FINAL REPORT

EIA/041.2/92

China Light and Power Company Limited

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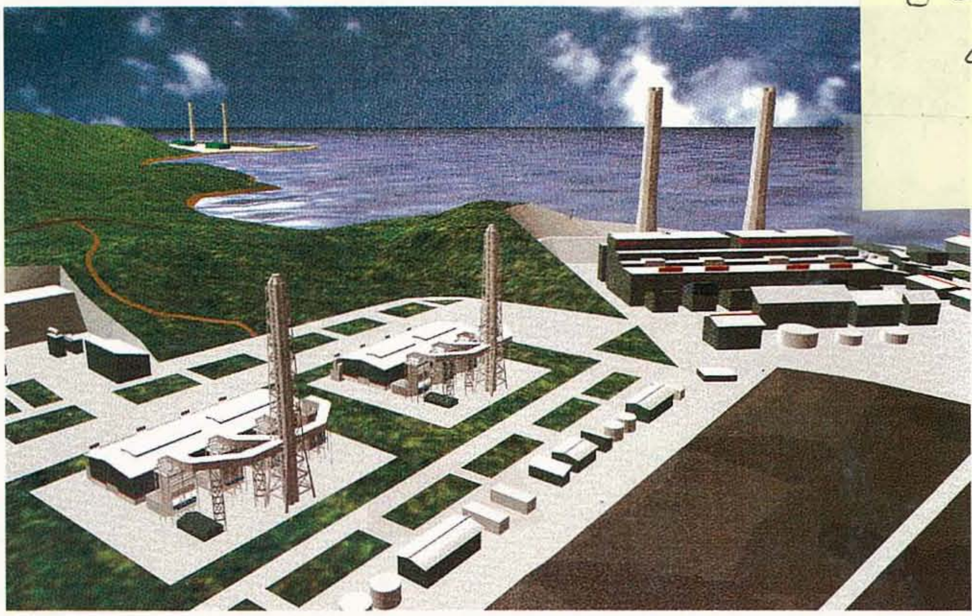

EIA of the Proposed 6000MW Thermal Power Station at Black Point: *Initial Assessment Report*

Volume 2 : Construction Phase

November 1992

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China Light and Power Company Limited

EIA of the Proposed 6000MW Thermal Power Station at Black Point

Initial Assessment Report

Volume 2 : Construction Phase EIA

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Copy No. :

EXECUTIVE SUMMARY

The China Light and Power Company Ltd (CLP) proposes to develop a large thermal power station (LTPS) in Hong Kong to meet forecast electricity demand during the late 1990s and into the next century.

In November 1989 CLP commissioned ERL (Asia) Ltd to lead a team of consultants to undertake a Site Search Study and Environmental Impact Assessment for the LTPS. The purpose, scope and objectives of the study were agreed between CLP and the Hong Kong Government Planning, Environment and Lands Branch (PELB) which set up an interdepartmental Study Management Group to assist in and monitor the progress of the study and to make recommendations to the Secretary for Planning, Environment and Lands at appropriate stages of the study.

The three phase Site Search study, comprising the identification of potential areas, the identification of potential sites and a comparative assessment of sites, resulted in the selection of Black Point.

The findings of the Site Search Report were accepted by the Study Management Group in August 1990 and following scrutiny by the Development Progress Committee (DPC) were submitted for approval to the Land Department Planning Committee (LDPC). The findings were endorsed by the LDPC on 7th December 1990.

Following the endorsement of the recommendation of the Black Point site, the Environmental Impact Assessment for the LTPS at the Black Point location was initiated, comprising two elements; the Initial Environmental Assessment, and the Key Issue Assessments.

The Initial Environmental Assessment provides an assessment and evaluation of the net environmental impacts and cumulative effects of the development, defines measurable parameters likely to be affected by the LTPS, and identifies environmental monitoring requirements.

The Key Issue Assessments provide detailed examinations of those environmental issues which could not be resolved at the initial assessment stage because of their complexity and need for detailed study as a result of their particular importance to the environmental acceptibility of the LTPS.

The need for two such Key Issue Assessments was identified at the commencement of the EIA, both of which were required to start at the same time as the Initial Assessment to ensure completion in line with the project programming. These were:

- the Stack Emissions (ie Air Quality) Key Issue Assessment; and
- the Water Quality Key Issue Assessment

The scope of work for these studies were agreed with the HK Environmental Protection Department, and the studies proceeded in parallel with the Initial Environmental Assessment. The findings of these studies are to be reported separately, in the Key Issue Assessment Reports.

During the discussion of the Draft of the Initial Assessment Report, the need for a third Key Issue Assessment was identified, dealing with the generation of solid byproducts. As with the two other Key Issue Assessments, the scope of the study was agreed with the EPD, and the findings are to be reported separately, in the Solid Byproducts Key Issue Report.

A summary listing of the issues considered in the Key Issue Assessments is provided at the end of this summary.

The findings of the Initial Assessment Report for the construction and operational phases of the LTPS are :

CONSTRUCTION PHASE

Air Quality Impacts

Good site dust practices in addition to careful siting of dust generating activities can effectively reduce the generation of dust by up to 90% and will ensure that adverse impacts on the environment and workforce are minimised. Construction impacts upon air quality both on and off site are therefore not considered to be significant.

Noise

Daytime noise levels during construction works are predicted to be well within the background plus 10 dB(A) criterion for receptors in the Black Point area.

Exceedances ranging from 2 - 9 dB(A) of the night-time noise criterion of 45 dB(A) are predicted at four of the five sensitive receivers, caused by nighttime dredging and marine support activities. It is recommended that where practicable, dredging activities be rescheduled to daytime hours, and the quietest type of dredger and silenced equipment used wherever possible.

Water Quality

Impacts arising from general construction activities will be minor and controlled by good construction site practice. Sediment plume modelling conducted at the Site Search stage indicates that the elevation in suspended solids at the nearest sensitive recievers during the dredging of marine muds will be insignificant when compared to the natural range of conditions in Deep Bay. Monitoring will be required during dredging works to ensure compliance with the Deep Bay Guidelines. Results obtained during initial dredging for the seawall should be used to assess the possible need for controls during the dredging for the access channel and turning basin.

Waste Disposal

Significant impacts from the disposal of construction wastes are not anticipated. Overburden and site debris can be disposed of at the adjacent WENT landfill, whilst chemical wastes will be taken to the Chemical Waste Treatment Facility on Tsing Yi. Marine sediments dredged from the site will require disposal at Gazetted Dump Sites. The need for additional disposal capacity has been recognised by FMC and sites such as disused borrow pits appear attractive. Suitability for dump site disposal will be confirmed by further sampling and analysis once the exact dredging area is known.

Traffic

It is anticipated that no significant traffic impacts need occur from LTPS construction. Road traffic impacts can be minimised by using marine transport for plant, materials and the workforce, by scheduling road deliveries outside peak hours and by careful design of site exits. Marine traffic, even at peak, involving 20 vessel movements per day, will only add approximately 5% to existing levels in the area and is thus not predicted to be significant.

Ecology

The site is of relatively low terrestrial ecological conservation value, and any fauna present are expected to escape during initial site clearance. Specimens or seeds of the two protected plant species found within the site can be relocated, either to AFD gardens or within the landscaping for the LTPS. The impact of construction activities on terrestrial ecology is thus not predicted to be significant.

Sampling of the marine ecology to date has not revealed any rare species. The sampling programme will be continuing in order to obtain data for all seasons and results will be considered in the Water Quality key issue report. The Chinese White (Pearl River) Dolphin is known to use the Urmston Road area, and the construction works may disturb the dolphins habitat; whilst the LTPS construction works will only be a part of the overall development planned for the shores of the Brothers Channel and Urmston Road, this is considered a potentially significant marine ecological impact associated with the construction of the LTPS.

Civil Aviation

Consultation with CAD and the New Airport Master Plan Study Consultants indicates that the construction activities will not violate the obstacle limitation surfaces associated with the future Chek Lap Kok airport or the existing Kai Tak flight paths. No impacts are therefore predicted.

Socio-Economics

The construction of the LTPS will provide a significant source of employment, which in turn will lead to the development of other goods and service related industries which will have a positive effect on the area. The site is located sufficiently far from population centres such that reduction in property value as result of disturbance from the LTPS construction work is unlikely to be of concern.

Cultural Heritage and Fung Shui

The Black Point area has been identified by the Antiques and Monuments Office (AMO) as an important archaeological site. A full mitigation plan for the investigation of these resources will be devised to the satisfaction of AMO.

Recreational and Visual Amenity

Yung Long beach will be removed by LTPS construction, although it is planned, in any event to be lost to PADS development.

Siting the LTPS to the north of Black Point substantially limits visual impacts during the construction period, although receptors to the south will be visually aware of the construction of the coal-fired unit stacks.

Decommissioning

Decommissioning of the LTPS is likely to begin around 2030 for Phase 1 of the station, and 2040 for Phase 2. Whilst CLP will be required to comply with the environmental legislation in force at that time, the broad issues which will need to be addressed have been identified, and generic mitigation measures to minimise impacts recommended; specific mitigation measures should be agreed with EPD (or its future equivalent) prior to the works commencing.

OPERATIONAL PHASE

Air Quality

Assuming that the EPD's BPM for emissions control are implemented, it is considered that the potential for human health impacts is only possibly significant with respect to the short term, i.e. 1-hour average concentrations. The extent and type of mitigation measures required cannot be determined at this stage, however, because of the uncertainty attached to the predictions made so far. This will be resolved during the Stack Emissions Key Issue Assessment.

The power station emissions are unlikely to cause significant dry acid deposition impacts however, the contribution of wet deposition requires further investigation in the Stack Emissions Key Issue Assessment.

Noise

Detailed assessment of noise impacts from the operation of the LTPS indicates that no significant impact will result either during the daytime or at night, from the operation of LTPS plant.

Water Quality

The operation of the LTPS is expected to be acceptable with regard to marine water quality. The following two key issues have be identified as requiring further study:

- Effect of sea flow patterns and the extent of the cooling water discharge thermal plume
- Dispersion of toxic metal discharges

The results of the mathematical modelling of these will be carried out as part of the Water Quality Key Issue Assessment.

Waste Disposal

Appropriate disposal locations for MARPOL and general operational wastes are available and will not give rise to significant impacts. Beneficial uses of PFA, FBA and gypsum have been identified and options which avoid the generation of solid byproducts (gypsum dissolution in seawater and seawater scrubbing suggested). However, these issues are to be studied further, and the findings presented in the Solid Byproducts Key Issue Report.

Traffic

No significant impacts are predicted to arise from operational road and marine traffic related to the LTPS.

Ecology

No significant impacts on terrestrial vegetation as a result of particulate, metal or dry acid species deposition are predicted. Potential impacts relating to wet acid deposition require further study and will be reported in the Stack Emissions Key Issue Report.

The marine ecological assessment is continuing, to allow the full annual seasonal range to be reported. The Chinese White (Pearl River) Dolphin makes use of the Urmston Road channel, and the development and operation of the LTPS, in conjunction with other deep waterfront industrial activities has the potential to affect the dolphins' environment. Further assessment on marine ecological issues will be presented in the Water Quality Key Issue Report.

Civil Aviation

The stacks for coal fired units will project above the anticipated obstacle limiting surface of the new airport at Chek Lap Kok. This is not considered significant due to the shielding effect of the Castle Peak range to the east, and will be discussed with CAD and the consultants for the new airport. The LTPS is not considered to pose any significant risks to aircraft from thermal or cloud generation effects.

Socio Economics

Operation of the LTPS will provide positive socio-economic impacts by enabling a future power shortfall in Hong Kong to be avoided, and providing direct and spin-off employment. The possibility of adverse impacts on commercial mariculture in Deep Bay is being addressed in the Water Quality Key Issue Assessment.

Cultural Heritage and Fung Shui

No significant cultural impacts are anticipated. Fung Shui impacts and mitigation requirements to be incorporated into the detailed design and layout of the LTPS are under investigation by CLP and local experts.

Visual

In the context of the semi-industrialised nature of the area, the visual impact of the LTPS is considered to be moderate. Should PADS developments proceed, the LTPS will be compatible.

Risk

The nearest population centres are under no significant hazard from the consequences of gas or oil incidents at the LTPS. Risks to potential PADS users immediately south of Black Point may be avoided by locating the gas pipeline route and oil berthing facilities such that the hazard distances involved lie wholly within the LTPS site.

A list of Key Issues to be addressed in specific Key Issue Reports is presented below.

Report	Issue
Stack Emissions - KIA	– Mitigation measures for emission control with respect to short term exposure (1-Hour AQO) and NO_2 – Recommend stack heights for coal, combined cycle and OCGT units – Assessment of contributions from LTPS to wet acid deposition
Water Quality - KIA	– Assessment of seaflow pattern and extent of thermal plume from cooling water discharge – Assessment of the dispersion of toxic metals from cooling water discharge – Assessment of impacts to marine ecology
Solid By-Product - KIA	– Confirm quantity of solid byproduct arisings from LTPS and Territory -wide over the next 20 years – Propose technically practical, economically feasible and environmentally acceptable management strategies for the byproducts (FBA,PFA,FGD gypsum and wastewater treatment sludges) over the same period

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1. INTRODUCTION

1.1 Background to the EIA

1.1.1 The Proposed Development

The China Light and Power Company Ltd (CLP) proposes to develop a large thermal power station (LTPS) in Hong Kong to meet forecast electricity demand during the late 1990s and into the next century. It is anticipated that the LTPS would ultimately provide 6000MW of power. Studies to date have assumed that approximately 5000MW would be generated from coal-fired units and upto 1000MW from gas turbine units fired on oil. Natural gas firing of part of the plant has also been considered and a site chosen so as not to preclude this option. The question of fuel type is one that is under active consideration by CLP as are options regarding the type of plant to be installed.

The implications for the extent and nature of environmental impacts resulting from fuel and plant choices require that two alternative fuel options be considered by the present study. These options are presented in Section V2/1.3.

1.1.2 Project History

In November 1989 CLP commissioned ERL (Asia) Ltd to lead a team of consultants to undertake a Site Search Study for the LTPS, based upon investigation of the following main issues:

- engineering feasibility;
- security of marine fuel supply;
- security of the transmission system;
- operational requirements;
- environmental protection;
- compatability with government planning;
- costs.

The purpose, scope and objectives of the study were agreed between CLP and the Hong Kong Government Planning, Environment and Lands Branch (PELB) which set up an interdepartmental Study Management Group (SMG) in order to:

- provide appropriate information for the consultants and advise on Government's opinions and concerns;

- monitor the progress of the study and review its findings;

- make recommendations to the Secretary for Planning, Environment and Lands at appropriate stages of the study.

The study consisted of three phases, as outlined below:

o **Phase 1: Identification of Potential Areas**; wherein possible areas for location of the LTPS were identified on the basis of adequate marine access for fuel delivery and avoidance of conflict with strategic development plans e.g. PADS. A shortlist of 9 general areas was agreed with the SMG and were taken forward to Phase 2.

- **Phase 2: Identification of Potential Sites**; during which civil engineering, transmission issues and strategic planning conflicts received more detailed attention. A shortlist of sites at the following areas:

  - Black Point;
  - Southwest Lantau;
  - Soko Islands;
  - Artificial Island area (south of Lantau);
  - Po Toi Island;

  was identified for comparative assessment in Phase 3.

- **Phase 3: Comparative Assessment of Sites**; this was undertaken emphasising environmental issues and resulted in an overall ranking of the sites and recommendations regarding site selection.

Details of the site selection process, including the sites considered, the methodology devised and the selection criteria adopted were presented in the Site Search Report[1] and the Site Search Executive Summary[2].

The study resulted in the selection of Black Point for the following reasons:

- The **Black Point** sites were assessed as acceptable on all issues, although it was noted that significant engineering and navigation issues are required to be resolved to achieve this situation.

  The Black Point site was judged to have considerable advantages over the others in the following areas:

  - the technological and environmental impact aspects of transmission lines;

  - PFA (and possibly FGD by-product) storage potential at existing Tsang Tsui Lagoons;

  - planning and amenity aspects;

  - the technological aspects of air pollution control.

- The choice of the **Artificial Island** site would have incurred an unacceptably high-risk transmission system, a significant strain on the Territory's fill resources, a delay of one year to the project programme and likely unacceptable impacts on the Territory's solid waste management strategy.

- Sites at **Po Toi** would have required the acceptance of an uproven transmission link configuration resulting in an unacceptability high-risk transmission system with a probable delay of one year to the project programme.

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1 ERL (1990) 6000MW Thermal Power Station Site Search Report. ERL (Asia) Ltd September 1990 for CLP.

2 ERL (1990) 6000MW Thermal Power Station Site Search Executive Summary ERL (Asia) Ltd September 1990 for CLP.

- The site at **Siu A Chau** would probably have involved unacceptable impacts on the Territory's solid waste management strategy and possibly unacceptable air quality impacts affecting upto 50% of the Lantau Country Parks.

- The sites at **Southwest Lantau**, although the best on security of supply grounds, were unacceptable because short-term and severe air quality impacts could not be avoided over much of western Lantau on occasions. In addition, the siting of the power station itself would have caused substantial degradation of the landscape and would have represented an unprecedented level of conflict with the Country Parks Ordinance.

The final recommendation of the Black Point site for the LTPS was, therefore, conditional upon:

- the possible need for additional emissions control at the nearby Castle Peak Power Station (CPPS) to be investigated in detail during the EIA study;

- design of the cooling water system to prevent adverse effects on Deep Bay, to the north of the site;

- agreement with the Civil Aviation Department on the compatability of the LTPS chimney stacks with the requirements of the new airport at Chek Lap Kok;

- agreement on transmission lines separate from those serving CPPS and preferably across the Castle Peak Firing Range;

- agreement on modifications to the passage practices in the Ma Wan Channel.

The findings of the Site Search Report were accepted by the SMG in August 1990 and following scrutiny by the Development Progress Committee (DPC) were submitted for approval to the Land Development Planning Committee (LDPC). The findings were endorsed by LDPC on 7th December 1990. The location of Black Point within the Territory of Hong Kong is illustrated in Figure V2/1.1(a).

1.2 Objectives of the EIA and Initial Assessment Report

The objectives of the EIA, following identification of the (Black Point) site, were defined in the study brief and are as follows.

- to describe the characteristics of the LTPS and related facilities;

- to identify and describe the elements of the community and environment likely to affect or be affected by the LTPS including potential impacts on marine activities, obstacles in the environment from an aeronautical point of view, visibility reduction effects, updrafts caused by generation of hot air and effects on performance of radio navigational aids;

- to minimise pollution, environmental disturbance and nuisance arising from the total development and its construction, operation and decommissioning;

- to identify, predict and evaluate the net environmental impacts and the cumulative effects, including transboundary pollution, if any, expected to arise due to the construction, operation and decommissioning of the proposed development and any associated facilities;

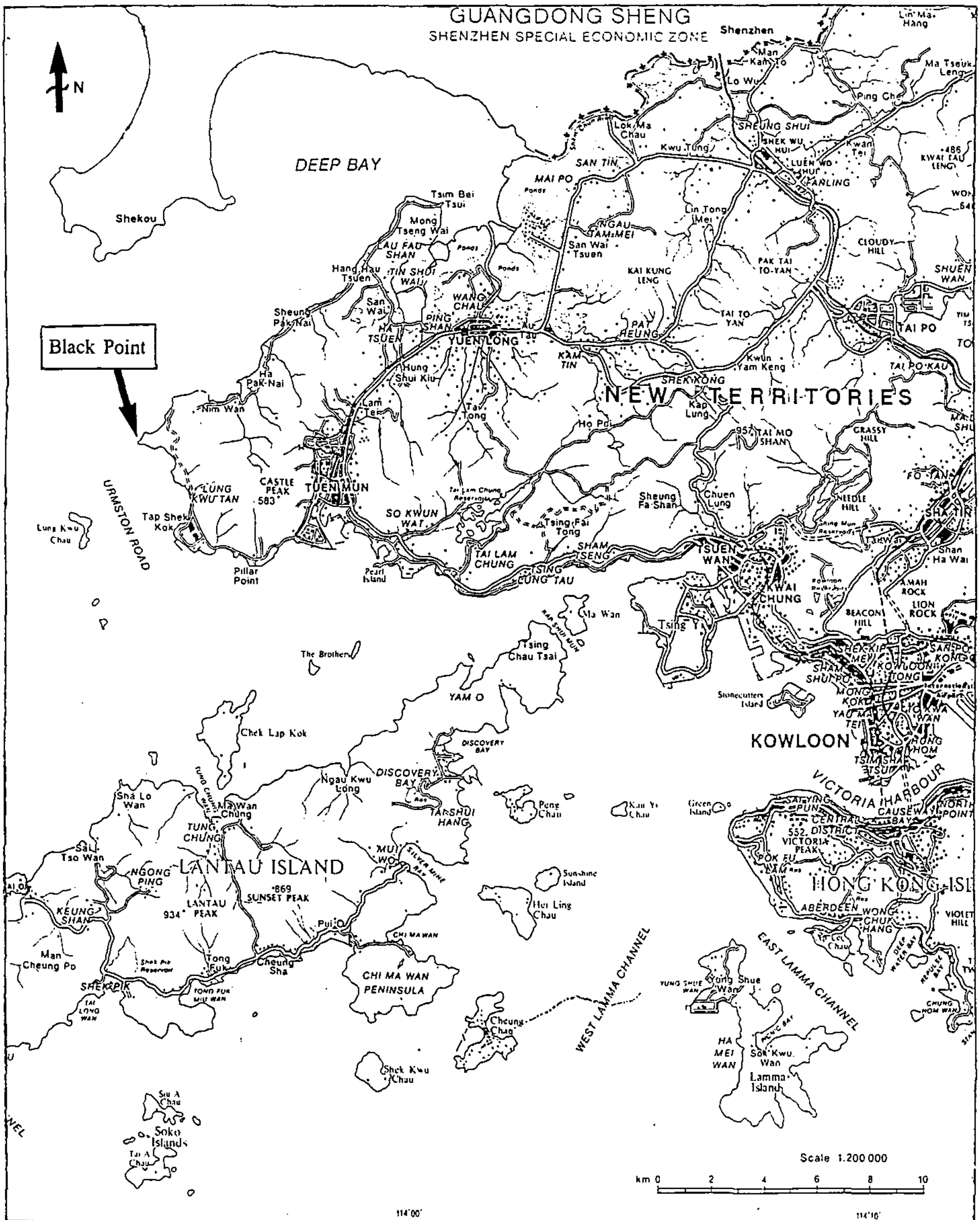

Figure V2/1.1 (a)

The Location of Black Point within the Territory of Hong Kong

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- o to identify and specify methods, measures and standards to be included in the detailed design, which are necessary to mitigate these impacts and reduce them to acceptable levels;

- o to design and specify the environmental monitoring requirements for background, impact and compliance monitoring to ensure that the conditions mentioned above are met;

- o to design and specify environmental audit requirements for compliance and post-project audit, which will review the data from the monitoring programme to ensure that statutory requirements, policies and standards are met and that the necessary remedial works are identified to remedy any unacceptable consequential or unforeseen environmental impacts of the works.

The structure of the study requires that this Initial Assessment Report (IAR) should:

- o provide an initial assessment and evaluation of the net environmental impacts and cumulative effects of the development located at the site identified in the **Site Search Report**, including any transboundary pollution arising from the total development, sufficient to identify those issues of key concern during the construction, operating and decommissioning phases of the LTPS, which are likely to influence decisions on the LTPS;

- o define measurable parameters likely to be affected by the LTPS and identify any environmental monitoring studies which are required both to provide a baseline profile of existing environmental conditions and to monitor impact and compliance during implementation, commissioning, operation and future decommissioning of the LTPS;

- o provide an initial definition of environmental audit requirements for compliance and post-project audit, which shall include a review of the monitoring data both to identify compliance with regulatory requirements, policies and standards and to define any remedial works required to redress unanticipated or unacceptable consequential environmental impacts; and

- o propose a detailed programme of investigation and reporting able to meet all other objectives of the assessment.

In addition, two **Key Issues** were identified at the commencement of the EIA, which required an immediate start in order to ensure completion in line with project programming. These were:

- Stack Emissions;
- Water - both cooling water and the effects of reclamations.

It is anticipated that a need for further KIRs may arise from the study and consideration of the findings of this report. The EPD have indicated that a Key Issue Report is needed on Solid By-Product Management.

The programme of EIA study report submissions identified to date is indicated in Figure V2/1.2(a).

Figure V1/1.2(a)
Programme of EIA Study and Report Submissions

Report	October	1990 N	D	J	F	M	A	1991 M	J	J	A	S	O
IAR	●						*						
Stack Emissions KIR	●											*	
Water Quality KIR	●											*	

● = start-up
* = completion

1.3 Scope of the Study

The scope of the study was outlined in the brief. The IAR presents the results of the assessment of the project and identifies a number of Key Issues which will address specific areas of impact in sufficient detail to determine their sigificance. As a consequence of the possibility that some units of the LTPS may be gas-fired it was necessary to consider the likely impacts to be associated with a firing scenario other than the coal base-case. CLP, therefore, directed ERL to consider two alternative firing scenarios, the outlines of which are presented in Table V2/1.3(a). It should be noted, however, that it is not the purpose of the EIA to compare these options on environmental grounds; gas-firing can only be undertaken if economically viable and if a secure supply can be ensured.

The IAR has considered oil firing only as an operational contingency. The effects of oil firing on a more frequent basis will be considered as part of the Stack Emissions Key Issue Assessment.

Table V1/1.3(a)
Alternative Firing Scenarios for the LTPS

Scenario	1996	97	98	99	00	01	02	03	04	05	06	07	08
		PHASE 1							PHASE 2				
I Coal	680	680			680	680		680	680			680	680
II Gas and Coal													
Gas	600	600			600	600							
Coal								680	680			680	680

All figures are Megawatts.
April commissioning assumed in each case.

The IAR addresses the following:

- **Construction**: Quantification of impacts where appropriate, assessment of the mitigation effects of proposed control measures, evaluation of effects on the existing environment, assessment in view of current statutory requirements and an evaluation of control procedures for construction of the LTPS. Discussion of impacts includes the following:

  - analysis of the method of construction and identification of potential major sources of dust and noise;

  - assessment of the impact of dust and noise producing processes, plant, vehicles and machinery on adjacent air and noise sensitive receivers;

  - consideration of the impacts of construction activities on the aquatic environment including effects of reclamation, jetty, berth, pipeline, intake, outfall and seawall construction and effects from silty runoff on water quality and circulation;

  - evaluation of the land and marine access requirements, including the environmental impacts related to the movement of borrow material, dredging and maintaining marine access;

  - consideration of the impacts from construction of fuel storage facilities including impacts on the landscape character, visual impact and erosion and runoff during construction;

  - identification of the socio-economic impacts upon existing villages, cultural impacts upon places of worship and any identifyable fung shui implications; and

  - consideration of the impacts of construction activities, such as the use of tower cranes, on the aeronautical environment.

- **Operation** : For the operation of the LTPS the following were assessed for each of the two firing scenarios :

  - the cumulative impact of noise producing plant, vehicles and machinery associated with the operation of the site on adjacent noise sensitive receivers;

  - the direct and indirect enviromental impacts and cumulative effects on a local and a regional scale, due to aerial emissions from the proposed power station and associated facilities including the effects of sulphur oxides, nitrogen oxides, acid deposition, hydrocarbons, total suspended particulates, respirable suspended particulates, odour, toxic metals and chemicals, visibility and photochemical reactions, taking into account discharge and ambient standards as advised by the Director of Environmental Protection. Studies are continuing as part of the Stack Emissions Key Issue;

  - aqueous emissions (in terms of process effluents, cooling water, surface drainage, furnace bottom ash (FBA) pulverised fuel ash (PFA) and flue gas desulphurisation (FGD) wastes, leachate and on-site sewage & sullage) are identified and quantified with consideration for adequate interception, handling, treatment and disposal in order to comply with discharge and disposal guidelines approved by the Director of Environmental Protection. The necessary controls to minimise marine pollution are scoped. Studies are continuing as part of the Water Quality Key Issue;

- the effects of marine transport requirements on marine traffic, both those generated in or trading with Hong Kong and those to/from Chinese ports in the Pearl estuary, and water quality;

- transboundary pollution impacts;

- the effects of land transportation requirements on traffic congestion and road safety together with potential noise and dust impacts along proposed transportation routes;

- the disposal of any solid wastes in an integrated plant lifetime strategy, and the various possible methods of disposal and/or utilisation. Studies are continuing as part of the Solid By-products Key Issue study;

- the environmental impacts associated with the installation and operation of fuel supply and storage systems;

- visual impact of the installation;

- environmental monitoring requirements including baseline, impact and compliance monitoring;

- environmental audit requirements including compliance and post-project audit which will review the environmental monitoring data to identify compliance with regulatory requirements, policies and standards and any remedial works required to redress unacceptable consequential or unanticipated environmental impacts;

- the impact of construction activities, associated with the installation of later units, occuring concurrently with the operation of the plant.

1.4 Structure of the IAR

1.4.1 This report is organised in three volumes, as follows:

- Volume 1: The Surrounding Environment;
- Volume 2: The Construction Phase EIA;
- Volume 3: The Operational Phase EIA.

The scope of these volumes is outlined in the following sections.

1.4.2 Volume 1: The Surrounding Environment

This volume concentrates on the characteristics of the surrounding environment, describing both its present state and the manner in which it is anticipated to develop during the lifetime of the LTPS. The purpose is to define the receiving environment into which the LTPS will be placed. The lifetime of its operation and the planned development of the area are such that major changes are likely to occur. The impact of the LTPS can only be realistically assessed against an appreciation of the likely state of the surrounding environment during the project's lifetime. This volume is organised as follows:

o **Section 1**: An introduction outlining the background to the study, its scope and objectives and an indication of its outputs.

- o **Section 2**: Planning and Landuse; in which relevant aspects of the existing environment are described both in their present state and in the way they are anticipated to change during the lifetime of the project.

- o **Section 3**: Summary and Interpretation of Environmental Baseline Data; in which the baseline data collection programme is described and ambient air, water, sediment, noise and ecological conditions are summarised on the basis of initial site specific monitoring results and other existing relevant information. This section is supported by a presentation of data contained in the following annexes.

  - Annex V1/A – Meteorological Data
  - Annex V1/B – Air Quality Data
  - Annex V1/C – Marine Water Quality and Sediment Data
  - Annex V1/D – Groundwater Quality Data
  - Annex V1/E – Noise Environment Data
  - Annex V1/F – Terrestrial Ecology Data
  - Annex V1/G – Marine and Littoral Ecology Data

1.4.3 Volume 2: Construction Phase EIA

This volume describes the planned construction of the LTPS and predicts the likely associated impacts. Its organisation is as follows.

- o **Section 1**: Introduction (as for Vol.1)

- o **Section 2**: Contains a description of the proposed development including its main features, and phasing and programming details. In addition, a summary of the precise site layout development process is presented.

- o **Section 3**: describes the construction activities that will be required during the course of the development, both for initial site formation and installation of the first units and for subsequent construction periods when additional units are added to the LTPS.

- o **Section 4**: Describes the likely effects on Air Quality by identifying potential impact sources and sensitive receptors that may be affected; allowing prediction of likely levels of air pollution, which are assessed against existing criteria and anticipated changes in background levels.

- o **Section 5**: Noise impacts are predicted, based on assumptions of the plant to be used and their associated sound power levels, together with the location of noise sensitive receivers. Likely changes in ambient noise levels are also considered and the resulting predictions are assessed against knowledge of the existing noise levels obtained from the monitoring programme and relevant criteria contained in the Noise Control Ordinance.

- o **Section 6**: The impacts of construction activities on water quality will result primarily from dredging of marine sediments and the formation of reclaimed areas and the construction of the cooling water outfall and natural gas pipeline. The likely impacts associated with these activities are the subject of a detailed modelling exercise currently underway. It is expected that the result of this exercise will be presented in the Key Issue Report on Water Quality. The IAR is confined to a review of previous work undertaken in the area, together with the results of water quality and marine ecology sampling carried out for the study.

- **Section 7**: Waste disposal requirements during the construction phase are addressed in this section. Potential waste sources are identified from knowledge of construction activities and the necessary disposal arrangements are indicated.

- **Section 8**: Road and marine traffic generated by construction activity is estimated. Discussion of traffic impacts is confined in this section to severance and disturbance/nuisance effects. Air quality and noise impacts associated with site traffic are covered under Sections 4 and 5 respectively.

- **Section 9**: Both Marine and Terrestrial ecology impacts arising from construction are considered in this section. Terrestrial ecological impacts include both immediate site effects, and impacts on areas surrounding the site that may be affected by noise and dust. Marine ecology effects that may occur as a consequence of water quality impacts, will be examined via the modelling exercises in the Key Issue Report on water.

- **Section 10**: Possible impacts with regard to civil aviation are outlined in this section. Specifically, the height of construction equipment such as cranes is considered.

- **Section 11**: The socio-economic effects of plant construction are considered in this section. In particular, levels of local employment generation are considered.

- **Section 12**: The implications for cultural heritage in the area and potential Fung Shui effects are addressed in this section, on the basis of available recorded information.

- **Section 13**: Details impacts on recreation and visual amenity resulting from construction, based on preliminary plant layout.

- **Section 14**: Presents Conclusions and Recommendations.

- **Annex V2/A**: Contains a series of figures which illustrate the site development process which resulted in the present layouts.

- **Annex V2/B**: Contains Requirements for Environmental Monitoring to gauge impacts and test compliance during the Construction Phase.

- **Annex V2/C**: Considers impacts that will occur in the event that a coal conveyor is constructed between the existing CPPS and the LTPS at Black Point.

- **Annex V2/D**: Presents the current Construction Profile.

1.4.4 Volume 3: Operational Phase EIA

This volume describes the operational and decommissioning phases of the LTPS, and associated impacts. Impacts resulting from concurrent construction activities necessary for the installation of subsequent units are also detailed in this volume, which is organised as follows:

- **Section 1**: Introduction (as for Vol.1)

- **Section 2**: (as for Vol.2)

- **Section 3**: Presents an initial assessment of air quality impacts including an inventory of atmospheric emissions, identification of potentially sensitive receptors and appropriate criteria against which to identify impact significance. Alternative scenarios resulting from the two possible firing strategies are outlined. The effect of likely changes in background air quality (particularly SO_2 and NO_x) is a critical aspect of this. The air quality study will continue toward submission of a Stack Emissions Key Issue Report in October 1991.

- **Section 4**: Consideration of operational noise impacts involves an inventory of noise sources for each of the two fuel scenarios. Sensitive receivers are located and the effect upon them is modelled. These impacts are assessed against a predicted increase in background noise levels to allow impact identification and the development of mitigation proposals.

- **Section 5**: Presents the progress in the Water Quality Key Issue Studies. This proceeds from an inventory of effluent sources and likely discharges for both fuel scenarios, together with identification of sensitive receptors, to an indication of the likely effects of hydraulic changes and cooling water impacts. Consideration is given to likely changes in background concentrations when assessing the potential significance of impacts and the need for mitigation.

- **Section 6**: Solid by-product disposal requirements are predicted from an inventory of solid by-product sources and a preliminary solid by-product disposal strategy is developed. Both limestone/gypsum and seawater FGD systems are considered.

- **Section 7**: Operational road and marine traffic are predicted, the latter taking account of the two fuel scenarios. Severance and disturbance that may be associated with these movements are described. Noise and air quality impacts resulting from traffic are assessed in Sections 3 and 4 respectively.

- **Section 8**: Data outputs from the air quality study (Section V3/3) and the water quality study (Section V3/5) are used as a start point for the assessment of ecological impacts, with further input from preliminary marine and terrestrial ecological surveys. Potentially beneficial effects from proposed landscape planting and habitat provision are also considered.

- **Section 9**: Civil aviation implications, related to building heights and thermal plumes from stacks are explored.

- **Section 10**: Potential Socio-economic impacts are considered, in particular the generation of employment opportunities by LTPS development.

- **Section 11**: The cultural heritage and Fung Shui implications of the operation are assessed.

- **Section 12**: The visual impact is described, on the basis of the site location and the preliminary design layout of the plant. Zones of visual influence diagrams and montage illustrations are presented. Macro-scale mitigation potential is indicated.

- **Section 13**: This is a Risk Assessment of Scenario II concerning the supply and use of natural gas (NG) at the LTPS.

- **Section 14**: Key findings are presented, both definitive for the completed studies and preliminary for those areas of study that are the subject of Key Issue Reports.

- **Annex V3/A**: Illustrative figures of the site development process.

- **Annex V3/B**: Presents operational noise data.

- **Annex V3/C**: Investigates the likely impacts associated with the provision of a coal conveyor between the existing CPPS and LTPS.

- **Annex V3/D**: Illustrates pathways of trace elements through coal-fired units and FGD systems.

- **Annex V3/E**: Presents requirements for Environmental Monitoring to gauge impacts and test compliance during the operational phase.

- **Annex V3/F**: Indicates Environmental Audit requirements.

2. THE PROPOSED DEVELOPMENT

2.1 General Description of the LTPS

The Environmental Assessment for the LTPS has been based on two distinct development scenarios located within the same site envelope at Black Point in the North West New Territories. These scenarios represent two possible alternative developments depending on the availability of gas as a fuel option. The LTPS will also include up to 10 gas turbine units in open cycle for peak lopping and emergency standby.

Other major facilities which are required in addition to the power plant itself include three 400kV transmission links to distribute the generated power and a marine berth for the fuel and limestone vessels and the possibility of a cooling water discharge outfall that extends beyond the site envelope.

The LTPS is a phased development that will be built over a period of years starting with ground breaking in late 1991 and ending with commissioning of the final units in 2008. The concept is to have the first 2 units operating by 1 April 1997 and keep under review the need for and timing of subsequent units. A simplified programme for the two developments is shown in Figure V2/2.1(a). Ultimately it is envisaged that the LTPS will produce some 6000 MW of electricity.

A site area of about 120 hectares is required for 6000MW of generating capacity for Scenario I, including provision for the coal stockpile and storage of reagents and by-products from any FGD process which is required. Although the figures indicate a similar area is required for each Scenario this may be reduced for Scenario II to about 80 hectares due to a reduction in coal, FGD reagent and by-product storage requirements. Ideally, 40 ha of the site should be located on rock for both Scenarios in order to support the heavy power blocks. In the absence of unweathered rock at formation level, piled foundations or other substructures extending into the underlying rock will be required.

The site area does not include space for ash storage lagoons. It is proposed that the present lagoons at Tsang Tsui will accomodate the ash from the early years of operation. This is one of the advantages of the Black Point location in that new lagoons are not needed from the outset. This provides time for other ash utilisation routes to be developed.

It is preferable for the LTPS to be located at a coastal site for two reasons. Firstly, to allow coal and limestone delivery by large bulk carriers direct to the plant; the EIA has assumed a minimum requirement for the marine facility is the capability to berth vessels of 180,000 - 200,000 deadweight tonnage (dwt). A 20m channel depth would provide an underkeel clearance of 10% of the ship's draught. This was a key consideration in identifying potential site areas in the early stages of the Site Search for the LTPS. Secondly, the need for large quantities of cooling water advocates a coastal position.

It is assumed that the first main unit will be commissioned by April 1996. Programming is discussed further in the following section in relation to specific construction activities.

2.2 The Two Fuel Scenarios

The Site Search Study was conducted on the premise that the LTPS will have conventional, external-combustion, steam-cycle generating units, fired by coal. The technical suitability and hazard implications for accepting natural gas as a fuel was however also included as a siting criterion.

Now, two specific fuel scenarios are being used in the environmental initial assessment study (and in any Key Issues work). These are, all coal and a combination of natural gas and coal. The purpose of this is not to discover which is environmentally preferable but to assess the environmental implications of each so that an informed decision can be made by CLP that covers all the necessary elements of security of supply, operability and costs as well as environment and planning.

The two fuel Scenarios are given in Table V2/2.2(a). In Scenario I coal is the sole fuel through the whole development. In Scenario II natural gas is the sole fuel in Phase 1, that is for the first half of the ultimate station and coal is used for Phase 2, the second half. In both Scenarios back-up fuel (in the form of oil) is required. Also in both Scenarios up to 1000MW of open cycle gas-turbine capacity would be installed.

The consumption of fuels under these two Scenarios and the generation of solid by-products are shown in Tables V2/2.2(b) and (c) for Scenarios I and II respectively. These characteristics of the two Scenarios have profound influence on what facilities are provided and when.

Scenario I : All Coal

This Scenario comprises a LTPS of 8 x 680 MW (nominal) conventional external combustion steam cycle generating units fired by coal, combined with up to 10 x 100 MW (nominal) gas turbine units in open cycle fired by distillate. Figures V2/2.2(a) and (b) indicate the extent of development for this Scenario in Phase 1 and Phase 2.

Scenario II : Gas/Coal

This scenario comprises a LTPS of 4 power trains each consisting of 2 or 3 Gas Turbines with a waste heat recovery boiler and steam turbine, together with 4 x 680 MW (nominal) conventional external-combustion, steam cycle generating units fired by coal and 10 x 100 MW gas (nominal) turbine units in open cycle fired by natural gas. The gas units would be installed in Phase 1 and the coal units in Phase 2. Figures V2/2.2(c) and (d) indicate the extent of development for this Scenario in Phase 1 and Phase 2.

2.3 Project Programme

Introduction

This section summarises the civil works which will need to be undertaken to develop the LTPS Scenarios from a greenfield site. Specific details are given in Section V2/3.0.

The work described is that which is required to develop the power station to a point where the major items of the plant can be installed inside the buildings. Activities are described broadly in the order in which they take place.

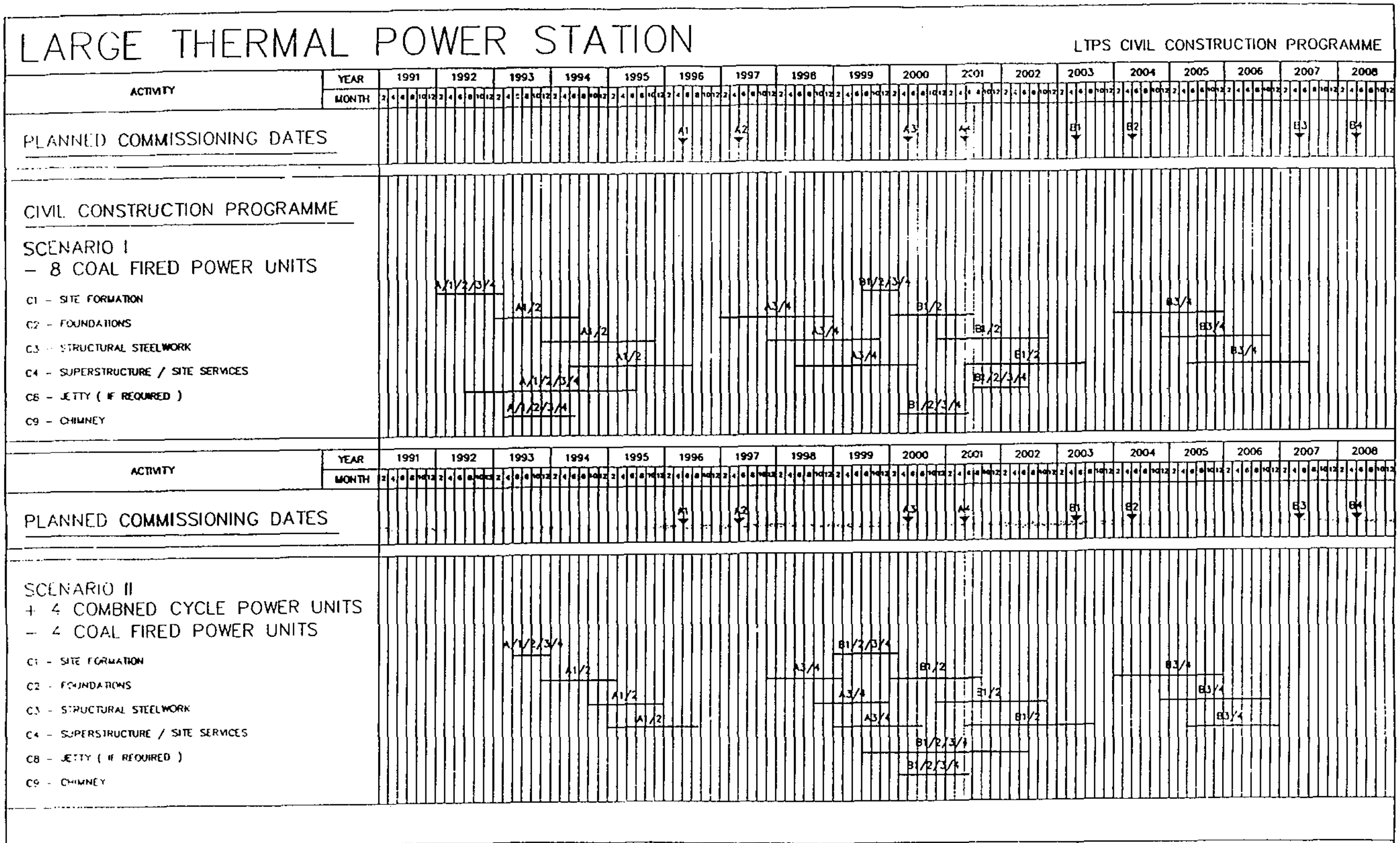

Figure V2/2.1(a) LTPS Civil Construction Programme

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Table V2/2.2(a)
The 2 Fuel Scenarios

	Phase 1						Phase 2						
1 April STS	96	97	98	99	00	01	02	03	04	05	06	07	08
Unit No.	Unit 1	Unit 2			Unit 3	Unit 4		Unit 5	Unit 6			Unit 7	Unit 8
SCENARIO I													
– Coal only	680	680			680	680		680	680			680	680
SCENARIO II													
– Natural Gas	600	600			600	600		–	–			–	–
	c/c	c/c			c/c	c/c							
and													
Coal	–	–			–	–		680	680			680	680

STS – Steam to set (start)
c/c – combined cycle

Table V2/2.2(b)
Scenario I – Fuel Consumption and Solid By-product Generation

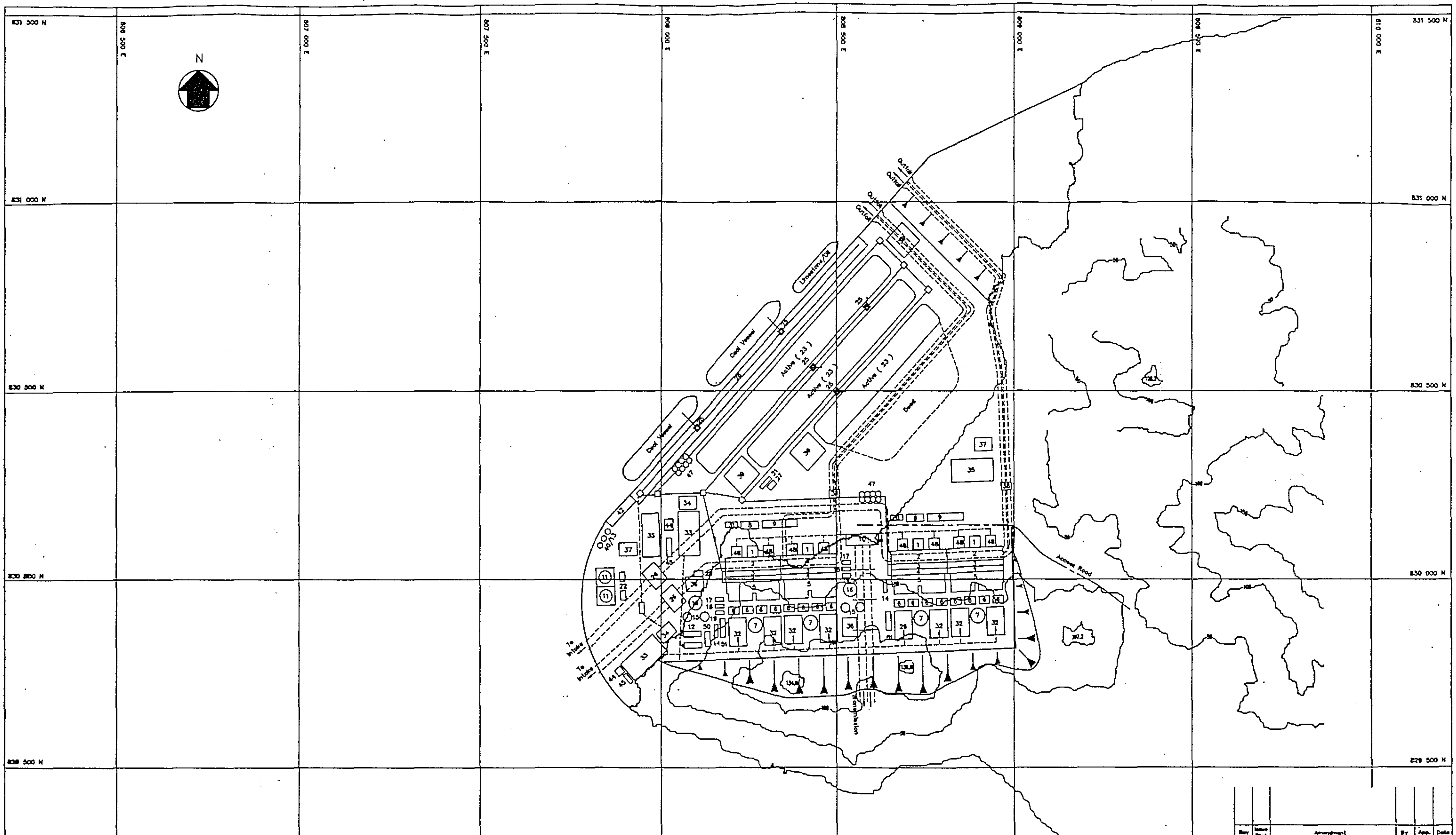
Annual Fuel Consumption	98/99	2002	2005/06	2010	Comments
Coal x 10^6 tonnes					
LMR	1.00	2.00	4.00	6.00	Lower Merit Ranking[1]
HMR	3.60	7.20	10.80	14.40	Higher Merit Ranking[1]
0.87 HMR	3.12	6.24	9.36	12.50	a 5% up-lift is included to take account of energy needs for FGD.
Oil tonnes	18,750	37,500	56,250	15,000	
Natural Gas	0	0	0	0	
Annual Ash Production					
PFA tonnes	393,000	786,000	1,179,000	1,571,000	assuming 14% ash content in HMR coal (average)
FBA tonnes	44,000	87,000	131,000	175,000	
Cumulative Ash Production	end of March 2000	end of March 2003	end of March 2007	end of March 2010	
PFA x10^6 tonnes	1.38	3.54	8.06	12.57	
FBA x10^6 tonnes	0.14	0.39	0.9	1.37	
Limestone/Gypsum FGD					
Annual limestone required tonnes per year	140,000	280,000	420,000	560,000	from limestone/gypsum FGD system (disposal grade gypsum)
Annual gypsum produced tonnes per year	156,600	313,200	469,800	626,400	
Cumulative Gypsum Production x 10^6 tonnes	0.39	1.33	2.51	5.40	

Note: These figures may be revised with the Solid By-Product Key Issue Report.

[1] For definition; see Final Site Search Report, p.20, 3.5.2

Table V2/2.2(c)
Scenario II – Fuel Consumption and Solid By-product Generation

Annual Fuel Consumption	98/99	2002	2005/06	2010	Comments
Coal x 10^6 tonnes					
LMR	–	–	1.00	2.00	Lower Merit Ranking
HMR	–	–	3.60	7.20	Higher merit ranking
0.87 HMR	–	–	3.12	6.24	a 5% up lift is included to take account of energy needs for FGD.
Oil tonnes	18,750	37,500	56,250	15,000	
Natural Gas /m^3	1.5 x 10^9	3 x 10^9	3 x 10^9	3 x 10^9	
Annual Ash Production					
PFA tonnes	–	–	393,000	786,000	assuming 14% ash content in coal (average)
FBA tonnes	–	–	44,000	87,000	
Cumulative Ash Production	end of March 2000	end of March 2003	end of March 2007	end of March 2010	assuming 14% ash content (average)
PFA x10^6 tonnes	–	–	1.38	3.54	
FBA x10^6 tonnes	–	–	0.14	0.39	
Limestone/Gypsum FGD					
Annual limestone required tonnes per year	–	–	140,000	280,000	from limestone/gypsum FGD system (disposal grade gypsum)
Annual gypsum produced tonnes per year	–	–	240,000	480,000	
Cumulative gypsum production x 10^6 tonnes	–	–	0.84	2.16	



STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE
1	CONTROL BLOCK	21	COAL PLANT SUBSTATION	41	SEWERAGE TREATMENT WORKS
2	TURBINE HOUSE	22	FUEL OIL PUMP HOUSE	42	HEAVY LOAD BERTH
3	AUXILIARIES ANNEXE	23	COAL STORE	43	DISTILLATE OIL STORAGE TANKS
4	BUNKER BAY	24	CONVEYOR		([illegible] T EACH)
5	BOILER HOUSE	25	STACKER RECLAIMER / UNLOADER	44	LIMESTONE PLANT CONTROL ROOM
6	PRECIPITATOR	26	C.W. PUMP HOUSE	45	LIMESTONE PLANT MAINTENANCE
7	CHIMNEY	27	COAL PLANT AMENITIES BUILDING		BUILDING
8	ADMINISTRATION BLOCK	28	SEAWALL BERTH	46	GATEHOUSE WEIGH BRIDGE
9	STORE	29	ASH LAGOON	47	BLENDING BUNKERS (4 x 2000T)
10	400kV SUBSTATION	30	SETTLING LAGOON	48	GENERATOR TRANSFORMERS
11	FUEL OIL TANKS	31	TRAINING & INFORMATION BUILDING	49	MOBILE COAL PLANT BUILDING
	(30,000 T EACH)	32	FGD PLANT	50	132 kV SUBSTATION
12	GAS TURBINE UNITS	33	LIMESTONE GRINDING PLANT	51	FGD SCRUBBER PLANT / ASH PLANT
13	DUST SILOS	34	LIMESTONE STORAGE BUILDING		AMENITIES
14	ASHPLANT SUBSTATION	35	GYPSUM DEWATERING PLANT		
15	RECIRCULATED WATER TANK	36	WATER TREATMENT PLANT		
16	TOWNS WATER TANK	37	GYPSUM STORAGE AREA		
17	H_2 GENERATION PLANT HOUSE	38	SEAL WELL		
18	STATION AIR COMPRESSOR HOUSE	39	COAL STORE RUNOFF TREATMENT		
19	FIRE SERVICES PUMP HOUSE		PLANT		
20	WATER TREATMENT PLANT HOUSE	40	ASH BUNKERS		

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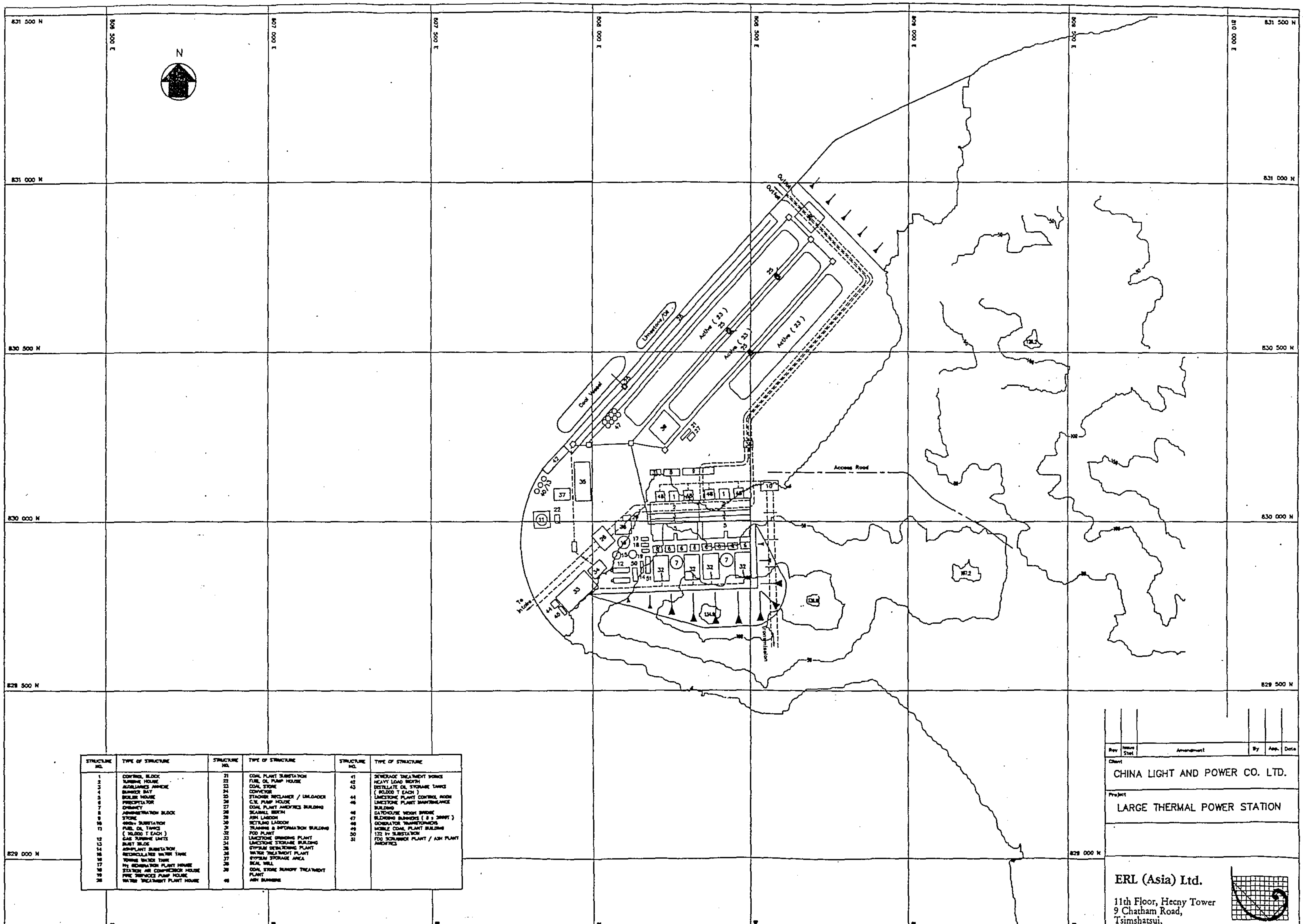
Figure V2/2.2(b) LTPS at Black Point: Scenario I, Phase 2



STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE
1	CONTROL BLOCK	21	COAL PLANT SUBSTATION	41	SEWERAGE TREATMENT WORKS
2	TURBINE HOUSE	22	FUEL OIL PUMP HOUSE	42	HEAVY LOAD BERTH
3	AUXILIARIES ANNEXE	23	COAL STORE	43	DISTILLATE OIL STORAGE TANKS (80,000 T EACH)
4	BUNKER BAY	24	CONVEYOR	44	LIMESTONE PLANT CONTROL ROOM
5	BOILER HOUSE	25	STACKER RECLAIMER / UNLOADER	45	LIMESTONE PLANT MAINTENANCE BUILDING
6	PRECIPITATOR	26	C.W. PUMP HOUSE	46	GATEHOUSE WEIGH BRIDGE
7	CHIMNEY	27	COAL PLANT AMENITIES BUILDING	47	BLENDING BUNKERS (8 x 2000T)
8	ADMINISTRATION BLOCK	28	SEAWALL BERTH	48	GENERATOR TRANSFORMERS
9	STORE	29	ASH LAGOON	49	MOBILE COAL PLANT BUILDING
10	400kv SUBSTATION	30	SETTLING LAGOON	50	132 kv SUBSTATION
11	FUEL OIL TANKS (30,000 T EACH)	31	TRAINING & INFORMATION BUILDING	51	FGD SCRUBBER PLANT / ASH PLANT AMENITIES
12	GAS TURBINE UNITS	32	FGD PLANT		
13	DUST SILOS	33	LIMESTONE GRINDING PLANT		
14	ASH PLANT SUBSTATION	34	LIMESTONE STORAGE BUILDING		
15	RECIRCULATED WATER TANK	35	GYPSUM DEWATERING PLANT		
16	TOWNS WATER TANK	36	WATER TREATMENT PLANT		
17	H_2 GENERATION PLANT HOUSE	37	GYPSUM STORAGE AREA		
18	STATION AIR COMPRESSOR HOUSE	38	SEAL WELL		
19	FIRE SERVICES PUMP HOUSE	39	COAL STORE RUNOFF TREATMENT PLANT		
20	WATER TREATMENT PLANT HOUSE	40	ASH BUNKERS		

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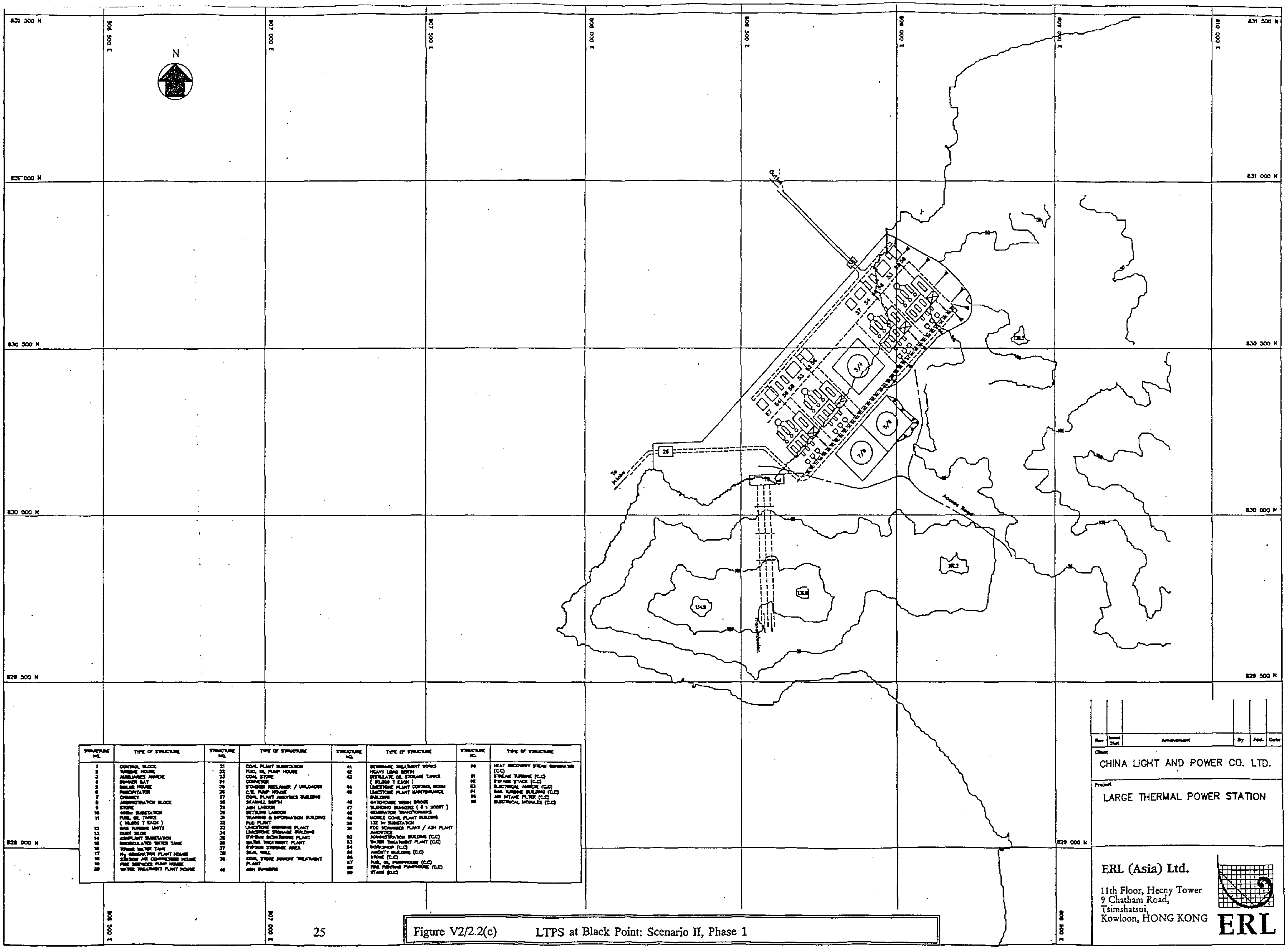
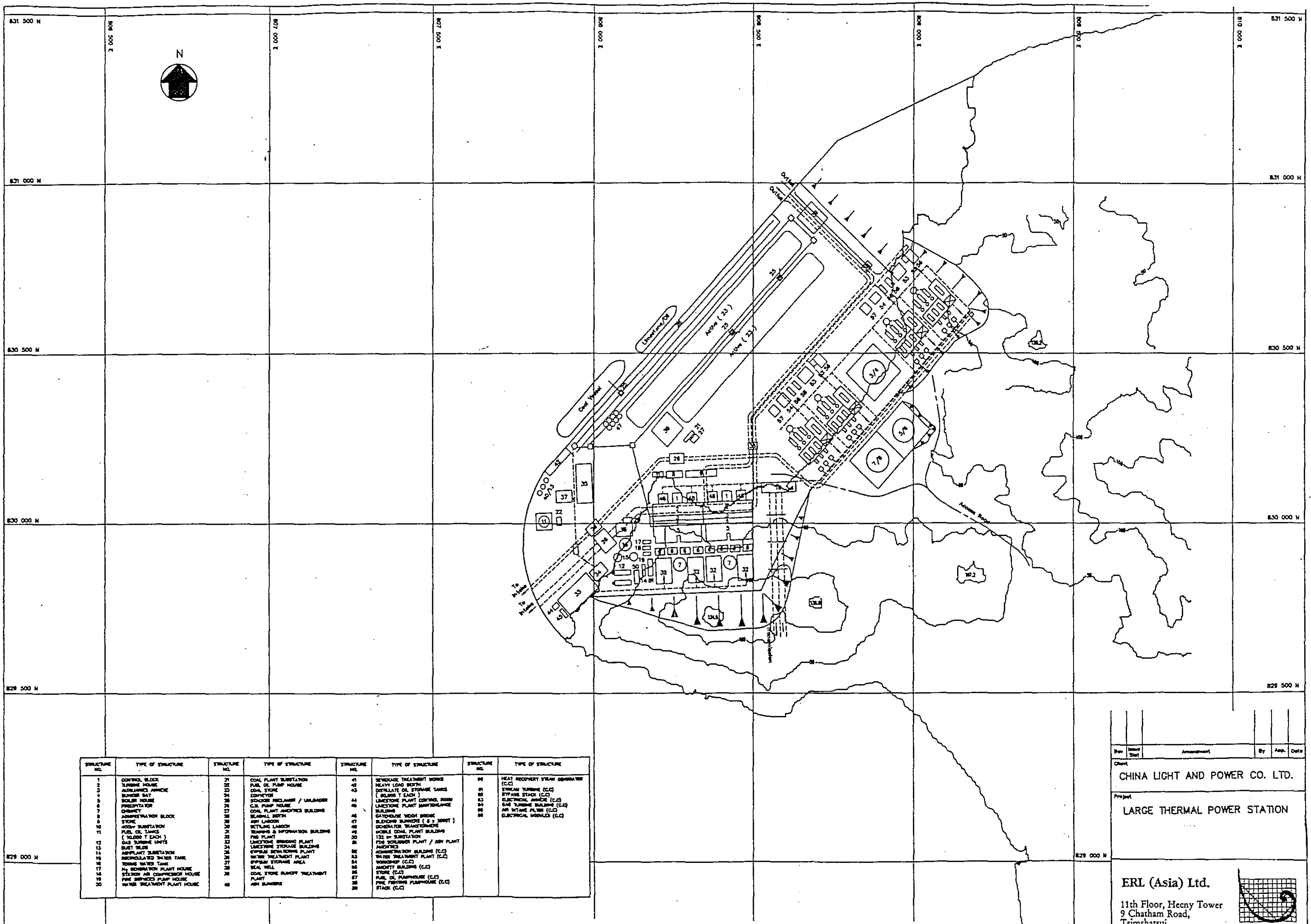
Figure V2/2.2(a) LTPS at Black Point: Scenario I, Phase 1



STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE
1	CONTROL BLOCK	21	COAL PLANT SUBSTATION	41	SEWAGE TREATMENT WORKS	90	HEAT RECOVERY STEAM GENERATOR (C.C)
2	TURBINE HOUSE	22	FUEL OIL PUMP HOUSE	42	HEAVY LOAD BERTH	91	STEAM TURBINE (C.C)
3	AUXILIARIES ANNEXE	23	COAL STORE	43	DISTILLATE OIL STORAGE TANKS (10,000 T EACH)	92	BYPASS STACK (C.C)
4	BUNKER BAY	24	CONVEYOR	44	LIMESTONE PLANT CONTROL ROOM	93	ELECTRICAL ANNEXE (C.C)
5	BOILER HOUSE	25	STACKER RECLAIMER / UNLOADER	45	LIMESTONE PLANT MAINTENANCE BUILDING	94	GAS TURBINE BUILDING (C.C)
6	PRECIPITATOR	26	C.W. PUMP HOUSE	46	GATEHOUSE WEIGH BRIDGE	95	AIR INTAKE FILTER (C.C)
7	CHIMNEY	27	COAL PLANT AMENITIES BUILDING	47	BLENDING BUNKERS (8 x 200T)	96	ELECTRICAL MODULES (C.C)
8	ADMINISTRATION BLOCK	28	SEAWALL BERTH	48	GENERATOR TRANSFORMERS		
9	STORE	29	ASH LAGOON	49	MOBILE COAL PLANT BUILDING		
10	400kV SUBSTATION	30	SETTLING LAGOON	50	132 kV SUBSTATION		
11	FUEL OIL TANKS (10,000 T EACH)	31	TRAINING & INFORMATION BUILDING	51	FGD SCRUBBER PLANT / ASH PLANT AMENITIES		
12	GAS TURBINE UNITS	32	FGD PLANT	52	ADMINISTRATION BUILDING (C.C)		
13	DUST SILOS	33	LIMESTONE GRINDING PLANT	53	WATER TREATMENT PLANT (C.C)		
14	ASHPLANT SUBSTATION	34	LIMESTONE STORAGE BUILDING	54	WORKSHOP (C.C)		
15	RECIRCULATED WATER TANK	35	GYPSUM DEWATERING PLANT	55	AMENITY BUILDING (C.C)		
16	TOWNS WATER TANK	36	WATER TREATMENT PLANT	56	STORE (C.C)		
17	H_2 GENERATION PLANT HOUSE	37	GYPSUM STORAGE AREA	57	FUEL OIL PUMPHOUSE (C.C)		
18	STATION AIR COMPRESSOR HOUSE	38	SEAL WELL	58	FIRE FIGHTING PUMPHOUSE (C.C)		
19	FIRE SERVICES PUMP HOUSE	39	COAL STORE RUNOFF TREATMENT PLANT	59	STACK (C.C)		
20	WATER TREATMENT PLANT HOUSE	40	ASH BUNKERS				

Figure V2/2.2(c) LTPS at Black Point: Scenario II, Phase 1



STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE	STRUCTURE NO.	TYPE OF STRUCTURE
1	CONTROL BLOCK	21	COAL PLANT SUBSTATION	41	SEWAGE TREATMENT WORKS	60	HEAT RECOVERY STEAM GENERATOR (C.C)
2	TURBINE HOUSE	22	FUEL OIL PUMP HOUSE	42	HEAVY LOAD BERTH	61	STEAM TURBINE (C.C)
3	AUXILIARIES ANNEXE	23	COAL STORE	43	DISTILLATE OIL STORAGE TANKS (80,000 T EACH)	62	BYPASS STACK (C.C)
4	BUNKER BAY	24	CONVEYOR	44	LIMESTONE PLANT CONTROL ROOM	63	ELECTRICAL ANNEXE (C.C)
5	BOILER HOUSE	25	STACKER RECLAIMER / UNLOADER	45	LIMESTONE PLANT MAINTENANCE BUILDING	64	GAS TURBINE BUILDING (C.C)
6	PRECIPITATOR	26	C.S. PUMP HOUSE	46	GATEHOUSE WEIGH BRIDGE	65	AIR INTAKE FILTER (C.C)
7	CHIMNEY	27	COAL PLANT AMENITIES BUILDING	47	BLENDING BUNKERS (8 x 3000T)	66	ELECTRICAL MODULES (C.C)
8	ADMINISTRATION BLOCK	28	SEAWALL BERTH	48	GENERATOR TRANSFORMERS		
9	STORE	29	ASH LAGOON	49	MOBILE COAL PLANT BUILDING		
10	400kV SUBSTATION	30	SETTLING LAGOON	50	132 kV SUBSTATION		
11	FUEL OIL TANKS (10,000 T EACH)	31	TRAINING & INFORMATION BUILDING	51	FGD SCRUBBER PLANT / ASH PLANT AMENITIES		
12	GAS TURBINE UNITS	32	FGD PLANT	52	ADMINISTRATION BUILDING (C.C)		
13	DUST SILOS	33	LIMESTONE GRINDING PLANT	53	WATER TREATMENT PLANT (C.C)		
14	ASHPLANT SUBSTATION	34	LIMESTONE STORAGE BUILDING	54	WORKSHOP (C.C)		
15	RECIRCULATED WATER TANK	35	GYPSUM DEWATERING PLANT	55	AMENITY BUILDING (C.C)		
16	TOWNS WATER TANK	36	WATER TREATMENT PLANT	56	STORE (C.C)		
17	H_2 GENERATION PLANT HOUSE	37	GYPSUM STORAGE AREA	57	FUEL OIL PUMPHOUSE (C.C)		
18	STATION AIR COMPRESSOR HOUSE	38	SEAL WELL	58	FIRE FIGHTING PUMPHOUSE (C.C)		
19	FIRE SERVICES PUMP HOUSE	39	COAL STORE RUNOFF TREATMENT PLANT	59	STACK (C.C)		
20	WATER TREATMENT PLANT HOUSE	40	ASH BUNKERS				

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Figure V2/2.2(d) LTPS at Black Point: Scenario II, Phase 2

2.3.1 Site Formation

This involves excavation of soil and rock from the land based section of the site and formation of the reclamation and seawall.

- **Site Excavation**

  An attempt has been made to balance the cut volume with the fill requirement for the reclamation. Cut and fill volumes are detailed in Section V2/3.1 together with the area located on rock. This area is predominantly reserved for the power blocks which have strict settlement criteria.

  Material generated by the cutting will be available for filling operations. A 15% bulking factor has been included in estimating the quantity of material available for fill. Any excess fill generated for the reclamation may be either stored in an area adjacent to the reclamation or sold in the market place; however no account has been taken at this stage of the market potential for the sale of this excess fill. Since construction work on the power station occurs at a time of peak demand for fill, this could be seen as contributing to the Territory's available fill resources.

  Site formation will require the creation of significant backslopes. These slopes will require protection from the elements; typically this is done by a combination of sprayed concrete, rock bolting, grassing and planting. Run off and groundwater from these backslopes and the catchment area external to the site will require drainage to accommodate the natural water flow and prevent flooding. Provision must be made to accommodate flow from the valley between Black Point and the firing range as the natural path of this run off will be obstructed by the development.

  Similarly, provision must be made for diverting or protecting the route of the existing ash pipeline from Castle Peak to Tsang Tsui as this at present runs across the proposed development.

- **Site formation**; essentially consists of the following activities:

  - dredging a trench for the perimeter seawall of the reclaimed area and dredging within the area to be reclaimed if required, and subsequent disposal of the dredged material;

  - levelling of the land-based part of the site to about +7mPD and the generation of fill material;

  - construction of the seawall;

  - filling inside the seawall to create the reclamation, using fill material generated by site levelling wherever possible.

  It is considered uneconomic and unnecessary to remove the marine mud internally to the seawall to the same depth as beneath the seawall. Existing borehole information indicates that there may be up to 15m of marine mud in certain locations within the site perimeter. Experience gained from trial embankments at Chek Lap Kok indicates that if a layer of marine mud of about 10m is left and drained with proprietary vertical drains to a capping layer above, approximately 90% of the expected consolidation will occur within the first year. With careful programming and controlled filling operations, the construction of the foundations for those buildings which are located on the reclaimed area (the ancillary buildings) need not commence until the majority of this consolidation has taken place. Therefore it is assumed that only marine mud above a thickness of 10m will be removed from the area within the seawall boundary.

The seawall around the reclamation will have considerable weight of its own in addition to the lateral forces acting on it from the retained material. For this reason, it is necessary to found the seawall on strata with a higher bearing capacity than that of typical marine mud. The marine mud will therefore be dredged along the line of the seawall down to the underlying alluvium or sand.

2.3.2 Berthing Facilities

The timing of berth construction is contingent upon which development Scenario is adopted. The main difference is that with Scenario II, Phase 1 will not require a large berth for coal vessels. Gas for the combined cycle units would be supplied by a pipeline probably from Lung Kwu Chau where an isolating valve station would be constructed.

However for Scenario I a berth will be required for Phase 1 with a depth requirement of 20 metres. (During Phase 2 of Scenario II a berth will be constructed similar to that provided in Phase 1 of Scenario I). The berth would be extended for a further 180,000 dwt vessel when needed. It is also possible that a conveyor will be provided from Castle Peak to transport coal.

Irrespective of which Scenario is developed and prior to construction of any permanent berth for the carriers, a shallow berth would be established to allow access to the site for plant and materials.

Berthing facilities will be provided by either a seawall or jetty :-

- **Seawall berth**

  The conventional seawall provided for the reclamation must be modified for a seawall berth to form a vertical face instead of the conventional 1 in 3 slope of a perimeter seawall. The vertical face is likely to be formed using pre-cast concrete caissons which must be of sufficient mass and suitably restrained to resist the lateral forces of ships berthing against it, in addition to the forces imposed by the fill material retained behind the wall. Vessel protection from berthing impact is required in the form of an extensive fender system along the length of the seawall berth.

- **Jetty berth**

  In order to provide a berthing structure at some distance from the site a finger jetty would be built out from the perimeter seawall to deeper water. This would terminate in a jetty head against which the ships will berth. It is likely that the entire structure would be open piled and similar to that at the CPPS or formed from caissons in the same manner as a seawall berth. The jetty approach would be an open piled trestle structure with a reinforced concrete desk.

The general principle adopted is to align the berthing face parallel to the predominant current regime, in so far as this is indicated by marine contours and existing flow information.
At each of the berth locations a certain amount of dredging would be required for the carriers to gain access. For coal carriers a turning circle of 600m diameter near the berth and a

channel width of up to 300m on the approach has been assumed as a typical requirement; this is likely to be sufficient for a carrier in the 180,000 dwt class. These are not intended as design criteria but are representative of typical dimensions. In the course of the detailed design, account will need to be taken of the marine environment prevailing along the channel length and in the manoeuvreing area.

Appropriate design and loading criteria will be taken into account if large vessels are to remain alongside the berths during typhoons.

2.3.3 Road Access

Road access has been identified from the WENT southern access road to the eastern edge of the site. Road construction will immediately precede site formation, and be by conventional construction methods. It is not anticipated that the WENT access road to the temporary unloading jetty will be used as a main access for the LTPS.

The alignment of this road is shown in Figures V2/2.2(a–d).

2.3.4 Foundation Construction

The depth of weathering of the rock on the site has been estimated from existing geological information as 20m. Those buildings on unweathered rock will have shallow concrete foundations and those on weathered rock or on the reclaimed area may have piled foundations. Foundation construction will be carried out by conventional construction techniques. The time required to construct the building foundations is on the critical path for meeting the programme for commissioning of the first two units.

2.3.5 Cooling Water System

The cooling water (CW) system will have a capacity of approximately 15 million m^3/day. The system comprises an intake structure, requiring a water depth of at least 10–15m, leading to the CW pumphouse, from where the water is pumped to the main power block.

During operation of the power station, the cooling water will flow through the condensers in the turbine hall via a system of underground culverts; these culverts must be established during the early stages of site construction. The CW system terminates at the marine outfall, for which typically a minimum water depth of 5m is required.

The correct location of the CW intake and outfall is critical to the operation of the power station and for minimising the environmental impacts of the cooling water discharge. The system should be designed to minimise recirculation of the discharged water to the intake and to avoid situations where high levels of suspended solids in the intake water could lead to problems of deposition in the condensers. Similarly any effects on the CPPS must be assessed. Preliminary locations of the CW intake and outfall have been defined based on what is currently known of the local current regime and are shown on Figures V2/2.2(a–d). Detailed assessment and optimisation will be carried out in the preliminary design stage.

2.3.6 Erection of Structures on Site

Once construction of the foundations for the buildings and other structures on site has progressed sufficiently, erection of the structural framework for the buildings can begin. Erection may then proceed progressively as the foundations are completed. The frames for the main building housing the power blocks, and for most of the ancillary buildings are likely to be of structural steelwork. Some of the smaller ancillary buildings may have a structural frame of reinforced concrete rather than steel.

Structural steelwork will be clad generally in profiled metal roof and wall sheeting, the treatment of which will be designed to minimise the visual intrusion of the LTPS. In most cases buildings with a reinforced concrete frame will be clad in brickwork, or concrete blockwork, and then rendered or tiled.

As the buildings are erected, installation of the LTPS plant and equipment will also commence. Some large items of equipment will be installed before the cladding is added to the building framework. Items of plant will generally arrive in pre-fabricated units to minimise the amount of assembly required on-site.

2.3.7 Chimneys

There will be two distinct types of chimney to be constructed for each Scenario. The chimneys associated with gas turbines both in open and closed cycle with be of steel. Due to the increase in temperature and lower levels of pollutants in flue gases associated with gas-firing, the heights of these chimneys are far less (60 - 80m) than for the coal-fired system.

For the conventional coal-fired units it is likely that the chimney height will be of the order of 250m. These generally comprise a reinforced concrete windshield enclosing the flues which carry the flue gases.

2.3.8 Ash Storage Facilities

The LTPS site is adjacent to the Tsang Tsui ash lagoons which currently serve CPPS. Depending on the extent to which alternative means of ash marketing are permitted, and their success, additional lagoon capacity may have to be provided to serve both power stations. The lifetime of the existing lagoon, and timing and size of any additional facilities would thus depend very much on Government's future strategy for utilisation of PFA in construction materials and the active promotion of its use in reclamations.

2.4 Evolution of LTPS Site Location and Layout

2.4.1 Introduction

With Government endorsement of the location of CLPs LTPS (LDPC 7th December 1990) at Black Point, the focus of the study shifted towards definition of a precise location and layout. In order to do this, a number of constraints which had been considered during the Site Search Study were applied in a more specific manner to the Black Point area. The section that follows indicates the various options that were considered and the criteria that were used to differentiate between them.

In order to explore the various site location and layout criteria meetings were held involving CLP and their consultants for the LTPS design. The participants and their areas of responsibility in the project development were as follows:

–	CLP	:	Operational requirements and plant engineering
–	Mouchel Asia Limited	:	Civil Engineering
–	BMT (Peter Fraenkel)	:	Marine Issues
–	Sandwells	:	Materials Handling
–	Black and Veatch	:	FGD by–products and fly ash disposal
–	RMJM	:	Architectural treatments and landscaping
and	ERL (Asia) Ltd	:	Environmental Issues

2.4.2 Stage 1

Major constraints to site location at Black Point were identified as:

- the need for access to 20m water depth to allow berthing of large coal carriers either by dredging or a long sea jetty;
- the need to avoid the North–West New Territories Sewage outfall, currently under construction to the south of Black Point;
- the requirement for a secure 400 KV supply route;
- compatibility with PADS guidelines;
- land ownership issues;
- the environmental benefits of retaining part of the Black Point ridge.

A number of site locations and layouts were subsequently developed for consideration.

2.4.3 Stage 2

Five preliminary site options emerged. These are depicted in Annex V2/A and Figures V2/A1 to 5. Each site was considered in turn on the basis of engineering, marine, mechanical and electrical, and environmental issues, the findings of which are summarised in Table V2/2.4(a). Site design was complicated by the need to consider two Phases of development and to accept the possibility that the second Phase would not necessarily be developed. Potential conflicts were identified between reclamation phasing and landforms and operational requirements; for example the need to provide a transmission corridor across the Phase 2 area at Phase 1 stage. Suggestions for improvements to each of the sites in these respects were incorporated into the next stage. In addition, a sixth option was developed, intended to incorporate the most suitable features of options 4 and 5.

At this stage key location considerations were the following:

- the compatibility or otherwise of the option with PADS proposals; both for full site development and for Phase 1 only;
- the need to locate the power blocks and stacks on solid rock foundations, which confined them to the Black Point promontory; site options were thus primarily concerned with the location of the coal stockyards;
- the need to minimise dredging costs; both capital and operational and the quantities of marine sediment for disposal;

- concern to minimise the length of any open-piled structure connecting the site with a jetty berth; both to minimise any inconvenience to shipping and to reduce the risk to security of coal supply resulting from impact damage;

- compatibility between Phase 1 and Phase 2 outlines in order to minimise changes in hydraulic flow conditions and facilitate practical jetty location and alignment;

- sensitive receptors to noise and air quality impacts located south of the site would be benefitted by location of the site to the north of the point. Particularly as it was considered unlikely at this time that a residual portion of the Black Point ridge would be available for shielding;

- the need to avoid the sewage outfall and its reserve, for existing and future pipelines;

- the desire to avoid the need for large lengths of seawall to be constructed in deep water.

The six stage 2 options are presented in Figures V2/A6 to 11.

2.4.4 Stage 3

The six options to emerge from stage 2 incorporated suggested modifications as far as was practicable. The subsequent site location meeting considered the results and found that a modified Option 4 presented the best option for development to the north of Black Point and that Option 6 should be considered as a basis for site location to the south of the point.

At this stage it emerged that the issue of seawall berthing and high dredging costs versus long finger jetty berthing and jetty security was one that could be considered almost independently of site options ie. that each of the main options could be modified to take a seawall or a jetty, once financial considerations regarding the costs of dredging and jetty construction and maintenance had been made and the results of hydraulic modelling at Black Point were known. It also became clear that the optimal layouts for development of both the northerly and the southerly options enabled a fringe of the Point to be left in place. This was considered to be of considerable benefit in terms of reducing both noise and visual impact to the residents of Lung Kwu Tan in the event that the site to the north of the point was chosen. The retention of part of Black Point was adopted as a main design aim.

Stage 3 Options 4 and 6 are illustrated in Figures V2/A12 and 13. It was considered that the phasing of these two favoured options could be further refined and that, for option 6 in particular, the layout and development of the coal stockyard could be further developed.

2.4.5 Stage 4

The subsequent editions of Options 4 and 6 were considered by the design group. At this stage it was determined that Option 4 was the most likely to proceed to detailed design. CLP, therefore, instructed ERL to proceed with the IAR assuming that a variation on Option 4, with either a sea wall or a jetty, would be built. It was stressed, however that the IAR should also indicate the environmental impacts that would occur in the event that Option 4 was ruled out and a variant of Option 6, to the south of the point, was adopted.

Also at this stage, two new options were presented. They were Options 7 and 8 (presented in Figures V2/A14 and 15 and were the first to be developed for Scenario II, the gas/coal scenario. Essentially the same site location criteria as used for the coal only sites were applied to these new options. The main differences with the coal only option relating to site features were as follows:

- reduced size of coal stockyards;
- a maximum of two high stacks;
- potentially a much smaller site if Phase 2 were not developed, and one with a much reduced visual aspect due to the absence of high stacks;
- a phased jetty construction.

Of the two gas/coal sites it was considered that option 8, to the north of Black Point, represented the best alternative on environmental grounds (mainly noise and visual issues).

2.4.6 Stage 5

Further refinements were made to site designs located to the north of Black Point, two for Scenario I coal and two for Scenario II and these are illustrated in Figures V2/A16 to 19. Comments suggested that stockyard orientation in option 4D should be rotated to be more in line with the prevailing wind direction. In addition, Mouchel Asia Limited were requested to develop Scenario II with flexibility for either all CCGT or CCGT and coal combined. It was at this stage in site development that CLP's requirement for complete fueling flexibility was introduced. Whilst the EIA process continued with the two scenarios originally defined, actual site design attempted to keep all options open regarding each successive set of units so that, theoretically, any fueling combination of coal and gas for the four pairs of units could be easily achieved within the site boundary. A feature of this was that the first CCGT units, in the event of gas-firing, would be located as far north as possible.

Gazetted areas for the borrow pit boundary and the Island East Transfer Station (IETS) jetty and road access to Western New Territories Landfill (WENT) required consideration. It was understood from discussions with EPD that encroachment onto this area would only be acceptable if alternative access to WENT were provided by CLP. Other considerations included the need to optimise the site level and the cut and fill balance, as well as developing initial cost estimates of the layouts. The intention was to firmly establish an outline reclamation shape which would represent the final development of the various "northern" options, and which could the be used as an input to hydraulic and water quality modelling.

2.4.7 Site Envelope and ongoing refinements

Site development and refinement continued, with the aim of exploring all layout and location possibilities. The prime objective was to fix a site 'envelope' within which complete LTPS development flexibility was possible, without compromising environmental considerations or constraining the construction process or plant operability. Principal considerations at this stage included:

- o the aim of balancing cut and fill at all stages of the development
- o the location of heavy plant on areas of hard rock
- o minimisation of dredging requirements
- o preservation of a significant portion of the Black Point ridge

The resulting layouts, at the time of writing are indicated in Figures V2/2.2(a–d). Fill balancing and appropriate plant foundation have been achieved by polarising the plant locations, such that Black Point itself is reserved for coal units, whilst CCGT units can be developed on the rock to the north of the existing Yung Long beach. This arrangement maintains development flexibility. Seawall alignment is a product of the cut and fill balance and dredging minimisation. A substantial part of Black Point ridge is maintained.

The site refinement process will continue. Of particular concern are the Cooling Water system arrangements. The environmental assessment of this aspect will be addressed in the Water Quality Key Issue Report.

2.4.8 Summary

The preference for development of a site to the north of Black Point inevitably involves a trade–off between different types of environmental impact. The key environmental factors considered in this trade–off, and reasons for the choice of the northern option can be summarised as follows:

- noise impacts to the village of Lung Kwu Tan, during both construction and operation will be lower due to:
  - maximising the distance between site activities and the village;
  - shielding obtained by retention of a substantial part of the Black Point ridge.
- visual impacts will be reduced as follows:
  - stockyards will not be visible from Lung Kwu Tan;
  - jetties, if used, will be less conspicuous;
  - retention of the southern fringe of Black Point will act as a substantial screen. Although some of the development (tops of boiler houses, stacks) will still be visible, visual intrusion will be minimised.
- Flow characteristics are unlikely to be greatly modified around Black Point (a major operational design requirement).
- There is no indication that siltation rates in the bays to the south of Black Point would be increased in the long–term.
- Avoids conflicts with the PADS boundaries for other developments.
- Visual and recreational amenity beach at Yung Long is lost.
- Archaeological site at Yung Long affected, although organisation of an investigation and excavation programme should be acceptable mitigation.
- Two beaches to the south of Black Point (Lung Kwu Tan) and Lung Kwu Sheung Tan, the only known breeding sites of the giant King Crab (Tachypleus gigas) in Hong Kong should remain unaffected, providing a suitable cooling water outfall location is achieved.

3. CONSTRUCTION ACTIVITIES

3.1 Programme

The construction programme, as currently proposed, is shown in Figure V2/2.1(a). Clearly, this may vary as the construction programme evolves.

3.2 Site Formation

Site formation for the LTPS is scheduled to start at the end of 1991 for the all coal-fired Scenario (I) and at the beginning of 1993 for the gas/coal fired Scenario (II). This will comprise the levelling of the land based section of Phase 1 to about +7mPD. This will generate sufficient fill material to reclaim the marine section of the site. The marine section is estimated to be covered by, on average, 10–15m of very soft marine mud. In order to provide sufficient bearing capacity and to satisfy settlement criteria it is necessary to either remove this mud or ensure its rapid containment and consolidation. Due to the large quantities of marine mud involved and the shortage of dumping site capacity in Hong Kong, it is considered practicable to leave a layer of 10m maximum thickness within the reclaimed area and induce its consolidation with the use of a vertical drainage system. In addition to this the reclaimed area will require containment with the construction of a sea wall. This sea wall will require founding on the alluvial deposits beneath the marine mud and consequently the mud beneath the seawall line will have to be removed. Methods for the clearance of existing vegetation, should be submitted to EPD for approval prior to work commencing.

3.2.1 Excavation (landside)

The Black Point peninsular comprises predominantly Cheung Chau granite overlain by up to 4 metres of very dense silty sand. Cheung Chau granite is a medium grained granite and the depth of weathering is estimated to be up to 20 metres. It is possible to excavate weathered rock by machine but unweathered or slightly weathered rock will require blasting.

The general method of excavation of the area will commence with the mobilisation of plant and development of haul routes. There will be a layer of topsoil over the site which will be removed prior to the removal of the dense sand which overlays the granite. It is likely that the top soil will be removed from site and sold. The dense sand, however, will either be stored at a borrow area or transferred direct to barges for use in the reclamation. This will depend on the relative timing of the seawall construction and vertical drain installation in the marine mud.

The removal of both top soil and dense sand will be carried out using tracked excavators and rippers, and large wheeled loaders will load off-road trucks for movement of the material.

Excavation of the underlying granite will require blasting. The method employed for blasting will be to develop at least two blast faces which will be typically 400m long with a bench height of about 15m. Rock drills will be employed to provide locations for the explosive. The material grade size required (and consequent hole/explosive spacing) will be approximately 1000mm down (careful control of this is required so as not to create problems with piling at a later date). With an average production of 30,000m^3 per day and an average powder factor of 0.46 kg/m^3 the required explosive consumption will be of the order of 15 tonnes. It is likely that 24 hour shifts will be employed with the drilling and blasting occuring in the early morning and material loading/removal occuring in the afternoon/night. Whilst lowering the general level of the site, backslope stability and benching will be of primary importance. For the locations and orientations of these backslopes refer to Figure V2/2.2(a) to (d). For the description and number of plant items required for the excavation activity refer to Annex 2D, item 1.

3.2.2 Reclamation

The haul routes will lead to an area which will be used for the loading of the excavated material onto barges for use in the reclamation. It is possible that a large amount of backfilling will be required using barges due to the necessity for filling in a controlled manner in order not to damage the vertical drainage system, either by punching into the marine mud or by creating a mud wave. In order to create the conditions conducive for the efficient operation of the drains a layer of granular material (up to 1.5m thick) should be lain over the top surface of the marine mud. If this granular material is not available on site it may be necessary to import it, although there are proven marine deposits in the local area and it is not anticipated that any long haul distances will be required. After the laying of this granular material, reclamation using the excavated rock may start. The fill level will be brought up in layers of controlled thickness, using bottom dumping barges wherever possible. This will help maintain a uniform overburden pressure on the marine mud. Once the water depth becomes insufficient for this operation, the use of end dumping directly from the haul trucks will be employed, together with dozers for the fill dispersion. For the description and number of plant items used for this activity refer to Annex 2D, item 1.

3.2.3 Construction of the Seawall

For both Scenarios the method of construction of the seawall will be the same. The wall will run from the tip of Black Point, in a curve round to the Tsang Tsui ash lagoons, a length of some 3 km (see Figure V2/2.2(a)). The difference between the two Scenarios will lie with the amount of land reclaimed during each phase. Its conceptual design has been based on that at the CPPS. Excavated rock will be used both for the core and for the external armour which provides sea protection. The seawall typically has an internal filter layer to prevent migration of fill through the outer covering of rock. The berth section of the seawall will require a vertical face and it is likely to be constructed of concrete caissons filled with excavated material.

3.2.4 Internal Filling to Reclamation

For each site the quantity of material required for the internal filling operation has been estimated from the available bathymetric information. An allowance has been made for settlement, since the fill will be placed on the compressible marine mud.

3.2.5 Scenario I Site Formation Details

- **Phase 1**

  With Scenario I the rock excavation for the first four coal units will result in excavation of some 7.75 Mm^3 of rock providing approximately 13.5 ha of rock based land. The fill generated will be used to reclaim a further 68 ha of land. The seawall required to contain this reclamation will be approximately 3km long and will be sufficient for both phases. It is anticipated that this activity will take at least 14 months of intense quarrying, dredging and filling activity.

o **Phase 2**

Due to the lower terrain in the vicinity of the second four coal units the excavation will result in some 6 Mm^3 of rock providing approximately 15 ha of land based site area. It is not anticipated that all of this land will provide a rock base for the foundations due to its location in the Yung Long Valley. The excavated material will be used to form a further 24 ha of land, leaving a requirement for 3 Mm^3 of fill to the north east of the phase I reclamation[1]. PFA may be used for this purpose. It is anticipated that this activity will take some 8 months to complete.

3.2.6 Scenario II Site Formation Details

o **Phase 1**

The excavation for the four combined cycle units for phase 1 of Scenario II will produce some 2 Mm^3 of material and result in approximately 8 ha of land. Again due to the location it is not anticipated that all of this area will provide a rock base for foundations due to the location. The resulting material will provide sufficient material for the reclamation of a further 16 Ha of land requiring 1.75 million m^3 of fill and a containment wall some 900m long[1]. It is anticipated that this activity will take approximately 8 months.

o **Phase 2**

Phase 2 of Scenario II comprises essentially the same as Phase 1 of scenario I. The excavation will produce some 7.75 Mm^3 of rock and 13 ha of land which will be used to create a further 50 ha of land requiring approximately 7 Mm^3 of fill and 3 km of seawall[1]. This reclamation will surround Phase 1 reclamation. It is thus important to note that no large berthing facilities will be provided in the Phase 1 development. It is thus necessary that all fuel (gas + oil) will have to be piped to site. As with Phase 1 of Scenario I it is anticipated that this activity will take some 14 months of intense activity.

3.3 Construction of Berthing Facilities

It has not been possible at the time of writing, to determine the form of construction of the berth. The final decision of berth form will be based on, but not limited to, the following considerations:-

- Proximity of deep water;
- Quantity of capital/maintenance dredging;
- Relative capital/maintenance costs of each structure;
- Ease of vessel berthing in all tidal conditions;
- Risk to other shipping;
- Security of structure;
- Long term effect of structure on local bathymetry/coastline;

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1 Due to the site topography, the volumes quoted are very sensitive to the precise location of the LTPS.

3.3.1 Seawall Berth Construction

The most likely method of construction of a seawall berth would be to use concrete caissons. These could be constructed adjacent to or remote from the site and then floated into position. Once located these hollow caissons would be flooded and filled with a suitable fill material.

3.3.2 Jetty Construction

The jetty berth may also be formed using concrete caissons, or as an open structure. The most likely method of construction for an open structure be with the use of floating cranes installing circular steel piles. The piles are likely to be both vertical and raking piles. These piles would be connected by a reinforced concrete deck slab which would form the working surface.

3.3.3 Scenario I

- Main Berth :

  Facility will be provided for carriers of 30,000 dwt and over.

  For the final development sufficient berthing length for two 200,000 dwt coal carriers (approximately 295m long) and one 30,000 dwt limestone carrier. Oil tankers will share the same frontage, resulting in an overall berthing length of around 950m.

  The time required to construct a jetty sufficient for Phase 1 of this Scenario would be some 36 months, with a reduced period of 12 months to extend for Phase 2. These durations relate to a single side berthing jetty. The time required for construction of a seawall berth would be incorporated into the site formation period. The time period would have to be increased to allow for this activity, however, it is not anticipated that subsequent activities on the critical path would be delayed.

- Heavy Load Berth :

  A facility will be provided for barges up to 2000 Tonnes. It is desirable to have a quay wall berth with a flat bed to enable the barges to ground and lie level at low tide to allow the load to be rolled on/rolled off. The berth length should be approximately 100m.

3.3.4 Scenario II

- Main Berth :

  Again facility will be provided for carriers of 30,000 dwt and over. However it will be necessary to berth these vessels only for Phase 2.

  No berth construction is required for Phase 1 but should a jetty be constructed in Phase 2 this is likely to take 36 months. Seawall construction for Phase 2 would be the same as for Scenario I.

- Heavy load berth :

  The requirements here are as for Scenario I.

Due to the hazards and comparably few benefits for a jetty in this location it is likely that the seawall (single side berth) option will be adopted. However at this stage of the development both options are still being considered.

3.3.5 Access Dredging

It is likely that dredging for access to the berth will be required for both jetty and seawall berth options. For the seawall berth option the quantity of both capital and maintenance dredging will be far higher than for a jetty. The method of dredging will be to use cutter/suction type dredgers with the capital dredging occuring in sufficient time for the berth to become operational for "steam to set" of Unit 1.

3.4 Foundation Construction

The foundations for each of the scenarios will depend on the ground conditions encountered in the specific area. Two general alternatives have been identified, these being shallow foundations and piling. Although these will probably not be the only type of foundations constructed on site they best demonstrate the fundamental differences between foundations on rock and foundations on soft ground.

Shallow foundations will comprise blocks of, generally reinforced, concrete. These support both the structure and very large items of plant. It is likely that at least one batching plant will be set up on site to satisfy the high demand for concrete at the peak of construction. It is also likely that a crushing plant will be employed on site to provide aggregate for the concrete.

Piled foundations comprise many different types, from hand dug caissons through steel cased piles to cast in-situ displacement piles. If the ground conditions are poor then it is likely that steel cased piles will be used. In better ground it is likely that the hand dug caisson method will be employed. Clusters of piles are usually connected by `pile caps' which in turn support the loads from the superstructure.

In addition to piled foundations on reclaimed land areas, raft foundations for lightly loaded Ancillary Plant buildings and structures may also be used.

For both Scenarios and in both Phases there will be differing percentages of shallow and piled foundations. However, the foundations associated with the combined cycle units will be less complicated than for those of coal fired units. For both Scenarios an overlap of two months has been allowed for between site formation and foundation construction for both Phases. This activity is on the critical path as the erection of steelwork for the support of plant within the power blocks is dependant on its ordered completion. Annex 2D, item 2 details the plant involved in this activity.

3.4.1 Scenario I

It is estimated that the construction of foundations for all buildings for the first two coal units in Phase 1 will take approximately 18 months. However, it is the foundations for the main power block and boiler house which are on the critical path. Consequently it is these foundations that will be started and completed first. Subsequently the ancillary building foundations will be completed in order to allow sufficient ancillary plant to be operational in time for certain key dates in the commissioning of the LTPS.

The period of time allowed for the construction of the foundations for the second two coal units has been increased to 24 months due to the fact that the location of these foundations is on ground of lower quality. The consequent piling operations will be more time consuming than shallow foundations construction.

A similar time span for the two sets of two coal units has been allowed within Phase 2 of the development.

3.4.2 Scenario II

As has been previously indicated the foundations associated with the combined cycle units are less complicated than those associated with the coal units. Consequently a reduced duration of 16 months has been allowed for the first two combined cycle units of Phase 1 of this scenario. The foundations associated with the second two units have been allocated the same time duration. The location of all combined cycle units is such that it is anticipated that a higher percentage of piling will be required than for the first four units of Scenario I. This is mainly a consequence of firstly attempting to balance the cut and fill for the phases and secondly the reduced land take for combined cycle units. This results in the need to commence site operations from the northern end of the site for Phase 1 of Scenario II as opposed to from the southern end of the site for Phase 1 of Scenario I.

The durations for construction of foundations for the coal fired units (Phase 2) are consistent with those of Phase 1 of Scenario I and will be almost identical in content

3.5 Structural Steelwork

Generally the structural steelwork will be delivered to site prefabricated, painted and ready for erection.

It is considered that the tonnage of steelwork required to be erected is almost identical for both phases of both Scenarios except for the combined cycle units. Erection of the steelwork will use a relatively narrow assortment of plant. Essentially heavy and light duty cranes will be used quite often in tandem.

3.5.1 Scenario I

It is anticipated that a period of up to 24 months will be required to erect the structural steelwork required for each pair of units. As with the foundations, it is the main power block and boiler house steelwork which lie on the critical path, since rapid erection of this steelwork will allow early plant access.

It is anticipated that steelwork erection can begin approximately 10 months after the start of foundation construction.

(The steelwork required for coal handling facilities has been excluded from these quantities and durations.)

3.5.2 Scenario II

The quantity of steelwork required for the combined cycle units and their ancillary structures is significantly reduced from that required for coal units, resulting in a reduced steelwork erection duration of 16 months for each pair of the four combined cycle units in Phase 1. Commencement of steelwork erection for this phase follows the commencement of foundation construction by 10 months.

Phase 2 durations and commencement dates are identical to Phase 2 of Scenario I.

(The steelwork required for coal handling facilities has been excluded from these quantities and durations.)

3.6 Superstructure/Site Services

The superstructure refers to all other civil related items required for the completion of the structures. This will include cladding (both profiled sheeting and brickwork), external and internal finishes (doors, windows, floors etc.), above ground drainage, roads, hardstanding, fences, etc.

Site Services includes all the pipework and cabling associated with foul water, surface water, and contaminated water.

3.6.1 Scenario I

It is anticipated that the work associated with the superstructure and site services for one pair of coal fired units will take 26 months overall. Commencement of superstructure works is dependant on the status of structural steelwork erection. It is anticipated that approximately six months after the start of steelwork erection there will be sufficient areas to commence superstructure work. Site services will commence as and when external areas become available

3.6.2 Scenario II

A smaller amount of superstructure and site services work is required for the combined cycle units. It is anticipated that 20 months will be sufficient to complete the superstructure and site services associated with one pair of units. It is considered that approximately 4 months after structural steelwork erection begins, there will be sufficient area for superstructure work to begin.

Phase 2 durations and commencement dates are identical to Phase 2 of Scenario I.

3.7 Chimneys

As has been previously stated in Section V2/2.3.7 the chimneys associated with combined cycle units are fundamentally different to those associated with coal fired units. Items 4 of Annex V2/D indicate the materials and plant involved.

3.7.1 Scenario I

It is considered that two 250m high reinforced concrete windshields each housing two flues will be sufficient for each phase of Scenario I. These chimneys each comprise approximately 26,000m^3 of concrete, including foundations, and take approximately 15 months to construct including the internal steel flues. Construction normally commences early in the site programme so that free access can be afforded to the boiler backyard area.

3.7.2 Scenario II

It is assumed that each unit of 600MW (nominal) will comprise 2 gas turbines and 1 steam turbine. This is defined as the combined cycle power trains. The gas turbines will be run in combined cycle with the gases from each of the gas turbines being diverted to its own waste heat recovery boilers.

The height of these combined cycle chimneys is likely to be about 80m. The steam created from these waste heat recovery boilers will feed the steam turbine in each 600MW (nominal) power train.

Phase II : As with phase II of Scenario I it is assumed there will be two 250m high chimneys serving the 4 x 680 MW (nominal) units in Phase 2.

The chimneys serving the gas turbines in open cycle, the blast stacks and the boiler mounted combined cycle stacks will be of steel construction and the chimneys serving the coal fired units will be of reinforced concrete as those serving Scenario I units.

This results in a maximum of :-

8 x 80m steel chimneys (c/c)
2 x 250m concrete chimneys (coal)

As the chimneys associated with the combined cycle are essentally integral with the plant no activity is indicated for Phase 1.

Phase 2 duration and commencement date is again identical with Phase 2 of Scenario I.

3.8 Cooling Water Intake and Outfall Construction

The location of the cooling water system is fundamental to the efficient development of the power station. In positioning the culverts, intake and outfall structures consideration will be paid to recirculation of cooling water (CW), discharge effects on environment and adjacent industries (e.g. Castle Peak Power Stations), phased construction of the station and security of the structural components.

As may be seen from Figures V2/2.2(a) to (d) the provisional locations of the intake and outfall structures are the same for both phases of both scenarios. This will be the subject of detailed mathematical modelling but initial investigations indicate this layout as being a possible configuration. The quantity of water passing through the system will be approximately $23m^3$/sec per 660 MW coal fired set and $8m^3$/sec per 600 MW combined cycle set. No cooling water is required for the gas turbine in open cycle.

3.8.1 Scenario I

One of the main problems associated with the phased construction is that a corridor of land over Phase 1 will have to be sterilised in order to allow the Phase 2 culverts to be constructed at a later date. The alternative to this is to construct the culverts for Phase 2 within the Phase 1 stage. However this would involve a larger amount of pre-investment.

The Phase 1 C.W. system at present comprises an intake structure at western end of Black Point with the C.W. pumphouse located a short distance within the reclamation on good foundation strata. The location of the pumphouse also minimises the length of pressure culverts, which lead from the pumphouse to the turbine hall and thus reduces pumping costs. From the turbine hall pressure culverts will lead to a seal pit located to the north east of the turbine halls. Again the location of the seal pit should be such as to minimise the length of pressure culverts from the turbine halls. The function of the seal pit is to raise the head of water over a weir system sufficient to allow the water to fall through gravity culverts to the outfall location. The outfall is situated at the seawall, which avoids the Phase 2 coal store being located over the culverts. The construction programme for the culverts is within that indicated for the foundations on Figure V2/3.1(a). It is essential that the section of culverts beneath the turbine halls is completed early so as not to affect progress on steelwork erection.

Phase 2 will comprise construction of a second C.W. pumphouse and pressure culverts which are routed across Phase 1. As noted above, this will necessitate sterilising a corridor of land in Phase 1. A second seal pit will be required to the north east of the turbine halls and the gravity culverts will discharge along the same route as Phase 1. It may be necessary to extend the discharge points should the results of the modelling indicate that the environmental effects are significant from the present location.

3.8.2 Scenario II

Phase 1 of Scenario II will have the C.W. pumphouse and intake structure located off the northern point of Black Point resulting in a longer run of pressure culverts. This is due to the location of the combined cycle units relative to the preferred intake location. Phase II intake structure and pumphouse will be located as for Phase 1 of Scenario I and the intake structure for Phase 1 will be extended. Again the outfall locations for both phases will be as for Scenario I. Obviously the main disadvantage is the length of C.W. pressure culverts for Phase 1. However this is unavoidable if the flexibility is to be allowed for providing 4 coal units or 4 combined cycle units within Phase 2.

4. AIR QUALITY

4.1 Introduction

4.1.1 Site Effects

Air quality on and around the LTPS site may be affected by construction activities which will generate particulate and exhaust emissions. Construction for such an extensive project will expose large areas of site which will then be subject to dust generation as a result of particulate suspension by winds.

The isolated nature of the LTPS site will reduce the significance of any dust or exhaust emissions dispersed beyond the site limits. Peak dust and exhaust emission generation is likely to occur during 1992–93 when reclamation and various other civil construction tasks are in hand.

4.1.2 Microclimate

The level of emissions depends upon the way in which the nature and location of emission sources interacts with a number of key elements of the site microclimate; in particular wind direction and speed and atmospheric stability. These, in turn, are influenced by site form, equipment movements and the distortion of wind fields by site structures.

- **Wind direction and speed**: The role of wind direction is clear, but that of wind speed is less obvious. With increasing wind speed, emitted pollutants are mixed to a greater extent with the ambient air, and so diluted more. Wind speed and ground surface turbulence, however, can also increase the rate of dust generated from stockpiles and working surfaces.

- **Atmospheric stability**: Atmospheric stability is an indication of the atmosphere's inherent ability to mix ambient 'clean' air with the polluted air in plumes, in both the vertical and horizontal planes, as the pollutants travel with the wind.

4.1.3 Approach to Assessment

Based on review of the local meteorological conditions, general distances to receptors, and the proposed construction programme, ISC/Short-Term dispersion modelling was conducted to quantify probable levels of "uncontrolled" dust generation and resulting ground level concentrations.

4.2 Potential Sources of Impact

4.2.1 Introduction

During construction, two main forms of pollutants will be generated:

- Gaseous exhaust pollutants (SO_2, NO_x, hydrocarbons, CO) and particulates from mobile and fixed equipment.

- Particulate materials from excavation, material handling, and exposed surfaces.

Major sources of these pollutants will be construction dust generated from earth moving activities during the first phase of the construction in 1992–93. Later construction activities and installation of electrical and mechanical equipment will involve equipment and vehicle operations with attendant exhaust emissions. By this time, however, exposed ground surfaces will have been stablised and be less subject to dust resuspension by wind or traffic.

Exhaust emissions will also be somewhat reduced later in the construction programme since equipment will generally be of smaller power and under lower load factors. During 1994–97, construction air pollution will be primarily from gaseous exhausts from onsite power generation and other continuously operating diesel sources and from vessels. However, the impacts from exhaust emission should be limited due to the relatively small numbers of plant spread over a large site and the large distance to sensitive receptors.

4.2.2 Onsite Construction

Details of site construction activities are presented is V2/3 and V2/A.

Onsite construction activities have been reviewed and their potential to cause air quality impacts has been considered. Emission rates have been assigned to various activities, equipment, or other construction features. The major construction stages and activities which produce significant dust and other air pollutants include:

- **Reclamation**
  - clearance of excavation areas, blasting of bedrock, selection of seawall materials;
  - segregation and stockpiling of fill and aggregate;
  - transport and placement of seawall and fill material, compaction and grading of fill;
  - crushing and screening of materials for aggregate and specialised fill.

- **Foundations**
  - excavation of trenches; placement of forms and steel; concrete manufacture;
  - drilling piles;
  - pavement of site roadways and drains;
  - operation of concrete batching plant with aggregate stockpiles.

- **Jetty**
  - excavation for caissons and supports, drive/drill piling;
  - placement of caissons, decking and accessory facilities;
  - operation of concrete batching and aggregate stockpiles.

- **Structures, Chimneys, and Superstructures**
  - erection and covering of structures and chimneys;
  - operation of concrete batching plant and aggregate stockpiles.

- **Mechanical and Electrical Equipment Installation**
  - installation of mechanical and electrical equipment;
  - power and emission control units, coal unloading, and coal stockpiling;
  - transformers and switch yards, water intakes and treatment facilities;
  - connect and startup equipment.

During reclamation and foundation activities, the following sequence of tasks will generate the most air emissions:

- drilling and blasting;
- excavation of loosened materials;
- segregation and stockpiling of materials;
- loading of off-road/onsite trucks;
- transport and dumping of materials in reclamation areas;
- stockpiling and crushing of materials for aggregates and fills; and
- concrete batching, loading, and transport onsite for foundations and chimneys.

Movements of reclamation excavators, loaders, and haul trucks are likely to generate about 40% of the total uncontrolled emissions, while batch loading into the trucks and batch dumping from trucks on the reclamation will be responsible for the remaining 60%. During foundation work (1993–1996), emissions are likely to fall to about 30% of that during reclamation. For later activities, dust emissions are likely to be less than 10% of that during reclamation.

Later structural and installation activities will require plant items (generators, compressors, and welders), cranes, hoists, and trucks which will operate on stablised, and therefore less dusty, surfaces. Dust emissions from haul roads will generally be much lower than during the earlier activities.

4.2.3 Offsite Construction Activities

Offsite construction activities generally relate to deliveries and hauling of equipment, materials, and waste to and from the site. Road traffic can only access the site via the Southern Access Road from Tuen Mun, while marine traffic will use the Urmston Road–Brothers–Ma Wan channels (some may also come from the Pearl River). Anticipated traffic loads would typically be about 20 trucks and 30 buses per day on the Southern Access Road and about 5 ship passages along the southern navigational route. Thus, air quality impacts from offsite activities are not expected to be significant.

4.2.4 Scenario II

Construction for Scenario II will generally involve the same activities and would reach similar peak worst-case conditions as those estimated for the Scenario I, particularly during Phase 2. Scenario II will involve a shorter overall duration of activities and a smaller extent of excavation during Phase 1, and therefore the probability of reaching the "worst-case" conditions is likely to be less than that for the Scenario I.

4.3 Sensitive Receptors

Hong Kong Planning Standards and Guidelines identify several sensitive receptors:

- Residential areas;
- Nurseries, homes for the aged, hospitals and clinics;
- Schools and other educational institutions; and
- Active recreational activities.

Of these, only a limited number of residences and recreational activities are to be found near the LTPS site. Following relocation of the 3 existing residents of Yung Long the closest residence or other occupied buildings will be in Lung Kwu Sheung Tan, more than 600m south of the Black Point ridge crest and more than 1000m southeast of the active construction sites in Phase 1.

Construction of the contractors' access road and delivery of some equipment and materials will involve dust and exhaust emissions between the Lung Kwu Sheung Tan intersection on the Southern Access Road and the ridge crest. The Lung Kwu Sheung Tan residents may experience some degradation of local air quality during the initial construction as the contractors work along the ridge crest but this will only last for a short period of time. The retained ridge will act as a screen to reduce the dust impact to these receptors.

4.4 Statutory Criteria and Requirements

The main item of legislation relevant to air pollution from construction sites is the Air Pollution Control Ordinance Cap.311 (1983). In addition, the Air Pollution Control Order 1986 (Air Control Zones, Declaration) Air Control Objectives is relevant. Under these regulations, the Air Quality Objectives for dust or Total Suspended Particulates (TSP) and Respirable Suspended Particulates (RSP) are specified:

- TSP : 260 $\mu g/m^3$ averaged over 24 hours
  : 500 $\mu g/m^3$ hourly average based on EPD guidelines
- RSP : 180 $\mu g/m^3$ averaged over 24 hours

It will be necessary to ensure these conditions are not exceeded at the site boundary and recommendations for monitoring to ensure compliance are contained in Annex 2A.

4.5 Effect of Growth in Background Concentrations

Before the LTPS construction period, construction of the WENT Landfill and the NW New Territories Sewage Outfall is expected to be complete in 1992 and construction vehicles will no longer operate in the Lung Kwu Sheung Tan area. Some operational vehicle traffic for the sewage outfall will pass through the area, and most importantly, the refuse trucks will begin to deliver solid wastes to the Landfill. An estimated 300 truck deliveries per day will pass through Lung Kwu Sheung Tan and pass by the LTPS construction site from 1992-1997 (see V1/2.18). No other traffic generator in the Lung Kwu-Nim Wan area is assumed to begin construction or operations during the LTPS construction period. It has been assumed that any PADS development between Castle Peak and Black Point will begin after the Phase 1 LTPS construction period.

No other significant dust generators should be located within 2000 m of Black Point during the LTPS construction. Exhaust emissions from the additional landfill operation trucks will have a negligible air pollution impact due to limited numbers.

4.6 Significance of Impacts

The assessment of the generation and dispersal of atmospheric pollutants has involved assumptions regarding sources, duration of activities and rates of emissions, together with probable wind directions and speeds. The meteorological conditions used to equate to a typical worst case (wind speed 2 ms^{-1} stability D). Current construction schedules (see V2/3 and Annex 2A) and estimated activity levels were used, together with generally accepted dust emission rates[1] for such activities to produce "worst-case" uncontrolled emissions for each activity. Similarly, exposed areas of stockpiles and working areas were profiled.

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1 US EPA (1985) Compilation of Air Pollutant Emission Factors. Volume 1 AP-42, Fourth Ed.

Once each activity had been assessed, composite hourly and daily emissions were developed by taking the overall construction schedule and assessing the degree of overlap or simultaneous operation. Coincidence of several pollutant generating activities at one time then required the generation of a composite "worst-case".

The estimated hourly dust emissions from different sources are presented in Table V2/4.6(a).

Table V2/4.6(a)
Estimated hourly dust generation from various construction activities

Activity	Total Emissions kg/hr
o Reclamation	
- Excavator and loader movements	35
- Truck hauling	80
- Batch dumping into and from trucks	195
Total	**310**
o Foundations	
- Excavator and loader movements	20
- Crusher and batch plant	20
- Truck hauling	59
- Batch dumping	11
Total	**110**
o Chimneys	
- Truck hauling	5
- Stockpiles	0.3
- Crusher and batch plant	10
Total	**15**
o Structures and Superstructures	
- Truck hauling	10
- Stockpiles	0.6
- Crusher and batch plant	20
Total	**31**

The "worst case" period is predicted to be from late 1992 to early 1993 when there will be a concurrence of excavation, reclamation and foundation construction. Table V2/4.6(b) indicates the likely dust generation by various uncontrolled activities, together with resulting downwind ground concentrations at the site boundary under the "worst case" scenario.

Table V2/4.6(b) **Dust generation from fixed sources and consequent downwind concentrations**			
Construction Activities	**Particulate Emissions Rate (kg/hr)**	**Number of Area Sources**	**Downwind Ground Level Concentration at Site Boundary[1] ($\mu g/m^3$)**
Reclamation	195	2	4,600
Foundations	31	3	930
Chimney	10	10	120
Structures	21	2	500

[1] Assuming the distance from the geographical centre to the site boundary is 1,000m.

Once generated, dispersion of pollutants was determined assuming 2 m/s winds passing parallel with worst case working alignments (i.e. two works areas in series).

Since specific work areas are not known at this time, dispersion of the estimated hourly emissions was based on one hectare area sources at ground level. The standard ISC Short-Term Model was used for modelling dispersion of particulates with allowance for gravitational settling and deposition of the particles. Particle size distribution was assumed to have an average particle diameter of 30μm.

These dust emissions were assumed to come from one to three 100 m by 100 m working areas (centers separated by 350 m) with winds passing across both working areas. In general, excavation areas along the ridge will be south of the marine reclamation areas, therefore worst-case source-wind alignments will disperse dust over Deep Bay or Urmston Road. During foundation activities, foundation excavation would occur on Black Point, while crushers, batch plants, truck movements and dumping would be in the Yung Long area, and parallel winds would carry dust from the three source to the northeast (towards the ash ponds), or southwest over Urmston road.

Apart from fixed emission sources, vehicle movements on unpaved roads can generate significant dust. The quantity generated will depend on vehicle speed and weight, surface silt content and moisture content. The emission factor from vehicles travelling on unpaved roads has been estimated at 3.8 kg/vehicle/km according to USEPA. This gives predicted TSP concentrations, using the CALINE 3 model, of between 340-680 $\mu g/m^3$ at 1,000m distance from the unpaved road under different wind directions (i.e. parallel and cross wind situations). As it is not possible to fix the location of the haul road at this stage, the "worst-case" situation is being assumed. The maximum predicted concentration will 5,280 $\mu g/m^3$ at the site boundary.

The assessment performed provides a "worst-case" result. If typical site practice controls were observed and the most probable wind alignments, with the emission sources not lying in series were assumed, then the calculated ground-level concentrations would be greatly reduced. Similarly, use of the ISC model overestimates the apparent ground level concentrations for any locations to the south of the Black Point ridge as it does not take topographical shielding into account. In general, the receptors at Lung Kwu Sheung Tan will be protected by the ridge except when construction activities are occurring on the ridgetop. However, this will occur with only a fraction of the site plant and for a short period of time. It is expected that the residents at Lung Kwu Sheung Tan will not be affected.

Construction at the LTPS site will generate high levels (maximum of 310 kg/hr during "worst case" activities i.e. reclamation works) of construction dust under "worst-case, uncontrolled" conditions. With commonly applied control measures, however, emissions should be reduced by 90% and resulting average concentrations will be below the AQOs. Assuming a typical 90% reduction, the airborne concentration at the boundary of the site becomes 530 $\mu g/m^3$ during excavation and hauling activities for the reclamation under the "worst case" scenario.

However, this concentration will only occur when all the activities are happening together and when the wind is blowing in the critical direction carrying dust from every source to the site boundary. As this is an unlikely event and the layout of the haul road and emission sources are not definite, the particulate levels at site boundary will be within the guideline level of 500 $\mu g/m^3$. Similarly, the 24 hour average TSP will also fall within the AQOs since most of the operations will only be carried out during the day time. This alone is likely to reduce the predicted TSP concentration to 50% of the predicted values. This, together with the variability of the wind over the 24 hour period means the predicted 24-hour average TSP concentration will probably be between 100-200 $\mu g/m^3$.

As regards RSP, most of the construction dust will comprise large particles, the typical respirable content will be about 50% or less. As a result, the RSP concentration will be in the order of 50-100 $\mu g/m^3$.

With controls, most construction dust will be suppressed onsite and would be deposited within 200-500 m of the source with low percentages being carried further than the site boundary. For general good housekeeping and occupational health protection, mitigation measures commonly specified on major projects will be employed to minimise dust generation.

4.7 Mitigation Measures

Although construction impacts upon air quality are not predicted to be significant, a number of measures have been included to ensure that emissions are minimised. Such measures will reduce the potential for unexpected adverse impacts on the natural environment and the occupational health of the site workforce, as well as attaining the AQOs at sensitive receptors.

The following dust control measures will be implemented during construction.

- water spraying of batch loading and dumping from onsite, off-road haul trucks;
- wheel and undercarriage washing facilities should be installed at site exits and used diligently;
- drop heights should be kept to the minimun practicable when handling fill material;
- regular compaction and water sprays are recommended for un-paved haul roads within the site;
- site vehicles should be subject to speed restrictions and their movements should be confined to designated roadways when inside the site;
- contractors should provide pollution control measures such as bag filters for cement silo and spray systems at aggregate transfer points, for concrete batching plants and crushers;
- during site clearance, the areas of erodable material exposed at any one time should be kept to a minimum and, in the absence of rainfall, should be dampened using water bowsers with spray bars working in conjunction with the clearance plant. Large surface areas of friable soil must not be left exposed without dampening, and should be stabilised or sealed as soon practicable.

It should also be noted that stone crushing, grading and batching processes are classified as specified processes under the category of "Mineral Works", and will require the BPM pertaining at the time of construction to be applied which may include measures in addition to those identified above. Moreover, careful siting of the dust generating activities can further reduce the off-site impact.

5. NOISE

5.1 Introduction

This section identifies and assesses the potential impacts of construction noise on sensitive receivers in the Black Point area. The assessment has been based on the assumed construction programme (see Section V2/2.3) and equipment inventories provided in Annex V2/A.

Construction noise calculations have been carried out using the Site Noise computer program. This program carries out calculations in accordance with the principles embodied in the relevant Technical Memorandum. However, it enables calculations to be carried out to a higher level of detail and accuracy than would be possible if the method in the Technical Memorandum was strictly adhered to.

The program uses the sound power levels of construction plant corrected for distance, screening, on-time and soft ground attenuation. The screening or barrier calculations can be carried out either in accordance with the method given in BS 5228[1] or in accordance with the method given in Department of the Environment document entitled "Calculation of Road Traffic Noise". In this case, the latter option has been adopted since BS 5228 allows only a crude assessment of barrier attenuation (0, 5 dB(A) or 10 dB(A)). Although "Calculation of Road Traffic Noise" was not specifically written for the purposes of calculating construction noise levels, the authors of Site Noise included this option since they considered that the barrier calculation method was suitable for this type of application.

In carrying out the construction noise assessment for the EIA of CLP's LTPS, noise from both percussive piling and general construction works were considered together and assessed by comparison with either the background noise level (during the day time) or the relevant Acceptable Noise Level (ANL) contained in the Technical Memorandum on Noise from Construction Work other than Percussive Piling.

The principal reason for not distinguishing between the two types of noise is that nearby residents will not subjectively differentiate between piling and other construction noise. The overall noise level will be perceived by residents who will react accordingly. It would, therefore, be unrealistic to separate the two types of noise source. The EIA has, therefore, predicted the total noise levels from construction works and compared these levels with the most appropriate criteria.

The Noise Control Ordinance fulfils a different function in respect of construction noise, in that it seeks to control such noise by means of a permit system. Clearly, this statutory system will still be applicable in this case, but it is not a system which can be used to predict and assess the noise impact of construction works of this nature and magnitude.

On the basis of the current construction programme (see Section V2/2.3) assumptions were made regarding the location of construction activities and the way in which these locations will change during the course of construction. The progression of groups of plant required for each construction activity across the site was characterised as a "working line". The working lines for Scenario I and II are shown on Figures V2/5.1(a) and (b).

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1 British Standard BS5228 (1984): 'Noise Control On Construction And Open Sites'.

The numbers of each type of construction plant were taken from the construction programme in Annex V2/A. For each of these plant items a sound power level (SWL) in dB(A) was derived from various sources. Wherever possible the figures quoted in EPD's booklet entitled "Technical Memorandum for the Assessment of Noise from Construction Works Other than Percussive Piling" were adopted. In the absence of relevant data, assumptions were made by reference to, *inter alia*, BS 5228. These sound power levels are shown in the Table V2/5.1(a).

Table V2/5.1(a)
Plant Sound Power Levels

Plant Type	**Source of L_{WA}**	L_{WA}[1]
Off road truck	(CNP141)[2]	112
Road haul truck	(CNP141)	112
Pick up truck	(Estimate)	105
Concrete truck	(CNP044)	109
Excavation trips	(Estimate)	109
Wheeled loader	(CNP061)	112
Tracked Loader	(CNP061)	112
Rock Drill	(CNP161)	128
Motor auger	(CNP167)	114
Small crane	(CNP048)	112
Large crane	(Estimate)	115
Motor Host	(CNP121)	108
Compressor	(CNP001)	109
Electric welder	(Estimate)	106
Concrete pump	(CNP047)	109
Water pump	(CNP282)	103
Generator	(CNP101)	108
Crusher	(Estimate)	125
Batch plant	(CNP022)	108
Tug	(CNP221)	110
Motor dredger	(CNP052)	118
Motor barge	(Estimate)	118
Float crane	(CNP048)	112
Pile Driver	(CNP164)	115

[1]L_{WA} 'A' weighted sound power level expressed in dB(A).

[2]CNP Construction Noise Permit code number from Technical Memorandum on Noise from Construction Work Other Than Piling.

For the purpose of carrying out the assessment it has been assumed that all items of plant which are active on the site at any one time will be working for the whole of the relevant period, that is 0700–1900 hrs and/or 1900–0700 hrs. It should be noted that by adopting this assumption of 100% on-time the calculated noise levels are 'worst case' and, furthermore, the resultant noise levels are equally applicable to any given period during the day or night. Numerically, therefore, the calculated 12 hour L_{eq} will be the same as a 1 hour or 30 minute L_{eq}. Piling has been assumed to take place only during the daytime.

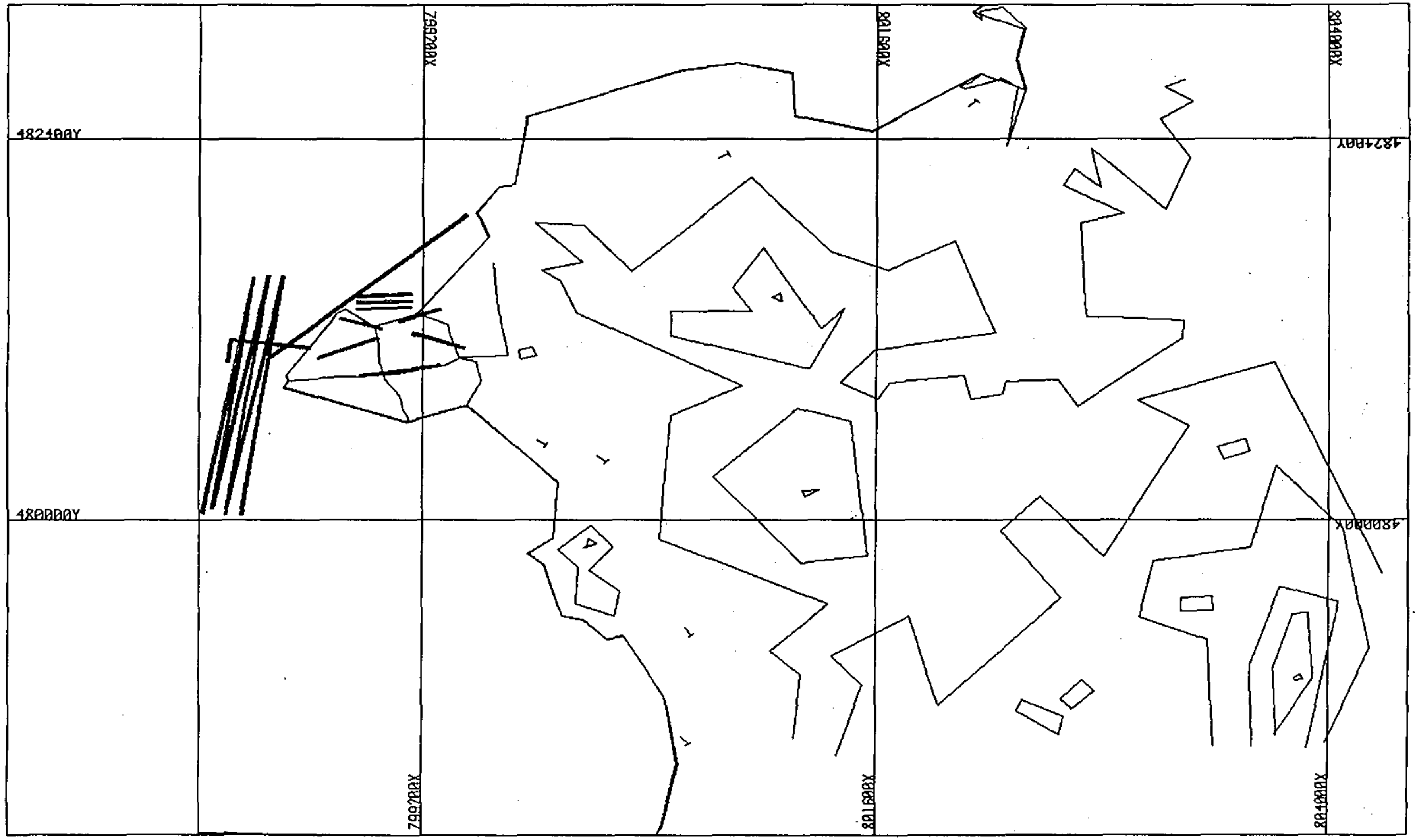

Figure V2/5.1 (a) **Construction Noise Assessment Working Lines – Scenario I**

ERL (Asia) Ltd.
11th Floor, Hecny Tower
9 Chatham Road,
Tsimshatsui,
Kowloon, HONG KONG

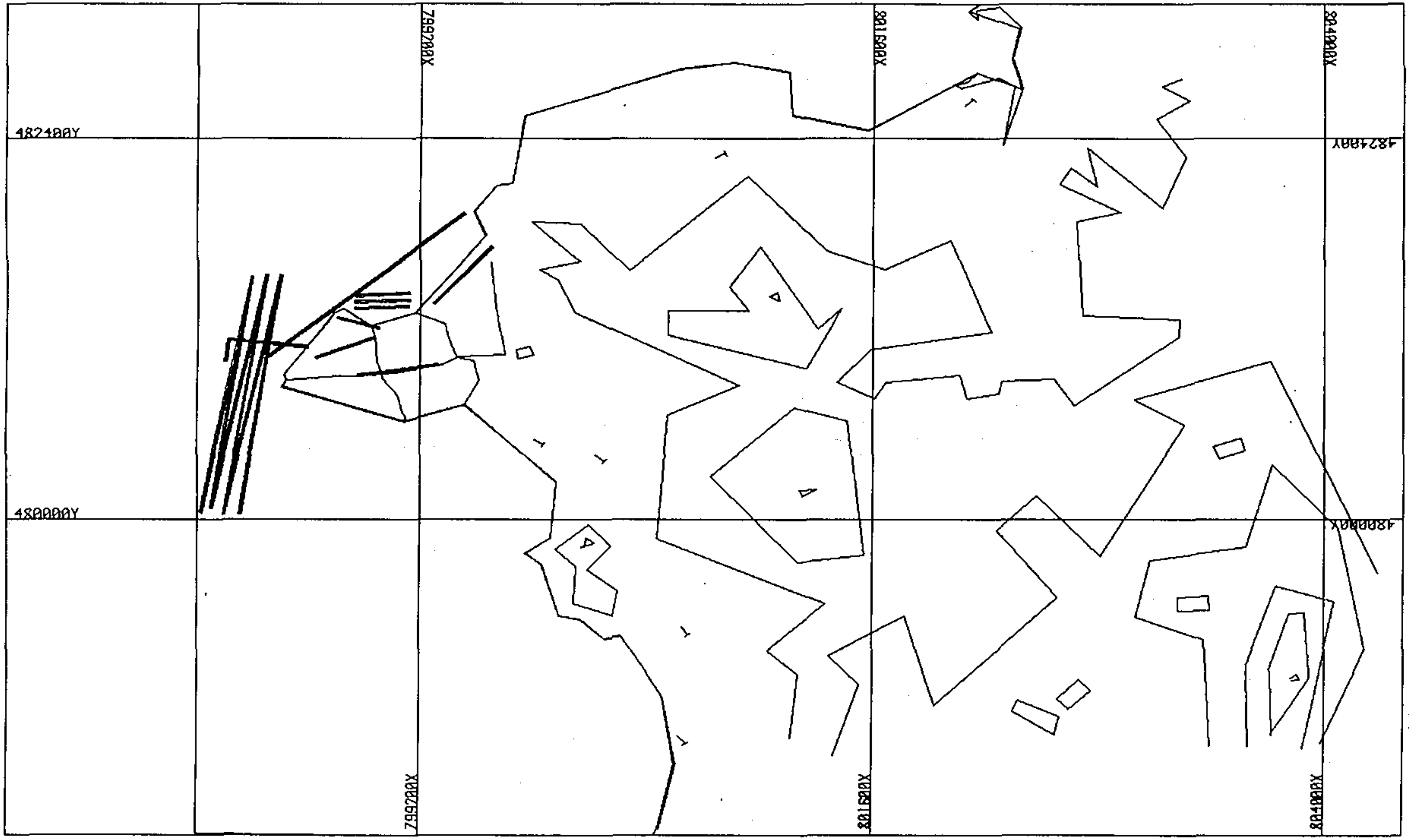

Figure V2/5.1 (b) Construction Noise Assessment Working Lines - Scenario II

ERL (Asia) Ltd.
11th Floor, Hecny Tower
9 Chatham Road,
Tsimshatsui,
Kowloon, HONG KONG
ERL

5.2 Potential Sources of Impact

The principal sources of potential impact are:

(i) rock drilling;
(ii) blasting, excavation and emplacement of granite from Black Point ridge;
(iii) rock crushing and grading during reclamation and site formation;
(iv) pile driving for chimney foundations, certain buildings, and, if required, jetty trestles;
(v) construction and use of temporary access road;
(vi) installation of plant.

The construction programmes for each phase of the two possible Scenarios last several years. The modelling has followed a "worst-case" approach, such that the period from each phase of either scenario giving rise to the greatest noise emissions has been modelled, i.e. during the initial preparation of the site, including excavation works on the crest of Black Point ridge, reclamation activities, and where applicable, jetty construction.

5.3 Noise Sensitive Receivers

As identified at site search stage, one of the advantages of the Black Point site is its relative remoteness from population centres, and this is reflected in the relatively distant receptor locations identified for this assessment, and in most cases, the small number of residences they represent.

To assess construction noise impacts, five locations have been selected to represent the nearest noise sensitive receivers. These locations are:

- Tai Shui Hang (to the north east of Black Point);
- Lung Kwu Sheung Tan (two receivers, to the south east of Black Point);
- Pak Long (to the south east of Black Point); and
- Lung Tsai (to the south east of Black Point);
- Tsang Tsui (to the north east of Black Point).

These locations are shown on Figure V2/5.3(a).

It should be noted that the one occupied house at Yung Long has not been taken to be a noise sensitive receiver since it will be removed prior to commencement of construction.

The two receivers at Lung Kwu Sheung Tan represent a small number of houses, only one of which appears to be permanently occupied. The remainder of these houses appear to be occupied only on a temporary basis.

The receivers at Pak Long and Lung Tsai together represent the community of about 800 people at Lung Kwu Tan.

5.4 Criteria

5.4.1 Day Time Criteria

Since there are no statutory criteria for general construction works during the day time (other than Sundays and public holidays), a background noise survey was carried out which has been used to develop appropriate assessment criteria. The results of this background noise survey are reported in detail in Volume 1, Annex E. On the advice of EPD, the criteria have been set on the basis of a 10 dB(A) exceedence above the arithmetic average of the twenty-four 30 minute L_{eq} measured values over the 12 hour (0700-1900 hrs) day time period. No future increases in background levels have been assumed.

These criteria are as follows:

- Lung Tsai: 71 dB(A)
- Pak Long: 71 dB(A)
- Lung Kwu Sheung Tan: 66 dB(A)
- Tai Shui Hang: 66 dB(A)
- Tsang Tsui: 66 dB(A).

5.4.2 Night-time Criteria

Under the Noise Control Ordinance, criteria are specified for construction noise during the evening and the night-time (1900-0700 hrs) and for Sundays and public holidays. These criteria are specified in the Technical Memorandum cited in Section V2/5.1. Since the area in the vicinity of Black Point is predominantly rural in nature, an Area Sensitivity Rating of "A" has been adopted. This gives a night time criterion of 45 dB(A) and an evening and public holiday criterion 60 dB(A).

No allowance has been made for any change in the Area Sensitivity Rating in future years due to potential PADS developments.

5.5 Effect of Growth in Background Noise Levels

Background noise levels in the Black Point area are expected to increase considerably in the near future, as a result of several major infrastructure developments in the area.

Opening of the South Access Road for general traffic and in particular refuse truck hauling, to the Nim Wan waste facility, will directly increase the noise levels along the road between the CPPS and the WENT Landfill. The road bed and traffic are elevated above the general land surface through the Lung Kwu Tan and Lung Kwu Sheung Tan areas, and traffic noises will pass directly (with less screening) into the receptors. Maintenance and operations for road and sewerage facilities at Lung Kwu Sheung Tan would also contribute noise to the area. Background noise levels along the road between the CPPS and the WENT landfill will be increased by around 5 dB(A) as a result.

A further major issue for the future background noise levels in the area is the planned development under the PADS scheme, involving the entire shoreline between CPPS and Black Point. It is possible that this development may not begin before the completion of Phase 1 of LTPS construction, however, such development plans should be taken into account when assessing the significance of any noise impacts from LTPS construction works on local residents, who, if they are not relocated as a result of the PADS scheme, will in any event be affected by noise from the development. PADS related developments would be expected to increase background noise levels by 5-10 dB(A).

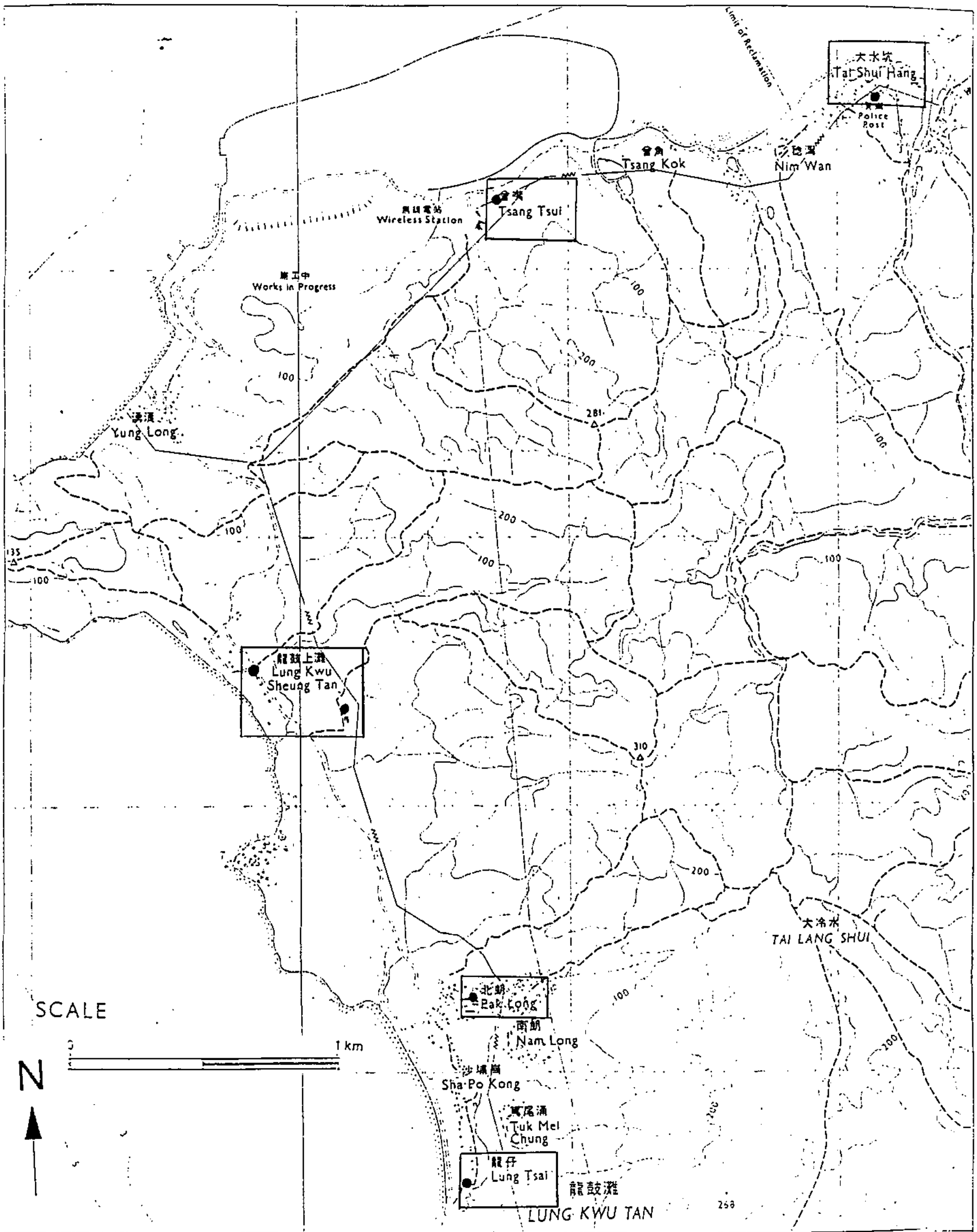

Figure V2/5.3(a)
Noise Modelling Receptor Locations

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5.6 Significance of Impacts

5.6.1 Daytime Noise

Table V2/5.6(a) presents the predicted daytime noise levels at the six receptor locations illustrated in Figure V2/5.3(a) for each phase of the two construction scenarios. When compared with the daytime noise criteria presented in Section V2/5.4.1 it can be seen that the criterion for each of the receptor locations is comfortably achieved throughout the "worst-case" construction period.

5.6.2 Night-time Noise

Table V2/5.6(b) presents the predicted night-time noise levels at the six receptor locations illustrated in Figure V2/5.3(a) for each phase of the two construction scenarios. When compared against the 45 dB(A) criterion applicable under the Area Sensitivity Rating "A" adopted for the Black Point area, it can be seen that the criterion will be exceeded at all receptors, with the exception of Pak Long for a period of 9 months under Scenario I Phase 1, and Scenario II Phase 2. Exceedance ranges between 2-3 dB(A) at Tai Shui Hang, to 9 dB(A) at the western i.e. seaward receptor at Lung Kwu Sheung Tan.

These exceedences arise from nighttime dredging and marine support activities, particularly those concerned with the dredging of the shipping access channel off the west and south of the Black Point promontory. Receptors to the south of Black Point are particularly exposed to these operations which, taking place in predominantly "open" water, do not receive any attenuation from intervening topography.

5.7 Mitigation Measures

Although it has been pointed out in Section V2/5.5 that daytime and night-time (by virtue of much of the PADS development works being 24 hour operations) background levels in the area are expected to increase in future, the predicted night-time exceedences of the 45 dB(A) criterion are considered significant, and it is suggested that the potential impacts might be mitigated by:

- Limiting of dredging and associated operations west and south of the Black Point promontory to the day-time period (0700-1900 hrs);
- Use of the quietest available dredger type;
- Ensuring that equipment is effectively silenced, particularly diesel powered plant.

These works are currently scheduled to be carried out on a 24 hour basis. Table V2/5.7(a), illustrates noise levels at receptors due to land-based works alone, which would normally be limited to ancillary generations and pumps during the night-time period.

Exceedences are not experienced at Pak Long because it is acoustically sheltered by the high ground immediately to the north east.

Table V2/5.6(a)
Predicted Daytime Noise Levels (Period Leq dB(A))

Scenario 1 Phase 1													
	Jan 92	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 93
Lung Tsai	31	50	54	54	51	51	51	50	50	50	38	38	34
Pak Long	28	34	42	42	49	49	49	43	43	43	39	39	36
Lung Kwu Sheung Tan (East)	34	52	57	57	58	58	58	54	54	54	45	45	41
Lung Kwu Sheung Tan (Wast)	39	52	57	57	59	59	59	55	55	55	46	46	43
Tai Shui Hang	38	48	48	48	49	49	49	48	48	48	42	42	41
Tsang Tsui	42	52	52	52	54	54	54	53	53	53	46	46	45
Scenario 1 Phase 2													
	Jul 99	Aug	Sept	Oct	Nov	Dec	Jan 00	Feb					
Lung Tsai	46	46	46	41	41	38	38	35					
Pak Long	49	49	49	44	44	40	40	37					
Lung Kwu Sheung Tan (East)	57	57	57	52	52	48	48	44					
Lung Kwu Sheung Tan (West)	58	58	58	53	53	49	49	46					
Tai Shui Hang	45	45	45	41	41	39	39	37					
Tsang Tsui	50	50	50	46	46	44	44	42					
Scenario 2 Phaes 1													
	May 93	Jun	Jul	Aug	Sept	Oct	Nov	Dec					
Lung Tsai	30	30	30	30	30	30	30	30					
Pak Long	32	32	32	32	32	32	32	32					
Lung Kwu Sheung Tan (East)	36	36	36	36	36	36	36	36					
Lung Kwu Sheung Tan (West)	37	37	37	37	37	37	37	37					
Tai Shui Hang	38	38	38	38	38	38	38	38					
Tsang Tsui	43	43	43	43	43	43	43	43					
Scenario 2 Phase 2													
	Jan 99	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 00
Lung Tsai	30	50	54	54	51	51	51	50	50	50	38	38	34
Pak Long	28	33	42	42	49	49	49	43	43	43	39	39	36
Lung Kwu Sheung Tan (East)	34	52	57	57	58	58	58	54	54	54	45	45	41
Lung Kwu Sheung Tan (West)	39	52	57	57	59	59	59	55	55	55	46	46	43
Tai Shui Hang	27	47	47	47	49	49	49	48	48	48	39	39	38
Tsang Tsui	31	51	51	51	54	54	54	52	52	52	44	44	42

Table V2/5.6(b)
Predicted Night-time Noise Levels (Period Leq dB(A))

Scenario 1 Phase 1

	Jan 92	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 93
Lung Tsai	22	50	51	51	50	50	50	50	50	50	23	23	22
Pak Long	24	33	36	36	34	34	34	33	33	33	25	25	25
Lung Kwu Sheung Tan (East)	28	52	53	53	52	52	52	52	52	52	30	30	29
Lung Kwu Sheung Tan (Wast)	31	52	54	54	52	52	52	52	52	52	33	33	32
Tai Shui Hang	38	48	48	48	48	48	48	48	48	48	38	38	38
Tsang Tsui	42	52	52	52	52	52	52	52	52	52	42	42	42

Scenario 1 Phase 2

	Jul 99	Aug	Sept	Oct	Nov	Dec	Jan 00	Feb					
Lung Tsai	27	27	27	24	24	22	22	21					
Pak Long	29	29	29	27	27	25	25	25					
Lung Kwu Sheung Tan (East)	37	37	37	32	32	30	30	29					
Lung Kwu Sheung Tan (West)	39	39	39	35	35	33	33	32					
Tai Shui Hang	27	27	27	25	25	24	24	24					
Tsang Tsui	30	30	30	28	28	27	27	26					

Scenario 2 Phaes 1

	May 93	Jun	Jul	Aug	Sept	Oct	Nov	Dec					
Lung Tsai	23	23	23	23	23	23	23	23					
Pak Long	25	25	25	25	25	25	25	25					
Lung Kwu Sheung Tan (East)	30	30	30	30	30	30	30	30					
Lung Kwu Sheung Tan (West)	32	32	32	32	32	32	32	32					
Tai Shui Hang	38	38	38	38	38	38	38	38					
Tsang Tsui	42	42	42	42	42	42	42	42					

Scenario 2 Phase 2

	Jan 99	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 00
Lung Tsai	20	50	51	51	50	50	50	50	50	50	22	22	21
Pak Long	24	33	36	36	34	34	34	33	33	33	25	25	25
Lung Kwu Sheung Tan (East)	28	52	53	53	52	52	52	52	52	52	30	30	29
Lung Kwu Sheung Tan (West)	31	52	54	54	52	52	52	52	52	52	32	32	32
Tai Shui Hang	23	47	47	47	47	47	47	47	47	47	25	25	24
Tsang Tsui	25	51	51	51	51	51	51	51	51	51	27	27	26

Table V2/5.7(a)
Night-time Noise Levels from Land Based Activities (Period Leq dB(A))

Scenario 1 Phase 1 (Worksites)	Jan 92	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 93
Lung Tsai			44	44	25	25	25	21	21	21	17	17	14
Pak Long			34	34	28	28	28	23	23	23	18	18	15
Lung Kwu Sheung Tan (East)			46	46	36	36	36	30	30	30	25	25	20
Lung Kwu Sheung Tan (Wast)			50	50	38	38	38	32	32	32	27	27	23
Tai Shui Hang			23	23	24	24	24	22	22	22	20	20	18
Tsang Tsui			26	26	27	27	27	24	24	24	22	22	20
Scenario 1 Phase 2 (Worksites)													
	Jul 99	Aug	Sept	Oct	Nov	Dec	Jan 00	Feb					
Lung Tsai	26	26	26	22	22	18	18	15					
Pak Long	28	28	28	24	24	20	20	17					
Lung Kwu Sheung Tan (East)	36	36	36	30	30	26	26	23					
Lung Kwu Sheung Tan (West)	38	38	38	32	32	29	29	26					
Tai Shui Hang	24	24	24	21	21	19	19	17					
Tsang Tsui	28	28	28	25	25	22	22	20					
Scenario 2 Phaes 1 (Worksites)													
	May 93	Jun	Jul	Aug	Sept	Oct	Nov	Dec					
Lung Tsai	17	17	17	17	17	17	17	17					
Pak Long	19	19	19	19	19	19	19	19					
Lung Kwu Sheung Tan (East)	24	24	24	24	24	24	24	24					
Lung Kwu Sheung Tan (West)	26	26	26	26	26	26	26	26					
Tai Shui Hang	15	15	15	15	15	15	15	15					
Tsang Tsui	21	21	21	21	21	21	21	21					
Scenario 2 Phase 2 (Worksites)													
	Jan 99	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept*	Oct	Nov	Dec	Jan 00
Lung Tsai			44	44	25	25	25	21	21	21	17	17	14
Pak Long			34	34	28	28	28	23	23	23	18	18	15
Lung Kwu Sheung Tan (East)			46	46	36	36	36	30	30	30	25	25	20
Lung Kwu Sheung Tan (West)			50	50	38	38	38	32	32	32	27	27	23
Tai Shui Hang			23	23	24	24	24	22	22	22	20	20	18
Tsang Tsui			26	26	27	27	27	24	24	24	22	22	20

6. WATER QUALITY

6.1 Introduction

Examination of Figures V2/2.2(a) to (d) (Scenarios I and II) indicates that the extent of interaction of the LTPS development with the marine environment is likely to be broadly similar ultimately, for both Scenarios. There will, however, be a difference in the timing of these impacts. Scenario I involves early complete seawall construction and access channel provision. Under Scenario II these facilities are not required until Phase 2. Construction impacts on water quality will arise from the dredging of marine sediment. This is the only large scale activity with the potential to cause significant impacts. Other construction activities, being essentially land-based, have much lower potential to affect the marine environment and any adverse impact should be avoided by good construction practice on site.

The extent and significance of any impacts on water quality will depend on the extent and duration of dredging activities, the amount of material removed, the method of removal and the proximity of receptors sensitive to water quality impacts. Impacts have been assessed against known background conditions established through routine and site specific monitoring and analysis programmes and in relation to statutory criteria discussed in V2/6.4. In addition, likely future developments in the areas, such as gazettal of borrow areas, are also considered, together with their potential to substantially alter baseline conditions in the future.

6.2 Potential Sources of Impact

Although the main potential for water quality impacts lies with the requirement to dredge a large quantity of marine sediment from the area. Other sources of impact, whilst not expected to be significant, are also considered in the following section.

6.2.1 Removal of Marine Sediments

It is estimated that a total of approximately 14 Mm^3 of marine sediment is likely to be removed during construction of the LTPS. The quantity is made up as follows:

– dredging of sea-wall line	1.26 Mm^3
– dredging access channel and turning basin	13.00 Mm^3
– total	14.26 Mm^3

This activity will occur in Phase 1 of Scenario I and Phase 2 of Scenario II. Scenario II Phase 1 will also involve a small amount of dredging for the Phase 1 seawall.

The need for these activities is considered below:

o **Dredging the sea-wall line**: the seawall around the reclamation will have considerable weight of its own in addition to internal forces acting on it from the material being retained. Consequently, it is necessary to found the seawall on strata with a higher load bearing capacity than that of marine mud. In order to do this, the mud will be removed along the line of the seawall, down to the underlying alluvium or sand. Figure V2/6.2(a) indicates the area from which mud will be removed. It is anticipated that this activity may take about 10 weeks and will occur early in the construction programme.

o **Dredging the access channel and turning basin**: Dredging to provide access for the 180,000–200,000 dwt coal carriers will require removal of mud to a depth of –20 m P.D. from the area shown in Figure V2/6.2(a). This volume may be reduced if it is decided that a jetty berth should be provided instead of a seawall facility. Dredging will occur during the construction period.

o **Dredging behind the seawall line**: It is considered unlikely that it will be necessary to remove much mud in the area behind the seawall. Installation of vertical drains to a capping layer above should ensure that 90% of total settlement will occur during the first 12 months. Consequently, construction of site buildings that do not require piled foundations will not be delayed significantly. Minimisation of the amount of mud dredged from this area will reduce the quantity of sediment put into suspension and also the mud disposal requirements of the project.

Impacts on water quality from dredging marine muds arise from the following:

- physical effects such as the suspension of solids in the water column, leading to a reduction in light penetration and increased retention of heat.

- chemical effects resulting from the release of sediment constituents such as toxic metals and complex organic compounds or material that has an oxygen demand, see Figure V2/6.2(b).

The level of oxygen saturation is of particular concern as a number of effects produced by sediment suspension combine to lower it. Reduced light penetration reduces photosynthesis and thus the rate at which oxygen is produced in the water column. Similarly, the increase in solids in the water column results in more energy from sunlight being retained, which increases the temperature. This also acts against oxygen levels as oxygen is more soluble in colder water. Furthermore, reduced primary production reduces the uptake of nutrients from the water column.

In both cases the extent of impact is related to the amount of material put into suspension. This is a function of the quantity and nature of the sediment, and the method of dredging. Chemical effects are also a function of the degree of sediment contamination. The quantity of material requiring removal has already been considered. Potential physical and chemical effects are further considered below.

o **Physical Effects**

Physical effects will depend on the amount of material put into suspension during dredging activities. This will depend, in part, on the dredging method used.

Two main dredging methods will be available for construction of the reclamation:

- **Grab Dredger**: This is one of the most common forms of mechanical dredger, comprising a slewing crane which lowers and hoists a grab in and out of the water. Grabs may be either pontoon-mounted or fitted to self-propelled hopper vessels. The former discharge spoil into barges alongside, which then transport material to the dump site. Grabs perform best in soft or loose muds and are ideally suited to working in confined areas.

- **Trailer/Cutter Suction Hopper Dredger (TSHD)**: This is a sea-going, self propelled vessel which is equipped with a suction pipe which trails across the seafloor or, in the case of a CSHD, a cutting head. The excavated fluid is discharged into a hopper where the solids settle whilst excess water is discharged via an overflow. This technique, which serves to minimize the water and maximise the solid content of the material transported to the dump site is known as Lean Mixture Overboard (LMOB) and, if used, contributes a large proportion of the solids put into suspension. At disposal grounds, trailer dredgers can discharge their load directly through doors or valves in the bottom of the hull.

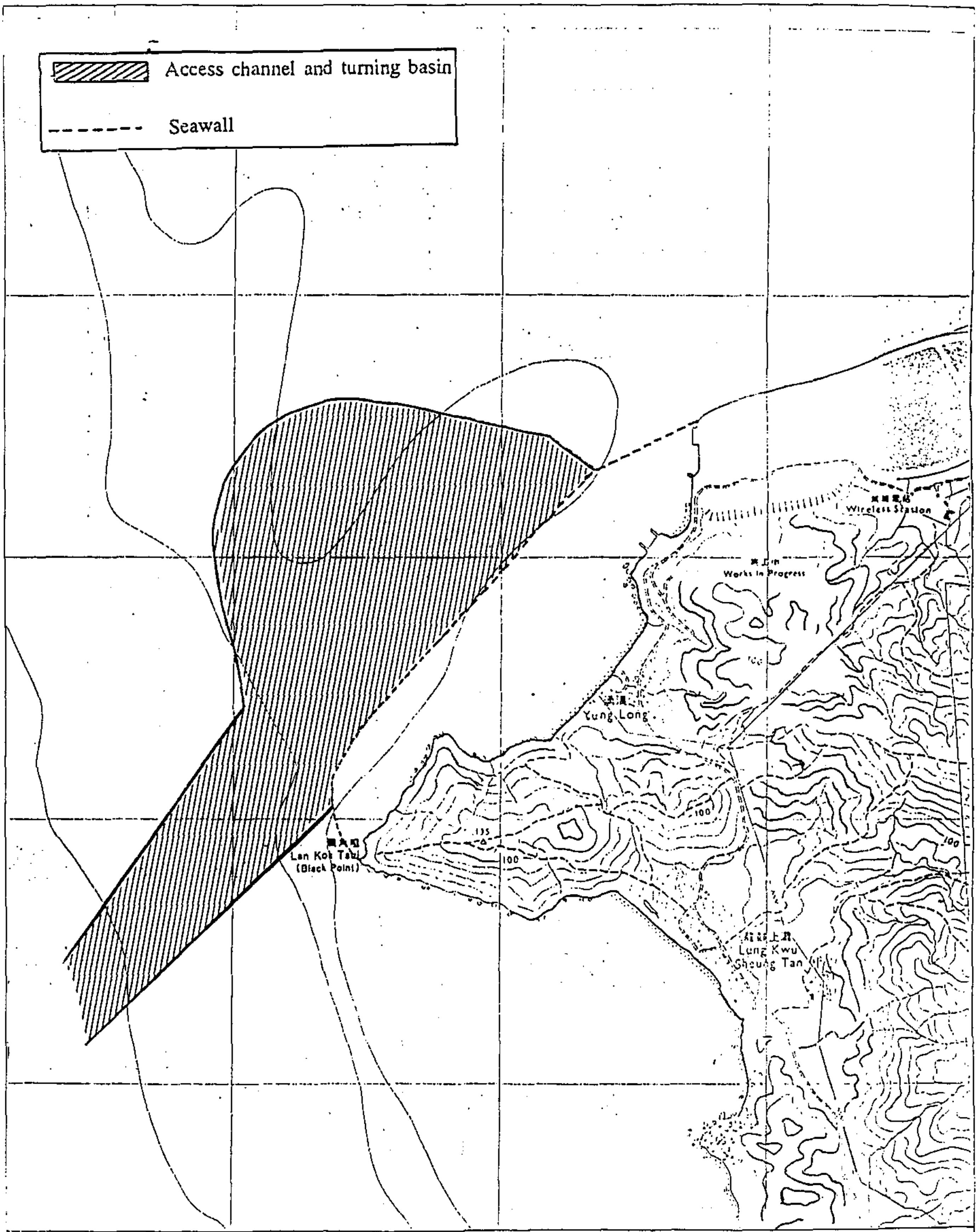

Figure V2/6.2(a)

Provisional area for marine mud removal; seawall and access channel

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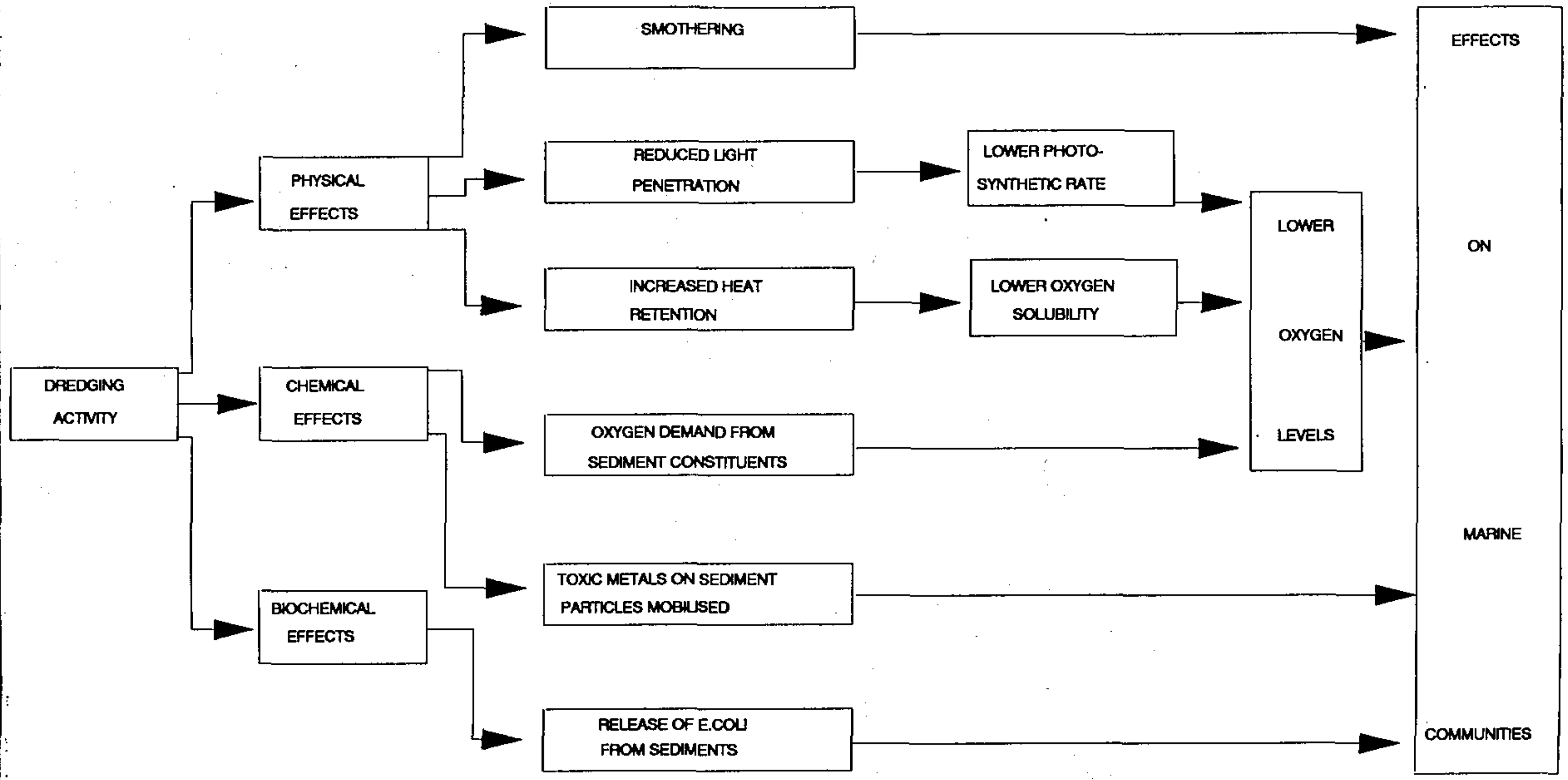

Figure V2/6.2(b) Network Of Effects Produced By Dredging Of Marine Sediments

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Of these two methods it is considered likely that TSHDs will be employed for the majority of the work. Grab dredgers may be used where water is of insufficient depth to allow access to the TSHDs. When sufficient material has been removed, however, it is likely that TSHDs will be favoured as their production rate will be higher.

Once in suspension, the length of time that material remains in the water column is chiefly related to grain size. Fine particles (<63 μm) may remain in suspension for several days, whilst larger fractions will be deposited more quickly. The length of particle residence time in the water column determines the potential to cause impact. Over a few days, suspended material will be subject to several tidal movements which may bring it into contract with sensitive receptors. Results from EPD routine monitoring at stations in outer Deep Bay indicate that a high proportion of the sediment (>90%) is in the silt/clay fraction. The extent of sediment movement during LTPS construction is being considered in hydraulic modelling exercises which will be reported in full in the key issue report on water quality.

o **Chemical Effects**

Also of concern regarding water quality is the potential for toxic metal contamination from the sediments. All marine sediments contain trace metals. Sediments that have been subject to industrial/domestic pollution commonly contain elevated levels of toxic metals. If such sediments are dredged, the potential exists for toxic metals, as part of the sediment, to be mobilised into the water column. Metals thus become available for uptake by filter feeding animals, such as oysters. The Deep Bay Guidelines for Dredging Reclamation and Drainage developed interim guideline values for metal contamination of sediments. It was stated that if the metal content of any sediments exceeded these values then their suitability for disposal at marine dumping grounds could not be assumed. The limit values are as follows:

Cadmium	:	15*
Chromium	:	500
Copper	:	500
Lead	:	200
Mercury	:	5
Nickel	:	500
Zinc	:	2000

* (mg/kg on a dry weight basis)

Data obtained from EPDs routine monitoring programme, and from more specific monitoring undertaken by CLP (see Figure V1/3.4(a)) indicate that the sediments which will require removal and disposal are unlikely to be significantly contaminated. Table V1/3.4(a) presents summary statistics for the sediments in the area. The positions of the sampling stations are indicated in V1/Annex C.

Once the exact boundaries of the access channel and the turning basin have been determined, sampling of the mud requiring removal will be undertaken to confirm the suitability of the mud for disposal in gazetted areas.

6.2.2 General Construction Activities

General construction activities may also have an impact on water quality. Once dredging is complete, seawall formation will proceed using fill material excavated from Black Point. Placement of this fill will also cause an increase in suspended solids but is likely to be insignificant in comparison to that raised by dredging activities. On-going site construction will have the potential to cause water pollution from the following:

- **Debris and rubbish** disposed over the seawall, such as used construction materials and packing for materials delivered to site.

- **Sewage Effluents** from the site. A workforce of approximately 3,000 max. will be required for site construction. Assuming an average BOD production of 60g per day per individual and assuming each worker spends 12 hours on site and in that time contributes 50g, the total BOD load from the site will be 150 kg. This will require some form of treatment before discharge. In addition, it is likely that canteen facilities will be provided on site. These are likely to generate a significant BOD load as a result of food preparation and wash waters. A total site BOD load of 300 kg/day has been assumed.

- **Liquid spillages**: a number of liquids are likely to be stored on site, such as oil, diesel, solvents etc. Any spillages are likely to result in water quality impacts.

6.3 Sensitive Receptors

A number of sensitive receptors could potentially be affected by dredging operations. These can be considered as on-site, near-field and far-field receptors.

6.3.1 On-site Receptors

The initial results of the marine survey being carried out as part of this study, together with other reported work in the area indicate that a diverse, but not uncommon, marine benthic fauna exists in the areas where dredging will occur. As a result of this activity, benthic habitats in the dredging areas indicated in Figure V2/6.2(a) will be lost. Construction of the cooling water outfall may also affect an area as yet un-specified. Of these areas, some will be lost completely, being replaced by reclamation. Other areas will be subject to periodic disturbance as a result of maintenance dredging (see V3/5.2.11).

The results of the marine survey are summarised in V1/3.8 and presented in Annex 1G:

6.3.2 Near-field receptors

The near-field receptors are essentially the same as those identified for the on-site area. They may, however, be affected in a different way. Periodic disturbance, in the form of maintenance dredging is likely to occur every 3 to 4 years. It is considered that the time required to re-establish a benthic marine community in Hong Kong waters may typically be 2 years[1]. In addition, adjacent areas will experience 'smothering' effects due to the settling out of material adjacent to the site.

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1 Holmes P.R. (1988) Environmental Implications of Exploiting Marine Sand. in Marine Sand and Gravel Resources of Hong Kong. Whiteside, P. and Wragge-Morley. N. (eds) Geological Soc. of Hong Kong, Seminar Proceedings 1987.

In addition, the CPPS cooling water system is a potential receptor. The intake is located approximately 4 km away from the dredging site but ebb tidal currents will pass directly from the dredging site to the intake. An increased suspended solid load has the potential to increase abrasion within the cooling water system.

6.3.3 Far-field receptors

Far field receptors may be affected by increased turbidity or the transport of contaminants released from the sediment into the water column during dredging. The extent of impacts will depend upon the direction in which the sediment plume is predicted to travel and the proximity of the sensitive receptor to Black Point.

Some 3 km north-east of the edge of the dredging area, in Outer Deep Bay, is a mariculture Subzone designated under the Deep Bay Water Control Zone. Figure V1/6.3(a) indicates the extent of the zone, which runs northeastwards from Nim Wan, for a distance of aproximately 9 km. The zone extends approximately 2 km off the coast. Specific water quality objectives apply to this zone, in addition to those specified for Deep Bay as a whole, and are considered in Section V2/6.4. The mariculture zone is designed specifically to protect oyster cultivation in the area, although coastal shrimp ponds also rely on acceptable water quality. (see V1/2.3.7) Some 6 km northeast of the site is the Pak Nai SSSI used as a hightide roost site by gulls and terns, and at the eastern edge of inner Deep Bay is the Mai Po marshes SSSI. The principal receptors to water quality impacts are the filter feeding shellfish, both mussels and oysters. They will be susceptible both to the physical effects of "clogging" gills and general smothering and also to the chemical effects of absorbtion of any toxic elements from the sediments, into the tissues. Consequent impacts would include the economics of lost shellfish production and medical effects associated with consumption of contaminated shellfish.

Shellfish are particularly at risk because unlike other marine species they are unable to move from the area. Other marine species may, however, experience some stress as a result of construction activities. Whilst no specific evidence is available, the possibility that the Black Point area is a spawning ground would increase the potential for impacts. Marine species may require very specific conditions for spawning, which could be affected if dredging coincides with a spawning period.

The position of the area on the boundary between the Pearl Estuary and the South China Sea makes it likely that some species are living at their northernmost or southernmost extent and may be susceptible to small changes in water quality. The Chinese White (Pearl River) Dolphin is known to inhabit the water in the area and may diurnally migrate between marine Hong Kong waters and the estuarine Deep Bay environment. These potential receptors are considered in detail in V1/3.8 and V2/9. The statutory requirements pertaining to water quality in Deep Bay are considered in the section that follows.

6.4 Statutory Criteria

6.4.1 The Black Point LTPS site lies at the southerly end of the boundary between the Deep Bay and the North Western Water Control Zones (WCZ). In November 1990 the Water Quality Objectives (WQOs) for the Deep Bay WCZ were gazetted (see also V1/2.3.3). The objectives for the North western WCZ were not gazetted at the time of writing but are anticipated during 1991. They will, therefore, be in force by the time construction begins. Because of the nature of the Deep Bay ecosystem and the need to preserve certain internationally significant ecological areas (V1/6.3.3) it is likely that the Deep Bay Objectives will be more rigorous than those to be applied to North Western Waters, where the level of ecological interest is not as high. Consequently, it is considered that the Deep Bay Water Quality Objectives (DBWQO) as shown in Table V1/6.4(a) are appropriate criteria by which to assess the impacts on water quality.

6.4.2 Deep Bay Water Quality Objectives (DBWQO)

The DBWQO are designed to ensure the maintenance of acceptable water quality conditions in Deep Bay (see also V1/2.3.3). They now form part of the Water Pollution Control Ordinance Cap.358. Under this regulation certain subzones are defined. The Mariculture Subzone has been described in V1/6.3.3. In addition, a Yung Long Bathing Beach Subzone is defined. The Yung Long beach lies immediately north-east of Black Point and under both development scenarios I and II will disappear under reclamation for the LTPS.

The DBWQO of most relevance concerning the effects of construction of the LTPS are the following:

- A: Aesthetic appearance
- B: Bacteria
- D: Dissolved oxygen
- H: Suspended Solids

and these are considered in turn.

o **Aesthetic appearance**: The aesthetic appearance criterion applies throughout Deep Bay and has a number of components which serve to restrict any materials which may be visually offensive such as oil, detergents, general debris, sewage or anything liable to cause discolouration of the water. Some of these materials have the potential to cause more than aesthetic impact. For example, birds and mangroves are likely to be sensitive to the effects of oil. This objective is of relevance mainly to general construction activities. It will be necessary to ensure that spillages of oil or diesel do not occur from the LTPS site and that debris from construction is not disposed of to the sea. Observance of good construction practice should ensure that this is not a problem.

o **Bacteria**: Items a) and d) in section B. Bacteria of V1/6.4(a) are relevant to Deep Bay marine waters. A maximum level of Escherichia Coli is specified for Yung Long beach, but as construction of either Scenario will remove the beach this criterion is not relevant. A separate criterion is relevant for the mariculture sub-zone and requires the annual geometric mean of E. Coli not to exceed 610 per 100 ml. The presence of E. Coli in the water column is an indication of recent or continuing faecal pollution. LTPS construction could contribute E. Coli either via sewage discharges from the site or from mobilisation of E. Coli in marine sediments. The importance of this criterion is to prevent significant faecal contamination of oysters and other shellfish intended for human consumption.

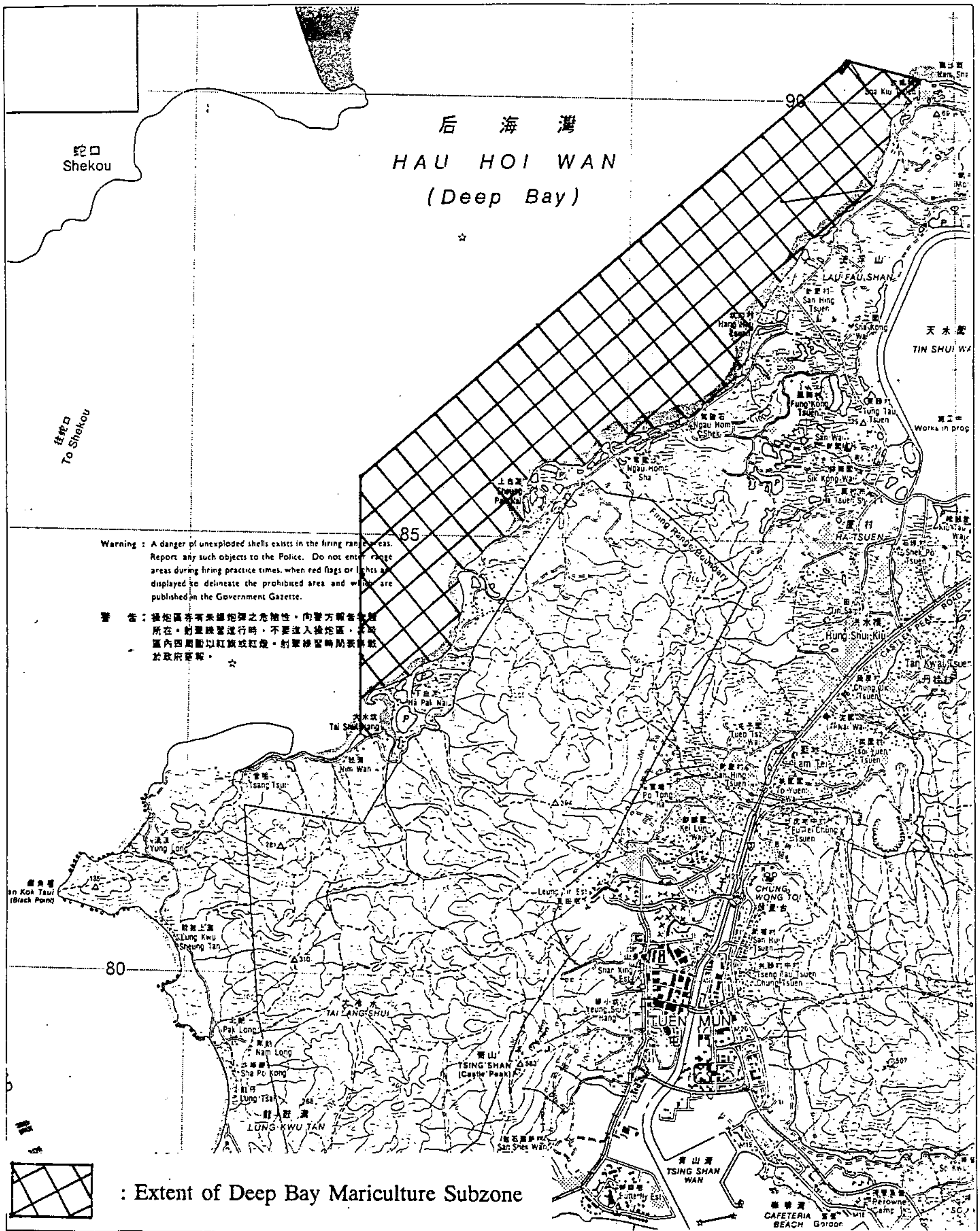

Figure V2/6.3(a) Deep Bay Mariculture Subzone

Source: Water Pollution Control Ordinance Cap. 358

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11th Floor, Hecny Tower
9 Chatham Road,
Tsimshatsui,
Kowloon, HONG KONG

ERL

- o **Dissolved Oxygen**: minimum levels of dissolved oxygen are specified for different areas of Deep Bay, with the most stringent applying to the Mariculture Subzone where "the dissolved oxygen level should not be less than 5 mg/l for 90% of the sampling occasions during the year." As outlined in Section V1/6.2.2, dissolved oxygen levels may be supressed by a number of effects produced by suspension of sediments

- o **Suspended Solids**: A general limit of no greater than a 30% rise above background levels is specifed for the whole of Deep Bay . In addition, there is a requirement that discharges should not give rise to the accumulation of suspended solids which may adversely affect aquatic communities. It should be noted that Deep Bay is a naturally turbid environment and that the flora and fauna are adapted to high levels of suspended solids. Nevertheless, filter feeding species are still susceptible to "clogging" and to "smothering" if the suspended solids levels are too high.

In addition to the provisions of the Deep Bay Water Quality Objectives, further requirements are provided by WQOs developed for Inner, Middle and Outer Deep Bay under the Deep Bay Integrated Environmental Management Study[1] and incorporated into the Deep Bay Guidelines for Dredging Reclamation and Drainage Works[2]. Under these recommendations, upper limit levels in water are supplied for eight toxic metals, as follows:

–	Mercury	< 300 μg/l[1]
–	Cadmium	< 1 mg/l
–	Copper	< 5 mg/l
–	Lead	< 10 mg/l
–	Zinc	< 40 mg/l
–	Nickel	< 30 mg/l
–	Chromium	< 15 mg/l
–	Arsenic	< 25 mg/l

The importance of the objectives are that they "ideally should be achieved in order to maintain the environmental and ecological status of the Bay."

The Objectives outlined above were developed taking the following factors into consideration:

- other national and international water quality standards;
- available evidence on the impact of contaminants on marine life;
- existing and projected water quality in Deep Bay;
- existing and proposed beneficial uses of waters in Deep Bay; and
- the occurrence of particularly unfavourable hydrographic and/or meteorological conditions.

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1 ERL (Asia) Ltd 1988 Deep Bay Integrated Environmental Management Study for EPD.

2 ERL (Asia) Ltd 1990 Deep Bay Guidelines for Dredging Reclamation and Drainage Works for EPD.

1 All values are annual arithmetic mean dissolved, the division between dissolved and particulate metals to be defined by a 0.45 μm filter.

It is against these criteria, which were recently developed and implemented specifically for Deep Bay, that water quality impacts have been assessed. The WQO for North Western Waters are due to be gazetted in 1991. It is unlikely that the objectives will be more stringent than those applied to Deep Bay. Consequently, it is considered unlikely that significant impacts will occur in Urmston Road.

6.4.3 Discharge Limits

Under the Technical Memorandum, effluents discharged to the coastal waters of Deep Bay are subject to standards for particular volumes of discharge. The anticipated volume of contaminated drainage from site facilities is 600 m^3/day. This places the discharge in the category of flows between 600 and 800 m^3/day, to which the limits in Table V2/6.4(a) apply.

Table V2/6.4(a)
Discharge limits likely to apply to contaminated site drainage from the LTPS Construction Site

	Flow Rate >600 and ≤800 m^3/day
pH	6 – 9
Temperature (°C)	45
Colour (lovibond units 25mm Cell length)	1
Suspended Solids	50.0
BOD	20.0
COD	80.0
Oil & Grease	20.0
Iron	5.0
Boron	2.0
Barium	2.0
Mercury	0.001
Cadmium	0.001
Other toxic metals individually	0.4
Total toxic metals	0.8
Cyanide	0.1
Phenols	0.25
Sulphide	5.0
Total Residual Chlorine	1.0
Total Nitrogen	100.0
Total Phosphorus	10.0
Surfactants (total)	15.0
E. Coli (count/100 ml)	1000.0

Note: All units mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Source: Standards for effluents discharged into the coastal waters of the Deep Bay Water Control Zone in the Technical Memorandum on Effluent Control.

6.5 Significance of Impacts

6.5.1 Introduction

As part of the EIA for the LTPS, it was identified at an early stage that water quality impacts could be significant. Consequently a water quality key issue assessment was specified. The basis of this assessment will be hydraulic and water quality modelling that is currently being undertaken by Hydraulics Research Limited. The results of this modelling will determine the likely behaviour of the cooling water discharge plume from the LTPS and the hydraulic effects of the proposed reclamation. Some general observations regarding the likely behaviour of material put into suspension and thus the potential for impacts to occur can be made, based on knowledge of the background conditions and on some coarse modelling exercises that were performed as part of the Site Search study. Full details of the modelling exercise are contained in Technical Paper C of Supporting Volume 1 to the Final Report on the Site Search for the LTPS.

6.5.2 Site Search Modelling of the Sediment Plume

The size of the plume of sediment generated by dredging activities at each of five potential LTPS sites considered in the Site Search was estimated using a simplified Gaussian plume model which took account of the following:

- mean current velocity;
- tidal excursion (the product of the mean current velocity and duration of the tidal period);
- the transverse mixing co-efficient;
- depth of the water column; and
- shear velocity.

The product of the model is an estimate of the plume volume for ebb and flood tide. This is combined with an estimate of the amount of material likely to be put into suspension by dredging activities during each tidal period to give the concentration of suspended sediment in the plume in mg/l.

A number of assumptions were made regarding the nature and duration of dredging activites and the quantity of material likely to be mobilised during the dredging operation. This was then averaged out over the whole of the plume. The values produced were thus mean values. It should be noted that it is likely that there would be marked variation about the mean as the concentration would decay approximately exponentially with distance from the point of dredging activity.

The criteria used for assessing the impacts at this stage of the study were related to the degree of change in water quality characteristics at sensitive receptors, as compared to the range of natural fluctuation and the value of these receptors.

The results of the modelling exercise during the site search indicated that the concentration of suspended solids in the plume would on average be 2.5 mg/L on the flood tide and 1.6 mg/L on the ebb, lower concentrations than were predicted for other sites due to the stronger tidal currents in the Black Point area.

It is likely that the plume will encroach on Outer Deep Bay during the flood-tide. The WQOs for Deep Bay state that there must not be an increase of greater than 30% above the ambient in this area. The ambient conditions for water quality in outer Deep Bay are summarised in Table V2/6.5(a).

Table V2/6.5(a)
Ambient Suspended Solids levels in Outer Deep Bay (DM4) and Urmston Road (NM5) as monitored by EPD (mg/L)

	DM4	NM5
Mean	14.3	7.5
Summer Mean	14.2	6.5
Winter Mean	14.5	8.5
Maximum	52.0	15.0
Minimum	2.5	1.5
No. of observations	29	15

Note: Samples depth averaged; Summer period = April - September, Winter period = October - March. Mean of all samples since January 1988.

The data for suspended solids from Deep Bay indicate an annual range of between 2.5 and 52 mg/L. An increase of 30% to the upper end of the range would mean a maximum level of 68 mg/L. The publication "Marine Water Quality in Hong Kong 1990" summarises water quality conditions in the territory for 1989. This report specifies a mean suspended solids level of 19.3 mg/L with a range 2.5 to 91.5. The implications of this are greater latitude in the impacts considered acceptable for dredging for the LTPS.

The nature of dredging is such that suspended solids levels in the lower two or three metres of the water column may become significantly elevated, to the order of several thousand mg/m^3. This increase may not necessarily be reflected at the surface, where suspended solids levels may not be significantly elevated. As a consequence, a key aspect to the hydraulic modelling exercise currently underway as part of the Water Quality Key Issue Assessment will be to determine the extent of water movement at the base of the water column. The base of the water column will experience the elevated levels of suspended solids together will associated oxygen depletion and possible mobilisation of metal species. This is also the part of the water column that will come into contact with the oysters in the mariculture subzone. Significant movement of the base of the water column could produce impacts in the mariculture subzone of Deep Bay.

It should be noted, however, that the Deep Bay Guidelines[1] are intended to avoid the need for repetitious EIA studies. Under these guidelines it was determined that no more than a 30% increase in suspended solids would be acceptable. Consequently, provided that CLP ensure works compliance by regular monitoring during periods of dredging and modification of dredging practice of necessary, further EIA study to determine precise sediment behaviour is not strictly necessary.

6.5.3 Chemical Contamination

It appears unlikely that the chemical effects of resuspension of sediment will be significant. Both EPD and CLP monitoring results indicate that toxic metal levels in sediments in the area are an order of magnitude lower than the Deep Bay Interim Guideline values.

6.5.4 Effects of Other Construction Activities

The effects on water quality from other construction activities is likely to be minimal. Site boundary security will need to be maintained and good construction practice should be observed to ensure that litter, fuels and solvents do not gain access to Deep Bay Waters.

The effect of the sewage discharge, provided it receives adequate treatment, should not be significant. Assuming a site population of 3,000 and water usage of 200 litres/person/day, a flow rate of 600 m^3/day is produced, for which the effluent standards, taken from the Technical Memorandum Standards for effluents discharged to coastal waters of the Deep Bay Water Control Zone, are:

- Suspended Solids 50 mg/L
- Biochemical Oxygen Demand 20 mg/L

These standards should be readily achievable with installation of the appropriate treatment units.

6.6 Mitigation measures

In the event that a significant effect is predicted to occur as a result of sediment plume impingement, two main forms of mitigation measures are possible; as considered in the following sections.

6.6.1 Changes to dredging practice

Levels of suspended solids produced by dredging can be substantially reduced by the provision of silt curtains around the dredger. A silt curtain is comprised of a tough, abrasion resistant permeable membrane and is suspended from floating booms in such a way as to ensure that the passage of turbid waters through the curtain is restricted. The curtain should be installed with enough slack to accomodate the tidal rise and fall, with the bottom edge weighted at regular intervals to ensure it remains in place.

1 ERL (Asia) Ltd (1990) Deep Bay Guidelines for Dredging Reclamation and Drainage Works, for EPD HK Government.

Other modifications to practice include not using an LMOB system with hopper dredgers. This would have marked implications for plant requirements and programming, however, as the load carried by the dredger would contain far less solid material and the hopper would reach capacity quicker, necessitating more frequent journeys to the dump ground and resulting in less time spent at the dredging area.

The improvement in suspended solids levels to be obtained by the use of silt curtains and the implications of using LMOB are illustrated in Table V2/6.6(a).

Table V2/6.6(a)
Turbidity Levels and Sediment Resuspension for Grab and Hopper Dredgers

Dredger Type	**Grab Dredger**	**Grab Dredger**	**Trailer**	**Trailer**
Circumstance	Watertight grab with silt screen	Watertight grab without silt screen	no LMOB	LMOB
Size, m^3	3	3	6,100	6,100
Production Rate, m^3/hr	102	166	5,400	4,125
Increase of Turbidity close to the dredger mg/l	20	100	150	400

In addition to these measures, other dredging practice modifications are possible. In the event that grab dredgers are used in inshore areas the following could be employed:

- use of closed grabs;
- accurate and careful loading of barges to minimize "splashing";
- no overloading of barges.

6.6.2 Scheduling of dredging

If it is identified that significant suspended solids elevation is being caused at, for example, the mariculture subzone, it would be possible to suspend dredging operations immediately prior to and during the flood tide. In this way sediment movement towards the sensitive receptor is likely to be greatly reduced. This practice would, however, have signifcant implications for programming and plant requirements. It may be that this option is considered inappropriate for certain activities on the critical construction path, for example dredging the seawall trench. It may be applicable, however, for dredging of the access channel and the turning basin, as these areas are not likely to be required until later.

It is recommended that during dredging of the seawall line, a comprehensive sampling programme should be carried out consisting of 24-hour monitoring of suspended solids levels and turbidity within the water column at a point on the southwestern boundary of the Deep Bay Mariculture Subzone. Sampling should be carried out for 24 hours immediately prior to the onset of dredging, in order to determine baseline conditions. A further 24 hour sampling should then be conducted after dredging begins, to determine the extent of impact on the sensitive receptor. This will provide information with which to verify the results of hydraulic modelling and determine the acceptability of the dredging required for the marine access channel and turning basin against the Deep Bay Guideline value of a 30% maximum increase in suspended solids.

6.6.3 General Construction Activities

Minimisation of the potential for water quality impacts arising from general construction activities is to be achieved by observation of good construction practice. A number of measures in particular should be observed:

- **Debris and Litter**: In order to comply with the aesthetic criteria for Deep Bay, contractors should be required, under special conditions of contract, to ensure that site security is optimised and that disposal of any solid materials, litter or wastes should not occur to the waters of Deep Bay. Particular care will be required at barging points where delivery of the workforce or construction materials occur.

- **Oils and Solvents**: To prevent spillages of fuel oils or other polluting fluids to Deep Bay Waters, all fuel tanks should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the tank size.

- **Sewage**: All polluted water should be treated before discharge. Small integrated treatment units are available which combine grease traps and treatment chambers with aeration and settlement facilities. The treated effluent can subsequently be discharged, providing it complies with the Technical Memorandum Standards for effluents discharged to coastal waters of the Deep Bay Water Control Zone. This level of treatment should be readily achieved by standard portable treatment units.

6.7 Summary

The construction impact on water quality will be primarily a result of mud dredging activities. Model predictions of sediment movement will form part of the Water Quality key issue and will determine the movement of the sediment plume under different conditions of the tide. Dredging will inevitably produce greatly elevated levels of suspended solids in areas immediately adjacent to the dredger. These may contravene the 30% maximum increase objective stipulated for waters in Deep Bay. Of interest will be whether or not the increase in suspended solids levels is extended to areas remote from the dredger and towards sensitive receptors such as the mariculture subzone of Deep Bay. In such an event, a number of mitigation measures are possible including the use of silt curtains on grab dredgers and the suspension of the LMOB practice for hopper dredgers. In addition phasing on some of the works would allow dredging to be carried out only on the ebb tide so that suspended particles are carried away from the entrance to Deep Bay.

7. WASTE DISPOSAL

7.1 Introduction

7.1.1 The Nature of Wastes

During construction of the LTPS waste materials will arise from a number of sources. This section considers the nature of these materials and the requirements for their disposal. Wastes are taken to include the following:

- debris which may be naturally transported from the site, for example by runoff;
- debris transported by vehicle or vessel from the site for treatment and/or disposal elsewhere;
- debris disposed of by burial on site; and
- material disposed of at sea in designated disposal grounds.

The large workforce, size of the site and extensive material requirements will generate large quantities of refuse, non-salvagable debris and marine sediments.

7.1.2 Related Sectors

Construction solid wastes will be gathered into areas from which they can be removed in economic quantities rather than as generated each day. Such waste storage areas may generate dust and, during the summer rainy season, discharge sediment. Waste generation, therefore, indirectly relates to air and water quality sectors. Sorting, loading, and hauling of wastes and debris also contribute to construction traffic and various secondary air pollutants and noise generation from such activities. Disposal of construction wastes (e.g., organic soils, vegetation, etc) requires landfilling and contributes to initial and ongoing adverse effects of landfill operations: ecology, cultural resources, and visual and recreational amenities.

7.1.3 Previous and Concurrent Studies

The Government of Hong Kong has recognised the adverse effects associated with landfilling, demolition and other construction wastes and of generation and disposal of dredged marine sediments. Efforts are currently underway to develop methods of recycling and improved use of construction debris in order to reduce demolition waste contributions to the territory's limited landfill capacity[1]. EPD has also recently commissioned a study to consider the appropriate disposal of contaminated dredged sediments.

7.1.4 Site Characteristics

The LTPS site at Black Point generally has a thin veneer of organic soils and very meager vegetation overlying weathered and unweathered granite. Conseqently, the amount of material unsuitable for fill and thus requiring disposal should be low in comparison to site area. Proximity to the sediment-laden Pearl and Shenzen River discharges and the need for dredging to provide ship access have resulted in a large volume (14 Mm^3) of marine sediment requiring disposal.

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1 EPD (1989) Waste Disposal Plan for Hong Kong. EPD HK Government.

7.2 Potential Sources of Impact

7.2.1 Construction waste generation will generally involve amounts of unusable fill debris, dredged sediments, or refuse and waste from workers, equipment, and equipment packaging and onsite fabrication. Wastes can be assigned to particular work activities:

- **Reclamation**
  - plants, trees, surface debris, and structures;
  - organic rich soil unsuitable for fill;
  - marine sediments unsuitable for support seawall or fill ;
  - equipment and vehicle maintenance wastes (sludges, containers, etc); and
  - employee sanitary and support wastes.
- **Navigation and Berths**
  - dredging for structural support of berths; and
  - dredging of approach channel and turning basin.
- **Foundation Construction**
  - scrap and un-reusable wood from forms;
  - wrapping for steel and other materials;
  - unusable cement mixes and cement cleaning;
  - equipment and vehicle maintenance; and
  - employee sanitary and support wastes.
- **Structures and Installation**
  - materials and equipment wrappings;
  - equipment and materials cleaning, coating, and painting wastes;
  - equipment and vehicle maintenance; and
  - employee sanitary and support wastes.

7.2.2 Scenario I

Waste arisings from reclamation and navigation/berthing activities are directly related to the amount of excavation and filling for the coal stockyard facilities and dredging for coal deliveries. Pollution control equipment (FGD) associated with Scenario I development will also involve significant land areas for equipment and by-product storage. Wastes related to construction equipment and employees (upto 3000) and mechanical and electrical installation will increase during the early two years and continue at about the same levels during 1994 through 1998.

Phase 2 construction of Scenario I will begin late in 2000 and extend to 2007 and by such time research and development efforts may have produced reclamation uses for fined-grained materials (e.g., currently unusable dredge spoils) and improved construction debris reuse and recycling. Such developments should reduce or eliminate many waste/residual impacts experienced during the Phase 1 construction and early operations. No significant sources of impacts are considered for concurrent construction of Phase 2 facilities and Phase 1 operations of Scenario I.

7.2.3 Scenario II

Construction for Scenario II will involve approximately 15% less construction waste soil and spoils. Equipment installation wastes for Scenario II would also be reduced (no FGD or electrostatic precipitators) along with their attendant packaging and paint/cleaning waste generation. Employee related wastes may be reduced by 30% because of the reduced amount of concurrent construction activities. As indicated above, improved use of dredged materials and recycling or improved disposal of construction wastes would lessen the impacts of Phase 2 construction.

General construction equipment maintenance and worker-related wastes would remain significant especially during Phase 2, which is virtually identical with Phase 1 of Scenario I.

7.3 Statutory Criteria and Requirements

The Government of Hong Kong is encouraging waste minimisation, reuse, recycling, and other alternatives to landfilling and ocean disposal. Specific controls, requirements, and criteria for construction solid wastes are generally related to their composition, potential hazardous contents and bulk compared to the available assimilative capacity.

7.3.1 Regulatory Requirements

The principal instrument for control of wastes is the Waste Disposal Ordinance 1989, Cap. 354 (see V1/2.3.4) but others also apply indirectly. Many Regulations and Ordinances may be directly or indirectly applied to solid waste generation, transport, treatment, and disposal. Prohibitions on open burning, discharge to marine and inland waters, and local landfills will require construction wastes and debris to be gathered, transported, and disposed of properly. Dust and runoff controls will eventually yield muddy sludges which are unsuitable for fill and may require disposal either to landfills or ocean disposal areas. Regulatory requirements also include approved plans for dredging, transport, and disposal. Applicable Ordinances and Regulations are listed in Table V.2/7.3(a).

7.3.2 General Contracting Requirements

Onsite burial of unsuitable fill materials can endanger later construction and operations and will not be permitted. Open burning of construction debris will be prohibited, and every practical effort will be made to cooperate with Government programmes to recycle or reuse such debris. Disposal of paints, solvents, and cleaning chemicals will be coordinated with the operators of the CWTF at Tsing Yi and efforts will be made to prevent onsite disposal or evaporation.

7.3.3 Dredged Marine Sediments

Disposal of fine-grained marine sediments will be of increasing concern during the next four to seven years as PADS related projects begin to generate huge quantities of this material. The only currently accepted method of disposal is for discharge of uncontaminated spoils at the Gazetted Dump Sites, the nearest being Cheung Chau. Total current disposal capacity, however, is insufficient to receive an estimated 200+ Mm^3 planned for disposal by 1994/5. Spoil re-use and selection of alternative disposal sites are under study and will be determined within 1991. Dredging is required after 1993 and alternatives to the existing sites will have to be determined in 1991 for the Chek Lap Kok Airport and other government projects.

The Deep Bay Guidelines[1] specify limits for metal concentrations in sediments. In the event that these are exceeded it should not be assumed that disposal in gazetted dump sites will be permitted the limit values are presented in V2/6.2.1.

Table V2/7.3(a)
Pertinent Ordinances and Regulations concerning Solid Wastes

Waste Disposal Ordinance 1980, Waste Disposal Plan	Cap. 354
Summary Offences Ordinance	Cap. 228
Discharge limits and requirements	Sec. 4D
Dirt on Public Streets (from trucks)	
1989 Marine littering enforcement	
Road Traffic Ordinance, Road Traffic (Construction and Maintenance of Vehicles) Regulations	Cap. 374
Public Health and Municipal Services Ordinance	Cap. 132
Nuisance from dust and fumes	
Public Cleansing and Prevention of Nuisances (Regional Council By-laws)	Cap. 132
Carrying of mud onto street	
Littering from specified vehicles	
Building (Demolition Works) Regulations	Cap. 123
Demolition dust nuisance controls	
EPD Guidelines for Dust Suppression Measures for Construction Sites	
Hong Kong Planning Standards and Guidelines Ch.9	
Dumping at Sea Act 1974 (Overseas Territories) Order 1975	Cap. 102
License required	
Limited dumping locations	
Limited dumping methods	
Monitoring requirements	
International Convention for the Prevention of Pollution from Ships	
MARPOL Convention 73/78	
UK's Orders in Council	
Public Reclamations and Works Ordinance	Cap. 113
Filling and Borrow Areas	

1 ERL (Asia) Limited (1990) Deep Bay Guidelines for Dredging, Reclamation and Drainage Works.

7.4 Affected Receptors

The volume of solid wastes generated directly affects the filling or use rate of the various disposal facilities. These "receptors" will include:

- Refuse collection and haulage to WENT Landfill
- Chemical Waste Treatment Facilities
- Maritime Disposal Sites

7.4.1 General Refuse and Landfill Disposal

The WENT Landfill has a scheduled lifespan equivalent to 32 years (capacity of 57 million tonnes) and is scheduled to come on-line in mid-1993 and will be available to receive construction wastes from the LTPS. However, suitable rock wastes will be used wherever possible for reclamation purposes to minimise the volume requiring disposal. The distance from the LTPS site to the WENT landfill is approximately 2 km and construction wastes can be delivered by truck. The arrangement is ideal as the proximity will limit other impacts associated with vehicle movements, such as noise and dust generation. The route to WENT should not affect any sensitive receivers.

7.4.2 Chemical Wastes

During the early stages of construction, earthmoving equipment and some vessels may be serviced on the construction site and will generate oily sludge which will require either recycling or disposal. The Government of Hong Kong will have in operation by 1993 the Chemical Waste Treatment Facility (CWTF) at Tsing Yi, for treatment of waste oil sludges and other chemical wastes. It is intended that the CWTF will have the capacity to treat 100,000 tonnes of chemical wastes per annum, comprising the following:

- Incinerator wastes : 15,000 t/a
- MARPOL wastes : 23,000 t/a of which
  - 10,000 will be incinerated
  - 13,000 will go to water treatment
- Physical/Chemical : 70,000 t/a of which;
  - acids : 20,000 t
  - alkalis : 35,000 t
  - PCB etchants : 12,000 t

Treatment will involve a complex of interrelated units equipped to carry out; neutralisation/oxidation/reduction/metal precipitation/settlement/sludge dewatering/filtration and pH management. It is likely, therefore, that the facility will be able to adequately treat any chemical wastes arising from the LTPS construction site.

A future facility, the Chemical Waste Bulking and Treatment Facility at Area 38 (4 km south) may become available during the course of Phase 2 construction.

7.4.3 Dredged Sediment Disposal

The seawall berth construction and associated approach channel and turning basin will require dredging and disposal of 14 Mm^3 of dredged spoils. Unusable dredged sediments may be disposed under license at the Cheung Chau Marine Dump Site south of Lantau Island if they are found to be uncontaminated. A possible alternative would be to deposit unusable dredged sediments in the existing worked out borrow pits within Deep Bay (see also Section 7.5.4). The disposal sites "East of Ninepins" and Mirs Bay can also be used although at greater expense and incurring longer travel times. The existing capacity of the site is less than 35 Mm^3, of which the LTPS direct contribution will represent 40 percent; however the capacity is thought to be presently exceeded[1] or near it's final limit[2].

A governmental committee for planning reclamation, sand mining, and dredged materials disposal is meeting to locate new disposal areas or methods since the anticipated disposal needs of the PADS projects would exceed 100 Mm^3 by 1995 while the "other" normal projects would produce another 80 Mm^3. Whether by marine disposal or by long-term reclamation, or a combination of both, the solution will need to serve public and private sector requirements and provide safe and appropriate placement of the dredged materials from the LTPS site.

7.5 Significance of Impacts

7.5.1 Introduction

The significance of LTPS-generated wastes should be viewed in the light of other concurrently contributing sources. The EPD has directed considerable resources to the development and implementation of the Waste Disposal Plan in order to provide Hong Kong with waste management facilities that can meet the demands for the next 20-30 years. Over the next 10 years, considerable amounts of construction and demolition waste will be produced and very large amounts of dredged materials will be generated from reclamation for the airport and other PADS projects:

- **Current Projects**: The WENT Landfill will provide the LTPS construction site with a readily accessible landfill for disposal of unusable construction debris. Construction of the Area 38 Deep Waterfront Industrial and River Trade Facilities may generate large amounts of construction debris which will also be disposed of to the WENT Landfill or dredged spoil dumping sites.

- **Proposed Projects**: The southern PADS projects for the new sea port, access, and airport on Lantau Island will generate enormous amounts of dredged material for disposal at sea or in reclamations, together with construction debris for landfilling, during the same construction period as that of the LTPS at Black Point. All dredged material from the Lantau developments is likely to be discharged at the Cheung Chau Disposal Site. Solid construction wastes will probably be conveyed by barge to the WENT Landfill for disposal. Chemical and general hazardous wastes will be conveyed to the CWTF at Tsing Yi which should be available from 1993.

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1 ERL (1990) 6000MW Thermal Power Station Final Site Search Report. P.52.

2 EPD (1990) Environment Hong Kong (1990).

The current schedule for the Black Point–Tap Shek Kok PADS reclamation assumes completion of the southern portion (cargo handling area) by 2001 and of the northern portion (Deep Waterfront Industries) by 2006. Solid waste and dredged spoil generation from these areas will therefore overlap with the later LTPS construction of Phase 1 and early stage of Phase 2 construction.

7.5.2 General Refuse and Landfill Disposal

Unlike many Hong Kong construction operations, the LTPS construction will not generate any significant demolition debris, and the unusable fill materials generated will generally include vegetation, other organic materials, and fine–grained organic rich soil during the initial earthwork activities. During later activities, general maintenance shops, worker–related solid wastes, and equipment wrapping and similar materials will dominate. Some stormwater sediment sump and concrete debris may be delivered to the landfill. Onsite canteens, showers/washing facilities, and other related sanitary facilities will produce general sanitary sewage for up to 3000 workers which will be treated onsite and discharged to outer Deep Bay and sanitary sludges requiring land disposal. These wastes will be collected and disposed of through existing offsite facilities and will not be landfilled.

7.5.3 Chemical Wastes

During the early stages of construction, earthmoving equipment and other mechanised plants, together with some sea vessels, may be serviced at the LTPS site. During later stages of construction, large volumes of paints, solvents, and cleansers will be used for structural and equipment coatings and cleaning, and spent liquids and sludges should be collected and conveyed by road or barge for treatment at the CWTF.

7.5.4 Dredged Sediment Disposal

Construction of Scenario I facilities will result in approximately 14 Mm^3 of dredged material in Phase 1 which will be disposed of in a Gazetted Marine Dumping Site or other alternatives (filling seafloor depressions caused by sand removal, for example, in Urmston Road). Dredging for Scenario II would produce a similar volume of material.

The large dredging volume and the current state of inadequate capacity for use or disposal would greatly heighten the significance of waste disposal under normal circumstances. However, disposal of muds should also be viewed in the context of the PADS projects and the coordinating activities of the Fill Management Committee (FMC). The FMC has recognised the inadequacy and the even greater impending demand for disposal or re–use and has issued a map indicating areas in the territory to be dredged for fill, including several in the Black Point, Urmston Road, and Deep Bay area. It is possible that these could be considered for future sediment disposal, and it is understood that FMC is sympathetic to these possibilities.

Results of sampling indicate that the levels of toxic metal contamination in the sediments are very low and as such will not require special disposal provisions. (see also V2/6) Once the exact area requiring disposal is finalised, further sampling and analysis of sediments will be carried out to confirm their suitability for conventional disposal.

7.6 Mitigation

7.6.1 Dredged Sediment Disposal

Disposal of dredged materials may eventually become a potential significant impact for the later stages of the LTPS project construction. CLP and other major future sources of dredged materials are closely coordinating dredging for possible uses for reclamations and reduction of disposal needs and are exploring possible alternative disposal on the northwestern seafloor for backfilling in sand mining areas. Generally, surface soils and other organic rich alluvium will be stockpiled for re-use as cover or used by others for landscaping.

Design of the reclamation has taken into account the dredged disposal problem and incorporates use of sand drains in poor seafloor sediments rather than dredging the poorly consolidated materials and requiring even larger amounts of fill materials.

7.6.2 Other Wastes

Other waste materials produced during the construction period can be dealt with either through use of the territory's waste management facilities (i.e., WENT Landfill, CWTF at Tsing Yi, and perhaps later the CWBTF in Area 38) or wherever feasible through recycling merchants, e.g., for spent oils, wood, plastics, paper, and metal scrap.

Solid waste disposal and recycling does not appear to be of sufficient importance to be deemed a significant effect, presuming that suitable disposal sites can be found in two years of further study and governmental coordination.

7.7 Summary

Construction debris and other wastes suitable for landfilling can be disposed of at the nearby WENT site. Chemical wastes will be treated at the CWTF, with the option of either land or sea transport from the LTPS site. Marine sediments are likely to be disposed of to sea, either at existing gazetted Marine Dump Sites or at new facilities to be identified by FMC.

8. TRAFFIC

8.1 Introduction

Traffic impacts from construction arise from the movement of large amounts of equipment, materials and workers to and from the construction site and along roadways in residential and commercial areas, the existing traffic of which is often predominantly smaller vehicles. Such new traffic imposed on the existing roadways and through previously non-industrial areas may increase congestion, interference, and accidents and other non-traffic impacts.

CLP has chosen to deliver equipment and materials primarily by sea to minimise impacts upon the more limited road transport system. Marine transport of equipment, materials and workers would be consistent with existing maritime traffic and easily within the navigational capacity of the channel.

- West New Territories Landfill, Environmental Impact Assessment[3];
- Development Study of Tuen Mun for Special Industrial Area 38[4];
- Second Comprehensive Transport Study[5];
- Port and Airport Development Strategy.

These studies have indicated existing and future problems of congestion and insufficient traffic capacity for junctions in Tuen Mun. They have also indicated that specific projects could supplement existing road capacity and eliminate adverse effects.

8.2 Potential Sources of Impacts

During the construction period, employment estimates predict an initial workforce of 1000 in 1992, increasing to 3000 in 1994, continuing at 3000 until 1997, and then decreasing to 2000 until the year 2008. Except for some equipment for initial mobilisation and access construction, equipment and bulk materials will be delivered to the site by sea. Construction employee road traffic could generate about 60 bus roundtrips each day. The starting point for a bussing system is likely to be Tuen Mun Ferry/LRT Terminal.

It is estimated that construction will generate the following maximum traffic loads (all as heavy goods vehicles, large buses, 1000 dwt vessels, or equivalents)

- Road : 130 vehicle roundtrips (peak hour of 30 ROTs)
- Marine : 10 vessel roundtrips (peak hour of 2 ROTs)

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3 Mott, Hay and Anderson (1987) Western New Territories Landfill Environmental Impact Assessment Final Report Nov. 1987, EPD.

4 Scott Wilson Kirkpatrick, ERL (Asia) Limited et al (1990) Expanded Development Study of Tuen Mun Area 38. Working Papers and Final Report. Oct. 1990.

5 Second Comprehensive Transport Study. Transport Dept, May 1989.

Construction effects will arise from the following:

- Road Interference, including:

  - Junctions along the Lung Mun (D-15) Road, such as for Area 38, China Cement Works and CPPS;

  - LRT and buses at junctions at Tuen Mun Ferry/LRT Terminal;

  - Loaded refuse trucks on the Southern Access Road; and

  - Weekend recreational traffic in Lung Kwu Tan and Lung Kwu Sheung Tan.

  Road traffic from movement of workers, equipment, and supplies may contribute to congested access at the southeast corner of the LTPS site and along the Southern Access Road-Lung Mun Road corridor. Although the road is suitable for loaded trucks, the combination of construction traffic for Area 38 (100 trips per day), existing CPPS and China Cement traffic (300 per day), and LTPS (maximum of 100 per day) may be added to the new and increasing landfill refuse truck traffic (200 per day). Traffic along this single corridor may increase modal interference, general traffic levels, congestion at junctions, travel times, and accidents.

- Marine Interference, including:

  - Brothers and Urmston Road shoreline marine and river terminals;

  - Shekou-Victoria Harbour marine traffic; the main hovercraft route passes Black Point;

  - Loaded refuse barge movement to WENT Landfill.

  The primary source of marine transport effects will be the presence of construction traffic required for reclamation, jetty and breakwater construction, and access dredging. Because of the existing and future ship use of Urmston Road, increased marine construction along the channel at Black Point will interfere with navigation into both the Pearl River and Deep Bay. During construction, deep (5-20 m) draft ships could serve the LTPS site and will reach the site after passing other construction operations for Area 38. Construction vessels will deliver equipment and materials, and extensive piling, dredging, and reclamation work will require a number of vessels working along or near the main navigation channel of Urmston Road and entry into Deep Bay.

  Lower marine traffic and transportation effects would arise with the use of natural gas in Scenario II for the LTPS. A coal receiving jetty or access channel would still be required although it would be delayed for five years (Phase 2), but the construction vessel traffic through Urmston Road during Phase 1 construction may be reduced by only about only 1-3 vessel roundtrips per day.

8.3 Affected Resources

8.3.1 Road Transport

The Lung Mun-Southern Access Road is the only road system serving the LTPS project site. The potential receptors of traffic impacts are considered below:

- **Southern Access Road**

  The Southern Access Road to the WENT Landfill is under construction and should be completed before construction begins on the LTPS. This road will greatly improve the existing access into Yung Long and through Lung Kwu Sheung Tan and Lung Kwu Tan. The rural environment of these villages will be changing during the next 10 years as construction for maritime industries proceeds with planned developments along the Lung Mun Road and north of CPPS. Because of transportation deficiencies north of CPPS, Lung Kwu Tan and Yung Long have continued as rural areas and are virtually cut off from the rest of the New Territories, although they still attract some recreational users. With completion of the Southern Access Road, weekend traffic should significantly increase.

  Close to the LTPS, conflicts may emerge with WENT traffic. Steep grades at the north end of Lung Kwu Sheung Tan will mean that the fully loaded refuse trucks will be unable to easily move or merge with construction traffic from the LTPS site. Minor maintenance and operations traffic for sewerage facilities at Lung Kwu Sheung Tan should not complicate traffic in the area.

- **CLP Castle Peak Power Station**

  The entrance for CPPS lies at the transition between the Southern Access Road and the Lung Mun Road and at the east end of narrow corridor with high rock overhangs. The entrance has about 600 entries/exits daily, of which about one-third is private cars, vans, and other small vehicles. The remainder is one-third coaches and buses and one-third lorries, trucks, and other heavy vehicles. Increasing refuse truck traffic will further delay or congest movements in this corridor and around the entrance. Similarly, additional LTPS road traffic will further increase congestion.

- **Lung Mun Road**

  Road delivery of LTPS construction workers and equipment, materials, and supplies can only reach the LTPS site by way of the Tsuen Wan-Tuen Mun Dual Carriageway and the Lung Mun Road which extends to and passes the site as the Southern Access Road. All through traffic will pass along this road through Tuen Mun via several signal controlled, but currently congested road junctions. Heavy truck or worker buses will add to the existing congested circulation at these junctions. The Southern Access Road and attendant domestic refuse hauling will directly increase traffic levels along Lung Mun Road in Tuen Mun and Area 38 and the road between CPPS and the WENT Landfill.

- **Area 38**

  Area 38 development may result in decreased heavy truck traffic as the relocation of existing container storage areas with high truck traffic will be replaced with other uses depending more upon marine transport.

8.3.2 Marine Transportation

The location of Black Point permits ocean-going vessels to deliver directly to the site. However, the same access also allows local marine transport to pass through or across the area between river ports in Guangdong, Shenzhen, and Hong Kong. The Tsang Tsui Quarry transports seawall and fill materials along the Deep Bay channel and Urmston Road. As indicated below, the WENT Landfill is planned to receive barge-borne solid waste which requires refuse barges and tugs to pass Black Point at least five roundtrips per day.

It has been assumed that, in keeping to the main river channel, ocean-going ships passing through the Ma Wan Channel will also pass the Black Point site. In any event, the Ma Wan channel is the narrowest part of the deep water channel and consequently, any adverse impacts might be expected at this point.

Marine Department recorded approximately 2,000 ocean-going ship movements in 1988, of which 550 were by vessels passing to CPPS or other ports on the south new territories coast. The remaining 1,450 movements were by ships of between 300 and 5,000 dwt going to and from the PRC. It appears, therefore, that the busiest point of the Ma Wan channel is also the narrowest point, and that ocean-going traffic decreases with distance westwards.

Data regarding smaller craft such as river trade vessels, ferries, tugs, lighters and fishing vessels are not recorded by Marine Department. For PADS studies, however, the number of small vessel movements in 1988 was estimated at 201,000 of which:

- 109,600 were river trade vessel movements;
- 36,600 were ferries on the Central/Tuen Mun Service;
- 34,400 were ferries to and from the PRC;
- 20,400 were small vessel movements.

These figures imply that at least seventy per cent (or 144,000) movements continue westward of Tuen Mun and round to Black Point, with an average of 395 movements per day. Assuming that much LTPS construction marine traffic will originate at Tuen Mun, it is against a background level of 395 small vessel movements and 4 large vessel movements a day that site generated traffic should be assessed. In the event that construction traffic originates elsewhere it should be considered against a higher background number of vessel movements.

The PADS plans call for marine industrial development along the entire shore from the Tuen Mun Ferry/LRT Terminal, through Area 38, past Lung Kwu Sheung Tan and the LTPS, and northeast past Yung Long to the WENT Landfill. At this time, only Area 38 development has been the subject of detailed analysis and may be under construction at the same time as that for the LTPS. The waterfront development for Lung Kwu Sheung Tan is assumed to occur after completion of the LTPS Phase 1 facilities (2000); the marine facilities northeast of LTPS are assumed not to be in place until after 2005 and thus completion of most Phase 2 construction.

Chek Lap Kok Airport and North Lantau

Construction of the airport and its transportation corridor will involve a massive marine operation for dredging and reclamation vessels, transport of dredged sediments and reclamation fill, transport and disposal of construction wastes, and conveyance of workers to and from the site. This marine traffic will use the Ma Wan and Brothers channels and Urmston Road for access to and from, the South Cheung Chau disposal site, Tuen Mun Terminal (and perhaps Shekou Terminal), and the WENT Landfill (and perhaps the CLP ash lagoons). These vessel movements will occur at the same time as the Phase 1 LTPS vessel traffic and will aggravate the congestion in the Brothers and Ma Wan channels.

8.4 Assessment Criteria and Requirements

8.4.1 Recognized, Designated, and Significant Features

Various government reports have indicated concerns regarding the transport congestion in the Tuen Mun Terminal area. No restrictions (e.g., limiting heavy truck operating periods) have been imposed to date on traffic in the area.

No restriction has yet been placed on use of the Southern Access Road. A double uncontrolled junction has been located in Lung Kwu Sheung Tan for access to either side of the road. Navigation warnings (e.g., lights, buoys, and horns) and patrols will be required during marine construction both for project coordination requirements and to prevent others from interferring with or jeopardising construction operations.

8.4.2 Transport Requirements

Transportation requirements generally focus on transporting workers to the work site, most likely by buses from the Tuen Mun Terminal.

Flagmen generally govern trucks accessing carriageways (i.e., from the site to the South Access Road).

8.5 Significance of Impacts

8.5.1 General

Assessment of the significance of potential road traffic impacts has considered likely increases in congestion at the Lung Mun Road intersections in Tuen Mun and possibly at Southern Access Road junctions within Lung Kwu Tan and Lung Kwu Sheung Tan. LTPS construction will contribute some traffic load to these roads but it is considered that significant impacts can be avoided either by scheduling or by use of marine transport whenever possible.

Assessment of impacts concentrates on those from the construction of Scenario I facilities which is likely to feature major marine activities and large demand for labour and supplies delivered by sea or along Lung Mun-Southern Access Roads. The significance of impacts from Scenario I construction would be substantially increased during the Phase 2 construction period, since operational traffic (5-10 ROTs per shift change) would be added to the construction traffic (maximum 30 ROTs per hour).

The Transport Department is conducting further analyses of the overall traffic congestion and should provide an overall improvement plan incorporating the requirements of the WENT landfill, CLP, and the future PADS development.

8.5.2 Road Traffic

Vehicle trip generation has been estimated for various construction stages during Phase 1, and the maximum traffic loading during simultaneous foundation, structural fabrication, and equipment installation in 1994-1997. Since most construction traffic would be heavy goods vehicles and buses, they will generally be of similar mode to those on the road and therefore will not significantly change modal mix. Any traffic increase could intensify congestion in southern Tuen Mun and at various points along the Lung Mun and Southern Access roads. Since junction congestion is recognised to be significant, several mitigation measures can be employed by CLP for the LTPS construction.

General increases in traffic in the Tuen Mun Terminal area and south Tuen Mun should not significantly increase road congestion, although significant congestion is expected to occur with or without the LTPS construction contribution. The highest traffic loading from construction at LTPS will only contribute about 10% to total flows and does not represent a significant change to road loading compared to the operating traffic load of CPPS, the China Cement Works, and existing Area 38 uses. Any contribution to the congestion at intersections in southern Tuen Mun could be mitigated easily.

8.5.3 Marine Traffic

Marine traffic for construction of the Scenario I would generate a maximum daily traffic of about 10 vessel ROTs along Urmston Road for five years. The significance of this marine traffic is increased during dredging operations in Phase 1, when possible congestion at the Black Point channel may occur between various public transport requirements, refuse barge traffic, and LTPS vessel operations. Such operations requires the regulatory review and approval of an enforceable plan for local marine transport, dredging operations, and movement of dredge spoil vessels to the Cheung Chau disposal site or other closer sites if available.

In view of the existing marine traffic levels (V2/8.3) and likely worst-case LTPS traffic generation it is not considered that LTPS related marine construction traffic will constitute a significant impact in itself. The figures indicate a maximum increase of 5% on current vessel movements.

8.5.4 Concurrent Construction Traffic

Following completion of Phase 1 (Scenario I) construction and initial operations of the LTPS, Phase 2 construction will start in 2001 and will add some traffic to the normal operations traffic loads. During this Phase 2 construction period, other projects will have been implemented or scheduled and may increase both construction (Lung Kwu Tan shoreline industrial areas) and operations (Area 38) traffic on the South Access–Lung Mun Road.

Present intersections in south Tuen Mun and around the Tuen Mun Ferry/LRT Terminal will have by then exceeded their capacities, especially if Area 38 development is fully successful and Lung Kwu Tan development proceeds.

8.6 Mitigation

Several mitigation measures will be implemented during construction to reduce the intensity, duration, and significance of impacts on maritime and road transport to acceptible levels.

8.6.1 Project Measures

Primary transport effects will occur in the the vicinity of the Black Point site and appropriate mitigation measures can be summarised as follows:

- **Road Traffic**
  - Marine transport of equipment, and materials will be used wherever practical;
  - Bussing for employees;
  - Scheduling deliveries to avoid peak hour periods where practicable;

- Colour–coding signs and striping for construction vehicles;
- Controlled junctions and prominent signs on Southern Access Road approaches;
- Paving and turning/stacking lanes on the main road; and
- Entry controls and adequate stacking and parking lanes off the main road.

o **Marine Traffic**

- Navigational controls.

8.6.2 Other CLP Facilities (Castle Peak Power Station)

CLP transport can be coordinated between CPPS and construction of the LTPS (and later concurrent construction and operations at LTPS). The CPPS entrance should be reviewed and possibly revised in order to anticipate increased cross traffic to entry and exit from CPPS, especially for increasing refuse truck traffic from the WENT Landfill.

9. ECOLOGY

9.1 Introduction

Consideration of the ecological effects of construction includes both the terrestrial and marine environments.

The natural vegetation of Hong Kong is sub-tropical. The north west New Territories includes a number of important ecological areas, such as Mai Po SSSI and other sites in the Deep Bay area. In general, however, the western side of the Castle Peak Firing Range including Black Point is not particularly rich in floral and faunal communities, probably due to the steep terrain, thin topsoil and exposure to winds. The vegetation cover on the hillside consists predominantly of grasses with more shrubs and trees in the valleys. In the mid-level area, the natural vegetation pattern is greatly disrupted by the on-going construction activities for the roads associated with WENT landfill, the NWNT sewerage scheme and the excavation of fill materials from the Government Borrow Area.

The vegetation pattern in the Black Point area is illustrated in Figure V1/3.7(a). The annex V1/F also contains a detailed description of the general terrestrial community at the area. In summary, the vegetation features:

o Black Point headland	–	the southern face is scattered with barren boulders with sparse grass patches and shrubs at the seashore edge;
	–	the northern face has more luxuriant grasses and more vigorous shrubs.
o Yung Long	–	dense shrubs, some small woodland areas with areas of cultivation at the rear of the beach.
o Lung Kwu Sheung Tan	–	traces of cultivated fields at the back of the beach and orchards inland;
	–	vegetation pattern disrupted by construction works.

The marine hydrology and ecology of Deep Bay and Urmston Road have been considered in a number of studies:

- Deep Bay Integrated Environmental Management study[1].
- Deep Bay Guidelines for Deep Bay Reclamation and Drainage Works[2].
- The Tin Shui Wai Development[3].
- The North West New Territories Sewerage Scheme[4].
- PFA Disposal to Ash Lagoons at Deep Bay[5].

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1 ERL/EPD (1988) Deep Bay Integrated Environmental Management Study.

2 ERL/EPD (1990) Deep Bay Guidelines for Dredging, Reclamation and Drainage Works.

3 Binnie and Partners (1985) Tin Shui Wai Development: Environmental Impact Assessment of Land Preparation Aspects, Final Report.

4 Mott MacDonald/TDD (1989) North West New Territories Sewerage Scheme. Environmental Assessment Final Report.

5 ERL (1985) Castle Peak Power Station PFA Disposal Lagoon at Tsang Tsui and Associated Works.

Additional marine ecology studies, in the form of seasonal surveys are underway to supplement the baseline data for the Black Point area. Initial survey results are summarised in V1/3.8 and presented in Annex V1/G. A number of shore and marine surveys are being carried out. Surveys of the rocky and sandy intertidal shoreline are being conducted in summer and winter, whilst fish surveys are being taken seasonally. The results of the first surveys are summarised in V1/3.8 and presented in detail in Annex V1/G.

9.2 Terrestrial Ecology

9.2.1 Potential Sources of Impacts

In view of its relatively poor ecological communities, (summarised in V1/3.7) the conservation value of the Black Point area is considered to be limited. Nevertheless, the construction of the LTPS will inevitably remove the natural floral community on the site which may contain individual plant and animal species of ecological interest. Construction activities, especially those producing airborne dust, will also introduce additional stress to the terrestrial community nearby, by reducing the photosynthetic rate. This may provoke changes in the faunal community if it forces grazing animals to look for food elsewhere.

Specifically, the following activities will have direct or indirect impacts upon the vegetation and wildlife of the project area and the immediate vicinity.

- o *Direct losses* will occur as a result of access, clearing, excavation, filling and other civil works.
- o *Disruption and disturbance* will arise from blasting, rock-crushing, piling, hauling, erection and installation activities which will produce a combination of noise, dust, odours and intrusive lighting.
- o *Indirect effects* from dust and exhaust emissions and sediment runoff.

These activities will have the greatest impact during 1992 – 1993 when most of the site will be cleared of all existing vegetation and dependent wildlife. Later activities will create adverse effects from disturbance, disruption of movements and indirect ecological effects via reduced vegetation production. These activities will be most important within 100m of the site boundary and generally west of the Southern Access Road.

9.2.2 Statutory Criteria/Requirements

This section will assess the impacts due to the LTPS construction under the following assessment criteria:

- o Statutory Criteria/Requirements: Removal of protected species under HK Government Ordinances. The items of legislation relevant to the protection of wildlife and vegetation are:

  - Wild Animals Protection (Cap.170) Ordinance 1980;
  - Forests and Countryside (Cap.96) Ordinance 1984 and Regulations 1984;
  - Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187).

  Under the Wild Animals Protection Ordinance, designated wild animals are protected from hunting, whilst their nests and eggs are protected from injury, destruction and removal.

A list of plants is designated for protection from destruction, injury or removal under the Forests and Countryside Ordinance. The main purpose of the Ordinance is to protect the gazetted plants from large scale harvesting for commercial purposes rather than to preserve individual examples of rare species. In fact, many of the designated plants such as orchids are commonly found on Hong Kong hillsides.

The purpose of the Animals and Plants Ordinance is to restrict the import and export of scheduled species, the population of which has been declining in Hong Kong or in other areas.

- removal of rare vegetation which is of scientific interest, although it may not be gazetted;
- loss of important animal habitats due to the direct disturbance (physical removal) or indirect disturbance (upsetting the ecological balance) of the site;
- removal of 'Fung Shui' woods which are not only of ecological but also cultural importance (refer to section 12 Vol 2);
- a retarded photosynthetic rate due to the deposition of airborne dust on surrounding vegetation.

It should also be noted that CLP intend to reinstate cut slopes at the site and to provide tree planting on the hillside within the site. This will provide an opportunity to recover both the visual and ecological resources to a certain extent.

9.2.3 Significance of Impacts

Assessment of the significance of ecological impacts associated with the LTPS construction works under the mentioned criteria requires detailed information of the species composition within the site. Species lists for specific areas are not usually available in Hong Kong, unless an intensive ecological survey at the area of interest has been performed in the past. There are no known records of ecological surveys of any kind at Black Point and Yung Long. In view of this, a baseline survey is being carried out which covers two seasons, winter and summer. The winter survey was completed in January 1991 and the summer survey is scheduled for completion in July 1991. The study area covers the LTPS site and its immediate surrounds and access road. A description of the ecological habitats and floral list for the first season survey is also presented in the Annex V1/F.

The first season survey established that the coastal flatlands at Yung Long and Lung Kwu Sheung Tan do not have native woodland or shrubland and that the few trees are all planted and mostly exotic. Land that is not currently cultivated is covered in a varying mixture of native and exotic weedy species. The exotics – a curious mixture of species of American (e.g. Agave vivipara, Lantana camara, Mikania micrantha, Opuntia stricta) and African (e.g. Crassocephalum crepidioides, Rhynchelytrum repens) origin – are signs of continued disturbance. At the rear of the beach there is an admixture of native coastal species, such as Hibiscus tiliaceus and Scaevola sericea.

The grassland at Black Point headland has plant species similar to other areas such as Chek Lap Kok. It is dominated by Ischaemum spp., Arundinella setosa, Eulalia speciosa, and Cymbopogon tortilis, with a varying admixture of Rhodomyrtus tomentosa, Eurya japonica, Rhaphiolepis indica and other shrub species. The fernland consists of almost pure stands of Dicranopteris linearis. The shrubland patches are very varied. The commonest species, in addition to Rhodomyrtus, Eurya and Rhaphiolepis, are Baeckia frutescens, Embelia laeta, Litsea rotundifolia, and Melastoma sanquineum, with the climbers Alyxia sinensis and Gnetum montanum. In one small area, Aporusa chinensis, Bridelia tomentosa, Cratoxylum cochinchinense, Schefflera octophylla and Sterculia lanceolata form a low woodland.

This type of vegetation is an unpromising habitat for mammals, other than the common hillside rat. However, two civet species, Paguma larvata and Viverricula indica (Nick Goodyer, pers. comm.) may live in the shelter of boulders on the headland. Traces of droppings of pangolin (Manis pentadactylia) have also been found in the area.

The habitat available is unlikely to support any of the rarer animals species, which require wetlands or woodland. The rocks on the north face of the headland have been used in the recent past as a roost by a large flock of sea-birds, probably cormorants, but such roosts are not unusual in rocky coastal areas near Mai Po.

Given the species information provided by the survey and considering the criteria presented in 9.2.2, the significance of ecological impacts at the Black Point site can be summarised as follows:

- **Rare and Protected Plant Species**

  No species of plant or animal found in the area to be developed is rare or endangered in Hong Kong. However, several species are protected under current legislation. Gardenia jasminoides is protected under the Forestry Regulations (Cap. 96, section 3) while Phoenix hanceana is covered by the Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187). Neither species is rare in Hong Kong and the reasons for their current protection are unclear. Similarly, several common orchid species, all of which are protected, are to be expected, but are not detectable in a winter survey. In any case, rare and endangered orchid species are largely confined to wooded upland valleys in Hong Kong.

- **Loss of animal Habitat**

  All birds and all mammals, except rats, mice and shrews, are protected in Hong Kong under the Wild Animals Protection Ordinance (Cap. 170). The pangolin and the two civet species are widespread in the Territory at low densities. All three species will move away from the area once development starts other suitable habitats inland.

- **Fung Shui Woods**

  Fung Shui woods are usually adjacent to local villages and consists of native forest trees. They are purposely planted and protected due to the strongly held Cantonese belief in Fung Shui (good fortune ensured by the favourable location of activities in relation to the elements of the physical environment). Although there is a household at Yung Long, no Fung Shui woods were found during the survey. The area does exhibit some Fung Shui potential, however, in particular the course of a stream between two hills. (see Section V1/2.14)

- **Retarded Rate of Photosynthesis**

  Airborne dust from various construction activities will be deposited on the leaf surfaces of shrubs and grasses within close proximity to the site boundary. This will reduce the light intensity, affect the photosynthetic wavelengths received and thus suppress the photosynthetic rate of the plants. Dependent animals may be affected by a reduced food supply due to the retarded growth rate of the plants and will be forced to move elsewhere. However, the frequent heavy rain in summer will wash away the surface dust and lessen the impacts. Moreover, the immediate area of the site is mainly common scrubland supporting small dependent animals which will be able to migrate to neighbouring grassland areas if necessary.

Although significant in itself, due to the intake of a large piece of land, the area is designated for industrial development under PADS which would mean the loss of the terrestrial ecology of the area is inevitable at some point during the next 5 – 15 year period.

9.2.4 Mitigation of Impacts

Many different site locations and layouts were considered for the LTPS at Black Point (see V2/2.4) Environmental concerns regarding noise and visual impact centred on the need for preservation of a southern portion of the Point. This has provided a buffer between the LTPS and villages to the south. Terrestrial ecological impacts have also been minimised by the balancing of cut and fill to reduce excavation requirements and preservation of "natural" rocky shore environment on the south side of Black Point.

The LTPS development will need to resume the cultivated farm at Yung Long. It is likely, however, that produce from this source will be for domestic or local consumption and its loss will not be significant with regard to agricultural production in the area as a whole.

A way to prevent loss of the gazetted plant species (Gardenia jasminoides and Phoenix hanceana) is to transplant them to other areas, probably AFD's gardens. Both these plant species are quite common in Hong Kong and the reason for protection is probably to prevent commercial harvesting. The removal of plants within the site itself will not significantly affect the occurrence of these plants in Hong Kong. In view of the large number of individual specimens within the site area, it is recommended that only certain specimens, selected on the basis of vigorous growth, are relocated. Alternatively, CLP could introduce the plants into the LTPS landscaping areas or for the restoration of cut slopes.

Birds and mammals will probably escape and seek sanctuary in nearby areas at the initial stage of construction. These mammals rely on the scrubland habitat which is readily available at a higher level on the hillsides and at Mai Po. It is necessary, however, to ensure the site is not enclosed at the very beginning, to allow an escape route for the animals.

In view of the low ecological value of the scrubland nearby, dust suppression at source should provide sufficient mitigation and no additional measures are likely to be required.

9.2.5 Summary

The site exhibits no native woodland or shrubland and thus does not warrant primary ecological value status. It is also unlikely to support any rare fauna, although if present they will have chance to escape during early site activity. There appear to be no rare or endangered plant species on site although two species, Gardenia jasminoides and Pheonix hanceana are protected. Good examples of these species warrant replanting, ideally within the LTPS site.

The summer terrestrial ecological survey will occur in July. Any additional protected species noted will also be relocated.

9.3 Marine Ecology

9.3.1 Potential Sources of Impacts

Marine construction activities will last for more than two years during site formation and the early phases of civil and structural works for Scenario I. Major marine construction activities during Phases 1 and 2 will involve:

- *Phase 1 (1992-1997)*

  - Dredging :

    2500 m for complete seawall base [and seawall berths](50+m wide, 13 ha; seafloor)
    100 m for intakes and outfalls (10+m wide, 0.1 ha; seafloor)
    90 ha for approach channel and turning basin

  - Reclamation :
    75 ha (seafloor; 1000 m of rocky and 600 m of sandy intertidal zone)

  - Jetty Berths (dredging for and placement of caissons)
    800 m (50+m wide, 4 ha; seafloor)

  - Trestle Pilings (connecting landside with jetty berths, Phase 1 Only)
    1200 m (20 m width, 2.5 ha; seafloor)

- *Phase 2 (2001-2008)*

  - Dredging:
    10 ha for turning basin extension (seafloor)

  - Jetty Berth Extension (dredging and placement of caissons,)
    500 m (50+m wide, 2.5 ha; seafloor)

These activities will cause direct loss of marine benthic biota and disturbance to virtually all marine biota both within and adjacent to the dredging and reclamation areas (and jetty berths if used). Underwater noises, propellers and other submerged equipment movements, suspended solids, and induced currents from equipment and vessels will also contribute to impacts. Disturbances by barge and other vessel deliveries will be more frequent and of longer duration than those used during subsequent operational stages and generally contribute to construction disturbances of the local marine biota.

During dredging, reclamation, and equipment deliveries, frequent docking of barges and other vessels along the seawalls will disrupt existing marine circulation in the vicinity of Black Point. Such temporary alterations of marine circulation will in turn alter erosion and siltation rates in the vicinity. Because of the several years of Phase 1 construction, some induced effects of seafloor and shore alterations during the reclamation and dredging will become apparent even before operations begin. These more permanent, induced effects are considered in V3/5.

Marine ecological effects of Scenario I will differ from those of the Scenario II only by the time of their occurrence and some areal dimensions and overall sizes; the sources of impacts will be identical. Effects from Phase 1 construction in Scenario I will be very similar to those of Phase 2 construction of Scenario II. The trestle in both scenarios would be the same, but the jetty berths for a single coal bulk carrier would be shorter than in Scenario I.

9.3.2 Statutory Criteria and Requirements

Assessment criteria and requirements for marine biota can be based largely on the economic value of oysters, other commercial shellfish, and general commercial fin-fisheries. To this must be added the value of more general "biota" or communities that serve to support the commercially valuable species.

The rarity of individual species and communities is often used as an indication of ecological significance or importance; rarity may be officially recognised through regulatory protection, such as for sea turtles and marine mammals, including dolphins. Coral heads and reefs in Hong Kong are recognised as significant because of their sensitivity, rarity and the fact that the community represents the northernmost occurrence of the species.

The commercial value of shellfish (oyster) beds is well-established in the Territory, including Deep Bay. Deep Bay oyster fisheries are recognized in the designation of a Mariculture Subzone within the Deep Bay Water Quality Objectives (WQO), which specifies maximum levels of suspended solids and E. Coli and minimum levels of dissolved oxygen (V2/6). The boundary of the mariculture subzone lies some 3 km northeast of the LTPS site. The nearest other officially recognized mariculture area is at Ma Wan, some 20 km to the east along the Urmston Road.

In considering the significance of these marine ecological impacts it is necessary to consider possible developments in the area under PADS.

Future development plans for the eastern shore of Urmston Road, Black Point, and the southern shore of Deep Bay have assigned much of the shoreline and shallow seafloor to marine industries with reclamation and dredging for maritime service. The gazettal of Marine Borrow areas in Urmston Road and the outer edges of Deep Bay will allow deepening of the seafloor to more than 20m depth (see V1/2.5).

9.3.3 Significance of Impacts

Construction impacts will affect several marine communities:

- Rocky and sandy shore (littoral);
- Muddy, sandy, and rocky bottom;
- Shallow, shelf, channel margin and open water.

The composition of the various communities is presented in Annex V1/G and a summary is presented in V1/3.8.

On the sandy shores a number of common clam and snail species were recorded together with (at Yung Long beach only) a numbers of species of the worm Ceratonereis. The rocky shores also support a number of snail and clam species. The seafloor sampling included a number of polychaete worm species as well as echinoderms such as urchins, starfish and sand dollars. Also present were snails, clams, crabs and shrimps and some fish species. In the open water, jellyfish, crabs and fish were present. Based upon current sampling, no unique or uncommon species were encountered.

Marine ecological impacts occurring as a result of construction are as follows.

- Direct Losses

  Reclamation of the shallows at Yung Long will cause the loss of approximately 120 ha of muddy and rocky bottom communities and loss or displacement of open water, free-swimming communities. Phase 1 seawall construction and reclamation will enclose the entire area and reduce the seafloor by about 90 ha, leaving an enclosed open seafloor of about 25 ha. Although this seafloor will have been disturbed by activities and siltation, the enclosing seawall would allow some tidal circulation into the area and a new seafloor habitat will develop.

- Losses with Replacement

  The existing intertidal community along the north shore of Black Point will be initially eliminated, but a similar community will gradually recolonise the rocky seawall (2500m) around the reclamation area. The relatively smooth character of the existing rocky intertidal habitat will be replaced by a seawall with many crevices and holes between the broken rocks. The rougher character of the seawall will actually improve the habitats for many intertidal and subtidal attached and free-living biota.

  Adverse effects of initial losses of the community will continue for two to four years until recolonisation restores the existing community levels. Recolonising organisms will come from rocky shores to the north-east along Deep Bay and along Urmston Road south of Black Point. Net construction effects will, therefore, be a loss of biotic production for a period of up to four years during construction. During operations improvements in biotic production and diversity at these sites can be expected.

  The existing muddy seafloor ecology will also be affected by dredging for the navigational approach channel and turning basin, totalling 100 ha. Since most of the affected seafloor is at a depth of more than 5 m, the deeper dredged seafloor bottom will be rapidly recolonised by virtually identical species as exist in southern Urmston Road and the Brothers Channel. The loss of biotic productivity represented by the loss of organisms and the absence of their productivity during the recolonising period will be temporary.

- Losses with Alteration

  Construction of the trestle and jetty berths will replace about 10 ha of muddy bottom and open water communities with biota characteristic of rocky bottom and intertidal communities. Pilings and caissons are often considered as benefits when placed in open water and on muddy bottoms because of the improved fish habitat and increased numbers of food species for important fishes. Increased habitat diversity created by the piling and caissons can compensate for direct loss of bottom communities and open water habitat for fisheries. As indicated above, losses during construction and until re-colonisation will be compensated for by benefits during the operational phases.

- Disruption

  Construction and related activity within the marine environment will directly disrupt the normal movement of marine organisms through the primary tidal channel for Deep Bay. Construction of the seawall, cooling water intake and outfall, trestle, and jetty berths and marine deliveries will require movement of vessels and operation of equipment that will cause indirect effects which will drive away many important marine organisms.

Such disruption, like loss of open water habitat, will reduce available habitat and will compress marine biota into poorer habitats and may lead to a decline in numbers or productivity of the disturbed biota. Declines in numbers and productivity will continue for at least three years and could persist for longer depending on the dredging for the final navigational access.

The size of disrupted open water is of particular significance because of its location within the tidal circulation of Deep Bay and probable primary fisheries access to the bay.

The Pearl River Dolphin was seen several times during the winter marine ecological surveys, although previous assessments have not identified the River Dolphin as a species occurring in the area. One existing reference[1] indicates that the northern end of Urmston Road is an area frequently used by the dolphin. During marine ecological surveys, dolphins were observed during the late afternoon moving northward through the northern end of Urmston Road.

The ecological requirements of this sensitive marine mammal are not known and the effects of construction vessel traffic, dredging, and reclamation can not be reasonably estimated at this time.

In considering the significance of these marine ecological impacts it is necessary to consider possible developments in the area. Future development plans for the eastern shore of Urmston Road, Black Point, and southern shore of Deep Bay have assigned much of the shoreline and shallow seafloor to deep waterfront marine industries with reclamation and dredging for maritime service. The gazettal of marine borrow areas in Urmston Road and the outer edges of Deep Bay will allow deepening of the seafloor to more than 20 m depth and. These planned losses and disturbances of seafloor and intertidal zones and associated disturbance increases from maritime traffic will radically alter the entire shoreline, much of the seafloor, and the open water environ adjacent to the LTPS site at Black Point.

Construction of the LTPS at Black Point will have direct adverse effects upon the marine biota of the Urmston Road and Deep Bay communities adjacent to Black Point during the first three years of construction. Later construction activities (excluding final navigation dredging) will have little or no direct effect upon the marine biota. The extent of far field effects, for example upon the mariculture subzone of Deep Bay, is under consideration as part of the Water Quality Key Issue study.

9.3.4 Mitigation of Impacts

Several measures can be implemented during construction to reduce or minimise adverse effects on the marine ecology or to compensate for some adverse effects. Direct losses can not be directly mitigated although some effects can be compensated by improvement elsewhere.

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1 World Wide Fund for Nature (1991) Various reported sightings submitted to and compiled by WWFN for the period Nov. 1990 to Feb. 1991.

- **Direct Losses**

Adverse effects of direct losses could be somewhat reduced by the scheduling of dredging, berth construction, and reclamation to avoid the peak reproductive periods (e.g., spawning, breeding, and spat settlement) which generally occur in the Spring or Autumn. Losses following the peak reproductive season (e.g., Summer and mid Winter) would have less adverse effect than losses before the peak season.

- **Turbidity**

Dredging, seawall and jetty installation, and other open water activities will generate increased turbidity which can be reduced by proper selection of dredging and dewatering methods or treatments. Dredging of the seawall during the peak suspended solids period of the summer would reduce the potential adverse effects of siltation and turbidity. Initial placement and completion of the seawall can limit turbidity effects of reclamation to within the enclosed area which will be lost by reclamation filling. Drainage from the enclosed reclamation area can be treated to reduce discharge of turbid waters. Use of cutter-head suction dredgers reduces the turbidity compared to clam-shell but requires controls on the discharge of entrained sea water.

- **Compensation**

The most important construction effect is the direct loss of open water and bottom communities. Since "new" marine open water environs can not be practically made, "improvements" of existing communities remain the only viable means of compensating for the adverse effects upon natural marine ecology. Habitat improvement for fisheries and general marine ecology is a well-recognised method of compensation; generally the only important question is what kind and how much of habitat needs to be improved to compensate for the losses due to the project.

Basic concepts of fisheries and wildlife management have established that habitat improvement can promote "important" biota and transform existing "poor" or "disturbed" habitats either by elimination of other adverse effects, by increasing the diversity of habitats, and by forming habitats that support specific recognized important species. A typical improvement would involve control of sewage waste discharge to improve an existing polluted marine habitat which would encourage re-establishment and increase in the numbers and diversity of marine biota. Creation of "reefs" and marshes has been proposed throughout the world to increase diversity and to establish habitats which are widely recognized as more significant than a turbulent coarse sand bottom or beach or clay bottom.

Habitat improvements around Black Point and in northern Urmston Road, and western Deep Bay could involve development of "reefs" in shallow (0 to -2m) and deeper (-3 to -5 m) zones (e.g., tide pools along the LTPS seawalls).

Navigational and existing commercial fisheries uses in Urmston Road and Deep Bay would not allow such habitat improvements in areas immediately adjacent to Black Point. Shallow (3-5 m) areas along the west side of Urmston Road (South East Bank north of Lung Kwu Chau to the banks northwest of Chek Lap Kok) lie outside the normal navigational channels and have restricted access because of their proximity to the territorial/provincial boundary. Such areas could be developed for fisheries habitats and would contribute directly to improvement of fisheries within Urmston Road and the eastern Pearl River estuary. Development of marshlands would require greater care since attracted birds could pose hazards to airport operations at Chek Lap Kok.

Other compensatory measures could include the establishment of a Pearl River Dolphin Observatory at the LTPS. A suitable location night be the cut slope, towards the top of the Black Point Ridge. An observation building could be equipped with high-powered binoculars from which suspected diurnal migrations of the dolphin past Black Point could be observed. The World Wide Fund for Nature already operates a dolphin-watch and might be interested in collaboration. The observation post could have educational possibilities.

9.3.5 Summary

The significance of marine ecological impacts can be summarised as follows:

- **Losses**

  The direct loss of the sand beach at Yung Long is of minor ecological significance, while the loss of the intertidal rocky shore is more important. However, the rocky intertidal community will actually be significantly improved by the construction of the rocky seawall into deeper water; the total rocky surface will be increased because of the crevices and cavities between the rocks. The jetty berths and trestle piling will also improve the ecological conditions for intertidal communities.

  Total loss of ecological communities of the shallow seafloor and open water cannot be avoided nor will the direct and continuing loss of productivity be replaced by recolonisation. No significant commercially or scientifically unique communities or species are known or are reported to occur in the area. The loss is thus not considered of particular significance and the fisheries and ecological losses may be compensated by improved habitats and productivity in other similar environs.

- **Disturbances**

  The most significant potential impact upon the marine ecology of the LTPS area is the possible impact of the local losses of foodchain productivity and disturbance of the known habitat for the Pearl River Dolphin. The proposed plans for development of the north and south shores of the Brothers Channel (and the southeasterly portions of Lantau Island), the eastern shore of Urmston Road, and the south shore of Deep Bay and the associated increase in maritime use, may have significant adverse impacts upon the use of these waters by the River Dolphin. Although the LTPS is only one small part of the total development plan, it will contribute to the potential restriction of the Dolphin range and its support.

  Changes in currents and siltation patterns during construction may also disturb fisheries movements between the spawning grounds of Deep Bay and the deeper waters of Urmston Road-Brothers Channel-Ma Wan Straits to the open sea. The extent and significance of these issues will be considered further in the Water Quality Key Issue study.

10. CIVIL AVIATION

10.1 Potential Sources of Impact

The Study Brief (Item 4.5(a)(vii)) requires that the heights of construction equipment be examined in relation to civil aviation in the territory.

Through consultation with various consulting engineering and contracting firms it has been established that the highest construction equipment would be cranes and that the maximum height would be approximately 100m.

10.2 Significance of Impacts

Construction will be taking place at the site intermittently over a long period (from late 1991 to late 2007). From 1991–1997 Kai Tak International Airport will be operational and from 1997–2007 (and beyond) it is planned that Chek Lap Kok will replace it.

Consultations have been held with the CAD and the New Airport Master Plan Study Consultants, with reference to the preliminary interim safeguarding chart prepared for Chek Lap Kok, which indicates that the 100m cranes would not penetrate any of the obstacle limitation surfaces associated with Chek Lap Kok airport.

11. SOCIO-ECONOMICS

11.1 Introduction

Any socio-economic effects resulting from the construction of the LTPS will be the same for either Scenario I or II. Construction will take place as and when new units are committed in response to forecast electricity demand. This will mean waves of construction over a period from late 1991 to 2008.

This section identifies and assesses likely socio-economic effects resulting from the construction activities. The word 'impact' usually has a negative connotation in environmental assessment. However the socio-economic impacts can be good rather than bad and the term as used in this section applies to either.

The choice of Black Point for the LTPS minimised the potential for adverse socio-economic impacts due to the low population in the vicinity and the small scale of agricultural, fisheries and recreational activity.

11.2 Potential Sources of Impact

The sources of potential impact are:

- the influx of construction workers;
- spin-off employment;
- land acquisition;
- noise and dust pollution.

11.3. Significance of Impacts

11.3.1 Influx of Construction Workers

Up to 3,000 people are needed to construct the LTPS. If a permanent work camp were to be established at or near Black Point this could have potentially negative effects on the small population in the vicinity. However, no work camp will be established. All the construction workers will be transported to the site each day by buses, provided by the contractors and will leave the area the same way at the end of their shift; some senior personnel may travel to the site by car or CLP mini bus from the Castle Peak site or from east of Tuen Mun. The influx of construction workers will thus have no negative local socio-economic consequences.

As far as the wider economy is concerned, the LTPS project will clearly provide many construction jobs over a long time period. Some of the wages earned by the workers will be spent in Hong Kong on goods and services, which will be beneficial to the territory's economy. Some workers may come from outside the territory (typically from Third World Countries) and the remittances sent to their families will in turn benefit the economics of their home communities.

11.3.2 Spin-off Employment

The presence of the construction site will necessitate the provision of a wide range of goods and services which will generate spin-off employment and inject project funds into the economy of Hong Kong and to a large extent the major new towns of Tuen Mun, Yuen Long and eventually Tin Shui Wai. Examples of this employment are:

(i) Services for employees

- marine transport;
- catering supplies;
- medical care;
- entertainment;
- accommodation.

(ii) Goods and services for the site

- vehicle and plant maintenance/hire;
- road transport;
- construction supplies; aggregate, cement, re-bars, shuttering, fuel oil, steel work, cladding, paint etc;
- tradesmen; carpenters, electricians, crane operators, welders, scaffolders etc;
- materials recyclers; rock fill, wood, nails, plastic, paper and board, lube oil;
- site office supplies;
- landscape contractors.

If the bay to the south of Black Point is reclaimed for Deep Waterfront Industry and a Cargo Working Area, during the period of its construction and the establishment of industries on it, the local demand for these goods and services will considerably increase possibly leading to enhanced profits through economies of scale.

11.3.3 Land Acquisition

The impact of land acquisition on local communities would be very slight. The only location to be affected is Yung Long. This is a hamlet of a few dwellings, with some attendant cultivated land, which lies wholly within the preferred site layout envelope.

The settlement at Lung Kwu Sheung Tan consists of about 20 scattered huts among cultivated land. It is not encroached on by the preferred site layout envelope and will be sheltered by the Black Point ridge. If the PADS development for Deep Water Front Industry goes ahead however the settlement would possibly be relocated.

11.3.4 Noise and Dust Pollution

It is a feature of many projects that nuisance from noise and dust pollution can reduce the value of property during the construction period. Where that period extends over many years this would be a serious problem. In the case of the Black Point LTPS, a site has been selected which is sufficiently far from large numbers of people not to cause a significant problem of this kind.

The Noise Assessment (see Section V2/5) indicates that depending on the scheduling of the works, some night time disturbance may be caused during the marine works for the LTPS, but this is unlikely to significantly affect property values in the Black Point area.

The Construction Air Quality Assessment, (Section V2/4) also indicates that dust nuisance will not arise at properties in the vicinity of the LTPS site.

11.4 Mitigation Measures

The construction phase of the LTPS project will result in economic benefits in Tuen Mun/Yuen Long, the territory and in guest-workers home countries. Although these benefits will be very minor at a macro level they would benefit individual people and companies involved considerably. Clearly these positive impacts need no mitigation.

To the very limited extent that several dwellings in the immediate vicinity of the site will have to be relocated mitigation will take the usual form of negotiated compensation.

12. CULTURAL HERITAGE AND FUNG SHUI

12.1 Introduction

The Site Search Report for the LTPS identified Cultural Resources as a category of potential impact, and sites were reviewed for their cultural resources. The presence of archaeological resources were indicated near Black Point.

The Black Point landform and location is an area of past and existing cultural interface between the Pearl River and the South China Sea. Historic fisheries resources of Deep Bay, the deep water channel of Urmston Road, access to Hong Kong, and locally available freshwater and arable land form a basic framework with the potential for important cultural settlements and their physical remains.

The northern slope drainage of Black Point will be radically altered by construction for site access and support facilities. Drainage alterations will affect the Fung Shui of the area and will impact on possible subsurface archaeological resources. Construction excavation and reclamation will remove most vegetation on the northern slopes of Black Point and such losses will alter the Fung Shui within and perhaps beyond the LTPS site. Mitigative preservation of the ridge line, the existing rock/vegetation texture of the southerly slopes, and the pastoral-rural landscape of Lung Kwu Sheung Tan will maintain Fung Shui to the south of Black Point, although this will be affected by PADS development in any event.

Black Point forms the westernmost headland in the New Territories and demarcates the Pearl Estuary from the ocean waters to the south and east. Similar rocky outcrops in Hong Kong have historic rock carvings and inscriptions. At present no rock arts are known of on Black Point but such absence may reflect lack of adequate investigations. Presence of large rock outcrops (as seen from distance points and aerial photos) indicates a potential for rock arts on Black Point. However, thick groundcover makes access difficult and obscures rock faces from view.

12.2 Potential Sources of Impacts

12.2.1 Construction impacts upon cultural resources are expected to be more significant and direct than those occurring during LTPS operations. The extensive earthworks required for the proposed site form the major source of potential impacts upon cultural resources and the Fung Shui of the area.

Losses of potential historic and archaeological resources may result from the following construction activities:

- site clearing of vegetation, soil and soft rock,
- mass excavation of the lower northern slopes of Black Point ridge,
- trenching for pipelines, drainage facilities, and structural foundations in sediments and soils beyond the excavation areas.

Any earthworks has potential for impact upon cultural and traditional resources and the impact can be defined by the area of activity rather than the volume of the earthwork involved. Within the LTPS site, cultural and traditional resources are not uniformly distributed nor are they uniformly documented. Once clearing and soft ground excavations are complete, continuing drilling, blasting, and rock excavation will not significantly affect any cultural resources. The resulting final landform and structures, however, are likely to significantly affect the Fung Shui of the site and surrounding areas.

The total impact from either Scenario is likely to be similar, however the phasing of the two Scenarios will affect the times at which impact will occur. In Scenario I, the main site of interest (see V1/2.14) may not be affected until Phase 2 whereas with Scenario II, the most important areas will be affected during Phase 1 construction.

Notwithstuding the above, construction of the LTPS at Black Point may also result in positive impacts in archaeological terms, by providing an opportunity to investigate remains which would otherwise have remained unknown.

Landform and drainage activities will also change the Fung Shui of the site and surrounding areas during construction. The wide variety of construction activities required during earthworks, foundations/structure construction, and area restoration, is likely to affect the Fung Shui throughout the construction period. Perimeter zones and entry areas will be restored and landscaped to reduce visual effects in their immediate vicinity, affecting the Fung Shui during the later period of the construction phase.

12.3 Assessment Criteria

The government, through the Antiquities and Monuments Office (AMO), has recognised several archaeological and historic locations within the Lung Kwu Sheung Tan area and Yung Long and is likely to require an "adequate" conservation program, (e.g., salvage removal of representative samples, preservation through design, and relocation).

With regard to burial sites; graves should not be removed from designated burial areas, whilst for burials in undesignated areas, permission is required from the District Office before relocation. Notice should be posted on the grave in order to inform decendants or owners of the intention to remove the site. The owners will then contact the District Office in order to arrange compensation and relocation. If it appears that the grave belongs to no-one then relocation to a government burial ground is likely to be recommended.

12.4 Effects on Archaeological Resources and Fung Shui

12.4.1 Archaeological Resources

The effects of LTPS construction upon archaeological resources are summarised in the following listings in terms of comparisons between estimated resources and the possible extent of recovery:

- **Resources which could be Affected:**

  - Yung Long : 25% of volume with significant remains or 25,000m^3
  - Lower Black Point slopes : 10% of volume with significant remains or 25,000m^3
  - Ridge lands : 35 features
  - Access road and drains : 10% of volume with significant remains or 200m^3
  - Yung Long subtidal areas : 25% of volume with significant remains or 15,000m^3
  - Seawall and dredged areas : 10% of volume with significant remains or 11,000 m^3

12.4.2 Fung Shui and Locational Cultural Resources

Initial project layouts have been reviewed by the local Fung Shui specialist and were modified to reduce the assessed adverse effects.

12.5 Significance of Impacts

The future plans for the entire northwestern shoreline of the New Territories have been indicated by the PADS studies. These plans entail the development of industry close to the shore with supportive infrastructure and residential developments located on the landside of the industries.

Of particular relevance are PADS plans for port facilities between CPPS and Black Point and river-related maritime industries between Black Point and the Tsang Tsui lagoons. In addition, the Area 38 reports[1] support the eventual construction of a double- or triple-laned dual carriageway extension up to the entrance of the China Cement Works. Such future developments will radically change the general setting of the area and will affect the cultural resources, and the value of any mitigation measures for the Fung Shui at the LTPS site on Black Point may be diminished. It is against these possible developments that impacts should be considered.

Adverse impacts to cultural resources on Black Point and its immediate surrounding area will occur during the construction phase but may not be significant. The final degree of impact is linked to the opportunities for mitigation. The adverse effects will largely involve unrecovered archaeological resources. If sufficient time is available and investigative digs are carried out in the appropriate way (see V2/12.5), significant recovery of materials and collection of information can be made. Previous mitigation plans have been regarded as adequate when less than 10 percent of the specific areas have been salvaged.

12.6 Mitigation

Archaeological effects may be mitigated by archaeological salvage programmes, and monitoring prior to construction and also by recovery during construction. Some landscaping and site restoration features will lessen any adverse effects upon the Fung Shui of the area.

Thorough documentation of known or suspected historical, archaeological and other cultural resources within the LTPS project site and along access routes will greatly increase knowledge of the cultural heritage in the area and allow improved assessments and mitigation. Examination of submerged resources may also contribute knowledge regarding early settlements in Hong Kong.

Improved information and recovery methods for salvage operations in construction sites will also contribute to future cultural conservation.

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1 Scott Wilson Kirkpatrick, ERL (Asia) Limited (1990) Expanded Development Study of Tuen Mun Area 38.

12.6.1 Historical Resources

No historical resources have been identified on the LTPS site and, therefore, no specialised mitigation is required. A few residential and agricultural structures are present at Yung Long but not of a value likely to warrant preservation. Some documentation and inspection should be undertaken for the three structures and components in the proposed site area (especially their door jams and lintels before and during their demolition).

During site clearance, interviews with local residents and photographic records of surrounding structures should be made in order to document historic uses of the area. No further historic mitigation should be required. If during land clearing, historic foundations or burial grounds are encountered they should be preserved, protected, or mitigated as indicated by the archaeological mitigation programmes or as required by laws pertaining to human burials.

12.6.2 Archaeological Resources

Significant archaeological resources are known to exist within the projected construction areas, or immediately adjacent to them, and significant adverse effects will occur in the absence of mitigation.

The following outlines a mitigation plan which would mitigate the potentially adverse effects of LTPS construction. Once construction plans are finalised, a detailed mitigation programme should be prepared and approval sought from the AMO.

- **Pre-Construction Exploration**

  During site investigations, all borings and shallow exploratory excavations should be reviewed by experts in order to identify any subsurface indications of archaeological occupations. Surveys requiring clearance of vegetation should also include inspection of exposed rock surfaces and soils for indications of rock arts and other archaeological features.

- **Resources Delineation and Inspection**

  Initial LTPS site layouts should be reviewed following detailed site surveys and any extensive excavations for infrastructure or seawall trenches across dry or submerged alluvial sediments be evaluated for possible impacts on buried cultural resources. Prospective archaeological resources within the LTPS site and associated access and drainage routes should be defined for further study. Priority should be allocated to the various resource areas based on a consideration of:

  - Forecasted excavations for the site vicinity (potential for impact).
  - Estimated depth/thickness/extent of occupational layers.
  - Additional site inspections.

  Site inspections may involve a trial trench of 1m x 1m or 1m x 2m and potholes together with hand-augered bores to depths of excavation. Data from these excavations would be used to assess the value and define the anticipated perimeters of significant resources. If an area or feature is deemed to be of sufficient value or importance, or if the entire resource would be destroyed by LTPS construction, more controlled excavations or explorations be undertaken for further analyses.

A soil testing programme should be developed for various representative construction areas to ascertain the general character and significance of remains in various locations to be removed or substantially altered by construction. Testing of about one or two percent of the high potential areas should be adequate to characterise the resources.

- **Resources Salvage**

Salvage would involve representative (random or regular) sampling (1–20%) of an occupation or feature for the purposes of recording general archaeological information about the resources. Salvage is not "full" (80–100%) controlled excavation of the site, although later salvage during construction may involve recovery of large artifacts and photographic documentation of some features.

Rock inscriptions and carvings could be relocated within the protected landscaping of the project as part of the salvage.

Because of construction scheduling and land acquisition, later salvage shall be conducted in concert with mobilization of initial contractors (use of some contractors' equipment could be included in their contracts).

- **Full Resource Protection and Recovery**

If an area is considered by CLP as vital to the facilities layout and requires foundation excavations, then some sites may be considered by the AMO to require full excavation.

- **Conservation and Storage**

Proper conservation and storage of resources include the preservation, curation, and storage of the recovered remains in a suitable institution. It may be possible to establish a limited exhibition of finds at the LTPS site; but these tasks are principally the responsibility of the AMO.

The Antiquities and Monuments office with the assistance of CLP carried out detailed archaeological investigations of their site at Penny's Bay on Lantau, prior to construction of their new gas turbine plant. The excavations yielded significant finds which culminated in an exhibition at the Museum of History in Kowloon Park. Similar exhibition of representative remains discovered at Black Point, if warranted, would be a significant contribution to archaeological knowledge and would serve to stimulate further interest in the subject area.

The on-site presence of a local expert, or awareness amongst the workforce of the form of rock-arts will increase the likelihood of any such resources being noted during initial site clearance. Rock art discoveries should be photographed for record; CLP may wish to preserve any suitably sized rocks for siting within landscaped areas of the new LTPS.

12.6.3 Fung Shui

Whilst Fung Shui to the north of Black Point will be significantly affected, it should be noted that location of the site to the north of Black Point and preservation of a substantial portion of the ridge will do much to minimise Fung Shui losses for areas to the south of Black Point.

Adverse effects upon the Fung Shui aspects of the LTPS will be avoided where possible and accepted if impractical to mitigate. Further review of the secondary adverse effects on the surrounding areas will require additional surveys and inspection to develop an acceptible mitigation programme for the residents and clans affected in Lung Kwu Sheung Tan.

Special efforts will be focused on the contractors' and the LTPS site entrance areas and possible drainage facilities in the area south of Black Point ridge crest. Entry layouts will be modified to minimise adverse effects on the local area. Since only the stacks will be generally apparent to residents and visitors to the south of Black Point, selective landscaping and planting will be used to mitigate visual and recreation amenities and either to reduce adverse or improve remaining Fung Shui elements south of the ridge crest.

13. RECREATIONAL AND VISUAL AMENITY

13.1 Introduction

The prevailing character of the area is typical of Hong Kong, comprising a combination of long seaward views, prominent terrain and an indented coastline. Urban influences are confined to views of Shekou, which lies some 8 km to the north across Deep Bay. The New Town of Tuen Mun lies about 7 km to the south-east, affected by the "visual shadow" of the intervening Castle Peak Range, and hence does not have views of the site. The New Town of Tin Shui Wai lies some 13 km to the north-east of the site; a distance over which any visual impact is likely to be dissipated by atmospheric conditions.

The coastlines north and south of the site vary substantially in their landuse character. To the north, beyond the existing ash lagoons, it is characterised by traditional rural settlements set in gardens and Fung Shui woodland. The lagoons, which have reclaimed a large section of the shoreline, represent one of several industrial intrusions which continue to the south of the site, including quarries, port activities, a cement works and the CPPS.

The amenity value of the Black Point area is low, with industrial developments such as the Tsang Tsui ash lagoons immediately adjacent to the site, CPPS to the south, and the Castle Peak Firing Range to the east, tending to discourage recreational visitors.

13.2 Sources of Impact

The main sources of impact to the recreation and visual amenity arising from the LTPS construction activities are:

- The excavation of the northern flank of the Black Point promontory; leaving cut slopes around 100m in height on the northern side and the removal of weathered material from the ridge crest;

- The infilling of the bay between the tip of the Black Point promontory and the Tsang Tsui ash lagoons, including the loss of Yung Long beach;

- The erection of the power generating blocks and ancillary buildings averaging 35-78m in height for coal-fired plant, or 25m in height for combined cycle gas turbine units.

- The erection of exhaust stacks around 250m in height, one for each pair of coal-fired units, i.e. a total of 4 stacks for Scenario I, 2 stacks for Scenario II, (the exact height of the stacks must await the outcome of the Key Issue Assessment on Stack Emissions).

- The temporary installation of tower cranes up to 100m in height, and the movement of other construction plant within the site.

- The possible provision of a trestle jetty extending upto 1,800m west from the tip of Black Point, with a vessel berth about 750m long at its seaward end.

13.3 Sensitive Receptors

The principal sensitive receptors of visual impacts associated with construction of the LTPS are the inhabitants of the two coastal fringe settlements to the south of Black Point; Lung Kwu Sheung Tan, (about 1km to the south of the Black Point promontory) and Lung Kwu Tan, about 3km to the south of Black Point. Lung Kwu Sheung Tan has a current population of about 65, and Lung Kwu Tan has about 800 inhabitants. Both of these settlements, however, will be substantially shielded from the LTPS by the southern face of the Black Point promontory; Lung Kwu Tan will be further shielded by the 70m high rock outcrop immediately to the north of the village.

Shekou in the PRC may also be able to view the site, although this will be from a distance of some 8 km across Deep Bay, which, given seasonal constraints on visibility due to haze and low cloud at coastal locations, would be the typical maximum viewing distance for the area.

To the north of Black Point, the site will be visible from the Nim Wan Road between Ha Pak Nai and Sheung Pak Nai although these views would be from some 4–5km distance and the LTPS would be seen in the context of the neighbouring Tsang Tsui ash lagoons.

Recreational walking in the Black Point area is understood to be very limited, partly due to its existing industrial facilities and the Castle Peak Firing Range; the youth hostel at Nim Wan is now only open by special arrangement, due to a lack of regular visitors.

With regard to amenity loss, the (non-gazetted) beach at Yung Long which lies within the LTPS site, is used for recreational activities including windsurfing and canoeing. Although the tendency for the water to be "muddied" by the predominantly north easterly winds and, in the summer, by heavily silt laden flows from the Shenzen River limits its appeal for swimming, the beach has clean sand and an open viewing aspect. It is, therefore, considered to be of significant amenity value.

13.4 Significance of Impacts

Two types of landscape would be displaced by the project: a landuse pattern of grassland, scrub and small fields surrounding an agricultural hamlet; and a coastline of bay and headland, including the northern slopes of Black Point itself.

The landuse features are typical of rural Hong Kong, and are neither individually notable nor do they contribute significantly to the scenic value of the surrounding area. No part of the Black Point area is designated for its landscape quality. Consequently, the displacement of landuse features is not anticipated to generate a significant impact on landscape character.

Clearly, the appearance of the northern side of the Black Point promontory will be radically altered by the construction works for the LTPS, with construction works being carried out on the site initially in isolation and subsequently in conjunction with the operation of the power blocks as they are completed. These works however, will be in an already industrialised landscape on the northern coastal fringe of the Black Point area. Consequently, the significance of the impact is considerably less than if the receiving environment were wholly natural.

The layout of the power blocks has been also developed so that the most visually acceptable elements of the power station face out to sea, with the boiler houses and other unattractive facilities facing the back slope of the site, further lessening the significance of the impact. It is also intended that the LTPS be painted in muted colours such as greys and greens, to help it blend into the adjoining landscape.

To the south of the promontory, sensitive receivers will be screened from the works (except during the construction of the upper portions of the coal fired plant stacks) by the retention of the southern flank of the Black Point promontory; it is CLP's intention that this southern flank of the ridge is preserved, notwithstanding the PADS development proposals for the area, so as to maintain the visual, noise and security screening of the power station it provides.

Visual impacts from the construction of the LTPS are thus not considered significant.

Although it is not gazetted, the loss of the beach at Yung Long will constitute a loss to the recreational amenities of the area and such a loss is considered to be significant. However, it should be noted that this beach would be lost to the PADS development in any event.

13.5 Mitigation Measures

As noted above, CLP have already made considerable efforts to avoid and mitigate visual impacts from the LTPS, most significantly, the development of a site layout which allows the preservation of the ridge line and southern flank of the Black Point promontory, and which conceals the unattractive elements of the plant from the remaining northern viewpoints. Further measures to enhance the visual aspects of the LTPS, and to develop the positive aspects of its construction, could include:

- High standards of site house-keeping;
- Lessening the angle of slope as it approaches the crest of the slope;
- The early planting of indigenous trees and shrubs on irregular ledges/terracettes on the slope face;
- It is to be expected that as a prestigious facility, the construction of the LTPS will be of considerable interest to local and international dignitories, politicians, professional bodies and the general public. CLP already provide information and visitor facilities at CPPS, which received some 14,000 visitors in 1990. It is therefore recommended that a viewing facility be provided, perhaps on Black Point ridge, to enable interested groups to view the LTPS site during the construction works. Once the development has reached the stage at which a more permanent information and visitor centre can be provided within the main LTPS site, this viewing platform could perhaps be retained for use as an observation platform for the Chinese River Dolphin (see Section V3/8 Ecology).

14. DECOMMISSIONING

14.1 Introduction

Given the 25 to 30 year anticipated operational life of the LTPS, the process of decommissioning will not get underway until around 2030 for Phase 1 and around 2040 for Phase 2. Clearly in the intervening 40 to 50 years, the techniques employed for the decommissioning process, the disposal/reuse of the materials produced, and the statutory requirements relating to them are likely to change considerably from those applicable today. Whilst CLP will be required to comply with the legislation in force at the time decommissioning is carried out, the following provides an indication of the general approach to issues which will need to be addressed to ensure that at the end of its useful life, the LTPS is decommissioned in such a way as to minimise environmental impacts, and maximise the potential for the recycling/reuse of its component parts and materials. Specific requirements for such mitigation should be agreed with EPD (or its future equivalent body) before the decommissioning work commences.

14.2 Sources of Potential Impact

The principal sources of potential environmental impacts from the decommissioning process are similar, with respect to the works carried out on site, to those discussed in detail in Volume 2 of this IAR, which dealt with the construction of the power station. Additional potential impacts, however, relate to possible soil contamination arising over the period of the site's use and during the decommissioning process. The main sources of potential impact are thus:

- Noise, dust and surface water quality impacts from the demolition works;
- Traffic disruption and congestion caused by heavy vehicle movements removing materials from the site by road;
- Take–up of landfill and marine disposal site capacity by demolition wastes;
- Soil/ground contamination accumulated over the life time of the plant, and as a result of spillages and the emptying of pipework/storage vessels during the decommissioning process.

14.3 Sensitive Receivers

With regard to potential impacts derived from the site works themselves, the principal receivers are anticipated to be the facilities planned for the area under the Tuen Mun Port Development. These landuses are principally industrial, however, and are thus not particularly sensitive. Furthermore, these developments will be concentrated to the south of the Black Point ridge and will thus be shielded from noise and dust impacts.

The receivers affected by impacts from the transportation of materials by road would clearly depend upon the future development of the transport infrastructure in the area and the vehicle routing, but based on the current situation, the Lung Kwu Tan villages and the Tuen Mun contribution are likely to be the principal areas which could be affected.

Site workers and future building foundations, below ground services and site occupants are the principal receptors at risk from potential soil contamination.

14.4 Mitigation Measures

Advances in environmental management requirements and the day to day techniques of decommissioning over the next 40 years are likely to bring about a new generation of mitigation measures applicable to the LTPS decommissioning process. However, a number of general mitigation principles, based on current knowledge and experience, are outlined below.

- House keeping/ site control measures at least equivalent to those employed during the construction period will be applied and strictly enforced to ensure that air, noise and water quality criteria are achieved;

- The removal of dismantled plant and demolition materials from the site will be by marine transport wherever practicable, so as to minimise HGV traffic;

- Demolition materials will be recycled or put to positive use where possible, depending upon the legislation prevailing at the time, or disposed of to appropriately designated disposal facilities where this is not possible;

- Wherever possible, site plant will be dismantled for reuse or recycling, so as to minimise the volumes of material requiring disposal;

- Tanks, pipework, sumps and other storage or reception vessels will be emptied and cleaned before their demolition or removal, and their contents appropriately disposed of;

- Stockpiles of materials, such as fuel or FGD reagents, will be removed from the site (by marine transport where practicable) for use elsewhere or appropriate disposal;

- Site investigations will be undertaken early in the decommissioning process to establish the presence and degree of any soil and groundwater contamination accumulated over the life of the facility, and enable worker protection and site remedial measures to be identified and implemented if necessary.

- An environmental monitoring programme will be developed drawing on the statutory environmental protection criteria applicable at the time, and sensitive receivers in the area, to be implemented during the decommissioning process.

15. CONCLUSIONS AND RECOMMENDATIONS

15.1 Introduction

The significance of the impacts associated with the construction of CLP's LTPS at Black Point is determined both by the nature and scale of the development and by the characteristics of the environment into which it will fit. In this regard it is important to consider the stages of site selection and layout refinement which were carried out prior to the site-specific EIA.

Environmental and planning considerations were a major component of the decision framework that resulted in the choice of Black Point during the Site Search. During detailed site design, as is explained in V2/2.4, the evolution of the final site location and layout options was influenced by environmental factors. Of particular importance with regard to construction impacts was the decision to develop north of Black Point whilst maintaining a large part of the ridge. This decision substantially reduced the likelihood of significant air quality, noise and visual impacts to the sensitive receivers in Lung Kwu Tan and Lung Kwu Sheung Tan.

15.2 Categories of Impact

This section deals briefly with the extent and significance of each category of construction impact, as they are presented in the report. Recommendations for monitoring, further assessment or mitigation are made where appropriate:

- **Air Quality (Site and Roads)**: It is predicted that air quality impacts from dust generation will be insignificant. The alignment of the site is such that winds with the capacity to produce "worst-case" conditions involving passage over a number of significant dust sources within the site, will carry dust emissions out over Deep Bay or Urmston Road. In addition, conventional good site practice will reduce dust generation by 90%.

- **Noise**: Daytime noise levels during construction works are predicted to be well within the background plus 10 dB(A) criterion for receptors in the Black Point area. However, night-time dredging and associated maritime support activities are predicted to exceed the 45 dB(A) night-time noise criterion; re-scheduling of dredging activities to the daytime period to avoid this impact may be necessary.

- **Water Quality**: Impacts arising from general construction activities will be minor and insignificant and will be controlled by good construction site practice. Impacts relating to the dredging of an estimated 14 Mm^3 of marine sediments for both Scenarios may be significant in relation to the Deep Bay Guidelines for Dredging Reclamation and Drainage Works which require no greater than a 30% increase in suspended solids levels compared to the natural range. The nearest receptors are oyster beds 3 km north-east of the site. Sediment plume modelling conducted at the Site Search stage indicates that the elevation in suspended solids at the receptors is likely to be insignificant when compared to the natural range of conditions in Deep Bay. Monitoring will be required during dredging works to ensure compliance. The results obtained during initial dredging for the seawall line will be used to assess the possible need for controls during the year-long dredging programme required for the access channel and turning basin.

- **Construction Waste**: Overburden and site debris can be disposed of at the adjacent WENT landfill whilst chemical wastes will be taken to the Chemical Waste Treatment Facility on Tsing Yi. Marine sediments dredged from the site will require disposal at Gazetted Dump Sites. This will be at a time when large quantities of similar material from PADS related projects will also require disposal. The need for additional disposal capacity has been recognised by FMC and sites such as disused borrow pits in Urmston Road appear attractive. Sediment sampling and analysis from areas adjacent to the LTPS site indicate that it is very unlikely that the sediments are significantly contaminated with toxic metals and consequently will not require special disposal facilities. Suitability for conventional Dump Site disposal will be confirmed by further sampling and analysis once the exact dredging area is known.

- **Traffic**: It is anticipated that no significant traffic impacts need occur from LTPS construction. Road traffic impacts can be minimised by using marine transport of plant, materials and the workforce, by scheduling road deliveries outside peak hours and by careful design of site exits. During Phase 2 construction, PADS developments in the area may have substantially altered background traffic levels but it is likely that the necessary improvements to road infractructure will also have been made. Marine traffic, even at peak times, will only add approximately 8% to existing levels and is thus not predicted to be a significant increase in the Black Point area.

- **Ecology**: The terrestrial ecological value of the Black Point area is considered to be poor. The area has been subject to frequent burning and no remnants of natural woodland vegetation exist. The trees present are largely non-native species. Two protected plant species, Gardenia jasminoides and Phoenix hanceana were noted during the ecological survey and robust specimens will be relocated to AFD gardens or within the LTPS site. No evidence of rare fauna was found although this cannot be ruled out. Any such species are likely to be able to escape during initial site clearance. The impact on terrestrial ecology is not considered significant.

  Marine ecological impacts will include direct effects at the site, with the loss of a large intertidal and subtidal area and its associated benthic communities. The loss of the intertidal rocky shore community on the north of Black Point will, however, be temporary and is likely to be replaced by a larger community on the new seawall for the LTPS. Benthic communities in the area that will form the access channel and turning basin will be disrupted by lowering of the seabed and regular disruption through maintenance dredging every four years. Sampling to date has not revealed any rare species. The sampling programme will be continuing in order to obtain data for all seasons and results will be considered in the Water Quality Key Issue Report. The Chinese White (Pearl River) Dolphin is known to use the Urmston Road area. The possible disturbance of the dolphin's habitat is a potentially significant impact on the marine ecology of the area associated with the LTPS. Although the LTPS is only one part of the overall development plan for the north and south shores of the Brothers Channel and the eastern shore of the Urmston Road, it will contribute to the potential restriction of the dolphin's range.

- **Civil Aviation**: No significant impacts are predicted.

- **Socio-Economics**: LTPS construction will provide a significant source of employment for the Tuen Mun area from 1992 until 2008.

- **Cultural Heritage and Fung Shui**: The LTPS will affect an important archaeological site. Site development will, however, provide the opportunity for thorough site investigation and recording which may otherwise not occur. A full mitigation plan will be devised, to the satisfaction of the AMO.

- **Recreational and Visual Amenity**: The LTPS construction will completely remove the Yung Long beach which, while not gazetted, is a significant local recreational resource although it would, in any event, be lost to PADS development. Siting the LTPS to the north of Black Point substantially limits the extent of visual impact during construction. Receptors at villages to the south will be aware of tall stack construction when it occurs.

- **Decommissioning**: Decommissioning of the LTPS is likely to begin around 2030 for Phase 1 of the station, and 2040 for Phase 2. Whilst CLP will be required to comply with the environmental legislation in force at that time, the broad issues which will need to be addressed have been identified, and generic mitigation measures to minimise impacts recommended; specific mitigation measures should be agreed with EPD (or its future equivalent) prior to the works commencing.

ANNEXES

ANNEXES

ANNEX V2/A

LTPS AT BLACK POINT: SITE EVOLUTION DIAGRAMS

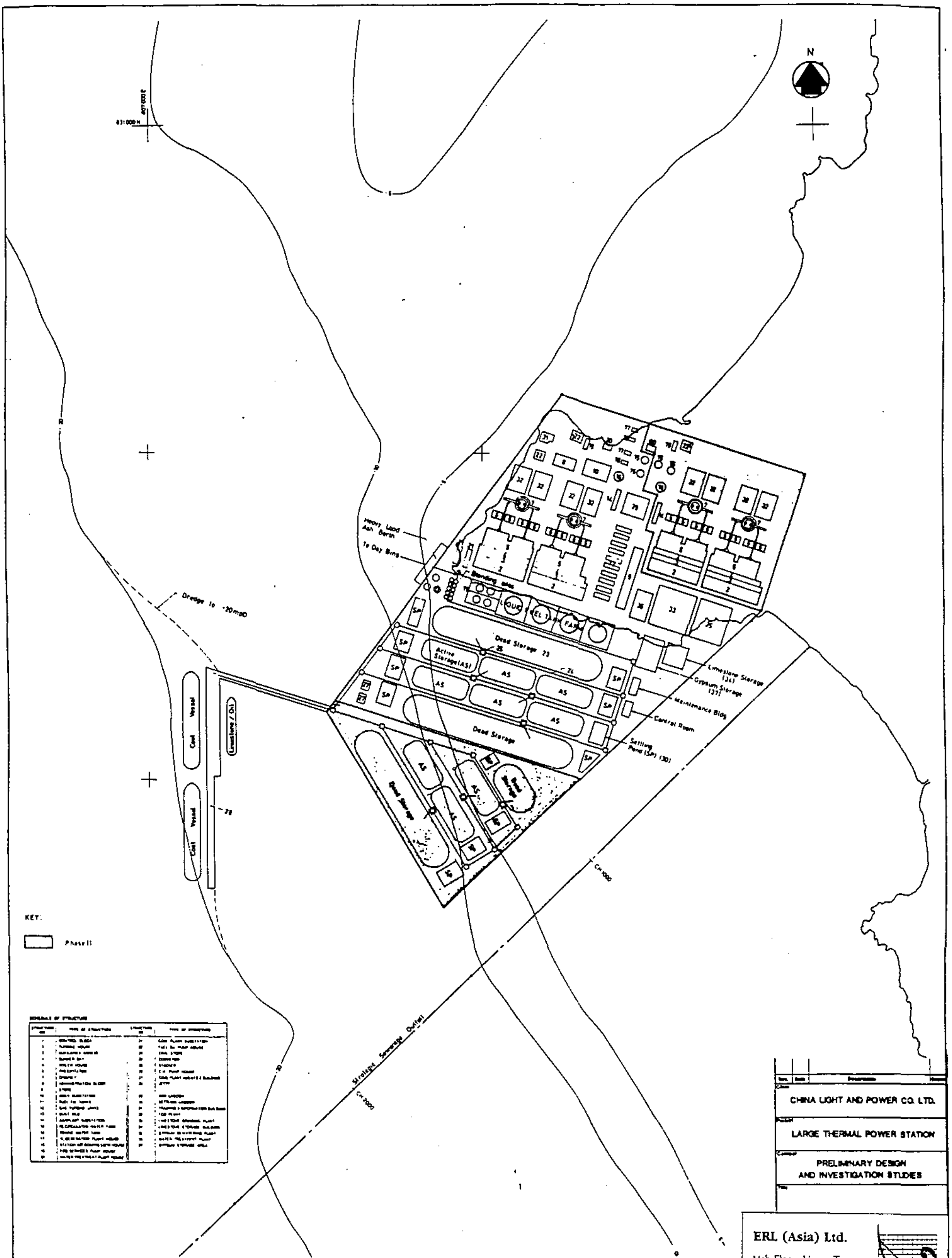

Figure V2/A1 LTPS at Black Point: Stage 1, Scenario I Option 1

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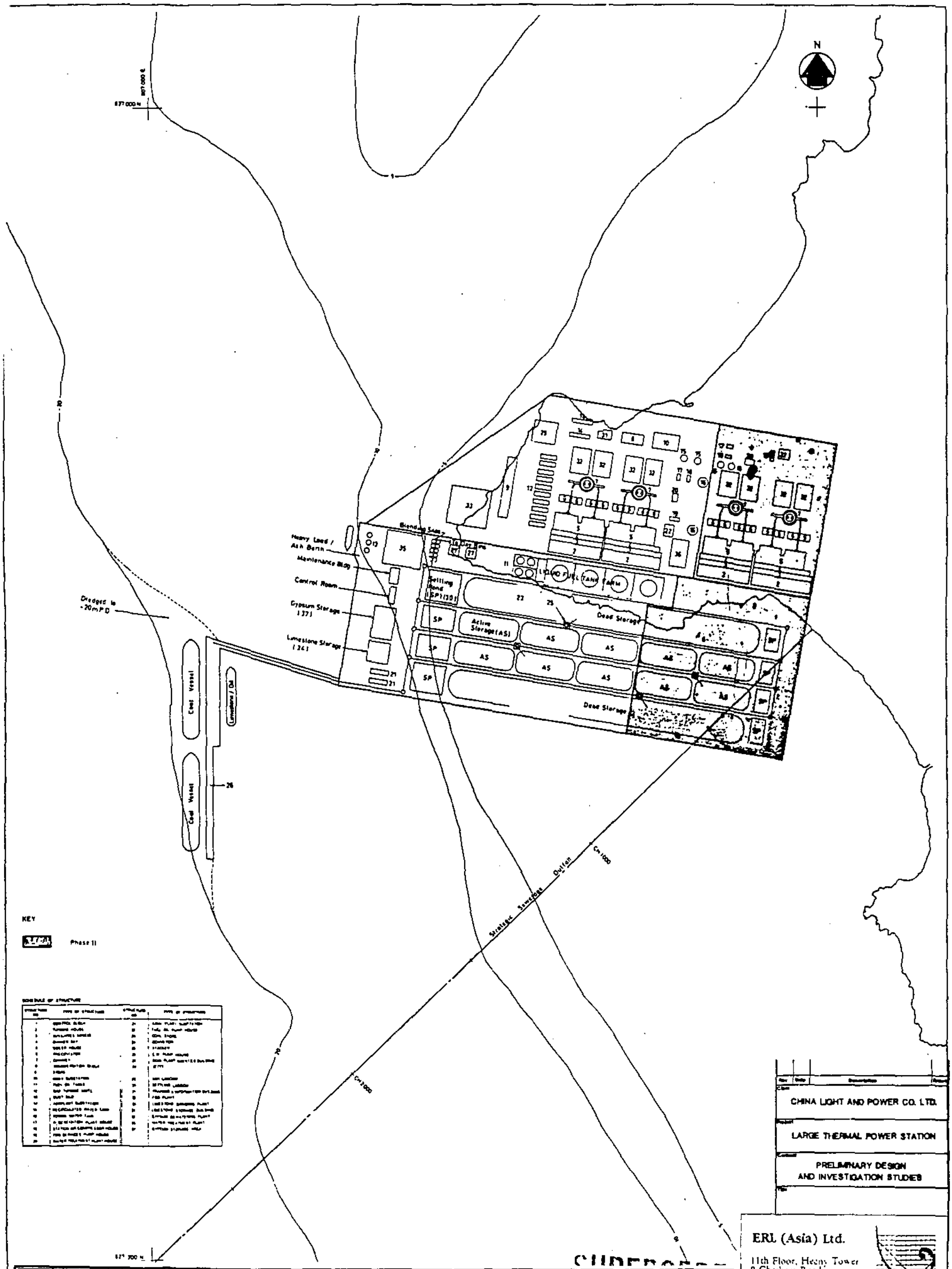

Figure V2/A2 LTPS at Black Point: Stage 1, Scenario I Option 2

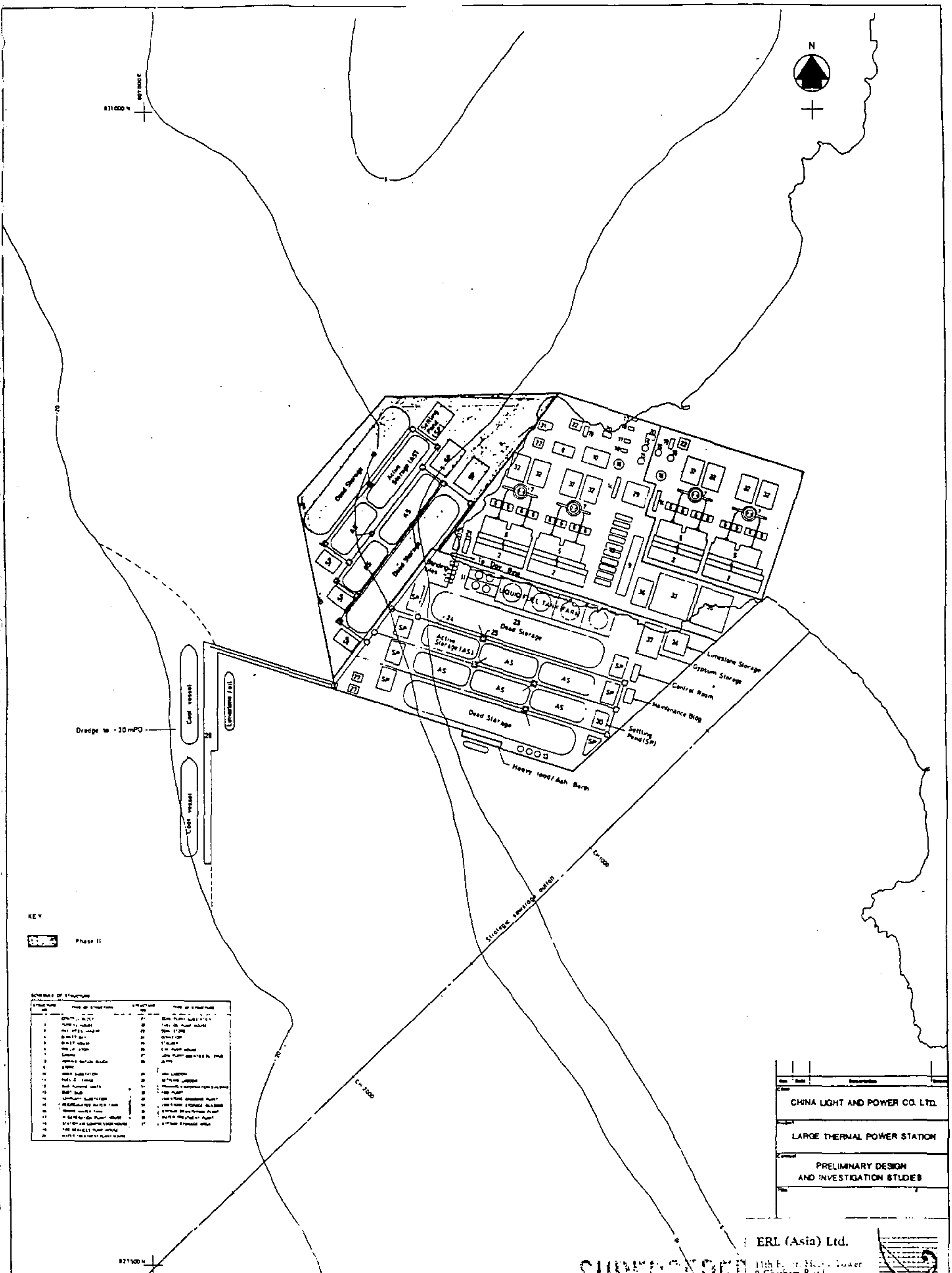

Figure V2/A3 LTPS at Black Point: Stage 1, Scenario I Option 3

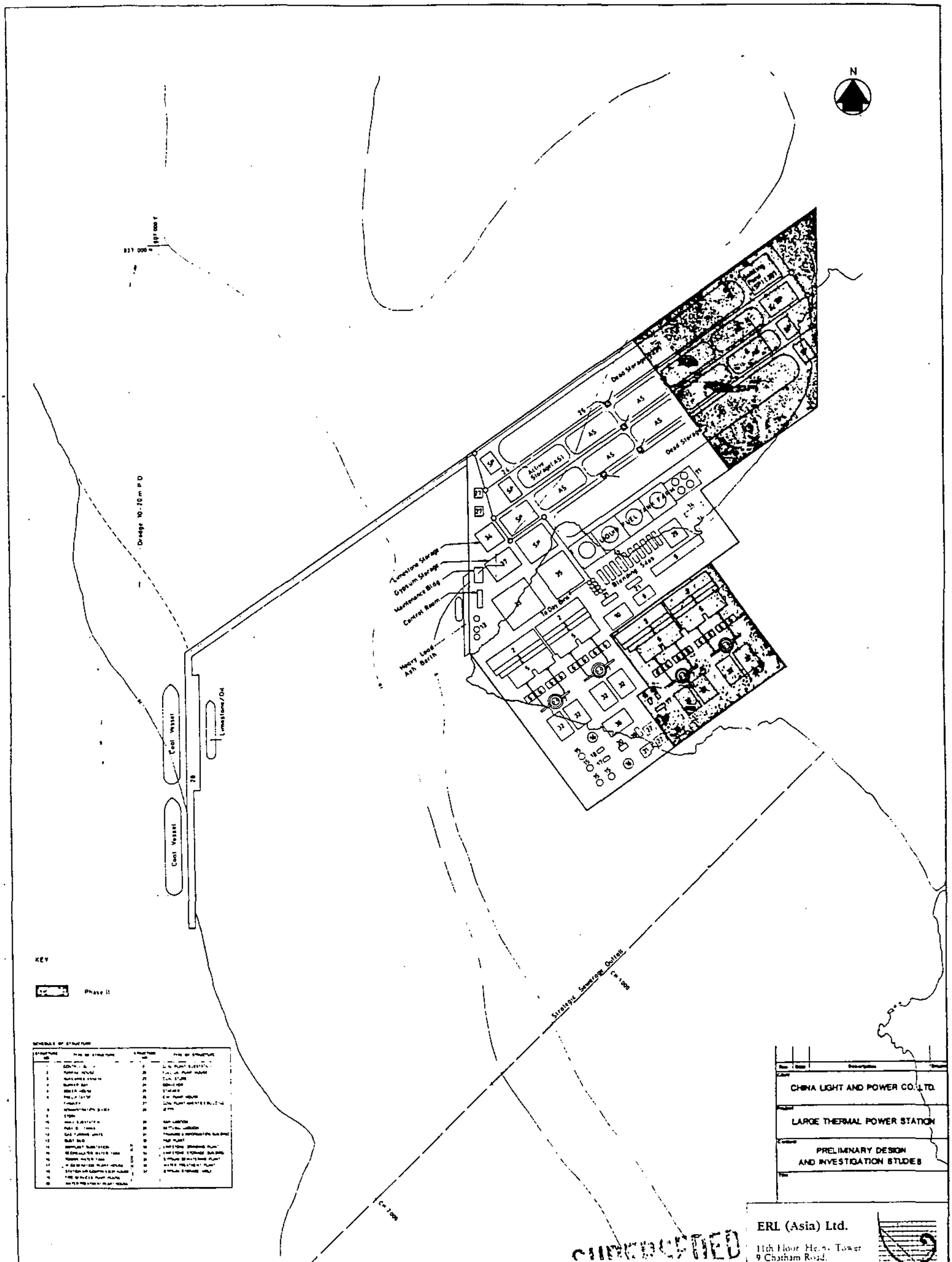

Figure V2/A4 LTPS at Black Point: Stage 1, Scenario I Option 4

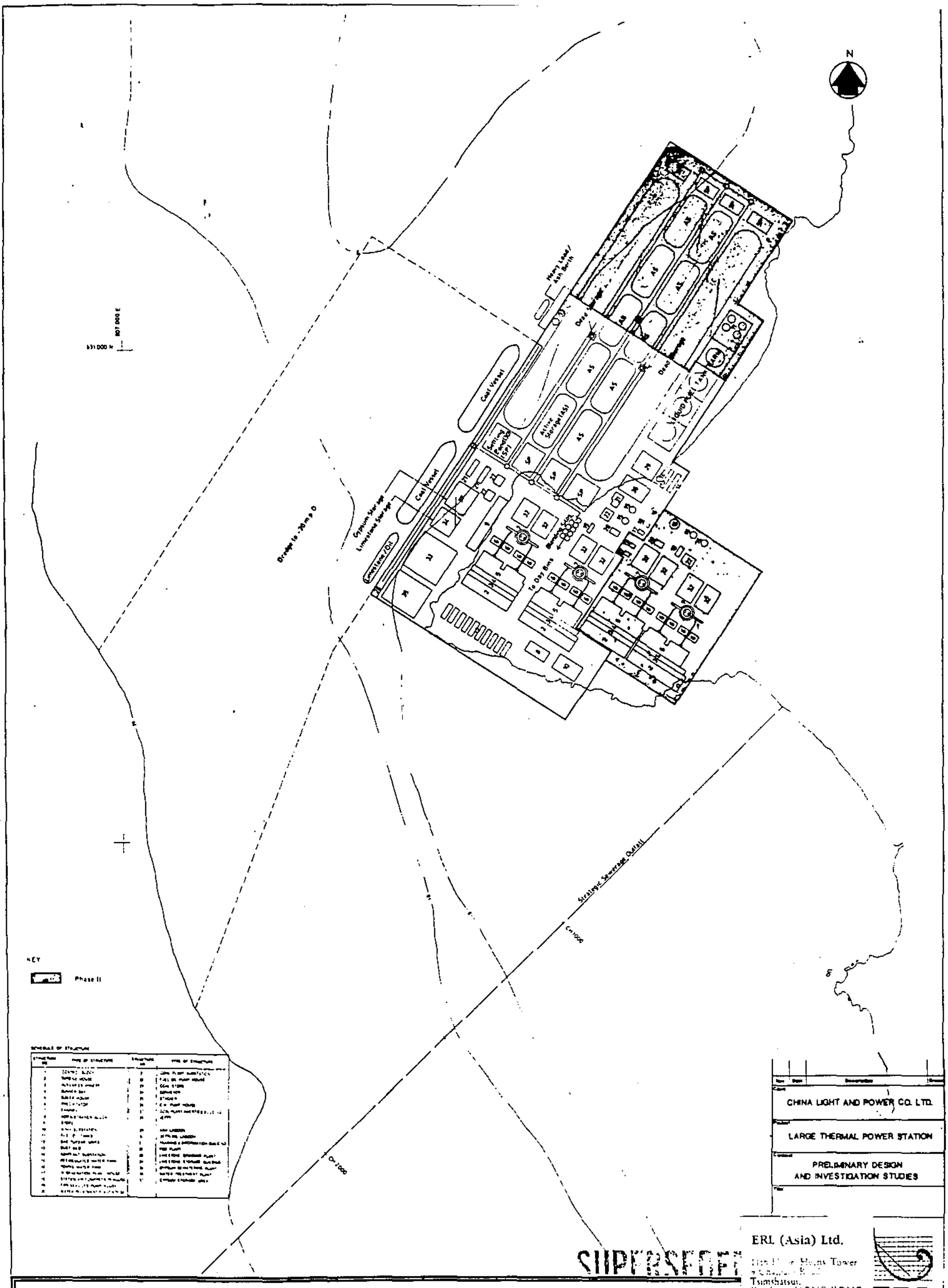

Figure V2/A5 LTPS at Black Point: Stage 1, Scenario I Option 5

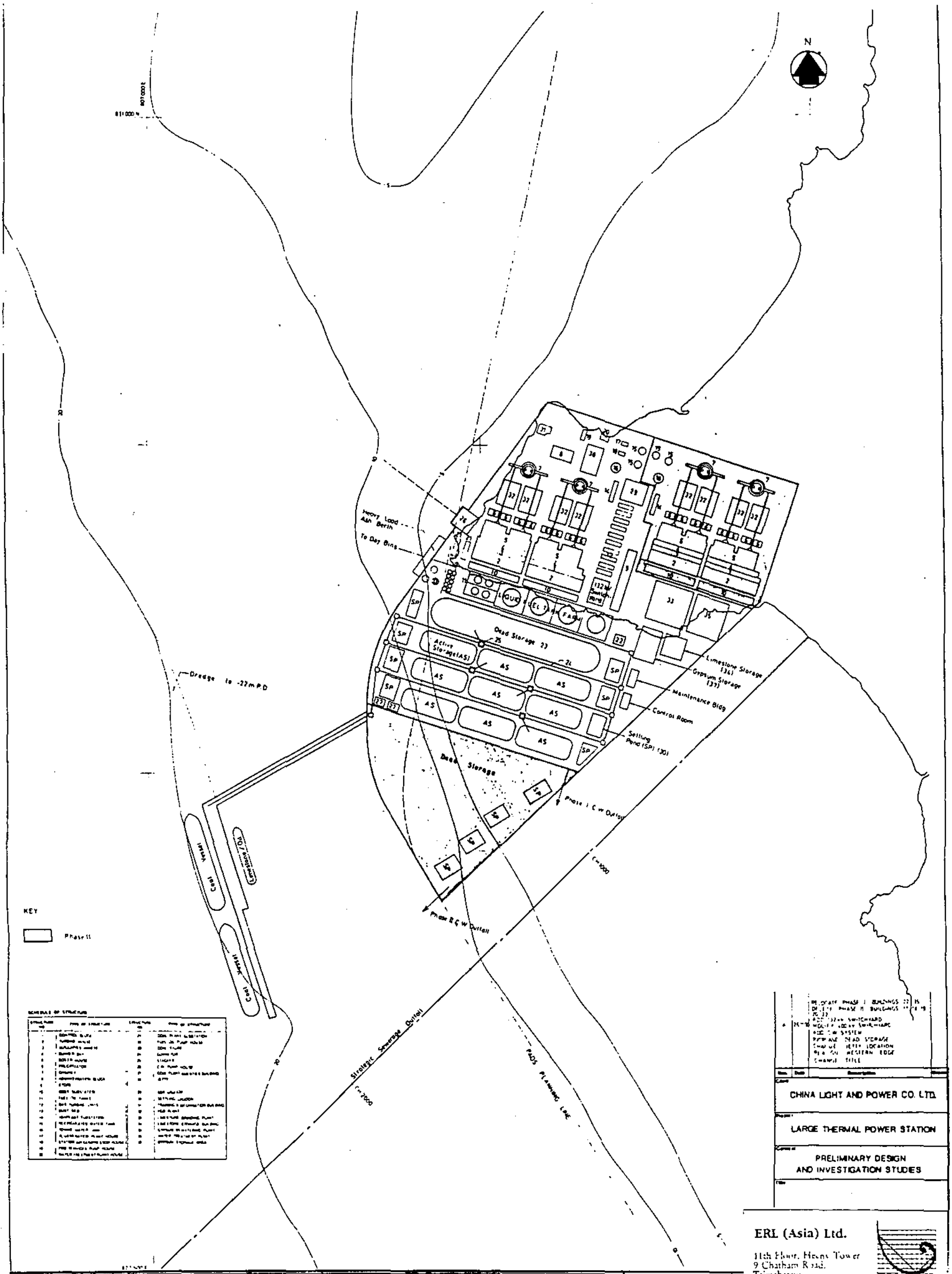

Figure V2/A6 LTPS at Black Point: Stage 2, Scenario I Option 1

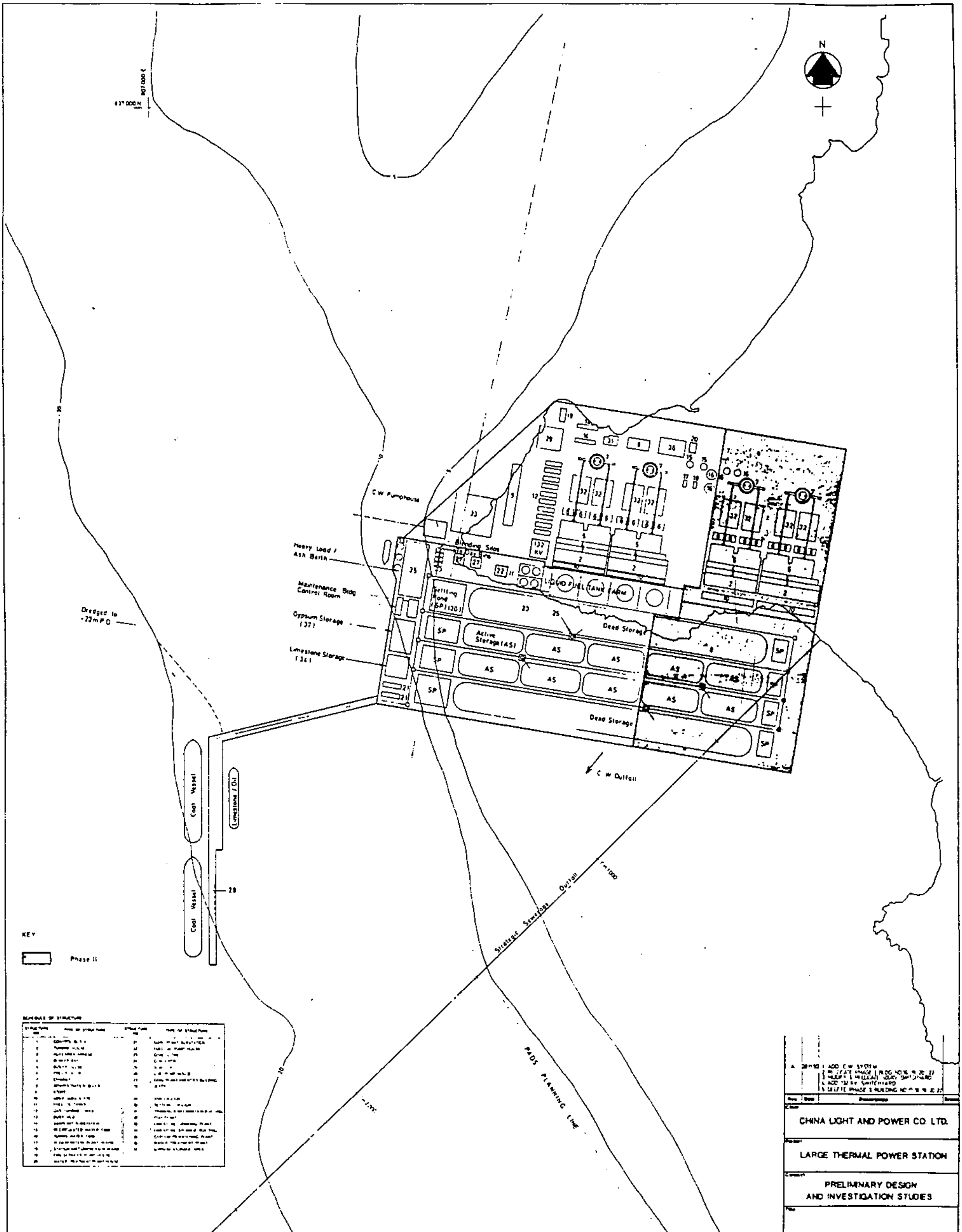

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Figure V2/A7 LTPS at Black Point: Stage 2, Scenario I Option 2

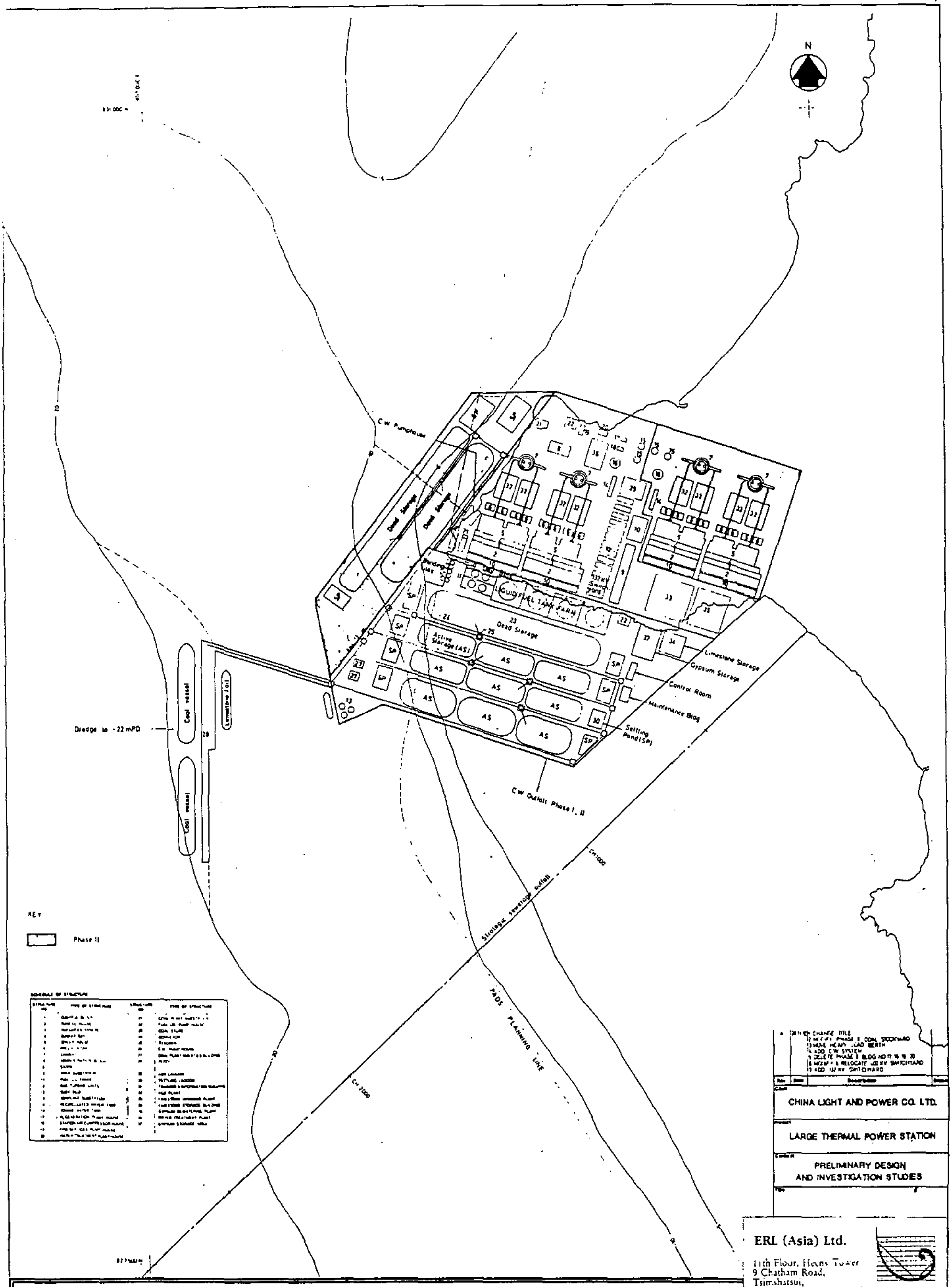

Figure V2/A8 LTPS at Black Point: Stage 2, Scenario I Option 3

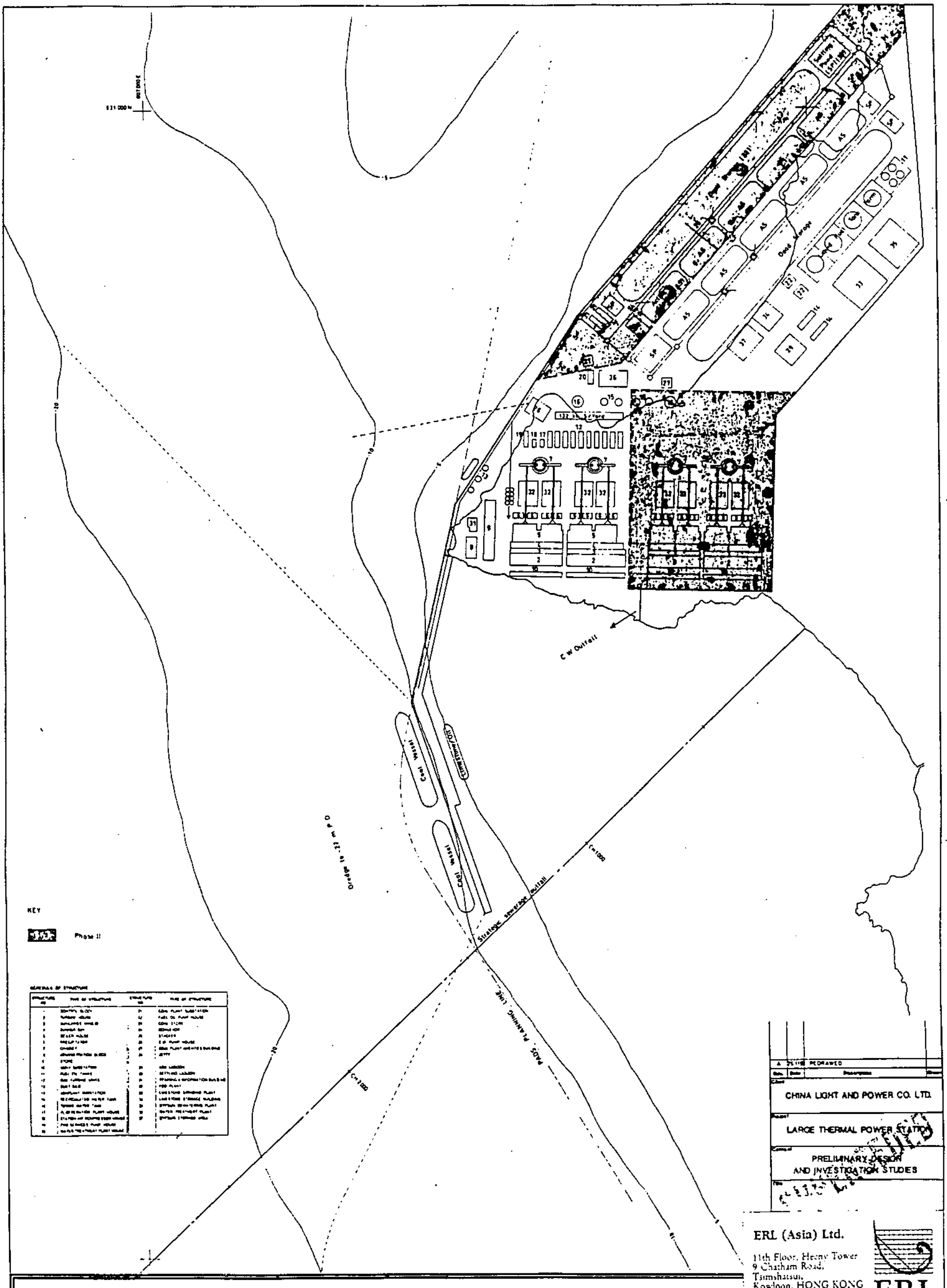

Figure V2/A9 LTPS at Black Point: Stage 2, Scenario I Option 4

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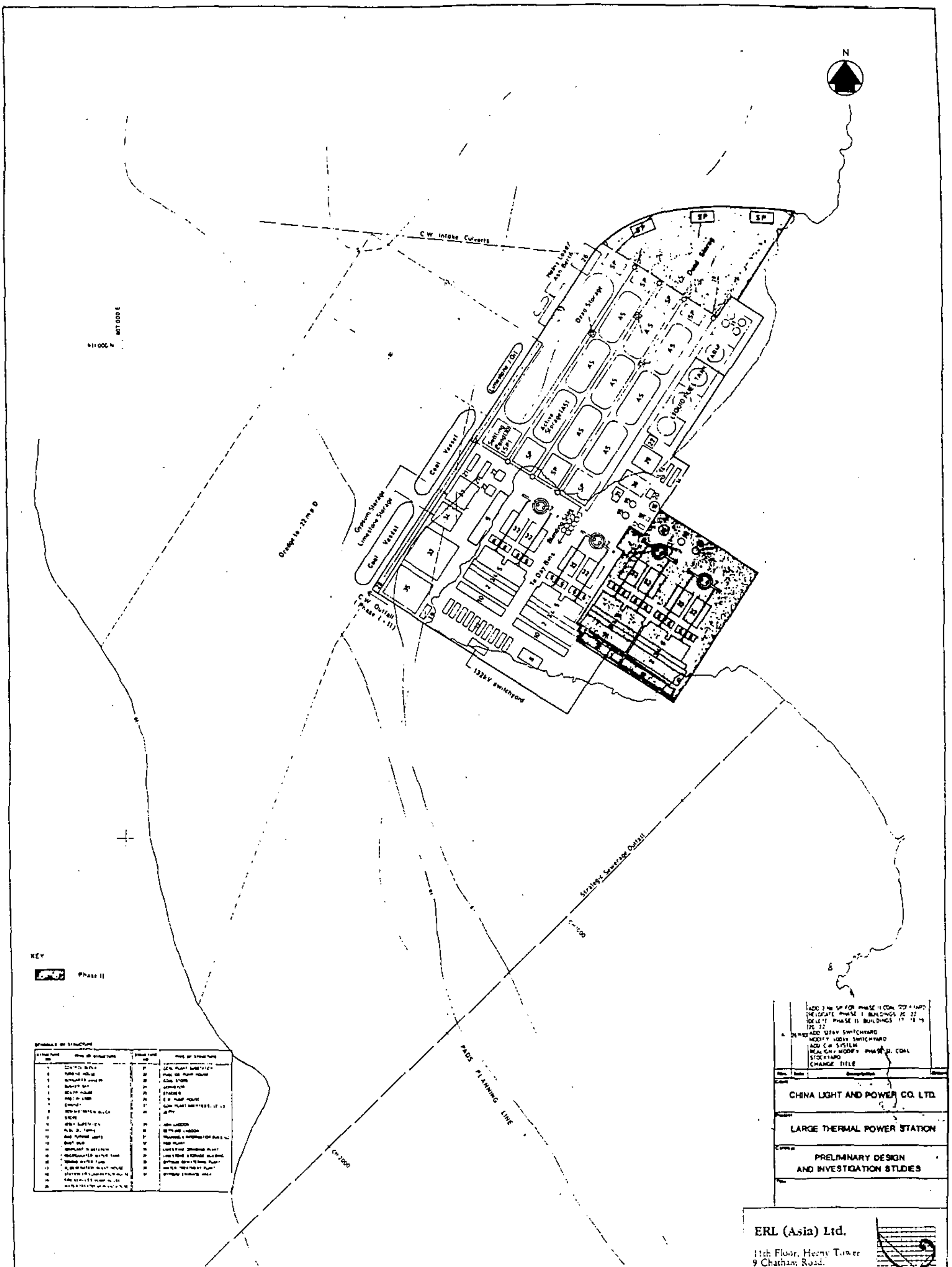

Figure V2/A10 LTPS at Black Point: Stage 2, Scenario I Option 5

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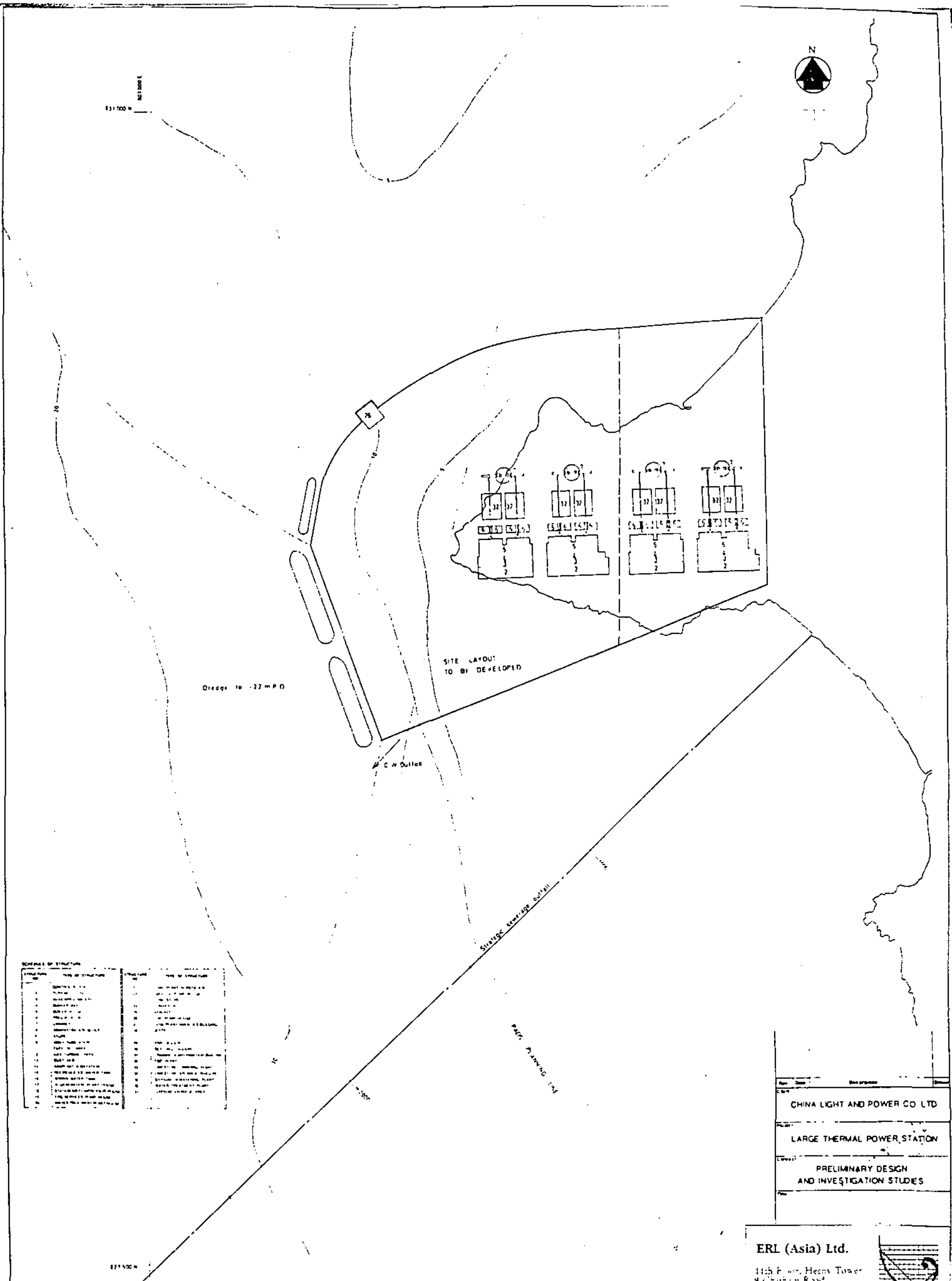

Figure V2/A11 LTPS at Black Point: Stage 2, Scenario I Option 6

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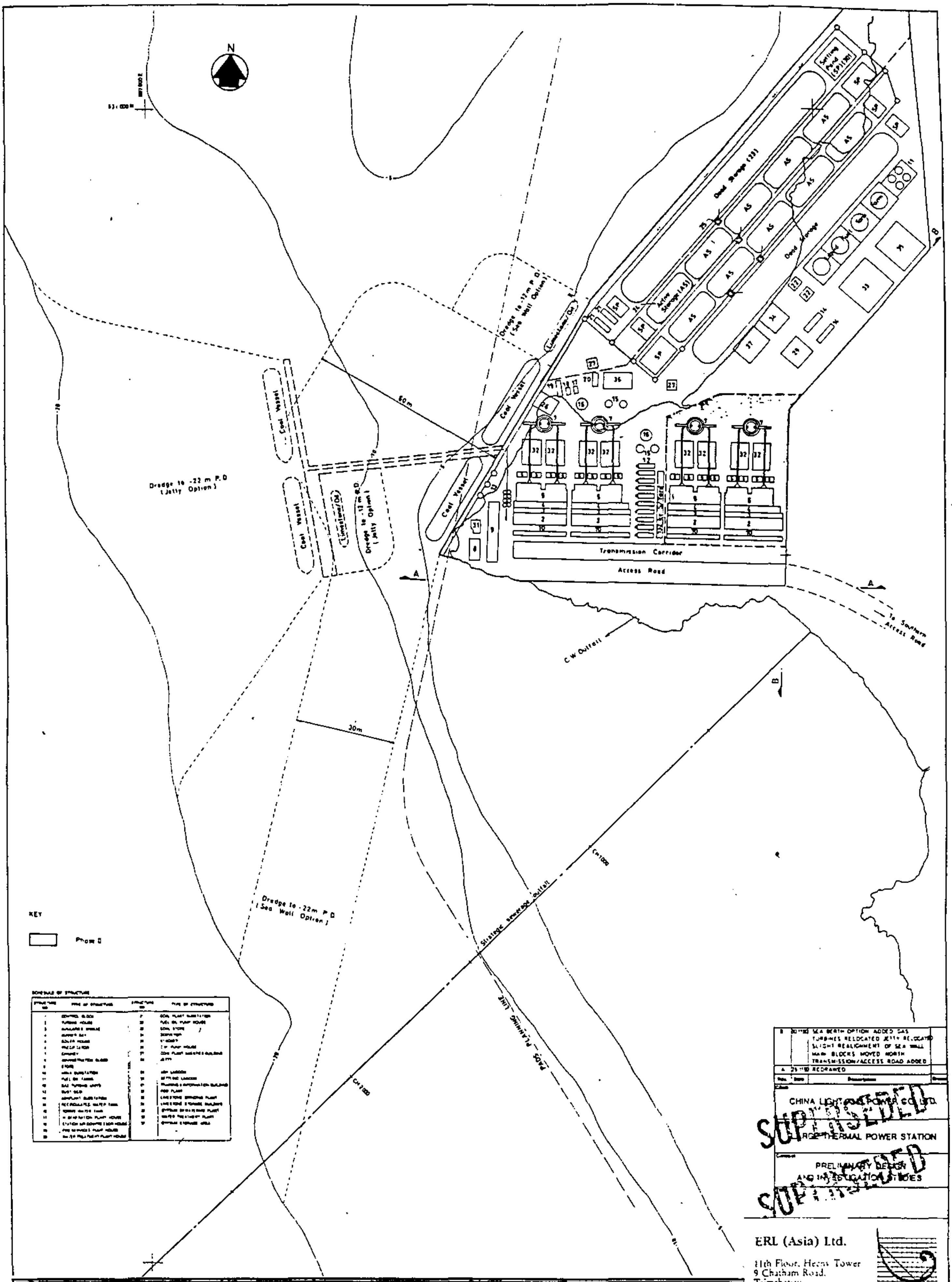

Figure V2/A12 LTPS at Black Point: Stage 3, Scenario I Option 4

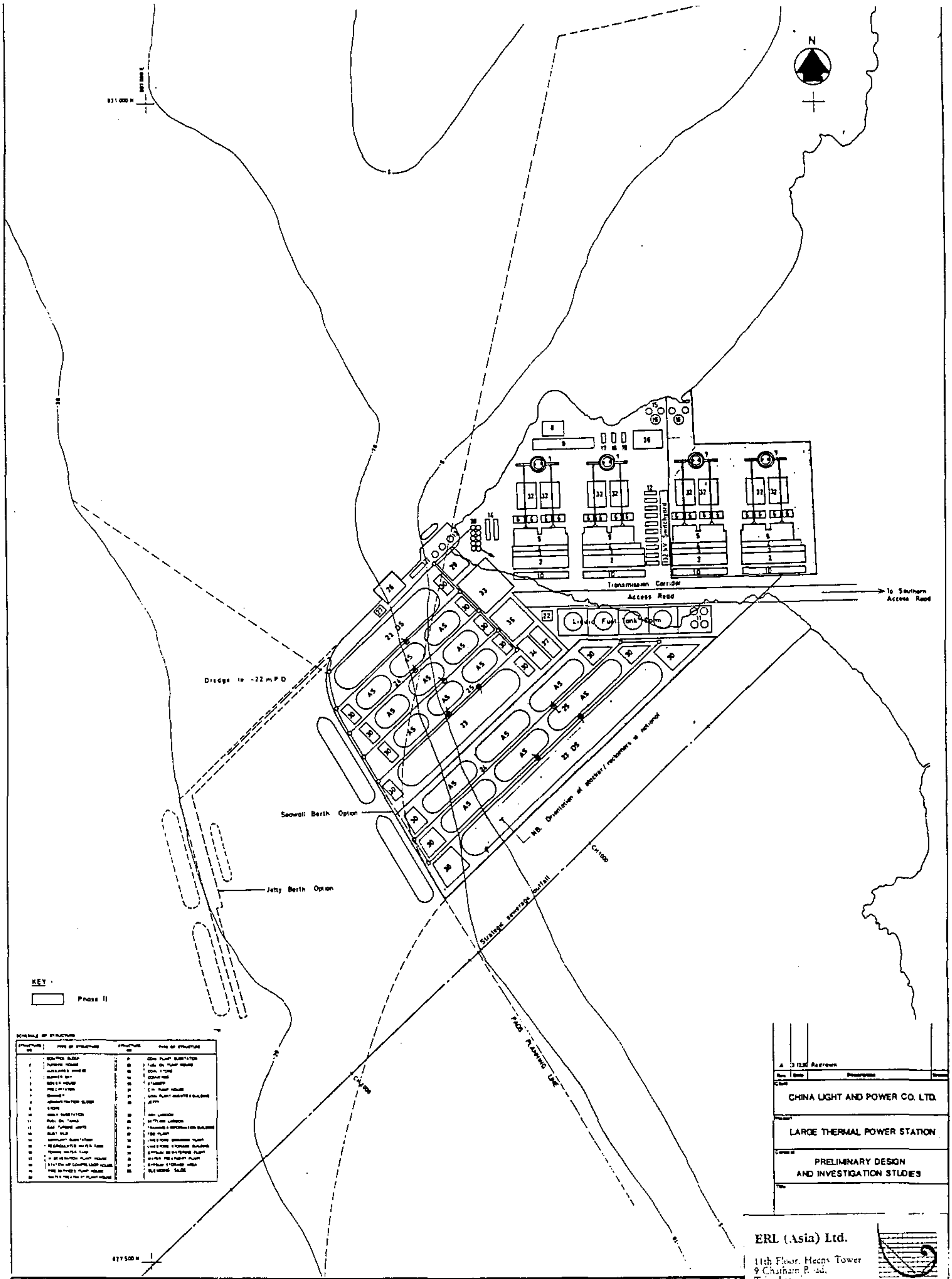

Figure V2/A13 LTPS at Black Point: Stage 3, Scenario I Option 6

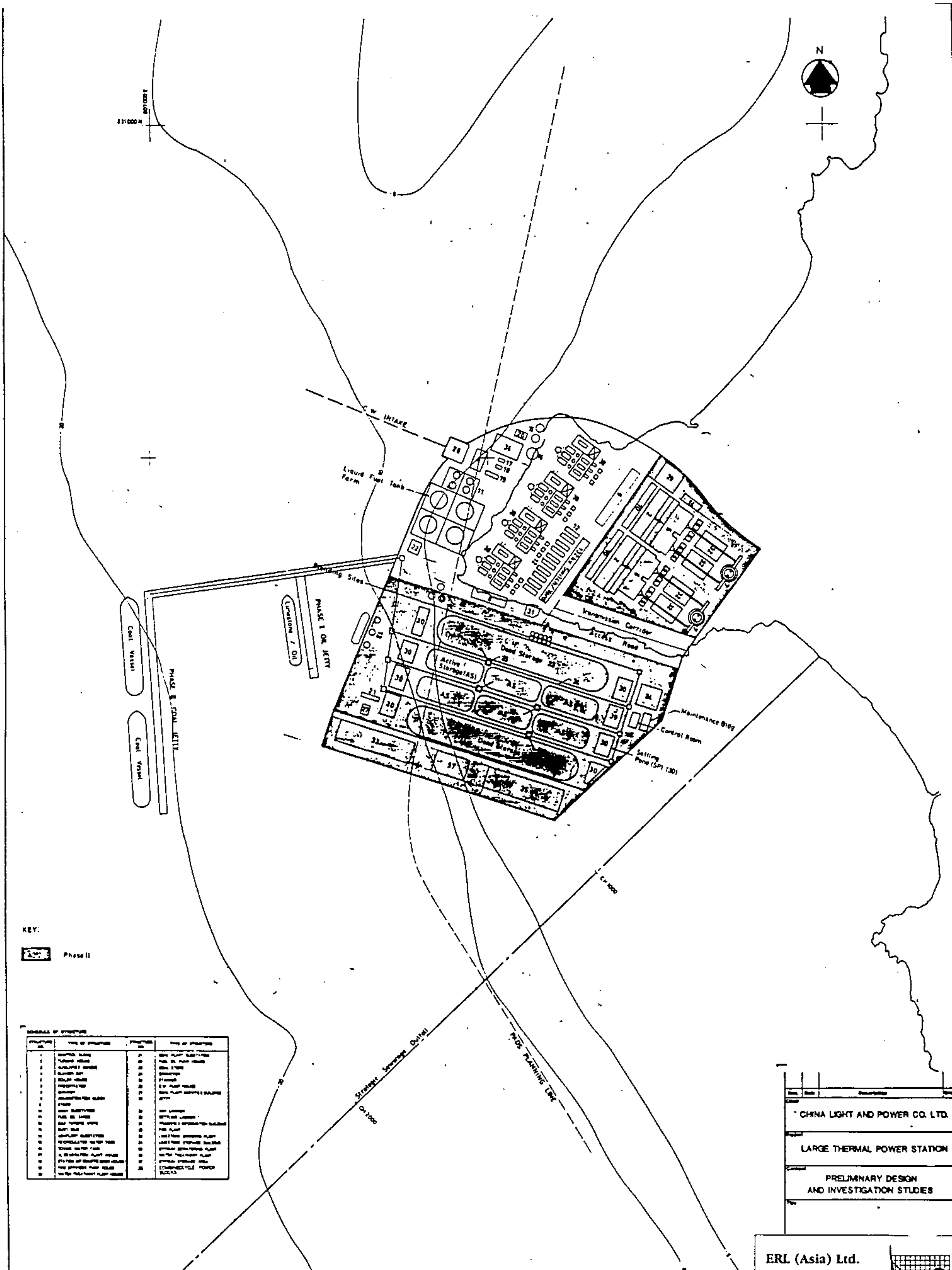

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Figure V2/A14 LTPS at Black Point: Stage 4, Scenario II Option 7

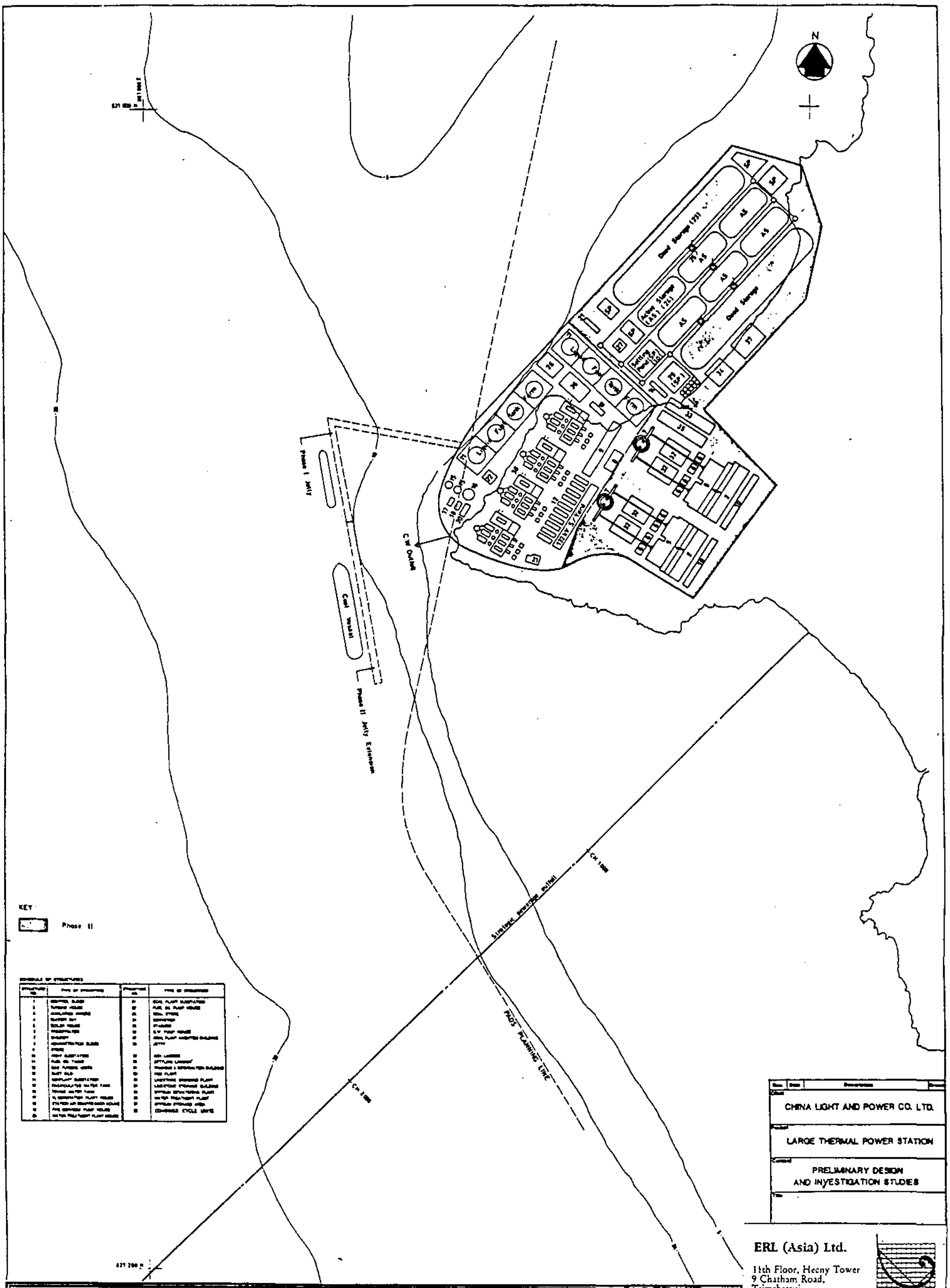

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Figure V2/A15 LTPS at Black Point: Stage 4, Scenario II Option 8

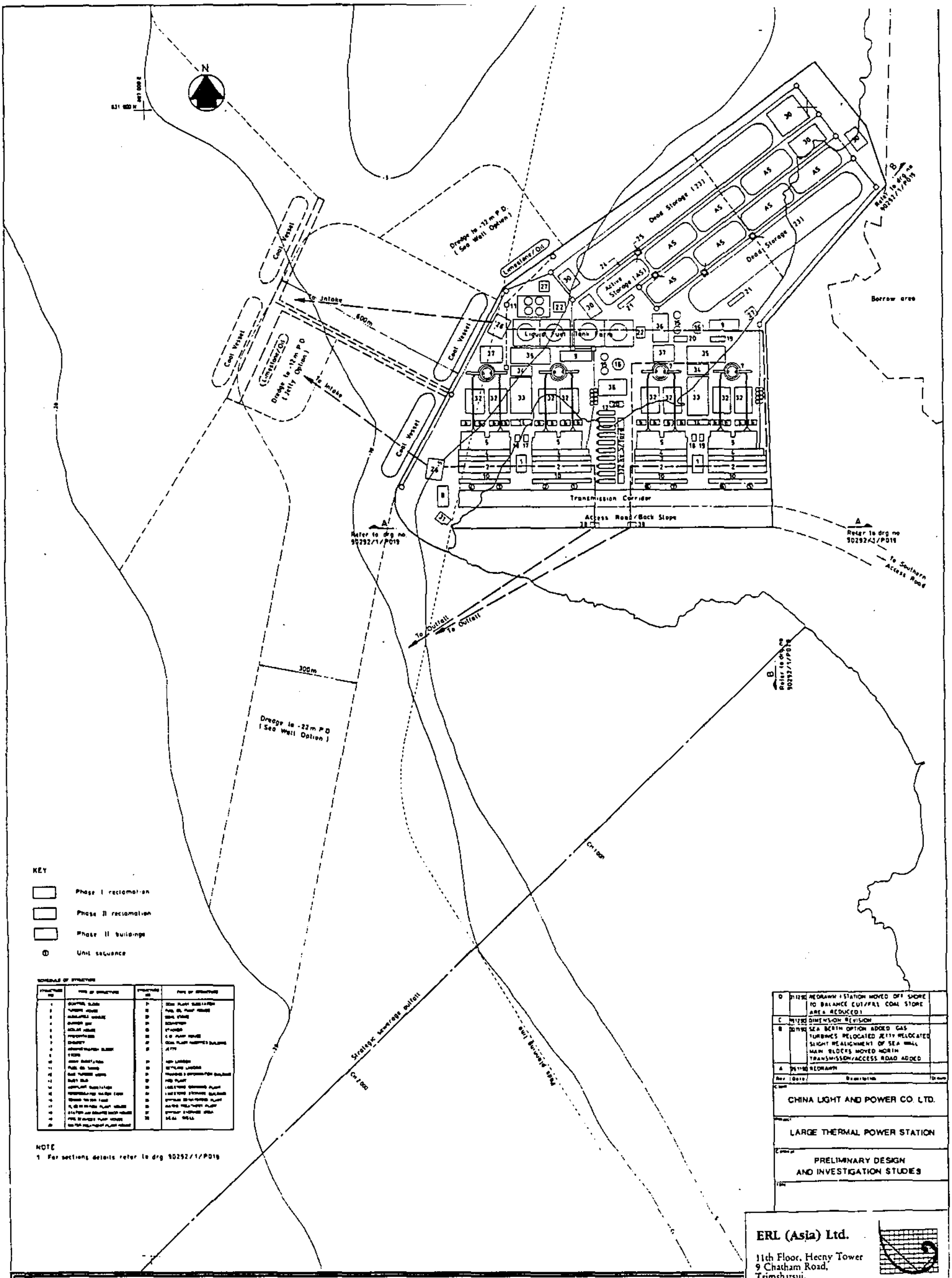

Figure V2/A16 LTPS at Black Point: Stage 5, Scenario I Option 4

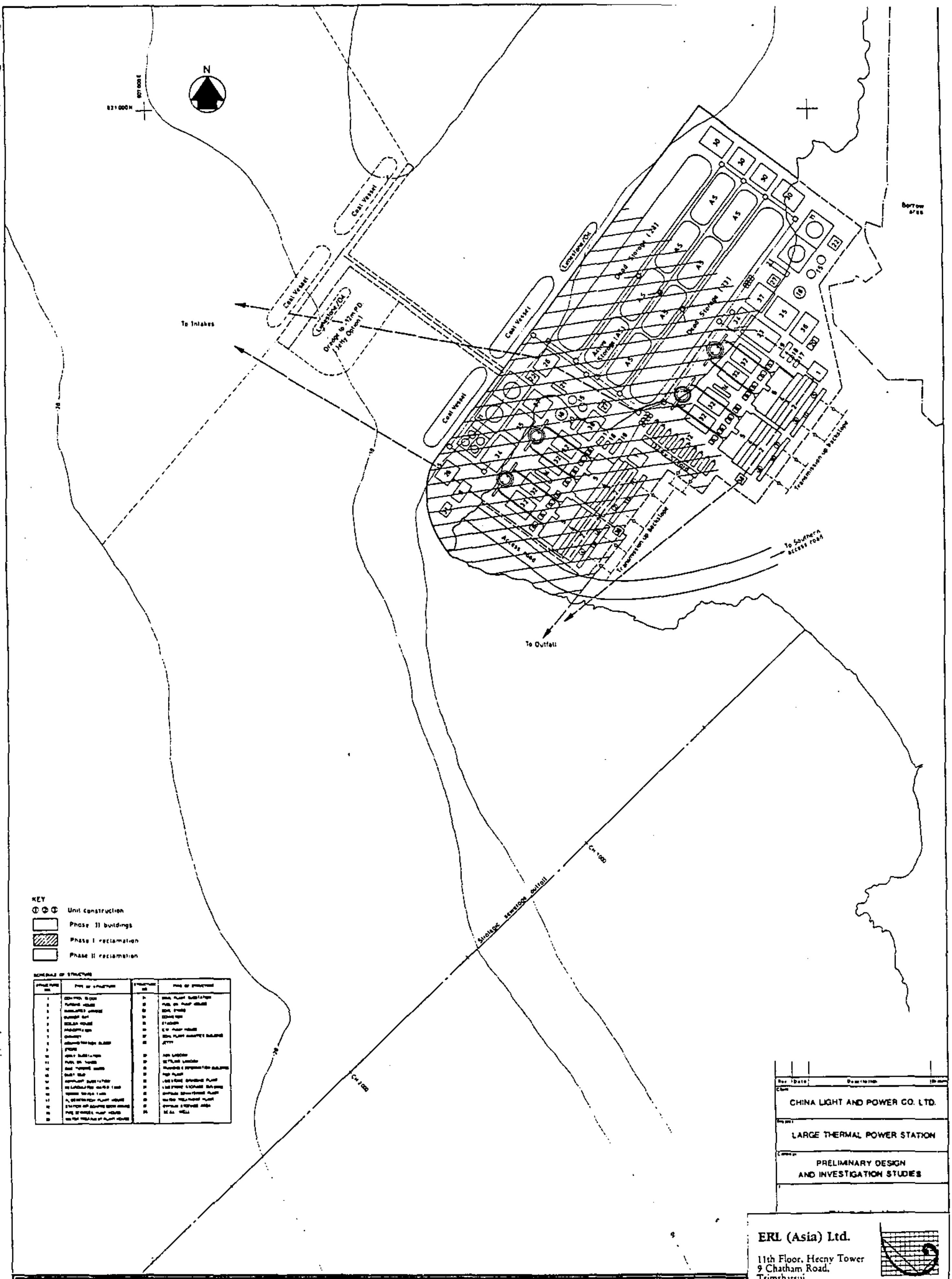

Figure V2/A17 LTPS at Black Point: Stage 5, Scenario I Option 9

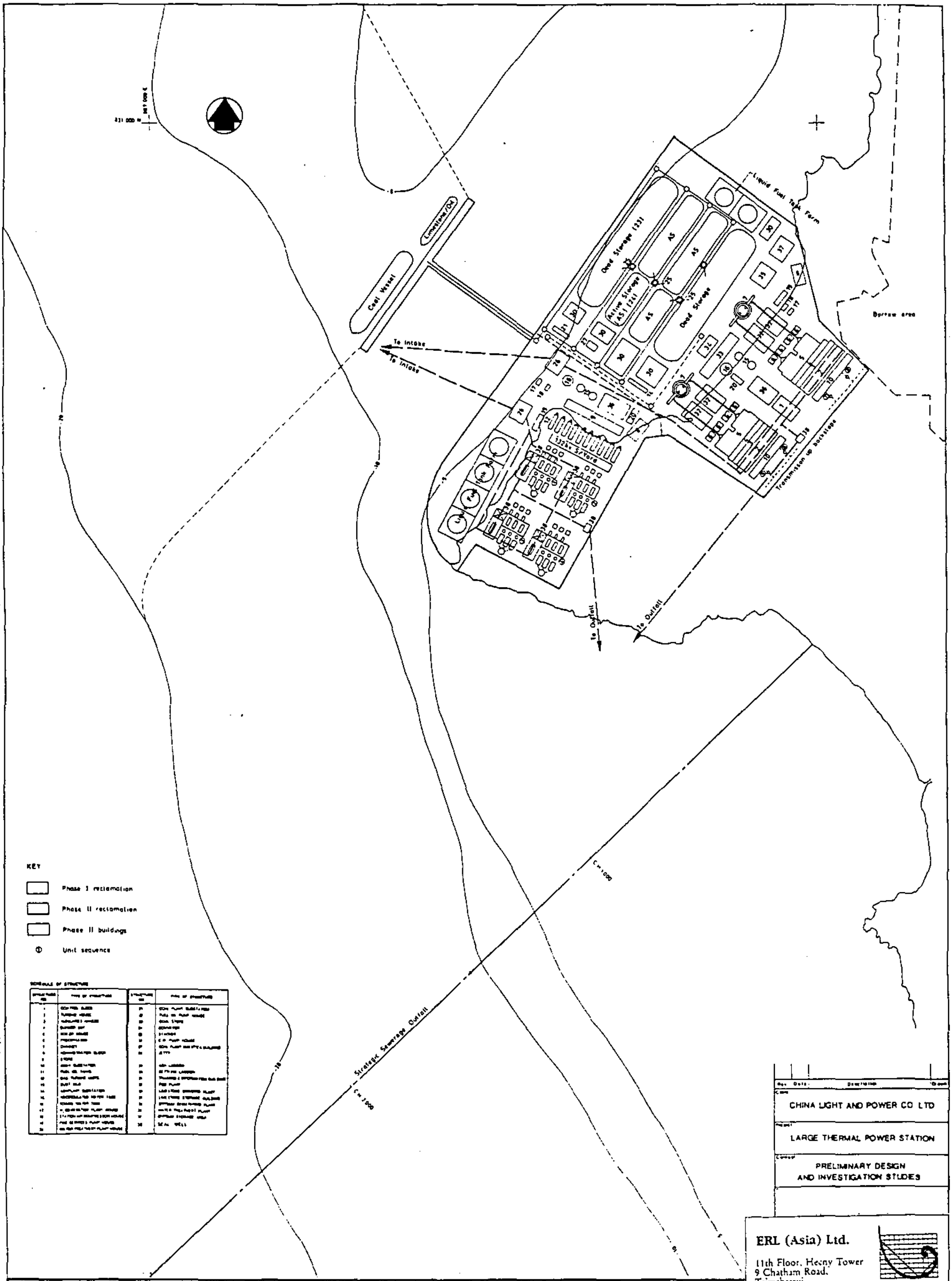

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Figure V2/A18 LTPS at Black Point: Stage 5, Scenario II Option 10

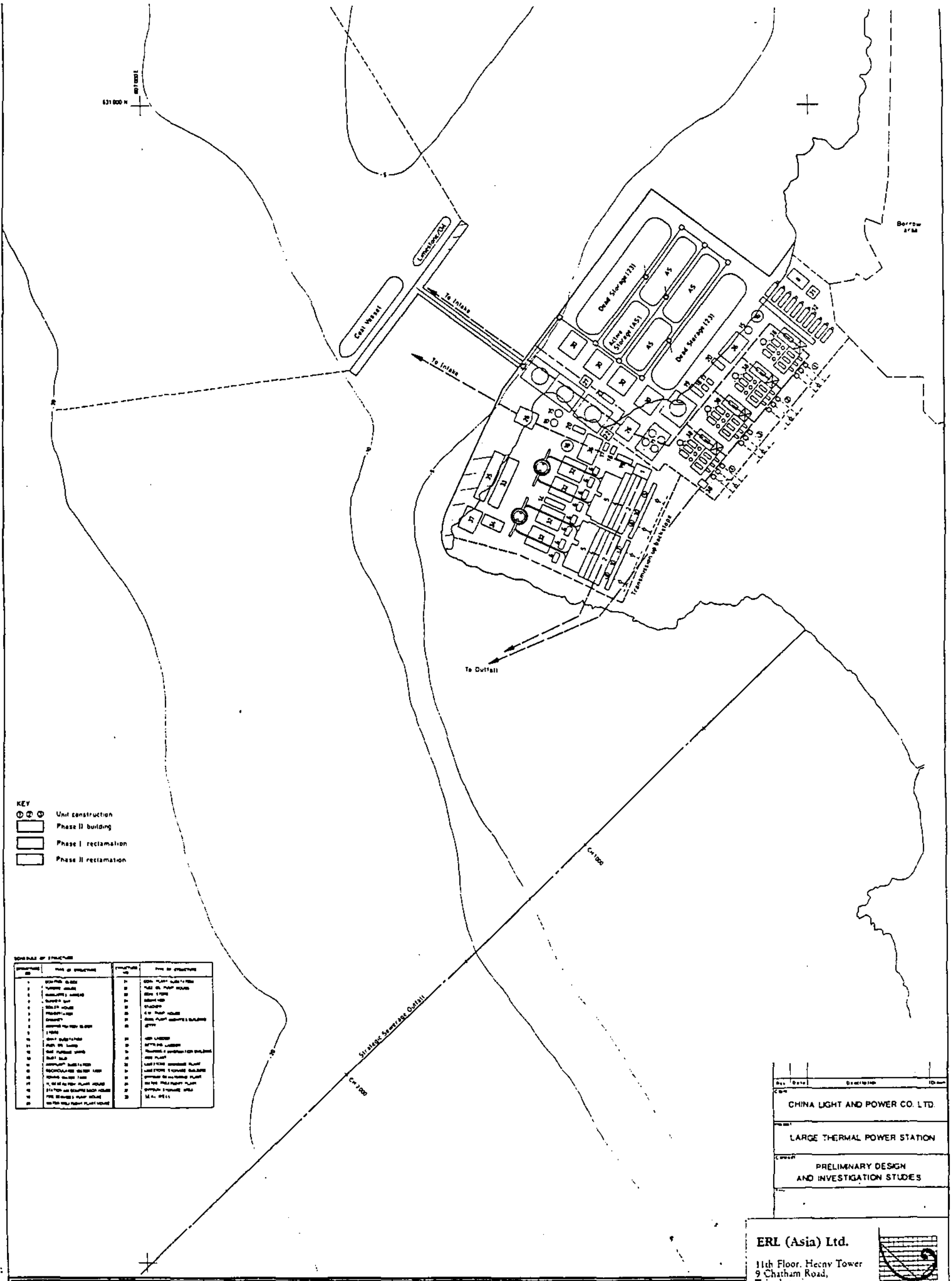

Figure V2/A19 LTPS at Black Point: Stage 5, Scenario II Option 11

ANNEX V2/B

ENVIRONMENTAL MONITORING DURING THE CONSTRUCTION OF THE LTPS

B1. WATER POLLUTION CONTROL AND WATER QUALITY MONITORING

Introduction

The following section includes proposals for procedures designed to safeguard water quality during the construction phase of the LTPS. Studies proceeding as part of the water quality key issue study may identify conditions or requirements that will lead to a revision of monitoring proposals.

It is intended that monitoring should be intensive during the 1st phase of dredging work for seawall construction. If the results of this programme indicate a very low potential for impacts at the Mariculture Subzone it is intended that monitoring should occur on a more infrequent basis during subsequent dredging for the access channel and turning basin. This latter phase of work is currently programmed to last approximately one year.

B1.1 General Requirements

a) The construction works should be carried out in such a manner as to minimise adverse impacts on water quality, in accordance with the Deep Bay Guidelines on Dredging Reclamation and Drainage works, and to ensure that the Water Quality Objectives (WQO) for Deep Bay as specified in the Statement of Water Quality Objectives (Deep Bay Water Control Zone) under the Water Pollution Control Ordinance (Cap. 358) are maintained.

b) If levels of suspended solids are recorded in excess of the natural ambient range by 30%, or if the dissolved oxygen level is recorded as less than 5 milligrams per litre as a consequence of the construction works, necessary measures to promote conditions that comply with the WQO should be taken.

B1.2 Water Quality Objectives

The aim is to minimise adverse impacts resulting from the construction operations on the water quality within Hong Kong waters. The construction work will be subjected to control by the statement of Water Quality Objectives, for the Deep Bay Water Control Zone gazetted in 1990, and that for the planned North Western Waters Control Zone. To achieve these objectives design and implementation of methods of working should aim to:

(i) minimise disturbance to the seabed while dredging

(ii) minimise leakage of dredged material during lifting

(iii) minimise loss of material during transport of fill or dredged material

(iv) prevent discharge of fill or dredged material except at approved locations

(v) prevent the unacceptable reduction, due to the Works, of the dissolved oxygen content of the water adjacent to the Works.

B1.3 Water Quality Monitoring Equipment

Appropriate equipment should be provided for the measurement of suspended solids, turbidity, dissolved oxygen and temperature.

B1.4 Water Quality Monitoring

Monitoring should be carried out in accordance with the following:

a) Baseline conditions for the various water quality parameters should be established prior to the commencement of the marine works. The baseline should be established by measurement of turbidity, suspended solids (mg/L) and dissolved oxygen concentration (D.O. in mg/L) at the locations specified in B1.5.

b) During initial dredging for seawall construction, monitoring should occur for two 24 hour periods at the sites specified in B1.5, in order to establish the conditions at all states of the tide.

c) Should the monitoring programme record levels of suspended solids in excess of 30% above the ambient range, or levels of dissolved oxygen below 5 mg/L, then monitoring should continue whilst modifications to dredging practice are implemented and until such time as conditions return to a level where the WQOs are complied with.

B1.5 Positions of Designated Monitoring Stations

Water quality monitoring should be carried out at the following locations:

(i) Midway between the site boundary and the boundary of the Mariculture Subzone of Deep Bay, approximately 500m north of the Tsang Tsui Ash Lagoon at Grid Ref. 49QHQ005833[1];

(ii) At the boundary of the Mariculture Subzone at Grid Ref 49QHQ020840; and

(iii) At a point within the Mariculture Subzone at Grid Ref 49QHQ029855;

in order to provide an indication of the source of any suspended solids affecting the Mariculture Subzone.

B1.6 Recording of Monitoring Data

The results of all Water Quality Monitoring should be retained and be made available for inspection by EPD. In the event of any exceedance of WQOs recorded during the course of the works, a record of mitigation measures, adopted in order to restore water quality to a level compliant with the WQOs, will be retained and be made available for inspection by EPD.

B1.7 Mitigation in the event of an Exceedance of WQO

In the event of an exceedance of WQO, a review of dredging practice should be carried out. This may include the following:

(a) a review of working methods (for example suspension of the use of the Lean Mixture Overboard Practice).

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[1] Note: all Grid References are UTM grid.

(b) inspection and maintenance or replacement of any marine plant or equipment contributing to the deterioration.

A record of actions should be kept and made available for inspection by EPD.

B1.8 General Procedures to Minimise Pollution during Dredging, Transporting, and Dumping.

(a) All Construction Plant shall be designed and maintained to minimise the risk of silt and other contaminants being released into the water column or deposited in other than designated locations.

(b) Measures to minimise pollution should include :

(i) mechanical grabs if used should be designed and maintained to avoid spillage and should seal tightly while being lifted

(ii) cutterheads of suction dredgers should be suitable for the material being excavated and should be designed to minimise overbreak and sedimentation around the cutter

(iii) all vessels should be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence form vessel movement of propeller wash

(iv) all pipe leakages should be repaired promptly and plant should not be operated with leaking pipes

(v) the Works should cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the Site or dumpling grounds

(vi) all barges and hopper dredgers should be fitted with tight fitting seals to their bottom openings to prevent leakages of material

(vii) excess material should be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessel is moved; and

(viii) loading of barges and hoppers should be controlled to prevent splashing of dredged material to the surrounding water and barges or hoppers should not be filled to a level which will cause overflowing of material or polluted water during loading or transportation.

B1.9 Contract Conditions

It is recommended that contract conditions should contain clauses that require the contractor to comply with WQOs and the requirements of the marine sediment Dumping Licence.

B2. CONSTRUCTION NOISE MONITORING

In order to demonstrate compliance with appropriate noise limits to minimise the disturbance to the general public caused by construction noise, the following construction noise monitoring procedures are recommended:

(a) all sound level measurements should be carried out and recorded by suitably experienced personnel.

(b) a schedule of proposed sound measurement times and locations should be produced and submitted to EPD for approval. The measurement times should be at appropriate intervals and chosen to fairly represent normal construction activities.

(c) construction noise monitoring should be carried out using appropriate equipment which is kept in a good state of repair in accordance with the manufacturers instruction.

(d) the sound level meters used should comply with the International Electrotechnical Commission Publication 651: 1979 (type 1) and 804 : 1985 (type 1), specification as referred to in the Technical Memorandum to the Noise control Ordinance.

(e) the construction noise level monitoring should be carried out at 1 meter from the external facade of the nearest identified sensitive receivers or on the boundary of the construction site.

(f) construction site noise levels should be recorded as the average of three consecutive Leq(5min) measurements. Where a permit is given to work during restricted hours, additional measurements should be taken during the restricted hours.

(g) baseline monitoring to determine and agree pre–existing ambient sound levels should be carried out prior to the commencement of the construction works where the noise climate may be affected by other developments, further baseline measurements should be made.

(h) Checking of ambient noise levels should be carried out on two occasions per year separated by not less than one monthly intervals, for each location. The checking should be carried out when construction activities are not taking place.

B3. MONITORING OF DUST (TSP) LEVELS ARISING FROM THE CONSTRUCTION WORKS

In order to demonstrate that no disturbance to sensitive receivers has been caused by construction dust, (measured as total suspended particulate and herein referred to as "dust (TSP)"), the following construction dust (TSP) monitoring procedures should be carried out:

(a) dust (TSP) level should be measured and recorded by suitably experienced personnel.

(b) the measurements taken should be used to assess the measures taken to control construction dust (TSP) levels on the site.

(c) the dust (TSP) levels should be measured by the "High Volume Method for total suspended particulate" as described by the United States Environmental Protection Agency in 40 CFR Part 50.

(d) the construction dust (TSP) level monitoring should be carried out at a site close to or at the site boundary. The location of the dust (TSP) monitoring should be notified EPD. The agreed locations should not be located near major roads and should be free from local obstructions or sheltering.

(e) monitoring shall consist of :

 (i) the collection of a one hour sample during the working day once a week at a location to be agreed.

 (ii) the collection of 24 hour samples, twice a month

ANNEX V2/C

CONSTRUCTION ASPECTS OF THE COAL CONVEYOR

C1. INTRODUCTION

The location of the LTPS at Black Point approximately 3.5km north of the CCPS introduces the potential for a coal conveyor between the two sites. This would have certain operational advantages in allowing flexibility in the extent and timing of the LTPS coal stockyard and coal vessel berth.

C2. NOTIONAL CONVEYOR SPECIFICATION

The notional specification for the primary features of the conveyor are as follows:

Conveying rate	–	from 1000 tonnes per hr up to 3000 tonnes per hr
System type	–	conventional, curved conventional, cable belt and tube are all under consideration by CLP
Two way conveying	–	not essential, but possible with all except the curved conventional type
Total length of system	–	depends on exact routing but approximately 5km
Cross sectional dimentions	–	approximately 2.5m high x 2.5m wide

The facility would be fully enclosed by metal cladding to protect the coal from wind, rain and pilfering. A chain-link fence might be provided down each side for its full length. It would not require an access road along its length, but access for maintenance would be required. It is considered that a footpath would be sufficient and that permanent illumination would not be needed.

C3. ROUTING

(i) Direct routing across the bay has been examined and rejected.

(a) Overwater

This provides a simple straight-line route with no overland routing constraints and readily allows two-way conveying. However the problems of integrating the system with the PADS reclamation are currently viewed as precluding this option.

(b) Submarine Tunnel

This is attractive as it provides a straight-line route that is both out of sight and out of the way of the PADS reclamation. However preliminary engineering investigations indicate that the subsea geology is unsuitable for tunneling and would result in substantial differential settlement and resultant misalignment of the conveyor. Construction of the PADS reclamation on top of it could also pose problems during construction of the reclamation and with subsequent loadings on its surface.

(ii) Overland routing has also been considered

(a) Close to the shore line

This would pass along Lung Kwu Tan bay, possibly going through a tunnel at the headland mid-way along the bay, keeping close to the existing road and an existing right-of-way for a pipeline. Re-routing and integration into the Tuen Mun Port Development would probably be needed if this PADS scheme goes ahead.

(b) Further in-land

An alternative land route, involving fewer transfer points (needed at each direction change), was considered. This is set back about 200m from the beach but it passes through the existing villages and cultivated land of Lung Kwu Tan and Lung Kwu Sheung Tan. It was rejected on that basis.

(iii) Land Tunnel

This option has been considered but the cost of a tunnel for the whole route is regarded by CLP as prohibitive.

This leaves option (ii)(a) above, the shoreline route along the existing road as the most likely route at this stage.

C4. CONSTRUCTION DETAILS

None are available at this stage, but the following assumptions can be made:

- the structure is relatively light and rapid to assemble on prepared foundations;
- the construction vehicles and equipment would be correspondingly light and large numbers of vehicles would not be needed;
- frequent passing places for local access across the conveyor would be required. These could be under or over depending on the local situation;

- the construction time overall would be about 12 months with about 9 months being taken up by preparation of the foundations and provision of access crossings;

- nightime and weekend working would not be necessary.

C5. LIKELY IMPACTS AND THEIR SIGNIFICANCE

C5.1 Introduction

Based on the above assumptions, the character of the activity would be similar to that of construction of a minor road, and will involve four principal impact categories:

- o Construction dust;
- o Construction noise;
- o Surface water run-off;
- o Visual impacts.

However, if the mitigation measures identified above are adopted impacts from the construction of the conveyor are considered to be acceptable.

C5.2 Construction Dust

Construction dust from earth moving activities such as material handling and stockpiling can become a nuisance to the public if uncontrolled. However, in view of the limited amount of excavated material to be handled on-site, impacts from these activities will be confined close to the source, and good site housekeeping practices should ensure that no significant dust impacts arise.

C5.3 Construction Noise

The main sources of construction noise will arise from powered mechanical equipment on the conveyor route during foundation preparation and possible shallow-depth piling at some locations where the ground conditions are soft.

Any impacts from these works will in any event, be short-lived as the construction activities will be transitory as work on the conveyor progresses along the route.

Noise impacts that may arise from these activities can be minimised through the proper observance of appropriate site-housekeeping practises, such as regular maintenance of effective silencing on motorised plant, and through the use of non-percussive piling methods where practical. Noise from the construction activities are thus expected to be controlled such that the acceptable noise levels specified in the Technical Memoranda under the Noise Control Ordinance are achieved.

C5.4 **Surface Water Run-off**

Appropriate bunded areas will be provided for the siting of fuel tanks and other solvents. In the event of spillage, leakage or tank burst the bund capacity will contain the fluid and prevent significant surface water contamination. Special attention will be paid at stream crossings to ensure that debris and building materials do not enter the water course.

C5.5 **Visual Impacts**

The transitory nature of the works will result in visual impacts being caused only for a brief period (i.e. wecks) to individual receptors during the construction works. Strict application of good site housekeeping practice will further reduce the overall impact of the construction works, and any security lighting which may be necessary should be kept to a minimum, with directional lighting units used wherever possible.

ANNEX V2/D

CONSTRUCTION PROFILE

CONSTRUCTION PROFILE

LTPS-IAR-SCENARIO I

Note: This assumes 8 coal units will be built and commissioned in four pairs; two pairs in Phase 1 and two in Phase 2.

1) Reclamation works including seawall

Description: site mobilisation and clearance, removal of topsoil, removal of marine deposits (to various depths), reclamation of foreshore and seawall construction, installation of drains in marine deposits, blasting of rock outcrop and removal for reclamation use, slope stability and protection works.

All seawall work is completed in Phase 1.

Working hours: 24 hours, 7 days/week

Start/complete: Phase 1 12/91 - 2/93
Phase 2 9/99 - 2/2000

Materials	Phase 1	Phase 2
Marine deposit removed	4,344,000 m^3*	-
Fill material placed	5,130,000 m^3	1,380,000
Material for seawall	1,685,000 m^3	-

Location - Whole site area (progressive construction starting in Phase 1 area)

Excavations primarily along south and west quadrant and reclamation across northern quadrants. Phase 2 excavations and reclamation will continue eastward from Phase 1 areas.

Plant Type	No.	Duration (hrs)	
Dredger (grab/suction)	3	24	* assumes only deposits removed beneath are seawall.
Tugs/ancillary boats	2+1	24	
Barges (bottom dumping)	3	24	
Floating crane (seawall and caissons)	1	24	
Rock drills (fuel-powered)	10+	10	(blasting and rock anchors)
Tracked excavators + ripper	4	12	
Wheeled loaders (large)	3	12	
Off-road trucks (large 30+ cu m)	15	12	
Road trucks (spoil, 15 cu m)	4	12	
Concrete pump	1	6	(for shotcreting)
Ancillary plant (i.e. generators, lighting)	10	24	
Crusher/Screening Plant	2	12	

2) Foundation Construction (including piling)

Description: Excavation for trenches and foundations, placement of forms and rebar, pouring of concrete, and placing of backfill.

Working hours 12 hour 6 days/week

Start/complete Phase 1 12/92 - 06/94 + 12/96 - 12/98
Phase 2 12/99 - 06/2001 + 12/2002 - 12/2003

	Phase 1	Phase 2
Excavation	1,000,000 m^3	1,200,000 m^3
Concrete	700,000 m^3	900,000 m^3
Backfilling	200,000 m^3	250,000 m^3

Location – Whole site area, but most work along south half of site for example foundations; rock excavation only on unreclaimed lands.

Note: activity split into 2 for each phase. Second section for each phase is six months longer due to more complicated foundations [extra piling].

Plant Type	**No.**	**Duration (hrs)**	
Blasting (rock drill)	1	1–2 charges per day for rock excavations	
Tracked excavator	2	12	
Mobile crane	3	12	
Pumps (water)	2	24	
Dozers	2	12	
Crusher/screening plant	1	12	
Concrete batch plant	1	12	
Concrete trucks	8	12	
Compressor + pokers etc	3	12	
Trucks (spoil removal)	2	12	
Trucks (backfill material)	2	12	
Pumps (concrete)	2	3	
Generator	1	24	(until Unit 1 commissioned)

Note: All durations are averaged over entire activity duration.

3) Structural Steelwork

Description:	deliver, offload, placement, and erection of steelwork	
Working hours:	12 hours	6 days/week
Start/complete:	Phase 1	10/93 – 10/95 + 10/97 – 10/99
	Phase 2	12/2000 – 12/2002 + 12/2004 – 12/2006

	Phase 1		Phase 2
Tonnage⁺	25,000 T *	+	25,000 T *
	40,000 T **	+	40,000 T **

⁺ Tonnage for each phase split equally in time periods.

Location – Main volume of work in power block area (turbine halls, Annexes, bunker bays, boiler house, precipitators, flues); light steelwork for ancillary buildings over entire site, excluding coal facilities.

Plant Type	**No.**	**Duration (hrs)**	
Heavy duty tracked cranes	2+2	12	(2 for boiler houses plus 2 for main building)
Mobile light duty cranes	2	12	(part time)
Generator	2	12	

* Turbine halls, annexes, bunker bays, and ancillary plant buildings

** Boiler houses only

4) **Chimney (for coal fired units)**

Description:	Construction of chimney foundations, slipforming of two windshield chimneys, erection of internal floors, and installation of flue liners and ancilliary finishes.		
Working hours:	Slip forming Other	24 hours, 7 day/week 12 hours, 6 day/week	
	Phase 1		Phase 2
Start/complete foundation + windshield	1/94 - 4/95	1/2001 - 2/2002	
Volume of concrete in chimneys	1 x 250m chimney	: :	Superstructure 14,750 m^3 foundations 6,500 m^3 and piling as necessary
	Phase 1		Phase 2
Start/complete flues/internals	4/95 - 4/96		2/02 - 2/03
Location:	Chimney area		

Plant Type	**No.**	**Duration (hrs)**
Generators	2	24
Hoist (concrete placement + rebar supply)	1	24
Trucks (concrete)	2	24
Concrete batch plant	1	24

5) **Piling**

- Piled supports in reclaimed areas (where required) would be expected to be formed using hand dug caisson method requiring very little mechanical plant.
- For the jetty the piling requirements are discussed in the relevant section.
- For the CW pumphouse and CW pressure culverts some piling may be necessary but this will depend on the location of the various elements of the system in relation to the reclaimed and unreclaimed land.
- For the chimney piling is envisaged.
- Seawall berths and main jetty berths would be formed with sand-filled caissons with no piling; steel trestle to jetty berths would be piled.

6) **Superstructures/site services**

Description:	Installation of shuttering, fixing rebar, placement of concrete, construction of finishes, installation of site services.		
Working hours	12 hours	6 day/week	
Start/complete	Phase 1	4/94 – 06/96 + 04/98 – 06/2000	
	Phase 2	06/2001 – 08/2003 + 06/2005 – 08/2007	
	Phase I		Phase II
Concrete	350,000 m^3	+	250,000 m^3
Location:	at each individual building on site together with site service trenches.		

Plant Type	**No.**	**Duration (hrs)**
cranes (medium duty mobile)	3	12
cranes (light duty mobile)	2	12
trucks (concrete)	3	12
compressors	4	12
generators	4	12
excavators	2	12
trucks (spoil & backfill)	2	12

7) **Jetty**

Construction period:	contingent on jetty or seawall. Plant is supplied assuming jetty. 3 year period incl. dredging.	
Description:	driving of piles, uses precast concrete caissons for berths, construction of precast deck slab, installation of fendering, dredging access channel, provision of rock sockets into granite.	
Working hours:	jetty work	12 hours, 6 day/week
	piling	12 hours, 7 day/week
	dredging	24 hours, 7 day/week
Start/complete	Phase 1	6/92 – 6/95
	Phase 2	6/04 – 6/05
Materials:	piling	9,300 T + 4,700 T
	concrete	24,000 m^3 + 13,000 m^2
	dredging	15,000,000 m^3 – this is for initial dredging only for seawall berth option
Location:	jetty	

Plant Type	**No.**	**Duration (hrs)**
(Floating) Pile driving rig	1	12⁕
Barge (general)	1	12
Barge (concrete)	1	12*
Floating crane	1	12
Compressor/pokers	2	12
Auger for rock sockets	1	12
Dredger (suction)	1	24
Barges	3	24
Tugs	1	24

* It is assumed that the concrete for the manufacture of precast units will be made onshore at a separate batching plant.

⁕ Heavy piling equipment. Pile size upto 1,300mm diameter and upto 40m long.

8) **Site Access Road (outside site) will connect to the South Access Road**

Description:	site clearance, blasting/removal of rock to form embankments, cuttings, drainage works and road surfacing, slope stability and protection works. Will only be constructed in Phase I.	
Working hours:	12 hours	6 day/week
Start/complete:	Phase 1 Phase 2	1/92 – 1/93
Road:	Length 1,500m, width 7m	

Location: Initial use of Slurry Line Road (track) west of South Access Road

Plant Type	No.	Duration (hrs)
Dozer	1	12
Rock drill	1	2
Trucks (spoil)	3	12
Excavator	2	12
Vibrating roller	2	12
paving machine	1	12
Trucks (concrete)	1	6
Trucks (material import)	1	12

Note all equipment will not be in use at the same time.

9) **Construction Material Deliveries**

The descriptions of the site specific construction activities do not allow for the plant which will deliver materials to site (e.g. cement, bricks) or transport the heavy plant (dozers, cranes etc.). These are listed below:

Description: transport to site of construction materials (cement, sand, rebar, steelwork, finishing materials, cladding, steel piles (jetty))

transport heavy equipment to site on low loader.

Working hours – as required

Start/complete	Phase 1	1/93 – 10/97
	Phase 2	1/00 – 9/04

Location – all site

Plant Type	No.	Duration (hrs)
Low loaders	say	3 per day for 1st week then 1 per day for each week
Material delivery	say	10 trucks per day

Excludes reclamation material and sand aggregate obtained from crushing rock, and plant for reclamation operations.

Batching plant (900 m^3/day)	3	12
Stockyards (rail mounted cranes)	2	12
Crushing plant for aggregate capacity to be advised	1	12

Note, much construction material and equipment to be delivered by sea.

10) **Equipment Placement and Installation**

Sections 1–9 cover only civil works and do not include installation of mechanical, electrical, and instrumentation equuipment. Following completion of foundations and structural supports equipment may be delivered and installed beginning with Units 1 and 2 and common supporting equipment. Boilers and turbines for Units 3–4 will be delivered later and in sequence with the operating demand for the Power Station.

Description: transport to site of equipment including boilers, turbines, gas turbines, oil tanks, coal handling cranes, spreaders/reclaimers, conveyors, etc. generally by marine barge.

Working hours – as required

Start/complete	Phase 1	1/94 – 10/2000
	Phase 2	1/2001 – 9/08

Location – all site

Plant Type	No.	Duration

Note, much construction equipment likely to be delivered by sea.

CONSTRUCTION PROFILE

LTPS - IAR - SCENARIO II

1) **Reclamation works including seawall**

Description: as for Scenario I

Working Hours: as for Scenario I

Start/complete	Phase 1	04/93 - 12/93
	Phase 2	12/98 - 12/99

	Phase 1	Phase 2
Marine deposit removed	225,000 m^3	900,000 m^3
Fill material placed	1,750,000 m^3	7,000,000 m^3

Location - whole site area (progressive construction starting in Phase 1 area)

Note: Final quantities will depend on final site layout adopted.

Plant Type	**No.**	**Duration (hrs)**	
Dredger (grab/suction)	1	24	See notes for Scenario I
Tugs/ancilliary boats	1	24	
Rock drills	5	10	
Excavator + ripper	2-3	12	
Dozer (large)	2	12	
Trucks	10	12	
Concrete pump	1	6	
Barges (bottom dumpling)	2-3	24	
Floating crane + ancilliary plant (compressors, lighting etc.)	1	12	

2) **Foundation construction (including piling)**

Description:	as Scenario I	
Working hours:	as Scenario I	
Start/complete:	Phase 1	10/93 - 02/94 + 10/97 - 02/99
	Phase 2	12/99 - 8/2001 + 12/2003 - 12/2005

Excavation	$0.8 \times 10^6 + 1.2 \times 10^6$ m^3
Concrete	$0.6 \times 10^6 + 1.0 \times 10^6$ m^3
Backfilling	$0.2 \times 10^6 + 0.25 \times 10^6$ m^3

Location - as Scenario I

Plant Type	No.	Duration (hrs)
Blasting (rock drill)	1	may be 1-2 charges per day on unreclaimed land
Tracked excavator	2	12
Mobile crane	2	12
Pumps (water)	2	24
Dozers	2	12
Concrete trucks	4	12
Trucks (spoil)	4	12
Trucks (backfill)	1	12
Pumps (concrete)	2	3 hours/day each

Note : Construction programme for Phase I shorter than for Scenario I due to simpler foundations and construction for combined cycle plant.

3) **Structural Steelwork**

Description:	as Scenario I	
Working hours:	as Scenario I	
Start/complete	Phase 1	8/94 - 12/95 + 01/98 - 12/99
	Phase 2	10/2000 - 10/2002 + 10/2004 - 10/2006

Tonnages
4,000 T* + 25,000 T***
10,000 T** + 40,000 T****

Location:
* Turbine Hall (Gas and Steam) Control and Electrical building and Ancillary buildings
** Waste Heat Boilers, chimney, blast stack
*** Turbine Hall, Annexe, Bunker Bay and Ancillary buildings
**** Boiler Houses only

Plant Type	No.	Duration (hrs)
Heavy duty tracked	2	(for Phase 1)
cranes	2+2	(for Phase 2)
Generator	1	
Mobile light		
Duty crane	2	

Note: construction programme shorter than Scenario I due to simpler foundations and steelwork.

4) **Chimney**

Description and all other items as Scenario I except programme

Start/complete	02/2000 - 04/2000	windshield
	04/2000 - 05/2001	flues

Note: No duration for phase I as chimney is an integral part of plant for combined cycle.

5) **Piling**

Description etc as Scenario I.

6) **Superstructures/site services**

Description – as Scenario I

Working hours – as Scenario I

Start/complete	Phase 1	12/94 – 07/96 + 12/98 – 07/2000
	Phase 2	04/2001 – 01/2003 + 04/2005 – 06/2007

Concrete 0.1×10^6 m^3 + 0.35×10^6 m^3

Location – as layout plan

Plant Type

as Scenario I

7) **Jetty (if required)**

Construction period: Contingent on seawall or jetty. Plant is supplied assuming jetty. 3 year period including dredging. No deep berthing requirements for phase I as fuel will be piped to site.

Description – as Scenario I
Working hours – as Scenario I
Start/Complete Phase II 06/99 – 06/2002

Material	Piling	9,300 T
	concrete	24,000 m^3
	dredging	900×10^4 m^3 (upto 10m of silt over area of 1.8km^2)

Location – jetty

Plant Type	**No.**	**Duration (hrs)**

as Scenario I

8) **Site Access Road**

Description etc as Scenario I

9) **Construction Material deliveries**

Description – as Scenario I
Working hours: ditto

Start/complete	Phase 1	1/93 – 10/96
	Phase 2	1/99 – 10/03

Plant type/description – as option B except under Phase 1 only 2 no batching plants would be required.

10) **Site facility component areas**

	Phase 1	Scenario I Phase 2	
o CW Pumphouse	0.4	0.4	
o Coal store	22.0	22.0	
o Oil storage tanks	2.5	2.5	
o Boilers, Precipitators and Flues, FGD plant	9.0	9.0	
o Turbine Hall, Annexe and Bunkers	2.6	2.6	
o Gas Turbines	1.5	-	
o Substations, Transformers, overhead lines	1.3	0.7	
o Graded slopes	9.6*	6.4	(When all plant built)
o Streets, open areas	7.9	2.0	
o Ancillary plant buildings	2.0	2.0	
o Limestone/Gypsum storage & production areas	3.4	3.4	
o Jetty	1.2	0.7	
o Chimney	0.6	0.6	
o Access corridor	5.5	-	
o Transmission corridor	4.2	-	
	73.7	52.3	

Total site area = 73.7 – 9.6* + 52.3 = 116.4 ha