

**SECTION 3**

### 3 NOISE

#### 3.1 Introduction

- 3.1.1 The WCR alignment begins, at grade, at Tseung Kwan O Road P2 connection and follows the coastline south west passing through a short tunnel at Lei Yue Mun Headland. At Sam Ka Tsuen it passes onto elevated structure running along the front of the existing Yau Tong Industrial Area and proposed CDA site at Yau Tong Bay to connect with South East Kowloon (SEK) Trunk Road T2. In addition to the main WCR alignment, this assessment also considers the two associated slip roads to be provided at Lei Yue Mun.
- 3.1.2 The Study Area considered in this noise assessment encompasses a 300 m corridor running along either side of the WCR alignment (and associated road networks) for its entire length. In general, in areas densely populated by noise sensitive uses, a selection of Assessment Points (APs) have been used to represent a number of NSRs. The APs selected are considered to be the worst affected of the NSRs represented.
- 3.1.3 The WCR scheme includes the reclamation of a section of land from Victoria Harbour between Sam Ka Tsuen Typhoon Shelter and Yau Tong Bay. This reclamation will interfere with the operations of the FMO Kwun Tong Wholesale Fish Market (hereafter referred to as the 'Fish Market') currently located within the Yau Tong Industrial Area).
- 3.1.4 Where the WCR approaches SEK Route T2, local access to the WCR would be provided by slip roads connecting to the roundabout linking it with Cha Kwo Ling Road. The provision of the roundabout would require the resumption of land currently occupied by a Civil Engineering Department (CED) Maintenance Depot (hereafter referred to as the 'CED Depot').
- 3.1.5 In view of the impacts on the Fish Market and the CED Depot, TDD has committed to re-provision these facilities as part of the WCR Scheme. These will be located side by side on the waterside edge of the WCR reclamation, between the shore line and WCR, across from the future residential development planned for the existing Yau Tong Industrial Area.
- 3.1.6 The potential impacts associated with the relocation of the CED Depot and the Fish Market are provided in *Annex I* of this report. The results of this assessment show that no noise impacts would occur from the operation of the CED Depot and the Fish Market at their proposed locations.
- 3.1.7 This *Section* presents an assessment of the potential noise impacts associated with both the construction and operation of the proposed WCR. The quantitative assessment methodology which has been adopted for the assessment is presented and, where necessary, mitigation measures to ensure the appropriate protection of the identified NSRs have been recommended.

### 3.2 Government Legislation and Standards

#### *Construction Phase*

3.2.1 The principal legislation governing the control of construction noise is the *Noise Control Ordinance* (NCO) (Cap 400) and the *Environmental Impact Assessment Ordinance* (EIAO) (Cap 499). Guidelines concerning the assessment methodology and relevant criteria are provided in the supporting Technical Memoranda (TMs). The following TMs are applicable to the control of noise from construction activities:

- *Technical Memorandum on Noise from Percussive Piling* (PP-TM);
- *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (GW-TM);
- *Technical Memorandum on Noise from Construction Work in Designated Areas* (DA-TM); and
- *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM).

#### *Percussive Piling*

3.2.2 Percussive piling is the construction process which is most likely to generate noise impacts and as a result it is tightly controlled under the Construction Noise Permit (CNP) System. No percussive piling may be carried out in Hong Kong without first obtaining a CNP. A CNP will only be issued for percussive piling which is scheduled during normal working hours Monday to Saturday between 0700 and 1900 hours.

3.2.3 Percussive piling is prohibited at any time on Sundays and public holidays as well as during the weekday evening and nighttime hours (1900 to 0700 hours, Monday through to Saturday).

3.2.4 When assessing a CNP application for the carrying out of percussive piling, the Environmental Protection Department (EPD) is guided by the PP-TM. The EPD will look at the difference between the Acceptable Noise Levels (ANLs), as promulgated in the PP-TM, and the Corrected Noise Levels (CNLs) that are associated with the proposed piling activities. Depending on the level of noise impact on nearby Noise Sensitive Receivers (NSRs), the EPD would allow 3, 5 or 12 hours of daily piling time (see *Table 3.2a*).

**Table 3.2a Permitted Hours of Operation for Percussive Piling**

Amount by which CNL exceeds ANL	Permitted hours of operation on any day not being a holiday
More than 10 dB(A)	0800 to 0900 and 1230 to 1330 and 1700 to 1800
Between 0 dB(A) and 10 dB(A)	0800 to 0930 and 1200 to 1400 and 1630 to 1800
No exceedance	0700 to 1900

- 3.2.5 The Government is committed to phase out the use of diesel, pneumatic and steam hammer pile drivers, which are particularly noisy. The use of such pile drivers will be prohibited from 1 October 1999. Since July 1997, in preparation for the incoming legislative control, the Government no longer permits the use of diesel hammers on any Government projects.

*General Construction Works*

- 3.2.6 Noise generated by general construction works during normal working hours (ie 0700 to 1900 hours on any day not being a Sunday or public holiday) fall within the scope of the EIAO-TM. The recommended noise standards are presented in *Table 3.2b* below.

**Table 3.2b EIAO-TM Daytime Construction Noise Limit (Leq, 30 min dB(A))**

Uses	Noise Standards
Domestic Premises	75
Educational institutions (normal periods)	70
Educational institutions (during examination periods)	65

- 3.2.7 The NCO provides statutory controls on general construction works during the restricted hours (ie 1900 to 0700 hours Monday to Saturday and at any time on Sundays and public holidays). The use of powered mechanical equipment (PME) for the carrying out of construction works during the restricted hours would require a CNP. The EPD is guided by the GW-TM when assessing such an application.
- 3.2.8 When assessing an application for the use of PME, the EPD will compare the ANLs, as promulgated in the GW-TM, and the CNLs (after accounting for factors such as barrier effects and reflections) associated with the proposed PME operations. A CNP will be issued if the CNL is equal to or less than the ANL. The ANLs are related to the noise sensitivity of the area in question and different Area Sensitivity Ratings (ASRs) have been drawn up to reflect the background characteristics of different areas. The ASR is a function of the type of area in which the NSR is situated and the degree to which it is effected by so called influencing factors such as major roads and industrial areas. The ASR of a particular NSR is determined in accordance with the NCO and applicable TMs. The relevant ANLs are shown in *Table 3.2c*.

**Table 3.2c Acceptable Noise Levels (ANL, Leq, 5 min dB(A))**

Time Period	Area Sensitivity Rating		
	A	B	C
All days during the evening (1900 to 2300 hours) and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60	65	70
All days during the nighttime (2300 to 0700 hours)	45	50	55

3.2.9 In addition to the general controls on the use of Powered Mechanical Equipment (PME) during the restricted hours, the EPD has implemented a more stringent scheme via the DA-TM. The DA-TM regulates the use of five types of Specified Powered Mechanical Equipment (SPME) and three types of Prescribed Construction Work (PCW), which are non-PME activities, in primarily densely populated neighbourhoods referred to as Designated Areas (DAs). The SPME and PCW are as follows:

*SPME*

- handheld breaker;
- bulldozer;
- concrete lorry mixer;
- dump truck; and
- handheld vibratory poker.

*PCW*

- erection or dismantling of formwork or scaffolding;
- loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material; and
- hammering.

3.2.10 In the interest of offering additional protection to the population, the carrying out of PCW is generally prohibited inside a DA. As for the use of SPME, it would be necessary to comply with the DA-TM noise level requirements that are 15 dB(A) more stringent than those recommended in the GW-TM before a CNP would be issued.

*Operational Phase*

3.2.11 The EIAO-TM and Hong Kong Planning Standards and Guidelines (HKPSG) provides guidance on acceptable road traffic noise levels at the openable windows of various types of noise sensitive buildings. The relevant criteria are shown in *Table 3.2d*.

**Table 3.2d EIAO-TM Road Traffic Noise Planning Criteria**

Uses	Road Traffic Noise L10, (1 hr) dB(A)
Domestic Premises	70
Hotel and Hostels	70
Offices	70
Educational Institutions	65
Note: The criteria presented in the above table apply to noise sensitive uses which rely on open window ventilation	

- 3.2.12 The EPD Guideline for Traffic Noise Assessment Report for New Road Projects specifies that where an exceedance of traffic noise criteria recommended by EIAO-TM is identified, direct remedies should be incorporated in the road design (e.g. highway alignment, noise barriers, low noise road surfaces, etc).
- 3.2.13 In cases where practicable direct mitigation measures would not be wholly adequate in mitigating noise impacts, indirect technical remedies in the form of Noise Insulation Works (NIW) under the ExCo directive "*Equitable Redress for Persons Exposed to Increased Noise resulting from the use of New Roads*" may be considered. In order for a NSR to qualify for NIW the resulting residual impacts must satisfy the following three criteria:
- (i) the predicted overall noise level from the new road together with other traffic in the vicinity must be above a specified noise level e.g. 70 dB(A) for domestic premises and 65 dB(A) for education institutions all in L<sub>10</sub>, 1 hour;
  - (ii) the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total existing traffic noise level before the works to construct the road were commenced; and
  - (iii) the contribution to the increase in the predicted overall noise level from the new road must be at least 1.0 dB(A).
- 3.2.14 All properties considered eligible for NIW would be recommended to ExCo for approval.

### 3.3 Baseline Conditions

#### *Tseung Kwan O*

- 3.3.1 In the context of this EIA Report, the area broadly referred to as TKO is defined as the southern slopes of Chiu Keng Wan Shan and Pau Toi Shan (Devil's Peak) between Chiu Keng Wan, with connection to the TKO Road P2 and the eastern portal of the short tunnel cutting through the tip of Lei Yue Mun Headland. This area is essentially rural in nature with few scattered one or two storey dwellings or clusters of dwellings. There are currently no major roads in this area.

#### *Lei Yue Mun*

- 3.3.2 In the context of this EIA Report, Lei Yue Mun area refers to the area south west of the Lei Yue Mun Headland and includes the villages of Ma San Tsuen and Sam Ka Tsuen. This area is a densely populated residential area accommodating typical three storey village dwellings as well as the Hoi Bun school. The major noise sources in this area include industrial uses and marine activities. There are currently no major roads in this area.

### *Yau Tong Bay*

- 3.3.3 The existing noise environment at Yau Tong Bay is dominated by industrial noise and noise from marine activities to the south and east. The dominant source of noise to the north and east are road noise from Cha Kwo Ling Road and the Eastern Harbour Crossing (EHC) toll plaza. It should be noted that the NSRs identified in this area represent proposed developments. Given the number of proposed developments in this area and that construction of WCR is scheduled to commence in the final quarter of 2002, it is unlikely that these NSRs will actually experience the current noise environment described above.

### *Cha Kwo Ling*

- 3.3.4 Noise levels at Cha Kwo Ling are dominated by traffic noise from Cha Kwo Ling Road. The noise environment in this area will be affected not only by the WCR but also by the proposed South East Kowloon Trunk Road T2. Potential impacts from the proposed Trunk Road will not be addressed in this assessment as details of this roadway are under development and the assessment is considered to be outside this Study.

### *Yau Tong Centre*

- 3.3.5 The existing noise environment in and around Yau Tong Centre is dominated by road traffic noise from the existing roads.

## **3.4 Noise Sensitive Receivers**

- 3.4.1 The noise sensitive receivers considered in this assessment include existing residential, educational and religious uses as well as planned noise sensitive uses. These are described in the following paragraphs of this *Section*.

### *Existing Noise Sensitive Areas*

- 3.4.2 The existing noise sensitive areas that are likely to be affected by WCR include: the sparsely populated low rise residential area in the Tseung Kwan O Area, more densely populated low rise residential areas in Lei Yue Mun and medium rise residential blocks in Yau Tong Centre (*Figures 3.4a, 3.4c, 3.4d and 3.4i*). Hoi Bun School at Lei Yue Mun is also included as is the Bishop of Roman Catholic Church in Yau Tong Centre.
- 3.4.3 The Bishop of Roman Catholic Church is a modern building, the design layout of which incorporates a high perimeter wall, presumably to mitigate against traffic noise. It is assumed that the glazing of this church is acoustically equivalent to Type I as specified in the EIAO-TM<sup>(1)</sup> which may be used for NSRs which are exposed to criteria exceedances of up to 10 dB(A). The criterion for churches and schools which rely on open window ventilation is 65 dB L<sub>A10 (peak hour)</sub>. However,

<sup>(1)</sup> Openable gasketed window, 6mm pane, or transmission loss (TL) of 28 dB or above in 250 Hz octave-band and sound transmission class (STC) 31 or above.

with the central air-conditioning, the church will not rely on openable windows for ventilation and, therefore, would not suffer from excessive traffic noise impacts.

- 3.4.4 The Lei Yue Mun and Yau Tong areas (including sites earmarked for future residential developments) are classified as Designated Areas (DAs). DAs are considered to be more sensitive to construction noise and consequently the use of PME and carrying out of PCW during the restricted hours will be more tightly controlled in these areas.

### *Proposed Developments*

#### *Lei Yue Mun Housing Site*

- 3.4.5 Lei Yue Mun Housing Site will comprise of four residential blocks built above a purpose built platform shown in *Figures 3.4a* and *3.4d*. It will be located approximately 60 m due east of Yau Tong Centre with the proposed Lei Yue Mun slip roads constructed in the intervening land. NSRs within this development are likely to be exposed to noise generated by traffic using the Lei Yue Mun slip roads as well as Ko Chiu Road and the roundabout which connects the two roads. A total of ten APs have been selected within this development to represent those NSRs most likely to be affected by road traffic noise. Nine of these represent high rise residential dwellings while the remaining one represents a low rise kindergarten (one storey) with a one storey social centre for the elderly above.

- 3.4.6 The Territory Development Department (TDD) has proposed that the construction of the WCR slip roads at Lei Yue Mun shall be included in the platform relocation works contract in order to minimise potential construction impacts at the Lei Yue Mun Housing Site. Since the construction of the slip roads would clearly precede occupation of this development, potential NSRs within this development have not been included in the construction noise assessment of this Study.

#### *Yau Tong Estate*

- 3.4.7 Yau Tong Estate will be located immediately west of Lei Yue Mun Road shown in *Figures 3.4a* and *3.4e*. It will comprise of a total of sixteen 40 storey residential blocks, two standard primary schools and one special school. This development will be constructed in five distinct phases above a podium with an elevation of +50.25 mPD. One of the primary schools within this development has been reserved for the reprovisioning of Po Chiu College which will be affected by the proposed MTR Yau Tong Station. The proposed layout for this development already includes noise mitigation measures in the form of a 3 m horizontal barrier protruding from the podium edge which will provide some degree of protection from road traffic noise. Since this noise barrier is included in the development design and will be provided irrespective of whether or not WCR goes ahead, it has been included in the unmitigated road traffic noise model. A total of six APs have been selected within phase 5 of the development to represent those dwellings most affected by the WCR and its associated road network.



### *Ko Chiu Road Estate*

- 3.4.8 Ko Chiu Road Estate shown in *Figures 3.4a* and *3.4e* will be located immediately east of Lei Yue Mun Road and will comprise of a total of eighteen 36 storey residential blocks within five distinct phases. The construction of *Phases 1* and *2* are already complete and work is in progress for *Phase 4*. Six APs have been selected to represent the NSRs within *Phase 5* which are the NSRs most likely to be affected by traffic noise associated with WCR. It should be noted that the design of this development includes a 3 m horizontal noise barrier protruding from the podium edge. This barrier has been included in both the unmitigated and mitigated versions of the noise model.

### *Proposed Yau Tong Bay CDA Site*

- 3.4.9 An application has been made on behalf of a property developer to extend the boundary of the existing CDA site at Yau Tong Bay requiring the rezoning of two industrial areas and one G/IC site. The proposed extension would also include a section of seabed area.
- 3.4.10 The proposed layout shown in *Figure 3.4a* and *3.4f* outlined in the request for rezoning Yau Tong Bay<sup>(2)</sup> has been used for the purpose of this assessment. This layout includes provision for two office blocks and forty-one residential towers ranging from 39 to 43 storeys tall as well as five primary schools and three secondary schools. The site will be bounded by Cha Kwo Ling Road to the north and east, Ko Fai Road to the south and the elevated WCR road to the west. Mitigation measures in the form of 3 m boundary barriers (the minimum height proposed)<sup>(2)</sup> adjacent to Cha Kwo Ling Road directly in front of the proposed schools have been proposed within the layout of this development. These are included in the unmitigated road traffic noise assessment for this development. A total of ten APs have been selected to represent NSRs within this development.

### *Cha Kwo Ling Site*

- 3.4.11 It is proposed that a residential development is built immediately north east of the Eastern Harbour Crossing entrance shown in *Figure 3.4a* and *3.4g*. The development will comprise of 27 residential blocks, four primary schools and two secondary schools. Those NSRs most likely to be affected by WCR scheme are the residential blocks within the southern end of this site. Four representative APs have been selected to represent these NSRs.

### *Eastern Harbour Crossing Site*

- 3.4.12 This proposed development shown in *Figure 3.4a* and *3.4h* will be constructed above a commercial podium within the triangular area bounded by Cha Kwo Ling Road, Yau Tong Road and the approach road to the Eastern Harbour Crossing (EHC). The development will comprise of four distinct sites. Sites A (+40 mPD)

<sup>(2)</sup> Request for Rezoning Yau Tong Bay CDA Supplementary Planning Statement, Main Wealth Development Limited. November 1997.

and B (+25 mPD) which will be located in the north west and south west corners of the site will accommodate twelve and seven residential blocks, respectively. Sites C and D, in the eastern corner of the site (+15 mPD), and consequently the most likely to be affected by noise from WCR, will accommodate the three proposed primary schools.

- 3.4.13 For the purpose of the traffic noise assessment a total of three representative APs have been selected within this area. Two of these will represent the secondary school in Site D and one represents the residential block which is closest to Cha Kwo Ling Road. It is assumed that the proposed schools will have the standard six floors while the residential blocks will be 35 storeys tall.

#### *Yau Tong Industrial Area*

- 3.4.14 The Central and East Kowloon Development Statement has identified Yau Tong Industrial area (*Figures 3.4a and 3.4j*) to have redevelopment potential for employment and non-employment uses. Nevertheless, the details of land use proposals and development parameters need to be further studied. For the purpose of this assessment, it has been assumed that this development will be similar in nature to that proposed for the neighbouring CDA site.

- 3.4.15 Four APs within this area have been considered in the road traffic noise assessment. Three APs represent a facade parallel to the main WCR alignment at three different setbacks (20 m, 30 m and 50 m from the WCR alignment). The fourth represents a building facade perpendicular to the main alignment at a setback distance of 30 m from the Shung Shun Street Boundary.

- 3.4.16 For the purpose of this operational noise assessment, ten noise sensitive areas have been considered represented by a total of sixty-six Assessment Points (APs). These represent residential properties, schools and churches in the following areas:

- Lei Yue Mun (15 APs);
- Lei Yue Mun Housing Site Phases 1 and 2 (10 APs);
- Yau Tong Centre (5 APs);
- Yau Tong Housing Estate Phase 5 (6 APs);
- Ko Chiu Road Housing Estate Phase 5 (6 APs);
- Yau Tong Bay Residential Development (10 APs);
- Cha Kwo Ling Residential Development (4 APs);
- Residential Development at the Eastern Harbour Crossing Site (3 APs);
- Tseung Kwan O (scattered housing) (4 APs); and
- Future Residential Development at Yau Tong Industrial Area (4 APs).

- 3.4.17 In most cases a single assessment point will represent a number of properties having been selected as the facade which is most affected of those NSRs represented. In some cases, due to the orientation of the building with respect to the proposed road, it is necessary to assess the impacts at more than one facade. In such cases a separate AP is considered for each exposed facade. For low rise developments, noise levels are predicted for each of the floors (ground, first and

second). For schools, predictions are made for the first and top floors. Whilst for high rise developments a selection of floors are considered (first floor and every 5th floor).

3.4.18 The NSRs and APs considered in this assessment are shown in *Figures 3.4a-j* and are described in *Table 3.4a*.

**Table 3.4a Noise Sensitive Receivers**

NSR	Description	No. of dwellings represented	Affected Facade	Type
Lei Yue Mun				
N101	Ma San Tsuen Village House	12	N	Low Rise Residential
N102	Ma San Tsuen Village House	20	NE	Low Rise Residential
N103	Ma San Tsuen Village House	4	NE	Low Rise Residential
N104	Ma San Tsuen Village House	7	NE	Low Rise Residential
N105	Ma San Tsuen Village House	5	N	Low Rise Residential
N106	Sam Ka Tsuen Village House	4	NE	Low Rise Residential
N107	Hoi Bun School	1 School	N	Educational Establishment
N108	Sam Ka Tsuen Village House	5	N	Low Rise Residential
N109	Sam Ka Tsuen Village House	7	SW	Low Rise Residential
N110	Sam Ka Tsuen Village House	17	S	Low Rise Residential
N111	Sam Ka Tsuen Village House	21	E	Low Rise Residential
N112	Sam Ka Tsuen Village House	7	SE	Low Rise Residential
N113	Sam Ka Tsuen Village House	4	E	Low Rise Residential
N114	Sam Ka Tsuen Village House	1	E	Low Rise Residential
N115	Sam Ka Tsuen Village House	2	NE	Low Rise Residential
Lei Yue Mun Housing Estate				
N201	Lei Yue Mun Housing Site Block 4	70	SW	High Rise Residential
N202	Lei Yue Mun Housing Site Block 4	70	W	High Rise Residential
N203	Lei Yue Mun Housing Site Block 3	70	W	High Rise Residential
N204	Lei Yue Mun Housing Site Block 3	70	W	High Rise Residential
N205	Lei Yue Mun Housing Site Block 3	70	NW	High Rise Residential
N206	Lei Yue Mun Housing Site Block 2	70	W	High Rise Residential
N207	Lei Yue Mun Housing Site Block 3	Educational	W	Low Rise Kindergarten
N208	Lei Yue Mun Housing Site Block 1	70	W	High Rise Residential
N209	Lei Yue Mun Housing Site Block 1	70	W	High Rise Residential
N210	Lei Yue Mun Housing Site Block 1	70	NW	High Rise Residential

NSR	Description	No. of dwellings represented	Affected Facade	Type
<b>Yau Tong Centre</b>				
N301	Church	1 Church	S	Place of Worship
N302	Yau Tong Centre	120	S	Medium Rise Residential
N303	Yau Tong Centre	80	E	Medium Rise Residential
N304	Yau Tong Centre	140	E	Medium Rise Residential
N305	Yau Tong Centre	40	N	Medium Rise Residential
<b>Yau Tong Estate</b>				
N401	Yau Tong Estate Phase 5 - Block L	35	SW	High Rise Residential
N402	Yau Tong Estate Phase 5 - Block L	70	S	High Rise Residential
N403	Yau Tong Estate Phase 5 - Block L	35	SE	High Rise Residential
N404	Yau Tong Estate Phase 5 - Block L	70	E	High Rise Residential
N405	Yau Tong Estate Phase 5 - Block J	35	SE	High Rise Residential
N406	Yau Tong Estate Phase 5 - Block J	70	E	High Rise Residential
<b>Ko Chiu Road Estate</b>				
N501	Ko Chiu Road Phase 5 - Block H	35	S	High Rise Residential
N502	Ko Chiu Road Phase 5 - Block H	35	SW	High Rise Residential
N503	Ko Chiu Road Phase 5 - Block H	70	W	High Rise Residential
N504	Ko Chiu Road Phase 5 - Block I	70	W	High Rise Residential
N505	Ko Chiu Road Phase 5 - Block K	35	SW	High Rise Residential
N506	Ko Chiu Road Phase 5 - Block K	70	W	High Rise Residential
<b>Yau Tong Bay Development</b>				
N601	Yau Tong Bay	180	W	High Rise Residential
N602	Yau Tong Bay	180	W	High Rise Residential
N603	Yau Tong Bay	180	W	High Rise Residential
N604	Yau Tong Bay	180	S	High Rise Residential
N605	Yau Tong Bay	90	S	High Rise Residential
N606	Yau Tong Bay	90	E	High Rise Residential
N607	School	1 school	E	High Rise Residential
N608	School	1 school	N	High Rise Residential
N609	School	1 school	S	High Rise Residential
N610	School	1 school	S	High Rise Residential
<b>Cha Kwo Ling Site</b>				
N701	Cha Kwo Ling Site	90	SW	High Rise Residential

NSR	Description	No. of dwellings represented	Affected Facade	Type
N702	Cha Kwo Ling Site	90	S	High Rise Residential
N703	Cha Kwo Ling Site	90	SE	High Rise Residential
N704	Cha Kwo Ling Site	90	SE	High Rise Residential
Eastern Harbour Crossing Site				
N801	Site D Secondary School	1	W	School Site
N802	Site D Secondary School	1	S	School Site
N803	Eastern Harbour Crossing Site, Phase 3, Block T	140	S	High Rise Residential
Tseung Kwan O				
N901	Junk Bay	5	SE	Low Rise Residential
N902	Junk Bay	5	SE	Low Rise Residential
N903	Junk Bay	1	SE	Low Rise Residential
N904	North of Tunnel Section (Construction only)	1	S	Low Rise Residential
Future Development at Yau Tong Industrial Area				
N1001	Future Development at Yau Tong Industrial Estate (20m setback)	180	SW	High Rise Residential
N1002	Future Development at Yau Tong Industrial Estate (30m setback)	180	SW	High Rise Residential
N1003	Future Development at Yau Tong Industrial Estate (50m setback)	180	SW	High Rise Residential
N1004	Future Development at Yau Tong Industrial Estate	180	SE	High Rise Residential

### 3.5 Construction Noise

#### *Potential Sources of Impact*

3.5.1 The construction of the WCR will be broken down into five main stages indicated in *Figure 3.5a*, namely:

- TKO Section;
- Lei Yue Mun Headland (cut and cover tunnel) Section;
- Lei Yue Mun Section;
- Reclamation Works; and
- Marine Section.

3.5.2 The work will proceed from the TKO area and progress sequentially along the coast towards the Lei Yue Mun Headland.

- 3.5.3 The works will require a number of noisy activities including the use of heavy plant for excavation, filling, concreting and piling operations as well as on-site haul road traffic and potential increases in off-site traffic along site access routes. However, no percussive piling is anticipated.
- 3.5.4 Although full details of the construction activities and methods are not available at this stage, it is anticipated that the construction phase is likely to entail the following:
- site clearance;
  - bored piling and pile capping;
  - construction of superstructures (*in-situ* and precast);
  - drainage works;
  - road construction;
  - paving;
  - excavation works;
  - landscaping works;
  - tunnel construction;
  - backfilling and slopeworks;
  - dredging of marine sediment;
  - seawall construction;
  - reclamation works; and
  - marine piling.
- 3.5.5 The proposed scheduling of construction activities is shown in *Figure 2.3a*, whilst the proposed plant to be used in each construction activity and their individual sound power levels (SWLs) are presented in *Table A1* of *Annex A*. All plant noise levels specified have been selected referencing recognised noise standards. These levels are, therefore, considered to be representative of the plant operating under normal conditions.

#### ***Evaluation of Construction Noise***

- 3.5.6 Potential noise impacts are likely to arise at neighbouring NSRs as a result of the construction activities associated with WCR. The construction activities are likely to occur within five main areas as described previously.
- 3.5.7 Noise predictions have been made at each NSR for each of the five construction stages identified in the construction programme. The construction programme is presented in *Figure 2.3a* and the assumed plant teams required to complete each task are presented in *Table A1* of *Annex A*.
- 3.5.8 In order to allow for the worst case, all plant have been assumed to operate continuously and therefore a 100% of time is considered for each item of plant. The results are presented in *Tables A2a* to *A2e* of *Annex A*.
- 3.5.9 The results of the calculations indicate that if the construction activities remain unmitigated, cumulative construction noise levels as high as 21 dB(A) above the established criterion are likely to occur at all NSRs considered. Noise impacts can

be expected at all NSRs during each stage of the entire construction phase.

#### *Recommended Mitigation Measures*

3.5.10 Noise emissions from construction sites can be minimised through good site practice, selecting quiet plant, quiet working methods and through the use of temporary barriers. These methods are described in the following paragraphs.

#### *Good Site Practice*

3.5.11 Good site practice and noise management can considerably reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction:

- only well maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from onsite construction activities.

#### *Selecting Quieter Plant and Working Methods*

3.5.12 The Contractor may be able to obtain particular models of plant that are quieter than standard types given in the GW-TM. The benefits achievable for each of the measures proposed will depend on the details of the Contractors' chosen methods of working, and it is considered too restrictive to specify items of plant that a Contractor has to use during construction activities. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total SWL of all plant on the site, so that the Contractor is allowed some flexibility to select plant to suit his needs.

3.5.13 It should be noted that various types of silenced equipment can be found in Hong Kong. However, the EPD, when processing a CNP application, will apply the noise levels contained in the relevant statutory TM, unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

*Temporary Noise Barriers*

- 3.5.14 In general, movable noise barriers located between noisy construction activities and NSRs could give up to 5 dB(A) reduction from screening (estimated in accordance with the GW-TM). It would be possible for the Contractor to provide barriers, in the form of site hoardings, to achieve this level of reduction. Certain types of PME, such as generators and compressors, can be completely enclosed giving a total noise reduction of 10 dB(A) or more. Vertical barriers that can be located close to noisy plant can also be very effective at screening NSRs from particular plant.
- 3.5.15 By considering the above methods of mitigation, it is possible to develop a mitigation package, which can be adopted to minimise potential noise impacts. Three possible mitigation options have been considered in this assessment.
- (i) *Mitigation Option 1 (Mit 1)* - *Mitigation Option 1* utilise quiet plant where appropriate. The revised inventory of plant noise data and corresponding construction noise levels are presented in *Tables A3 and A4a to A4e* in *Annex A*, respectively.
  - (ii) *Mitigation Option 2 (Mit 2)* - In areas where *Mitigation Option 1* prove insufficient to protect NSRs from noise impacts, further mitigation will be required in the form of noise barriers. It is anticipated that a noise barrier with a skid footing and cantilevered upper portion, located close to the noise generating part of the PME such that the line of sight between source and receiver is broken, can provide at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant. The revised plant inventory and corresponding construction noise levels are presented in *Tables A5 and A6a to A6e*, respectively.
  - (iii) *Mitigation Option 3 (Mit 3)* - In areas where *Mitigation Option 2* prove insufficient to adequately protect NSRs from noise impacts, further mitigation will be required. This may involve imposing restrictions on the number of plant which may operate at any given time. This option may also include the use of more extensive movable barriers which should be used to screen working cells in which mobile plant are likely to operate. Using this method the maximum achievable barrier attenuation for mobile sources can be increased to 10 dB(A). The maximum allowable sound power levels (SWL) from any construction process are presented in *Table A7*.

*Table A8* show the revised plant inventory for *Mitigation Option 3*. Since these barriers will be movable and their location is dependent on the area being worked at anytime, it is not possible to specify either their exact location or dimensions. The barriers provided to screen mobile plant should be positioned around discrete working cells with their locations and dimensions selected to ensure that no direct line of sight exists between the specified NSR and the mobile plant. The locations and effectiveness of these barriers are to be monitored on a regular basis as part of the EM&A programme.



### *Residual Impacts*

- 3.5.16 The application of the above mitigation measures should ensure that all residential NSRs are adequately protected (see *Annex A-8*). Residual impacts are, however, likely at Hoi Bun School. It should be noted that the criterion for schools is in general 70 dB(A) but is reduced to 65 dB(A) during examination periods. Noise levels of up to 75 dB(A) at Hoi Bun School are anticipated during the dredging and construction of the seawall.
- 3.5.17 It is recommended that any dredging and seawall construction works likely to take place within 100 m of Hoi Bun School are scheduled to coincide with school holidays but at the very least must avoid the examination period. If appropriate scheduling of these activities is not possible to prevent noise impacts, a last resort the provision of indirect noise mitigation in the form of Type I<sup>(3)</sup> glazing as recommended in the EIAO-TM should be considered.

## **3.6 Operational Noise**

### *Potential Sources of Impact*

- 3.6.1 Traffic travelling along the WCR and its associated slip road connections has the potential to generate noise impacts at nearby residential developments. Potential impacts are likely to be greatest during the morning peak hourly flow, therefore only the morning peak hour has been considered in this assessment.

### *Assessment Methodology*

- 3.6.2 The proposed WCR network has been modelled using the proprietary traffic noise computer program, HFANoise, which implements the methodology of the UK Department of Transport's Calculation of Road Traffic Noise (CRTN). The model created includes existing roads which will be altered as part of the WCR scheme as well as existing roads which will remain unaltered but are likely to contribute to the overall road traffic level at one or more of the identified NSRs. In terms of this assessment the former will be classed as "new roads" and the latter as "existing roads". All roads included in the road traffic model including their classification are shown in *Figure 3.6a-b*.
- 3.6.3 It has been assumed in the assessment that the main alignment of the WCR as well as the Lei Yue Mun Slip Roads will be surfaced using low noise road surfacing. This surfacing has been included on road sections where there will be free flow traffic conditions except where the speed limit is 50 kph or less. Low noise road surfacing has been included in both the mitigated and unmitigated traffic noise models and is considered to be the most effective mitigation in these situations.

<sup>(3)</sup> openable well-gasketted window, 6mm pane, or transmission loss (TL) of 28dB or above in 250 Hz octave band and sound transmission class (STC) 31 or above.

- 3.6.4 Pervious (low noise) road surfacing has not been assumed for roundabouts or minor roads since it is unlikely to be very effective due to the relatively slow speed and anticipated start/stop nature of the traffic conditions. Pervious surfacing exposed to traffic conditions of this type are, in general, much less resilient to wear than their impervious counterparts, thus requiring more regular maintenance which may negate any potential benefits.
- 3.6.5 The prospective traffic flows for the design year (2021) have been presented in *Figure 2.4a*.
- 3.6.6 Noise levels at each of the representative NSRs have been predicted in terms of the hourly  $L_{A10}$  (peak hour) to one decimal place but are reported as integers, as is stipulated in CRTN.
- 3.6.7 Noise levels have been predicted at a total of 66 APs representing a total of approximately 3,850 residential dwellings, 140 classrooms and one church.

#### *Evaluation of Operational Noise*

- 3.6.8 The noise levels predicted for the design year, 2021, are presented in *Table B1* of *Annex B*.
- 3.6.9 Unmitigated noise criteria exceedances of up to 12 dB(A) are predicted for 39 of the APs considered. This equates to exceedances at approximately 2,820 dwellings and 75 classrooms. Direct noise mitigation are therefore proposed along the road alignment to protect against potential impacts at each of these NSRs.

#### *Recommended Mitigation Measures*

- 3.6.10 In order to mitigate against these noise impacts an extensive mitigation package has been developed. The extent of the direct mitigation proposed is shown graphically in *Figures 3.6c-f* with typical cross sections of the noise barriers provided in *Figures 3.6g-j*. The mitigated noise levels are presented in *Table B1* in *Annex B*.
- 3.6.11 The noise mitigation package developed for the WCR has been done so in accordance with the recommendations provided in the EIAO-TM. The mitigation proposed in each area is described and the rationale behind it explained in the following paragraphs. In some cases *indirect* noise mitigation, in the form of acoustic glazing and the provision of air-conditioning, are deemed necessary. This form of mitigation is considered only as a last resort having exhausted all feasible *direct* alternatives.

#### *Tseung Kwan O*

- 3.6.12 Unmitigated traffic noise levels at the representative APs in the Tseung Kwan O area (N901-N903) are predicted to be below the recommended EIAO-TM criteria. Consequently, no mitigation will be required in this area.

*Lei Yue Mun*

- 3.6.13 This section is represented by fifteen APs (N101-N115). All NSRs in this area, close to the WCR alignment and slip roads are low rise while the road section is elevated. The combination of road edge and parapet wall will provide adequate screening to protect all NSRs in this area from noise levels in excess of the EIAO-TM criteria.

*Yau Tong Centre and Lei Yue Mun, Ko Chiu Road and Yau Tong Housing Estates*

- 3.6.14 By the time that WCR is expected to be opened, this area will be densely populated. It is predicted that if no mitigation is provided to the WCR network, that approximately 1,040 dwellings will be exposed to noise levels up to 6 dB(A) greater than the EIAO-TM criteria.
- 3.6.15 Extensive direct mitigation is therefore proposed in this area to provide protection to as many NSRs as possible. This includes a 210 m noise enclosure on Lei Yue Mun slip roads.

Lei Yue Mun Slip Road Noise Enclosure

- 3.6.16 The proposed noise enclosure is approximately 210 m in length extending from the abutment (CH 430.00) to just before Lei Yue Mun Roundabout (approximately CH 640.00) shown in *Figure 3.6f*. This enclosure will be made up of two sections. The 130 m section closest to the roundabout will be enclosed on both sides as well as the roof. The second section (CH 510.00 - CH 430.00), 80 m in length, will be open along the western side.
- 3.6.17 The road in this area is bounded by high rise residential developments which will directly overlook it. While the use of alternative direct noise mitigation measures such as roadside or podium barriers would benefit low level properties, they are ineffective for higher level dwellings. This is demonstrated in the sensitivity tests which have been carried out for NSR N205, for various barrier configurations, and are presented in *Annex B*. The noise enclosure recommended is therefore considered to be the best option.
- 3.6.18 The proposed enclosure will protect Blocks 3 and 4 of Lei Yue Mun Housing Site (N201 - N207) and the majority of northern facing facades of residential blocks within Yau Tong Centre from criteria exceedances. This equates to approximately 580 dwellings.
- 3.6.19 No residual noise impacts are predicted for the Lei Yue Mun Housing Site. Noise impacts are, however, still likely to arise at eight APs (N305, N402, N404, N406 and N503 to N506) representing approximately 460 dwellings. At the majority of these APs (N305 and N406, N504 to N506) the noise levels are dominated by traffic using existing roads, therefore noise impacts at these NSRs are not considered attributable to WCR.

3.6.20 Residual impacts attributable to WCR will arise at three APs (N402, N404 and N503). These APs represent dwellings which overlook the Lei Yue Mun roundabout. These are likely to experience noise levels up to 5 dB(A) above the EIAO-TM criterion. To fully protect these properties, using direct mitigation measures, mitigation would be required to be applied directly to the roundabout. The practicability of providing direct noise mitigation in the form of noise barriers at the roundabout is governed by a number of constraining factors including:

- sight line requirements for the roundabout approaches and exits; and
- spatial constraints affecting the depth of footings/foundations for potential noise barriers imposed by existing utilities, future utilities and the proposed MTRC tunnel.

3.6.21 The Engineering Consultants were consulted regarding the type of noise barriers that would be feasible at the roundabout, located behind the footpath, to avoid sight line impairment. The proposed roundabout at the junction of Lei Yue Mun Road and Ko Chiu Road (South) adjacent to Lei Yue Mun Housing Site is situated within the protection zone of the proposed MTR tunnel for the Tseung Kwan O Line. The maximum allowable loading imposed by the noise barrier foundation is restricted to 20 KPa for foundation works within the MTR protection zone. With such restriction, it has been calculated that the maximum noise barrier that could be provided in this area would be a cantilever barrier consisting of a 5 m vertical section with a 2 m section protruding from the top at an angle of 45°.

3.6.22 The effectiveness of such a barrier configuration was investigated. The results concluded that the 3 m horizontal podium barriers which are included in the design of Ko Chiu Road and Yau Tong Estates are more substantial and therefore the addition of the roadside barriers would provide no additional benefit.

3.6.23 The other form of direct noise mitigation would be decking over the roundabout. However, due to the constraining factors listed out in *Section 3.6.20*, and the 20KPa restriction on the maximum allowable loading for foundation works within the MTR protection zone mentioned in *Section 3.6.21*, the option of decking over is considered impractical. As the WCR slip road connection to Lei Yue Mun Road (including the roundabout) is an essential route for TKO traffic to Hong Kong via Eastern Harbour Crossing, the option of not having the slip road/roundabout was not considered feasible. Other alternative engineering options such as flyover or tunnel to handle the road junction traffic were also considered but found not feasible for the following reasons:

- The existing Lei Yue Mun Road has dual-2 carriageways and is flanked by housing estates (ie. Yau Tong and Ko Chiu Estates) at either sides, and hence it cannot be widened and has no space to accommodate any proposed flyover ramp or tunnel approach road.
- With constraints imposed by the MTR tunnel (with 30m protection zone on either sides), Housing Department's footbridge and existing/future utilities located at the roundabout, the flyover and tunnel options are considered impractical.

- 3.6.24 As discussed above, all possible direct mitigation measures at source have been exhausted and, in accordance with the EIAO-TM, the impact has been reduced to the practical minimum. Therefore as a last resort, it is recommended that the residual impacts, affecting approximately 200 dwellings in this area, are addressed by measures within the development and indirect technical remedies, in the form of window insulation and air-conditioning.

#### *Yau Tong Coastal Section*

- 3.6.25 This section includes the proposed developments at Yau Tong Bay, Yau Tong Industrial Area and Cha Kwo Ling and the Eastern Harbour Crossing Site. If unmitigated, noise levels up to 12 dB(A) above the recommended criteria are likely to arise at 21 APs equating to approximately 1,780 dwellings and 70 classrooms. As a result extensive noise mitigation is proposed in this area.
- 3.6.26 Consultation with the Engineers for the SEK Route T2 Study has revealed that under this development a cantilever barrier (comprising of a 5.5 m vertical section and a 3.5 m cantilevered section protruding from the top) will be provided alongside the Cha Kwo Ling slip road. This barrier is necessary to prevent noise criteria exceedances at the proposed development in the Cha Kwo Ling. Its provision will, however, remain the responsibility of the SEK Route T2 Scheme. The mitigation to be provided in this area under the WCR Scheme include:

- absorptive cantilever noise barriers along the northern edge of both carriage ways of WCR in the vicinity of Cha Kwo Ling;
- semi-enclosure along the eastern bound carriageway of WCR between Sam Ka Tsuen Typhoon Shelter and the western end of the Yau Tong Bay CDA Site;
- vertical barrier along eastern edge of slip road D01; and
- cantilever barrier at Yau Tong Bay adjacent to Cha Kwo Ling Road (*Figure 3.6k*)

#### Cantilever Noise Barriers at Cha Kwo Ling

- 3.6.27 Absorptive cantilever noise barriers with a maximum vertical height of 6 m (*Figure 3.6j*) will be required along the northern edges of each WCR carriageway between the interface of WCR and SEK T2 and the EHC ventilation building (approximately CH1500.00- CH1700.00). This will protect NSRs within the Cha Kwo Ling Site (NSR 7) from traffic noise criteria exceedances.

#### *Semi-enclosure along WCR Alignment*

- 3.6.28 Along this portion of the WCR the NSRs will be both closer to and taller than those along the Cha Kwo Ling portion. The cantilever barriers proposed at Cha Kwo Ling would therefore not be sufficient to fully protect the high rise properties within the Yau Tong Bay and Yau Tong Industrial Area developments. This is demonstrated in the sensitivity tests which have been carried out for NSR N602, for various barrier configurations, presented in *Annex B*. A semi-enclosure, spanning across the eastern bound carriageway of the main WCR alignment is

therefore proposed to protect the high rise residential coastal development which will overlook the WCR shown in *Figure 3.6c-e*. The semi-enclosure will be approximately 1.2 km in length extending from the Sam Ka Tsuen Typhoon Shelter to the EHC ventilation building (CH 2900.00 - CH 1700.00). This will be sufficient to protect all those properties which directly overlook WCR in this area.

- 3.6.29 An 8 m high semi-enclosure would be required only in the vicinity of traffic sign gantry to allow an unobstructed view of the traffic signs on the gantry. A 6.8 m semi-enclosure would be required for the remaining portion of the roadway. The typical cross sections of the proposed semi-enclosure are shown in *Figures 3.6g-h*.

#### Vertical Barrier along Slip Road D01

- 3.6.30 A 150 m long noise barrier is recommended in this section along the outside of the eastern bound carriageway of the Slip Road D01 (CH 150.00 - CH 300.00). This barrier will be a vertical barrier of height 2 m for the first 100 m (CH 150.00 - CH 250.00) increasing to 3 m in height for the remaining 50 m (see *Figure 3.6i* for detail). This barrier will contribute to the overall protection of two schools within the Yau Tong Bay Development (N607 and N608).

#### Cantilever Boundary Barrier for Yau Tong Bay Development

- 3.6.31 The layout of the proposed Yau Tong Bay development shown in *Figures 3.4f* includes the provision of a 3 m vertical barrier alongside the boundary with Cha Kwo Ling Road. It is predicted, however, that following the opening of the WCR that this barrier will not be adequate to prevent traffic noise exceedances at the schools adjacent to Cha Kwo Ling Road (N609 and N610) *Figure 3.6k*. It is therefore recommended that this barrier is extended to a cantilever barrier comprising of a 5 m vertical section and a 2 m cantilevered section positioned at 3 m from the road edge.
- 3.6.32 The noise mitigation proposed for the Yau Tong Coastal Sections will reduce the number of APs exposed to noise criteria exceedances from 21 to 7 which equate to the protection of some 1,515 dwellings and 50 classrooms.
- 3.6.33 Assuming that the direct mitigation detailed in the above paragraphs are implemented, then traffic noise criteria exceedances are anticipated for 7 APs (N605, N606, N801 to N803, N1001, N1003) within the Yau Tong Coastal Section.
- 3.6.34 Two of these APs represent properties in the south western corner of the Yau Tong Bay site (N605 and N606). At these APs, noise levels will be dominated by traffic using existing roads. These impacts are therefore not considered to be attributable to WCR.
- 3.6.35 Noise impacts are predicted at two APs (N1001 and N1003) within the proposed residential development within Yau Tong Industrial Area. This site is proposed as a future employment and residential area, however no plans have yet been established for the site. It is presently unknown if employment areas or residential

units will be located facing WCR. It is however expected that a minimum setback of 20 m would be required for planning purposes.

- 3.6.36 Impacts are predicted for the 35th floor and above for any block positioned at a setback of 20 m from the road edge and for the 40th floor and above for any block 30 m from the road edge. Criteria exceedances within this development can therefore be avoided by appropriate layout and design involving the restriction of buildings heights with respect to their setback distance from WCR (for example, a minimum setback from WCR to a 40 storey building would be 30 m). These dwellings are therefore not included as residual impacts.
- 3.6.37 Noise impacts are also predicted for three APs within the EHC site (N801 - N803). At one of these APs (N803) the noise levels are dominated by traffic using existing roads<sup>(4)</sup>. These impacts are therefore not considered attributable to WCR. The noise impacts at the remaining two APs is a combination of noise from existing and new roads. At each of these APs the road sections which are the major contributors to noise from new roads are those within the roundabout. To fully protect these properties, using direct mitigation measures, would require mitigation to be applied directly to the roundabout. Direct mitigation applied to roundabouts is considered impractical due to various engineering and safety constraints.
- 3.6.38 Note that the proposed roundabout is considered the only acceptable and viable arrangement for this junction in terms of the engineering and transport requirements.
- 3.6.39 Assuming the mitigation packages described above are implemented, residual impacts attributable to WCR in the Yau Tong Coastal Section are likely to be approximately 20 classrooms and no dwellings.

*Overall Effectiveness of Noise Mitigation Measures*

- 3.6.40 The effectiveness of the noise mitigation package is summarised in *Table 3.6a*.

**Table 3.6a Effectiveness of Noise Mitigation Package**

Number of NSRs Considered	Number of Dwellings (%) (Approximate)	Number of Classrooms (%) (Approximate)	Number of Churches (%)
Total Number of NSRs considered	3,850	140	1
Total number of NSRs exposed to criteria exceedances (unmitigated)	2,820	75	0
Total number of NSRs protected from criteria exceedances (mitigated)	2,090 (74%)	55 (73%)	-
Total number of NSRs that will benefit by at least 1dB(A) as a result of the proposed mitigation	2,700	100	-
Total number of NSRs exposed to Residual Impacts attributable to WCR	200 (7%)	20 (27%)	-

<sup>(4)</sup> N803 represents the closest residential sensitive receiver of the previous layout for Eastern Harbour Crossing Site Phase 3. The latest conceptual layout (KC77/SITE/A/PR-14/C) shows that this receiver will be further from new roads.

- 3.6.41 Whilst key dimensions of the proposed noise barriers should be followed, the exact form of all the noise barriers proposed in this EIA are subject to detailed design when suitable equivalent configurations may be considered to be more appropriate.

### *Residual Impacts*

- 3.6.42 Residual noise impacts up to 6 dB(A) are likely to occur at thirteen of the sixty-six assessment points considered. These can be separated into two categories; those attributable to WCR (N402, N404, N503, N801 and N802) and those not attributable to WCR (N305, N406, N504, N505, N506, N605, N606 and N803).
- 3.6.43 It is estimated that the mitigation measures proposed will prevent noise criteria exceedances at a total of approximately 2,090 dwellings and 55 classrooms. However it is predicted that even if the proposed mitigation measures are implemented that residual impacts, attributable to WCR, will occur at approximately 200 dwellings and 20 classrooms.
- 3.6.44 Under the ExCo directive *Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads*, where direct mitigation cannot adequately protect *existing* NSRs from traffic noise impacts, the provision of indirect technical remedies in the form of acoustic insulation and air-conditioning may be required.
- 3.6.45 As a result, the planned and proposed NSRs (including N402, N404, N503, N801 and N802) will not qualify for NIW. Nevertheless, it is recommended that these residual impacts are abated using indirect mitigation measures, in the form of Type I glazing (as specified in the EIAO-TM) and air-conditioning.

## **3.7 Conclusions**

### *Construction Phase*

- 3.7.1 Residual impacts of up to 5 dB(A) above the criterion are likely at Hoi Bun School. It is recommended that construction works close to this school are scheduled to coincide with the school holidays. Construction works close to schools which require particularly noisy items of plant should be scheduled to avoid examination periods which are, in general, more sensitive to noise.
- 3.7.2 Potential noise impacts, at all other NSRs, resulting from the construction of WCR can be avoided through the use of suitable mitigation measures such as the use of quiet plant and construction techniques, movable noise barriers and reducing the number of plant operating simultaneously.
- 3.7.3 Since the Lei Yue Mun and Yau Tong areas fall within Designated Area, the use of any Specified Powered Mechanical Equipment or Prescribed Construction Works in these areas, during restricted hours, shall require a Construction Noise Permit.

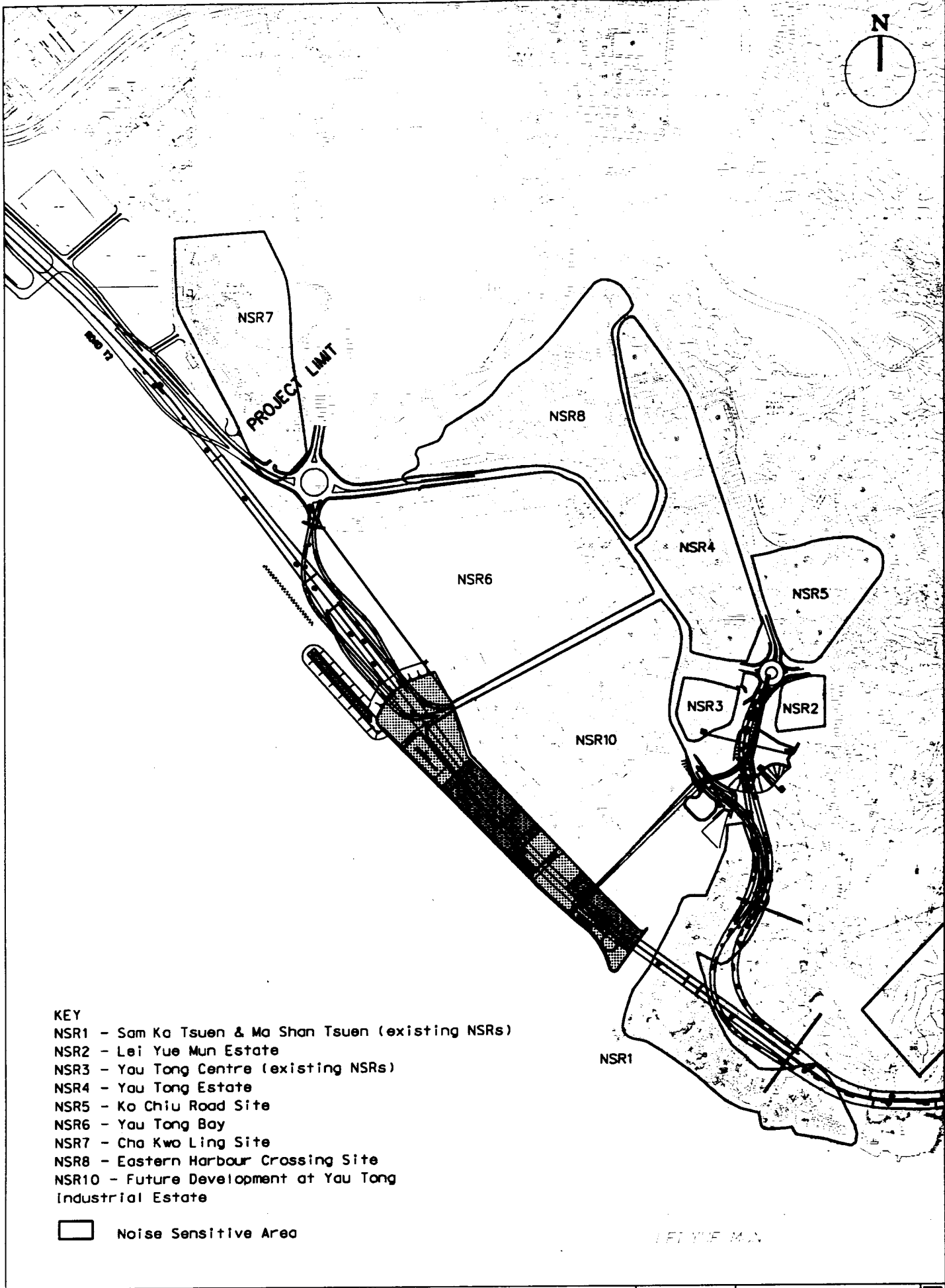
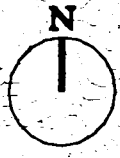


### ***Operational Phase***

- 3.7.4 Unmitigated, the operation of the WCR is likely to result in exceedances of the noise criteria at 39 of a total of 66 APs considered in this assessment. This equates to approximately 2,820 residential dwellings and 75 classrooms.
- 3.7.5 The proposed mitigation measures outlined in this assessment will protect a total of 2,090 dwellings and 55 classrooms from EIAO-TM criteria exceedances. It is estimated that this mitigation will benefit approximately 2,700 dwellings and 100 classrooms by at least 1 dB(A).
- 3.7.6 Residual impacts attributable to WCR are likely to occur at a total of 200 dwellings and 20 classrooms. Those affected fall within proposed or planned developments.
- 3.7.7 It is recommended that all residual impacts at future or proposed NSRs are abated using Type I glazing as described in the EIAO-TM and air-conditioning. This includes NSRs within the following developments; Yau Tong Housing Estate (N402 and N404), Ko Chiu Road Estate (N503) and schools within Eastern Harbour Crossing Site (N801 and N802).

### **3.8 EM&A Requirements**

- 3.8.1 Construction and operational noise levels and the effectiveness of the proposed mitigation measures will be monitored as part of the EM&A programme. Details of the proposed enforcement processes (including timing and responsibilities) are elaborated within the EM&A Manual and are summarised in *Section 10.3*. The EM&A Manual also provides an *Action Plan* which will be followed in the event of any criteria exceedance being recorded. The proposed construction noise mitigation measures would be incorporate in the Action Plan in the EM&A Manual.



KEY

- NSR1 - Sam Ka Tsuen & Ma Shan Tsuen (existing NSRs)
- NSR2 - Lei Yue Mun Estate
- NSR3 - Yau Tong Centre (existing NSRs)
- NSR4 - Yau Tong Estate
- NSR5 - Ko Chiu Road Site
- NSR6 - Yau Tong Bay
- NSR7 - Cha Kwo Ling Site
- NSR8 - Eastern Harbour Crossing Site
- NSR10 - Future Development at Yau Tong Industrial Estate

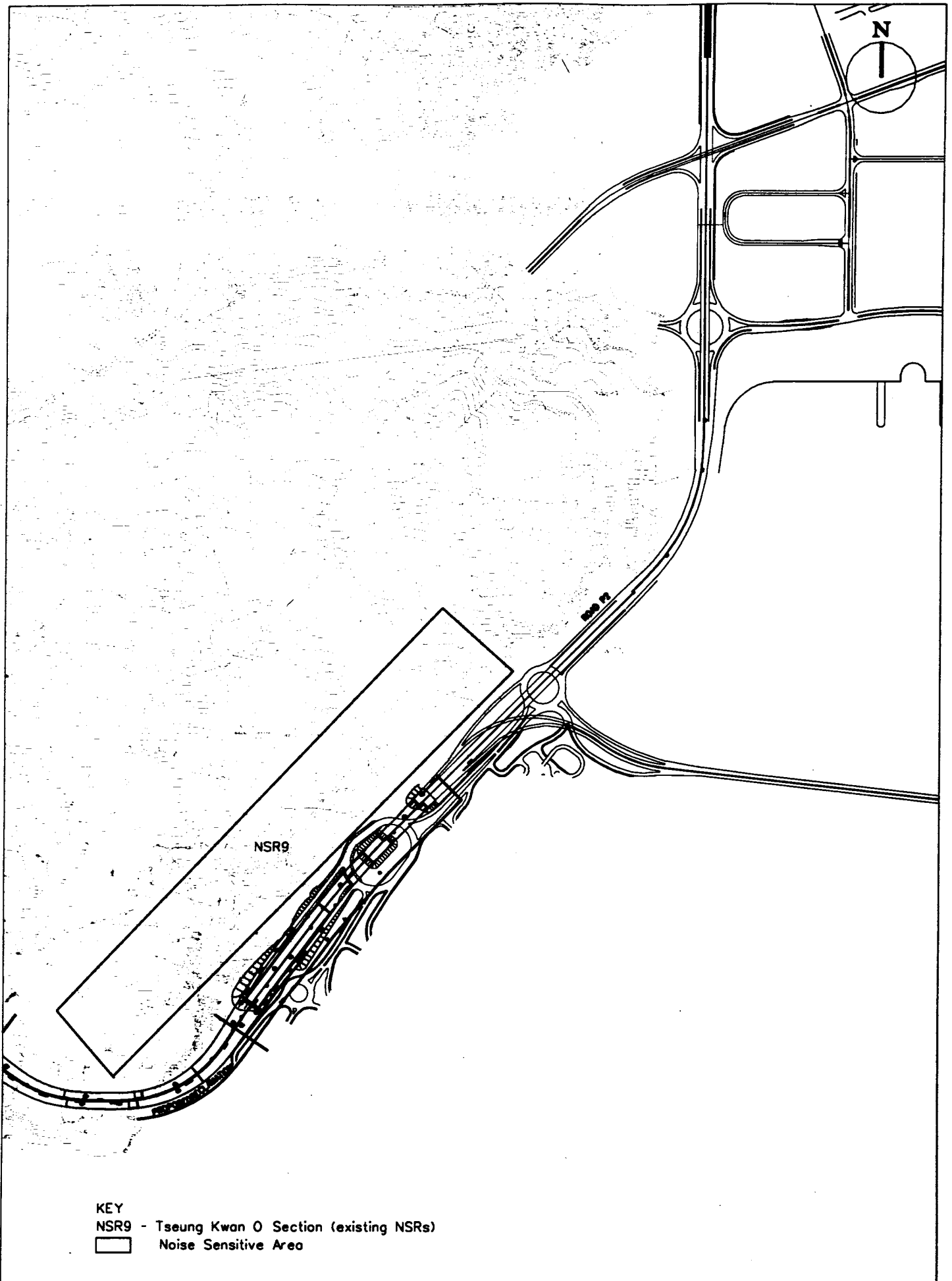
 Noise Sensitive Area

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WESTERN COAST ROAD - NOISE SENSITIVE RECEIVERS  
(sheet 1 of 2)

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**Majnsell**



KEY  
 NSR9 - Tseung Kwan O Section (existing NSRs)  
 [ ] Noise Sensitive Area

WESTERN COAST ROAD - NOISE SENSITIVE RECEIVERS  
 (sheet 2 of 2)

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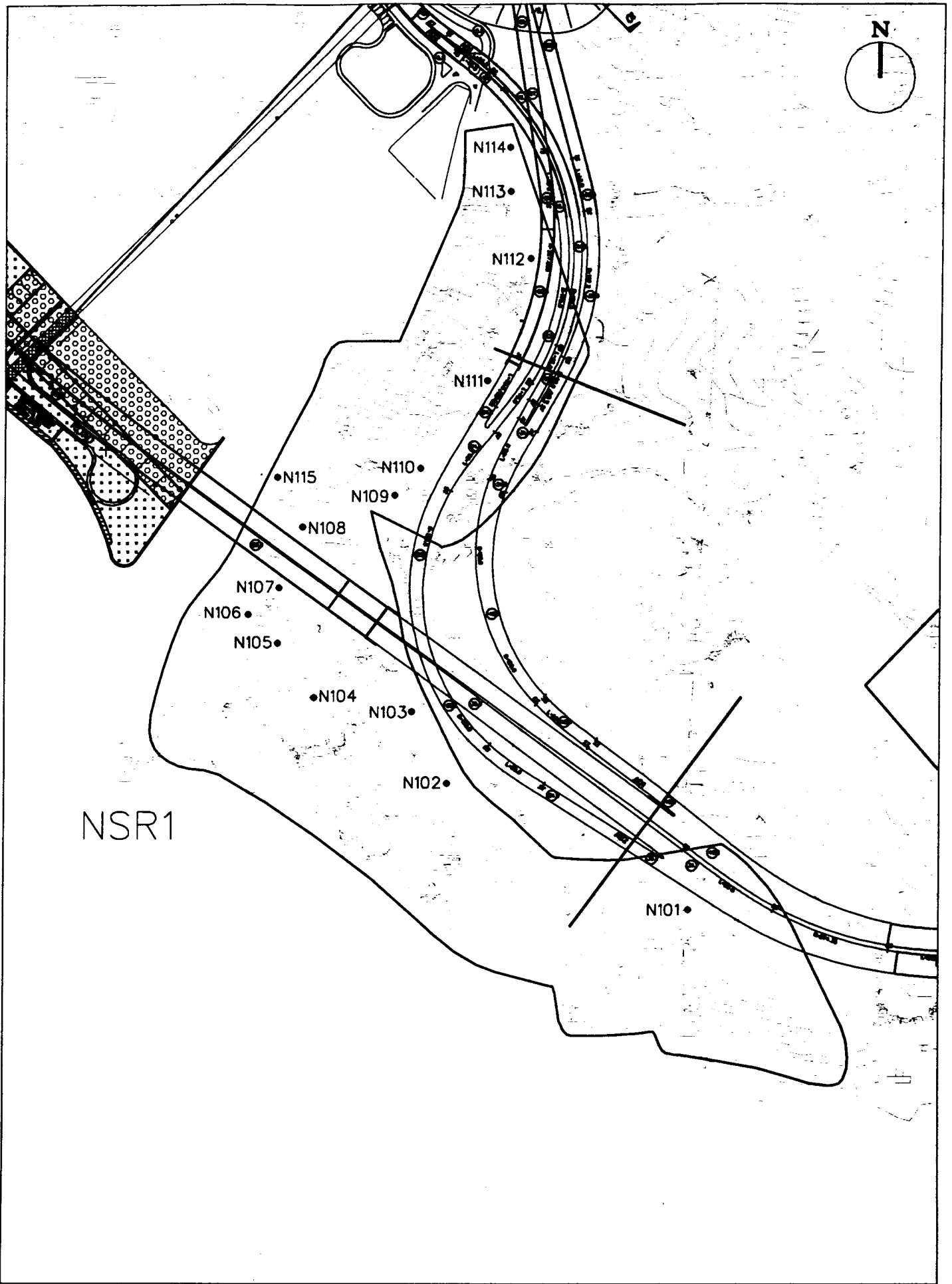
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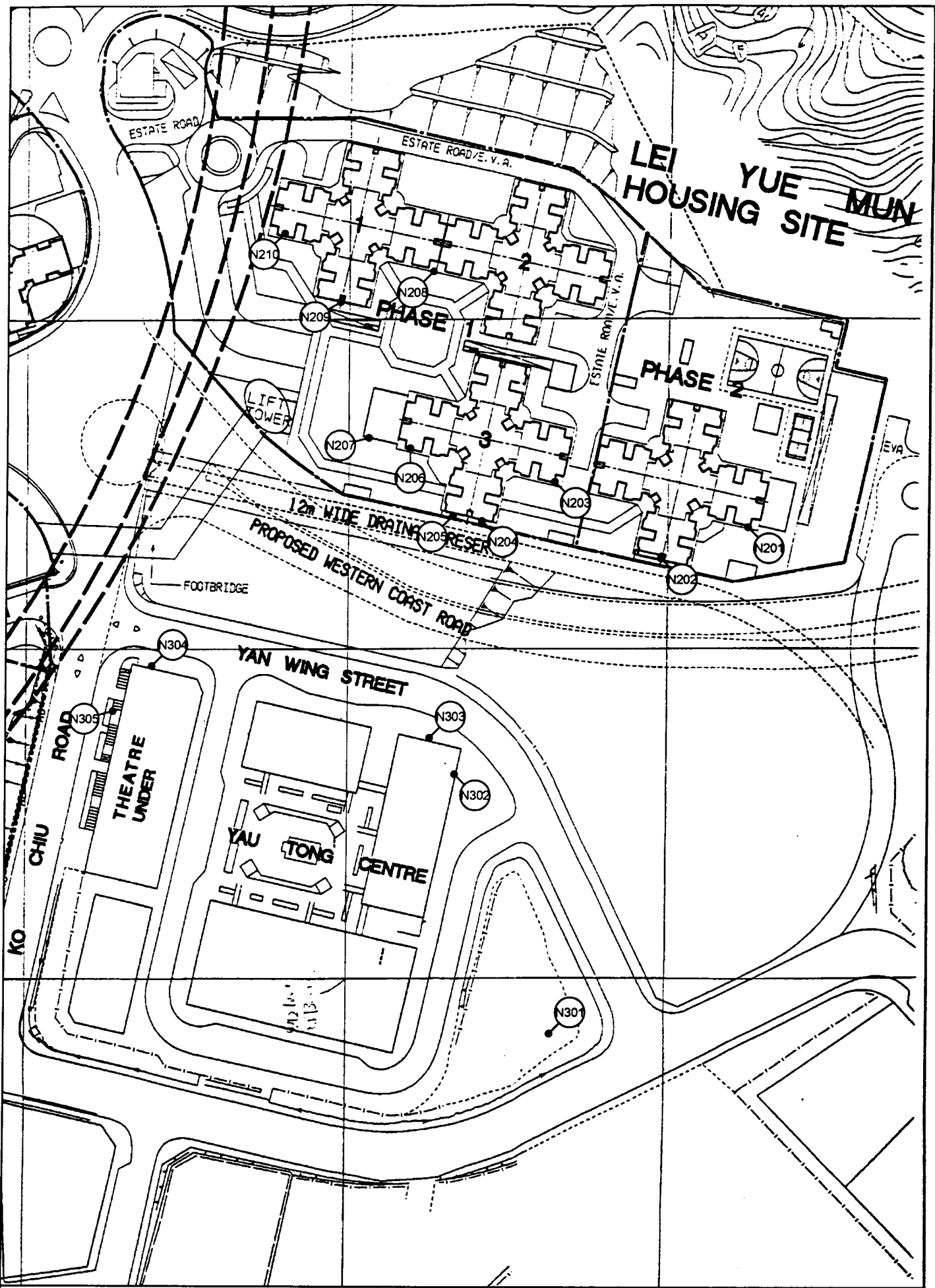


NSR1

NSR1 LEI YUE MUN - NOISE ASSESSMENT POINTS

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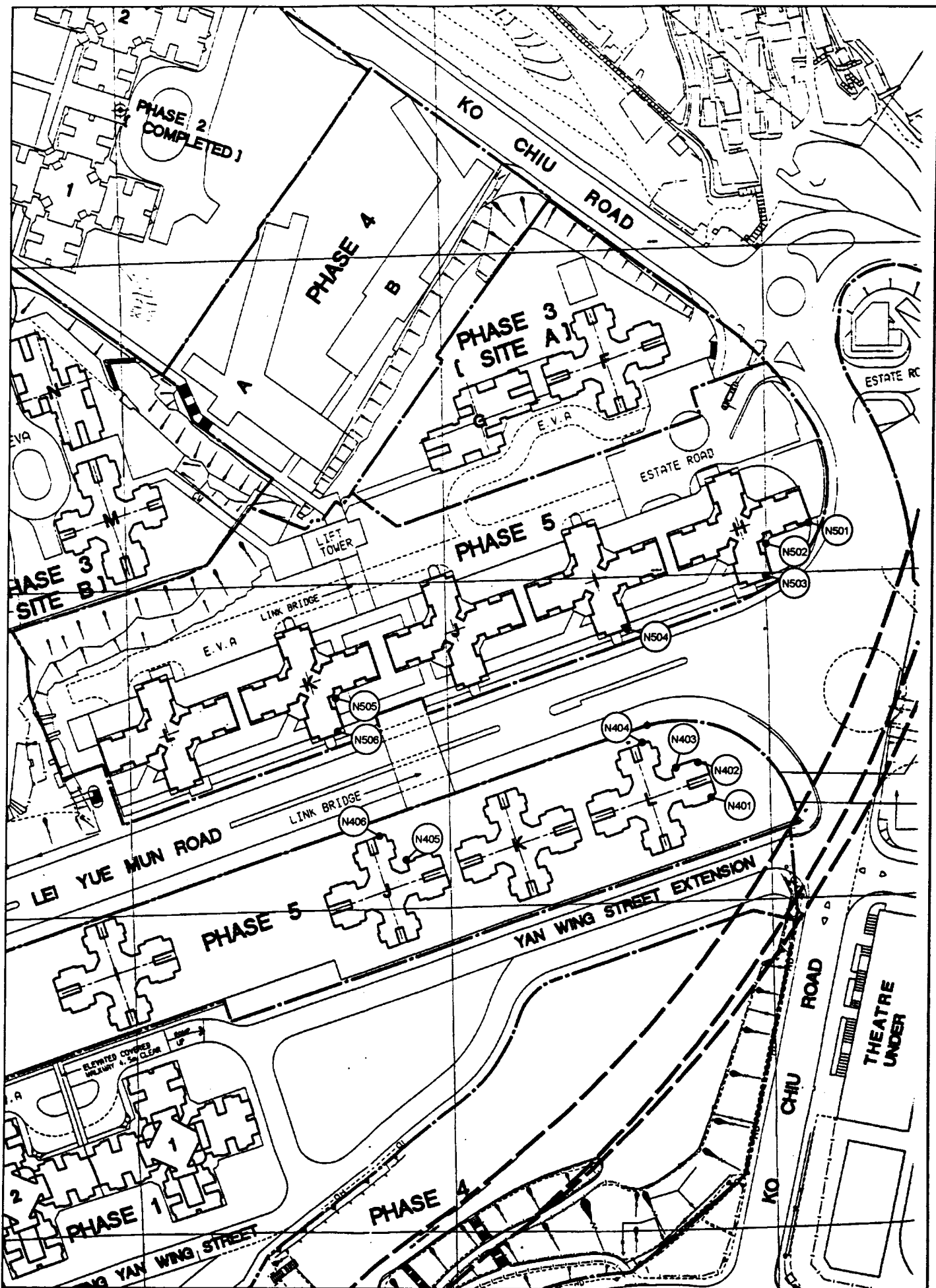
NSR2/NSR3 - NOISE ASSESSMENT POINTS

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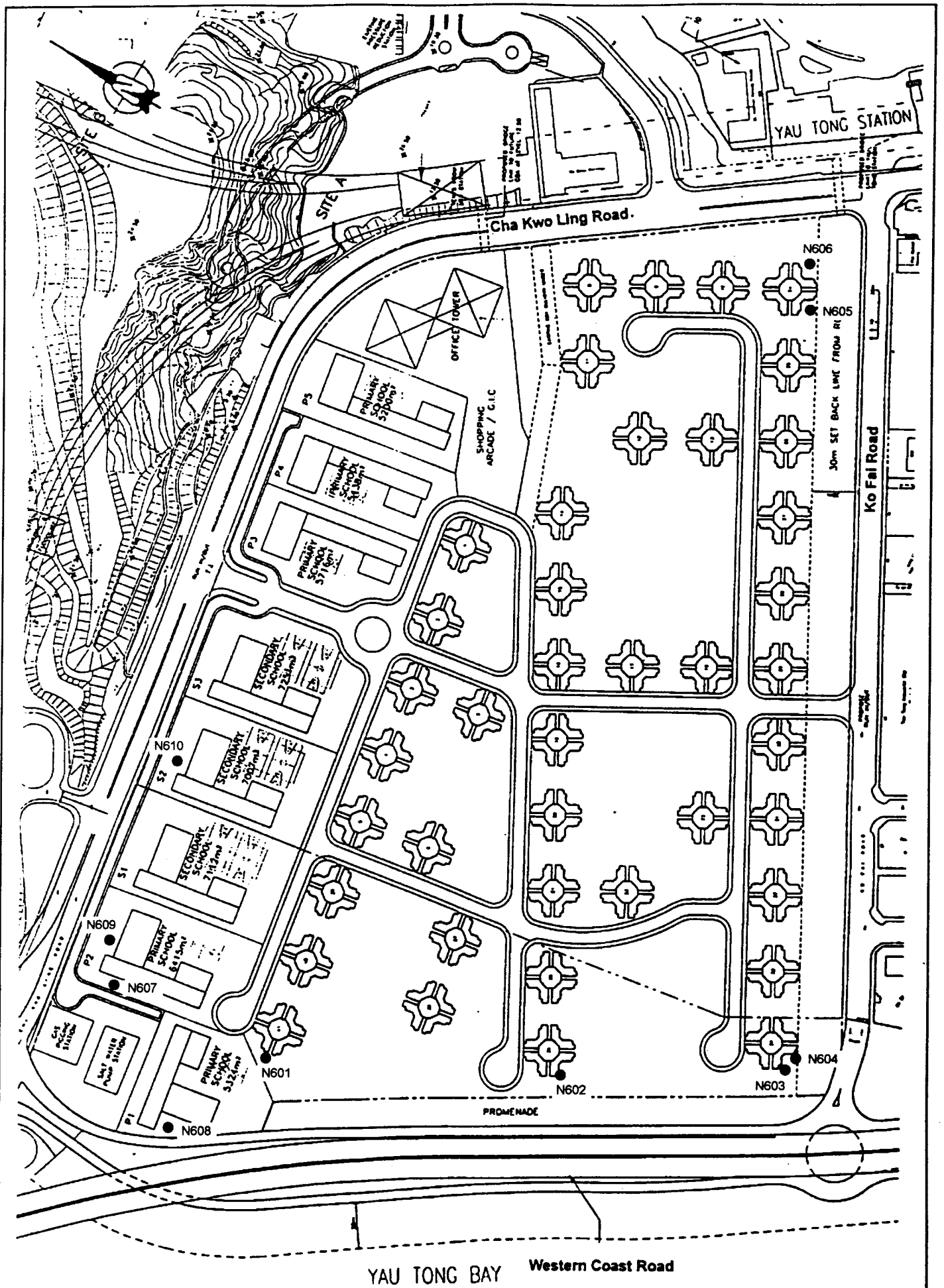
NSR4/NSR5 - NOISE ASSESSMENT POINTS

FIGURE No.

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NSR6 - YAU TONG BAY DEVELOPMENT

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DATE: Jan 99

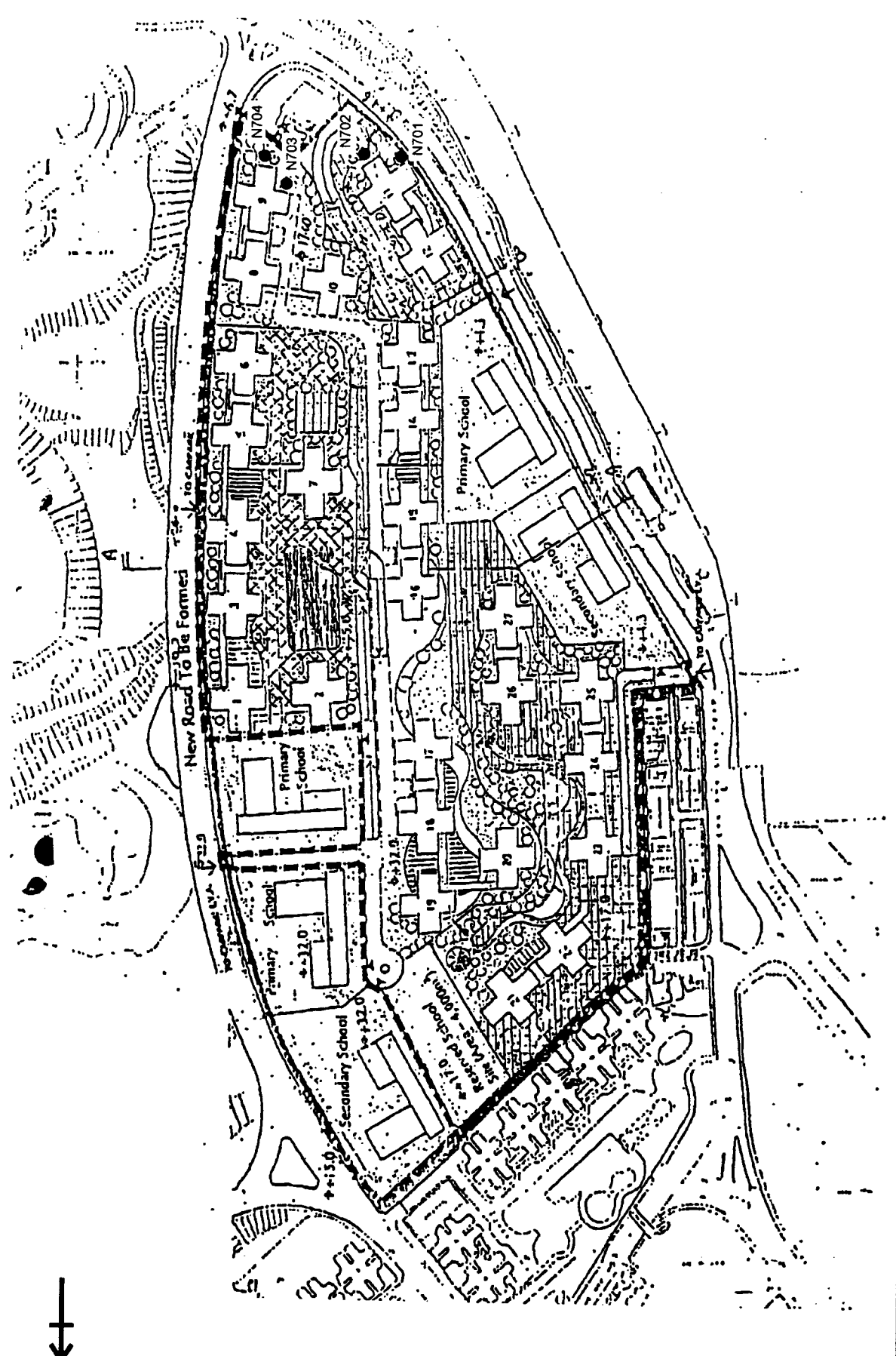
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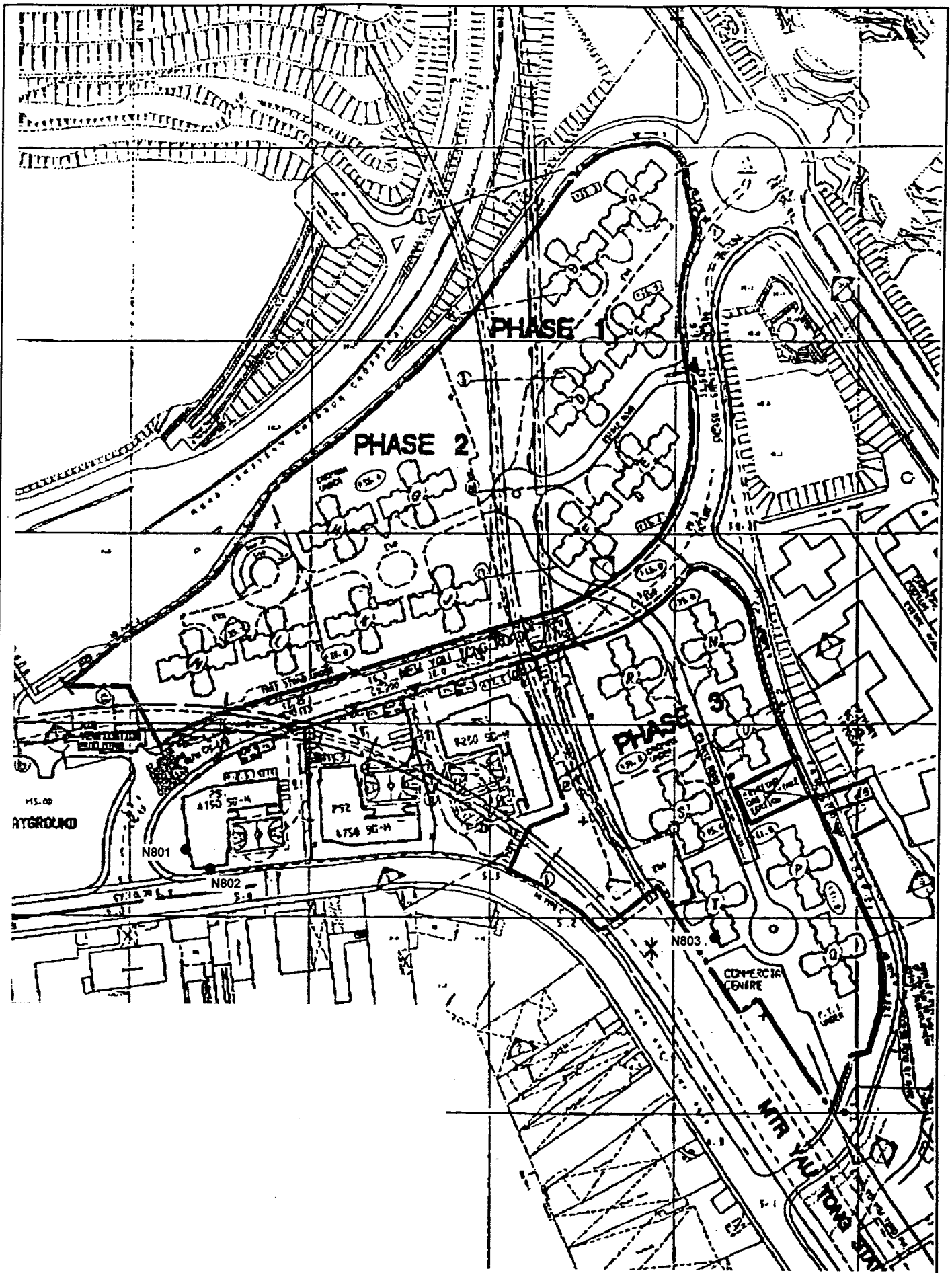
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NSR7 - NOISE ASSESSMENT POINTS





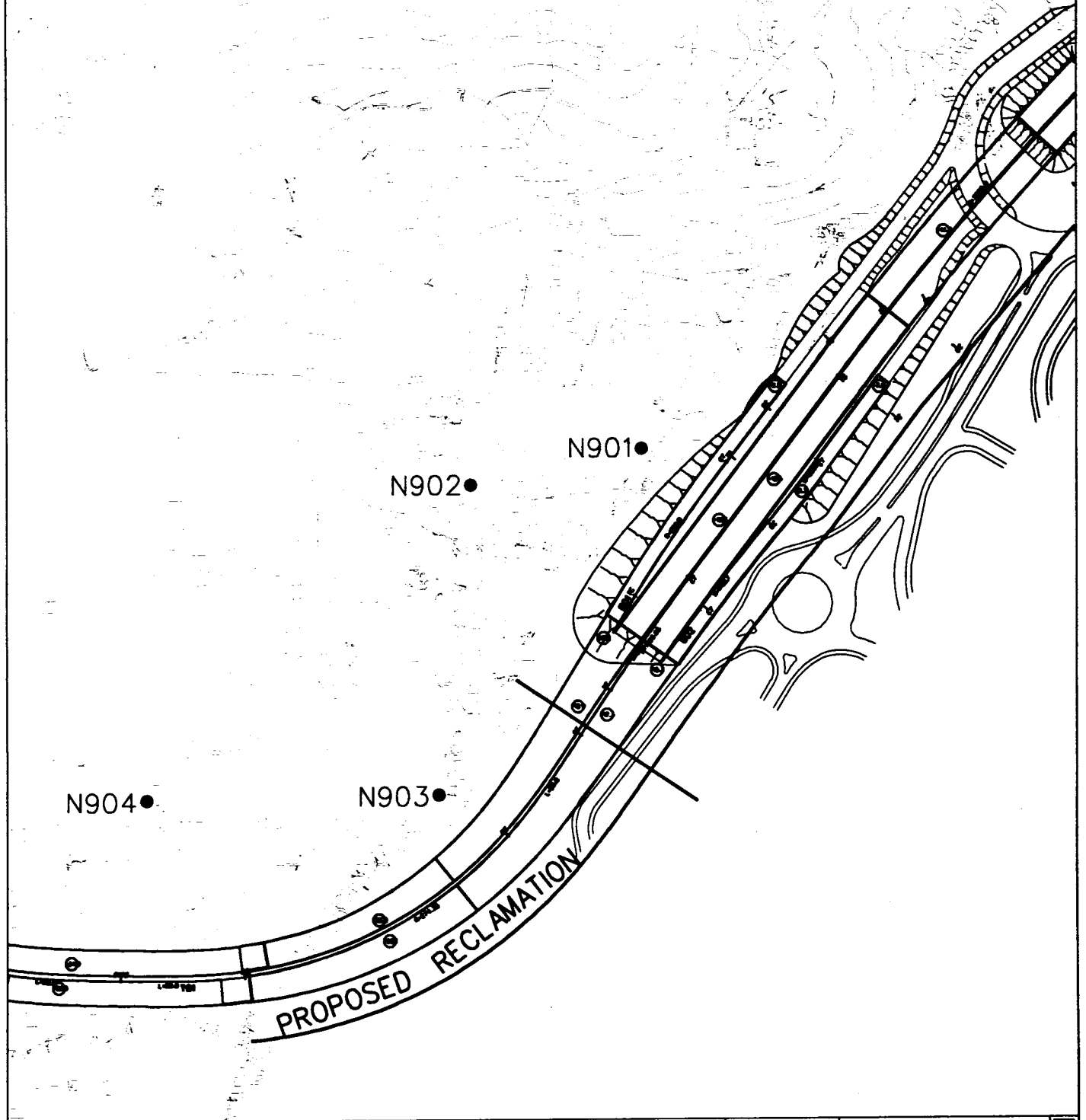
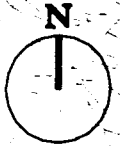
NSR 8-NOISE ASSESSMENT POINTS

FIGURE No.

3.4h

SCALE:  
NTS

DATE:  
Jan 99



NSR9 ASSESSMENT POINTS

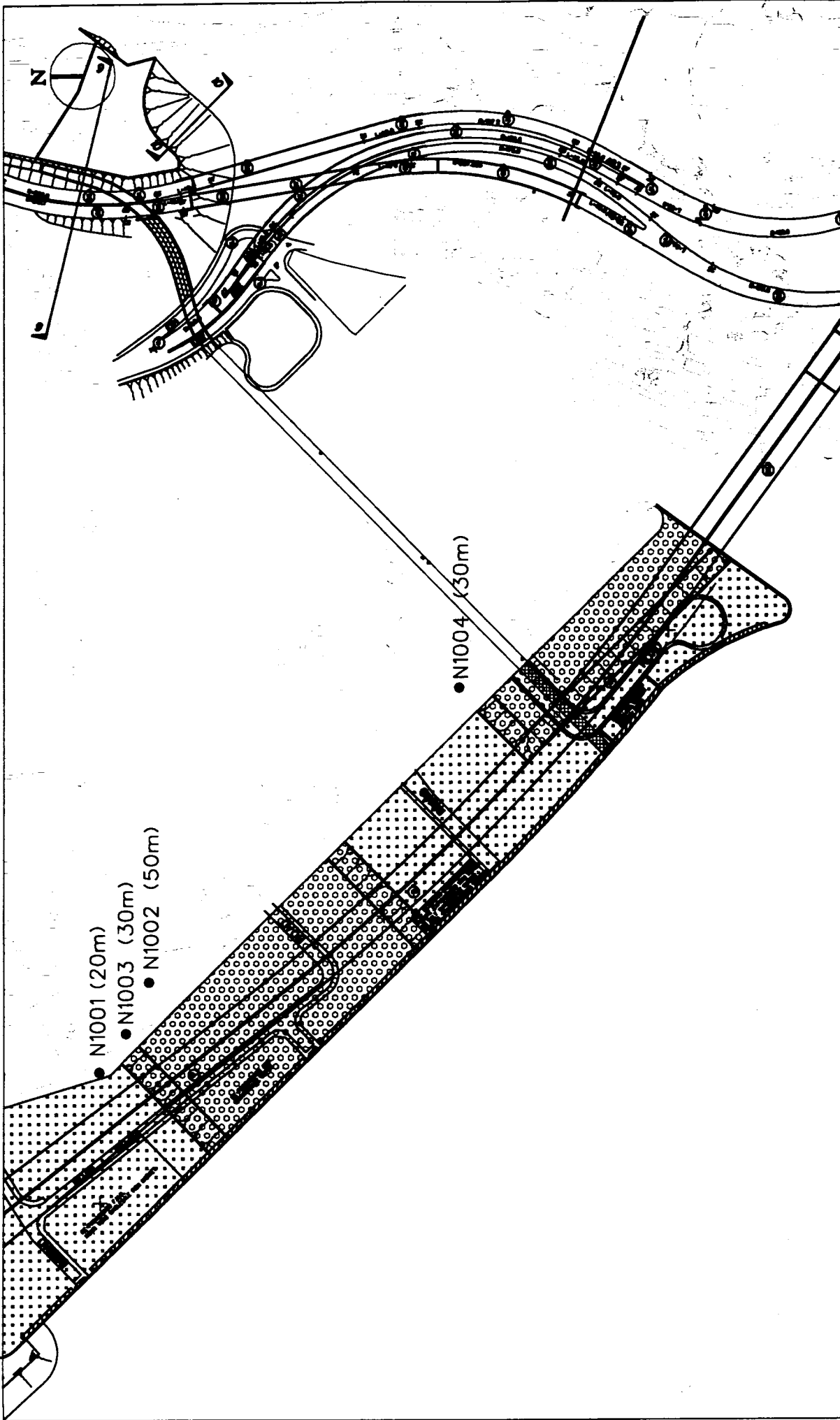
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DATE: JAN 00  
SCALE: 1:3700

FIGURE NO.  
3.4i

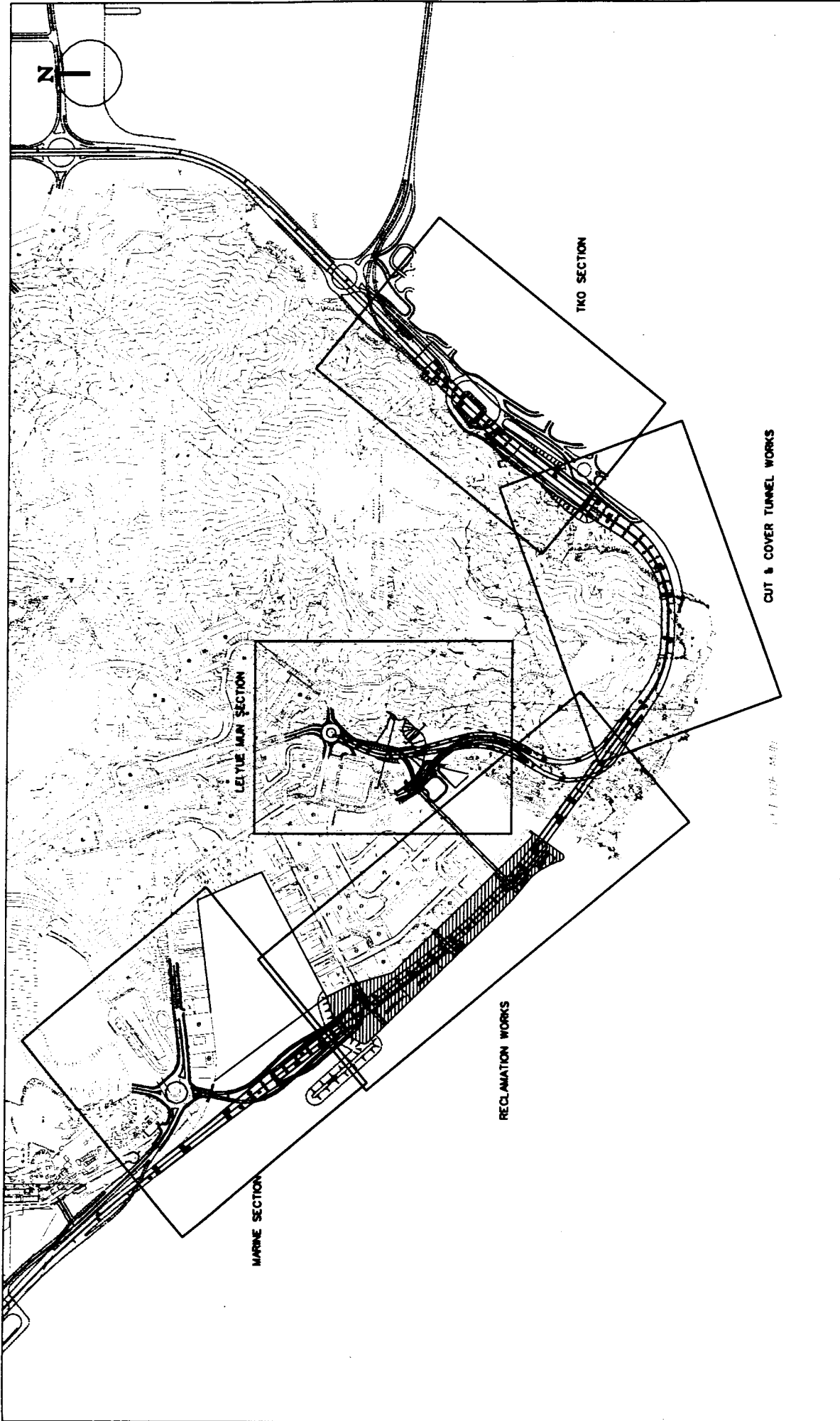




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 茂盛工程顧問有限公司  
 DATE: JAN 99  
 SCALE: 1:3700  
 FIGURE No. 3.4j

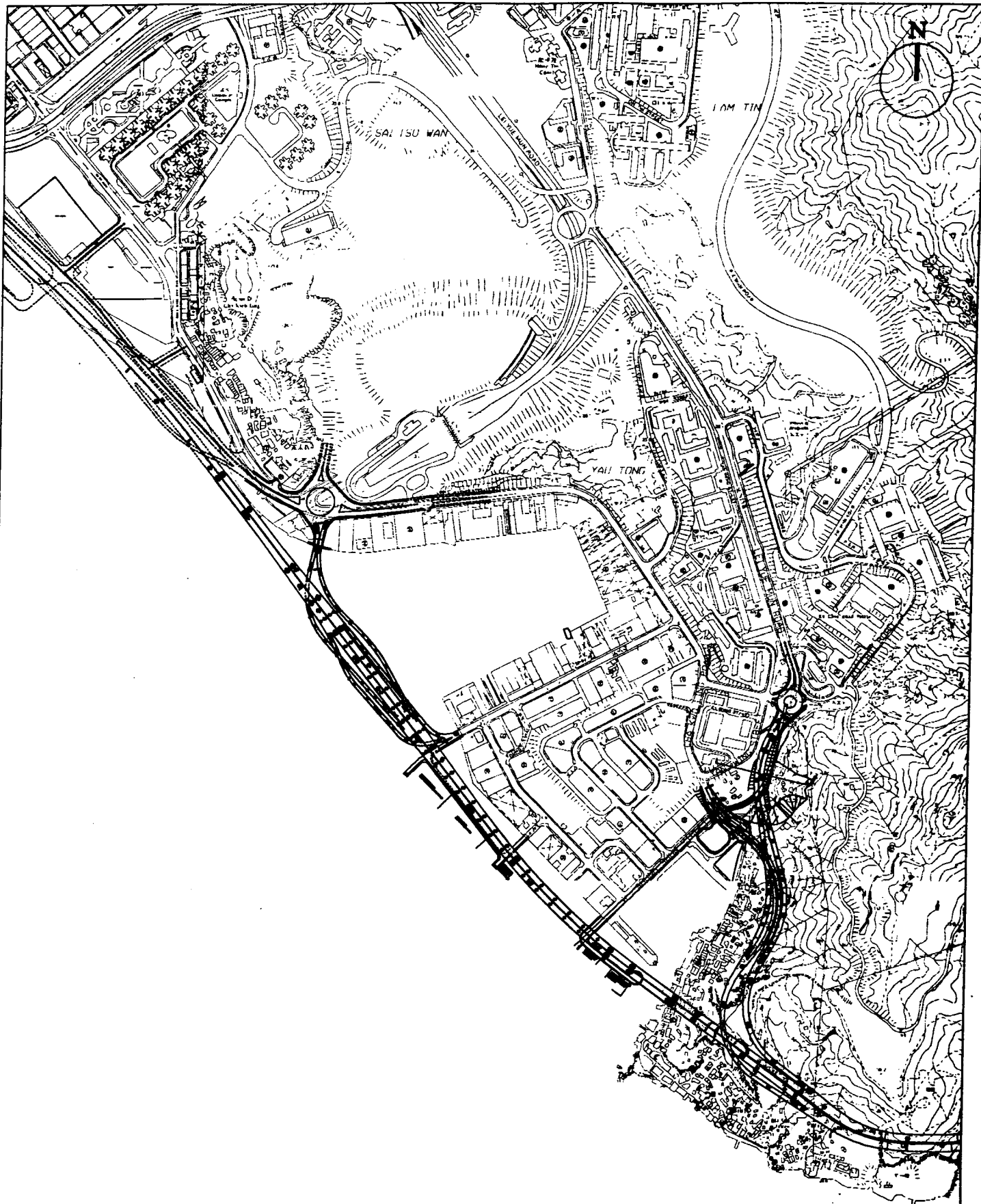
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NSR10 - NOISE ASSESSMENT POINTS



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DATE: JAN 00	FIGURE NO. 3.5a
SCALE: 1:10000	

CONSTRUCTION AREAS



KEY  
 — CLASSIFIED AS 'NEW ROAD' WITHIN WCR SCHEME

I FT YU F MUN

WCR CLASSIFICATION - YAU TONG

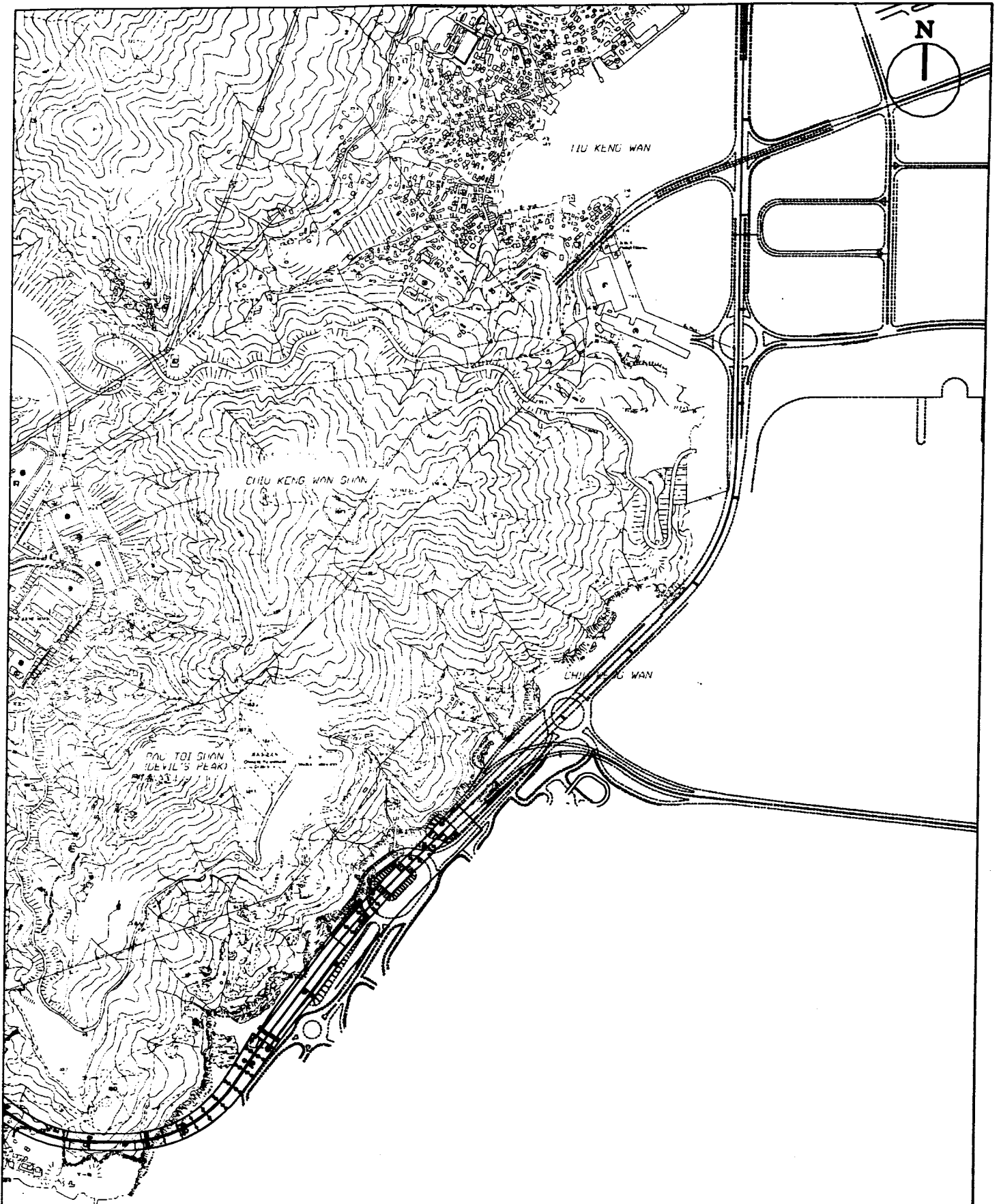
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DATE: JAN 99  
 SCALE: 1:11000

FIGURE No.  
 3.6a

3.6a  
 茂盛工程顧問有限公司  
 MALINSSELL CONSULTANTS ASIA LTD



KEY  
 — CLASSIFIED AS 'NEW ROAD' WITHIN WCR SCHEME

WCR CLASSIFICATION - TKO SECTION

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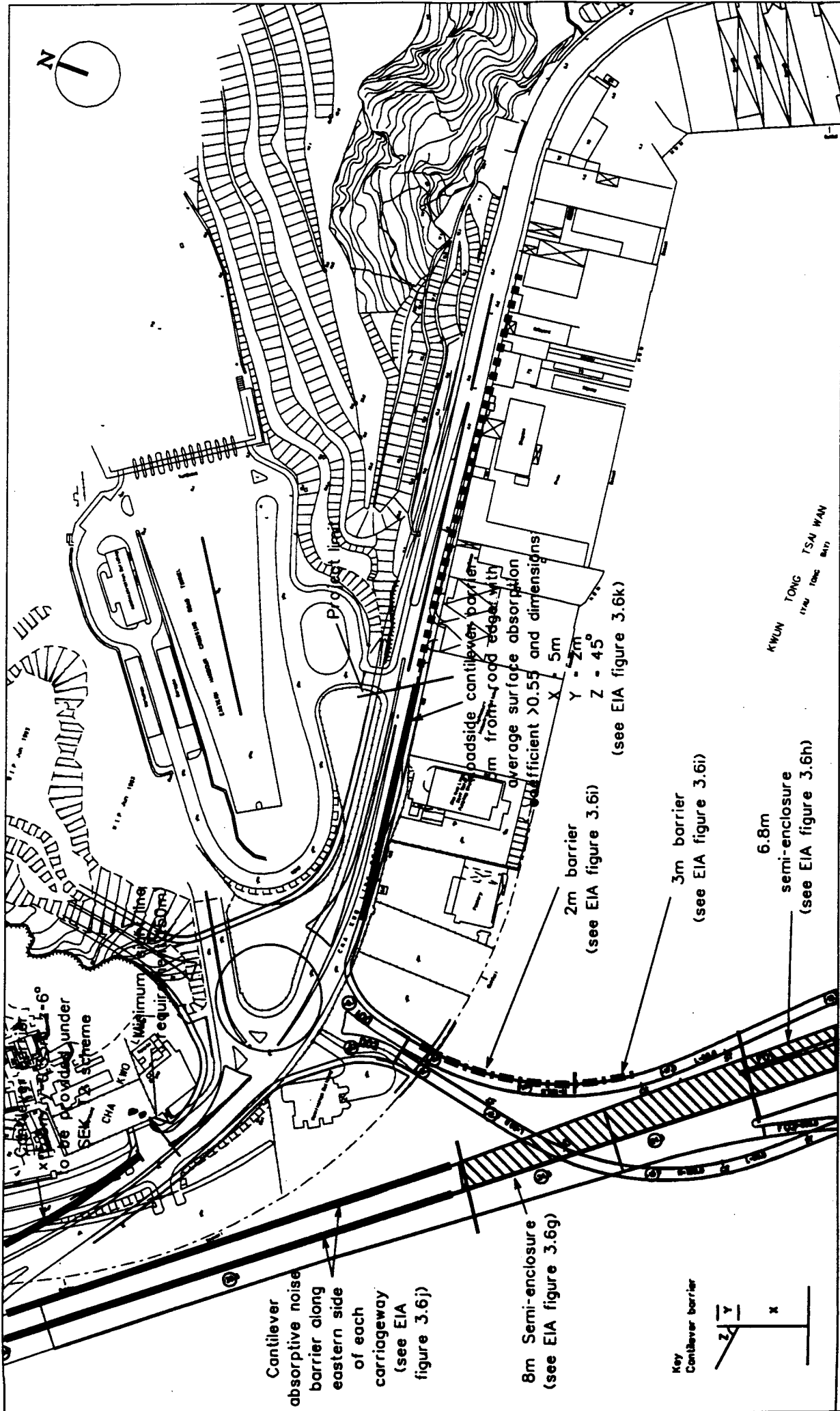
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 茂盛工程顧問有限公司

DATE: JAN 90

FIGURE No.

SCALE: 1:11000

3.6b



Cantilever absorptive noise barrier along eastern side of each carriageway (see EIA figure 3.6j)

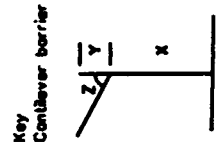
8m Semi-enclosure (see EIA figure 3.6g)

2m barrier (see EIA figure 3.6i)

3m barrier (see EIA figure 3.6i)

6.8m semi-enclosure (see EIA figure 3.6h)

5m overhang from road edge with average surface absorption coefficient > 0.55 and dimensions X = 5m Y = 2m Z = 45° (see EIA figure 3.6k)



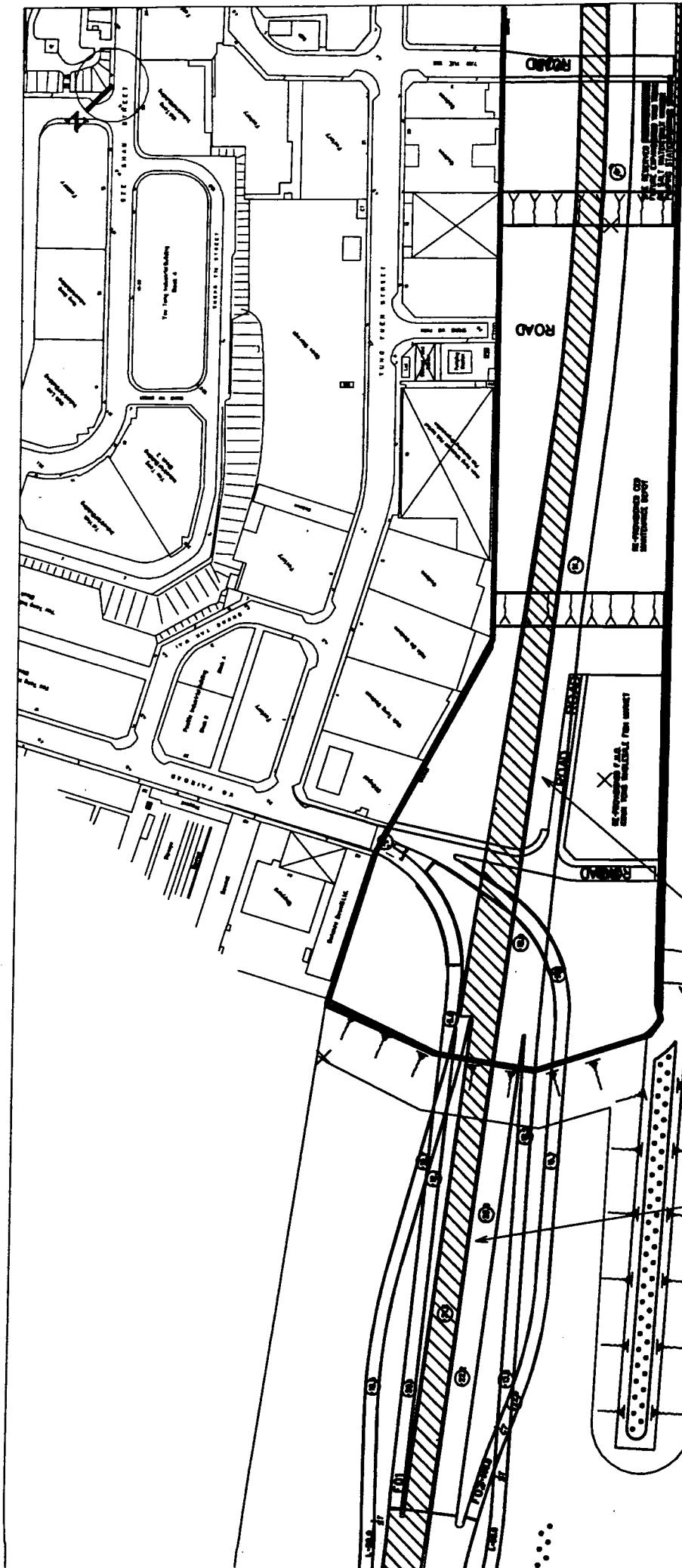
**WESTERN COAST ROAD NOISE MITIGATION**  
(sheet 1 of 4)

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DATE: JUN 99  
SCALE: 1:2000

FIGURE NO. 3.6C



6.8m semi-enclosure with 2.5m overhang above western carriageway (see figure 3.6h)

**WESTERN COAST ROAD NOISE MITIGATION**  
(sheet 2 of 4)

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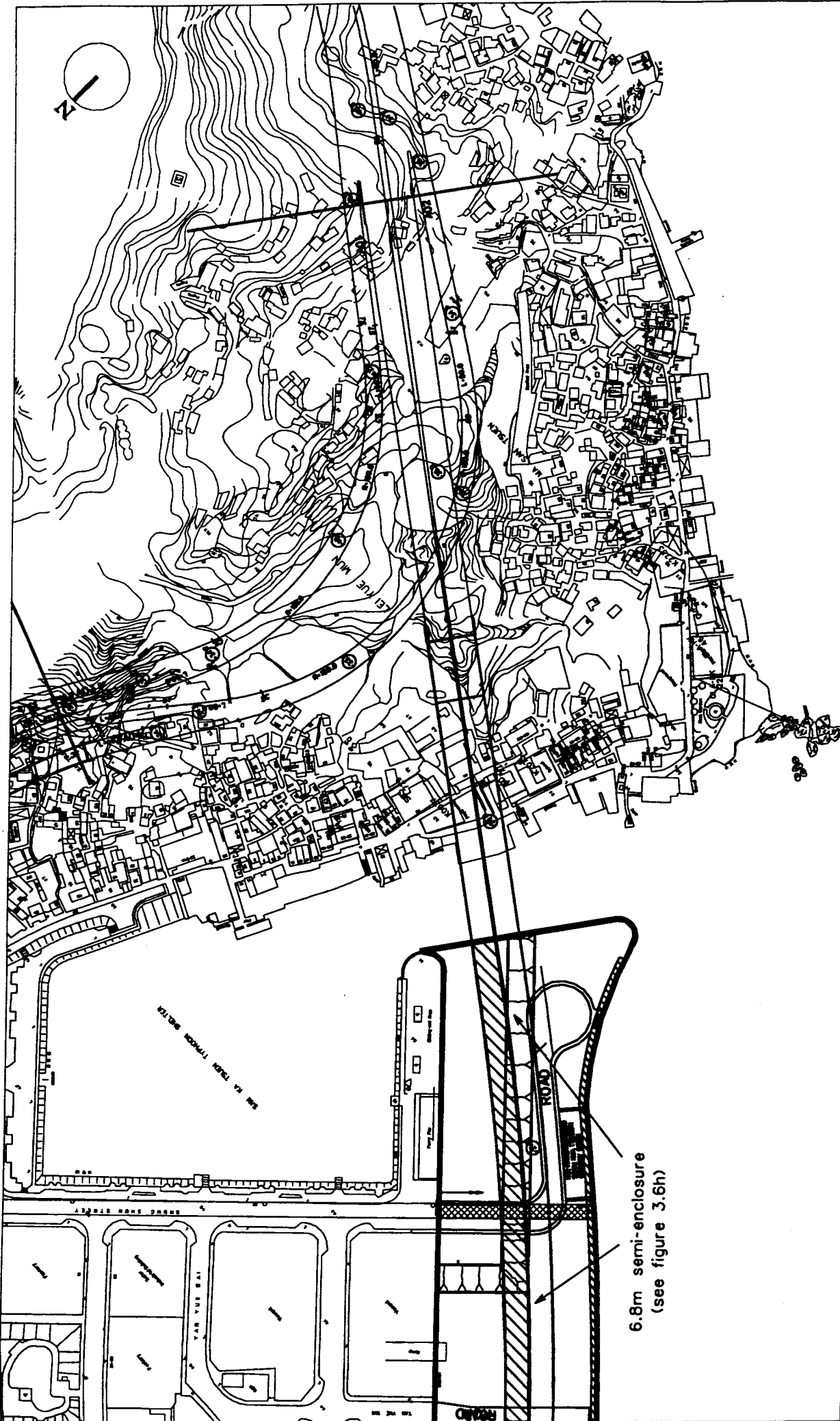
FIGURE NO.

SCALE: 1:2000

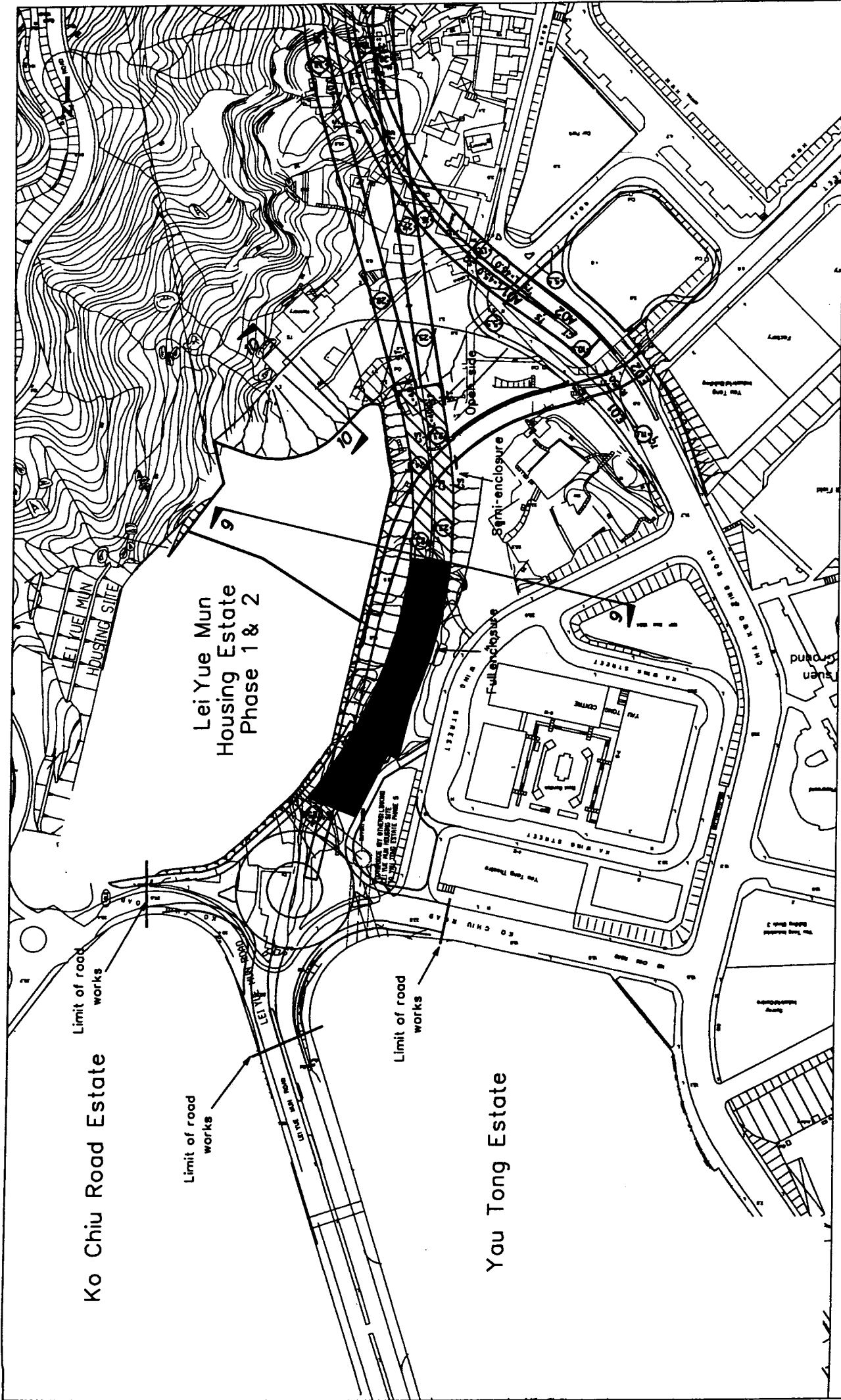
3.6d

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WESTERN COAST ROAD NOISE MITIGATION  
 (sheet 3 of 4)

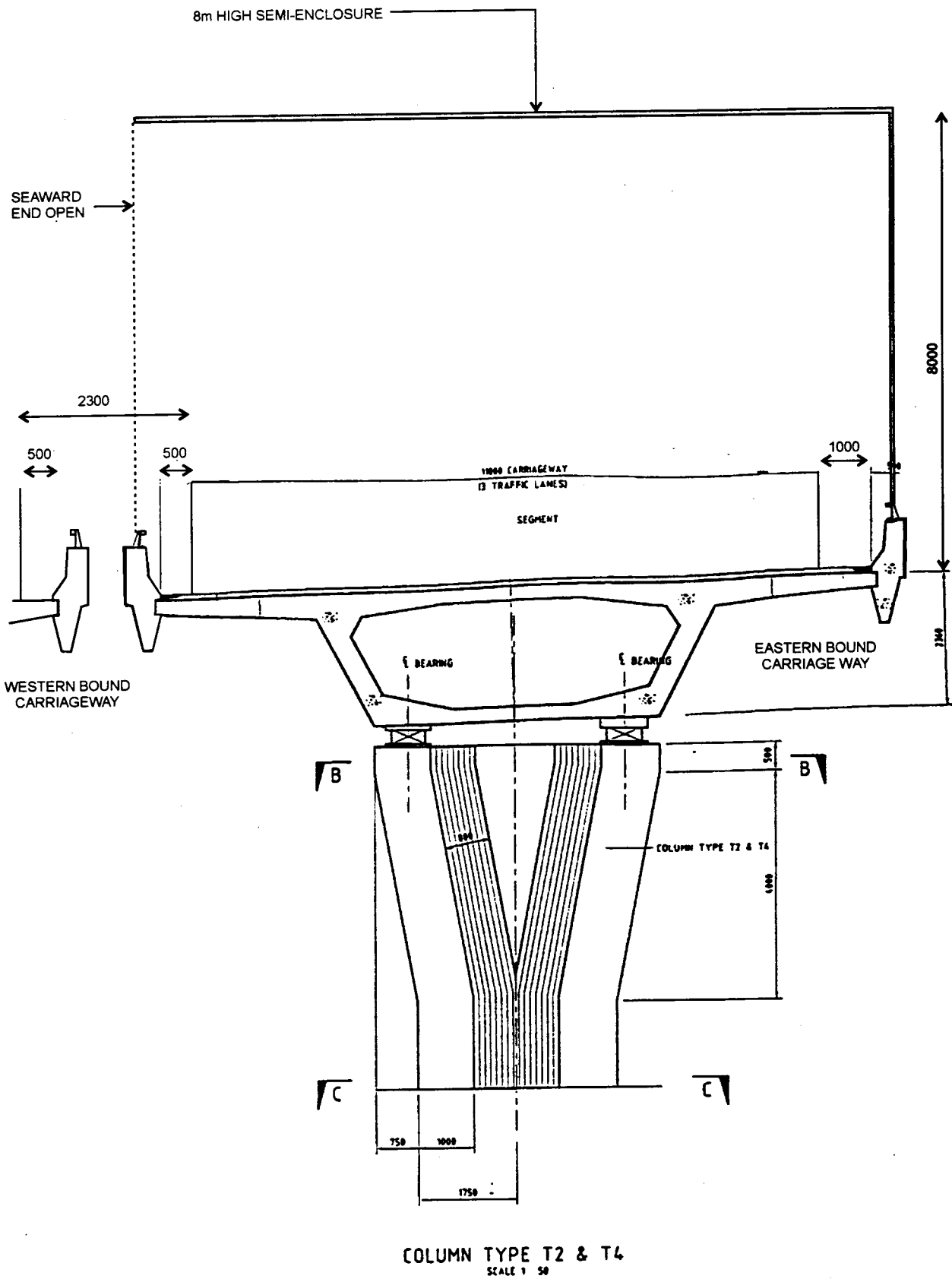


<b>MAUNSELL</b>	
MAUNSELL CONSULTANTS ABIA LTD 茂德工程顧問有限公司	
DATE: JUN 98	FIGURE NO. 3.6f
SCALE: 1:2300	
<p><b>WESTERN COAST ROAD NOISE MITIGATION</b> (sheet 4 of 4)</p>	
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Note 1: Semi-enclosure shown is indicative only, subject to engineering design

Note 2: For typical details of structural design of the semi-enclosure, refer to Figure No. 90297/PD315 of the Main Report

← SEA      → YAU TONG BAY DEVELOPMENT



8m SEMI - ENCLOSURE (EAST BOUND CARRIAGEWAY)

FIGURE No.

3.6g

SCALE:

NTS

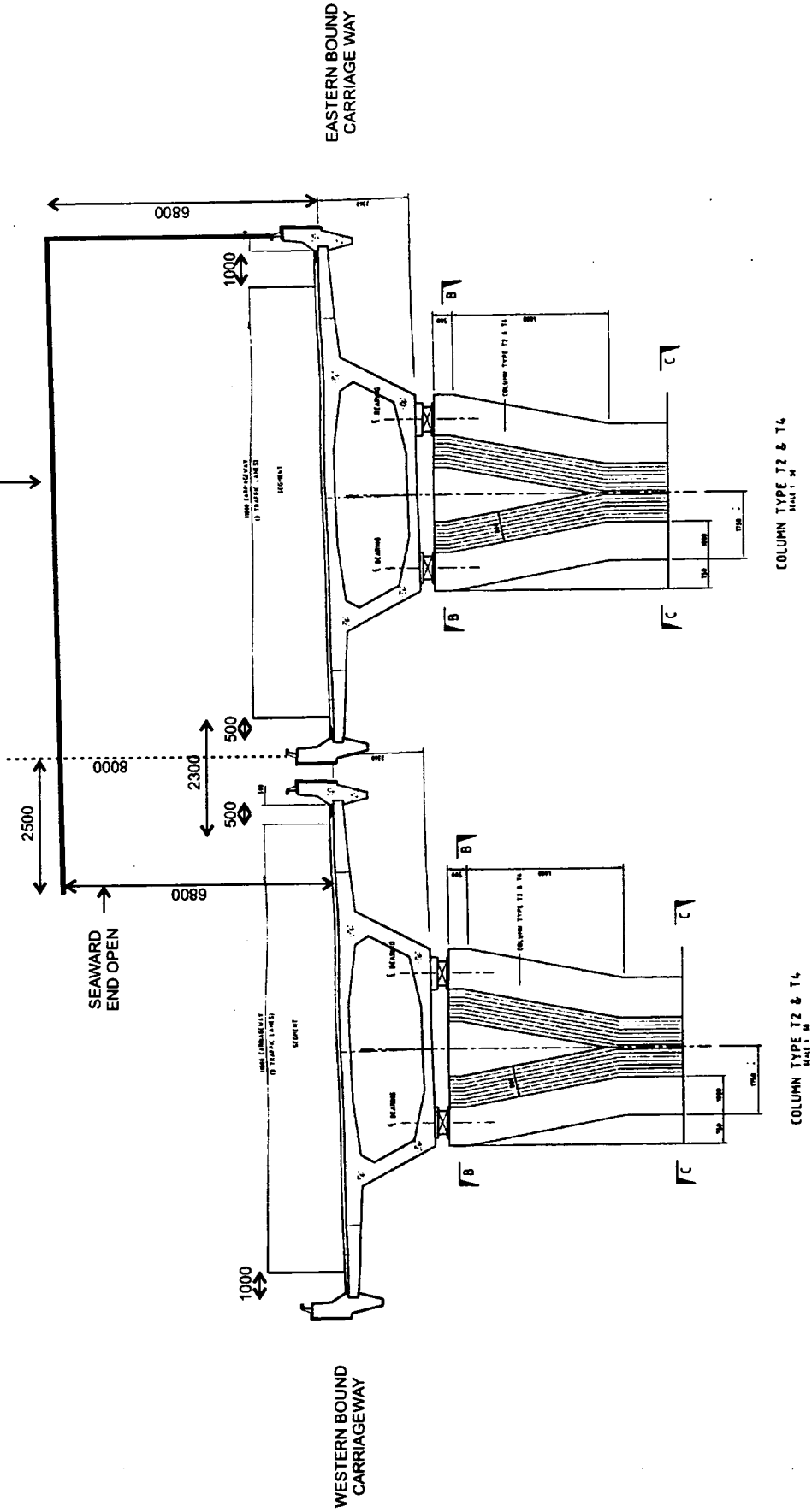
DATE:

Jan 99

Note 1: Semi-enclosure shown is indicative only, subject to engineering design  
 Note 2: For typical details of structural design of the semi-enclosure, refer to Figure No. 90297/PD315 of the Main Report

← SEA  
 → YAU TONG BAY DEVELOPMENT

6.8m HIGH SEMI-ENCLOSURE



CROSS SECTION OF 6.8m SEMI ENCLOSURE (WITH OVERHANG)

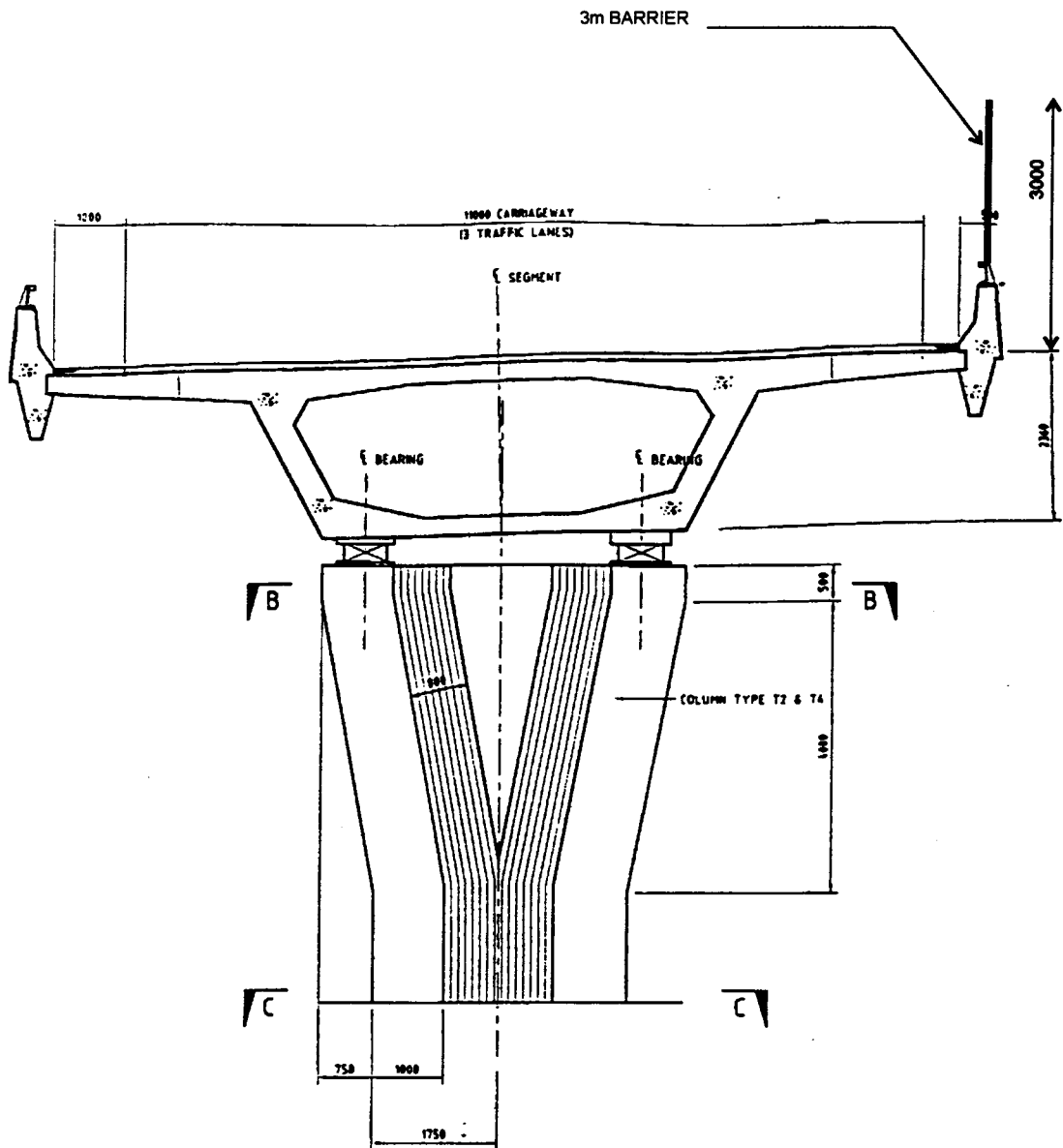
FIGURE No. 3.6h

SCALE: NTS

DATE: Jan 99

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← SEA → NOISE SENSITIVE RECEIVERS



COLUMN TYPE T2 & T4  
SCALE 1/50

NB: 2m ROADSIDE BARRIER HAS SIMILAR CROSS SECTION

Note: Barrier shown is indicative only,  
subject to engineering design

WCR ROADSIDE BARRIERS

FIGURE No.

3.6i

SCALE:  
NTS

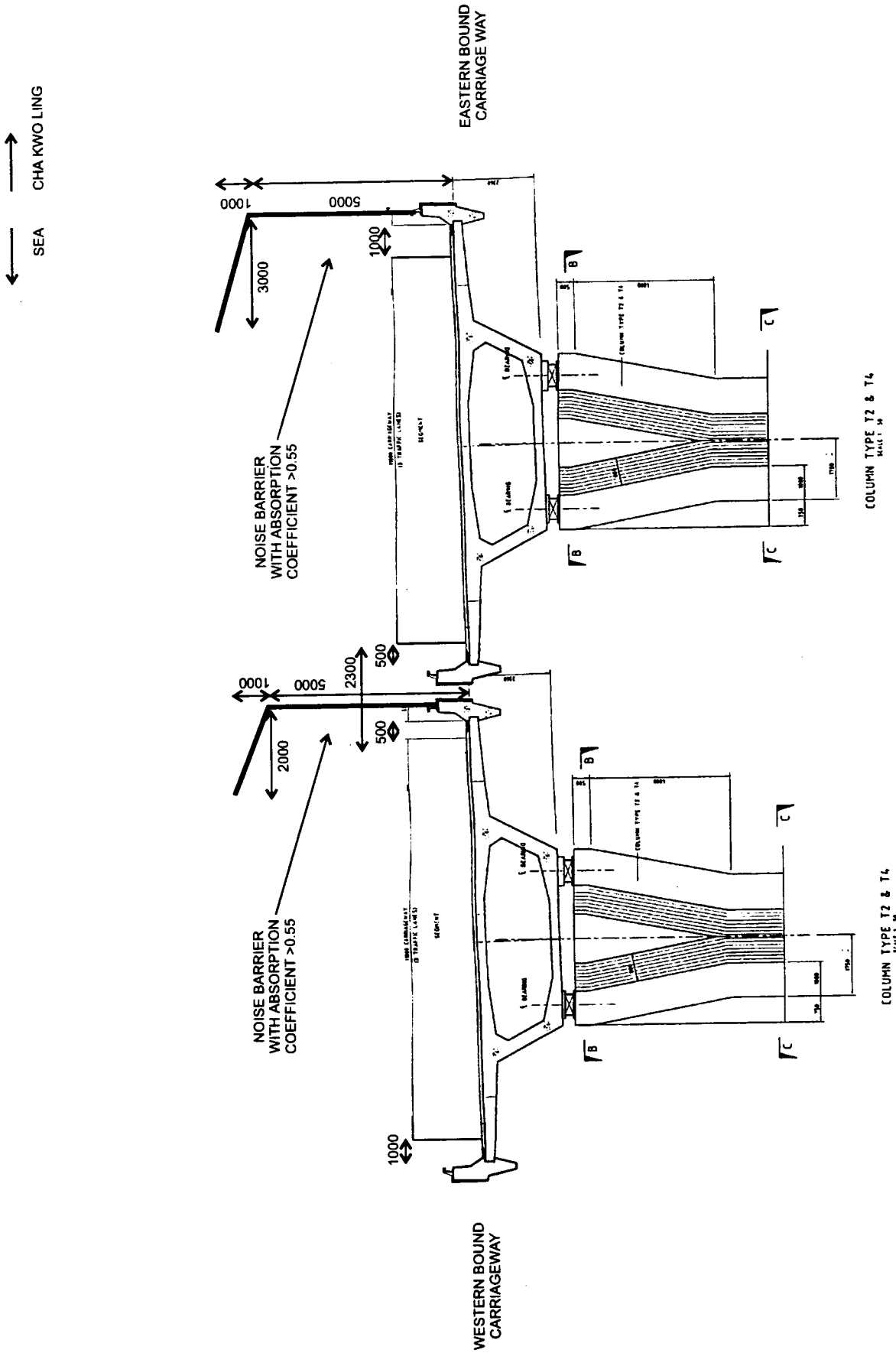
DATE:  
Jan 99

FILE: C1609/C1609.J5

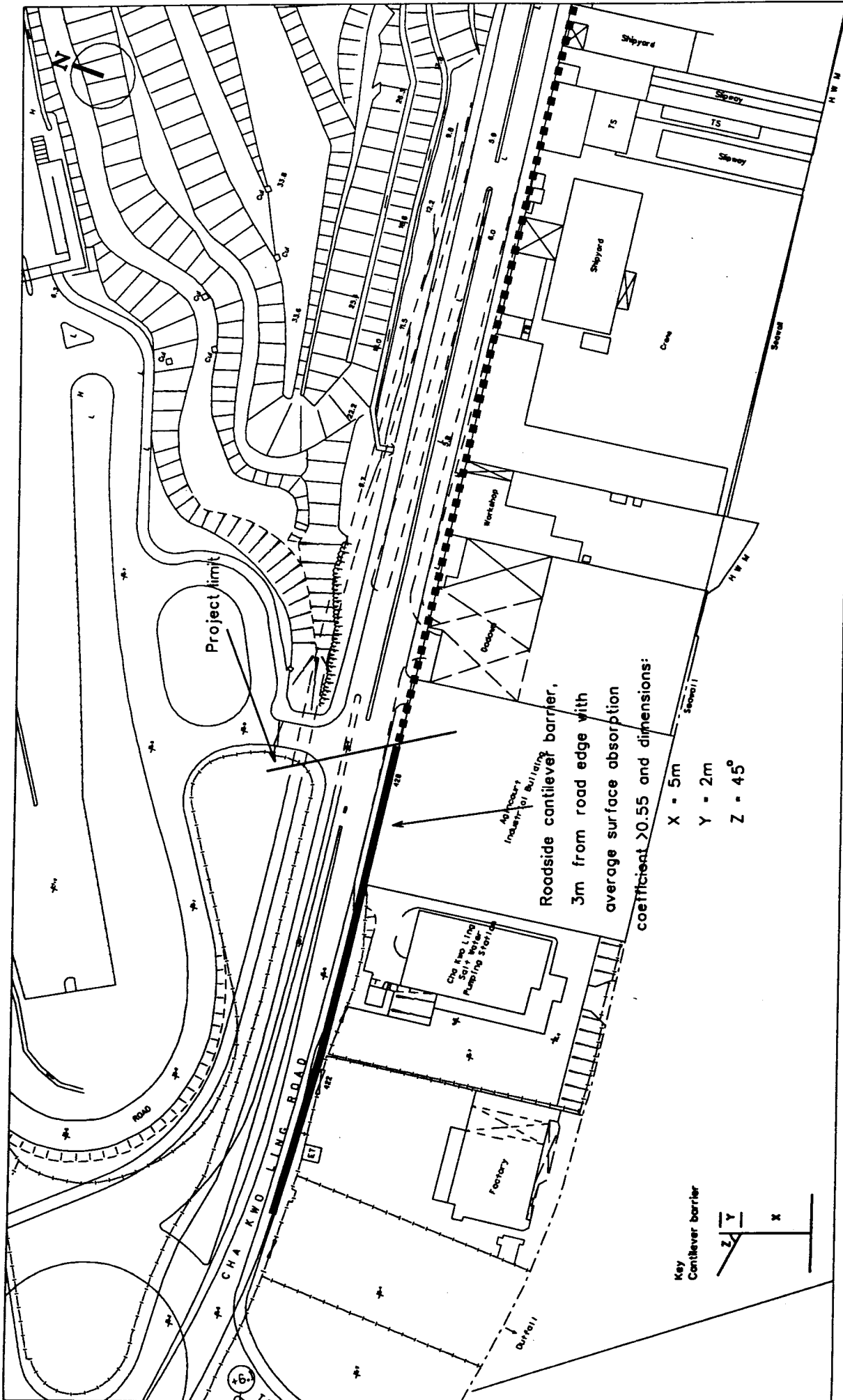
**Mansell**

CROSS SECTION OF WCR IN VICINITY OF CHA KWO LING

Note: Barrier shown is indicative only, subject to engineering design

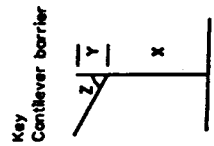


SEA ← → CHA KWO LING



Roadside cantilever barrier,  
 3m from road edge with  
 average surface absorption  
 coefficient >0.55 and dimensions:

- X = 5m
- Y = 2m
- Z = 45°



### YAU TONG BAY DEVELOPMENT NOISE MITIGATION

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DATE: JUN 99	FIGURE NO. 3.6K
SCALE: 1:1000	

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