Soils Contaminated by Different Types of Contaminants

Contaminant Type(s)	Estimated Volume (m ³)
Metals only	48,000
TPH / SVOCs	700
Metals and TPH / SVOCs	8,300
Dioxins and Metals / TPH / SVOCs	30,000
Total Estimated Volume	87,000

Groundwater Contamination

- 2.3 Although the laboratory results of groundwater samples reveal some exceedances in the screening criteria for risk assessment. A risk assessment has been undertaken to assess the risk posed by the contaminants in groundwater. The results of the risk assessment reveal that the concentrations of all chemicals of concern do not exceed the calculated 'allowable' concentrations and the risk posed by the contaminants in groundwater is acceptable.
- 2.4 As only a thin layer of TPH free product was discovered on the groundwater table in one well

during site investigation, the impact is considered insignificant.

Remedial Methods

2.5 The objectives of the remediation are:

- To clean up the site to the remediation targets and within the overall development programme with cost effective and well established method;
- To minimise the environmental impacts during the excavation, construction and operation of the remedial systems; and
- To protect construction workers adequately from site hazards.

Selection of Remedial Methods for Non-dioxin Contaminated Soil

2.6 Various treatment technologies have been screened and evaluated. Cement solidification has been proposed for soil contaminated with metals and biopiling for soil contaminated with TPH and/or SVOC, taking into account of the applicability and limitations of the treatment technologies.

Selection of Remedial Method for Dioxin-contaminated Soil

2.7 Various thermal and non-thermal technologies have been evaluated. Based on the comparative analysis in terms of effectiveness, implementability and cost implications, thermal desorption is proposed for the treatment of dioxin-contaminated soil and the residue generated will be destroyed by incineration at Chemical Waste Treatment Centre (CWTC).

Selection of Implementation Option

2.8 Five different implementation options in relation to remedial method as well as remedial location have been evaluated. The option of excavating all contaminated soil, and treating them either on-site at CLS or off-site at TKW (depending on the nature of contaminants) is recommended.

Outline of Proposed Implementation Option

2.9 The proposed implementation option is recapitulated in Table 2.2. These methods are proposed based on the evaluation of their effectiveness and implementability described above. During remediation, the contaminated soils will be excavated. Metal-contaminated soil will be treated on site whereas soil contaminated with other contaminants will be transported to TKW (please refer to Figure 2.1 for location of TKW site) for off-site treatment. The excavation plans for soil contaminated areas at Area 1, Area 2 and Area 3 are depicted in Figures 2.2, 2.3 and 2.4, respectively. The proposed decontamination works area at To Kau Wan is depicted in Figure 2.5.

Table 2.2 Proposed Remediation Methods for Soil Contamination

Soil Contaminant	Proposed Remediation Method	Location
Metals only	Cement Solidification	CLS
TPH / SVOCs	Biopiling	TKW
Metals and TPH / SVOCs	Biopiling followed by Cement Solidification	TKW

Dioxins and Metals / TPH / SVOCs	Thermal Desorption followed by Cement Solidification	TKW
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Confirmation Sampling and Testing

- 2.10 Confirmation sampling and testing have been proposed for the followings:
- i) Soil excavation to ensure complete removal of all contaminated soil;
 - ii) Biopile treatment to ensure attainment of cleanup targets for soil contaminated with TPH/SVOC;
 - iii) Cement solidification to ensure attainment of cleanup targets for soil contaminated with metals;
 - iv) Thermal desorption to ensure attainment for cleanup targets for soil contaminated with dioxins; and
 - v) Skimming of any TPH free product encountered at excavation areas to ensure complete removal of the TPH free product.

Mitigation Measures

- 2.11 Various environmental mitigation measures and health & safety measures have been proposed for soil excavation, stockpiling of soil, biopile treatment, cement solidification and thermal desorption. With the incorporation of these measures during excavation and operation of the remediation system, as well as the provisions of safety measures to site workers, there is no residual impact arising from land contamination. Mitigation measures have been proposed for excavation and operation of the remediation system regarding air, water, waste and ecology, and are provided in the respective chapters of the EIA Report.

3. AIR QUALITY IMPACT

- 3.1 Dust emission from the site is a concern for the building demolition, slope improvement works of CLS. Total Suspended Particulates (TSP) would be generated from materials handling and truck movement over haul roads. With the incorporation of dust control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation*, the TSP level at the ASR will be low. Mitigation measures have been proposed for the building demolition and slope improvement works CLS and are included in the chapter of air quality.
- 3.2 Excavation of contaminated area would disturb the soil, and dioxins bind onto the soil would be dispersed in form of dust. Modelling results indicated that the impacts at the ASRs are low and satisfied the hourly criteria. The following mitigation measures are proposed at work sites of contaminated pits.
- The top layer soils shall be sprayed with fine misting of water immediately before the excavation to avoid dust emission.
 - Inactive excavated area shall be covered by impermeable sheeting to minimise dust emissions.

- 3.3 Solidification will be conducted at the CLS to stabilise heavy metals in soil. Biopiling, thermal desorption and solidification as parts of the decontamination process will be conducted at TKW. The biopiles could reduce organic constituents by 99% whereas the solidification process could immobilise the toxic material. The design of thermal desorption plant and associated air treatment unit shall allow only 0.0001% of dioxins, organic gases and Polycyclic Aromatic Hydrocarbons (PAHs) from the soils, escaped as gaseous pollutants. Air emissions from these facilities have been modelled and assessed to be within the respective criteria. The following mitigation measures are proposed for the treatment facilities:
- The thermal desorption shall be of enclosed process;
 - For the thermal desorption process, the dioxin emissions shall be limited to 0.1 ng/m³ and Total Organic Compounds (TOC) emission limited to 20 mg/m³;
 - The design of thermal desorption plant is of enclosed type and together with the associated air treatment unit shall allow only 0.0001% of dioxins, organic gas and PAHs from the soils, escaped as gaseous pollutants;
 - TOC emission from the biopile shall be limited to 20 mg/m³, with maximum flow rate of 56 m³/min;
 - Back-up carbon absorber shall be installed for the biopile to ensure that the TOC criteria is satisfied;
 - The biopiles shall be covered by impermeable sheeting to avoid emission of VOCs; and
 - Mixing process at TKW will be enclosed and cement for solidification shall follow the *Air Pollution Control (Construction Dust) Regulation*.
- 3.4 Air quality impact associated with the decommissioning of TKW site will be low and complied with the criteria.
- 3.5 The health risk of inhalation associated with the operation of the treatment facilities has been assessed to be insignificant, and comply with international criteria.
- 3.6 With implementation of the proposed mitigation measures, there will be no residual impact.

4. WASTE MANAGEMENT AND TRANSPORTATION OF CONTAMINATED MATERIALS

- 4.1 Construction & Demolition (C&D) material will be generated during the demolition of the shipyard facilities. It is estimated that about 10,000m³ C&D material will be generated of which about 1,000m³ are contaminated. In addition, about 1,000 tonnes of steel and 5,000 m³ of general refuse will also be generated. It is considered that adverse waste impacts will not be generated provided that good site practices and sound waste handling practices recommended are strictly followed.
- 4.2 During slope improvement behind CLS, around 40,000m³ soil and 2,100m³ rock will be generated. It is considered that no adverse impact will arise provided that the excavated materials will be reused/ recycled within CLS as much as practical.
- 4.3 During remediation, about 87,000m³ contaminated soil will be excavated from Cheoy Lee

Shipyard and either treated on-site or transported to TKW for off-site treatment depending on the types of contaminants. The soils after treatment will turn to clean inert materials suitable for public filling. The condensate as the end product of the treatment and other chemical wastes will be collected and disposed of at the Chemical Waste Treatment Centre. Thus, no residual waste impact is expected.

- 4.4 The overall total of C&D material to be generated by this Project is estimated around 0.4Mm³. The C&D material will be reused and recycled as far as practicable in the land formation works within CLS site so as to minimise the amount of C&D material to be disposed of at public filling areas (PFAs).
- 4.5 Mitigation measures have been proposed in relation to waste collection, handling, transportation, storage and disposal to minimise environmental impacts.
- 4.6 To ensure proper waste handling and management procedures are strictly followed, the Contractor shall prepare the following documents for the Engineer's approval prior to work.
- Waste Management Plan;
 - Operational Plan;
 - Spill Handling Contingency Plan; and
 - Building Decommissioning Plan.
- 4.7 In addition, the following registration/ licence/ approval/ permit/ notification are required:
- Waste Producer Registration: The Contractor is required to be registered under the *Waste Disposal (Chemical Waste) (General) Regulation*;
 - Waste Collection Licence: A Waste Collection Licence under the *Waste Disposal Ordinance* is required for the transport/ delivery of chemical wastes to off-site waste disposal facilities;
 - Waste Disposal Licence: A Waste Disposal Licence is required for the operation of the off-site treatment facility a TKW for the treatment for dioxin-contaminated soil.
 - Approval for Using Large Container: Approval is required under the *Waste Disposal (Chemical Waste) (General) Regulation* for using chemical waste container with a capacity exceeding 450L.
 - Part A Notification: Prior notification to the Environmental Protection Department is required before any collection of Part A chemical waste.
 - Noise Permit: A Noise Permit under *Noise Control Ordinance* is required for night-time operation of the decontamination system and transportation of contaminated soil by trucks to TKW at night.
- 4.8 With implementation of the proposed mitigation measures, there will be no residual impact.

5. WATER QUALITY IMPACT

Building Demolition and Slope Improvement

- 5.1 During the building demolition and slope improvement, adverse water quality impacts arising from runoff and sewage effluent generated by the construction workforce are not likely with 'best practical' site procedures implemented. Regular site audits are therefore recommended to ensure that 'best site practices' and relevant mitigation measures be implemented throughout the Project.

Soil Remediation

At Cheoy Lee Site

- 5.2 After demolished the building, contaminated soils at CLS would be excavated for on-site and off-site treatment. Local groundwater will be drawn out (i.e. dewatering) when excavation proceeds below the water table. The groundwater with elevated metal and TPH levels, though not contaminated in accordance with risk-based assessment, would impose water quality impact if being directly discharged into the drainage channel. As a mitigation measure, the groundwater pumped out shall be recharged within CLS site in such a manner that it would not cause local rising of water table leading to contaminant migration. Wheel wash water and decontamination wastewater generated will be considered contaminated. A mitigation measure to install a centralised water treatment unit is recommended to treat the effluent before discharged. With the implementation of the mitigation measures, no adverse water quality impact is envisaged.
- 5.3 Impact of groundwater seepage to nearby marine water via the future drainage channel to the north of CLS site was also assessed. The drainage channel would be built above the existing CLS ground level thus this effectively isolates the groundwater from seeping into the channel. In any case, the groundwater, if any seeped into the channel would be diluted a lot, therefore water quality impact arising from the groundwater seepage to the nearby marine water is not likely. No impact on the artificial lake of the future water recreation centre is predicted arising from groundwater seepage. This is because:
- the planned water level of the artificial lake will be higher than the CLS water table level;
 - there is an impermeable liner at the bottom of the lake to subsurface contaminants infiltration; and
 - the soil contamination would be cleaned up during the CLS decommissioning, thus removing the contaminant source.
- 5.4 Pending receipt by the solidification facility, there would be temporary stockpiles of metal-contaminated soil. It is recommended that temporary stockpiles be lined with impervious sheeting, bunded and covered by impermeable sheeting during rain events whereby the volume of contaminated runoff and leachate would be reduced. The generation of contaminated runoff and leachate would be further minimised respectively by sheltering the solidification facility and controlling water addition during the solidification process. In the end, a licensed centralised wastewater treatment unit is recommended for treating the contaminated runoff and leachate prior to their discharging into local drainage. Taking the above considerations, no adverse impact arising from the operation of the solidification

facility is predicted.

At To Kau Wan Site

- 5.5 Biopile, thermal desorption process and solidification are the major decontamination processes conducted at the To Kau Wan decontamination site. Potential water quality impact of contaminating the nearby water bodies would be arising from various site effluents, viz. plant leachate, contaminated run-off from the thermal desorption plant, wheel wash water and decontamination water. It is therefore recommended to install a licensed centralised wastewater treatment unit for treating the effluent before being discharged. With the wastewater treatment unit in place and in operation, no adverse water quality impact is envisaged.
- 5.6 Other mitigation measures as follows have been recommended in relation to biopiling, thermal desorption and solidification desorption processes to minimise generation of contaminated runoff and leachate:

Biopiling

- Impermeable floor liner to be placed and associated leachate collection sump to be installed for the biopile,
- Concrete bund to be constructed along the perimeter of biopiles,
- Impermeable sheeting to be provided over the formed biopile during rain events.

Thermal Desorption

- Shelter and leachate collection system to be provided for the storage bin of dioxin contaminated soils,
- Concrete bund to be constructed at the perimeter of the plant,
- Runoff collection system to be installed for the plant.

Solidification

- Shelter to be provided for soil loading and unloading area and the entire facility,
- Concrete bund to be constructed at the perimeter of the facility,
- Any pits used for solidification process to be shallower than the water table to avoid leaching of the contaminated soil and to be lined with impermeable membrane.

6. ECOLOGICAL IMPACT

- 6.1 Based on the assessment, works associated with this project have the potential to cause high level impacts on ecological resources.
- 6.2 The greatest possible disturbance is to Rice-fish (*Oryzias curvinotus*) habitats at Mong Tung Hang Stream (MTHS), and restricted / protected plant species around CLS.
- 6.3 Detailed measures to mitigate high level ecological impacts arising from this project are recommended. Good construction practice is recommended to avoid / minimise disturbance to other habitats surrounding the shipyards.

6.4 The following mitigation measures are proposed:

Impacts to Restricted/Protected Plant Species

- Where possible, restricted/protected plant species are to be preserved *in situ*. Areas supporting the highest concentrations of restricted/protected species have been fenced off to prevent tipping, vehicle movement and encroachment of personnel into these areas.
- Design of slope works has been modified to minimise impact to the plants concerned.
- Plants directly affected by the proposed works are to be transplanted to suitable receptor site at Tai Tam Country Park. To maximise the transplantation success, seeds will be collected and stored in specialist facilities prior to transplantation. If transplanting proves unsuccessful, the introduction of germinated seed and stored plants to receptor sites shall be considered.

Impacts to Rice Fish (*Oryzias curvinotus*) Habitats at MTHS

- The lower course of MTHS will be affected by the proposed works at CLS. The specific nature of mitigation measures will be determined by the results of future studies of the stream as the Rice Fish previously recorded has not been found again in this study: It is recommended that more detailed surveys of fish populations are carried out prior to the commencement of fill works.
- If Rice Fish (*Oryzias curvinotus*) are found in future surveys, they shall be temporarily relocated to holding aquaria. A recreated habitat suitable for the fish shall then be constructed at MTHS, and the fish returned to the habitat.
- If no Rice Fish (*Oryzias curvinotus*) are found in future surveys, it will be possible to source a captive population, and re-introduce the fish to a re-created habitat at MTHS.
- Environmentally friendly design will be incorporated in the future drainage channel to encourage recolonisation of the lower stream fauna.

Disturbance to To Kau Wan

- The construction of biopiles (where high levels of activity may disturb the birds) shall take place from October-February, outside of the Ardeid breeding season;
- Bio-piles shall be placed at the west of the site, to minimise disturbance to area where egrets were seen;
- Blowers shall be placed at the back of biopiles to minimise disturbance to area where egrets were seen.

Shipyard Decommissioning and Transport of Harmful Contaminants

- All potentially harmful contaminants from CLS shall be handled, treated and disposed of in an appropriate manner; to minimise risks to human health and flora and fauna.

Fill / Slope Works

- Shotcrete should not be used for the slope works. The design of slope works shall make reference to the GEO Publication No. 1/2000 “Technical Guidelines on Landscape Treatment and Bioengineering for Man-made Slopes and Retaining Walls”.
- Works on slopes supporting natural vegetation shall be minimised as far as slope safety standards allow.
- Hydroseeding and planting of trees and shrubs including native species will be undertaken on newly created slopes.

6.5 With the proposed mitigation measures in place, residual impacts arising from the project will be ecologically acceptable.

7. IMPACT ON CULTURAL HERITAGE

7.1 An archaeological survey has been conducted for the CLS, and revealed artifacts of high archaeological values in CLS. Many artifacts of different periods, including the Late Neolithic period, Bronze Age, Tang Dynasty, Song Dynasty, Ming Dynasty and Ching Dynasty have been recovered in CLS, along the ancient coastal area.

7.2 Potential impact to archaeological resources may arise from landtake, ground compaction, topsoil or subsoil disturbance during construction, change in watertable and a limitation on accessibility for future investigation which may result in damage to, or loss of the archaeological remains. Preservation measures include covering the archaeological potential sites, where are not subjected to rescue excavation, by impermeable sheeting before filling. Detailed design of filling work should include diversion of site runoff to prevent any waterlogged conditions at the archaeological sites. On-site monitoring has been proposed to minimise the impacts of archaeological deposits. For areas where preservation in site is not possible, the impact in the heritage resources should be mitigated by rescue excavation. All rescue works have to be completed prior to the decontaminated works of CLS.

8. ENVIRONMENTAL MONITORING AND AUDIT

8.1 Environmental monitoring and audit are recommended for land contamination, air quality, water quality, waste management and ecology. Details of the recommended mitigation measures, monitoring procedures and locations have been presented in a stand-alone Environmental Monitoring and Audit Manual (EM&A). This will enable the Contractor to have early warning and provide necessary action to reduce impacts at specific areas if the assessment criteria are approached. The effectiveness of on-site control measures could also be evaluated through the monitoring exercise. All the recommended mitigation measures shall be incorporated into the EM&A programme for implementation.

8.2 A summary for all parameters to be monitored and audited during construction phase and operational phases are summarised in Table 8.1.

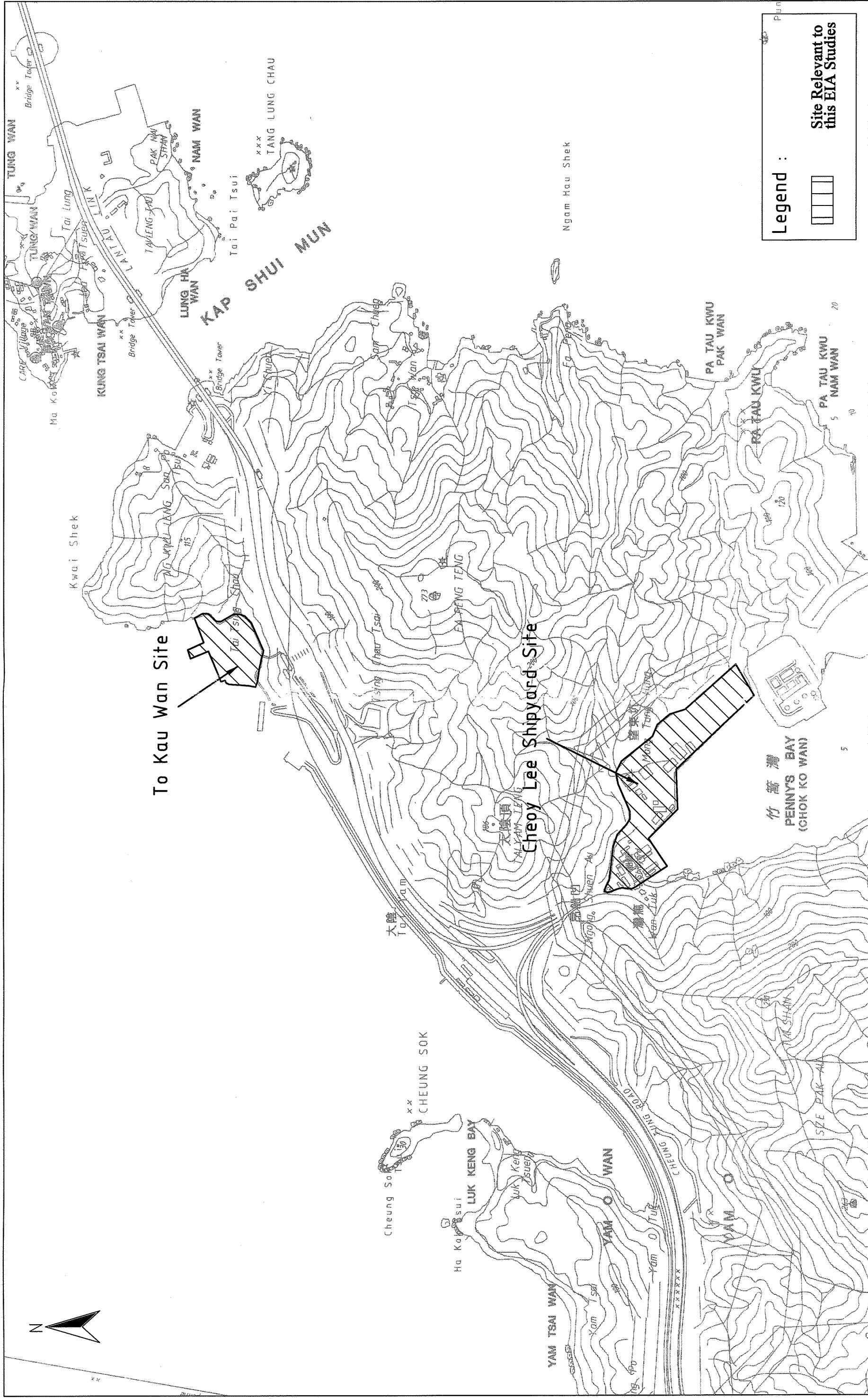
Table 8.1 Summary for All Monitoring Parameters

Parameter	Monitoring and Audit Requirements			
	Building Demolition and Slope Improvement Phases	Remediation Phase		TKW Decommissioning Phase
		At CLS	At TKW	
Land Contamination	Nil	<ul style="list-style-type: none"> Monitoring of groundwater level at recharge point and the proximate location during dewatering. Monitoring and confirmation sampling/testing shall be carried out to ensure complete removal of any free product encountered during excavation. Confirmation sampling/testing shall be carried out for: (i) soil excavation; (ii) biopile treatment; (iii) solidification; and (iv) thermal desorption process. 	<ul style="list-style-type: none"> Weekly site audits 	<ul style="list-style-type: none"> Weekly site audits
Air Quality	<ul style="list-style-type: none"> Weekly site audits 	<ul style="list-style-type: none"> Ambient TSP and dioxin monitoring at sensitive receivers. 	<ul style="list-style-type: none"> Ambient TSP and dioxin monitoring at sensitive receivers. Monitoring of TOC in biopile gas effluent Stack monitoring of dioxin emission from the thermal desorption plant CEM of TOC, O₂, CO₂ and CO from the stack of thermal desorption plant Weekly site audits 	<ul style="list-style-type: none"> Weekly site audits
Waste Management	<ul style="list-style-type: none"> Weekly site audits 	<ul style="list-style-type: none"> Weekly site audits 	<ul style="list-style-type: none"> Weekly site audits 	<ul style="list-style-type: none"> Weekly site audits
Water Quality	<ul style="list-style-type: none"> Weekly site audits 	<ul style="list-style-type: none"> Monitoring of the effluent quality of the water treatment 	<ul style="list-style-type: none"> Monitoring of the effluent quality of the water treatment 	<ul style="list-style-type: none"> Weekly site audits

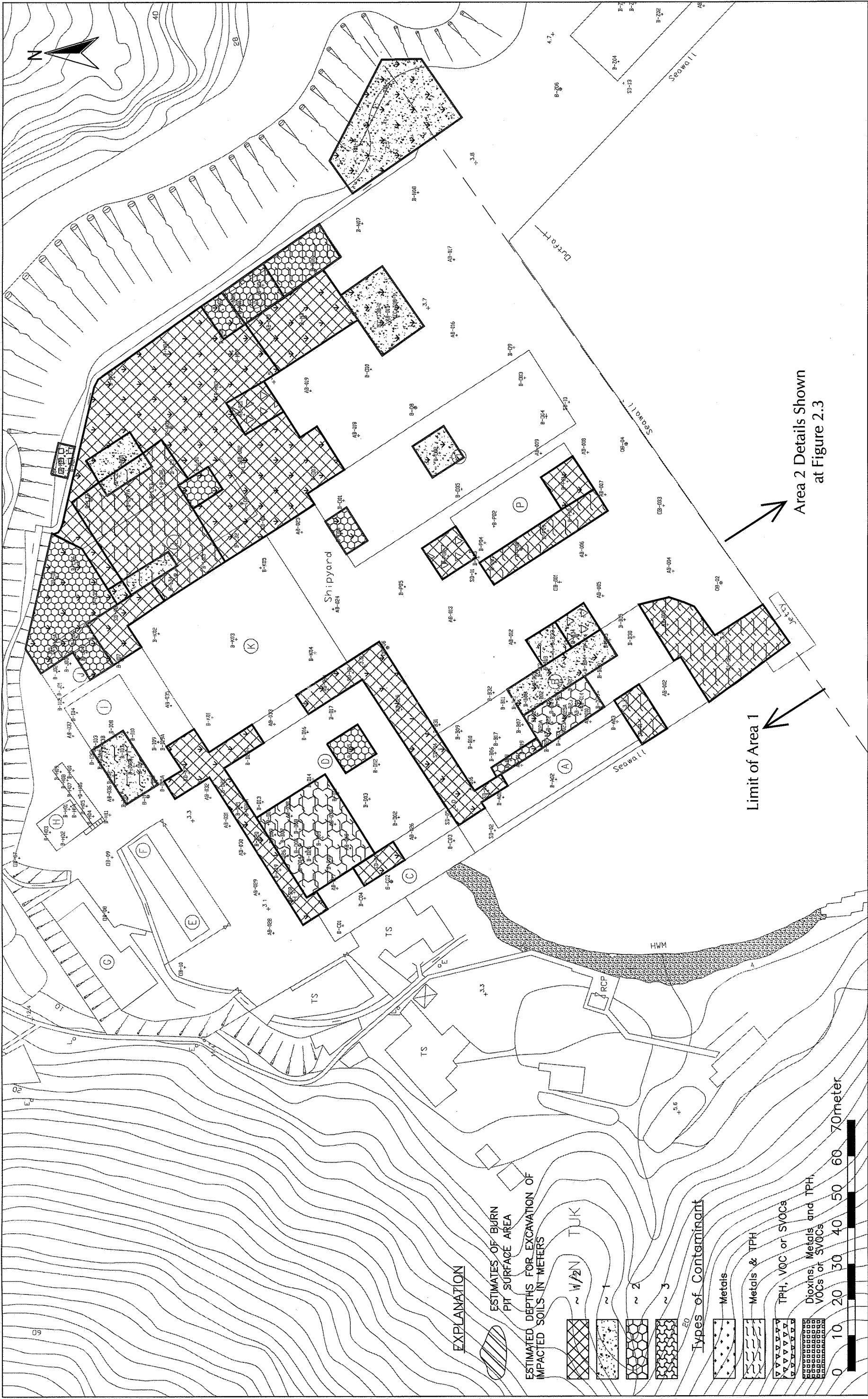
Parameter	Monitoring and Audit Requirements			TKW Decommissioning Phase
	Building Demolition and Slope Improvement Phases	Remediation Phase		
		At CLS	At TKW	
		unit (for wheel washing water and decontamination water) • Weekly site audits	unit (for wheel washing water, decontamination water, leachate and runoff from thermal desorption plant) • Weekly site audits	
Ecology	<ul style="list-style-type: none"> • Monitoring of transplanted plants at the receptor site. • Monitoring of stream fauna (e.g. macroinvertebrates at the new habitat prior to the relocation of Rice fish). • Monitoring of relocated fish species at the new habitat 			

9. CONCLUSIONS

- 9.1 The findings of this EIA have provided information on the nature and extent of environmental impacts arising from the decommissioning of the CLS. The EIA has, where appropriate, identified mitigation measures to ensure compliance with environmental legislation and standards.
- 9.2 Overall, the EIA Report for the decommissioning of the CLS has predicted that the Project will comply with all environmental standards and legislation after the proposed construction and operational stage mitigation measures are implemented. This EIA has also demonstrated the general acceptability of the residual impacts from the Project and the protection of the population and environmentally sensitive receivers. Environmental monitoring and audit mechanisms have been recommended during the decommissioning of CLS, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures.
- 9.3 The nature of the project is primarily of environmental improvement. Contaminated materials are permanently removed from the ground and cleaned up, removing a source of long term liability. After the shipyard is decommissioned, it provides room for the infrastructure in support of the Theme Park Development. The safety of the slopes is improved. The habitat of the Rich Fish which is of conservation interest will be recreated, and restricted/protected plants will be conserved on-site, or transplanted to a suitable receptor site. The archaeological artefacts are rescued or preserved from the site.

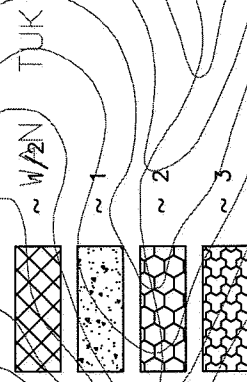


Title Agreement No. CE 68/99 Infrastructure for Penny's Bay Development - Engineering Design and Construction Decommissioning of Cheoy Lee Shipyard	Scale 1 : 15000	Project No. R06100	Maunsell MAUNSELL ENVIRONMENTAL MANAGEMENT CONSULTANTS LTD
	Date Feb 2002	Figure No. 2.1	

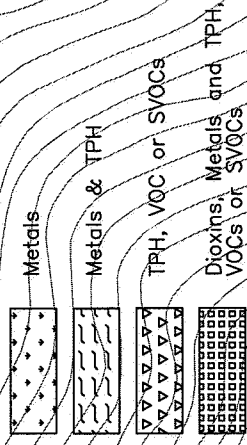


EXPLANATION

ESTIMATES OF BURN PIT SURFACE AREA
 ESTIMATED DEPTHS FOR EXCAVATION OF IMPACTED SOILS IN METERS



Types of Contaminant



Limit of Area 1

Area 2 Details Shown at Figure 2.3

Title

Agreement No. CE 68/99 Infrastructure for Penny's Bay Development - Engineering Design and Construction
 Decommissioning of Choey Lee Shipyard

Scale 1 : 1000

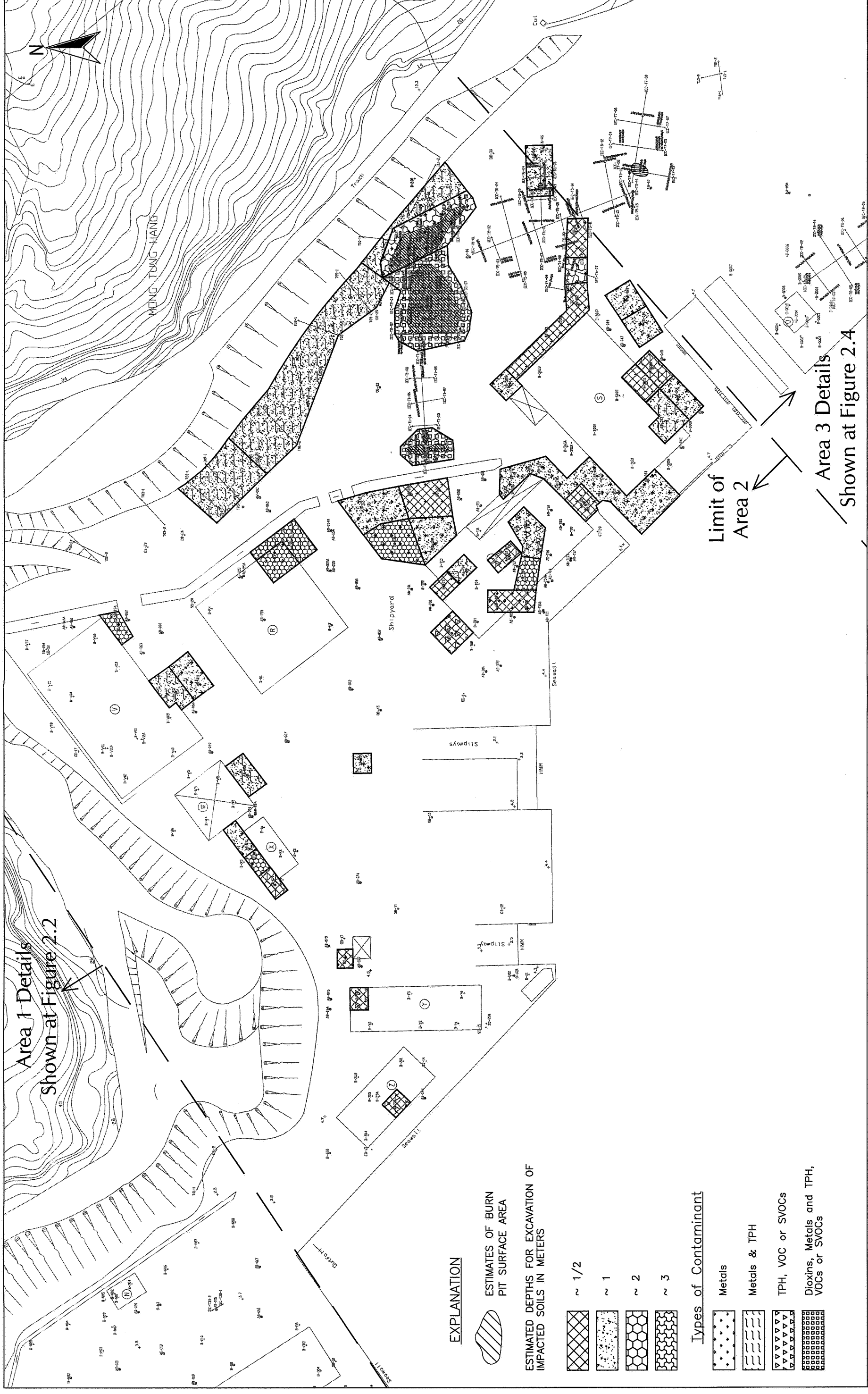
Date Feb 2002

Project No. R06100

Figure No. 2.2



Excavation Plan for Soil Contaminated Areas at Area 1



Area 1 Details
Shown at Figure 2.2

Area 3 Details
Shown at Figure 2.4

Limit of
Area 2

EXPLANATION

ESTIMATES OF BURN
PIT SURFACE AREA

ESTIMATED DEPTHS FOR EXCAVATION OF
IMPACTED SOILS IN METERS

- ~ 1/2
- ~ 1
- ~ 2
- ~ 3

Types of Contaminant

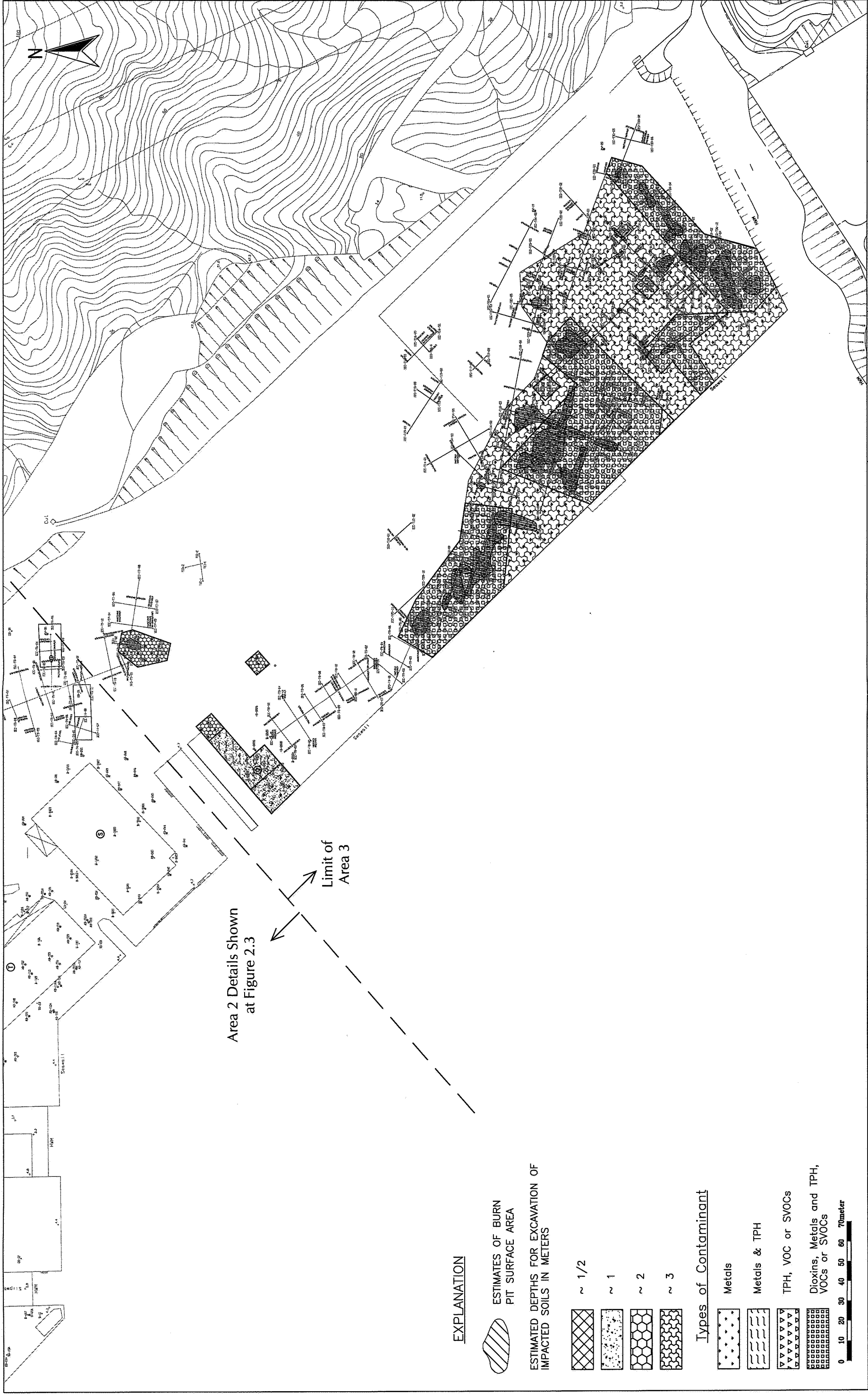
- Metals
- Metals & TPH
- TPH, VOC or SVOCs
- Dioxins, Metals and TPH,
VOCs or SVOCs

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Decommissioning of Choey Lee Shipyard

Excavation Plan for Soil Contaminated Areas at Area 2

Scale	1 : 1500	Project No.	R06100
Date	Feb 2002	Figure No.	2.3





EXPLANATION



ESTIMATES OF BURN PIT SURFACE AREA

ESTIMATED DEPTHS FOR EXCAVATION OF IMPACTED SOILS IN METERS

- ~ 1/2
- ~ 1
- ~ 2
- ~ 3

Types of Contaminant

- Metals
- Metals & TPH
- TPH, VOC or SVOCs
- Dioxins, Metals and TPH, VOCs or SVOCs



Title

Agreement No. CE 68/99 Infrastructure for Penny's Bay Development - Engineering Design and Construction
Decommissioning of Choey Lee Shipyard

Excavation Plan for Soil Contaminated Areas at Area 3

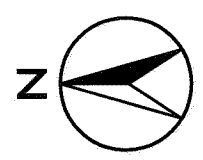
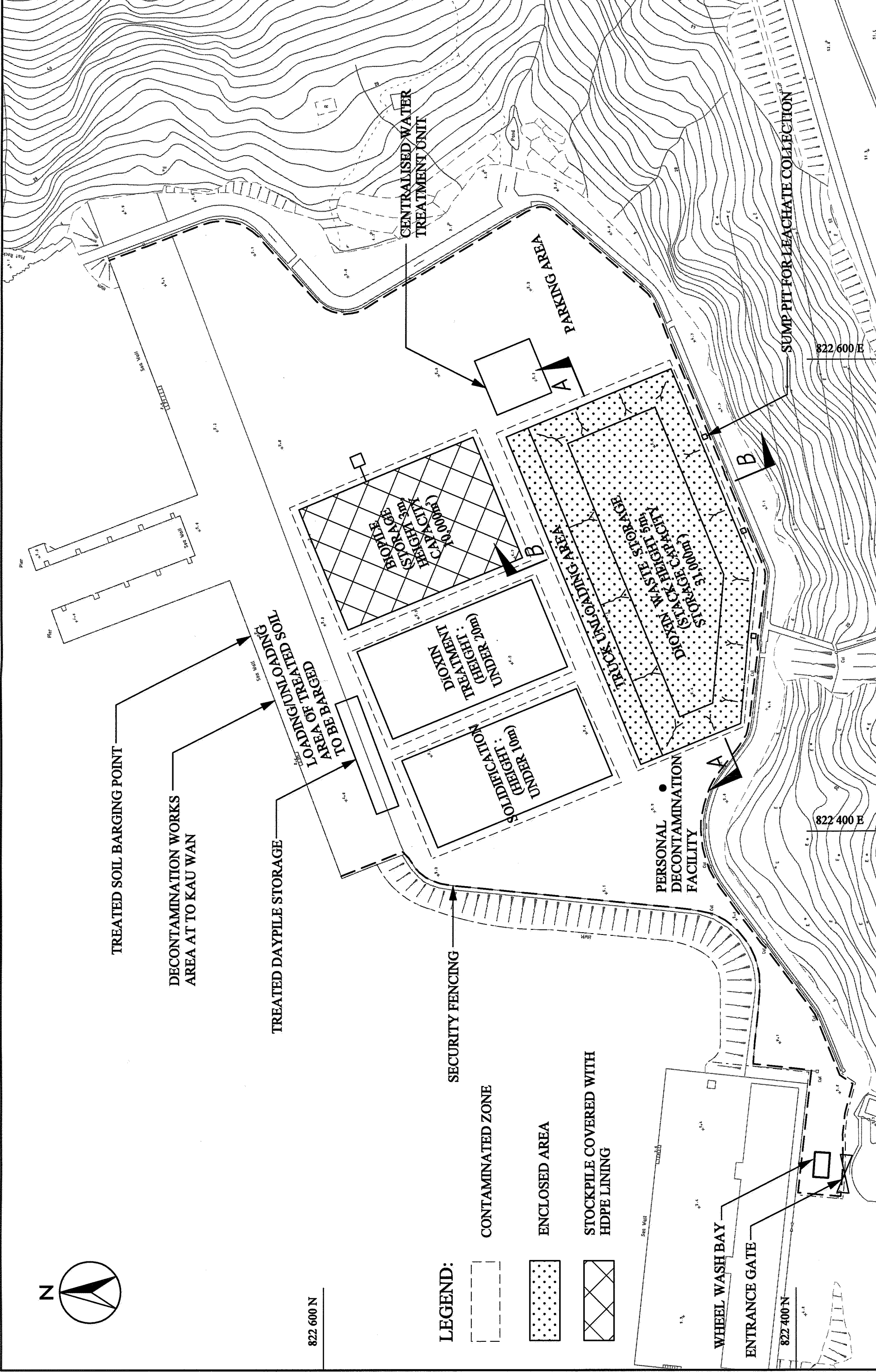
Scale 1 : 1800

Date Feb 2002

Project No. R06100

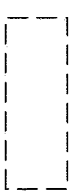
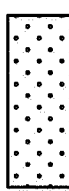

Figure No. 2.4

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MANAGEMENT CONSULTANTS LTD



822 600 N

LEGEND:

-  CONTAMINATED ZONE
-  ENCLOSED AREA
-  STOCKPILE COVERED WITH HDPE LINING

TREATED SOIL BARGING POINT

DECONTAMINATION WORKS AREA AT TO KAU WAN

TREATED DAYPILE STORAGE

LOADING/UNLOADING AREA OF TREATED SOIL TO BE BARGED

SECURITY FENCING

CONTAMINATED ZONE

ENCLOSED AREA

STOCKPILE COVERED WITH HDPE LINING

PERSONAL DECONTAMINATION FACILITY

WHEEL WASH BAY

ENTRANCE GATE

822 400 N

CENTRALISED WATER TREATMENT UNIT

PARKING AREA

SUMP PIT FOR LEACHATE COLLECTION

822 600 E

822 400 E

BOTTLE STORAGE (CAPACITY: 10,000L, HEIGHT: 3m)

DIOXIN TREATMENT (HEIGHT: UNDER 20m)

SOLIDIFICATION (HEIGHT: UNDER 10m)

TRUCK UNLOADING AREA

DIOXIN WASTE STORAGE (STACK HEIGHT: 5m, STORAGE CAPACITY: 31,000m³)

Title
 Agreement No. CE 68/99 Infrastructure for Penny's Bay Development - Engineering Design and Construction
 Decommissioning of Cheoy Lee Shipyard
 DECONTAMINATION WORKS AREA AT TO KAU WAN
 Date =
 SDATES

Scale
 1:1500

Date
 Feb 2002

Projects No.
 R06100

Figure No.
 2.5

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[N8B] K:R06100EIA/DRAWING/FEB02/EXCE_SUMMARY/N_2-5.DGN