Highways Department
The Government of Hong Kong Special Administrative Region

Agreement No. CE 87/95

Tsing Yi North Coastal Road Environmental Impact Assessment

Revised Final Assessment Report

萬碩

Mouchel Asia Environmental

in association with

Aspinwall Clouston
Wilbur Smith Assoicates

December 1997

Highways Department
The Government of Hong Kong Special Administrative Region

Agreement No. CE 87/95

Tsing Yi North Coastal Road
Environmental Impact Assessment

Revised Final Assessment Report

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Approved by	S.V. Jones	Project Director		19/12/97
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1.0 INTRODUCTION

1.1 Background

On the 23 February 1996, the Highways Department of the Hong Kong Government appointed Mouchel Environmental to undertake the Agreement No. CE 87/95 concerning the Environmental Impact Assessment (EIA) and Drainage Impact Assessment (DIA) studies for Tsing Yi North Coastal Road. The due date for the commencement of the studies was 28 February 1996.

A Preliminary Project Feasibility Study (PPFS) for this project was carried out by Highways/NT Region in March 1995. As part of the PPFS, the Director of Environmental Protection (DEP) has conducted an Environmental Review (ER) which covered potential construction/operation phase air, noise and water impacts. DEP concluded in the ER that an EIA should be carried out to assess further possible environmental impacts caused by this project, and to advise on possible mitigation measures, if any, to be included in the project. It is expected that the proposed project could have significant environmental impact, especially noise impact on the residents of Cheung On Estate, unless mitigation is applied. The EIA covers the noise, air, water impact assessment and waste management and proposes mitigation measures, where necessary. It also includes an ecological and visual impact assessment to assess the effect of the proposed project on the surrounding visual and ecological qualities.

1.2 Objectives of the Assignment

The objectives of the Assignment are to assess the potential environmental and drainage impacts associated with the construction and operation of the proposed Tsing Yi North Coastal Road. The environmental and drainage issues associated with the Preferred Alignment are discussed and assessed based on the Preliminary Design prepared by Highways Department. Preliminary environmental and drainage control measures are recommended for incorporation into the design to minimise environmental and drainage impacts to within the acceptable limits defined by the Hong Kong Government's environmental legislation and the Hong Kong Planning Standards and Guidelines (HKPSG).

1.3 Report Structure

In meeting the objectives set out above, the rest of this report is organised as follows:

- Section 2 describes the project of Tsing Yi North Coastal Road;
- Section 3 describes the environmental standards and guidelines;
- Section 4 assesses the noise impacts likely to occur during the construction and operation of the alignment and recommends appropriate mitigation measures;
- Section 5 assesses the air pollution impacts likely to occur during the construction and operation phase, together with appropriate recommendations for their mitigation;

- Section 6 assesses the water quality impacts likely to occur during the construction and operation of the alignment and recommends appropriate mitigation measures;
- Section 7 assesses the solid waster management likely to occur during the construction and operation of the alignment and recommends appropriate mitigation measures;
- Section 8 describes the ecological impacts likely to occur during the construction and operation of the alignment and recommends appropriate mitigation measures;
- Section 9 describes the environmental monitoring and audit during the construction and operation phase of the alignment;
- Section 10 describes the construction traffic and future year traffic volumes;
- Section 11 describes the visual impact assessment during the construction and operation of the alignment and proposed mitigation measures;
- Section 12 summarises the conclusions and recommendations of the Project.

2.0 PROJECT DESCRIPTION

2.1 General Project Description

The Brief defines that the Study shall cover the areas within 300 m from the centre line of the proposed Tsing Yi North Coastal Road. The boundary of the Study Area is shown on Figure 2.1

The major elements of the proposed Project include : -

i) construction of a dual 2-lane carriageway about 2.2km in length linking Lantau Fixed Crossing at its intersection with Route 3 and the Western approach to Tsing Tsuen Bridge. This carriageway will comprise four viaducts and be partly on cut or fill slopes;

ii) construction of two associated slip roads connecting with Tam Kon Shan Roundabout Interchange;

iii) Construction of two link roads (A&B) connecting with Tam Kon Shan Road;

iv) provision of a Traffic Control System (TCS) comprising closed circuit television, automatic incident detection devices, lane use signals, variable message signs, emergency telephones, VSLS, O&M radio system; and Public Address System to be integrated into the Tsing Ma Control Area (TMCA) TCS system; and

iv) provision of a sub-control centre at the Tam Kon Shan Roundabout Interchange including recovery vehicles and operational equipment, areas for storage of broken down vehicles; and parking spaces with covers for, among others, recovery vehicles.

It is expected that the project could have significant environmental impacts on the resident of Cheung On Estate unless mitigation is applied. The EIA will cover the environmental impact and propose mitigation measures. The existing section of Tsing Tsuen Bridge which has been constructed but not yet opened to traffic has been considered as new carriageway during the EIA Study. The extent of this section has been indicated on Figure 2.1a. The project also requires the assessment of the drainage impacts and drainage impact mitigation measures. The key objective of the EIA is to ensure that the project is designed and built with the minimum impact on the environment of North Tsing Yi as possible. It is inevitable that there will be objections to the project from local residents and careful attention to environmental matters will assist in acceptance of the Project.

2.2 Construction Activities

The main construction activities of Tsing Yi North Coastal Road comprise:

a. <u>At-grade section</u>

i. excavation

ii. filling
iii. haul road traffic
iv. road pavement
v. retaining structure

b. Viaduct section

i. viaduct foundation, substructure & superstructure
ii. road pavement

The preliminary construction programme of Tsing Yi North Coastal Road are anticipated to be commenced in September 1998 and covers a total period of approximately three years. The construction activities are likely to be between 08:00 to 19:00. It is not expected that there will be any major working in the evenings, at night or on Sundays or public holidays.

The schedules of equipment for the construction activities are shown in Tables 2.1 and 2.2.

Table 2.1 : The Sound Power Levels of the Equipment Associated with Various Construction Activities for at-grade Section

Activity	Noise Source	TM Reference Number (1)	Number	Sound Power Level (dB(A))
Excavation	Rock drill (hydraulic)	CNP182	1	123
	Bulldozer	CNP030	1	115
	Dumper	CNP066	1	106
	Dump truck	CNP067	1	117
	Excavator/loader	CNP081	1	112
	Pneumatic breaker	CNP027	1	122
Filling	Excavator/loader	CNP081	1	112
	Dump truck	CNP067	1	117
	Roller	CNP186	1	108
Haul road traffic	Lorry	CNP141	4 units/ hr. at velocity of 10 km/hr.	112
Road pavement	Road roller	CNP185	1	108
	Asphalt paver	CNP004	1	109
	Lorry	CNP141	2	112+3
Retaining structure	Vibrator	CNP170	1	113
	Crane	CNP049	1	95
	Concrete pump	CNP047	1	109
	Concrete lorry mixer	CNP044	1	109

Table 2.2 : The Sound Power Levels of the Equipment Associated with Various Construction Activities for Viaduct Section

Activity	Noise Source	TM Reference Number	Number	Sound Power Level (dB(A))
Viaduct Foundation, Substructure & Superstructure	Concrete lorry mixer	CNP044	1	109
	Concrete pump	CNP047	1	109
	Generator	CNP101	1	108
	Compressor	CNP001	1	100
	Vibrator	CNP170	1	113
	Tower crane	CNP049	1	95
	Piling rig (non-percussive)	CNP164	1	115
	Lorry	CNP141	1	112
	Pneumatic breaker	CNP027	1	122
Road pavement	Road roller	CNP185	1	108
	Asphalt paver	CNP004	1	109
	Lorry	CNP141	2	112+3

Note: (1) Refers to the Technical Memorandum on Noise from Construction Work other than Percussive Piling

2.3 Traffic Estimates

2.3.1 Models Used

Two levels of transport models were used in this study. On the strategic level, the Enhanced Comprehensive Transport Study Model (Enhanced CTS-2 1995) was used to provide the overall trip distribution pattern and traffic demand matrices. One the local area level, the SATURN (Simulation and Assignment of Traffic in Urban Road Networks) traffic assignment model was developed to assign trips generated by the Enhanced CTS-2 Model to a more detailed road network.

2.3.2 Existing Traffic Conditions

To assess the existing traffic conditions at the eastern end of the proposed Tsing Yi North Coastal Road, manual classified traffic counts were conducted at the Tam Kon Shan Interchange and also at the intersection of Tsing King Road and Nga Ying Chau Street. Figure 2.2 shows the location of the survey sites.

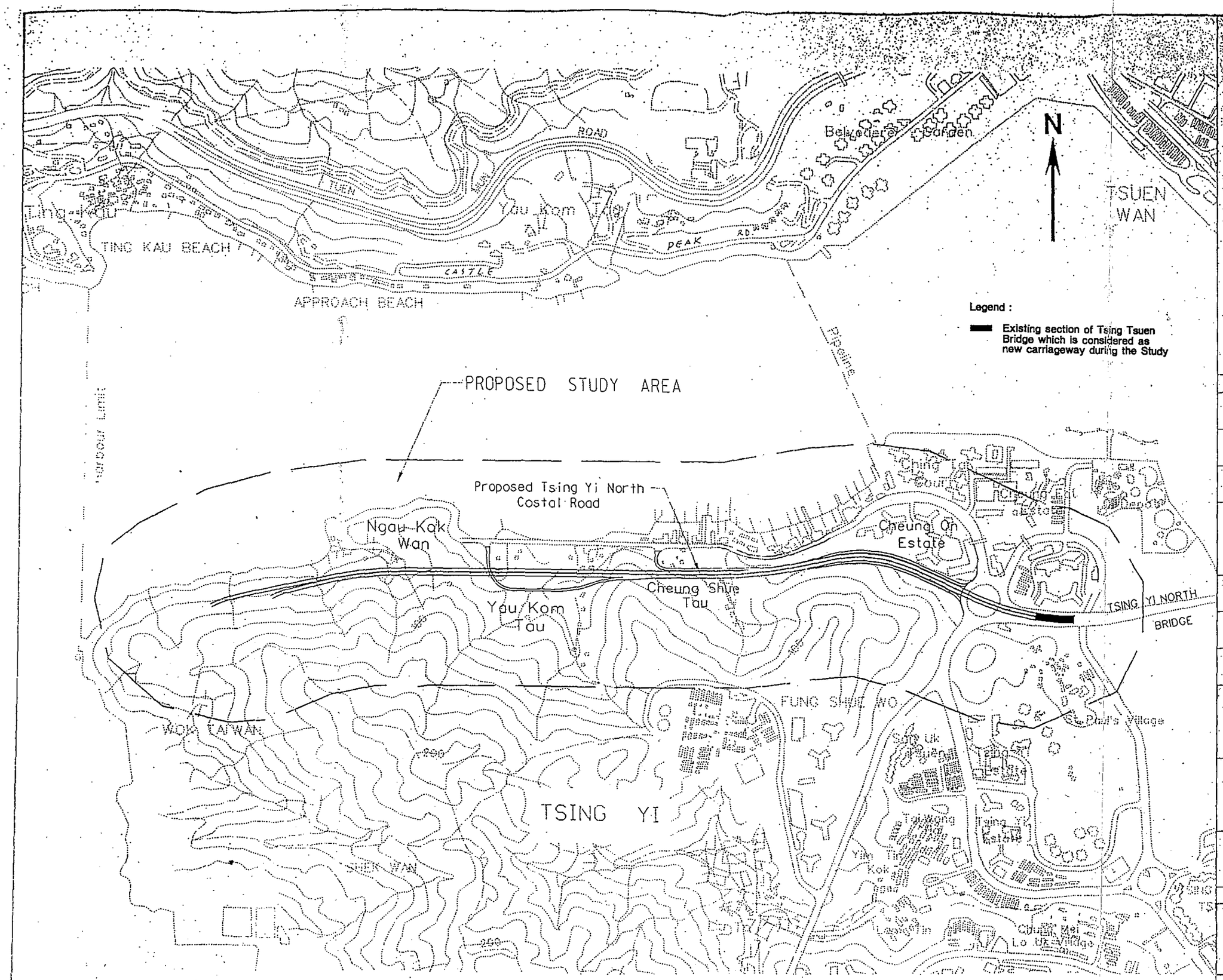
The survey was carried out on Tuesday, Wednesday and Thursday, 14 to 16 May 1996. It covered both the morning and afternoon peaks and took place from 7:00 to 10:00 AM and 4:30 to 7:30 PM.

The morning and afternoon peak hours for road traffic at the Tam Kon Shan Interchange were found to be 7:30 to 8:30 AM and from 5:15 to 6:15 PM. Figure 2.3 shows the existing traffic flows at the Tam Kon Shan Interchange and at the intersection of Tsing King Road and Nga Ying Chau Street.

2.3.3 Future Year Traffic Volume

For the operational phase assessment, the 2006, 2011 and 2016 traffic forecasts were considered. To determine the worst scenario in the fifteen years after the opening of Tsing Yi North Coastal Road in 2011, results from the CTS-2 model for years 2006 and 2011 were compared. In the absence of other planning data for future years beyond 2011, a growth rate based on the increase of trip matrix total of 2% per annum was assumed. This growth rate was based on WSA's Enhanced CTS-2 Model average 9.82% increase in total territory person trips, and screen-line flows to the north and south of the site, for the period 2006 to 2011. A 2% growth rate per annum was used to derive 2016 traffic flows.

By comparing the number of vehicles passing through the Tam Kon Shan Interchange for the three years 2006, 2011 and 2016, 2016 was found to be the worst scenario. Figures 2.4 and 2.5 show the estimated 2016 peak hour volumes. Figure 2.6 illustrates the estimated 1998 peak hour volumes used in the environmental impact assessment.



NOTES

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TSING YI NORTH COASTAL ROAD

drawing title
INVESTIGATION ASSIGNMENT
ENVIRONMENTAL IMPACT ASSESSMENT - STUDY AREA

Figure No.	scale
2.1a	1

office
HIGHWAYS / N.T. REGION

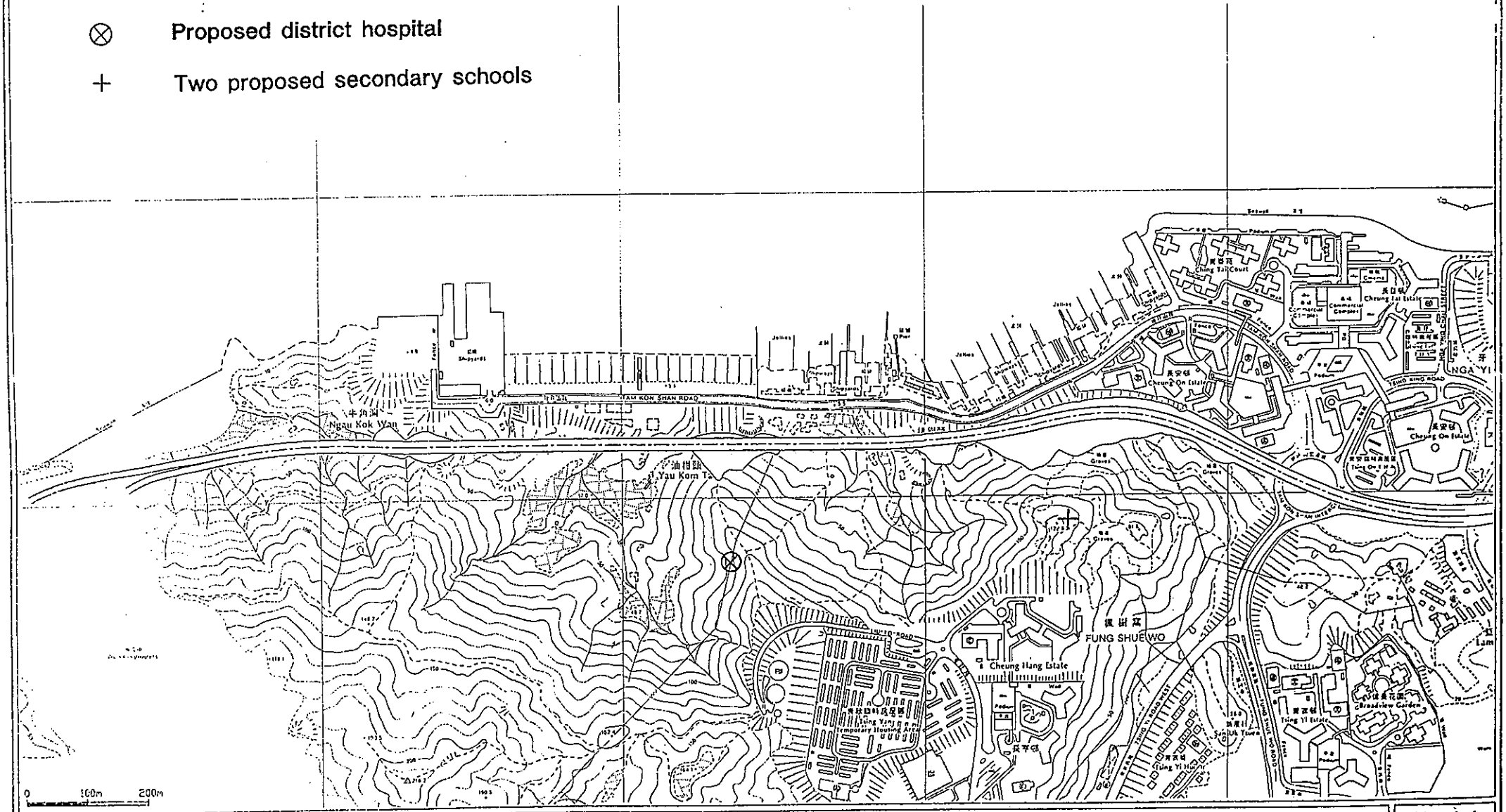
HIGHWAYS DEPARTMENT HONG KONG

N

Legend :

⊗ Proposed district hospital

\+ Two proposed secondary schools



The Locations of the Proposed District Hospital and Proposed Secondary Schools in the Study Area

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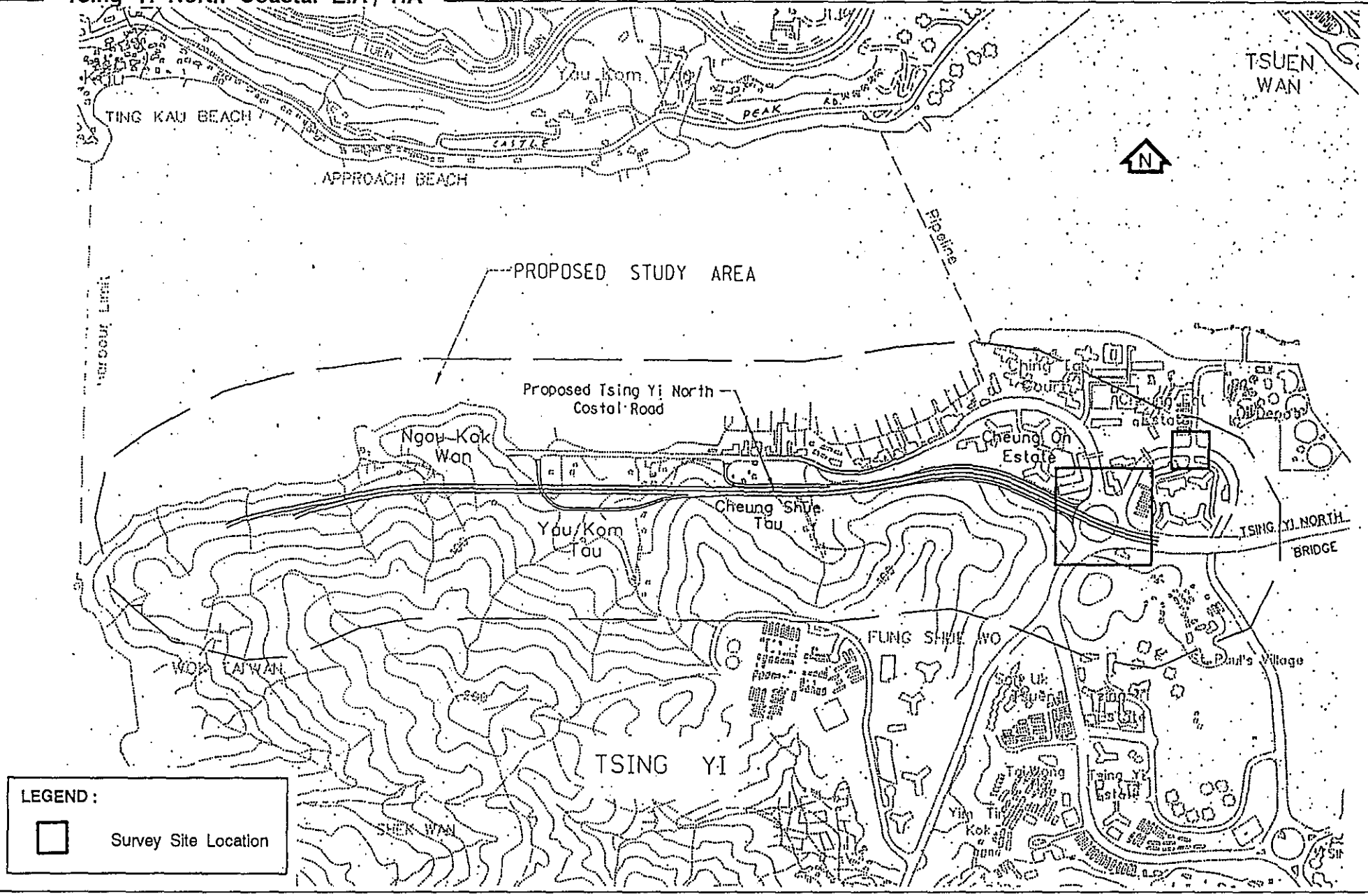
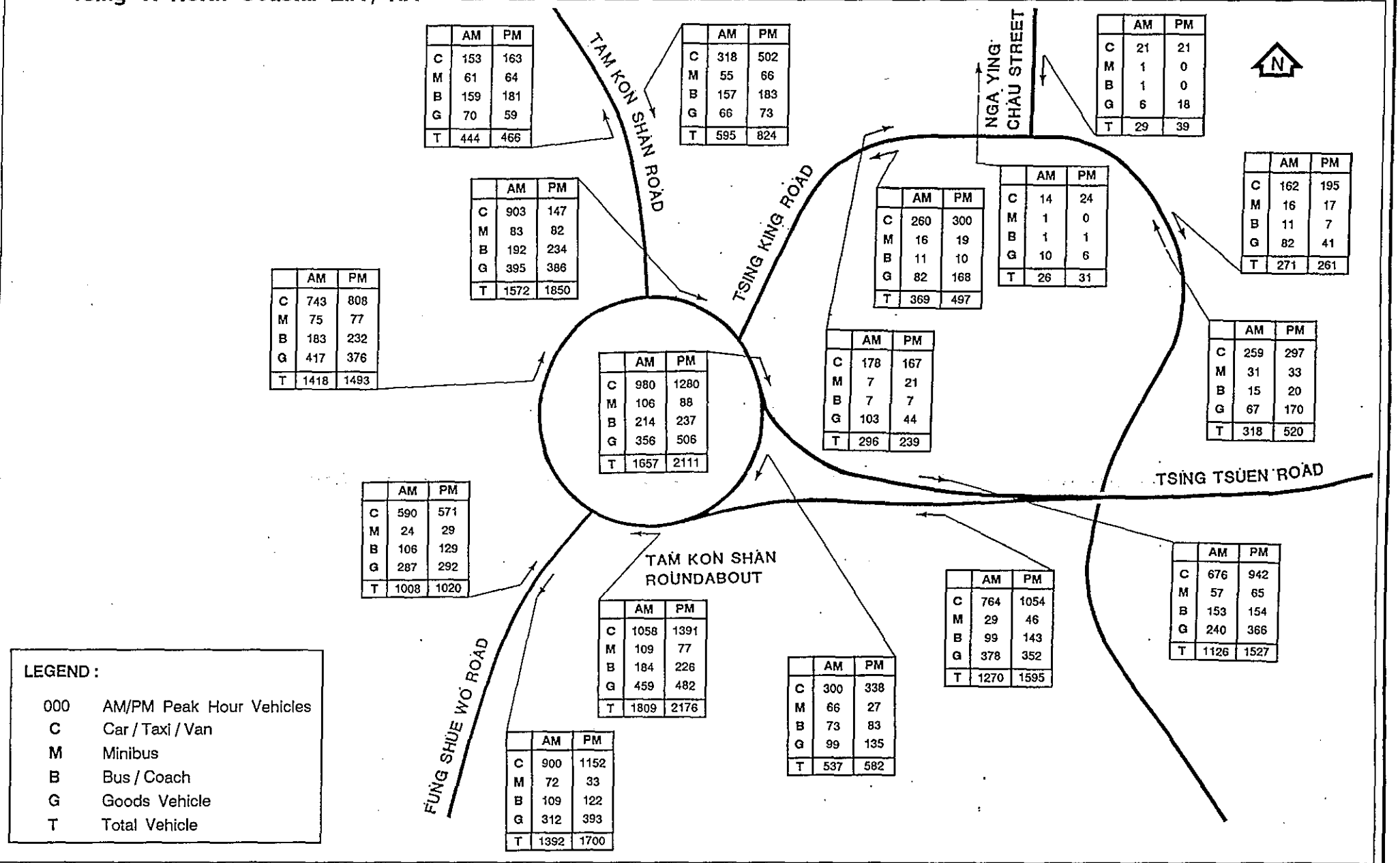
Drawing No. 2.1b



SURVEY SITES

Mouchel

Figure No.: 2.2



	AM	PM
C	153	163
M	61	64
B	159	181
G	70	59
T	444	466

	AM	PM
C	318	502
M	55	66
B	157	183
G	66	73
T	595	824

	AM	PM
C	21	21
M	1	0
B	1	0
G	6	18
T	29	39

	AM	PM
C	903	147
M	83	82
B	192	234
G	395	386
T	1572	1850

	AM	PM
C	260	300
M	16	19
B	11	10
G	82	168
T	369	497

	AM	PM
C	14	24
M	1	0
B	1	1
G	10	6
T	26	31

	AM	PM
C	162	195
M	16	17
B	11	7
G	82	41
T	271	261

	AM	PM
C	743	808
M	75	77
B	183	232
G	417	376
T	1418	1493

	AM	PM
C	980	1280
M	106	88
B	214	237
G	356	506
T	1657	2111

	AM	PM
C	178	167
M	7	21
B	7	7
G	103	44
T	296	239

	AM	PM
C	259	297
M	31	33
B	15	20
G	67	170
T	318	520

	AM	PM
C	590	571
M	24	29
B	106	129
G	287	292
T	1008	1020

	AM	PM
C	1058	1391
M	109	77
B	184	226
G	459	482
T	1809	2176

	AM	PM
C	764	1054
M	29	46
B	99	143
G	378	352
T	1270	1595

	AM	PM
C	676	942
M	57	65
B	153	154
G	240	366
T	1126	1527

	AM	PM
C	300	338
M	66	27
B	73	83
G	99	135
T	537	582

	AM	PM
C	900	1152
M	72	33
B	109	122
G	312	393
T	1392	1700

1996 AM/PM PEAK HOUR TRAFFIC VOLUMES
(VEHS/HR)

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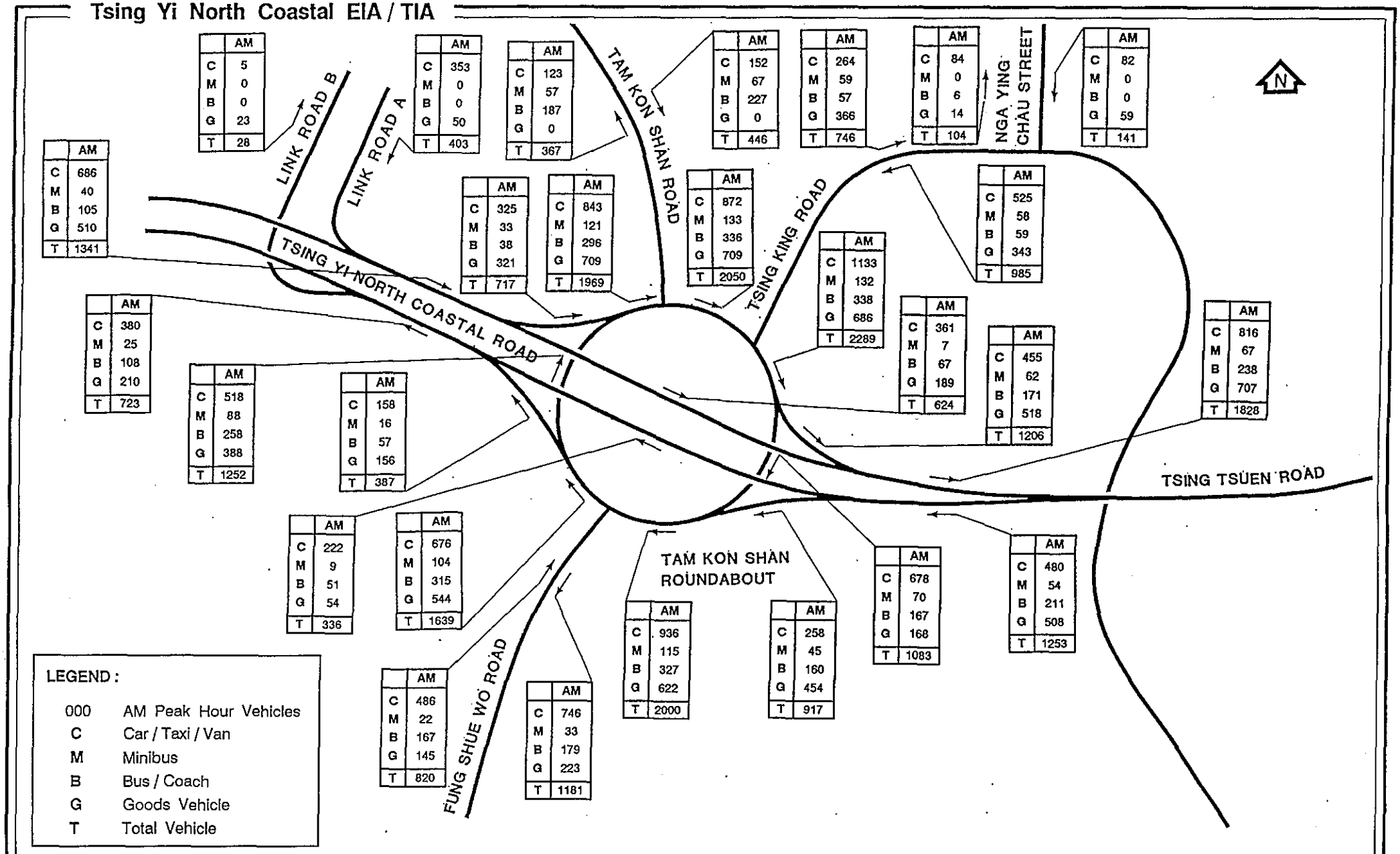
Figure No. : 2.3



	AM
C	5
M	0
B	0
G	23
T	28

	AM
C	353
M	0
B	0
G	50
T	403

	AM
C	123
M	57
B	187
G	0
T	367

	AM
C	152
M	67
B	227
G	0
T	446

	AM
C	264
M	59
B	57
G	366
T	746

	AM
C	84
M	0
B	6
G	14
T	104

	AM
C	82
M	0
B	0
G	59
T	141

	AM
C	686
M	40
B	105
G	510
T	1341

	AM
C	325
M	33
B	38
G	321
T	717

	AM
C	843
M	121
B	296
G	709
T	1969

	AM
C	872
M	133
B	336
G	709
T	2050

	AM
C	525
M	58
B	59
G	343
T	985

	AM
C	1133
M	132
B	338
G	686
T	2289

	AM
C	380
M	25
B	108
G	210
T	723

	AM
C	518
M	88
B	258
G	388
T	1252

	AM
C	158
M	16
B	57
G	156
T	387

	AM
C	361
M	7
B	67
G	189
T	624

	AM
C	455
M	62
B	171
G	518
T	1206

	AM
C	816
M	67
B	238
G	707
T	1828

	AM
C	222
M	9
B	51
G	54
T	336

	AM
C	676
M	104
B	315
G	544
T	1639

	AM
C	936
M	115
B	327
G	622
T	2000

	AM
C	258
M	45
B	160
G	454
T	917

	AM
C	678
M	70
B	167
G	168
T	1083

	AM
C	480
M	54
B	211
G	508
T	1253

	AM
C	486
M	22
B	167
G	145
T	820

	AM
C	746
M	33
B	179
G	223
T	1181

2016 AM PEAK HOUR TRAFFIC VOLUMES
(VEHS/HR)

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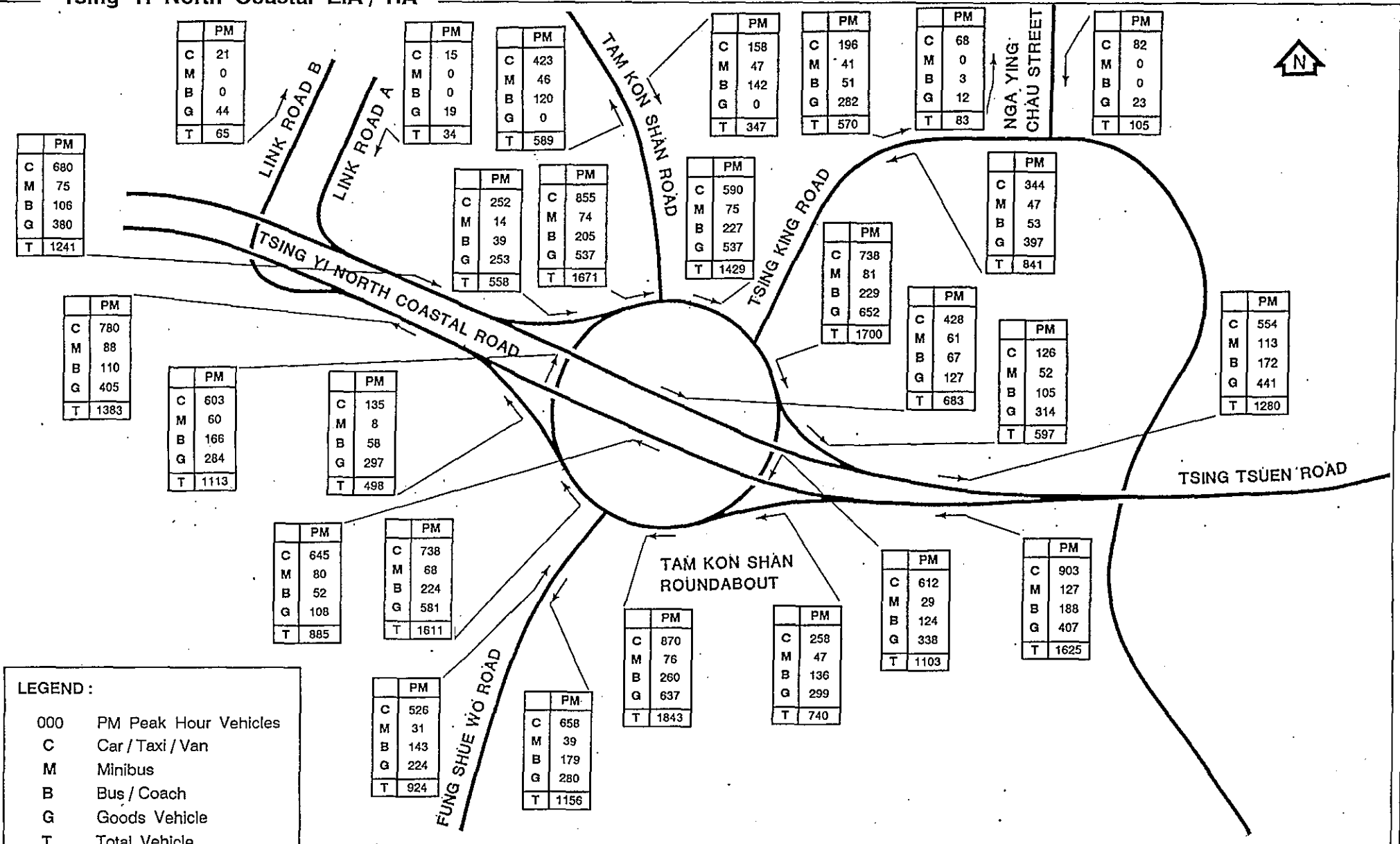
Figure No. : 2.4



	PM
C	21
M	0
B	0
G	44
T	65

	PM
C	15
M	0
B	0
G	19
T	34

	PM
C	423
M	46
B	120
G	0
T	589

	PM
C	158
M	47
B	142
G	0
T	347

	PM
C	196
M	41
B	51
G	282
T	570

	PM
C	68
M	0
B	3
G	12
T	83

	PM
C	82
M	0
B	0
G	23
T	105

	PM
C	680
M	75
B	106
G	380
T	1241

	PM
C	252
M	14
B	39
G	253
T	558

	PM
C	855
M	74
B	205
G	537
T	1671

	PM
C	590
M	75
B	227
G	537
T	1429

	PM
C	738
M	81
B	229
G	652
T	1700

	PM
C	344
M	47
B	53
G	397
T	841

	PM
C	780
M	88
B	110
G	405
T	1383

	PM
C	603
M	60
B	166
G	284
T	1113

	PM
C	135
M	8
B	58
G	297
T	498

	PM
C	428
M	61
B	67
G	127
T	683

	PM
C	126
M	52
B	105
G	314
T	597

	PM
C	554
M	113
B	172
G	441
T	1280

	PM
C	645
M	80
B	52
G	108
T	885

	PM
C	738
M	68
B	224
G	581
T	1611

	PM
C	870
M	76
B	260
G	637
T	1843

	PM
C	258
M	47
B	136
G	299
T	740

	PM
C	612
M	29
B	124
G	338
T	1103

	PM
C	903
M	127
B	188
G	407
T	1625

	PM
C	526
M	31
B	143
G	224
T	924

	PM
C	658
M	39
B	179
G	280
T	1156

2016 PM PEAK HOUR TRAFFIC VOLUMES
(VEHS/HR)

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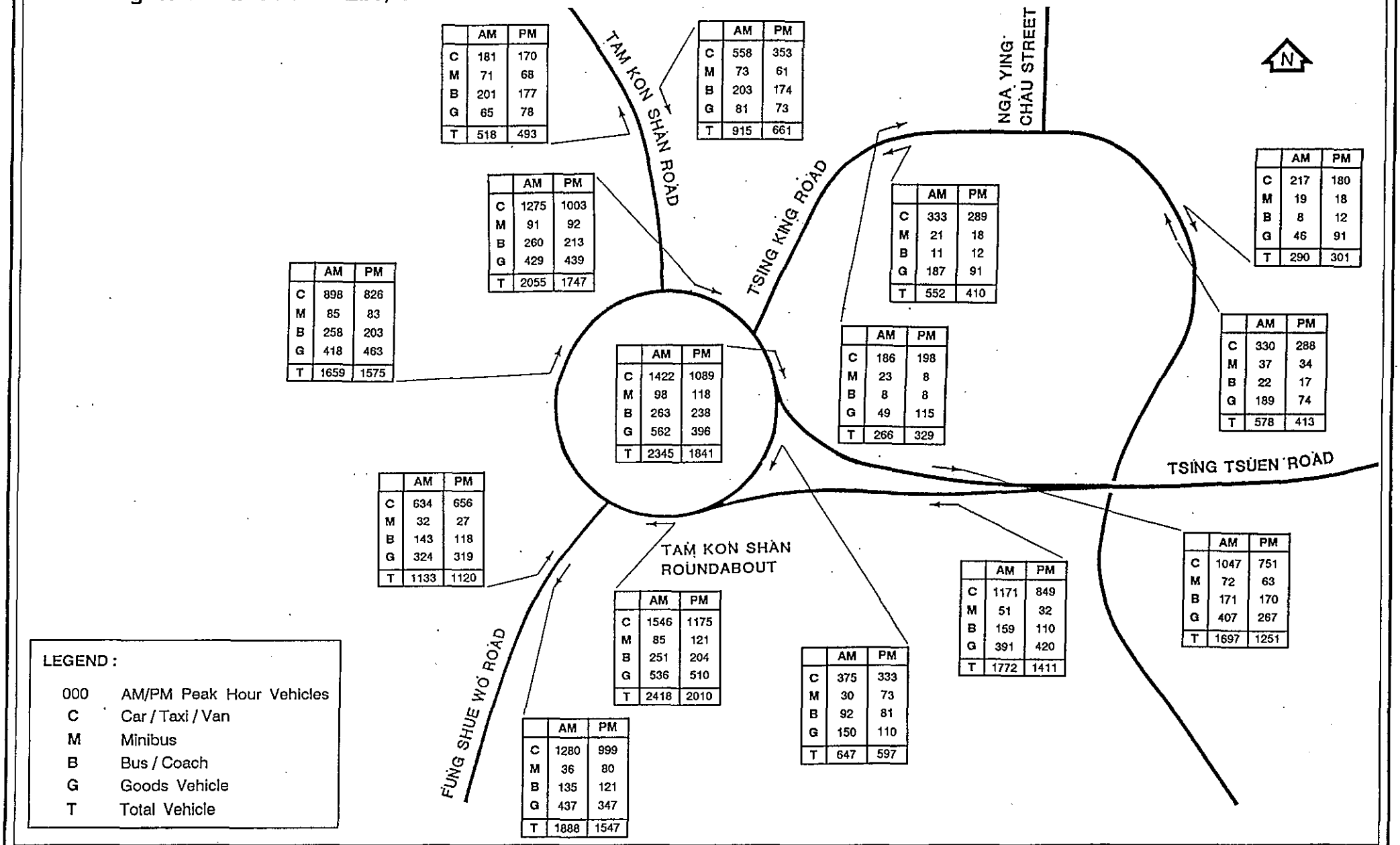
Figure No.: 2.5



	AM	PM
C	181	170
M	71	68
B	201	177
G	65	78
T	518	493

	AM	PM
C	558	353
M	73	61
B	203	174
G	81	73
T	915	661

	AM	PM
C	1275	1003
M	91	92
B	260	213
G	429	439
T	2055	1747

	AM	PM
C	898	826
M	85	83
B	258	203
G	418	463
T	1659	1575

	AM	PM
C	333	289
M	21	18
B	11	12
G	187	91
T	552	410

	AM	PM
C	217	180
M	19	18
B	8	12
G	46	91
T	290	301

	AM	PM
C	1422	1089
M	98	118
B	263	238
G	562	396
T	2345	1841

	AM	PM
C	186	198
M	23	8
B	8	8
G	49	115
T	266	329

	AM	PM
C	330	288
M	37	34
B	22	17
G	189	74
T	578	413

	AM	PM
C	634	656
M	32	27
B	143	118
G	324	319
T	1133	1120

	AM	PM
C	1546	1175
M	85	121
B	251	204
G	536	510
T	2418	2010

	AM	PM
C	1280	999
M	36	80
B	135	121
G	437	347
T	1888	1547

	AM	PM
C	375	333
M	30	73
B	92	81
G	150	110
T	647	597

	AM	PM
C	1171	849
M	51	32
B	159	110
G	391	420
T	1772	1411

	AM	PM
C	1047	751
M	72	63
B	171	170
G	407	267
T	1697	1251

1998 AM/PM PEAK HOUR TRAFFIC VOLUMES
(VEHS/HR)

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Figure No. : 2.6

3.0 ENVIRONMENTAL STANDARDS AND GUIDELINES

3.1 Noise

3.1.1 Non-restricted Hours

The noise generated by the construction of the Project during the non-restricted daytime hours (07.00-19.00) has been assessed with reference to the EPD recommended criteria in the Practice Note for Professional Persons No. ProPECC PN 2/93, as shown in Table 3.1.

Table 3.1 : Recommended Construction Noise Levels (Non-restricted Hours)

Noise Sensitive Receiver	Noise Level L_{eq} (30 min) dB(A)
Dwelling	75
School	70 (Normal school hours) 65 (During examination)

3.1.2 Restricted Hours

It is not expected that any work will be carried out during restricted hours. However the standards that would be applicable are included for completeness. The contractors would need to apply for a permit if they wished to carry out any work in the restricted hours.

For construction activities carried out during restricted hours (19.00-07.00), requirements stipulated by the *Technical Memorandum on Noise from Construction Work other than Percussive Piling* and the *Technical Memorandum on Noise from Construction Work in Designated Areas* under the NCO. NCO construction noise limits are determined with reference to the type of area within which the Noise Sensitive Receiver (NSR) is located. NSRs in the Study Area can generally be assigned an Area Sensitivity Rating (ASR) of "A", "B", or "C", reflecting that the receivers are situated in a rural or low density residential area, affected (directly/indirectly) or not affected by major road(s). The Basic Noise Levels from the *Technical Memorandum on Noise from Construction Work other than Percussive Piling* are outlined below in Table 3.2.

Table 3.2 : Basic Noise Levels (Restricted Hours)

Time Period	Acceptable Noise Level L_{eq} (5 min) dB(A)		
	ASR = A	ASR = B	ASR = C
All days during the evening (19.00-23.00) and general holidays (including Sundays) during the daytime and evening (07.00-23.00)	60	65	70

All days during the night-time (23.00-07.00)	45	50	55

The Basic Noise Levels from the *Technical Memorandum on Noise from Construction Work in Designated Areas* are outlined below in Table 3.3.

Table 3.3 : Basic Noise Levels (Restricted Hours)

Time Period	Acceptable Noise Level L_{eq} (5 min) dB(A)		
	ASR = A	ASR = B	ASR = C
All days during the evening (19.00-23.00) and general holidays (including Sundays) during the daytime and evening (07.00-23.00)	45	50	55
All days during the night-time (23.00-07.00)	30	35	40

3.1.3 Percussive Piling

No percussive piling is anticipated during the construction phase and therefore the criteria stipulated in the *Technical Memorandum on Noise from Percussive Piling* under the NCO are not applicable to the Project.

3.1.4 Road Traffic Noise

The impact of operational noise has been assessed with reference to the HKPSG which stipulate maximum L_{10} (1 hour) road traffic noise levels at sensitive facades of various NSRs (Table 3.4).

Table 3.4 : Acceptable Road Traffic Noise Levels

Noise Sensitive Receivers	Road traffic Noise L_{10} (1 hour) dB(A)
Domestic Premises	70
Places of Public Worship	65
Educational Institutions	65
Hospitals, Clinics, Homes for the Aged (wards & diagnostic rooms)	55

In case where the recommended practical direct remedies cannot protect the affected NSRs to HKPSG noise standards, the Exco directives - *Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads* shall be referenced to

identify which NSRs may be qualified for indirect technical remedies.

3.2 Air Quality

3.2.1 Air quality is regulated through the Air Pollution Control Ordinance, 1983 Cap. 311, which provides, *inter alia*, statutory Air Quality Objectives for each Air Control Zone. Air Control Zones have been declared for the whole of the Territory, and the associated Air Quality Objectives are provided in Table 3.5.

Table 3.5 : Hong Kong Air Quality Objectives

Pollutant	Concentration $\mu g/m^3$ (i) Averaging Time				
	1 Hour (ii)	8 Hours (iii)	24 Hours (iii)	3 Months (iv)	1 Year (iv)
Sulphur Dioxide	800		350		80
Total Suspended Particulates			260		80
Respirable Suspended Particulates (v)			180		55
Nitrogen Dioxide	300		150		80
Carbon Monoxide	30000	10000			
Photochemical Oxidants (as ozone (vi))	240				
Lead				1.5	

(i) Measured at 298°K (25°C) and 101.325 KPa (one atmosphere).
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Arithmetic means.
(v) Respirable Suspended Particulates means suspended particulates in air with a nominal aerodynamic diameter of 10 micrometers and smaller.
(vi) Photochemical oxidants are determined by measurements of ozone only.

Source : Air Pollution Control Ordinance

3.2.2 In addition to the Air Quality Objectives, Environmental Protection Department also recommended that a maximum hourly level of 500 $\mu g/m^3$ Total Suspended Particulates should not be exceeded at the boundary of any construction site.

3.2.3 The air quality inside the vehicle tunnels is regulated and guided by the Tunnel Air Quality Guidelines which were endorsed by the Hong Kong Environmental Pollution Advisory Committee on 26th October 1993. The guidelines are shown in Table 3.6

Table 3.6 : Tunnel Air Quality Guidelines

Air Pollutant	Averaging Time	Maximum Concentration	
		microgram/m^3	ppm
Carbon monoxide	5 minutes	115,000	100
Nitrogen dioxide	5 minutes	1,800	1
Sulphur dioxide	5 minutes	1,000	0.4

Note:- All limits are expressed as at reference conditions of 298°K (25°C) and 101.325 KPa (one atmosphere).

3.3 Water Quality

3.3.1 Introduction

The marine, surface and ground waters of Hong Kong are affected by a wide range of pollution sources including, domestic sewage effluent, contaminated storm water, industrial effluents, dredging and reclamation and construction works.

In the western part of the territory, which hydraulically includes the waters around Tsing Yi, the freshwater discharge from the Pearl River affects the salinity profile, temperature, nutrient loads and suspended solids concentrations in the local marine waters. The extent of the influence of the Pearl varies significantly between the two main seasons being greater during the wet season than during the dry season.

The quality of the surface waters is affected by the intensity and duration of rainfall events with the first flush at the start of a wet season storm may carry high loads of suspended solids and deposited organic waste from into storm drains and other surface water courses.

3.3.2 Environmental Standards - Marine Waters

Marine Water Control Zones

Marine water quality in Hong Kong is managed through the process of assignment of Beneficial Uses (BU) to Water Control Zones (WCZ). Associated with the BU are the Water Quality Objectives (WQO) which are a series of water quality parameters that are assigned numerical values, or permissible changes in magnitude. The Tsing Yi North Coastal Road is located within the Western Buffer Zone (WBZ) which was gazetted as a Water Control Zone in 1993. The Project is also located close to the Victoria Harbour Zone (VHZ) Phase I of which was gazetted at the end of 1994. The boundary between the two zones lies in the north-south limb of the Rambler Channel with the shoreline and adjacent waters from Tsuen Wan to Stonecutter Island and then eastwards lying in the Victoria Harbour Phase 1 Water Control Zone.

Although the Project site lies within the WBZ its proximity to the boundary of the VHZ is such that the WQO of the VHZ should be considered as part of the impact assessment.

Beneficial Uses for Marine Waters

The range of BU and identified sensitive receivers for the two zones are given in Table 3.7.

Table 3.7 : Beneficial Uses Applicable to Marine Waters of Western Buffer and Victoria Harbour WCZ

BU	Beneficial Use	Victoria Harbour	Western Buffer
BU-1	A source of food for human consumption	-	+
BU2	A resource for commercial fisheries and shell fisheries	-	+
BU3	A habitat for marine life and a resource for human exploitation	+	+
BU4	For bathing	-	+
BU5	For secondary contact recreation such as diving, sailboard and dinghy sailing	*	+
BU6	For domestic and industrial purposes	+	+
BU7	For navigation and shipping and use of officially approved and endorsed sheltered harbours and typhoon shelters as temporary havens	+	+
BU8	For aesthetic enjoyment	+	+

Note: * BU5 for Victoria Harbour covers the dinghy sailing off the Royal Hong Kong Yacht Club.

BU-1 is maintained by the application of the WQO directly to the food substance and not the water from which the food was taken. Consequently there are no defined parameters in the marine environment which are controlled.

WQOs expressed in terms of numerical values have been derived for particular quality parameters to ensure that water quality is suitable for the assigned BUs. The water quality parameters which are required to be controlled in order to maintain the prescribed BUs are given in Table 3.8.

Controlled Parameters

Table 3.8 : Water Quality Parameters to be Controlled for Specific Marine Related Beneficial Uses

Parameter	BU-1	BU-2	BU-3	BU-4	BU-5	BU-6	BU-7	BU-8
Aesthetic	-	+	+	+	+	+	+	+
Bacterial	-	-	-	+	+	+	-	-
Dissolved Oxygen	-	+	+	-	-	+	-	-
pH	-	+	+	+	+	+	-	-
Ammonia	-	+	+	-	-	+	-	-
Temperature	-	+	+	-	-	-	-	-
Colour	-	+	+	+	+	+	-	-
Suspended Solids	-	+	+	-	-	+	-	-
Salinity	-	+	+	-	-	-	-	-
Dangerous Substances	-	+	+	+	+	+	-	-

Water Quality Objectives

The WQO for the Western Buffer Zone and Victoria Harbour Phase 1 are defined in Table 3.9. These will be used to assess the current water quality and to establish standarsd to be met during the construction and operation phases of the project.

Table 3.9 : Marine Water Quality Objectives for the Western Buffer Water and Victoria Harbour Control Zones

Water Quality Parameter	Western Buffer Water Control Zone	Victoria Harbour Water Control Zone
Offensive odour, tints and colours	not to be present	not to be present
Visible foam, oil, grease, scum, litter	not to be present	not to be present
E.coli	annual mean not to exceed 610/100 mls secondary contact recreation sub-zone fish culture subzone bathing season mean not to exceed 180/100 ml bathing beach subzones	
Dissolved Oxygen within 2m of the bottom	not less than 2 mg/l for 90% of samples	not less than 2 mg/l for 90% of samples

Water Quality Parameter	Western Buffer Water Control Zone	Victoria Harbour Water Control Zone
Dissolved Oxygen depth averaged	not less than 4 mg/l for 90% of samples marine waters except fish culture sub zone not less than 5 mg/l for 90% of samples fish culture sub zone	not less than 4 mg/l for 90% of samples marine waters
pH value	values to be 6.5-8.5 change due to human activity less than 0.2	values to be 6.5-8.5 change due to human activity less than 0.2
Salinity	change due to human activity less than 10% of natural ambient level	change due to human activity less than 10% of natural ambient level
Temperature Change	change due to human activity not to exceed 2 Centigrade degrees	change due to human activity not to exceed 2 Centigrade degrees
Suspended Solids	human activity not to raise the natural ambient level by 30% nor cause accumulation of suspended solids which may adversely affect aquatic communities	human activity not to raise the natural ambient level by 30% nor cause accumulation of suspended solids which may adversely affect aquatic communities
Toxic Substances	not to be present at levels producing significant toxic effects	not to be present at levels producing significant toxic effects
Unionised Ammonia	annual mean not to exceed 21μg/l	annual mean not to exceed 21μg/l
Nutrients	not be present in quantities that cause excessive algal growth annual mean depth average inorganic nitrogen not to exceed 0.4 mg/l	not be present in quantities that cause excessive algal growth annual mean depth average inorganic nitrogen not to exceed 0.4 mg/l

The principal differences between the two zones lie in the microbiological objective, for which none are prescribed for Stage 1 of Victoria Harbour and the absence of mariculture activities in Victoria Harbour which thus requires a less stringent Dissolved Oxygen criterion.

In addition to the Statutory Objectives users of the marine waters have their own operational standards which are usually less stringent than those set for the WQO and hence are under most circumstances met. For example water taken from the sea by WSD for the seawater flushing network undergoes screening and chlorination prior to supply to the seawater network. The WSD have target values designed to minimise sediment accumulation in the system, safeguard public health and provide a water which is aesthetically acceptable for the purpose. The target values applied by WSD are given in Table 3.10.

For the West Kowloon Project area the MTRC suggested a critical threshold values of a suspended solids level of 180 mg/l for their cooling water system based on operational requirements.

Table 3.10 : Target Limits for Water Quality for Flushing Water

Water Quality Parameter	Target Limit
Colour	< 20 Hazen Units
Threshold Odour Number	<100
Turbidity	<10 NTU
E coli	<20 000/100ml
Dissolved Oxygen	>2mg/l
BOD	<10mg/l
Suspended Solids	<10 mg/l
Synthetic Detergents	<5mg/l
Ammoniacal Nitrogen	<1mg/l

3.3.3 Environmental Standards - Surface Waters.

Beneficial Uses

Beneficial Uses for surface freshwater within Hong Kong have been assigned into four main groups.

- Group A abstraction for potable water supply; these include all waters within water gathering grounds and within the boundaries of the country parks.
- Group B irrigation; these are mainly in the agricultural areas of the New Territories.
- Group C pond fish culture; these are waters passing through areas where there are large numbers of fish ponds and are mostly in the Yuen Long area.
- Group D general amenity and secondary contact recreation; these are waters generally large enough to allow secondary contact recreation, those draining urban and semi urban areas and those draining to the sea at gazetted bathing beaches.

In addition to these Specific Beneficial Uses there are the more general uses of preservation of aquatic life and use for storm water channels. Their quality requirements would equate to Groups B/C and D respectively.

Water Quality Objectives

To protect the beneficial uses within the Water Control Zone Water Quality Objectives are set in terms of qualitative aesthetic parameters and quantitative physico-chemical determinands. These are summarised in Table 3.11

Table 3.11 : Surface Water Quality Objectives for the Western Buffer Zone

Water Quality Parameter	WQO
Offensive odour, tints and colours	not to be present
Visible foam, oil, grease, scum, litter	not to be present
Colour	human activity not cause colour to exceed 30Hazen units in water gathering grounds human activity not cause colour to exceed 50Hazen units in other waters
E.coli	geometric mean of the five most recent samples to be less than 1/100ml in water gathering grounds geometric mean of the five most recent samples to be less than 1000/100ml in other waters
Dissolved Oxygen	not less than 4 mg/l
pH value	6.5-8.5 in water gathering grounds 6.0 - 9.0 in other waters
Salinity	change due to human activity less than 10% of natural ambient level
Temperature Change	change due to human activity not to exceed 2 Centigrade degrees
Suspended Solids	human activity not to raise the level to above 20 mg/l water gathering grounds human activity not to raise the level to above 25 mg/l in other water
Toxic Substances	not to be present at levels producing significant toxic effectss
Unionised Ammonia	annual mean not to exceed 21μg/l
BOD	3 mg/l water gathering grounds 5 mg/l other waters.
COD	15 mg/l water gathering grounds 30 mg/l other waters.

3.4 Solid Waste

3.4.1 Legislations concerning the handling, treatment and disposal of wastes in Hong Kong is described in the following Ordinances and Regulations:

i. Waste Disposal Ordinance (Cap 354)

ii. Crown Land Ordinance

iii. Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws (Cap 132)

iv. Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)

Waste Disposal Ordinance

The Waste Disposal Ordinance prohibits the unauthorised disposal of wastes, with waste defined as any substance or article which is abandoned. Construction waste is not directly defined in the Ordinance but is considered to fall within the category of "trade waste". Trade waste is defined as waste from any trade, manufacturer or business, or any waste building, or civil engineering materials.

Under the Ordinance, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and/or a prison sentence. The Ordinance also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently issued for the collection and transport of construction and/or trade wastes.

Crown Lands Ordinance

Construction wastes which are wholly inert may be taken to public dumps. Public dumps usually form part of land reclamation schemes and are operated by the Civil Engineering Department (CED). The Crown Land Ordinance requires that dumping licences are obtained by individuals or companies who deliver suitable construction wastes to public dumps. The licences are issued by the CED under delegated powers from the Director of Buildings and Land.

Individual licences and windscreen stickers are issued for each vehicle involved. The acceptance of material for public dumping is outlined in the Works Branch Technical Circular No. 2/93. Under the licence conditions public dumps will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with other suitable material is permissible. The material should, however, be free from marine mud, household refuse, plastic metal, industrial and chemical waste, animal and vegetable matter and other material considered unsuitable by the dump supervisor.

Public Cleansing and Prevention of Nuisances

These Regulations provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to fines of up to HK$ 200,000 and imprisonment for up to 6 months.

Waste Disposal (Chemical Waste) Regulation

Chemical wastes as defined under the Waste Disposal (Chemical Waste) (General) Regulation includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulations, if such substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment. A complete list of such substances is provided under the Regulation.

A person should not produce or cause to be produced chemical wastes unless he is

registered with the EPD. Any person who contravenes this requirement commits an offence and is liable upon conviction to a fine of up to HK$200,000 and to imprisonment for up to 6 months.

Producers of chemical wastes must treat their wastes utilising on-site plant licensed by EPD or engage with a licensed collector to take the wastes to a licensed treatment facility. For each consignment of wastes, the producer, collector and disposer of the wastes must sign all relevant parts of a computerised trip ticket. The transfer of wastes from cradle to grave can therefore be traced.

The Regulations prescribe the storage facilities to be provided on site including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He must also provide employees training in such procedures.

Hong Kong Planning Standards and Guidelines (HKPSG)

The Environment Chapter of the HKPSG provides guidance for including environmental considerations in the planning of both public and private developments. The Guidelines recommend that construction waste should be recycled as far as practical or otherwise disposed of at public dumps or landfills. The disposal methods required for dredged and excavated spoil are marine dumping and public dumping. However, the disposal of dredged and excavated spoil at public dump sites should also satisfy the requirements of the dumping licence.

3.4.2 Hong Kong Planning Standards and Guidelines (HKPSG)

The Environmental Chapter of the HKPSG provides guidances for recycling and disposal of construction waste.

3.4.3 The detailed explanations of the legislations are described briefly in Chapter 7 of this report.

3.5 Visual Impacts

3.5.1 There are no specific elements of legislation which govern landscape and visual impact or offer guidelines on visual assessment methodology. However, the Government has published the policy and guidance which is relevant to visual and landscape issues. The detailed information has been provided in Chapter 11 of this report.

3.5.2 In Hong Kong, there are currently no specific elements of legislation which govern landscape and visual impact or offer guidelines on visual assessment methodology. The Government has, however, published the following policy and guidance which is relevant to visual and landscape issues:

3.5.3 The 1990 Government White Paper on "Pollution in Hong Kong - A Time to Act" offers general policy objectives on avoiding environmental problems by considering all environmental impacts in the early stages of the development process. The Hong Kong Environmental Protection Department's (EPD) Advice Note 2/92 offers guidelines on the

environmental impact process for major private sector projects. This recognises visual impact as an issue of concern.

3.5.4 The "Environmental Guidelines for Planning in Hong Kong" (containing extracts from the Hong Kong Planning Standards and Guidelines) makes no specific reference to visual or landscape impacts in their "Guidelines on environmental matters which should be considered in planning and development activities in Hong Kong".

3.5.5 Chapter 10: Conservation of the Hong Kong Planning Standards and Guidelines (HKPSG) states the objective of retaining significant landscapes. Statutory land use zoning categories afford a varying degree of protection to such landscapes. It also refers to the need to assess environmental impacts of developments, but does not specify a methodology.

3.5.6 Several Government Technical Circulars are concerned with retaining landscape features and safeguarding the visual environment:

WBTC 24/94 / PELB 3/94 deals with tree preservation and minimising tree felling throughout the Territory. General Regulation 740 outlines the process whereby a tree felling application must be approved by Government in order to gain permission to fell or cut trees.

Due to adverse public criticism, WBTC 25/93 aims to control the visual impact of engineered slopes. This is specifically directed at public works projects and states that due consideration should be given to minimising adverse visual impacts.

3.5.7 The Highways Department based Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS), specifically review and comment on the aesthetics of highway related structures with a view to minimising visual intrusion and impact. While outside the normal EIA review and approval process, ACABAS comments are of particular relevance to this study where the visual impact of the road will be influenced by the need to construct several significant structures.

3.5.8 The Environment Impact Assessment Bill, introduced in draft form in January 1996, will (if passed) make environmental impact assessment part of the statutory development process. It includes a definition that an environmental impact is a change that a proposed development may cause on the environment affecting the well-being of people, flora fauna and ecosystems. Specific reference is made to visual impact. The Bill, however, does not recommend minimum standards to assess environmental impacts.

3.5.9 These general statements offer little specific guidance on standards for evaluation or methodologies for assessing landscape and visual impacts. Therefore, an assessment methodology has been developed based on current best practice in the United Kingdom developed jointly by the Institute of Environmental Assessment and The Landscape Institute. For this Study, it has been specifically adapted to Hong Kong's particular context and environmental planning objectives for urban and rural landscapes as well as the requirements of the Brief.

4.0 NOISE IMPACT ASSESSMENT

4.1 Noise Sensitive Receivers

The noise impact on NSRs within an area of 300m radius from the centre line of the Tsing Yi North Coastal Road has been considered. The Noise Sensitive Receivers locations are shown on Figures 4.1 and Figure 4.4.

The existing squatter huts along Tam Kon Sham Road were not considered as Noise Sensitive Receivers since all the squatter huts within our project boundary will be demolished and all the occupants will be re-housed before the commencement of the construction works. The names of building on which the Noise Sensitive Receivers are located are shown in Table 4.1.

Table 4.1 : The Noise Sensitive Receivers

NSR No.	Name of Building
R1	On Chiu House
R2	On Chiu House
R3	On Chiu House
R4	Tsing On Temporary Housing Area
R5	Tsing On Temporary Housing Area
R6	On Yun House
R7	On Yun House
R8	On Tao House
R9	On Tao House
R10	On Tao House
R10a	On Tao House
R11	On Kong House
R12	On Kong House
R13	On Kong House
R14	On Kong House
R15	On Yeung House
R16	On Yeung House
R17	On Hoi House
R18	On Hoi House
R19	On Hoi House
R20	On Hoi House
R21	On Hoi House
R22	Queen's College Old Boys' Association Secondary School
R23	Queen's College Old Boys' Association Secondary School
R24	Queen's College Old Boys' Association Secondary School
R25	Queen's College Old Boys' Association Secondary School
R26	Queen's College Old Boys' Association Secondary School
R27	Queen's College Old Boys' Association Secondary School
R28	On Pak House
R29	On Pak House
R30	On Pak House
R31	On Pak House
R32	Man Kiu Association No. 2 Primary School
R32a	Man Kiu Association No. 2 Primary School
Proposed Secondary Schools	Proposed Secondary Schools shown on Figure 4.4
Proposed Hospital	Proposed Hospital shown on Figure 4.4
MTR A	Proposed Residential Premises above proposed MTRC Station; shown on Figure 4.3
MTR B	Proposed Residential Premises above proposed MTRC Station; shown on Figure 4.3

4.2 The Existing Noise Environment

The existing noise environment in the area of the Project site is dominated by intermittent hammering from the shipyards, school activities (Queen's College Old Boys' Association Secondary School, TWGHs Wong See Sum Primary School and CNEC Lui Ming Choi Primary School) and road traffic. Although Tam Kon Shan Road is not a major traffic route, traffic counts have shown that the existing traffic flow is fairly heavy, particularly for the road section close to the Tam Kon Shan Interchange. Roadway noise therefore currently contributes to the overall noise environment in the Project area.

Background noise levels were monitored at three locations in the Study Area in October and November 1994 and June 1996. The locations of monitoring stations are shown on Figure 4.1. The daytime (07.00 to 19.00) results are summarised in Table 4.2.

Table 4.2 : Results of Background Noise Monitoring

Noise Sensitive Receivers	Locations	Periods	Locations of Microphones	Maximum Noise Levels (1 hour), dBA		
				L_{90}	L_{10}	L_{eq}
On Chiu House*	A	6/1996	Roof	70	73	72
On Tao House	B	10/1994	Roof	66.5	72.0	69.7
Queen's College Old Boys' Association Secondary School	C	11/1994	Roof	67.5	78.0	74.1

'*' indicates that the noise levels are average values during the daytime period (07:00 - 19:00).

4.3 Impacts During Construction

The main construction activities which have been identified to generate potential impacts at nearby NSRs fall into following main categories. These categories are as follows:

- excavation;
- filling;
- haul road traffic;

and construction of:

- road pavement;
- retaining structure;
- viaduct foundation, substructure & superstructure.

No percussive piling is expected. All other activities will be of small scale or suitably screened such that they will not contribute more noise than the activities which have been chosen for assessment. The plant inventory and sound power levels (SWL) associated with each activity in the construction site areas are established based on a preliminary plant inventory and have been summarized previously in Tables 2.1 and 2.2.

The construction noise at the Noise Sensitive Receivers (NSRs) was assessed according to the methodology quoted in the *Technical Memorandum on Noise from Construction Work other than Percussive Piling*. The Maximum Noise Levels at the Noise Sensitive Receivers During Construction Phase Without Noise Mitigation Measures are shown in Table 4.3.

Table 4.3 Maximum Noise Levels at the Noise Sensitive Receivers During Construction Phase Without Noise Mitigation Measures

Sensitive Receiver	Viaduct Section, dB(A)	At-Grade Section, dB(A)
R1	82	84
R2	80	83
R3	87	90
R4	87	90
R5	86	89
R6	79	82
R7	77	80
R8	82	85
R9	86	88
R10	88	91
R11	85	88
R12	86	88
R13	87	90
R14	88	90
R15	77	80
R16	76	79
R17	77	80
R18	80	82
R19	81	84
R20	80	82
R21	78	80
R22	82	85
R23	85	88
R24	83	86
R25	82	85
R26	85	88
R27	85	87
R28	76	78
R29	77	79
R30	78	81
R31	79	82
R32	73	76
R32a	73	75

4.4 Mitigation Measures During Construction

It can be seen from Table 4.3 of Maximum Noise Levels at the Noise Sensitive Receivers during Construction Phase without Noise Mitigation Measures that the construction noise has the potential for significant daytime noise impacts at the NSRs. Therefore, mitigation measures are required, and the following forms of mitigation are recommended and assumed during the calculation of residual noise levels. These measures should be incorporated into the Contract Specifications.

1) the construction activities should be carried out in the daytime period (08.00-19.00) only

2) silencers should be installed at the exhaust pipes of the dump trucks, excavators, loaders and the noise levels can be reduced by 5 dBA

3) mufflers should be installed at the rock drills (hydraulic) and pneumatic breakers and the noise levels can be reduced by 5-7 dBA

4) acoustic enclosures should be installed for the concrete pumps and generators and the noise levels can be reduced by 10 dBA

5) construction of temporary noise barriers along the construction site boundary such that the construction equipment will be totally screened. The barriers should have no openings or gaps and have minimum transmission loss of 10 dB.

The residual noise levels during construction phase after implementing the above mitigation measures is shown on Table 4.4. In addition to the above, the following standard noise pollution control clauses should also be incorporated into the Contract Specification for the Contractor to follow:

1) good site practice to limit noise emissions at source

2) avoidance of simultaneous noisy activities

3) selection of quiet plant and working methods

4) reduction in the numbers of plant operating in critical areas close to NSRs

It is noticed that the residual noise levels at NSR nos. R23, R26 & R27 (Queen's College Old Boys' Association School) during construction phase is all 72 dB(A) and will be higher than the limits of 70 dB(A) during normal school hours and 65 dB(A) during examination period. However, it is considered that the situation at these NSRs will be under control by good site practice and specific requirements under the Contract Specifications. The Contractor will be required under the Contract to make sure that the aforesaid noise level limits will not be exceeded when the construction works are being undertaken and if necessary, they should suspend their works near the secondary school during the school hours to ensure that the noise requirements are being complied with.

Table 4.4 Maximum Noise Levels at the Noise Sensitive Receivers During Construction Phase With Noise Mitigation Measures

Sensitive Receiver	Viaduct Section, dB(A)	At-Grade Section, dB(A)
R1	69	69
R2	67	67
R3	74	74
R4	74	74
R5	73	73
R6	66	66
R7	64	64
R8	70	70
R9	73	73
R10	75	75
R11	72	72
R12	73	73
R13	74	74
R14	75	75
R15	64	64
R16	63	63
R17	65	65
R18	67	67
R19	69	69
R20	67	67
R21	65	65
R22	69	69
R23	72	72
R24	70	70
R25	69	69
R26	72	72
R27	72	72
R28	63	63
R29	64	64
R30	65	65
R31	67	67
R32	60	60
R32a	60	60

4.5 Impacts During Operation

Operation noise is attributable solely to road traffic. The impact of road noise arising from the Tsing Yi North Coastal Road and other roads in the area has been calculated at the facades of the representative Noise Sensitive Receivers (NSRs) in terms of L_{10} (1 hour) in dBA using the SoundPlan package. The calculation methodology was based on the "Calculation of Road Traffic Noise", U.K. Department of Transport, 1988. Noise levels for receivers at several heights in the tower blocks were simulated to obtain a profile of noise impacts over the height of the building.

The following assumptions have been made for the modelling:

(a) peak hour traffic flows and vehicle mix in the year 2016 were obtained from the transportation modelling studies and input into the noise modelling;
(b) in view of the close proximity of the Noise Sensitive Receivers (NSRs) to the noise sources, effects due to the absorption by air have not been allowed for;
(c) meteorological conditions have not been allowed for as the receivers are close to the source;
(d) design speeds were used; 70 km/hr for the proposed main carriageway while the others were 50 km/hr.
(e) the existing section of Tsing Tsuen Bridge which has been constructed but not yet opened to traffic has been considered as a new carriageway during the noise impact assessment.

The Maximum Noise Levels, L_{10} (1 hour), dBA, at the Noise Sensitive Receivers During Operation Phase Without Noise Mitigation Measures are shown in Table 4.5.

Table 4.5 The Maximum Noise Levels, L_{10}(1 hour), dBA, at the Noise Sensitive Receivers During Operation Phase Without Noise Mitigation Measures

Sensitive Receiver	Predicted Maximum L_{10} Noise Level (1 hour) (without Noise Mitigation)
R1	78
R2	76
R3	80
R4	81
R5	82
R6	79
R7	79
R8	78
R9	78
R10	78
R10a	80
R11	74
R12	77
R13	77
R14	78
R15	70
R16	69
R17	69
R18	69
R19	76
R20	73
R21	72
R22	70
R23	79
R24	76
R25	74
R26	79
R27	76
R28	80
R29	79
R30	78
R31	76
R32	75
R32a	74
Proposed Sec Schools	62
* Proposed Hospital	72
MTR A	78
MTR B	75

Note: '*' the proposed hospital will not be directly facing the Tsing Yi North Coastal Road

4.6 Noise Mitigation Measures During Operation

The noise modelling has concluded that direct mitigation will be required. The proposed noise mitigation measures include the following:

a) Noise Reducing Highway Surfacing

The "Calculation of Road Traffic Noise" specifies that a noise reduction of 2.5 dBA from the basic noise level can be assumed with the provision of Noise Reducing Highway Surfacing when comparing with the concrete road surface or ordinary dense asphalt surface. Noise Reducing Highway Surfacing also have safety advantages of high friction. However, it is noted that existing Tsing Tsuen Bridge has no provision of Noise Reducing Highway Surfacing. The new main carriageway, including the existing section of Tsing Tsuen Bridge which has been constructed but not yet opened to traffic will be covered with Noise Reducing Highway Surfacing. The detailed extent of the proposed Noise Reducing Highway Surfacing is shown on Figure 4.6.

b) Semi-enclosure on Main Carriageway

A semi-enclosure approximately 8 metres high and approximately 22 metres wide open on the side away from the Noise Sensitive Receivers (NSRs) will be required on the main carriageway. The length of the semi-enclosure will be around 450 metres. The location of the semi-enclosure is shown on Figure 4.2 and starts at Ch.0+450 and ends at Ch.0+000. This design will be less expensive than a full-enclosure and air pollution within the semi-enclosure will not be an issue since there will be natural ventilation through the open side. Full enclosure is not recommended as it will not have any significant noise reducing benefit over semi-enclosure. The minimum Transmission Loss (T.L.) for the panel of the semi-enclosure are 29 dB at 125 Hz and 27 dB at 250 Hz.

c) Acoustic Barrier On Slip Road

An acoustic barrier approximately 7 metres high and approximately 2.9m wide open on the side away from the Noise Sensitive Receivers (NSRs) will be required on the curbside of the northern slip road (slip road A) from the carriageway. The location of the acoustic barrier is shown on Figure 4.2 and starts at Ch.0+600 and ends at Ch.0+203. The minimum Transmission Loss (T.L.) for the panel of the acoustic barrier are 29 dB at 125 Hz and 27 dB at 250 Hz. The vertical profile of the proposed semi-enclosure and inverted-L barrier are shown in Figure 4.5

The Maximum Noise Levels, L_{10} (1 hour), dBA, at the Noise Sensitive Receivers During Operation Phase With Noise Mitigation Measures are shown in Table 4.6. During the preliminary design phase of the project, Highways Department has already considered the option of using underpass for the proposed road section near Cheung On Estate. However, since the eastern end of the proposed Tsing Yi North Coastal Road has to connect with the existing end of Tsing Tsuen Bridge which is an elevated structure and has a level difference of about 8m above the ground level, this option has been ruled out as engineering infeasible.

Highways Department has also considered the feasibility of shifting the alignment of the proposed Tsing Yi North Coastal Road southward to increase the spacing between the proposed carriageway and Cheung On Estate. However, this will make the alignment of Tsing Yi North Coastal Road clash with the alignment of the Airport Railway which is running close to Tsing Yi North Coastal Road at its southern side near On Chiu House and On Pak House. Consequently, this option is also considered as engineering infeasible.

Concerning the existing section of Tsing Tsuen Bridge which now carries no traffic, this section of carriageway lies on an existing structure. The Structure Division of Highways Department confirmed that the existing structure will neither have the necessary strength capacity nor space for the erection of noise enclosure or noise barrier over it. As an alternative, the feasibility of erecting a noise enclosure resting on separate foundation for this section of carriageway has been investigated. This separate noise enclosure will cover both the main carriageway and the two adjacent slip roads. However, since this section of carriageway is very close to the Cheung On Estate at the northern side and very close to the Airport Railway at the southern side, this suggestion is considered as infeasible owing to the space restraint. Besides, this kind of massive structure is not recommended form a landscaping point of view as it will have a hugh visual impact on the surrounding environment.

Therefore, the only feasible direct mitigation measures for this section of carriageway is the application of noise reducing highway surfacing (NRHS). The detailed extent of the proposed NRHS is shown on Figure 4.6

To conclude, during the course of the EIA study, we have already examined all possible direct mitigation measures for the new carriageway and all feasible and cost-effective direct measures have been proposed under the report. Full noise enclosure is not recommended as it will not offer any significant noise reducing benefits over the semi-enclosure.

Table 4.6 The Maximum Noise Levels, L_{10}(1 hour), dBA, at the Noise Sensitive Receivers During Operation Phase With Noise Mitigation Measures

Sensitive Receiver	Predicted Maximum L_{10} Noise Level (1 hour) (with Noise Mitigation)
R1	77
R2	74
R3	78
R4	80
R5	82
R6	78
R7	78
R8	76
R9	73
R10	69
R10a	73
R11	66
R12	68
R13	67
R14	67
R15	64
R16	61
R17	58
R18	59
R19	70
R20	69
R21	68
R22	54
R23	67
R24	66
R25	64
R26	68
R27	67
R28	80
R29	78
R30	78
R31	74
R32	75
R32a	74
Proposed Sec Schools	62
* Proposed Hospital	72
MTR A	78
MTR B	75

Note: '*' the proposed hospital will not be directly facing the Tsing Yi North Coastal Road

Cost Benefit Analysis for the Semi-enclosure

For comparison, we have also investigated the additional noise reduction that would be achieved if a full enclosure is specified and the additional cost over and above the cost for a semi-enclosure.

Maximum noise levels at the most nearest Noise Sensitive Receivers from the road alignment have been compared for the semi-enclosure and full-enclosure on the main carriageway. The noise levels for the semi-enclosure and full-enclosure are shown in Table 4.7.

Table 4.7 Maximum Noise Levels At The Most Nearest Noise Sensitive Receivers From The Road Alignment For The Semi-enclosure And Full-enclosure

Noise Sensitive Receivers	Semi-enclosure Max. Noise Levels, dBA	Full-enclosure Max. Noise Levels, dBA
R3	78.2	78.2
R4	79.7	79.7
R5	81.8	81.8
R10	68.6	68.5
R12	68.0	67.9
R13	66.9	66.9
R14	66.9	66.9
R23	66.7	66.7
R25	63.6	63.6

It can be seen that the noise level difference between the semi-enclosure and full-enclosure at each noise sensitive receiver is below 0.1 dBA. Therefore, a full-enclosure would not provide any significant benefit in this case. A full enclosure would be more expensive due to the cost of the additional noise panels as the closed side and the ventilation system that would be required. The extra cost for the full-enclosure is tabulated in Table 4.8.

Table 4.8 Extra Capital Cost for a Full-Enclosure

Facilities	Capital Cost per Km
Ventilation fans	HK$12,000,000
Equipment (CCTV, Control Systems, hydrants, recovery, etc.)	HK$ 8,000,000
TOTAL	HK$20,000,000

The length of the semi-enclosure is 450 metres, therefore, the extra capital cost will be HK$9 million (excluding the capital cost of the side panel of 450m x 8m) for the full-enclosure design. It is assumed that HK$10 million is the total cost, including the power operating cost for the full-enclosure.

4.7 Benefits of the Recommended Noise Mitigation Measures

The benefits of the recommended noise mitigation measures are given in Table 4.10.

Table 4.10 Number of Flats, Classrooms Exceeding the HKPSG Limits

Noise Sensitive Receivers	No. of Flats/Classrooms Affected (without mitigation)	No. of Flats/Classrooms Affected (with mitigation)
i. Residential Premises in 1998	1061	-
ii. Existing and Proposed Residential Premises in 2016	2104	1259
iii. Man Kiu Associated No. 2 Primary School in 1998	12	-
iv. Man Kiu Associated No. 2 Primary School in 2016	12	12
v. Queen's College Old Boys' Association Secondary School in 1998	0	-
vi. Queen's College Old Boys' Association Secondary School in 2016	72	26

4.8 Residual Impacts

The results show that the some of the Noise Sensitive Receivers (NSRs) still exceed the standards of Hong Kong Planning Standards and Guidelines. This is because the traffic of the existing roads are also the noise dominant factor in that environment. We have also carried out a test according to the three Eligibility Criteria for Indirect Technical Remedies defined under the ExCo directive *"Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads"*. The three criteria are:

(i) the predicted overall noise level from the new road together with other traffic noise in the vicinity must be above 70 dB(A) for domestic premises and 65 dB(A) for school;

(ii) the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level; i.e. the total traffic noise level existing 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).

The Three Eligibility Criteria Test for the Maximum Noise Levels at the Noise Sensitive Receivers are shown in Table. 4.9

According to the results of Table 4.9, all the NSRs are not eligible for window insulation.

The residual noise levels at Queen's College Old Boys' Association School, NSR nos. R23 (67 dBA), R24 (66 dBA), R26 (68 dBA) & R27 (67 dBA) will marginally exceed the HKPSG standard for educational institute (65 dBA). The proposed noise semi-enclosure on the main carriageway cannot be further extended beyond Ch.0+450 since sufficient diverging distance should be provided for the diverging traffic running from the main carriageway to slip road A for safety reasons. Queen's College Old Boys' Association School is an existing NSR to be included in the test of eligibility of Indirect Technical Remedies and presented in Table 4.9. However, in view of the school has already equipped with double glazing windows and air conditioners, no provision of Indirect Technical Remedies is considered necessary even when the test result is positive.

4.9 Noise Sensitive Receivers for Future Developments

We have modelled two Noise Sensitive Receivers above the Tsing Yi MTRC Station and one NSR for the proposed secondary schools and one NSR for the district hospital at the western side of Cheung On Estate. All the Noise Sensitive Receivers are clearly shown in Figures 2.1b, 4.1, 4.3.

The Tsing Yi Outline Development Plan No. D/TY/A showing the levels of the proposed hospital and the proposed schools from Highways Department were received. The plan indicates only site areas for the proposed secondary schools and district hospital as there is no preliminary design for them. However, the proposed sites are included as noise sensitive receivers in order to confirm that noise mitigation will be practicable when the sites are developed. The purpose of assessing the noise impacts on the proposed hospital and school is to see if direct mitigation measures on the proposed new road is required.

The noise level at the site boundary of the proposed hospital was modelled as 72 dBA at the point nearest to the Tsing Yi North Coastal Road. Referring to the Layout Plan No. L/TY1/2B prepared by District Planning Office, the noise sensitive facilities of the proposed hospital will not be directly fronting the boadyard site and the proposed Tsing Yi North Coastal Road. It is considered that no direct mitigation measure is required.

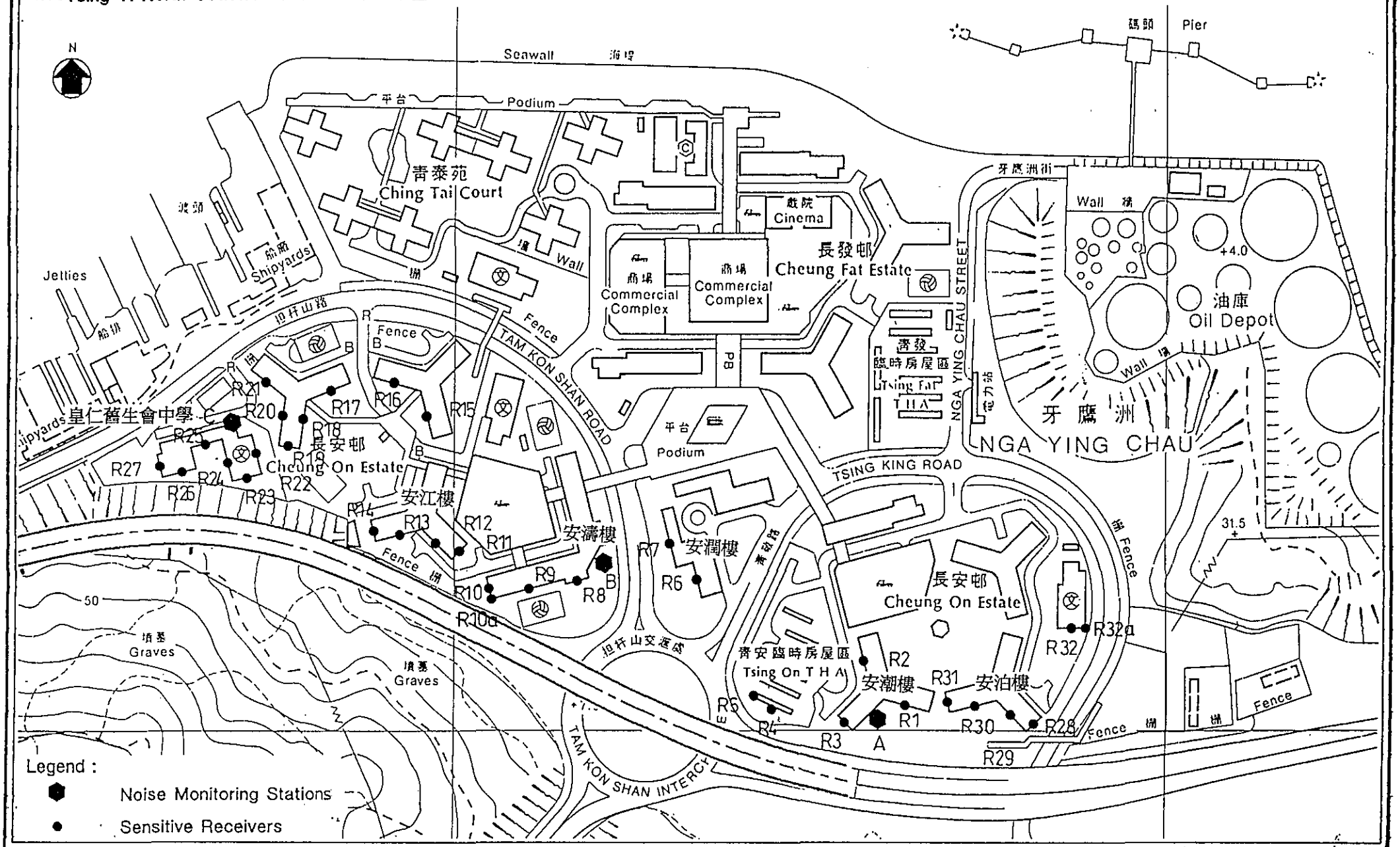
Referring to the Layout Plan No. L/TY1/2B, prepared by District Planning Office, the proposed schools will be at 85 mPD level. However, the landscape area directly facing the Tsing Yi North Coastal Road at the boundary of the proposed schools will be at 100 mPD level. The landscape area will act as a noise barrier around the boundary of the proposed schools. The maximum noise level at the site boundary of the proposed schools was modelled as 62 dBA at the point nearest to the Tsing Yi North Coastal Road. The maximum noise level of 62 dBA is below the standards of Hong Kong Planning Standards and Guidelines.

The eligibility of Indirect Technical Remedies test for planned NSRs, MTR A and

MTR B are not required. In view of both MTR A and MTR B would not be significantly affected by the proposed new road, identification of the development constrains is considered not necessary.

Table 4.9 The Three Eligibility Criteria Test for the Maximum Noise Levels exceeding 70 dBA L_{10}(1 hour), dBA, at the Noise Sensitive Receivers during Operation Phase with Noise Mitigation Measures

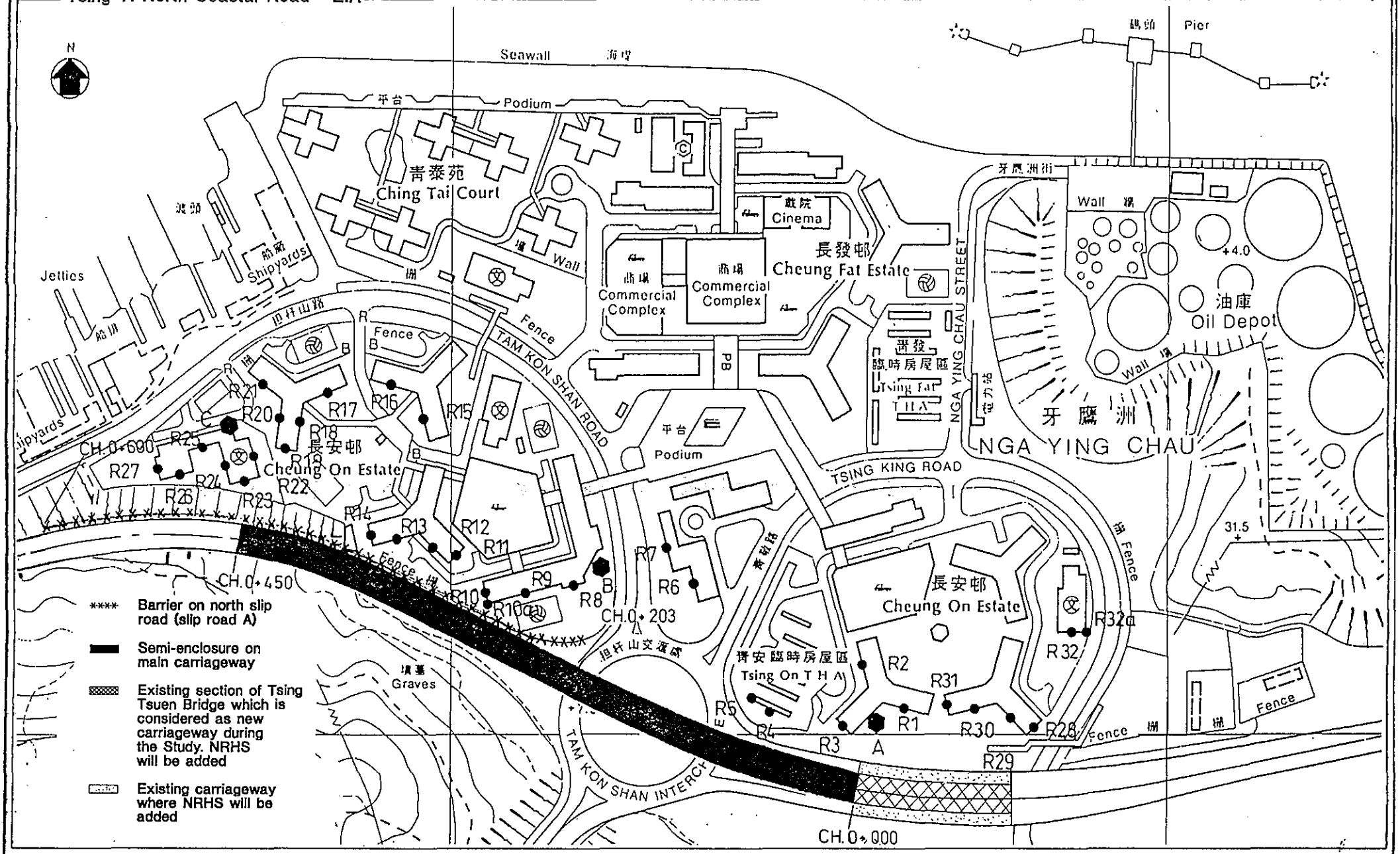
Sensitive Receivers	Year 2016 old roads	Predicted Maximum L_{10} Noise Levels (1 hour)	Year 1998 prevailing traffic noise level	Condition 1	Condition 2	Condition3
R1	76.7	77	76.8	Yes	No	No
R2	74 (74.01)	74 (74.137)	73.5	Yes	No	No
R3	78.2 (78.188)	78 (78.212)	79.0	Yes	No	No
R4	79.6	80	80.4	Yes	No	No
R5	81.8	82	80.5	Yes	Yes	No
R6	77.5	78	78.1	Yes	No	No
R7	78.0 (77.956)	78 (77.973)	79.2	Yes	No	No
R8	75.8	76	77.0	Yes	No	No
R9	72.1	73	73.5	Yes	No	No
R10a	72.5	73	72.3	Yes	No	No
R28	80.2 (80.218)	80 (80.229)	79.3	Yes	No	No
R29	77.6	78	77.3	Yes	No	No
R30	77.2	78	76.9	Yes	Yes	No
R31	73.8	74	74.0	Yes	No	No
R32	74.6	75	73.6	Yes	Yes	No
R32a	73.6	74	72.6	Yes	Yes	No
MTR A	78.0 (78.028)	78 (78.045)	77.1	Yes	No	No
MTR B	74.6	75	73.8	Yes	Yes	No



Locations of Noise Monitoring Stations and Sensitive Receivers

Mouchel

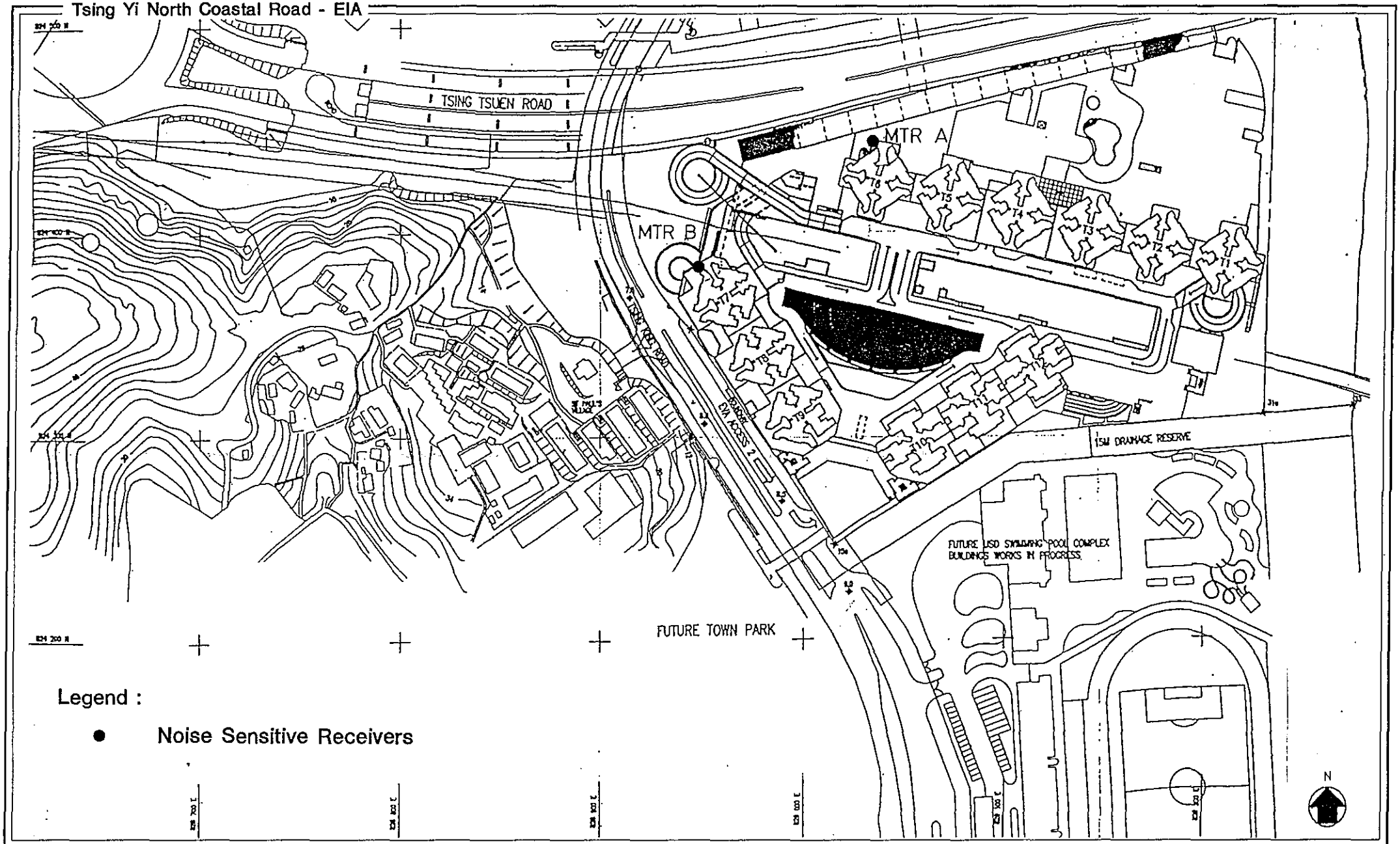
Figure No. 4.1



Locations of the Noise Mitigation Measures

Mouchel

Figure No. 4.2



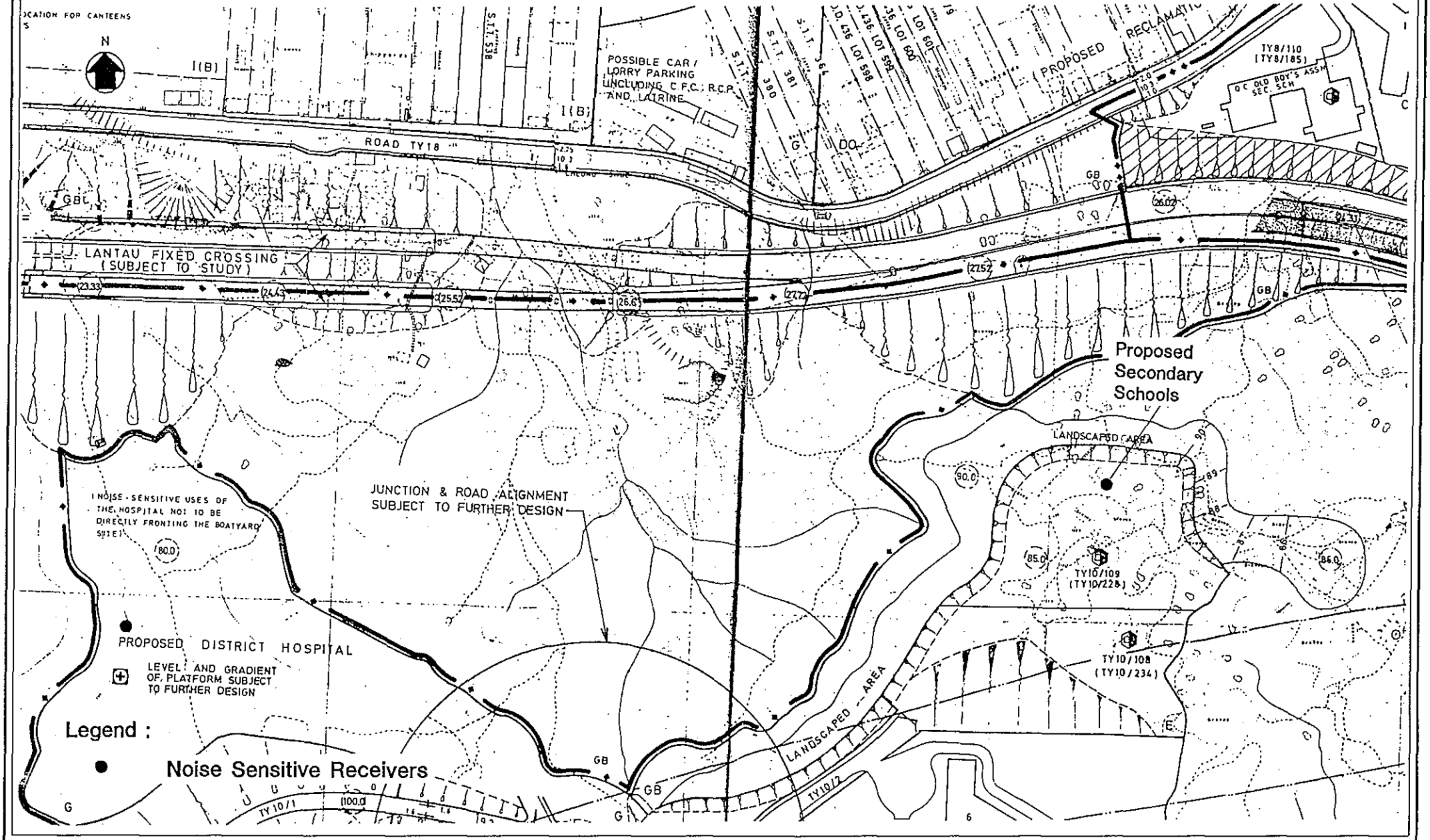
Legend :

● Noise Sensitive Receivers

Noise Sensitive Receivers Above the Proposed MTRC Station

Mouchel

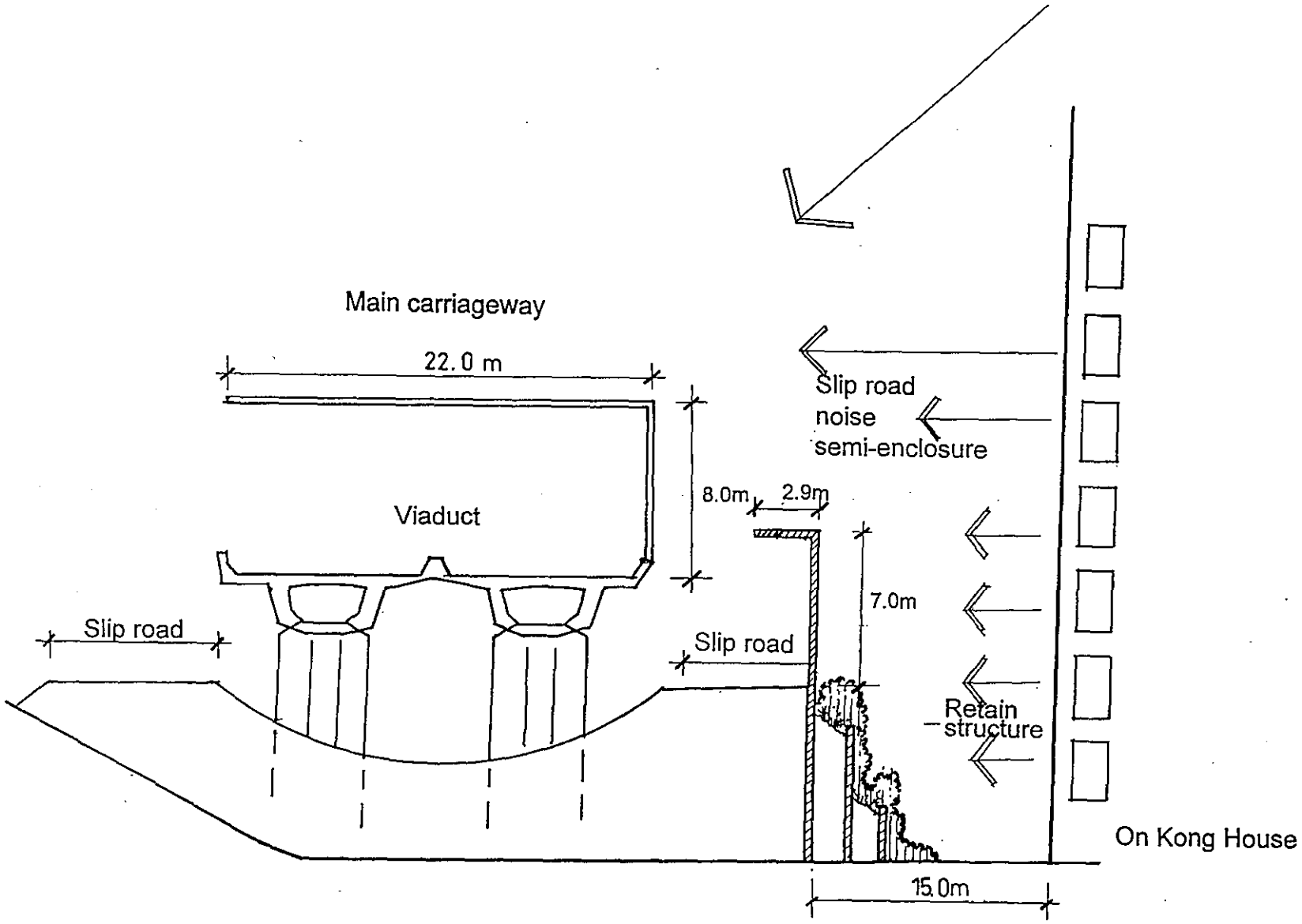
Drawing No. 4.3



The Locations of the Proposed Secondary Schools and Proposed District Hospital

Mouchel

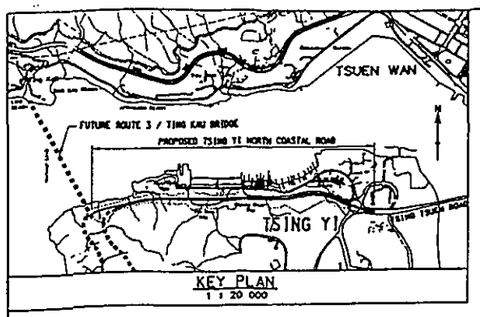
Drawing No. 4.4



Typical Cross - section at On Kong House

Mouchel

Drawing No. 4.5

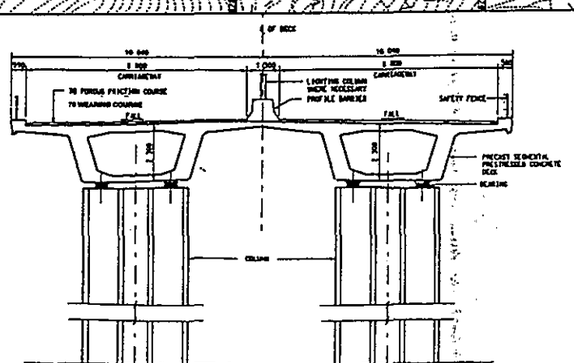


NOTES :
1. ALL LEVELS ARE IN METRES ABOVE M.R.P.D.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
3. THIS DRAWING SUPERSEDES PREVIOUS DRAWING NO. HK 203158 & 3402000.

SLOPES ARE NOT SHOWN FOR CLARITY

LEGEND :
- WORKS SITE LIMIT
- PROPOSED COLUMN
- 15.50 PROPOSED LEVEL
- PROPOSED FOOTPATH
- PROPOSED SUBWAY WITH No. INDICATED
- PROPOSED 7m HIGH NOISE BARRIER
- PROPOSED NOISE SEMI-ENCLOSURE
- G.S. PROPOSED SIGN GANTRY
- PROPOSED DIRECTIONAL SIGN
- NRHS WILL BE ADDED

ABBREVIATION :-
G.S. - GANTRY SIGN
A.G.S. - ADVANCED GANTRY SIGN



TYPICAL CROSS-SECTION OF VIADUCTS EXCEPT TAM KON SHAN VIADUCT

/ NOTES : ALL DIMENSIONS ARE IN MILLIMETRES.

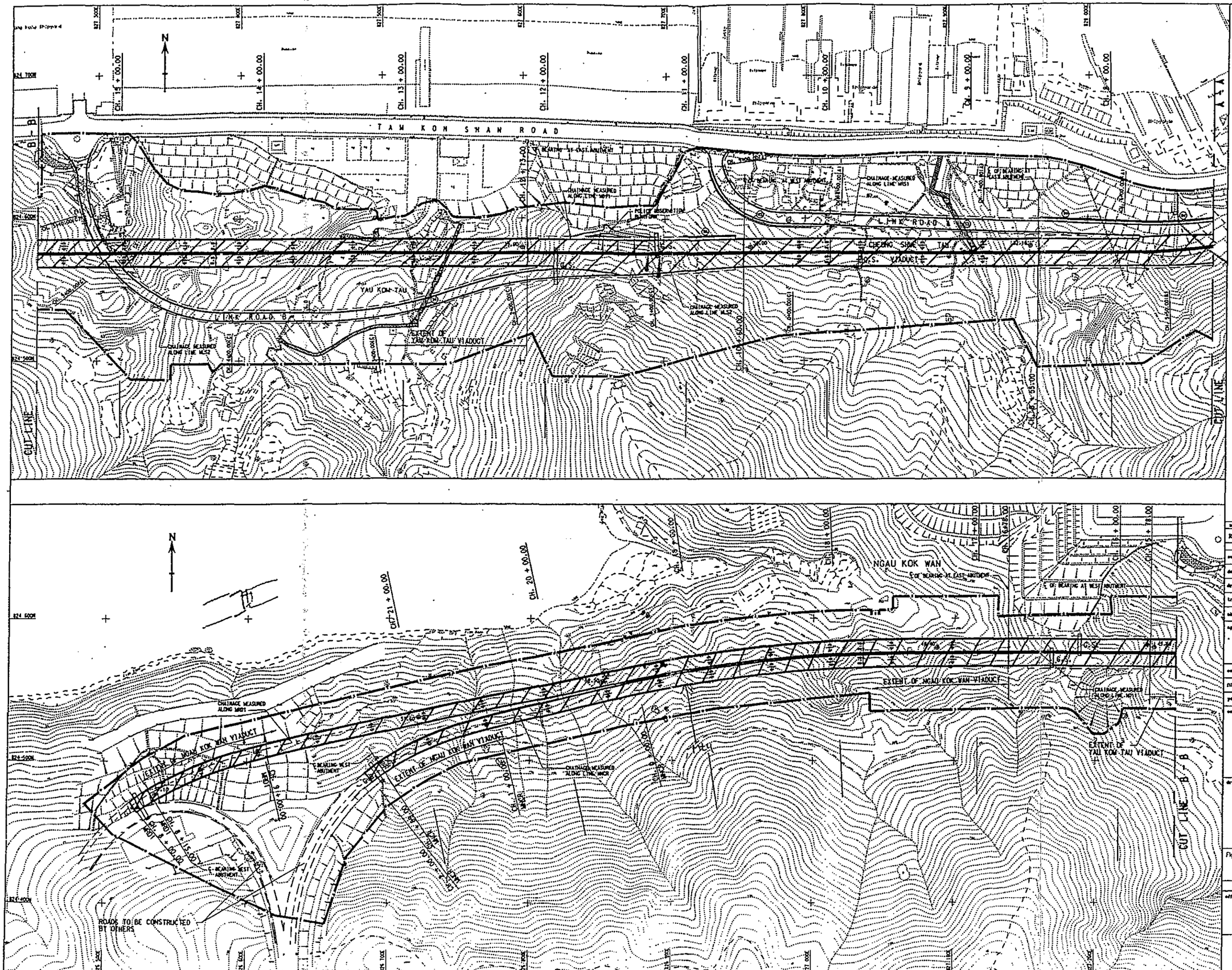
no.	date	description	initial
REVISION			

	name	date
surveyed		
designed	W. K. LAU	5/97
drawn	L. H. LAI	5/97
traced		
checked	K. C. POON	5/97
approved	for D. TSE SENIOR ENGINEER / C.W.	

contract no.
file no. HNT 54/125
project no. 6580TH
contract
TSING YI NORTH COASTAL ROAD
drawing title
SCHEME LAYOUT
(SHEET 1 OF 2)
Figure No. 4.6a
scale N.T.S.

office
HIGHWAYS / N.T. REGION

HIGHWAYS DEPARTMENT HONG KONG



NOTES :

1. ALL LEVELS ARE IN METRES ABOVE H.K.P.D.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
3. THIS DRAWING SUPERSEDES PREVIOUS DRAWING NO. HW 203158 & HW22021.

SLOPES ARE NOT SHOWN FOR CLARITY

LEGEND :

- WORKS SITE LIMIT
- PROPOSED COLUMN
- 15.50 PROPOSED LEVEL
- PROPOSED FOOTPATH
- (1) PROPOSED SUBWAY WITH No. INDICATED
- PROPOSED 7m HIGH NOISE BARRIER
- PROPOSED NOISE SEMI-ENCLOSURE
- G.S. PROPOSED SIGN GANTRY
- P.D.S. PROPOSED DIRECTIONAL SIGN
- NRHS WILL BE ADDED

ABBREVIATION :-

G.S. - GANTRY SIGN
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no.	date	description	initial
REVISION			

	name	date
surveyed		
designed	Y. K. LAU	5/97
drawn	L. H. LAI	5/97
traced		
checked	K. C. POON	5/97
approved	F. L. YU, SENIOR ENGINEER / C.W.	

contract no.

site no. HNT 54/125

project no. 6580TH

contract

TSING YI
NORTH COASTAL ROAD

drawing title

SCHEME LAYOUT

(SHEET 2 OF 2)

Figure No. 4.6b

scale N.T.S.

office

HIGHWAYS / N. T. REGION

HIGHWAYS DEPARTMENT HONG KONG

5.0 AIR IMPACT ASSESSMENT

5.1 Air Sensitive Receivers

Representative Air Sensitive Receivers (ASRs) have been identified according to the criteria set out in the Hong Kong Planning Standards and Guidelines (HKPSG) and the Air Pollution Control Ordinance (APCO), through site inspections and review of landuse plans of the Study Area. Locations of the ASRs are shown in Figure 5.1.

5.2 The Existing Air Pollution Environment

The air monitoring data at the nearest EPD monitoring stations to the Tsing Yi North Coastal Road could be used as the background air quality data for the air impact assessment. Air monitoring data for 1994 were requested from the Air Services Group of EPD. The background air quality data of 1994 at the Kwai Chung EPD monitoring station are shown in Table 5.1.

Table 5.1: The background air quality data of 1994 at the Kwai Chung EPD monitoring station

Pollutants	Range of Concentration (24 hour) (ug/m^3)	95 percentiles of Concentration (ug/m^3)
Nitrogen Dioxide (NO_2)	-	104 (1 hour)
Carbon Monoxide (CO)	-	1110 (1 hour)
Respirable Suspended Particulates (RSP)	30.70 - 84.87	-
Total Suspended Particulates (TSP)	56.41 - 129.56	-

5.3 Impacts During Construction

The likely air quality impact arising from the construction of Tsing Yi North Coastal Road is related to dust nuisance, and gaseous emissions from construction plant and vehicles.

SO_2 and NO_2 will be emitted from the diesel-powered equipment used. However, since the number of such plant required on-site will be limited, their gaseous emissions will be minor. It is therefore not expected to cause the Air Quality Objectives for these gases to be breached from the limited construction plant.

Potential dust nuisance will be the major concern from the construction of Tsing Yi North Coastal Road. There is no detailed construction programme for the construction activities, therefore, the major sources of dust on site have been assumed from

construction, vehicular movement over unpaved haul roads and erosion based on the preliminary programme discussed in Chapter 2 of this report.

The Fugitive Dust Model (FDM) was used to predict the likely dust impacts at the Air Sensitive Receivers (ASRs) from the construction of Tsing Yi North Coastal Road. Particulate emission rates for the identified potential dust sources were determined based on the USEPA publication *Compilation of Air Pollution Emission Factors (AP-42)(USEPA, 4th & 5th edition, 1985 & 1995).* It was assumed that 80% of particulates with size equal to 30 μm and the remaining 20% are respirable with size of 10 μm. The silt content was assumed to be 4.8% and the moisture content was assumed to be 4% in the Study. The figure has been used in previous study on similar projects, based on the emission information for different activities listed in AP42. Average dust density of 2500 kg/m^3 was assumed in this study. The background TSP(24 hour) concentration used in the impact assessment is 129.56 μg/m^3.

Meterological data of 1994 has been supplied by the Hong Kong Observatory weather station at the Ching Pak House. Mixing height information for 1994 was supplied at King's Park weather station. 1-hour, 24-hour TSP concentrations at the Air Sensitive Receivers were calculated.

In the assessment, a conservative approach has been adopted assuming the worst case scenario that all activities would be carried out in parallel with a 12 hour working day. In reality, the activities are of limited duration and could vary in time.

5.4 Mitigation Measures During Construction

The construction work is likely to cause unacceptable dust impacts on Cheung On Estate. The following dust control measures as part of good construction practice should be incorporated in the Contract Specification and implemented to minimise dust nuisance to within acceptable levels arising from the works:

(a) watering of unpaved roads, which results in road dust suppression by forming moisture cohesive films among the discrete grains of road surface material. An effective watering programme, i.e. twice daily watering with complete coverage, is estimated to reduce erosion and unpaved roads by 50%;

(b) watering at every 1.5 hours during construction is estimated to reduce dust emissions by 70%;

(c) where breaking of oversize rock/concrete is required, watering should be implemented to control dust. Water spray should be used during the handling of fill material at the site and at active cuts, excavation and fill sites where dust is likely to be created;

(d) dropping heights for excavated materials should be controlled to a practical height to minimize the fugitive dust arising from unloading;

(e) during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before

transport;

(f) all stockpiles of aggregate or spoil should be enclosed or covered and water applied in dry or windy condition;

(g) effective water sprays should be used on the site at potential dust emission sources;

Refer to the results of the construction impacts (mitigated), it can be seen that the dust impacts are all well within the standards of the Air Quality Objectives. The background dust concentrations are included in the results.

5.5 Impacts During Operation

Impacts on air quality during operation of the Tsing Yi North Coastal Road are due to the vehicular emissions along the open sections, the emissions from the side opening of the semi-enclosure and existing roads.

The background concentrations used in the impact assessment are:

NO_2(1 hour) : 104 $\mu g/m^3$
CO (1 hour) : 1110 $\mu g/m^3$
PM (24 hour) : 84.87 $\mu g/m^3$

AM peak hour traffic flows and vehicle mix in the year 2011 were obtained from the transportation modelling studies. Vehicular emission factors of NO_x, PM, CO for each vehicle type in the year 2011 were based on data supplied by EPD. NO_2 was assumed to be 20% of total NO_x emissions. The operation air pollution study assessed vehicular pollution along open sections of the roads and side opening of the semi-enclosure and barrier. The traffic emissions were modelled using the traffic pollution model CALINE4.

It is impossible to obtain a 24-hour averaging period results from CALINE4 as it is only a screening model. However, maximum concentrations for 24 hour period can be calculated by multiplying the maximum 1-hour concentration with the multiplication factors of 0.4 (+/-0.2). The factor is generally used to convert short term concentrations estimated by screening models to long term concentrations. The factor is accepted by regulatory agencies in the U.S.A.*

As the peak hour traffic occurs during daytime, neutral meterological conditions were assumed. Typical input parameters for the CALINE4 model are listed below:

Wind Speed	1 metre per second
Wind Direction	worst case for each receiver
Standard Deviation	20 Degree
Stability Class	D
Mixing Height	1000 metres
Temperature	25 Deg. C

The vehicular emissions at the Air Sensitive Receivers computed from the traffic were

superimposed on the background air quality data to predict the total air impacts. The results are compared with the standards defined in the Hong Kong Planning Standards and Guidelines.

The average emission factors of the year 2001 for the traffic vehicles do not differ too much when compared with year 2011, assuming the same number of traffic vehicles in the year 2001 as in year 2011. Therefore, we are confident that the air impacts at the Air Sensitive Receivers are all well below the required standards in year 2001.

It can be seen that the air impacts are all within the standards of the Air Quality Objectives.

5.6 Mitigation Measures During Operation

Mitigation measures during operation are not required. The semi-enclosure on the main carriageway is open throughout the entire length with 8 m high. The maximum concentration of the air pollutants within the semi-enclosure was modelled based on the theory developed by H. Ohashi and T. Koso in their Paper entitled "Longitudinal Diffusion of Exhaust Pollutants in Two-way Automobile Tunnels" presented to the 5th International Symposium on the Aerodynamics & Ventilation of Vehicle Tunnels, France, 20-22 May, 1985. The modelling methodology eliminated the piston effect associated with bi-directional traffic flow. The air quality inside the semi-enclosure in the year 2001 was modelled based on the assumption that there will be the same number of vehicles as in the year 2011. Therefore, the air quality calculation was in the worst case scenario. Maximum traffic flow inside the semi-enclosure is found to be in the PM peak hour of year 2011. The air quality within the semi-enclosure in the year 2001 and in the year 2011 are shown in Table 5.2:-

Table 5.2 : Maximum concentrations inside the Semi-enclosure during operation phase in the PM peak hour of year 2001 and year 2011

Year	Maximum Concentration inside the Semi-enclosure (ug/m^3)		
	PM	CO	NO_2
2001	306	6916	521
2011	252	6651	435

The results show that the maximum concentrations of the pollutants with the background concentrations included are all within the standards of the Tunnel Air Quality Guidelines.

5.7 Residual Impacts

The results indicate that the air pollutants will be reduced to acceptable levels over the entire study area.

* Note: 1. "Practical Guide to Atmospheric Dispersion Modeling", Trinity Consultants, Inc., U.S.A. Table 10-5, p.10-16.

2. Brode, R.W., 1988: Screening Procedures for Estimating the Air Quality Impact of Stationary Sources. EPA-450/4-88-010, U.S. Environmental Protection Agency, Research Triangle Park, N.C., U.S.A., p.4-17.

Table 5.3 Concentrations of Dust Impacts at the Air Sensitive Receivers during Construction Phase Assuming No Mitigation

Air Sensitive Receivers	Height (m)	Concentration of Total Suspended Particulates (ug/m^3)	
		1 Hour	24 Hour
R1	3	422	192
	6	333	174
	9	287	166
	12	255	160
	15	228	155
R2	3	404	232
	6	324	186
	9	287	169
	12	252	161
	15	227	156
R3	3	543	280
	6	398	201
	9	333	179
	12	282	168
	15	242	161
R4	3	630	329
	6	446	221
R5	3	636	319
	6	449	221
R6	3	486	215
	6	370	190
	9	312	178
	12	269	170
	15	243	162
	18	227	156
	21	212	150
	24	199	146
R7	3	367	204
	6	326	185
	9	284	171
	12	258	162
	15	235	156
	18	213	152
	21	202	148
	24	194	144
R8	3	647	300
	6	437	218
	9	350	193
	12	299	178
	15	267	166
R9	3	793	353
	6	503	253
	9	386	206
	12	325	184
	15	276	168
R10	3	893	411
	6	538	281
	9	409	215
	12	331	185
	15	274	168
	18	244	157
R11	3	716	365
	6	470	274
	9	375	220
	12	320	187
	15	275	167
R12	3	688	377
	6	479	282
	9	376	224
	12	320	189
	15	275	169

Note : Background dust concentrations were included in the results ; TSP(24hours) : 129.56ug/m^3

Table 5.3 Concentrations of Dust Impacts at the Air Sensitive Receivers during Construction Phase Assuming No Mitigation

Air Sensitive Receivers	Height (m)	Concentration of Total Suspended Particulates (ug/m^3)	
		1 Hour	24 Hour
R13	3	760	407
	6	505	296
	9	388	229
	12	323	191
	15	274	174
R14	3	785	430
	6	511	302
	9	389	230
	12	322	196
	15	272	177
R15	3	368	242
	6	310	214
	9	262	194
	12	242	178
	15	226	165
R16	3	360	234
	6	291	210
	9	249	193
	12	234	179
	15	219	167
R17	3	376	250
	6	294	228
	9	263	206
	12	243	187
	15	228	172
R18	3	430	289
	6	330	252
	9	292	217
	12	265	193
	15	246	176
R19	3	496	325
	6	367	269
	9	319	226
	12	280	197
	15	255	177
R20	3	444	295
	6	341	255
	9	296	219
	12	268	194
	15	247	177
R21	3	390	264
	6	311	238
	9	266	212
	12	248	190
	15	231	174
R22	3	542	347
	6	394	279
	9	334	229
	12	289	198
	15	262	182
R23	3	692	398
	6	476	295
	9	353	233
	12	306	206
	15	276	186
R24	3	641	367
	6	454	285
	9	344	230
	12	297	205
	15	270	187

Note : Background dust concentrations were included in the results ; TSP(24hours) : 129.56ug/m^3

Table 5.3 Concentrations of Dust Impacts at the Air Sensitive Receivers during Construction Phase Assuming No Mitigation

Air Sensitive Receivers	Height (m)	Concentration of Total Suspended Particulates (ug/m^3)	
		1 Hour	24 Hour
R25	3	590	338
	6	431	273
	9	337	226
	12	288	202
	15	261	186
R26	3	745	389
	6	490	285
	9	365	242
	12	310	211
	15	276	187
R27	3	762	375
	6	488	279
	9	371	241
	12	308	211
	15	274	188
R28	3	342	169
	6	298	163
	9	266	158
	12	235	154
	15	217	151
	18	202	148
R29	3	334	170
	6	299	164
	9	267	159
	12	236	155
	15	218	151
	18	202	148
R30	3	346	173
	6	308	167
	9	273	161
	12	239	157
	15	219	153
	18	204	149
R31	3	357	178
	6	314	168
	9	276	162
	12	242	157
	15	221	153
	18	207	149
	21	194	146
R32	3	284	153
	6	265	150
	9	243	148
	12	221	147
	15	200	145
	18	188	144
	21	181	142
R33	1.5	989	490
	3	795	369
R34	1.5	619	407
	3	546	356

Note : Background dust concentrations were included in the results ; TSP(24hours) : $129.56ug/m^3$

Table 5.4 Concentrations of Dust Impacts at the Air Sensitive Receivers during Construction Phase After Mitigation

Air Sensitive Receivers	Height (m)	Concentration of Total Suspended Particulates (ug/m^3)	
		1 Hour	24 Hour
R1	3	221	149
	6	193	144
	9	178	141
	12	169	139
	15	160	137
R2	3	215	162
	6	190	147
	9	178	142
	12	168	139
	15	160	138
R3	3	259	177
	6	213	152
	9	193	145
	12	177	142
	15	164	139
R4	3	285	192
	6	228	158
R5	3	287	189
	6	229	158
R6	3	240	156
	6	204	149
	9	186	145
	12	173	142
	15	165	140
	18	160	138
	21	155	136
	24	151	135
R7	3	203	153
	6	191	147
	9	177	142
	12	170	140
	15	162	138
	18	156	136
	21	152	135
	24	150	134
R8	3	290	183
	6	225	157
	9	198	149
	12	182	145
	15	172	141
R9	3	335	199
	6	245	168
	9	209	153
	12	190	146
	15	175	142
R10	3	366	217
	6	256	177
	9	216	156
	12	192	147
	15	174	141
	18	165	138
R11	3	312	203
	6	235	174
	9	206	158
	12	189	147
	15	175	141
R12	3	303	206
	6	238	177
	9	206	159
	12	189	148
	15	175	142

Note : Background dust concentrations were included in the results ; TSP(24hours) : 129.56ug/m^3

Table 5.4 Concentrations of Dust Impacts at the Air Sensitive Receivers during Construction Phase After Mitigation

Air Sensitive Receivers	Height (m)	Concentration of Total Suspended Particulates (ug/m^3)	
		1 Hour	24 Hour
R13	3	325	216
	6	246	181
	9	210	161
	12	190	149
	15	174	143
R14	3	334	223
	6	248	183
	9	210	161
	12	189	150
	15	174	144
R15	3	203	164
	6	186	156
	9	171	149
	12	164	145
	15	159	141
R16	3	201	162
	6	180	155
	9	167	149
	12	162	145
	15	157	141
R17	3	206	167
	6	181	160
	9	171	153
	12	165	147
	15	160	143
R18	3	223	179
	6	192	167
	9	180	157
	12	171	149
	15	166	144
R19	3	243	190
	6	203	173
	9	188	159
	12	176	150
	15	169	144
R20	3	227	181
	6	195	169
	9	181	157
	12	172	150
	15	166	144
R21	3	210	171
	6	186	163
	9	172	155
	12	166	148
	15	161	143
R22	3	257	197
	6	212	176
	9	193	161
	12	179	151
	15	171	146
R23	3	304	213
	6	237	181
	9	199	162
	12	184	153
	15	175	147
R24	3	288	203
	6	230	178
	9	196	161
	12	181	153
	15	173	147

Note : Background dust concentrations were included in the results ; TSP(24hours) : 129.56ug/m^3

Table 5.4 Concentrations of Dust Impacts at the Air Sensitive Receivers during Construction Phase After Mitigation

Air Sensitive Receivers	Height (m)	Concentration of Total Suspended Particulates (ug/m^3)	
		1 Hour	24 Hour
R25	3	272	194
	6	223	174
	9	194	159
	12	179	152
	15	170	147
R26	3	321	210
	6	241	178
	9	203	164
	12	185	155
	15	175	147
R27	3	326	206
	6	241	176
	9	205	164
	12	185	155
	15	174	148
R28	3	196	142
	6	182	140
	9	172	138
	12	162	137
	15	157	136
	18	152	135
R29	3	193	142
	6	182	140
	9	172	139
	12	163	137
	15	157	136
	18	152	135
R30	3	197	143
	6	185	141
	9	174	139
	12	164	138
	15	157	137
	18	153	136
R31	3	201	145
	6	187	142
	9	175	140
	12	165	138
	15	158	137
	18	154	136
	21	150	135
R32	3	177	137
	6	172	136
	9	165	135
	12	158	135
	15	151	134
	18	148	134
	21	146	134
R33	1.5	396	242
	3	336	204
R34	1.5	281	216
	3	259	200

Note : Background dust concentrations were included in the results ; TSP(24hours) : 129.56ug/m^3

Table 5.5 Concentrations of the Air Pollutants at the Air Sensitive Receivers During Operation Phase in the Year 2011

Air Sensitive Receivers	Height (m)	CONCENTRATION (ug/m^3)		
		CO (1 hour)	PM (24 hour)	NO_2 (1 hour)
R1	9	1529	93	150
	12	1514	93	149
	15	1496	92	147
	18	1477	92	145
	21	1455	91	143
R2	9	1521	93	150
	12	1508	93	149
	15	1491	92	147
	18	1472	92	145
	21	1450	91	143
R3	9	1631	95	161
	12	1609	95	159
	15	1582	94	156
	18	1550	93	153
	21	1516	93	149
R4	3	1732	98	173
	6	1723	97	172
R5	3	1736	98	174
	6	1725	98	173
R6	3	1603	95	161
	6	1594	95	160
	9	1580	94	158
	12	1560	94	156
	15	1537	93	153
	18	1510	93	150
	21	1481	92	147
	24	1450	91	143
R7	3	1536	94	153
	6	1529	93	152
	9	1517	93	151
	12	1502	93	149
	15	1484	92	147
	18	1463	92	145
	21	1441	91	142
	24	1417	91	139
R8	3	1710	98	173
	6	1698	97	171
	9	1677	97	169
	12	1648	96	166
	15	1613	95	162
R9	3	1820	100	186
	6	1806	100	184
	9	1779	99	181
	12	1741	98	177
	15	1691	97	171
R10	3	1886	102	193
	6	1877	102	192
	9	1853	101	190
	12	1808	100	184
	15	1744	98	177
R11	3	1789	100	182
	6	1774	99	180
	9	1748	98	177
	12	1711	97	173
	15	1664	96	168
R12	3	1800	100	183
	6	1785	100	182
	9	1759	99	179
	12	1721	98	174
	15	1672	97	169

Note : Background air quality concentration were included in the results ; PM(24hours) : $84.87ug/m^3$

NO_2(1hour) : $104ug/m^3$

CO(1hour) : $1110ug/m^3$

Table 5.5 Concentrations of the Air Pollutants at the Air Sensitive Receivers During Operation Phase in the Year 2011

Air Sensitive Receivers	Height (m)	CONCENTRATION (ug/m^3)		
		CO (1 hour)	PM (24 hour)	NO_2 (1 hour)
R13	3	1840	101	188
	6	1828	101	186
	9	1800	100	183
	12	1759	99	178
	15	1702	97	172
R14	3	1869	102	191
	6	1858	101	190
	9	1831	101	187
	12	1786	99	182
	15	1724	98	175
R15	3	1507	93	149
	6	1499	93	149
	9	1487	93	147
	12	1470	92	145
	15	1450	92	143
R16	3	1467	92	144
	6	1460	92	144
	9	1449	92	143
	12	1434	91	141
	15	1417	91	139
R17	3	1472	93	145
	6	1465	92	144
	9	1453	92	143
	12	1437	92	141
	15	1417	91	139
R18	3	1536	94	153
	6	1526	94	152
	9	1510	93	150
	12	1488	93	147
	15	1463	92	144
R19	3	1592	95	159
	6	1580	95	158
	9	1561	94	156
	12	1536	94	153
	15	1503	93	149
R20	3	1522	94	151
	6	1513	93	150
	9	1496	93	148
	12	1477	92	146
	15	1452	92	143
R21	3	1449	92	143
	6	1442	92	142
	9	1431	92	141
	12	1415	91	139
	15	1396	91	137
R22	3	1599	96	160
	6	1587	95	159
	9	1567	95	156
	12	1539	94	153
	15	1506	93	149
R23	3	1693	98	171
	6	1680	97	169
	9	1657	97	167
	12	1622	96	163
	15	1576	95	157
R24	3	1621	96	162
	6	1607	96	161
	9	1585	95	158
	12	1555	94	154
	15	1517	93	150

Note : Background air quality concentration were included in the results ; PM(24hours) : 84.87ug/m^3

NO_2(1hour) : 104ug/m^3

CO(1hour) : 1110ug/m^3

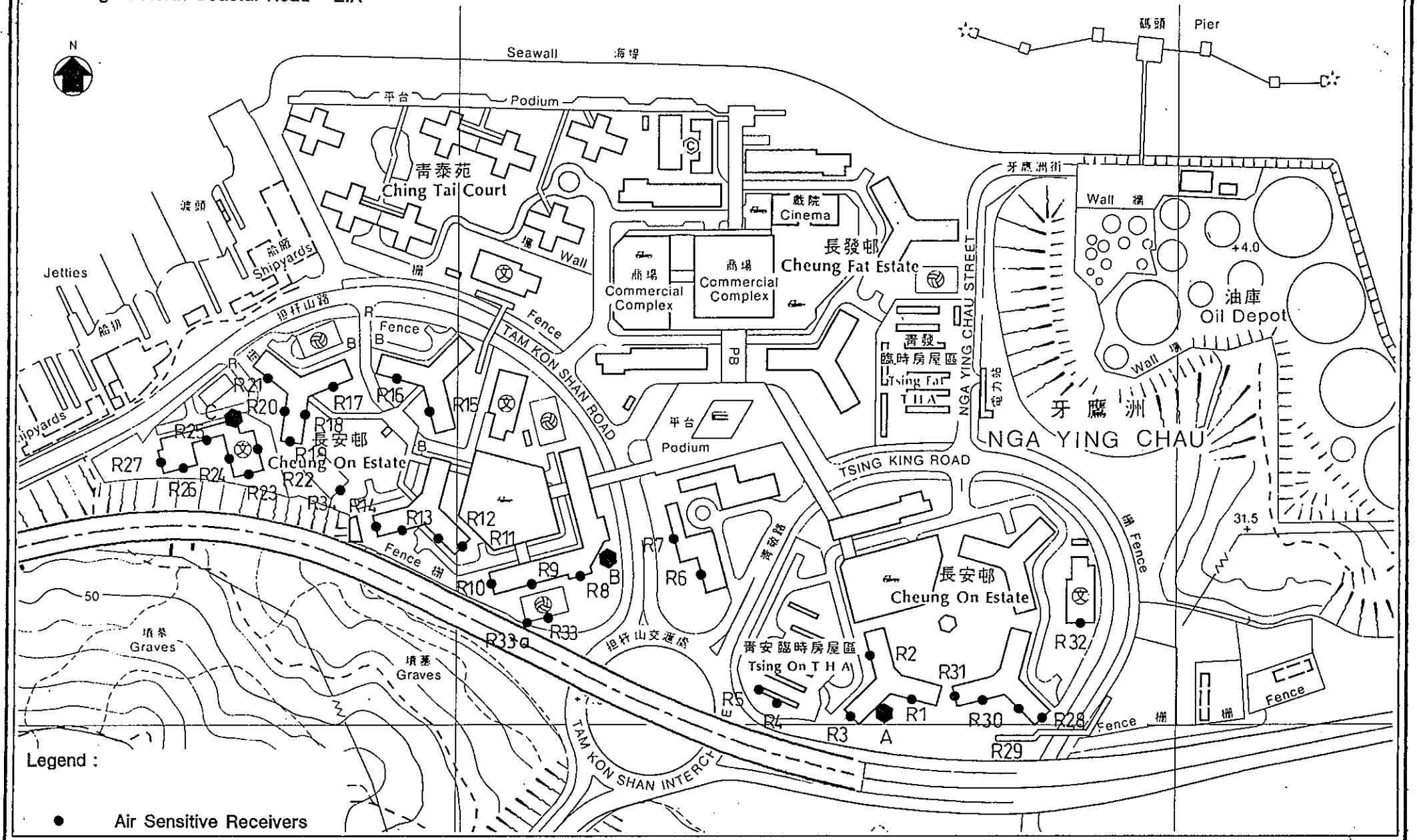
Table 5.5 Concentrations of the Air Pollutants at the Air Sensitive Receivers During Operation Phase in the Year 2011

Air Sensitive Receivers	Height (m)	CONCENTRATION (ug/m^3)		
		CO (1 hour)	PM (24 hour)	NO_2 (1 hour)
R25	3	1593	95	159
	6	1580	95	157
	9	1561	94	155
	12	1533	94	152
	15	1499	93	148
R26	3	1767	99	178
	6	1754	99	177
	9	1729	98	174
	12	1688	97	170
	15	1634	96	163
R27	3	1766	99	178
	6	1752	99	177
	9	1725	98	174
	12	1686	97	169
	15	1636	96	163
R28	9	1461	92	142
	12	1450	91	141
	15	1438	91	140
	18	1423	91	138
	21	1407	90	137
R29	9	1463	92	143
	12	1453	91	142
	15	1441	91	141
	18	1426	91	139
	21	1353	90	137
R30	9	1481	92	145
	12	1471	92	144
	15	1457	91	143
	18	1441	91	141
	21	1424	91	139
R31	9	1494	92	147
	12	1481	92	145
	15	1468	92	144
	18	1450	91	142
	21	1433	91	140
R32	9	1380	90	134
	12	1375	90	134
	15	1368	90	133
	18	1358	89	132
	21	1349	89	131
R33	1.5	1890	102	169
	3	1542	102	169
R33a	1.5	2017	105	208
	3	2038	106	211
R34	1.5	1714	98	173
	3	1710	98	173

Note : Background air quality concentration were included in the results ; PM(24hours) : 84.87ug/m^3

NO_2(1hour) : 104ug/m^3

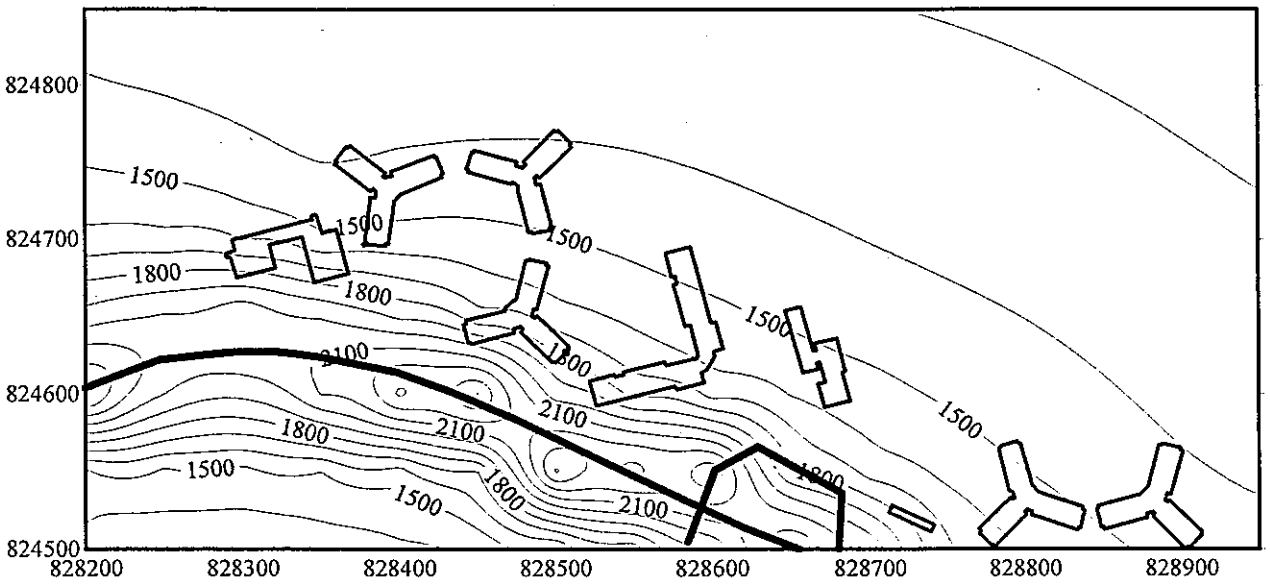
CO(1hour) : 1110ug/m^3



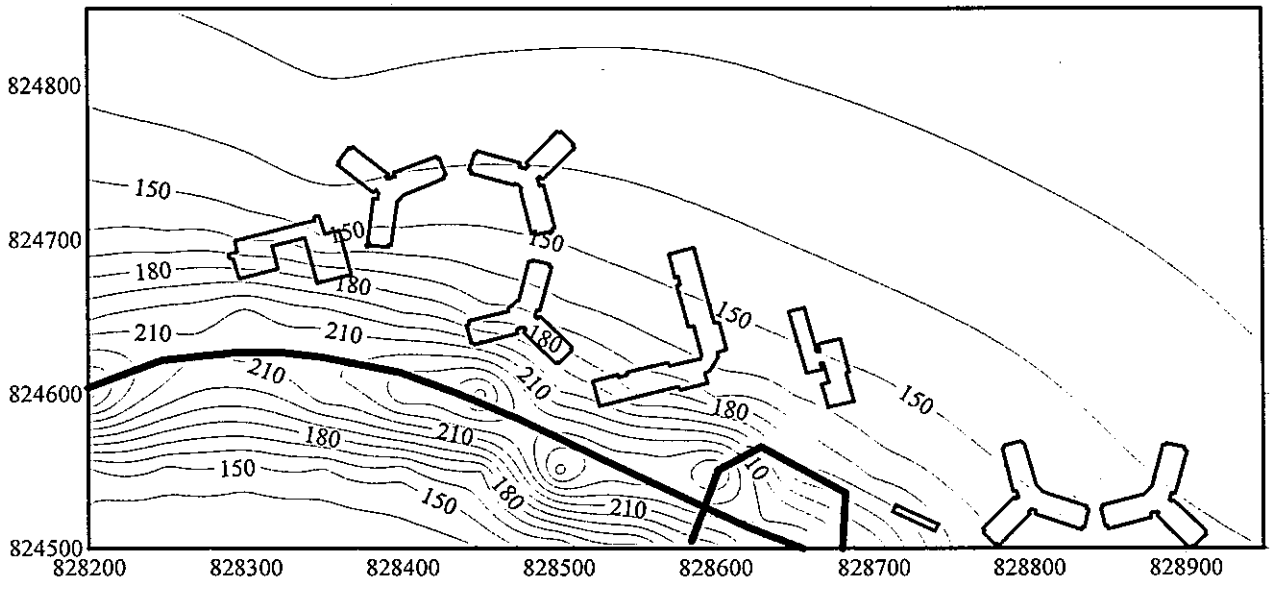
Locations of Air Sensitive Receivers

Mouchel

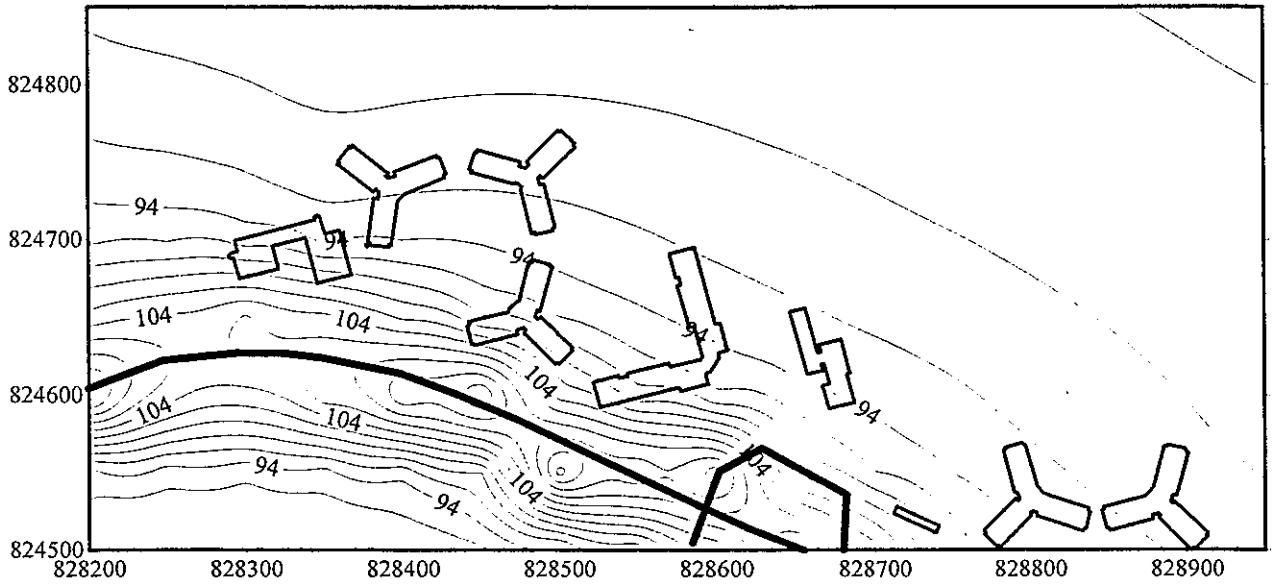
Figure No. 5.1



Carbon Monoxide concentration (ug/m3, 1 hour) contour linesat 10m from ground level.



Nitrogen Dioxide concentration (ug/m3, 1 hour) contour lines at 10m above ground level.



Respirable Suspended Particulate concentration (ug/m3, 24 hours) contour lines at 10m from ground level.

6.0 WATER QUALITY IMPACT ASSESSMENT

6.1 Water Sensitive Receivers

6.1.1 Marine Waters

Sensitive receivers are defined as those users of the marine environment whose use of the environment could be impaired as a result of a reduction in quality of the environment. Within the area there are a number of potential sensitive receivers were identified. These are as follows:

On both sides of the Rambler Channel between Tsuen Wan and Lai Chi Kok, the Water Supplies Department sea water intakes for flushing water and Drainage Services Department seawater intakes for band screen washing.

The mariculture zone at Ma Wan of approximately 46,300 m^2.

The gazetted Bathing Beaches including, Tung Wan (Ma Wan), Angler's, Gemini, Hoi Mei Wan, Casam, Lido, Ting Kau, and Approach where both swimming and secondary contact recreation activities take place.

In addition to the point use sensitive receivers, the Marine Water Quality in the WBZ and VHZ are considered as sensitive receivers.

The locations of the potential sensitive receivers were reviewed in the light of results of float track modelling carried out using the WAHMO hydrodynamic model for the EIA of the relocation of the North Tsing Yi Dockyards which showed that the predominant residual current through the Rambler Channel was west to east. Taking into account the activities which would be carried during the construction of the road and its operation it was considered that the point source users were sufficiently far away from the road as to be not considered to be under threat. However the marine water quality and the attainment of the water quality objectives could still be considered as a sensitive receiver. All the marine water sensitive receivers are shown in Figure 6.1. The simulated float tracks are shown in Figures 6.2-6.17.

6.1.2 Surface Waters

The Project Area contains several freshwater streams arising on the north facing slopes of Shek wan, Ngau Kok Wan and Cheung Shue Tau which discharge into the Rambler Channel. None of the area is designated as a Water Gathering Ground. Previously some of the streams around Yau Kom Tau and Cheung Shue Tau were used for irrigation but these have been channelised and are polluted mostly by the workshops around Tam Kon Shan Road and suffer from localised rubbish dumping. In the upper reaches the streams have retained their natural form.

The stream valley to the west of Ngau Kok Wan and the cement works is much more natural having sandy/rocky beds with small boulders. The streams further to the west, on the other hand, have been affected by reclamation and formation caused by other adjacent projects.

6.2 Existing Water Quality Environment

6.2.1 Available Background Data - Marine Water Quality

As part of its role in monitoring and protecting the marine environment in Hong Kong, the Environmental Protection Department (EPD) carries out routine water quality surveys throughout the Territory's waters. Annual summaries of Marine Water Quality have been provided by the EPD from their routine monitoring data set for station, WM4, adjacent to Ma Wan and two stations in the Rambler Channel, VM13 and VM14. These are used to define the water quality in the broad area in which the project is to be carried out. Data relating to specific marine water quality parameters are discussed in the following sections.

As part of their programme of monitoring the surface water quality in the territory EPD carry out routine surveys of major water courses. The streams originating in and passing through the project area are not sufficiently large to warrant their inclusion in the current monitoring programme and consequently there are no data available similar to that for the marine waters of the Rambler Channel. Other information on the water quality of the steams is limited to the observations made during the ecological assessment since there is no readily available other published information.

6.2.2 Influences on Water Quality Adjacent to the Project Area

The influences on water quality from sources adjacent to the Project site include the following:

- water from the Pearl River containing, in particular, high suspended solids;
- discharges from foul sewers and storm drains into the Rambler Channel; and
- restricted flushing of the Rambler Channel due to low tidal currents.
- construction of the Tsing Ma bridge and access routes..

6.2.3 Existing Compliance with Water Quality Objectives and other Water Quality Criteria

The existing marine water quality can be considered by comparison with the Water Quality Objectives (WQO) which have been identified by EPD as appropriate to the marine waters of Water Control Zones (WCZ), along with the criteria required by other users where these have been defined. The details of the WQO and the requirements of Sensitive Receivers have been given in detail in Section 3.3. The existing water quality condition, existing water quality compliance with the WQO and the sensitivity of the water quality to changes in the receiving environment is summarised below.

Dissolved Oxygen

Table 6.1 shows depth average and bottom layer concentrations for 1991-1994 at the three monitoring stations; values are given as the annual 10% ile.

Table 6.1 : Depth Averaged and Bottom Layer 10% ile Values for Dissolved Oxygen mg/l

Year	Depth Average			Bottom layer		
	WM4	VM13	VM14	WM4	VM13	VM14
1991	4.5	3.3	4.1	3.0	3.4	3.8
1992	4.4	3.4	3.7	4.3	3.5	3.4
1993	5.4	3.6	4.1	4.7	2.1	3.7
1994	3.8	3.4	3.8	3.5	3.8	4.1

The water quality at the three stations with respect to dissolved oxygen shows that over the previous four years the Depth Averaged objective 90% of samples exceeding 4mg/l has not been met at all times while the bottom layer value, 90% of samples exceeding 2mg/l is met.

E. coli

There are no WQO for *E. coli* for the VHZ; for the WBZ the annual *E. coli* mean should not exceed 610/100 ml. Values for the annual *E. coli* geometric mean are shown in Table 6.2.

Table 6.2 : Annual Geometric Mean E. coli Counts (No/100 ml)

Year	WM4	VM13	VM14
1991	79	1651	638
1992	122	2411	833
1993	134	10900	1275
1994	222	10820	2825

The WQO is currently complied with at WM4 but at VM13 and VM14 the maximum values exceed the target value of Water Services Department (WSD).

pH value

For the protection of the marine environment, the WQO value for pH is set between 6.5 and 8.5 pH units. Marine waters are generally well buffered systems and pH values usually remain stable. All three of the marine water monitoring locations comply with the WQO value.

Suspended Solids

The western part of Hong Kong's waters are strongly influenced by the quality of water in the Pearl River which carries very high suspended solid loads, particularly during the wet season. Table 6.3 shows the annual mean and maximum suspended solid

concentrations at the three EPD monitoring stations.

Table 6.3 : Annual Mean and Maximum Suspended Solids Concentrations (mg/l)

Year	WM4	VM12	VM14
1991	11 (32)	12 (50)	7 (16)
1992	13 (29)	19 (39)	7 (16)
1993	11 (23)	9 (26)	9 (23)
1994	16 (47)	9 (14)	9 (24)

There are no absolute values for suspended solids provided in the WQO, rather WQO is expressed in terms of an increase above background levels and a level which does not significantly affect the marine ecosystem. Users of marine water for activities such as flushing or cooling activities and other users have target values for the water which they abstract, this is explained in further detail in the following Sections.

The mean values for suspended solids at the monitoring stations in the Rambler Channel lie close to or above the WSD target level of 10 mg/l while the maximum values in all years are in excess of this value. Any activity which increases the suspended solids concentration in the water column is likely to have an impact on the quality of the water being taken for flushing. The data that have been reviewed indicate that at no time did the suspended solids concentration exceed the critical threshold established by the Mass Transport Railway Corporation (MTRC) for cooling water at 180 mg/l.

Toxicants

No data for toxicants are presented in the EPD annual reports, nor held on the standard marine water quality data base. The presence of active mariculture at Ma Wan, attached barnacles and the presence of bivalves and gastropods on piles and rocks along the shoreline of the Rambler Channel and the presence of small fish indicate that the water quality in this region is sufficient to support limited biological communities.

Ammoniacal Nitrogen

The WSD abstracts water from the Rambler Channel and Victoria Harbour for flushing purposes. This water is first screened and chlorinated before being pumped to service reservoirs and distribution. A target limit of 1 mg/l for ammoniacal nitrogen levels in this incoming water has been set for the purpose of minimising the chemical chlorine demand through the formation of chloramines. A summary of the ammoniacal nitrogen annual depth averaged levels at the five EPD monitoring stations is shown below in Table 6.4. This indicates that the WSD target value is presently being met at the three monitoring locations.

Table 6.4 : Annual Depth Averaged Concentrations of Ammoniacal Nitrogen in mgN/l (values in brackets are the maxima)

Year	WM4	VM13	VM14
1991	0.10 (0.30)	0.26 (0.61)	0.26(0.61)
1992	0.14 (0.23)	0.22 (0.39)	0.22 (0.39)
1993	0.11 (0.19)	0.18 (0.42)	0.18 (0.42)
1994	0.11 (0.25)	0.25 (0.51)	0.24 (0.56)

Unionised Ammonia

Unionised or free ammonia is toxic to marine fish and invertebrates. The concentration of the unionised form for any given total ammonia concentration is a function of both temperature and pH and to a lesser degree salinity. As a broad rule of thumb, over the range of temperatures and pH in Hong Kong waters approximately 10% of the total ammonia is present as unionised ammonia. Since the WQO is set at 0.021 mgN/l the equivalent total ammonia concentration is 0.21mgN/l. The data in the table above shows that within the Rambler Channel the concentrations are such that the WQO is likely to be being breached.

Nutrients

The WQO for nutrients which are primarily responsible for the promotion of phytoplankton blooms is set in terms of Inorganic nitrogen since this the usually the limiting nutrient in marine waters.. The annual average Inorganic Nitrogen concentrations at the three stations for the years 1991-1994 are shown below in Table 6.5.

Table 6.5 : Annual Average Total Inorganic Nitrogen Concentration (mgN/l)

Year	WM4	VM13	VM14
1991	0.30	0.45	0.44
1992	0.32	0.46	0.51
1993	0.34	0.65	0.49
1993	0.29	0.44	0.49

In the WBZ the annual average inorganic nitrogen concentrations are within the WQO of 0.4 mgN/l while within the VHZ the value of 0.4 mgN/l is exceeded where the nitrogenous loading from sewage discharges has a greater influence.

Short Term Marine Water Quality Variation in the Vicinity of the Project Site.

As part of the EIA on the North Tsing Yi Public Dump (Reclamation Works for District Open Space and GIC facilities in North Tsing Yi, Environmental Impact Assessment

Study, Final Assessment Report, 1995) water quality monitoring was carried out to determine smaller scale, within tide, variations in water quality. Dissolved oxygen, turbidity, temperature and salinity were measured at three depths in the water column at approximately 2 hour intervals at five locations. This showed that during a full tidal cycle suspended solids and dissolved oxygen exhibited a wide degree of variation.

Surface Water Quality

The quality in the streams is based on observations made during the surveys carried out as part of the ecological assessment. The water quality appeared to be satisfactory in terms of the beneficial uses which could be applied them, that is preservation of aquatic life in the upper reaches of the steams and as storm water channels in the lower reaches, in particular those around Cheng Shue Tau, Yau Kom Tau and Tam Kon Shan Road. However those in the latter area suffer from pollution from the adjacent workshops and from casual localised rubbish dumping.

6.3 Impacts During Construction

The impacts during the construction phase will occur primarily in the surface water streams since there are no activities scheduled to be carried out within the marine environment itself. Any impact on the marine environment will result from changes in quality in the steams discharging to the Rambler Channel and if these are controlled then there will be no effects on marine water quality.

The primary effects on the surface water quality will result from run-off from site works carrying elevated levels of suspended solids into the water courses and from disturbance of banks and stream bed material during works for realignment, bank reinforcement and widening. Secondary effects could result from the discharge of grey and black wastewater from temporary site accommodation and from run off from the site works carrying solids contaminated from fuel and oil spills from plant used on site. This run off includes that generated during storm events and also that generated by any vehicle wheel and subframe washing carried out as vehicles leave the site for the purpose of dust mitigation. Fuel and oil spilled onto unpaved permeable ground will soak into the subsoil with the consequential risk of movement into the groundwater.

It is not possible to quantify these impacts, however mitigation measures proposed in the next section would be expected to limit the impact and maintain conditions in the surface waters no worse than they are at the present time. Indeed the opportunity arrises during any realignment and bankworks for rubbish which has been dumped in the streams to be removed and conditions improved.

6.4 Mitigation Measures During Construction

During the construction phase the areas of exposed soil should be minimised to restrict the extent of erosion and quantities of solids running off into water courses. Areas in which works have been completed should be restored as soon as is practicable. The practice of hydroseeding should be encouraged to stabilise recently exposed surfaces.

Spoil heaps should be covered during the wet season to minimise losses, covering will also reduce the dust emissions during the dry season minimising impact on air quality.

Stream works carried out in the streams themselves should be carried out as far as is possible during the dry season.

Water pumped out from working areas should not be discharged directly to surface water courses but passed through settling tanks of sufficient capacity to allow for settlement of the suspended solids. Similarly the water from vehicle wheel washing should be passed through settlement tanks.

Wastewater from the site offices and toilet facilities, if located within a reasonable distance from the sewer in Tam Kon Shan Road, should be discharged to the sewer. Otherwise onsite chemical treatment and storage facilities should be provided, with regular collection of the wastewater carried out by tanker. Where non flush toilets are provided these should be chemical toilets and the holding tanks emptied by tanker on a daily basis.

In order to reduce suspended solids and oil discharges from the vehicle washing minimum water should be used and any drainage carried away to settlement tanks prior to discharge or reuse. Rain water should be discharged to an adjacent storm drain or culvert.

Fuel tanks on the site should be housed within bunded containment areas which should be regularly drained of rain water. Vehicle maintenance should be carried out on paved areas, spillages controlled by absorbents and waste oils collected in designated tanks prior to disposal off site. Rain water from maintenance areas should be discharged via a petrol trap to a suitable foul sewer.

For specific details relating to site management and construction of mitigation measures the Contractor(s) attention should be drawn to EPD publication "ProPECC PN 1/94" - Construction Site Drainage issued in August 1994 and any amendments issued prior to the commencement of works.

6.5 Impacts During Operation

During the operation of the Tsing Yi North Coastal Road impacts may arise from two sources but both would impact through the same route and as a consequence mitigation measures can be readily implemented. Both potential impacts arise from run off from the paved road surface. The first results from storm water carrying dissolved and particulate material from degradation of the road surface and tyres and from normal operational fuel and oil losses from vehicles. At the present time there is no available reliable quantitative information on these losses for either Hong Kong roads or roads with similar climatic and operational characteristics. The second source of impact will arise in the event of accidents involving one or more vehicles where fuel from ruptured fuel tanks will run off or be washed off into the surface water drainage system. Similarly spilled loads, either liquid or fine solids, may be washed into the surface drains by the emergency services.

6.6 Mitigation Measures During Operation

Contaminants present in the normal operation run-off will, by their chemical nature, be strongly adsorbed onto the particulate phase. Thus the use of solids traps, preferably in series, will control both the suspended solids in the run off and the contaminants adsorbed onto them. It is critical that these traps are maintained regularly and frequently to prevent the accumulation of solids with the resultant reduction in retention time and thus efficiency.

In the event of an accident resulting in the spillage of fuel or vehicle load, the primary objective should be to contain the spillage for removal from the road and its subsequent safe disposal. If this is not possible and the spillage enters the surface water drainage system, theses should be held back by interceptor tanks with both under and overspill weirs to retain floating and settleable material. These should be readily accessible for emptying in the event of an accident.

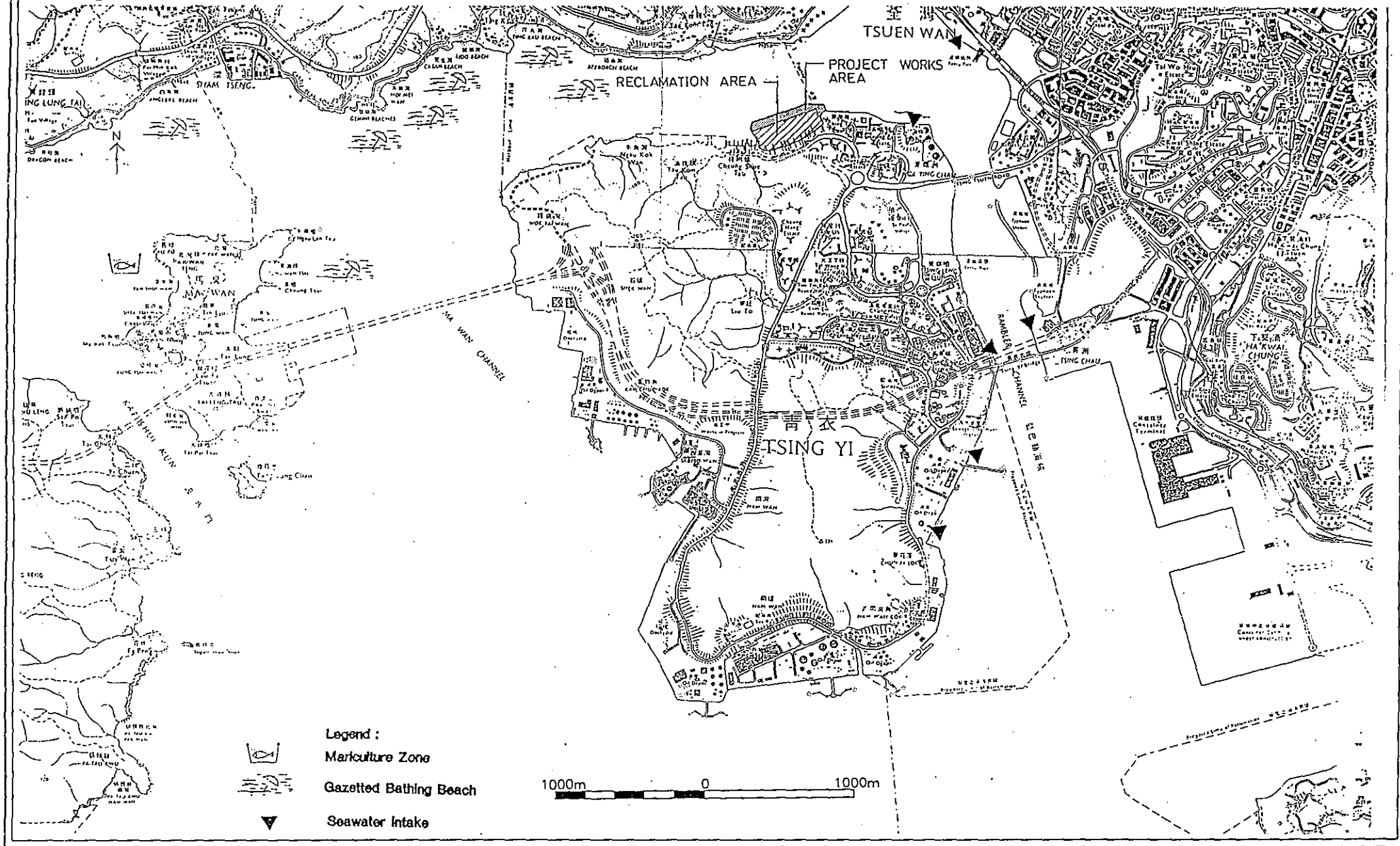
Since it is not normal practice in Hong Kong to install petrol interceptors on free moving sections of highways they have not been specified for the Tsing Yi North Coastal Road.

6.7 Residual Impacts

The significance of overall water quality impacts during each phase of the Project is shown in Table 6.6 below. If the mitigation measures indicated above are implemented it is not anticipated that there will be any residual impacts other than the presence of settlement/interceptor tanks at suitable points in the system and the requirement for vehicle access for their maintenance.

Table 6.6 : Overall Water Quality Impacts

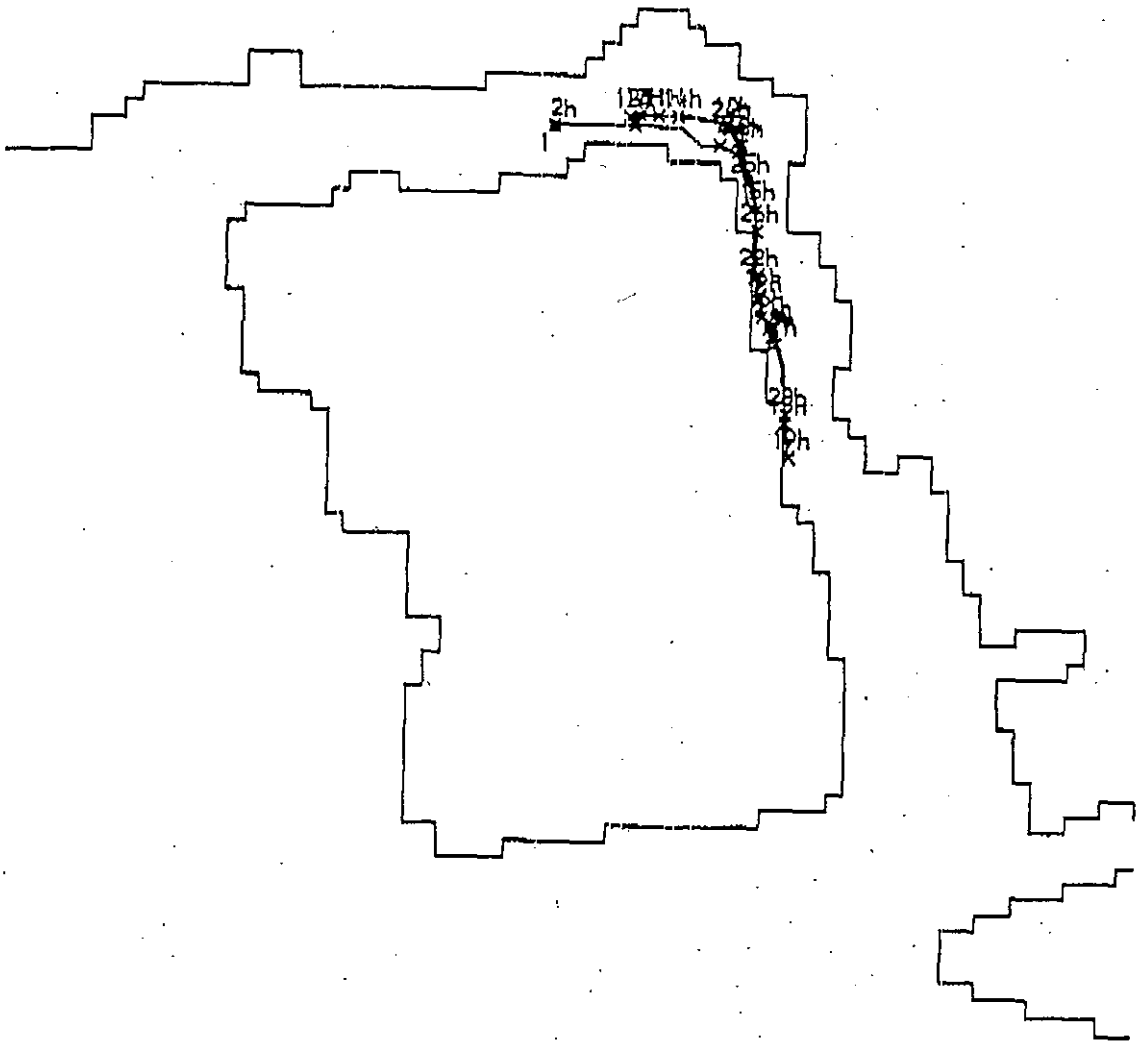
Phase	Duration	Activities	Anticipated Level of Impact
Construction works		Erosion from working surfaces	Insignificant effects of suspended solids if surface are restored or covered, run off intercepted and settled prior to discharge and stream works carried out during the dry season
		Vehicle operation	Insignificant if maintenance carried out on paved and bunded areas.
		Site facilities	Insignificant if wastewater discharged to sewer or tankered off site
Operational phase	Indefinite	Surface run off	Insignificant if interceptors included in the surface water drainage network



Marine Water Sensitive Receiver Locations

Mouchel

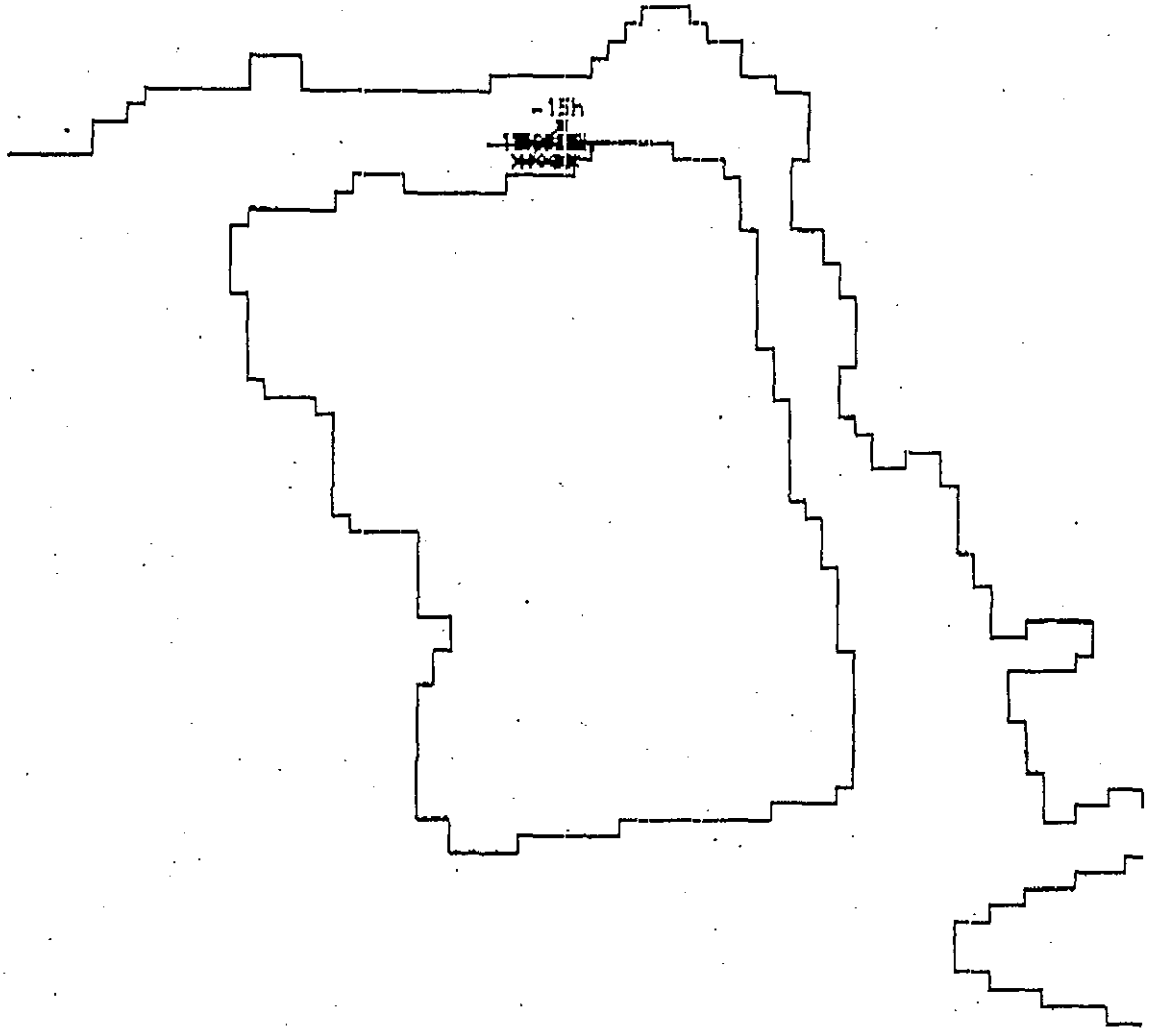
Figure No. 6.1



Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Neap Tide Bed Layer

Mouchel

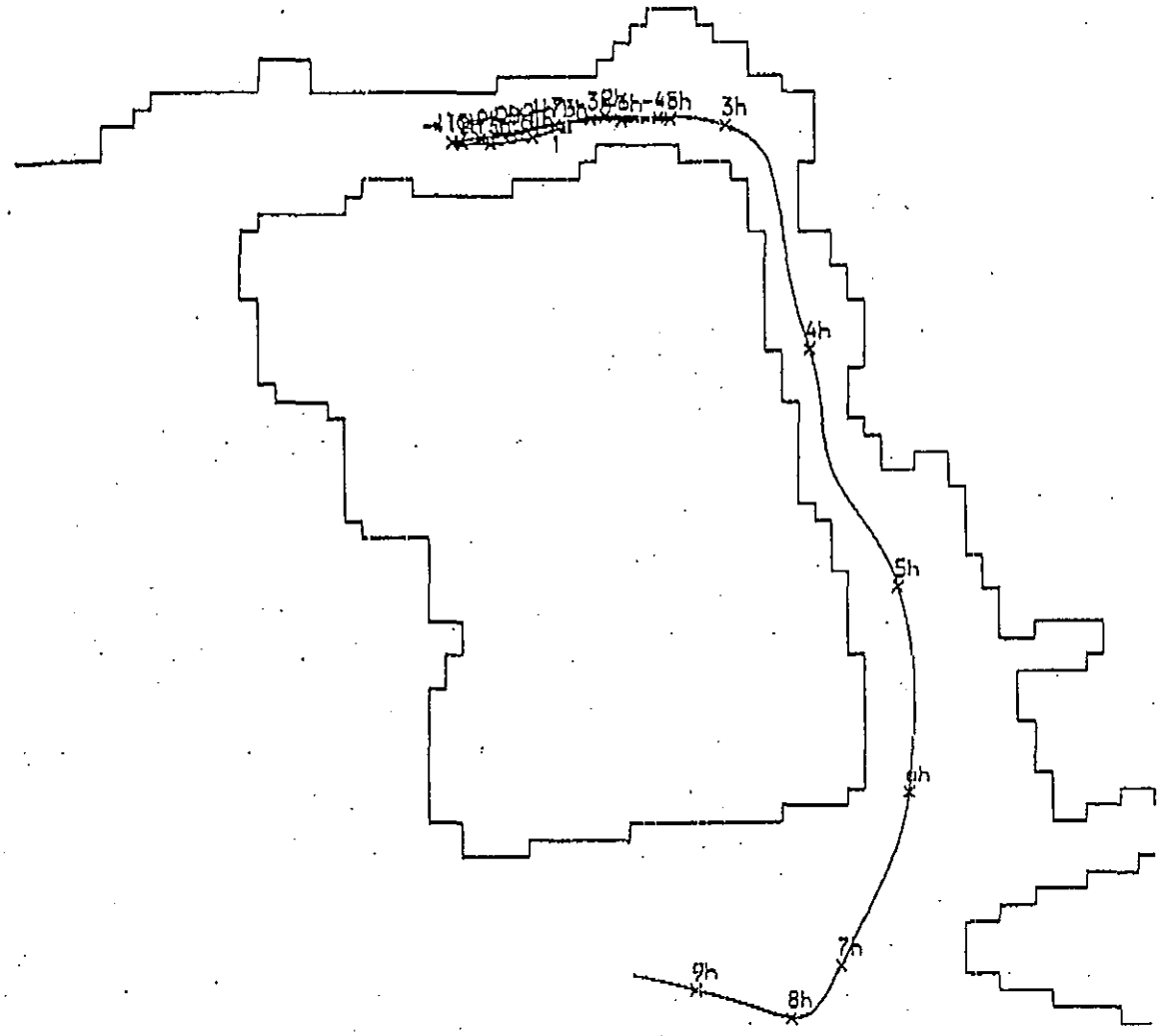
Figure No. 6.2



Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Neap Tide Bed Layer

Mouchel

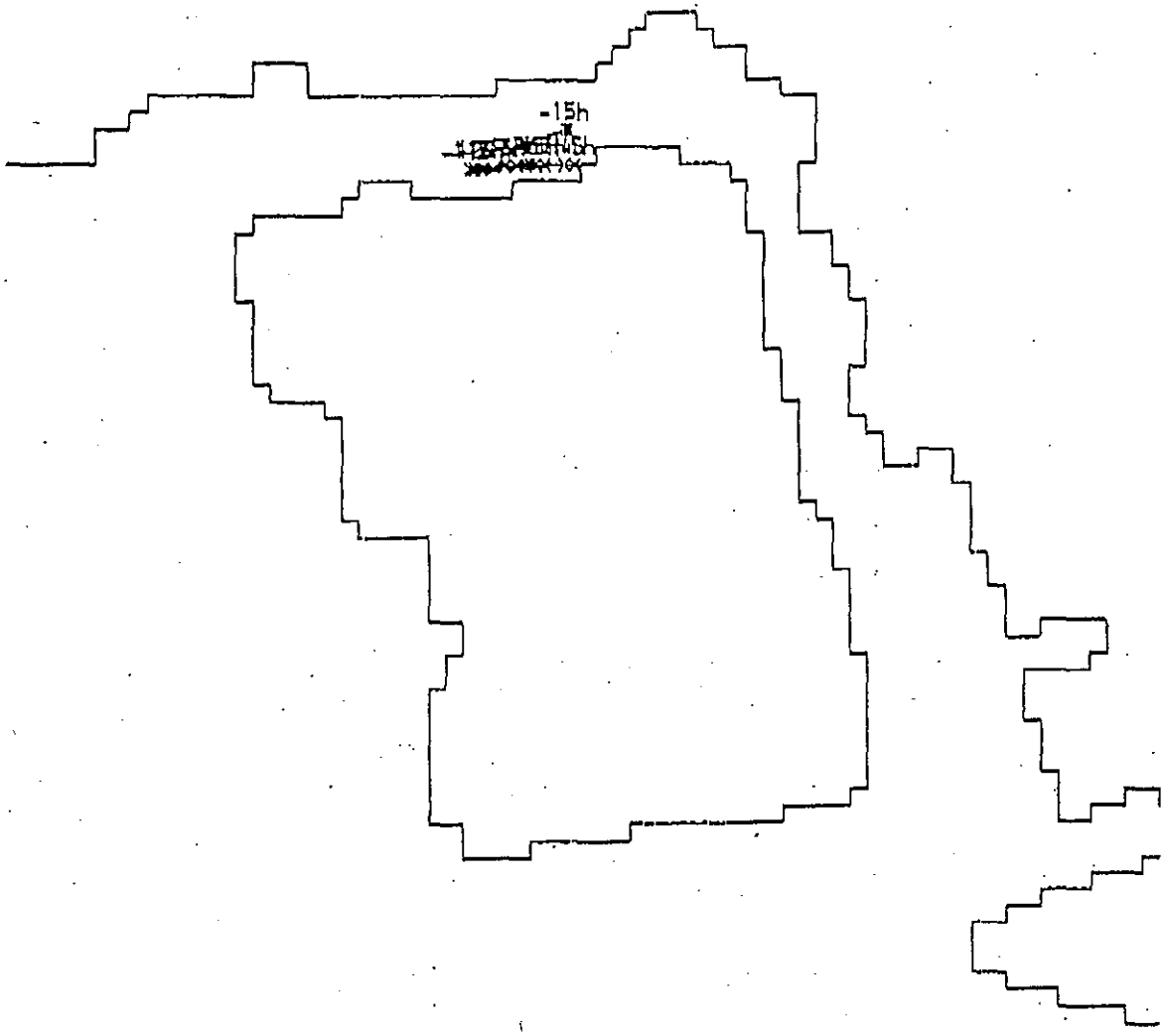
Figure No. 6.3



Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Spring Tide Surface Layer

Mouchel

Figure No. 6.4



Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Spring Tide Bed Layer

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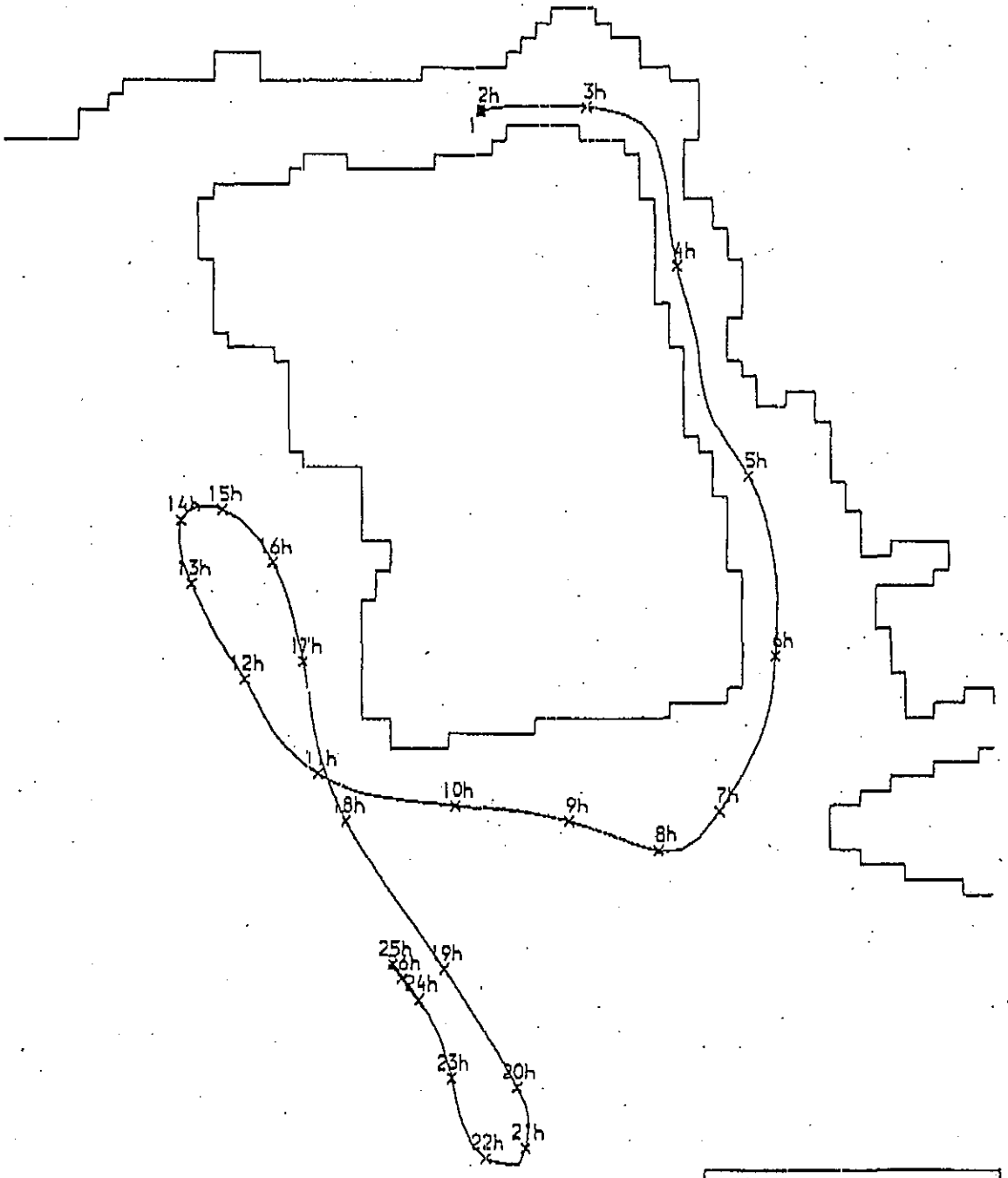
Figure No. 6.5



Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Spring Tide Surface Layer

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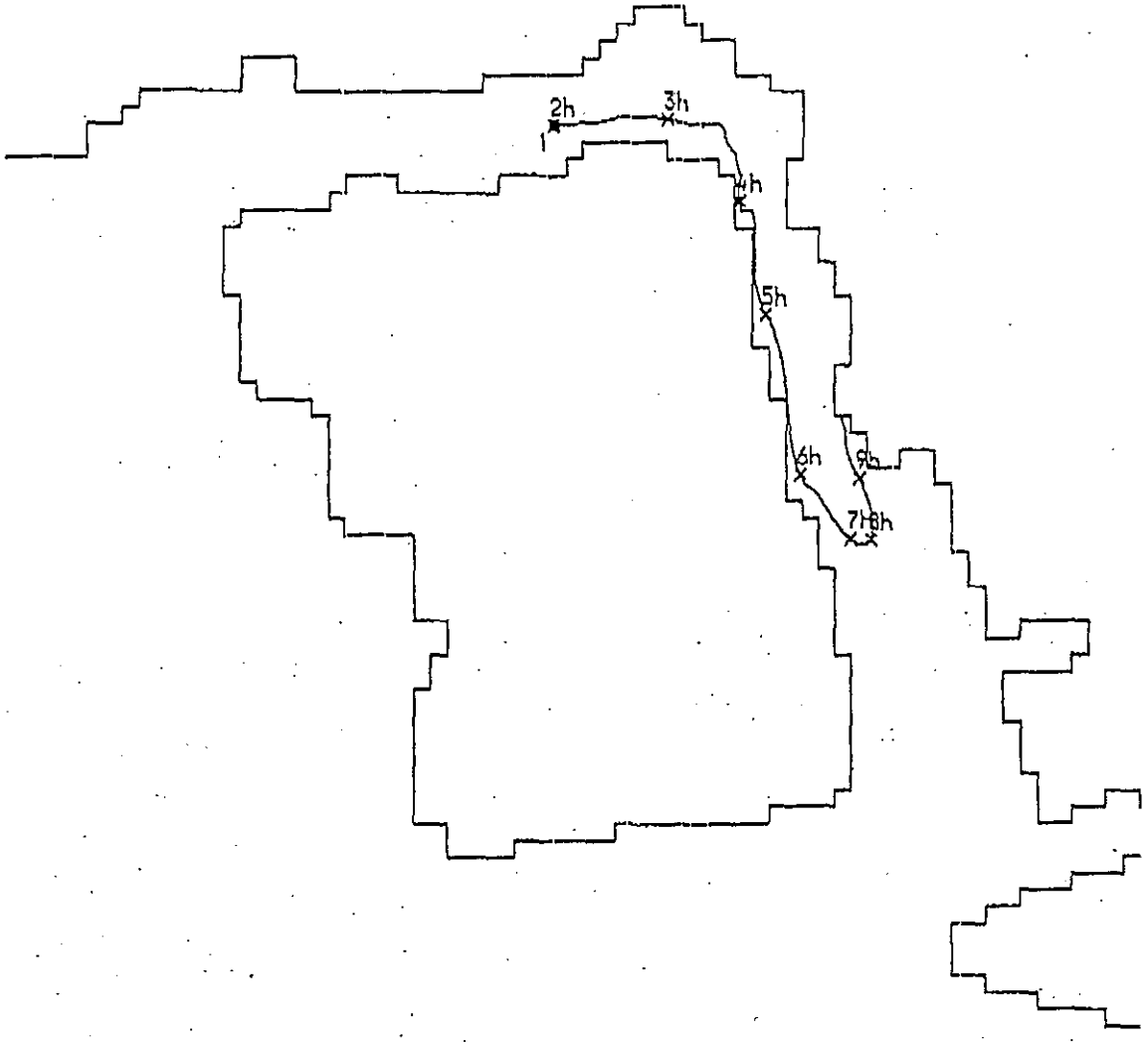
Figure No. 6.6



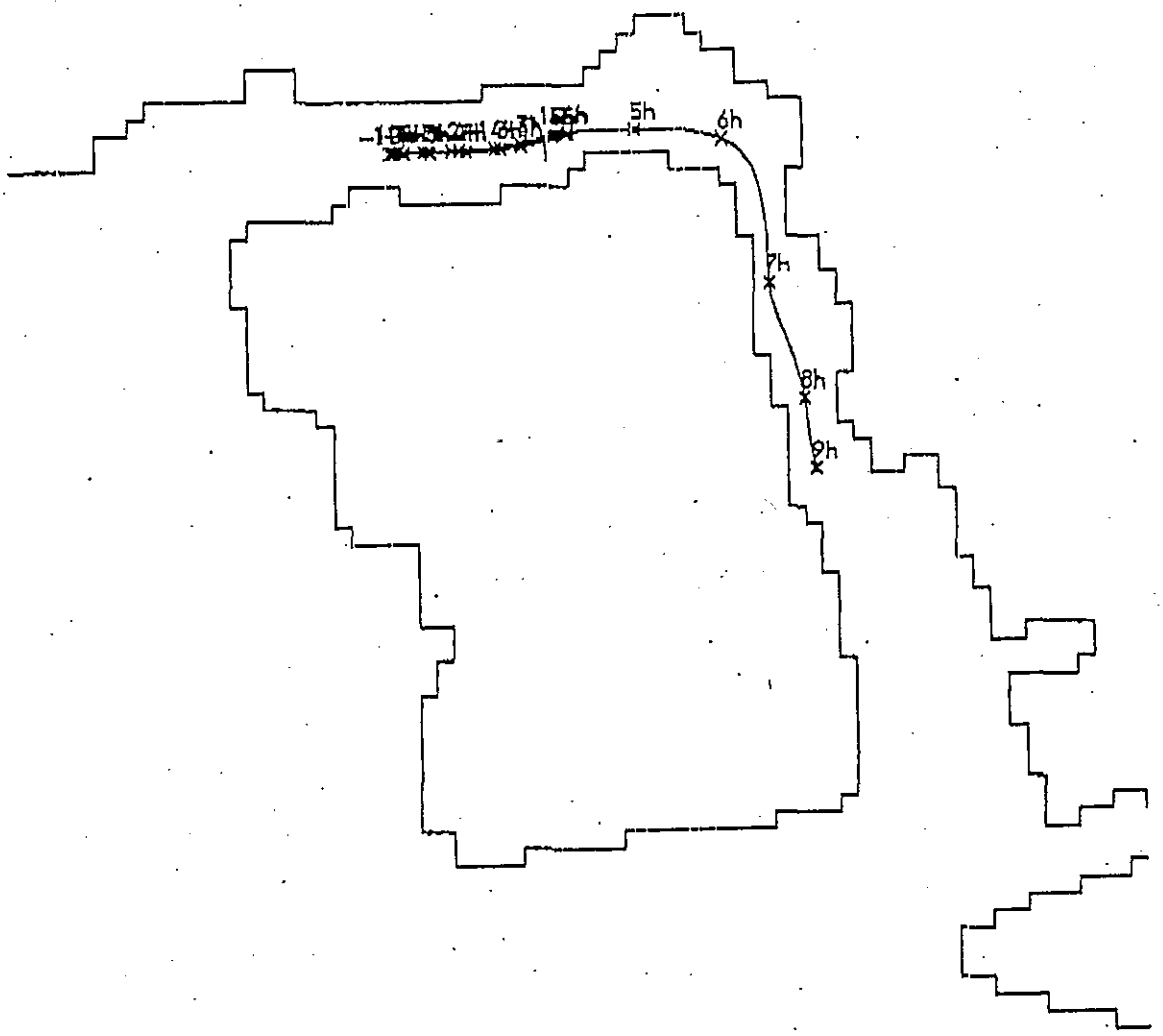
0 1000
Metres

Release Time +2hrs HW
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Spring Tide Bed Layer

Mouchel

Figure No. 6.7



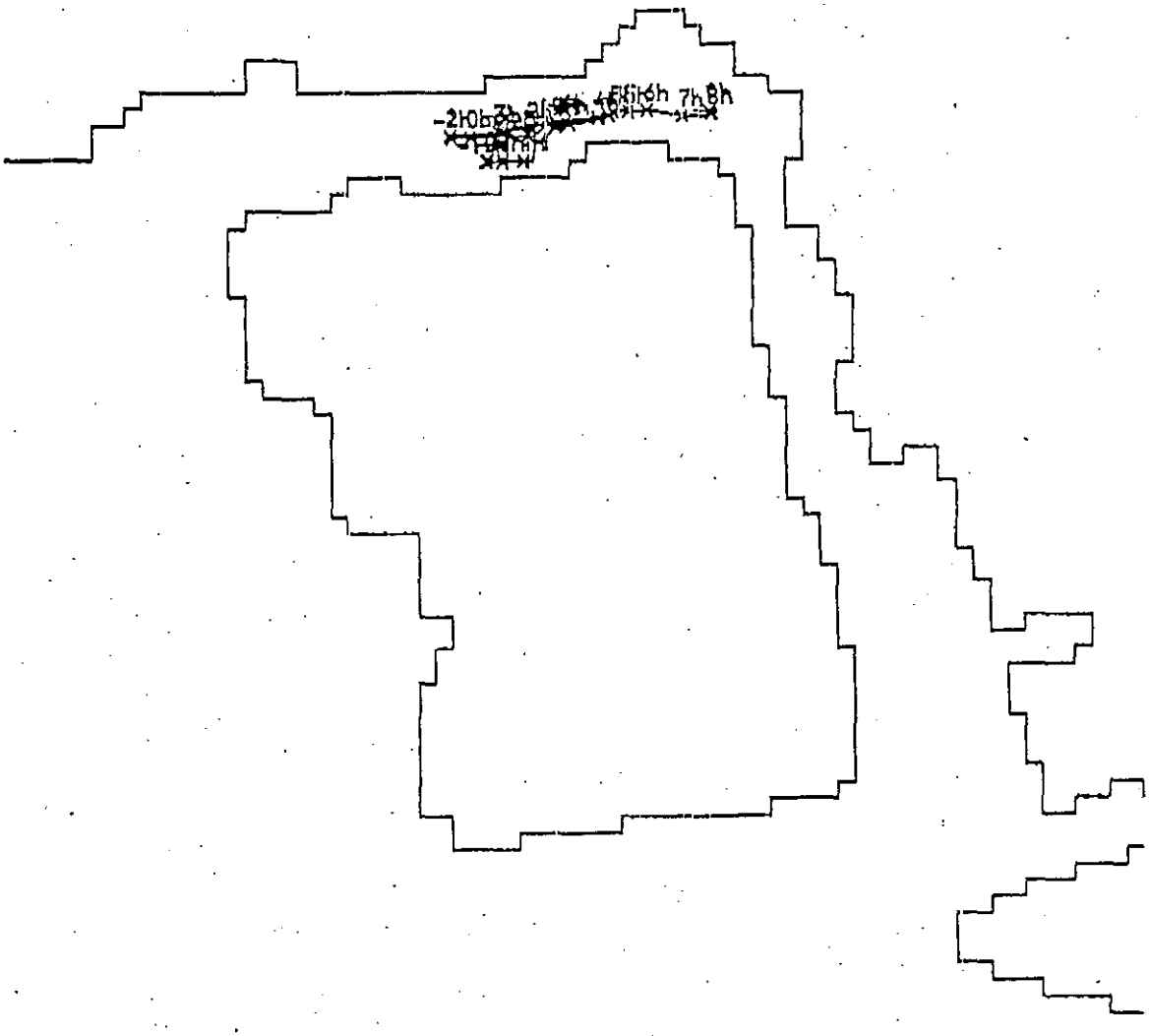
0 1000
Metres

Release Time -15hrs HW
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Neap Tide Surface Layer

Mouchel

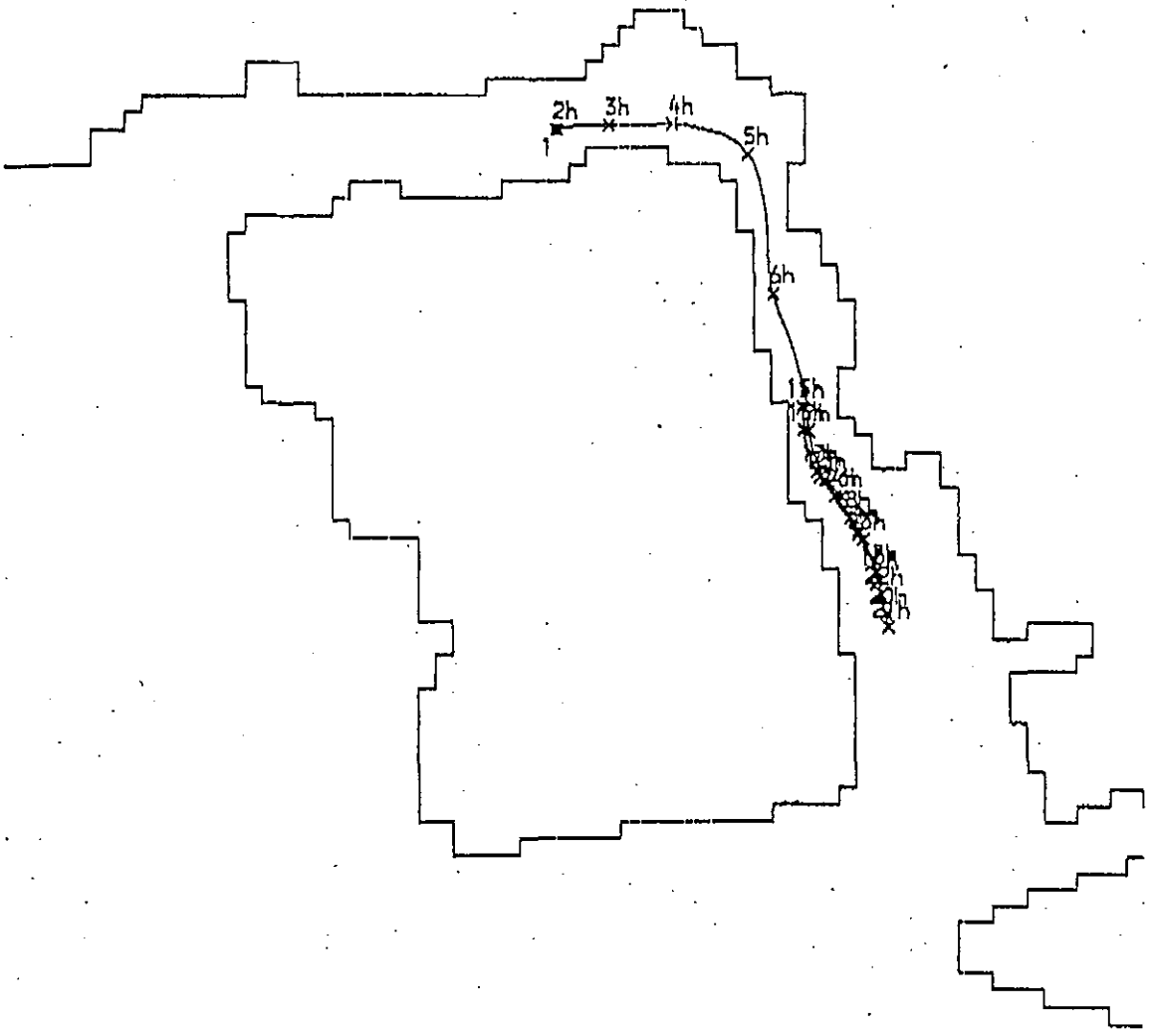
Figure No. 6.8



Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Neap Tide Bed Layer

Mouchel

Figure No. 6.9



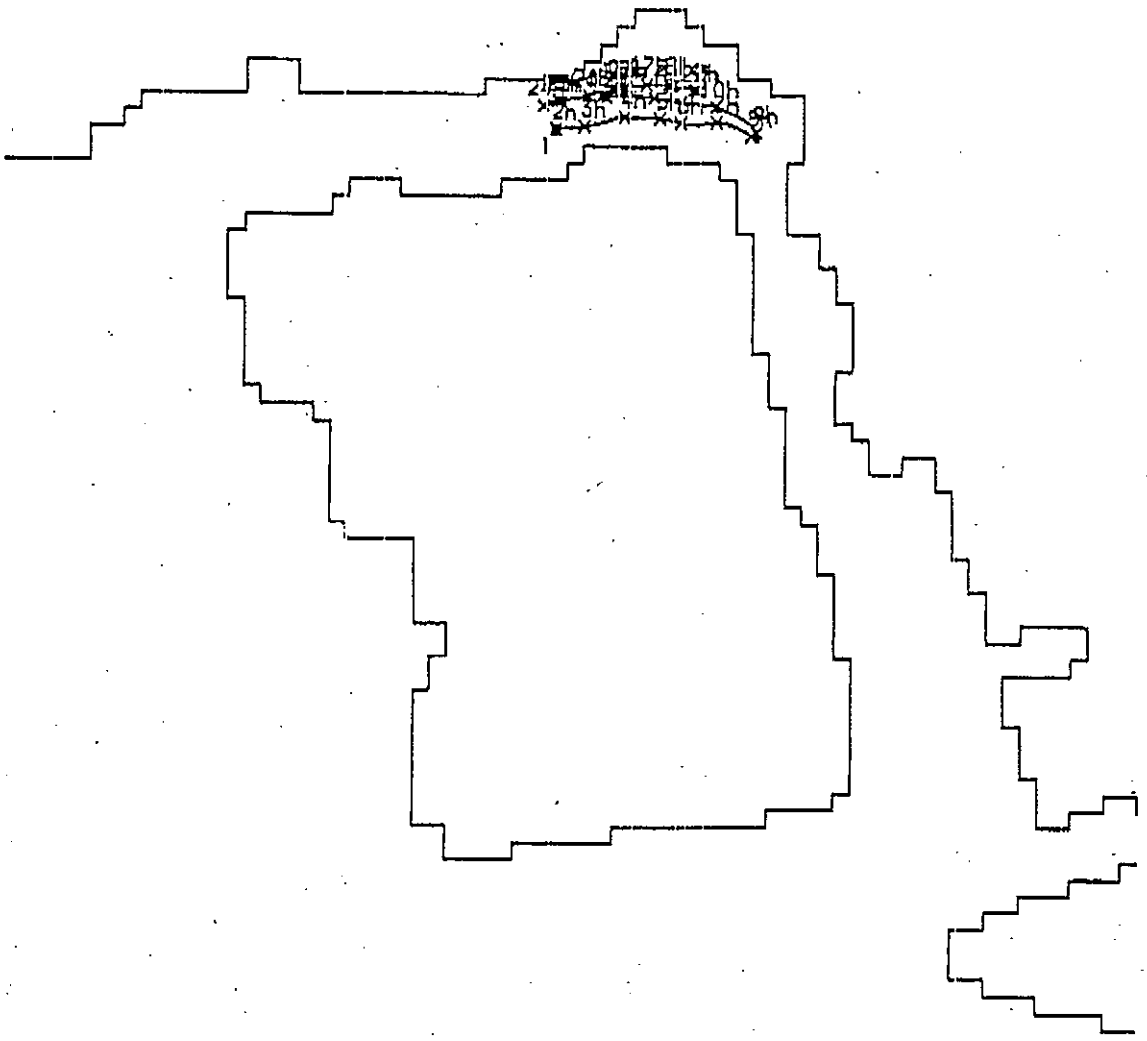
0 1000
Metres

Release Time +2hrs HW
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Neap Tide Surface Layer

Mouchel

Figure No. 6.10



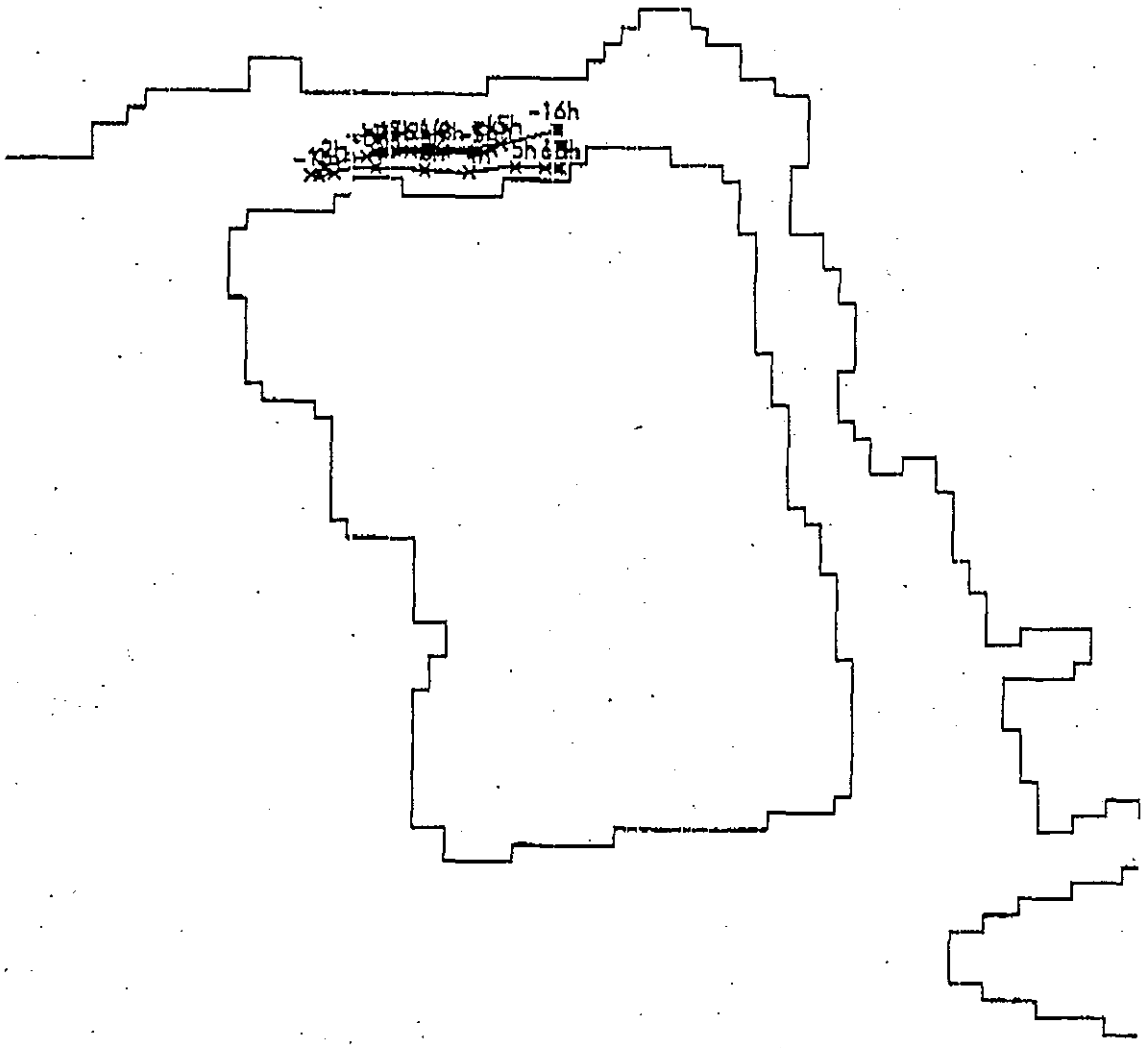
0 1000
Metres

Release Time +2hrs HV
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Wet Season Neap Tide Bed Layer

Mouchel

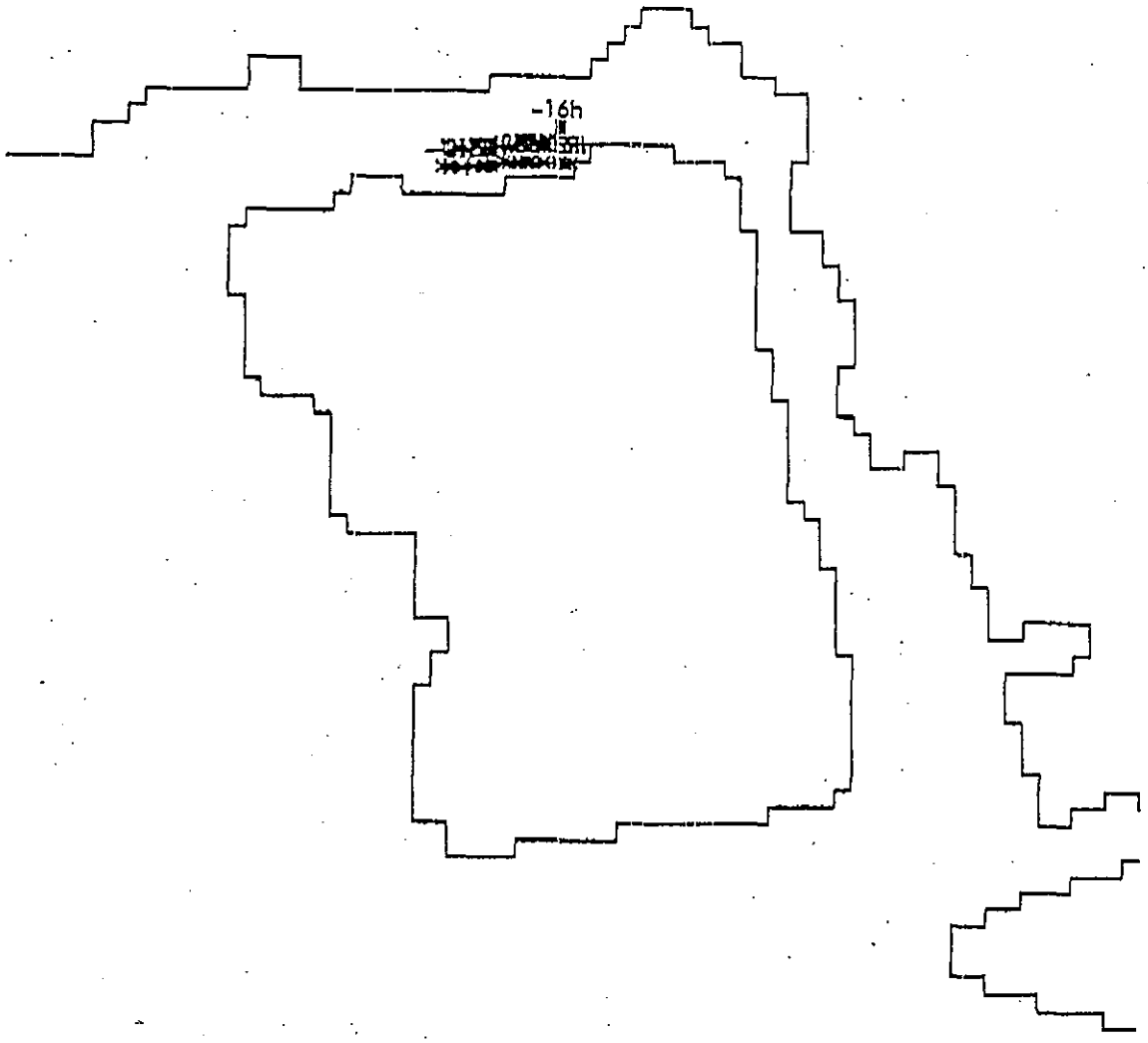
Figure No. 6.11



Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Spring Tide Surface Layer

Mouchel

Figure No. 6.12



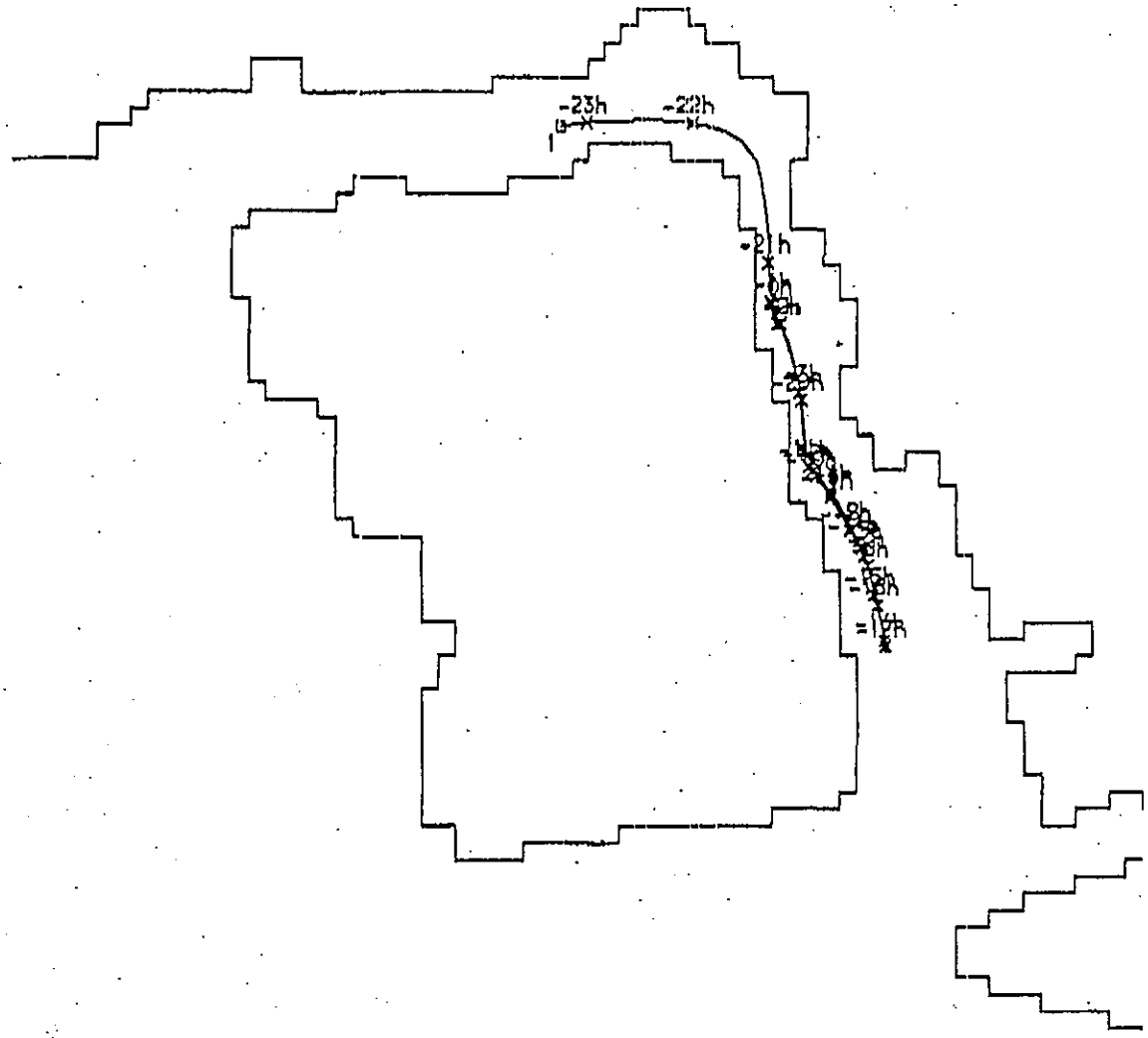
0 1000
Metres

Release Time -16hrs HW
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Spring Tide Bed Layer

Mouchel

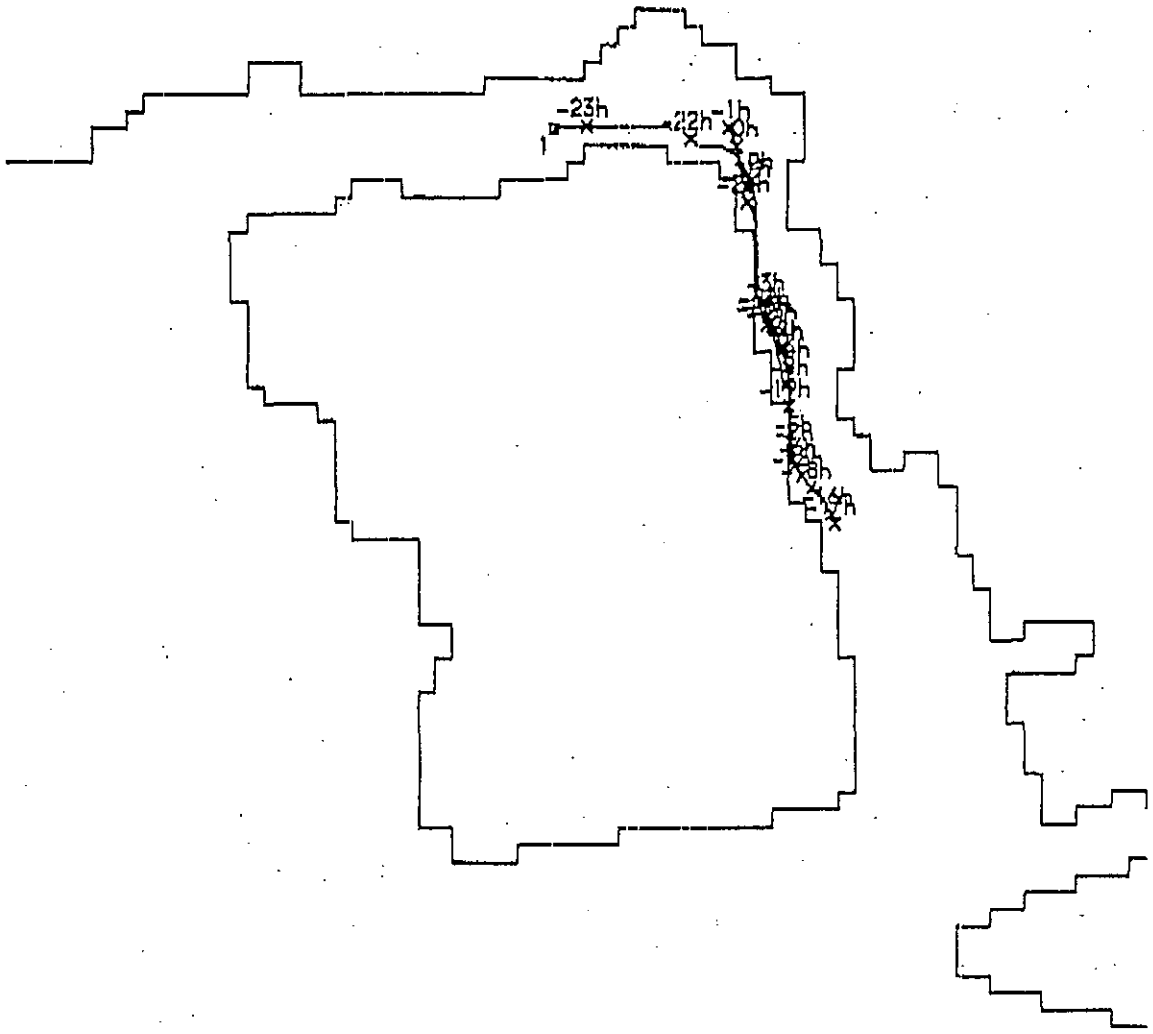
Figure No. 6.13



Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Spring Tide Surface Layer

Mouchel

Figure No. 6.14



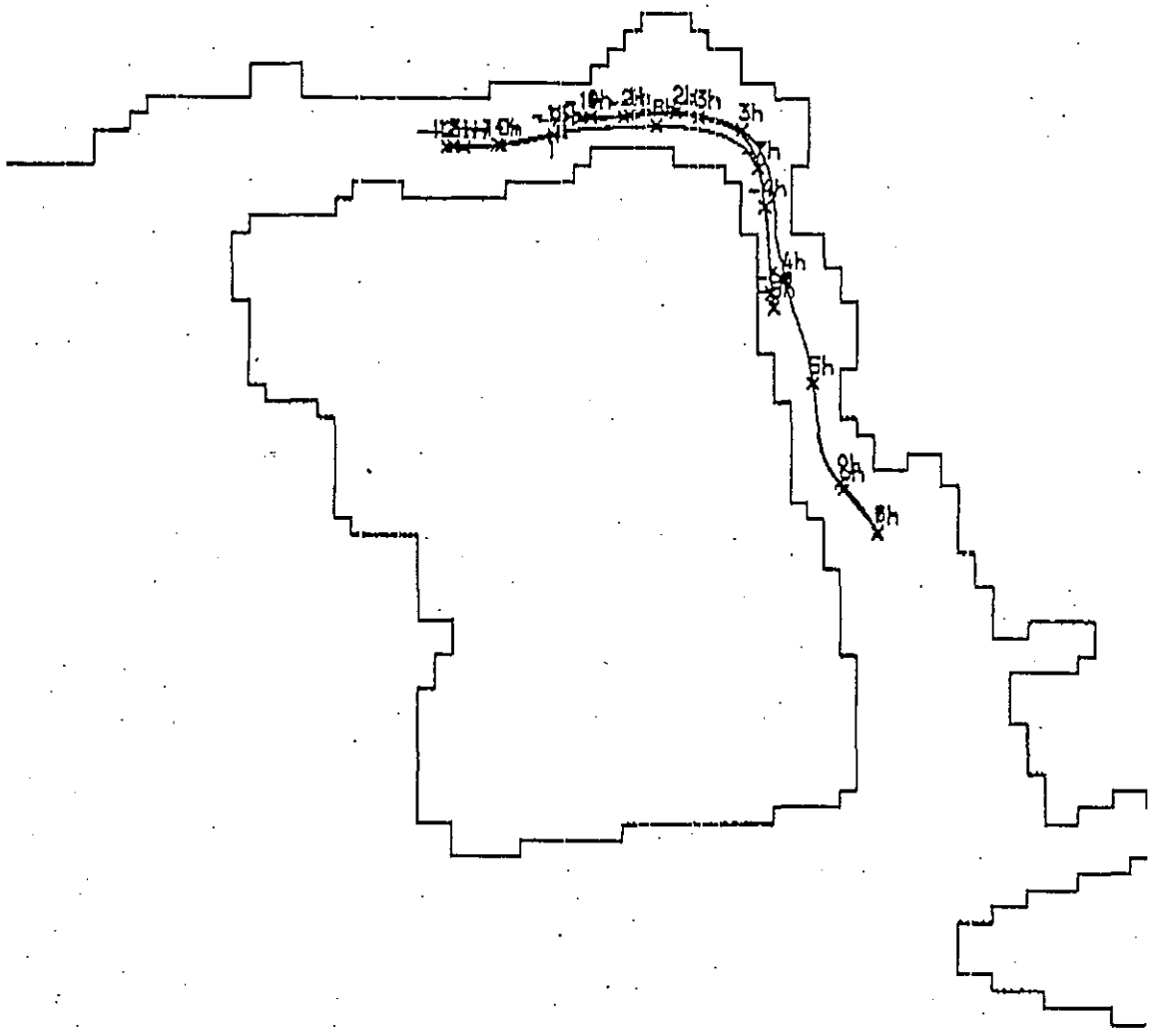
0 1000
Metres

Release Time +2hrs HW
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Spring Tide Bed Layer

Mouchel

Figure No. 6.15



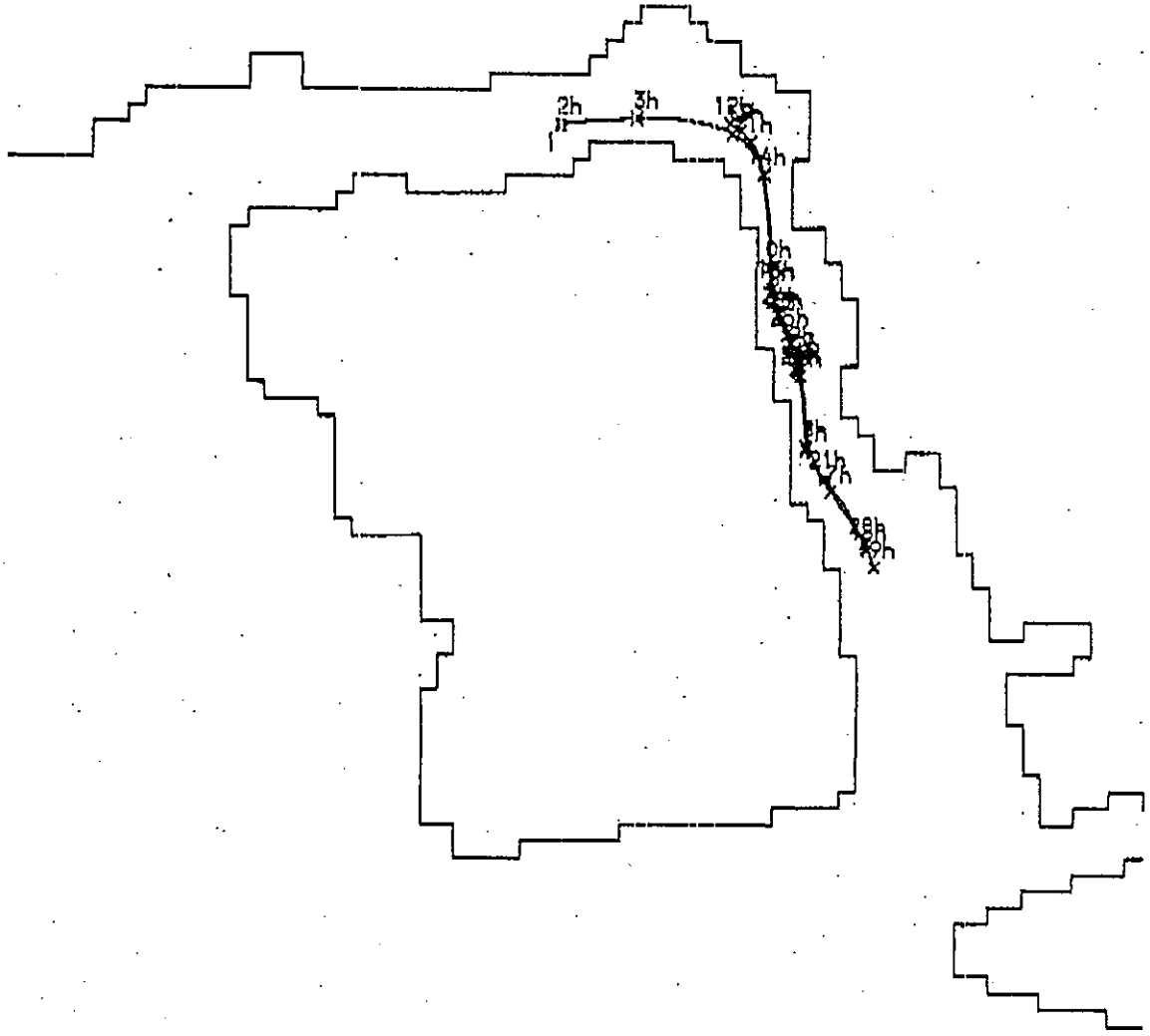
0 1000
Metres

Release Time -15hrs HW
1 Tide Simulation

Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Neap Tide Surface Layer

Mouchel

Figure No. 6.16



Tsing Yi North Coastal Road Simulated Float Tracks Dry Season Neap Tide Surface Layer

Mouchel

Figure No. 6.17

7.0 WASTE MANAGEMENT

7.1 Introduction

7.1.1 There will be no spoil disposal or waste management issues during the operation of the project. This Chapter therefore deals solely with waste management during construction.

7.2 Construction Waste Management

7.2.1 Activities during the construction phase will result in the generation of a variety of wastes which can broadly be classified into categories based on their nature and the options for their disposal. These include:

- excavated materials suitable for reclamation and fill;
- general construction waste;
- demolition waste;
- chemical waste;
- general refuse; and
- sewage.

Excavated material

7.2.2 Excavated material will mainly be rock, of which 90% is expected to be of good usable quality. Some of this material will be used as fill on site but there will be some surplus material that will require disposal to public dumps or land reclamation.

7.2.3 The storage and stockpiling of excavated material prior to utilisation on site or disposal at fill sites could lead to the generation of dust and may be visually intrusive.

7.2.4 The disposal of excavated materials also have the potential to result in additional noise impacts, possible congestion due to increased traffic, and dust and exhaust emissions from the haul vehicles.

General Construction Waste

7.2.5 General construction waste will arise from a number of site activities and may include:

- wood from formwork;
- equipment and vehicle maintenance;
- materials and equipment wrappings;
- unusable cement/grouting mixes; and
- damaged or contaminated construction materials.

7.2.6 The volume of construction waste generated will be dependant on the operating procedures and site practices, and hence cannot be quantified at this stage.

7.2.7 If construction wastes are generated in large quantities they may hinder normal construction activities and present a safety hazard if not removed, in addition to causing potential water quality impacts.

Demolition Waste

7.2.8 Demolition wastes will arise from site clearance. The exact volume of demolition wastes arisings is not known but is not likely to be significant on this project. The demolition wastes will be taken to landfill or, where free from putrescible materials, to public dumps.

7.2.9 The storage and disposal of demolition waste may present greater visual, litter, odour and dust impacts than that for excavated materials and general construction wastes. Demolition waste should therefore be removed from site as soon as practical.

Chemical Waste

7.2.10 Chemical wastes likely to be generated during the construction will, for the most part, arise from the maintenance of plant and equipment. These may include the following:

- spent filter cartridges containing heavy metals;
- scrap batteries or spent acid/alkali from their maintenance;
- brake clutch linings containing asbestos materials;
- used hydraulic and lubricating oil;
- spent mineral oils/cleaning fluids from mechanical machinery;
- spent solvents/solutions, which may be halogenated, from equipment cleaning; and
- paints and paint containers.

7.2.11 Chemical wastes pose environmental and health and safety hazards if not stored and disposed of in an appropriate manner but it is unlikely that of this project significant quantities of chemical wastes will be generated during the construction of this project. If chemical wastes do arise they should be handled, stored, transported and disposed of in accordance with the Code of Practice on the Package, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme published by EPD.

General Refuse

7.2.12 The construction works will result in the generation of a variety of general refuse requiring disposal. General refuse may include office waste, newspapers, food wastes from canteens and packaging waste and will generally be disposed of at landfill.

7.2.13 The storage of general refuse has the potential to give rise to a variety of adverse environmental impacts. These include odour if waste is not collected frequently (eg. daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The site may also attract pests and vermin if the waste storage area is not well maintained and cleaned regularly. In addition, disposal of wastes, at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

Sewage

7.2.14 The construction workforce will produce sewage which requires proper disposal. At

work sites where there are no foul sewers, chemical toilets will be provided.

7.3 Earthworks Volumes

Estimated Volumes and Timing

7.3.1 The earthworks quantities used in this section have been provided by Highways Department and it has been estimated that there will be a surplus of 0.6 million cu.m. of excavated material, most of which will be hard material from the rock cuttings.

7.3.2 The programme for the implementation of the overall scheme is in September 1998 to October 2001 and the surplus excavated material will be in good quality of rock and soils.

7.4 Waste Handling Measures

Excavated Material

7.4.1 Excavated material will be re-used on this project wherever possible. There will, however, be surplus material of approximately 0.6 million cu.m. made up of rock and soft material.

7.4.2 This is a substantial quantity of material and efforts should be made to identify re-use wherever possible. This needs further consideration during the detailed design of the project when the timing will be more certain.

General Construction Waste

7.4.3 This waste should be sorted on-site to remove material which is suitable for re-cycling or use in public dumps. The remainder will be disposed of at the nearest landfill site. The only construction waste sorting facility which is presently available in Hong Kong is at the SENT Landfill and it will not be convenient to send material from this site for such a long distance. A sorting facility should be set up on the site, unless a conveniently located Government facility is available. Suitable provisions should be included in the construction contracts to ensure that contractors sort and re-cycle waste.

Demolition Waste

7.4.4 Demolition waste should be treated in the same way as general construction waste.

Chemical Waste

7.4.5 The Contractor shall register with EPD as a chemical waste producer under the Waste Disposal (Chemical Waste) (General) Regulation. A licensed contractor should be employed to collect chemical waste for delivery to a licensed treatment facility. Suitable chemical waste storage areas should be formed on the site for temporary storage pending collection.

General Refuse

General Refuse

7.4.6 Temporary storage areas for general refuse should be enclosed to avoid environmental impacts. General refuse should be stored on site for the minimum time practical and should be disposed of to the nearest landfill.

Sewage

7.4.7 Sewage arisings from the Construction Workforce should be discharged to foul sewer where possible. The discharge standards of effluent should comply with the requirements of the Technical Memorandum "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters".

7.4.8 Sewage arising from chemical toilets should be transported by a licensed contractor to government Sewerage Treatment Works for disposal.

8.0 ECOLOGICAL ASSESSMENT

8.1 Introduction

This ecological assessment (EA) forms part of the Environmental Impact Assessment (EIA) for the proposed Tsing Yi North Coastal Road. It aims to address the ecological impact requirements set out in section 6.2.4.10 of the Brief.

The general format followed is that set out in Annex 16 of the draft Technical Memorandum (February 1996 version) to the Environmental Impact Assessment Bill which provides draft Guidelines for Ecological Assessments. This has to be read together with the Criteria set out in Annex 8.

This ecological assessment aims to provide sufficient and accurate ecological data to allow a complete and objective prediction and evaluation of the potential ecological impacts of constructing and operating the Tsing Yi North Coastal Road. This assessment also aims to assist the engineering design process in eliminating or minimising any adverse impacts and maximising ecological benefits.

Fieldwork surveys were carried out during April and May 1996. As a result of these surveys, key ecological resources have been identified and their value assessed. Potential impacts of the proposed works have been predicted and practicable alternatives, impact avoidance and mitigation measures have been suggested, where appropriate. Ecological monitoring and audit requirements have also been considered.

The regulatory framework which provides for the protection of ecological resources is also described.

8.2 Ecological Baseline Information

8.2.1 Introduction

For the purposes of this study and as required by the Brief, the study area has generally been defined as a minimum distance of 300 meters from the centreline of the proposed road alignment. Where ecological factors dictate, a larger area has been considered, for example with streams and water catchments. The EIA Study Area has been defined previously in Figure 2.1.

8.2.2 Review of Existing Information

Existing data from previous EIAs, research papers published in scientific journals, theses, books, and data from special interest groups and naturalists was reviewed for its relevance to this project. Existing information for this site and general area is very limited.

From the experience gained in equivalent road projects in the Territory, a number of key ecological issues are commonly encountered. These include:

Key Impacts on Ecosystems

- destruction of habitats of ecological significance e.g loss of natural woodland, freshwater habitats, tall scrubland etc.;
- destruction or disturbance to species of ecological significance including rare or protected species e.g orchids, bats etc.;

Engineering Construction Considerations

- the selection of "ecology friendly" engineering design principles e.g. major cut and fill works may have greater adverse ecological impact than, for example, tunnel;
- construction techniques adopted may involve off-route ecological impacts due to construction access or requirement for storage/works areas elsewhere;
- hydrogeological impacts due to alteration of water tables and catchments e.g. dewatering effect of roads can be locally severe
- safety requirements of heavily engineered slopes tend to prevent re-establishment of replacement habitats in any viable manner.

Operational Considerations

- damage or disturbance caused by fragmenting habitats e.g road can sever large tracts of woodland and disrupt mammal territories causing "road kill" to animals as migration paths are interrupted;
- contaminated surface water runoff from the highway may cause damage to receiving streamcourses. This is particularly the case in the event of accidents and spillages on the road when significant damage can potentially be caused downstream;
- air pollution from road traffic may have local effects on ecological habitats due to build up of dirty airborne residues from fuel etc. and thereby restricting growth rate of vegetation.

A list of some of the key references that are generally relevant to road construction projects in Hong Kong is given in Appendix A.

8.2.3 Habitat Survey and Assessment Methodology

The following methods were used to describe and evaluate the baseline ecological conditions on the site:

- Maps and aerial photographs were utilised to create a basic habitat overview;
- The site was surveyed in the field by suitably trained and qualified personnel. The

habitat types present were determined both within and beyond the Study Area boundary defined in the brief and their key characteristics described;

- Flora and fauna surveys were also carried out on selected representative areas listing typical species, recording dominant species and their abundance etc.;
- The possible presence of rare or protected species was investigated;
- Habitat features of particular value to different ecological groups were noted.

8.2.4 Survey Results

A draft outline habitat map was drawn up using aerial photographs. Two sets of photographs were used as follows:

Colour photograph numbers CN11388-91 covering the whole site flown on 27th September 1995.

Black and white photograph number A 41950 flown at 8,000 feet on 28th December 1995.

The proposed route was then surveyed on foot in April and May 1996 using the methods of ecological survey described above. The habitats identified from the aerial photographs were totally field checked and refined.

The basic habitat types found within the survey area are shown on Figure 8.1 and include:

- grassland/ low scrub
- tall scrub
- planted woodland
- cultivated land (including many mature orchards)
- freshwater streams
- urban

Thus, there is a limited variety of natural habitats found on the north coast of Tsing Yi Island including extensive areas of grassland/low scrub, small areas of tall scrub in sheltered or fire protected zones and a variety of freshwater streams some of which are seasonal. Many man-made habitats are present within the study area including planted woodland and extensive areas of mature orchards and cultivated land in the sheltered valleys where water is plentiful from local streams.

The dominant features and characteristics of each habitat are described below along with a section on species:

Grassland and Low Scrub

The grassland and low scrub on the proposed route are fire climax communities and are typical of habitats that are represented extensively in Hong Kong. This is the dominant habitat on the slopes above the formed cut slopes associated with the Tam Kon Shan

Road.

Typical species recorded include *Baeckea frutescens,* the dominant *Dicranopteris linearis, Miscanthus floridulus, Rhodomyrtus tomentosa, Melastoma sanguineum, Lantana camara, Dianella ensifolia, Ligustrum sinensis* and *Rhapiolepis indica.* Species recorded in this habitat type were common or very common.

The use of historical series aerial photographs to monitor the development of the vegetation in this area indicates that one of the factors controlling the development of habitats on this site is the regularity of hill fires. The composition of the plant community supports this with the dominance of fire resistant species such as *Rhodomyrtus tomentosa* and *Dicranopteris linearis*. The presence of numerous graves is likely to be a key factor contributing towards the hill fires.

The low scrubland and grassland habitats were generally found to support species which are locally very common and subject to frequent disturbance by fire. The types of low scrub and grassland communities encountered are habitat types which are generally widespread throughout the Territory.

Tall Scrub

Tall scrub can be found on the site in the sheltered zones and in areas more protected from regular hillfires. The main scrubland present is the Dicranopteris-Miscanthus-Rhodomyrtus-Baekea Association. This is commonly found throughout Hong Kong and is maintained as scrub regularly by hill fires. Most of the species present are extremely fire resistant including *Adiantus capilus-veneris, Eurya chinensis, Lycopodium scandens, Melastoma candidum, M. dodecandrum, Raphiolepis indica, Rhamnus chinensis, Rhodomyrtus tomentosa, Rhus chinensis, Smilax china* and *Viburnum sempervirens.* Other species recorded where they were more protected from fire or in the damper, sheltered ravines, included *Liquidamber formosana, Aleurites montana, Litsea spp., Strophanthus divaricatus* and *Schefflera octophylla.* These areas were showing signs of the potential to develop into a natural woodland community.

Several other weedy pioneer scrub species were recorded on cleared areas of cut slope above the existing road including *Lantana camara, Maesa perlarius, Rosa cymosa* and *Vitex negunda.*

The type of scrubland found on the site is relatively common in Hong Kong and sub-tropical China and the communities present are found elsewhere in the Territory.

No rare or protected plant species were recorded from the tall scrubland.

Planted Woodland

The key areas of woodland within the study area are exotic planted woodlands, with the dominant species being *Acacia confusa.* The planting appears to be associated with areas behind the infrastructure developments and may have been linked with past borrowing or formation. There is a large *Acacia confusa* plantation behind the Cheung On Estate. The ecological value of monoculture *Acacia* plantations is very limited.

Cultivated Land

There are patchy areas of cultivated land within the Study Area. The main crops under cultivation are bananas, longans, rose-apples and other fruit trees. These areas are clustered around the villages of Cheung Shue Tau and Yau Kom Tau. The valley cultivation around the latter village is quite extensive. There are also small areas of utilised for vegetables and cut flowers.

These areas of cultivation are of limited value to wildlife given the cultivation of the soil, the use of pesticides, herbicides and other chemicals including fertilisers and the high levels of disturbance.

No rare or endangered plant species were recorded from the cultivated plots within the project area.

Freshwater Streams

The Study Area contains several streams. Some of the streams around Yau Kom Tau and Cheung Shue Tau have been used for the purposes of irrigating the cultivated land and are now very much man-made water courses with limited natural habitat and vegetation associated with them except at the upper reaches where they are surrounded by natural habitats and the streamside vegetation is typically moderately diverse. Some of the lower reaches of these streams have been channelised and are polluted mostly by the workshops around Tam Kon Shan Road and suffer from localised rubbish dumping.

The stream valley to the west of Ngau Kok Wan and the cement works is much more natural and the streamside vegetation is quite diverse. These streams have a sandy/rocky bottom with small boulders and are well vegetated on the streambanks. The vegetation present would indicate that these streams appear to flow all the year round. Species which were recorded associated with these streams include *Juncus spp., Cyperus spp., Acorus gramineus, Polygonum hydropiper, Rumex spp., Centella asiatica, Sagittaria sagittifolia, Trigonospora ciliata.* Streamside trees included the dominant *Celtis sinensis* with *Ficus pyriformis, Syzygium jambos* and *Cinnamomum parthenoxylon* and *camphora.* The location of these streams of local conservation interest is shown on Figure 8.1.

The streams further to the west, on the other hand, have been affected by reclamation and formation caused by other adjacent projects.

All these species recorded are common species associated with streamcourses which are found through the Territory. No rare or protected plant species have been recorded on or near these streamcourses to date.

Urban Habitats

This category includes existing roads, houses, structures, workshops, industrial areas, housing estates etc. This habitat type is not considered to be of particular ecological interest.

Species

A preliminary list of all plant species recorded from the Tsing Yi North Coastal road site is given in Table 8.1 below. To date, no rare or protected species have been recorded from the site. It is considered unlikely that any of the currently protected plant species occur in the study area.

Table 8.1 : Plant Species Identified in the areas of Tall Scrub within the study area of the Tsing Yi North Coastal Road.

TREES	SHRUBS AND CLIMBERS	HERBS AND GRASSES
Bridelia monoica *Cinnamomum camphora* *Cratoxylum ligustrum* *Diospyros spp.* *Euphoria longan* *Ficus hispida* *Ficus variegata var. cholorcarpa* *Liquidamber formosana* *Litchi chinensis* *Litsea glutinosa* *Mallotus paniculatus* *Melia azedarach* *Musa paradisiaca* *Rhus chinensis* *Sapium discolor* *Sapium sebiferum* *Schefflera octophylla*	*Eurya chinensis* *Gordonia axillaris* *Lantana camara* *Ligustrum sinensis* *Melastoma spp.* *Maesa perlarius* *Mucuna spp.* *Psychotria rubra* *Raphiolepis indica* *Rhamnus chinensis* *Rhodomyrtus tomentosa* *Rosa cymosa* *Smilax china* *Strophanthus divaricatus* *Vitex negundo*	*Adianthus capillus-veneris* *Arundinella spp.* *Asparagus cochinchinensis* *Christella parasitica* *Cyperus spp.* *Dianella ensifolia* *Dicranopteris linearis* *Ipomea spp.* *Liriope spicata* *Lygodium japonicum* *Pteris semipinnata*

Bird species recorded during field visits are listed in Table 8.2.

Table 8.2 : Bird Species Recorded in the various habitats within the Study area for the proposed Tsing Yi North Coastal Road in April and May 1995 (after Viney, Phillipps and Lam, 1994)

Species
Black-eared kite
Spotted dove
Koel
Greater Coucal
Large Hawk cuckoo
Hair crested drongo
Black-necked starling
White Breasted kingfisher (evidence of nesting)
Crested myna
Magpie
Crested bulbul
Magpie robin
Japanese White-eye
Black-faced laughing-thrush

All these bird species are common in mixed scrub/grassland/woodland habitats. Of particular note, are the kingfishers, a few pairs of which are nesting in holes in the sandy cliffs on the route of the proposed road.

The study area is not known to support any rare invertebrate, amphibian or reptile species but rather it is likely to support common species typical of the cultivation, scrubland, abandoned cultivation, grassland, plantation woodland and stream habitats present. Two very common amphibians, Asian Common Toad *Bufo melanostictus* and Gunther's Frog *Rana guentheri* were recorded during field surveys at the site in May 1996.

Whilst no specific systematic survey has been undertaken to record mammals, it is considered that the site is unlikely to support many mammals other than very common species because of the high level of cultivation and general disturbance. It is, however, likely to support common species typical of the habitats present. The upper areas of the study area are more remote, provide more shelter and cover and are contiguous with extensive areas of natural scrub/woodland. They are therefore more likely to support mammals species such as barking deer and civets.

Summary

In summary, the general area is considered to be of limited wildlife interest given the extensive areas of man-made and disturbed habitats. No rare species have been recorded from the area to date. The small parts of the study area that contain natural habitats considered to be of local ecological interest are highlighted in Figure 8.1. These include areas of tall scrub and natural streamcourses.

For a project of this size, the area of natural habitats that could be impacted is extremely small.

8.2.5 Description of recognised sites of conservation interest

There are no gazetted or proposed Sites of Special Scientific Interest or Special Areas within or near the study area.

There are no other known sites of recognized conservation interest (as defined in the Notes accompanying Annex 16 to the draft Technical Memorandum of the EIA Bill) in the proximity of the proposed Tsing Yi North Coastal Road.

8.2.6 Determination of the need for further detailed surveys

The nature and value of any additional surveys would depend on the details of the proposed works. The proposed works do not affect any sites of recognised conservation interest or impact on any sizeable areas of important habitat or affect any rare or protected species.

This report has <u>not</u> highlighted any areas where additional information would be particularly valuable. It is not considered that the resources involved in conducting further specialist studies would be commensurate with the need for additional information.

However, if the proposed Tsing Yi North Coastal Road alignment is amended, then survey needs may change and any survey requirements would need to be reviewed.

8.3 Construction Impacts

8.3.1 Introduction

The existing information reviewed above provides a foundation for the evaluation of baseline ecological conditions within the study area, which then permits impacts to ecological resources to be predicted accurately.

This section describes the methods used for the evaluation of ecological resources in the project, and the results of surveys, which define the baseline ecological conditions within the Scheme. An assessment of impacts arising to these resources during the construction phase of the project is then made.

8.3.2 Potential Impacts of Construction

The proposed works will include the construction of a dual 2-lane carriageway about 2.1km in length linking the Lantau Fixed Crossing with Route 3 and the western approach to Tsing Tsuen Bridge. The main carriageway will comprise four viaducts and be partly on cut or fill slopes.

The works also include the construction of two associated slip roads connecting with Tam Kon Shan Roundabout Interchange and two link roads between the Tam Kon Shan Road and the proposed new carriageway.

Potential ecological impacts could arise from the following:

- loss of habitats due to the construction of the road and associated link and slip roads;
- loss of habitats due to the location of storage and works areas;
- the disposal of the surplus fill;
- the construction temporary access and haul roads during construction;
- any potential construction wastes and potential run off into natural stream courses;
- requirements for water during construction and any potential associated impacts on local streams;
- the possible damage that could be caused to the vegetation as a result of increased incidents of fire;
- the potential damage to surrounding areas from litter and construction materials;

- the potential impact to wildlife caused by increased disturbance.

8.3.3 Evaluation of Potential Construction Impacts

The results of the ecological and habitat surveys provide the template for the evaluation of impacts upon ecological resources predicted to arise from the proposed Tsing Yi North Coastal Road.

In this section, direct impacts such as habitat loss are evaluated, based upon the preliminary designs provided. Indirect impacts to other sites of ecological interest are also assessed.

There are five main areas of land which will be affected by the road proposals:

- the section of the road from the Tam Kon Shan interchange to the commencement of the Cheung Shue Tau Viaduct (approx 3ha);
- the small section between the end of the Cheung Shue Tau viaduct and the commencement of the Yau Kom Tau viaduct (approx 0.9ha);
- the section between the end of the Yau Kom Tau viaduct and the commencement of the Ngau Kok Wan Viaduct (approx 0.6 ha);
- the location of around 40 road column structures constructed on the ground within various habitat types with the road on decked structures above. Gaining access to these piers would also cause impact. Some of the piers will be accessed using the link and slip roads however, information supplied from HyD has indicated that for two Viaducts (Yau Kam Tau Viaduct and Ngau Kok Wan Viaduct) an access road between piers seems necessary;
- the areas of land impacts by the construction of the two link roads between the Tam Kon Shan Road and the new carriageway (estimated at around 2ha.).

The two works areas currently being investigated by HyD for setting up site offices and for storage of construction equipment and materials are both located in urban areas close to the existing Tam Kon Shan Road.

Impact significance is a product of the magnitude and scale of an impact and the asserted importance of the species or habitats likely to be affected.

The general criteria used to evaluate the ecological impacts are those set out in Annex 8 of the draft Technical Memorandum to the EIA Bill. Table 8.3 below provides remarks for each criteria used as it applies to this particular project.

Table 8.3 : Criteria* used to evaluate the ecological impacts of the Tsing Yi North Coastal Road

CRITERIA	REMARKS
Naturalness	There are no truly natural climax habitats present within the Study Area. The habitats least modified are the tall scrub and freshwater streams and these are rated higher in ecological terms that the other habitats present within the EIA study area.
Size	Because of the viaducts, only two very small (0.9ha and 0.6ha) areas and one slightly larger area of land (3.2 ha) will be impacted. The larger area of impact is located in habitats of limited ecological value such as grassland and low scrub and on disturbed areas of land.
Diversity	Survey results indicate that the species diversity of the habitats present on this site is low.
Rarity	No rare or protected flora or fauna have been recorded from this site to date.
Re-creatability	Most of the habitats present on this site are recreatable such as the grassland and low scrub. The two habitats which are more difficult to be re-created are the tall scrub and freshwater streams and these are valued higher.
Fragmentation	As the road is located fairly close to the existing Tam Kon Shan Road and is on viaduct for much of its length, habitat fragmentation is not seen as a major ecological issue.
Typicalness	The habitats located within this study area are typical within the field of ecological variation within Hong Kong. They are generally widespread throughout the Territory and the loss of small areas is not considered to be of major concern.
Position in an ecological unit	The study site lies within a general area of ecological paucity. It is not located in close proximity to a highly valued habitat of another type. Neither is an integral part of an important ecosystem. There are no site of known conservation value on Tsing Yi Island.
Potential value	Factors limiting the site from potentially developing into an area of greater natural conservation interest include: regular burning from hill fires, poor soil conditions, exposure to wind and salt spray, proximity to urban areas and general human disturbance. Its potential to develop into a site of greater nature conservation value is considered to be extremely limited.
Nursery/Breeding Ground	There are no known nursery or breeding grounds within the study area.
Age	The vegetation developed on this site is generally fairly young in nature conservation terms. The tall scrubland which in places is beginning to develop into woodland is considered to be the habitat of most value because of its age.

* Annex 8 of draft the Technical Memorandum to the EIA Bill

Based on the above criteria, the general site is considered to be of low ecological value. The criteria however indicate that the tall scrub and freshwater streams are considered to more highly valued as habitats of greater naturalness, increased species diversity and

being generally more difficult to recreate.

Estimated losses of habitat as a result of the proposed works for the main carriageway on land at Cheung Shue Tau, Yau Kom Tau and Ngau Kok Wan are as follows:

- 1.6 ha of grassland/low scrub
- < 0.2ha tall scrub
- approx 0.5 ha planted woodland
- 0.2ha cultivated land (including orchards)
- <100 m length freshwater streams

* 2.0 ha disturbed land/urban

The detailed design of the link road between the Tam Kon Shan Road and the new carriage way has not yet been undertaken. However, given the levels involved and the size of the road which are both known, it has been possible to made an estimate of the habitat losses as a result of the construction of these link road. These secondary roads are an important key part of the project as they are likely to be used as haul road during construction of the main carriageway and also to gain access to some of the piers.

Estimated habitat loss as a result of the construction of the two link roads are:

- 0.3 ha of grassland/low scrub
- 0.6 ha tall scrub
- 0.95 ha cultivated land (including orchards)
- <100 m length freshwater streams
- 0.2 ha disturbed land/urban

The area of cultivated land impacted by the western link road from the carriageway to the Tam Kon Shan Road is quite extensive and would involve the cutting of a large number of mature orchard trees. However, these are considered to be more of amenity and landscape value than of ecological value. Until the method of construction and the extent of the cut and fill associated with these link roads is known, it is not possible to be more specific about the impacts.

The total area of the more highly valued natural habitats of tall scrub and streams affected is small, with the western link road to the Tam Kon Shan Road causing the most damage to tall scrub habitats. Generally, the larger areas impacted are the habitats of less ecological value.

In addition to the above land, approximately 7 of the columns potentially fall in areas of

tall scrub and 6 fall close to streams. HyD have indicated that the working area for each pier should be approximately 15m x 15m. Gaining access to and between the individual piers, which will be required during construction, would cause additional loss of habitats. From the information available at present, it has not been possible to quantify these losses.

It should also be noted that the construction of the carriageway above Yau Kom Tau is likely to impact on the availability of nesting sites for soft, rock face dwelling birds such as *Halycon smyrnensis* (White-breasted Kingfisher).

8.3.4 Mitigation Measures

Mitigating for the loss of ecological resources is a concern for parts of the project, as noted above, to minimise the loss of species, habitat and ecological function. Potential mitigation measures are proposed and it is anticipated that as many as practicable will be incorporated into the detailed design of the road, where constraints, such as land resumption, topography and development pressures permit. Prescriptive mitigation measures for specific sites are given where possible.

All mitigation measures recommended are considered to be practicable and cost-effective within the context of Hong Kong.

Impact Avoidance

A product of the survey methods used in this study are habitat and ecological constraints maps upon which all key ecological features within the proposed works area are plotted. It is, therefore, possible to note, quickly and accurately, where the proposed road alignment will impact directly upon key ecological features. Thus, it is possible to use the survey maps during the detailed design process to determine the optimal route of the new road.

Using the information gathered in this way is recommended in the detailed design stage, in order to ensure that the minimal loss of habitat is undertaken, within the constraints of the project, as mentioned previously.

Construction methods which would cause ecological impacts should be avoided. With regard to the location of the piers, with an estimated working area of 15m x 15m, it should be possible to avoid the more sensitive ecological habitats. However, more damage to existing habitats is likely to result from gaining access to the pier locations and this is currently been investigated by HyD. The link road will probably be used to gain access to the Cheung Shue Tau viaduct. For the Yau Kam Tau viaduct, the link road will be used but access roads may be required between the link road and the pier sites. An access road between the piers under the Ngau Kok Wan viaduct will probably be required. Access to the Tam Kon Shan viaduct will probably be through the proposed slip roads near the existing Tan Kon Shan roundabout.

Minimization of Impacts

Measures to be adopted to minimise impacts during the construction phase to the

identified ecologically sensitive areas include:

- Fences to be erected on the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into sensitive areas;
- Explicit instructions to the workforce at the works sites concerning the importance of the area for wildlife and the limits of the construction work;
- Regular checks to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas;
- Prevention of the flow of pollutants and sediment into water bodies, including the streams, marshes and ponds within the works boundaries. This will require integration between disciplines working on the drainage impact assessment and drainage engineering design to ensure that the drainage proposed for the road is ecological sensitive and that impacts are minimised;
- High standards of dust control should be implemented to protect wildlife habitats adjacent to work sites;
- Planning of access routes should be undertaken to take account of nearby areas of ecological importance;
- All major works during the construction phase should, where possible be scheduled wherever possible outside the bird breeding season, between March and May. However, this is not seen as a critical factor in this project;
- Restoration and aftercare of temporary construction sites should be undertaken to standards as good as, or better than, the original condition.
- Maintenance of planted areas to remove climbers and ensure the survival of the trees, should be scheduled for the first 5 years.

Compensation for Impacts

Residual losses of habitat and species may be compensated by the incorporation of enhancement features into the design.

To compensate for the loss of tall scrub and planted woodland, and to enhance the ecological value and landscaping scope of the project, it is recommended that replanting be undertaken on temporary works areas and in designated replanting areas. Native species which are known to be resources for other local or migratory species, particularly birds and insects, are the preferred species for replanting (Corlett, 1992) and the species most appropriate for replanting on Tsing Yi are listed in Appendix C.

Specific ecological mitigation for the loss of cultivated and abandoned land and grassland is not considered necessary as these studies have indicated that these are of low ecological value. However, it should be noted that the cultivated land is dominated by

mature orchard trees and compensation for the general loss of trees should be undertaken. This is discussed more fully in the landscape assessment.

Summary of Key Mitigation Measures Recommended

The above mitigation measures should be implemented as far as possible for all the scheme. In addition, Table 8.4 provides a summary of specific recommended mitigation measures for key areas of ecological interest

Table 8.4 : Specific Recommended Mitigation Measures

Habitat or Species	Feature	Mitigation Measure
Tall scrubland	moderate species diversity, habitat of value to birds	Impact avoidance by undertaking minor alterations to route alignment, where possible; minimise damage by confining works and protecting existing vegetation.
Freshwater streams	key habitats of wildlife importance for plants, invertebrates, fish and amphibians.	avoid impacting on key streams where possible; avoid channelling road drainage into locally important streams.
Sandy cliffs	nesting sites for kingfishers	Where cliffs have to be removed during construction, ensure suitable alternative habitat is provided, where possible

In addition to long term habitat loss which is likely to be an impact of the project, temporary construction impacts could result from sedimentation and air quality degradation due to the embankment construction processes. Standard controls on these processes to minimize water quality deterioration, sedimentation and air quality impacts would contribute to minimisation of the short-term habitat degradation.

Other mitigation measures which could be considered to reduce short-term impacts could included:

- avoiding working during the peak rainy season, when major earthmoving and exposure of large volumes of earth/mud would cause the most problems, and making this a requirement of the contract;
- phasing the works so as to ensure that earthworks, if they had to be carried out by the contractor during the peak rainy season, were being carried out in the least sensitive areas.

8.3.5 Construction Impacts Key Issues

At this stage of the design, it has only been possible to identify the key likely impacts of constructing the proposed road and its associated slip and link roads.

For a project of this size, the impacts of the proposed road construction on the general

ecology of the area are predicted to be limited.

The two key issues are the avoidance and protection of the areas of tall scrub within the study area and the long term protection of the freshwater streams. In order to protect the streams, construction will need to be designed so as to avoid any direct impact and methods and timing of works will need to be implemented so as to avoid or limit damage to the streams.

During the design process, the location of the columns, link roads and any haul roads will need to be carefully considered so as to avoid any habitats of local ecological importance, where possible. Habitat disturbance due to piling and construction works for columns is likely to be potentially many times more extensive than the footprint of the column itself. This would be compounded by the necessary access for construction plant to each column site.

Also, in order to ensure the long term viability of the stream, drainage engineering design will need to ensure that no contaminated surface water run-off is channelled into the sensitive streams highlighted as being of local nature conservation interest.

8.4 Operation Impacts

8.4.1 Introduction

Operational impacts of highway projects on terrestrial ecology are typically rather limited. This is especially so when compared to the impacts of the construction works.

In order to appreciate and understand the context for operational impacts, this section identifies and evaluates the potential operational impacts and mitigation measures. The operational impacts are then summarised.

8.4.2 Potential Impacts of Operation

For this proposed road scheme, the following operational impacts could arise:

- habitat fragmentation
- contaminated surface water runoff
- vehicle generated airborne pollution

8.4.3 Evaluation of Potential Operation Impacts

Habitat fragmentation caused by extensive linear projects, such as roads like this, can have adverse ecological implications such as reduction in territory size, availability of local food sources and feeding grounds etc. However, given the location close to urban and disturbed, man-made areas and the elevated nature of the majority of the carriageway, very few extensive habitats are severed by this project. Habitat fragmentation is not considered to be a key issue for this project.

Adverse ecological impacts could occur to watercourse habitats by way of contaminated surface water runoff arising from the road. In the event of spillage or other accidental

discharge onto the road, the impact on streams locally can be devastating. Due to the unpredictability of such events, they cannot realistically be evaluated in a study of this type. Only a limited number of the streamcourses crossing the line of the road are of significant ecological value at present. These are mainly located at the western end of the proposed road.

Due to the likely density of industrial vehicular traffic on this road (this being a main purpose of the road), incidents may be more than usually common and significant. It will be necessary, for the limited number of streams of downstream ecological importance, to undertake mitigation measures to account for this.

As the road mainly passes well above the more natural habitats, detrimental effects from vehicle generated air pollution on adjacent vegetation, their growth rates and general well being, is not ecologically significant in this case.

8.4.4 Mitigation Measures

From the ecological viewpoint, there are very few habitats of ecological value likely to be affected by operational issues. The main operational issue which needs to be addressed is the contaminated runoff potentially affecting the key streams of local ecological value (identified in Figure 8.1). Consideration should be given to designing the road drainage so that contamination and spillage is intercepted within the boundary of the highway. Techniques such as the use of petrol interceptors, silt traps etc. should be specified for these sections of the road and sufficient upstands/curbs at the roadside should be introduced to contain any spillages within the road.

8.4.5 Operation Impacts Key Issues

Providing the scheme is designed from the initial stages to accommodate the long-term retention of and suitable management for the key areas of ecological interest, the operation phase of the project should not impact on any issues of ecological importance.

8.5 Conclusions

This study was undertaken to assess the impacts to ecological resources arising from the construction and operation of the proposed Tsing Yi North Coastal Road.

Basic ecological and habitat surveys using standard methods were carried out. These methods provided baseline ecological information on which to assess potential impacts. No sites of known conservation interest are located on or near the proposed road.

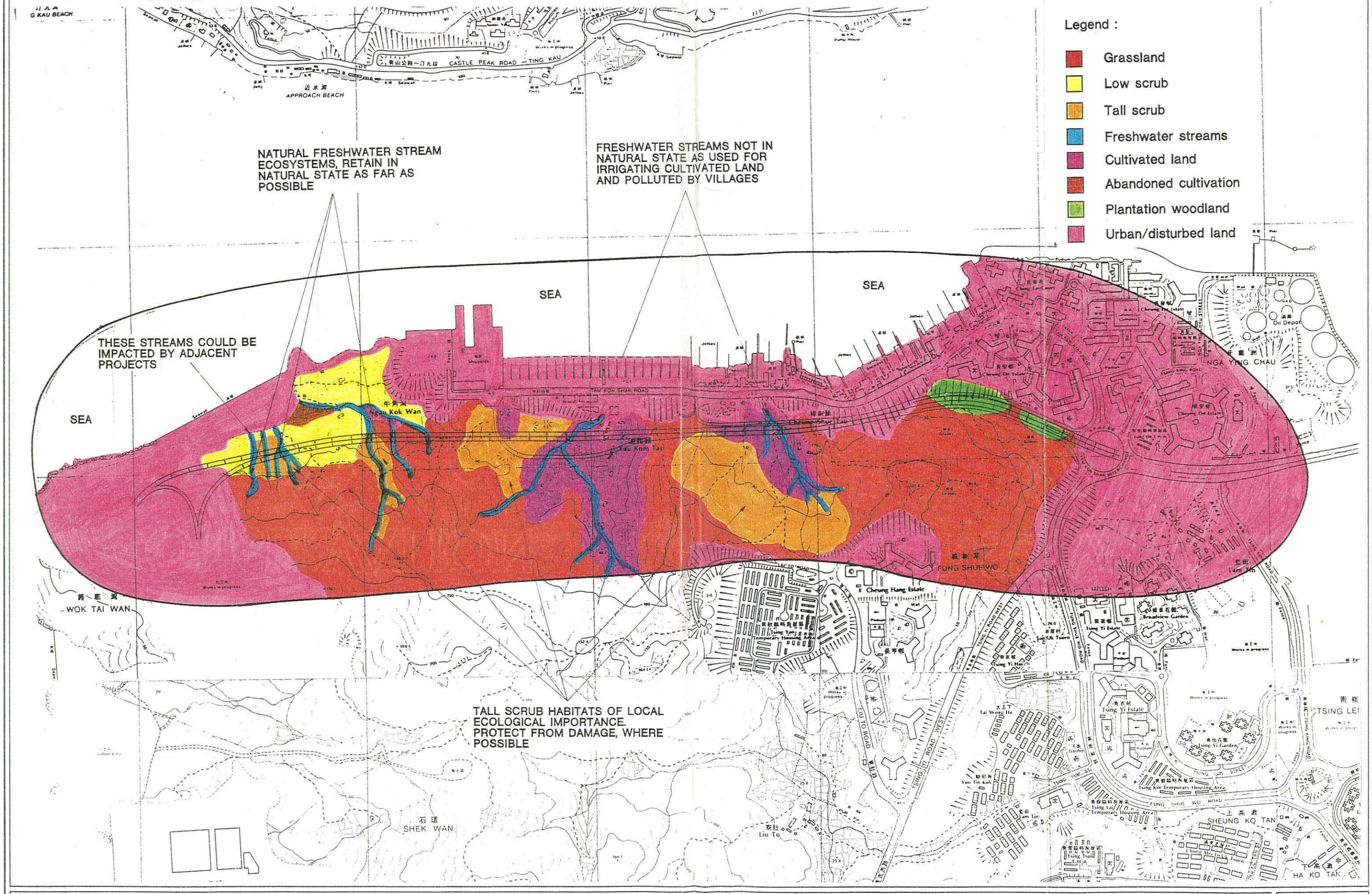
Based on the data provided and the engineering designs available, likely ecological impacts of the Tsing Yi North Coastal Road have been predicted. The key impacts will arise during the construction phase of the Project.

Much of the proposed road is on elevated structure and will not impact greatly on the existing vegetation.

Most of the scheme passes through or over existing habitats which have been assessed as of low ecological interest. Impacts in these areas will be minimal.

Other small sections of the proposed road impact areas of local ecological interest. These are the proposed road works located on small areas of natural tall scrub and the impacts on a limited number of small freshwater streams. The link road from the proposed new carriageway to the Tam Kon Shan Road would also impact on habitats of local importance. Mitigation measures have been suggested for these sections. Providing these mitigation measures are adopted and the schemes are designed to accommodate the long-term retention plus suitable management of the key features of ecological interest, the project should not cause unacceptable residual impacts.

No part of the proposed scheme is considered to impact on areas of high ecological interest.



The Basic Habitat Types in the Study Area of Tsing Yi North Coastal Road

Mouchel

Drawing No. 8.1

9.0 ENVIRONMENTAL MONITORING AND AUDIT

9.1 Purpose

9.1.1 The purpose of this chapter is to outline the procedures of the EM&A programme for monitoring the environmental performance of the Tsing Yi North Coastal Road construction activities, to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. However, EM&A programme is not needed during the operation phase of the Tsing Yi North Coastal Road. Water monitoring is not required during construction and operation phase of the Tsing Yi North Coastal Road. Monitoring and audit works are not required in the Drainage Impact Assessment (DIA) Study.

9.1.2 The Hong Kong Government's applicable environmental regulations for noise, air quality, water quality and waste, the Hong Kong Planning Standards and Guidelines, and recommendations in the Tsing Yi North Coastal Road EIA study report have served as guidance documents in the preparation of this chapter. This chapter fullfills the requirements of the Study Brief Clause 6.3.7 and follows the approach recommended in EPD's Generic EM&A Manual. The revised project scope is clearly stated in Section 2.1.

9.1.3 This chapter contains the following as required in Clause 6.3.7 of the Study Agreement:

(a) identification and recommendations for monitoring requirements for all phases of development, including :
- identification of sensitive receivers;
- monitoring locations;
- monitoring parameters and frequencies;
- monitoring equipment to be used;
- other necessary programmes for baseline monitoring and impact monitoring; and
- data management of monitoring results.

(b) the organisation and management structure, and procedures for auditing of the project and implementation of mitigation measures that are recommended for the project;

(c) the environmental quality performance limits for compliance auditing for each of the recommended monitoring parameters to ensure compliance with relevant environmental quality objectives, statutory or planning standards;

(d) organisation and management structure, and procedures for reviewing the design submissions, monitoring results and auditing the compliance of the monitoring data with the environmental quality performance limits, contractual and regulatory requirements, and environmental policies and standards;

(e) Event and Action plans for impact and compliance procedures;

(f) complaints handling, liaison and consultation procedures; and

(g) interim notification of exceedances, reporting procedures, report formats and reporting frequency including periodical quarterly summary reports and annual reviews to cover all construction, post-project and operational phases of the development.

9.2 Project Organization

9.2.1 The Highways Department of the Hong Kong Government is referred to as the "Employer" and the Project "Engineer". The Employer will designate an Engineer's Representative who will be responsible for the supervision of the construction of the project.

9.2.2 The Contractor who will be undertaking the construction shall be required to employ an Environmental Specialist to carry out the environmental monitoring including field measurements, sampling, laboratory testing, analysis of monitoring results, reporting and auditing. The Environmental Specialist shall be approved by the Engineer and the Director of the Environmental Protection Department (DEP). The ES shall be competent and shall have relevant environmental monitoring and audit experience on projects of a similar scale and nature.

9.2.3 The Environmental Specialist shall report directly to the Engineer's Representative and the DEP, and shall have the responsibility of carrying out the environmental monitoring and reporting. Details of the Environmental Specialist to be employed by the Contractor shall be submitted to the Engineer and DEP for approval prior to appointment. The Contractor shall not terminate the service of the approved Environmental Specialist unless a suitable replacement has been approved by the Engineer and the DEP so as to ensure no disruption to the monitoring and audit work. The Environmental Specialist shall not be in any way an associated company of the Contractor.

9.2.4 An Independent Environmental Auditor shall be employed by the Contractor and be approved by the Engineer. He/She shall provide an independent assessment of all environmental work and the Contractor's implementation of environmental mitigation measures required as part of the EIA. The Independent Environmental Auditor should have the relevant experience to audit all the monitoring data.

9.3 Construction Programme

9.3.1 The construction works for Tsing Yi North Coastal Road are anticipated to be commenced in September 1998 and shall cover a total period of approximately three years finishing in 2001. The construction activities are expected to be carried out 11 hours a working day and shall be between the hours of 08:00 to 19:00. It is not expected that there shall be any major works in the evenings, at night or on Sundays or public holidays. The environmental monitoring works should start at the commencement of the construction contract and up to the issue of the completion certificate.

9.4 Air Quality

9.4.1 Air Quality Parameters

Monitoring of the Total Suspended Particulates (TSP) levels shall be carried out by the Environmental Specialist to ensure that construction works are not generating dust which exceeds the acceptable level. The monitoring work shall be audited by the Independent Environmental Auditor.

1-hour and 24-hour TSP levels shall be measured to indicate the impacts of construction dust on air quality. The TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B. Upon approval by the Engineer's Representative and Independent Environmental Auditor, 1-hour TSP levels may be measured by direct reading methods.

All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and other special phenomena and work progress of the concerned site etc. shall be recorded in detail by the Environmental Specialist. A sample data sheet is shown in Figure 9.1.

9.4.2 Monitoring Equipment

A high volume sampler in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:

(a) 0.6-1.7 m^3/min (20-60 SCFM) adjustable flow range;
(b) equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;
(c) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
(d) capable of providing a minimum exposed area of 406 cm^2 (63 in^2);
(e) flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;
(f) equipped with a shelter to protect the filter and sampler;
(g) incorporated with an electronic mass flow rate controller or other equivalent devices;
(h) equipped with a flow recorder for continuous monitoring;
(i) provided with a peaked roof inlet;
(j) incorporated with a manometer;
(k) able to hold and seal the filter paper to the sampler housing at horizontal position;
(l) easy to change the filter; and
(m) capable of operating continuously for 24-hr period.

The Contractor shall be responsible for provision of the monitoring equipment and shall ensure that sufficient number of high volume samplers with an appropriate calibration kit are available for carrying out the baseline monitoring, impact monitoring and ad hoc monitoring. The high volume samplers shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labelled by the

Environmental Specialist.

Initial calibration of dust monitoring equipment shall be conducted by the Environmental Specialist upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference. All the data shall be converted into standard temperature and pressure condition.

The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded down in the data sheet as mentioned in Section 9.4.1.

If the Environmental Specialist proposes to use a direct reading dust meter to measure 1-hr TSP levels, sufficient information shall be provided to the Independent Environmental Auditor and Engineeer's Representative to prove that the instrument is capable of achieving a comparable result with the high volume sampler. The instrument should also be calibrated regularly, and the 1-hr sampling shall be determined periodically by high volume sampling to check the validity and accuracy of the results measured by direct reading method.

Wind data monitoring equipment shall also be provided by the Contractor and set up at appropriate locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the Environmental Specialist and agreed with by the Engineer's Representative and Independent Environmental Auditor.

For installation and operation of wind data monitoring equipment, the following points shall be observed:

(a) the wind sensors should be installed on masts at an elevated level 10 m above ground so that they are clear of obstructions or turbulence caused by the buildings;
(b) the wind data should be captured by a data logger and to be downloaded for processing at least once a month;
(c) the wind data monitoring equipment should be re-calibrated at least once every six months; and
(d) wind direction should be divided into 16 sectors of 22.5 degrees each.

In exceptional situations, the Environmental Specialist may propose alternative methods to obtain representative wind data upon approval from the Independent Environmental Auditor and Engineer's Representative and agreement from the EPD.

9.4.3 Laboratory Measurement/Analysis

A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, shall be used for sample analysis, and equipment calibration and maintenance. The laboratory shall be HOKLAS accredited.

If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the Engineer's

Representative and the measurement procedures shall be witnessed by the Independent Environmental Auditor and the Engineer's Representative. The Environmental Specialist shall provide the Engineer's Representative with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for reference.

Filter paper of size 8"x10" shall be labelled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.

After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper shall then be returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

All the collected samples shall be kept in a good condition for 6 months before disposal.

9.4.4 Monitoring Locations

The air quality sensitive receivers and the three dust monitoring locations are shown on Figure 9.2. Three air quality monitoring stations are sufficient which will cover the whole Study Area for dust impact measurements. The status and locations of dust sensitive receivers may change after issuing this manual. If such cases exist, the Environmental Specialist shall propose updated monitoring locations and seek approval from the Independent Environmental Auditor and Engineer's Representative and agreement from EPD on the proposal.

When alternative monitoring locations are proposed, the following criteria shall be followed:

(a) at the site boundary or such locations close to the major dust emission source;
(b) close to the sensitive receptors; and
(c) take into account the prevailing meteorological conditions.

The Environmental Specialist shall agree with the Independent Environmental Auditor and the Engineer's Representative on the position of the high volume samplers for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:

(a) a horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
(b) the distance between the sampler and an obstacle, such as buildings, shall be at least twice the height that the obstacle protrudes above the sampler;
(c) a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
(d) a minimum of 2 metre separation from any supporting structure, measured horizontally is required;
(e) no furnace or incinerator flue is nearby;
(f) airflow around the sampler is unrestricted;
(g) the sampler is more than 20 metres from the dripline;

(h) any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;
(i) permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
(j) a secured supply of electricity is needed to operate the samplers.

Prior to Project construction the construction schedule shall be established and the dust monitoring schedule shall be developed by the Environmental Specialist. The environmental monitoring schedule shall be approved by the Independent Environmental Auditor and the Engineer's Representative.

9.4.5 Baseline Monitoring

The Environmental Specialist shall carry out baseline monitoring at all of the designated monitoring locations for at least 14 consecutive days prior to the start of the construction works to obtain daily 24-hr TSP samples. 1-hr sampling shall also be carried out at least 3 times per day during the same period.

During the baseline monitoring, there should not be any construction with or dust generation activities in the vicinity of the monitoring stations.

In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the Environmental Specialist shall carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the Independent Environmental Auditor and the Engineer's Representative and agreed with EPD.

In the event that insufficient baseline monitoring data or questionable results are obtained, the Environmental Specialist shall liaise with the Independent Environmental Auditor and EPD to agree on an appropriate set of data to be used as a baseline reference and submit this data to the Engineer's Representative and Independent Environmental Auditor for approval.

Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. If the Independent Environmental Auditor considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should a change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, shall be revised. The revised baseline levels and air quality criteria shall be agreed with the Independent Environmental Auditor and EPD.

9.4.6 Impact Monitoring

The Environmental Specialist shall carry out impact monitoring during the course of the works. For regular impact monitoring, the sampling frequency of at least once in every six-days shall be strictly observed at all the monitoring stations for 24-hr TSP monitoring. For 1-hr TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs.

The specific time to start and stop the 24-hr TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.

In case of non-compliance with the air quality criteria, more frequent monitoring, as specified in the Action Plan in Section 9.4.7, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

9.4.7 Event and Action Plan for Air Quality

The baseline monitoring results will form the basis for determining the air quality criteria for the impact monitoring. The Environmental Specialist shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. Table 9.1 shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occur, the Environmental Team (comprising the Environmental Specialist and Independent Environmental Auditor), the Engineer's Representative and the Contractor shall undertake their specified actions in accordance with the Action Plan shown on Figure 9.3.

Table 9.1 Action and Limit Levels for Air Quality

Parameters	Action	Limit
24 Hour TSP Level in $\mu g/m^3$	For baseline level < 108 $\mu g/m^3$, Action level = average of baseline level plus 30% and Limit level For baseline level > 108 $\mu g/m^3$ and baseline level < 154 $\mu g/m^3$, Action level = 200 $\mu g/m^3$ For baseline level > 154 $\mu g/m^3$, Action level = 130% of baseline level	260
1 Hour TSP Level in $\mu g/m^3$	For baseline level < 154 $\mu g/m^3$, Action level = average of baseline level plus 30% and Limit level For baseline level > 154 $\mu g/m^3$ and baseline level < 269 $\mu g/m^3$, Action level = 350 $\mu g/m^3$ For baseline level > 269 $\mu g/m^3$, Action level = 130% of baseline level	500

9.4.8 Dust Mitigation Measures

The EIA report has recommended dust control and mitigation measures. The Contractor shall be responsible for the design and implementation of the following measures:

(a) watering is carried out two times a day on unpaved roadways;
(b) watering of the haul roads for every 1.5 hours should be carried out during hauling and construction activities to mitigate the dust impacts at the air sensitive receivers;
(c) watering is implemented to control dust where breaking of oversized rock or concrete is required;
(d) in areas that are subject to movement of fill materials and at active cuts, water spay shall be used to control dust;
(e) during loading and unloading of extra cut or fill materials, the materials shall be controlled to a practical height to minimise the fugitive dust arising;
(f) during transporation by truck, materials shall not be loaded to a level higher than the side and tail boards and shall be dampened or covered before transport;
(g) ensure that all stockpiles of aggregate or soil are enclosed or covered and watered two times per day;

If the above measures are not sufficient to restore the air quality to acceptable levels upon the advice of the Independent Environmental Auditor, the Contractor shall liaise with the Environmental Specialist on other mitigation measures, propose these measures to the Independent Environmental Auditor and Engineer's Representative for approval, and implement the measures.

9.5 Noise

9.5.1 Noise Parameters

The construction noise level shall be monitored by the Environmental Specialist and shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq (30 min) shall be used as the monitoring parameter for the time period between 0800-1900 hours on normal weekdays. For all other time periods, Leq (5 min) shall be employed for comparison with the NCO criteria.

As supplementary information for data auditing, statistical results such as L_{10} and L_{90} shall also be obtained for reference and shall be recorded by the Environmental Specialist. A sample data record sheet is shown in Figure 9.4 for reference.

9.5.2 Monitoring Equipment

As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring.

Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0dB.

Noise measurements shall not be made in the presence of fog, rain, wind with a steady speed exceeding $5ms^{-1}$ or wind with gusts exceeding $10ms^{-1}$. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

The Contractor will be responsible for the provision of the monitoring equipment. The Contractor shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

9.5.3 Monitoring Locations

The representative three noise monitoring stations which will cover the whole Study Area for construction noise survey are shown on Figure 9.5. If the status or locations of noise sensitive receivers change after issuing this manual, the Environmental Specialist shall propose the updated monitoring locations and seek approval from the Independent Environmental Auditor, the Engineer's Representative and agreement from EPD of the proposal to ammend the monitoring locations.

When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria:

(a) monitoring at sensitive receivers close to the major site activities which are likely to have noise impacts;

(b) monitoring at the noise sensitive receivers as defined in the Technical Memorandum; and
(c) ensurance of minimal disturbance to the occupants during monitoring.

The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made.

The Environmental Specialist shall agree with the Independent Environmental Auditor and the Engineer's Representative on the monitoring position and the corrections adopted.

The baseline monitoring and the impact monitoring shall be carried out at the same positions.

The Contractor shall establish the construction equipment list and construction schedule which shall be checked and approved of by the Independent Environmental Auditor and the Engineer's Representative.

The timing of the noise monitoring work shall be developed by the Environmental Specialist and approved of by the Independent Environmental Auditor, the Engineer's Representative and EPD and shall be based on the Contractors construction schedule.

9.5.4 Baseline Monitoring

The Environmental Specialist shall carry out one set of baseline noise monitoring prior to the commencement of the construction work over as 24 hour period. The baseline monitoring shall be carried out daily for a period of at least two weeks and shall be taken no earlier than three weeks prior to construction works being carried out.

In no circumstance should construction works be carried out within the influences of the monitoring stations during the two weeks of baseline monitoring.

The schedule on the baseline monitoring shall be submitted to the ER for approval before the monitoring starts.

Any non Project related construction activities in the vicinity of the stations during the baseline monitoring shall be noted, including the source and location.

9.5.5 Impact Monitoring

Noise monitoring shall be carried out at the designated monitoring stations once construction has commenced on a once a week basis.

Construction works are to be restricted to daytime hours. Therefore, during construction works, one set of measurements between 0800-1900 hours on normal weekdays shall be taken. There will be no construction works on Sundays or on public holidays.

For the Queen's College Old Boys' Association Secondary School, noise monitoring

shall be carried out at this NSR three times a week during school examination periods. The Environmental Specialist shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 9.5.6 shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

9.5.6 Event and Action Plan for Noise

The Action and Limit levels for construction noise are defined in Table 9.2. Should non-compliance of the criteria occur, action in accordance with the Action Plan shown on Figure 9.5 shall be carried out.

Table 9.2 Action and Limit Levels for Construction Noise

Time Period	Action	Limit
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A)
2300-0700 hrs of next day		45/50/55** dB(A)

* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.
** to be selected based on Area Sensitivity Rating.

9.5.7 Noise Mitigation Measures

Chapter 4 has recommended construction noise control and mitigation measures to reduce noise levels from project construction. The Contractor shall be responsible for the design and implementation of the following measures.

(a) construction shall be carried out during regular daytime hours (0800-1900) only within the area of influence of NSR;
(b) good site practices to limit noise emissions at the source should be implemented;
(c) simultaneous noisy activities should be avoided;
(d) quiet plant and working methods should be used;
(e) silencers should be installed at exhaust pipes of the dump trucks;
(f) mufflers should be installed at the rock drills (hydraulic) and pneumatic breakers;
(g) aucoustic eclosures should be installed for the concrete pumps and generators;
(h) reduction in the number of plant operating in critical areas close to NSRs;
(i) temporary noise barriers along the construction site boundary which have no openings or gaps and have a mimimum transmission loss of 10 dB(A) and are designed such that the construction equipment will be totally screened shall be used.

If the above measures are not sufficient to restore the construction noise quality to an

acceptable levels upon the advice of Environmental Specialist, the Contractor shall liaise and gain approval from the Independent Environmental Auditor and Engineer's Representative on other mitigation measures, proposed to reduce noise levels to an acceptable level and carry out these measures.

The measures may include but not be limited to ammendments to the construction schedule to restrict noisy equipment to certain time periods and restricting the type of equipment that can be used during construction at any one time.

9.5.8 Monitoring During Operation Phase

Noise monitoring works under the EM&A programme is not required during the operational phase due to the following reasons:

i) The residual noise levels under our study are estimated using the traffic data up to year 2016 which is the worst scenario within 15 years after the commissioning of new carriageways. By year 2016, the traffic flow along the 2 slip roads and Tam Kon Shan Roundabout will be nearly saturated. Therefore, we have confidence that the calculated residual noise levels under our study will be at the upper bound of the estimate and the actual noise levels at the NSRs after the operation of TYNCR will not be greater than those as predicted under our Study. Therefore, it is considered that noise monitoring during the operational phase is not necessary.

ii) Besides, the resources for implementing noise monitoring works during the operational phase will be a great problem. The civil works contractor under Highways Department will be able to carry out the monitoring works only within the first year after the operation of TYNCR, i.e. up to end 2002. However, as the traffic flows during this year will be far lower than those in year 2016 which have been assumed in the study, the noise monitoring results during this year will have little value.

After the year 2002, it will be difficult to find suitable resources to carry out the monitoring works.

9.6 Waste Management

9.6.1 Waste Management

The Contractor is responsible for waste control within the construction site, removal of the waste material produced from the site and implementation of any mitigation measures to minimise waste or redress problems arising from the waste from the site. The waste material may include any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the site onto any adjoining land, storm sewer, sanitary sewer, or any waste matter or refuse to be deposited anywhere within the site or onto any adjoining land.

9.6.2 Waste Management Mitigation Measures

When handling the waste material, the following measures shall be undertaken by the Contractor as listed in the project EIA:

(a) excavated mateirals shall be re-used wherever possible;
(b) general construction waste and demolition wate shall be sorted on-site to remove materials which are suitable for re-cycling or use in public dumps and the remaining material shall be disposed of at the nearest landfill site;
(c) the Contractor shall registed with EPD as a chemical waste producer under the Waste Disposal (Chemical Waste) (General) regulation.
(d) a licensed Contractor shall be employed to collect chemical waste for delivery to a licensed treatment facility.
(e) suitable chemical containment waste storage areas shall be formed on the site for temporary storage pending collection;
(f) for general refuse, temporary storage areas for general refuse shall be enclosed and refuse shall be sored on site for the miminum time practical and shall be disposed of at the nearest landfill;
(g) sewage arisings from the construction workforce shall be discharged to foul sewers where possible and shall comply with the requirements of the Technical memorandum "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters."
(h) sewage arising from chemical toilets shall be transported by a licensed Contractor to Government Sewerage Treatment Works for disposal.

The Contractor shall comply with the Waste Disposal Ordinance, the Dumping at Sea Ordinance, the Public Health and Municipal Services Ordinance and the Water Pollution Control Ordinance, and carry out the appropriate waste management work. The relevant licence/permit, such as the effluent discharge licence, the chemical waste producer registration, etc. shall be obtained. The Contractor shall refer to the relevant booklets issued by EPD when applying for the licence/permit.

During the site inspections and the document review procedures, the Environmental Auditor and Engineer's Representative shall pay special attention to the issues relating to waste management, and check whether the Contractor has followed the measures as listed above, the relevant contract specifications and the procedures specified under the laws of Hong Kong.

9.7 Ecology

9.7.1 Ecology Parameters

The EIA identified the potential for construction works to impact local ecology in the study area. Although the ecological impact assessment did not find areas located within the project site that were considered to be of high ecologically significance, the EIA did recommend measures to reduce the potention of impact to the general ecology of the area.

9.7.2 Ecology Mitigation Measures

The Contractor is responsible for avoiding potential impacts to ecology in the vicinity of the construction site, and shall implement the following mitigation measures to minimise ecolgical impacts.

(a) fences shall be erected on the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into sensitive areas;
(b) explicit instructions to the workforce at the works sites concerning the importance of the area for wildlife and the limits of the construction work;
(c) regular checks to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas;
(d) high standards of dust control shall be implemented to protect wildlife habitats adjacent to work sites;
(e) planning of access routes shall be undertaken to take account of nearby areas of ecological importance;
(f) all major works during the construction phase shall, where possible, be scheduled outside the bird breeding season, between March and May;
(g) restoration and aftercare of temporary construction sites shall be undertaken to standards as good as, or better than, the original condition;
(h) for freshwater streams which are key habitats of wildlife importance for plants, invertebrates, fish and amphibians, the Contractor shall avoid impacting on key streams where possible; avoid channelling road drainage into locally important streams;
(i) other mitigation measures to reduce short-term impacts should included:
- avoiding working during the peak rainy season, when major earthmoving and exposure of large volumes of earth/mud would cause the most problems, and making this a requirement of the contract;
- phasing the works so as to ensure that earthworks, if they had to be carried out by the contractor during the peak rainy season, are being carried out in the least sensitive areas.

During the site inspections and the document review procedures as mentioned in Section 9.9, the Independent Environmental Auditor shall pay special attention to the issues relating to ecology, and check whether the Contractor has followed the measures as listed above, the relevant contract specifications and the procedures specified under the laws of Hong Kong.

9.7.3 Ecological Monitoring and Audit

The purposes of ecological monitoring and audit are:

- to verify the accuracy of the predictions of the EIA study
- to detect any unpredicated ecological impacts arising from the proposed road construction; and
- to monitor the successfulness of the mitigation measures

Ecological Monitoring during Construction Phase

Ecological monitoring should be undertaken as a binding contract requirement.

In addition to landscape tasks, the primary ecological monitoring tasks should be:-

- briefing and training of construction contractors'/subcontractors' crews
- attend site meetings to agree working methods etc. prior to work commencing on site and to highlight areas of ecological importance
- marking special areas and features to be avoided and advising on the methods and details of protection
- liaising with survey and construction crews to modify layouts as needed to avoid sensitive areas,
- monitoring and reporting performance of construction crews through the submission of regular monthly progress reports
- immediately correcting situations which violate the intent of the mitigation plan.

Before commencement of any works on site or any setting out of works or storage areas, the baseline ecological surveys should be checked against final rehabilitation proposals to ensure minimum damage to existing vegetation and streams. It will be necessary to rope off and protect specific plants or habitats of special interest identified during the ecological surveys. The habitat and ecological constraints maps should enable this to be carried out effectively.

The programme of monitoring and audit from an ecological prospective will need to be integrated with the overall monitoring and audit plan for the project as a whole. For example, during construction water quality will need to be monitored regularly both for ecological and pollution control reasons. Parameters to be quantified and the sampling schedule should be defined prior to commencement of construction. Analysis should be conducted through a certified testing laboratory. Field testing of these parameters should be conducted by the monitoring team. If activities appear likely to cause exceedence of water quality objective limits which could affect the ecosystem, work should cease or be modified to rectify the problem. These issues should be required to be part of the contractual obligations of the contract.

Ecological Monitoring during Operation

Of potential concern during the early years of operation could be erosion of recently revegetated areas. This should be monitored visually, especially following storms and corrective measures should take place. Sediment loads should be quantified as part of the water quality sampling programme.

Contamination of surface and ground water by chemicals should not be a problem if chemicals are not used. Because of the limited importance of the site for wildlife, it is not considered necessary to maintain close liaison with local nature conservation experts.

Success of the replanting should be monitored by regular visual inspections and special care should be taken to ensure that any damaged, diseased or dying trees or shrubs are replaced as required. A detailed programme of visits should be agreed prior to commencement of the contract but is likely to be at least twice a year during the maintenance period.

Monitoring and Auditing of Mitigation

Mitigation measures should be audited to ensure effective implementation and to quantify results. Detailed monitoring plans should be developed to assess the progress of mitigation and modifications to plans made according to monitoring results. There will be an opportunity to benefit from experiences gained in early stages of the contract.

9.8 Site Environmental Audit

9.8.1 Site Inspections

Site Inspections shall be undertaken regularly to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. The recommended frequency of inspection is at least once per week, preferably three times per week.

The Independent Environmental Auditor is responsible for carrying out site inspections.

Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the site area and should also include the environmental conditions outside the site which are likely to be affected, directly or indirectly, by the site activities.

The Independent Environmental Auditor shall make reference to the following information while conducting the inspections:

(a) the EIA recommendations on environmental protection and pollution control mitigation measures as stated in this report;
(b) work progress and programme;
(c) individual works methodology proposals;
(d) the contract specifications on environmental protection;
(e) the relevant environmental protection and pollution control laws;
(f) previous site inspection results; and

(g) environmental monitoring data.

The Contractor shall update the Independent Environmental Auditor with all relevant information on the construction works to for carrying out the site inspections. The site inspection results and associated recommendations on improvements to the environmental protection and pollution control works shall be submitted by the Independent Environmental Auditor to the Engineer's Representative and the Contractor within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection.

Ad hoc site inspections shall also be carried out if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

9.8.2 Compliance with Legal and Contractual Requirements

There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong which the construction activities shall comply with.

In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the Engineer's Representative for approval shall be sent to the Independent Environmental Auditor for vetting to see whether sufficient environmental protection and pollution control measures have been included.

The Independent Environmental Auditor shall also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that the any foreseeable potential for violating the laws can be prevented.

The Contractor shall regularly copy relevant documents to the Environmental Specialist and Independent Environmental Auditor so that the checking work can be carried out. The document shall include at minimum the updated Work Progress Reports, the updated Works Programme, the application letters for different licence/permits under the environmental protection laws, and all the valid licence/permit. The site diaries shall also be available for the Independent Environmental Auditor's inspection upon his request.

After reviewing the document, the Independent Environmental Auditor shall advise the Engineer's Representative and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. The Independent Environmental Auditor shall advise the Contractor and the Engineer's Representativeon the current status on licence/permit application and any environmental protection and pollution control preparation works that may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements.

Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The Engineer's Representative and Independent Environmental Auditor shall follow up to ensure that appropriate action has been taken by the Contractor in order

that the environmental protection and pollution control requirements are fulfilled.

9.8.3 Environmental Complaints

Complaints shall be referred to the Environmental Specialist for carrying out complaint investigation procedures, the Independent Environmental Auditor shall audit the performance of the Environmental Specialist undertaking the response procedures.

The Environmental Specialist shall undertake the following procedures upon receipt of the complaints:

(a) log complaint and date of receipt onto the complaint database;
(b) investigate the complaint and discuss with the Independent Environmental Auditor to determine its validity, and to assess whether the source of the problem is due to works activities;
(c) if a complaint is considered valid by the Independent Environmental Auditor and due to works, the Environmental Specialist shall identify mitigation measures;
(d) if mitigation measures are required, the Environmental Specialist shall advise the Contractor accordingly;
(e) review the Contractor's response on the identified mitigation measures, and the updated situation;
(f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
(g) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;
(h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD); and
(i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

During the complaint investigation work, the Contractor and Engineer's Representative shall cooperate with the Environmental Team (consisting of the Environmental Specialist and Independent Environmental Auditor) in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation measures. The Independent Environmental Auditor and Engineer's Representative shall approve of the proposal mitigation measures and check that the measures have been carried out by the Contractor.

9.9 Reporting

9.9.1 General

The following reporting requirements based upon a paper documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the Engineer's Representative and EPD. The reports are required to be prepared by the Environmental Specialist. All reports shall be approved of in writing by the Independent Environmental Auditor and EPD.

9.9.2 Baseline Monitoring Report

The Environmental Specialist shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to four parties: the Contractor, the Engineer's Representative, the Independent Environmental Auditor and the EPD. The Environmental Specialist shall liaise with the relevant parties on the exact number of copies they want.

The baseline monitoring report shall include at least the following:

(a) up to half a page executive summary;
(b) brief project background information;
(c) drawings showing locations of the baseline monitoring stations;
(d) monitoring results (in both hard and diskette copies) together with the following information:
  - monitoring methodology;
  - equipment used and calibration details;
  - parameters monitored;
  - monitoring locations (and depth);
  - monitoring date, time, frequency and duration;
(e) details on influencing factors, including:
  - major activities, if any, being carried out on the site during the period;
  - weather conditions during the period;
  - other factors which might affect the results;
(f) determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data;
(g) revisions for inclusion in the EM&A Manual; and
(h) comments and conclusions.

9.9.3 Monthly EM&A Reports

The results and findings of all EM&A work required in this Manual shall be recorded in the Monthly EM&A Reports prepared by the Environmental Specialist. The Monthly EM&A Reports shall be prepared and submitted within 10 working days of the end of each reporting month, with the first report due the month after construction commences. A maximum of 4 copies of each Monthly EM&A Report shall be submitted to each of the four parties: the Contractor, the Engineer's Representative and Independent Environmental Auditor and the EPD. Before submission of the first EM&A Report, the Environmental Specialist shall liaise with the parties on the exact number of copies and format of the reports in both hard copy and electronic medium.

The Environmental Specialist shall review the monitoring programme every 6 months or on as needed basis in order to cater for the changes in surrounding environment and nature of works in progress and shall document all observation in the monthly report.

9.9.4 First Monthly EM&A Report

The first monthly EM&A report shall include at least the following :

(a) 1-2 pages executive summary;
(b) basic project information including a synopsis of the project organisation, programme and management structure, and the work undertaken during the month;
(c) a brief summary of EM&A requirements including:
- all monitoring parameters;
- environmental quality performance limits (Action and Limit levels);
- Event-Action Plans;
- environmental mitigation measures, as recommended in the project EIA study final report;
- environmental requirements in contract documents;
(d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;
(e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
(f) monitoring results (in both hard and diskette copies) together with the following information;
- monitoring methodology
- equipment used and calibration details
- parameters monitored
- monitoring locations (and depth)
- monitoring date, time, frequency, and duration;
(g) graphical plots of trends of monitored parameters over the past four reporting periods for representative monitoring stations annotated against the following:
- major activities being carried out on site during the period;
- weather conditions during the period; and
- any other factors which might affect the monitoring results;
(h) advice on the solid and liquid waste management status;
(i) a summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels) that have been provided by the Independent Environmental Auditor;
(j) a review of the reasons for and the implications of noncompliance including review of pollution sources and working procedures;
(k) a description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;
(l) a summary record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints; and
(m) An account of the future key issues as reviewed from the works programme and work method statements.

9.9.5 Subsequent Monthly EM&A Reports

The subsequent monthly EM&A reports shall include the following :

(a) title page
(b) executive summary (1-2 pages)
- breaches of all Action and Limit levels;
- complaint log;

- reporting changes; and
- future key issues

(c) contents page

(d) environmental status:
- drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- summary of non-compliance with the environmental quality performance limits; and
- summary of complaints

(e) environmental issues and actions
- review issues carried forward and any follow-up procedures related to earlier non-compliance (complaints and deficiencies);
- description of the actions taken in the event of noncompliance and deficiency reporting;
- recommendations (should be specific and target the appropriate party for action); and
- implementation status of the mitigatory measures and the corresponding effectiveness of the measures

(f) future key issues

(g) appendix
- action and limit levels;
- graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following: major activities being carried out on site during the period; weather conditions during the period; and any other factors which might affect the monitoring results;
- monitoring schedule for the present and next reporting period;
- cumulative complaints statistics; and
- details of complaints, outstanding issues and deficiencies.

9.9.6 Quarterly EM&A Summary Reports

The Environmental Specialist shall submit Quarterly EM&A Summary Reports which should be around 5 pages (including about 3 of text and tables and 2 of figures) and shall contain at minimum the following information:

(a) up to half a page executive summary;

(b) basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;

(c) a brief summary of EM&A requirements including:
- monitoring parameters;
- environmental quality performance limits (Action and Limit levels); and
- environmental mitigation measures, as recommended in the project EIA study final report;

(d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;

(e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

(f) graphical plots of the trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against;
- the major activities being carried out on site during the period;
- weather conditions during the period; and
- any other factors which might affect the monitoring results;

(g) advice on the solid and liquid waste management status;

(h) a summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

(i) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;

(j) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

(k) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;

(l) comments (e.g. effectiveness and efficiency of the mitigation measures), recommendations (e.g. any improvement in the EM&A programme) and conclusions for the quarter; and

(m) proponents' contacts and any hotline telephone number for the public to make enquiries.

9.9.7 Data Keeping

The site documents such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the Monthly EM&A Reports for submission. However, the document shall be kept by the Environmental Specialist and be ready for inspection upon by the Independent Environmental Auditor request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. All the documents and data shall be kept for at least one year after completion of the construction contract.

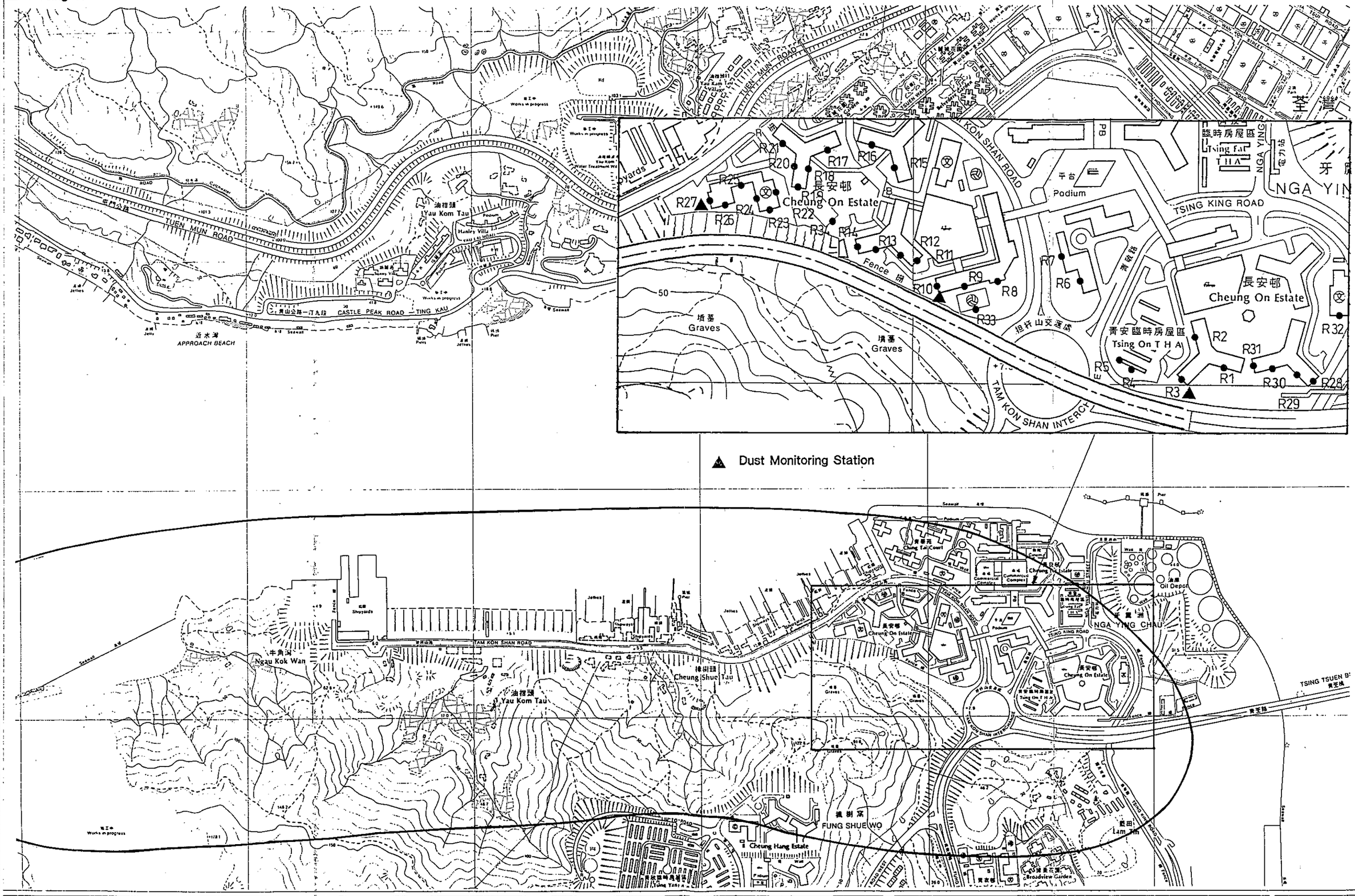
9.9.8 Interim Notifications of Environmental Quality Limit Exceedances

With reference to Event/Action Plans, when the environmental quality limits are exceeded, the Environmental Specialist shall immediately notify the Contractor, Engineer's Representative, Independent Environmental Auditor and EPD, as appropriate. The notification shall be followed up with advice to each party on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Figure 9.8.

Figure 9.1: Data Sheet for TSP Monitoring

Monitoring Location:		
Details of Location:		
Sampler Identification:		
Date & Time of Sampling:		
Elapsed-time Meter Reading	Start (min.)	
	Stop (min.)	
Total Sampling Time (min.):		
Weather Conditions:		
Site Conditions:		
Initial Flow Rate, Qsi	Pi (mmHg):	
	Ti (°C):	
	Hi (in.):	
	Qsi (Std. m^3):	
Final Flow Rate, Qsf	Pf (mmHg):	
	Tf (°C):	
	Hf (in.):	
	Qsf (Std. m^3):	
Average Flow Rate (Std. m^3):		
Total Volume (Std. m^3):		
Filter Identification No.:		
Initial Wt. of Filter (g):		
Final Wt. of Filter (g):		
Measured TSP Level ($\mu g/m^3$):		

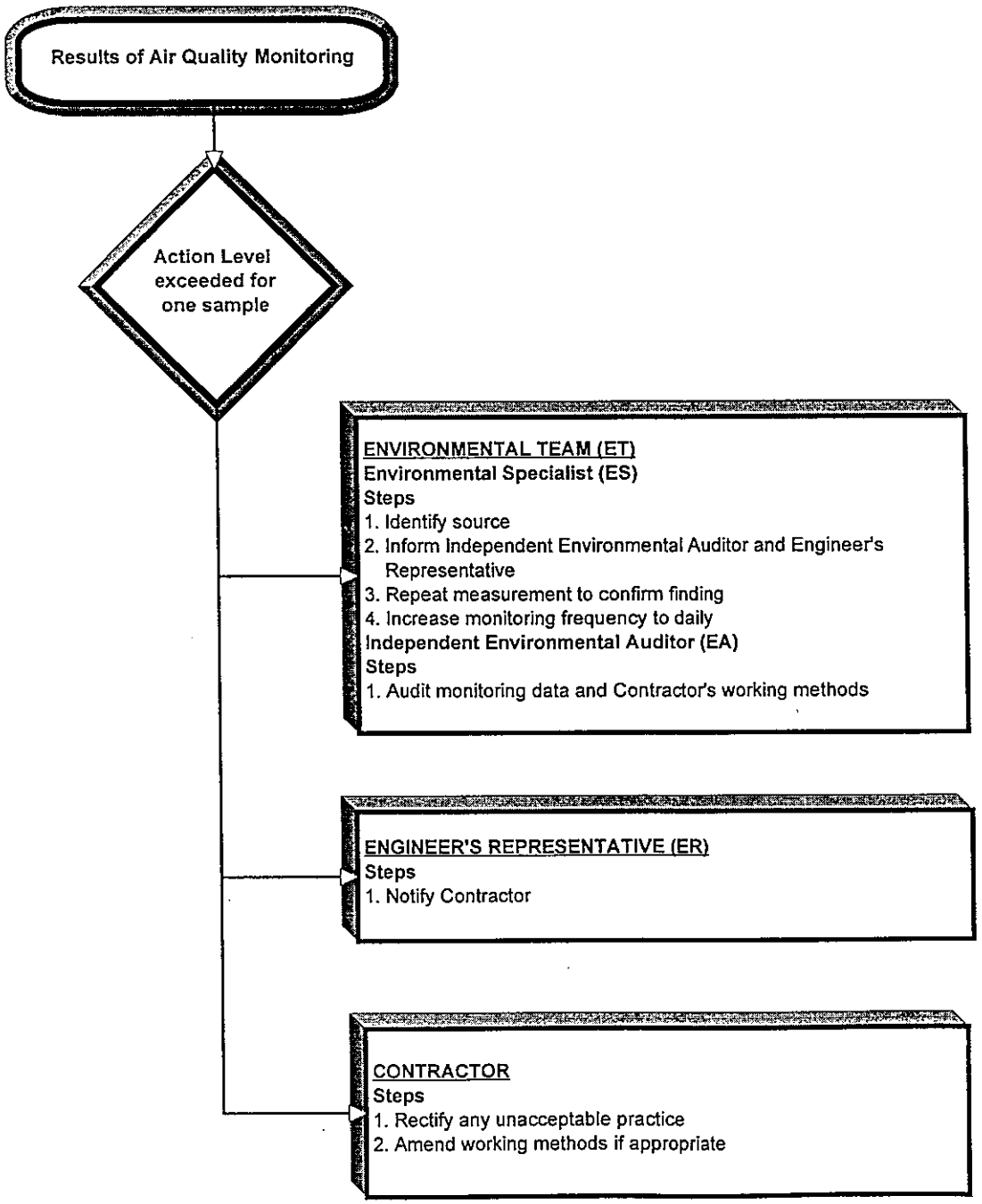
	Name & Designation	Signature	Date
Field Operator :			
Laboratory Staff :			
Checked by :			



Dust Sensitive Receivers and Monitoring Locations

Mouchel

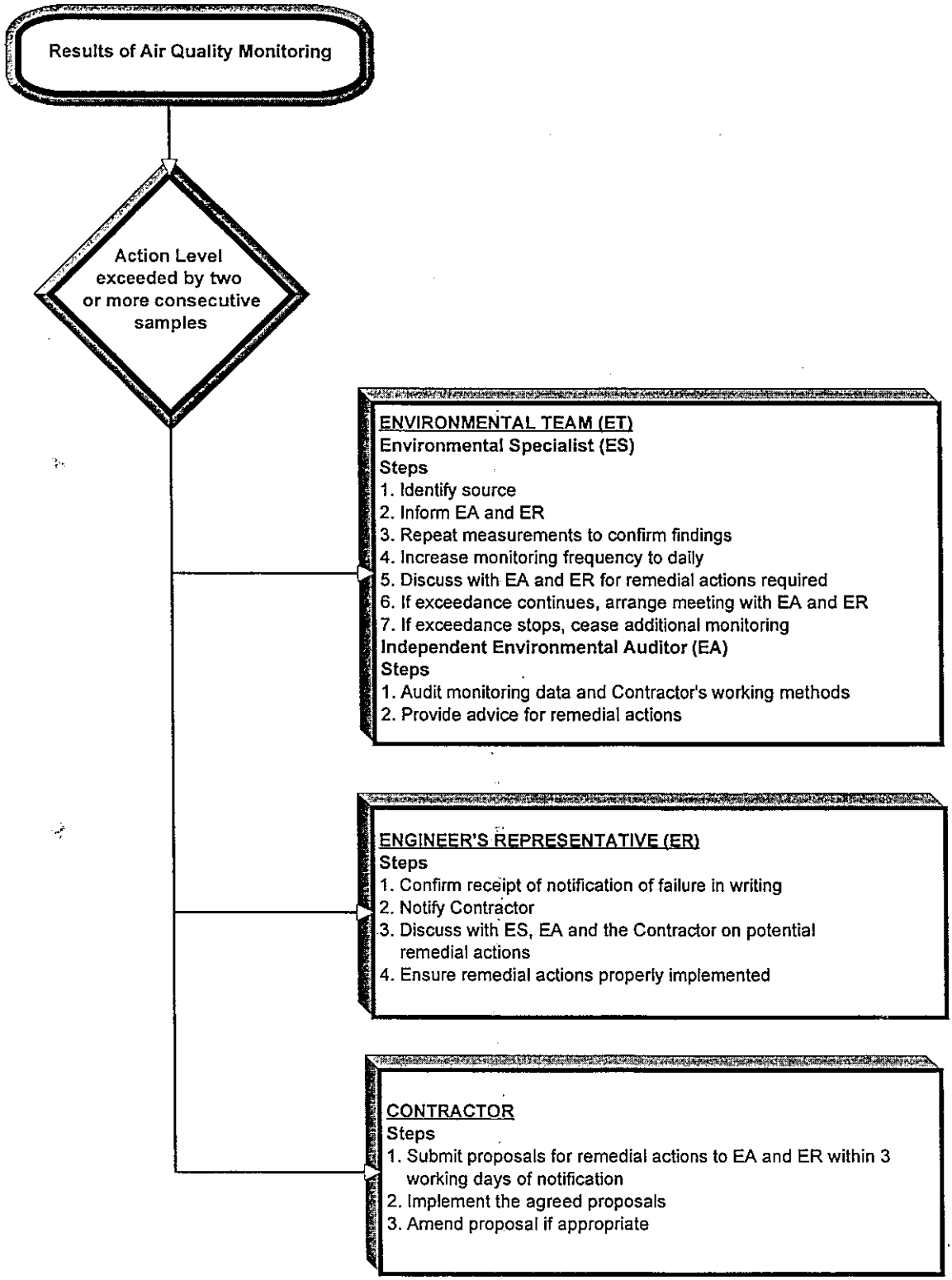
Figure No. 9.2



Event and Action Plan for Air Monitoring Action Level Exceeded for One Sample

Mouchel

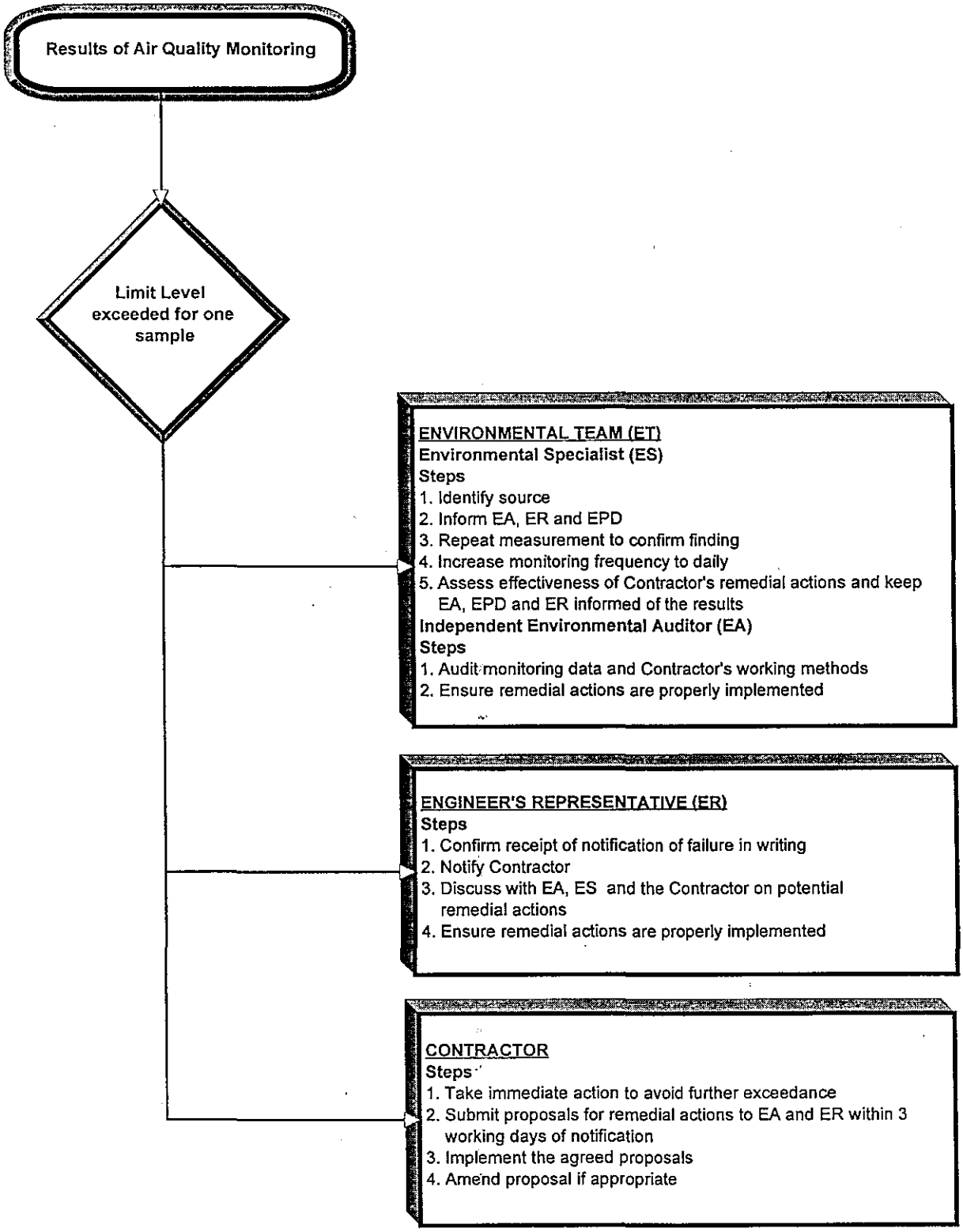
Figure No. 9.3a



Event and Action Plan for Air Monitoring Action Level Exceeded by Two or More Consecutive Samples

Mouchel

Figure No. 9.3b



Event and Action Plan for Air Monitoring Limit Level Exceeded for One Sample

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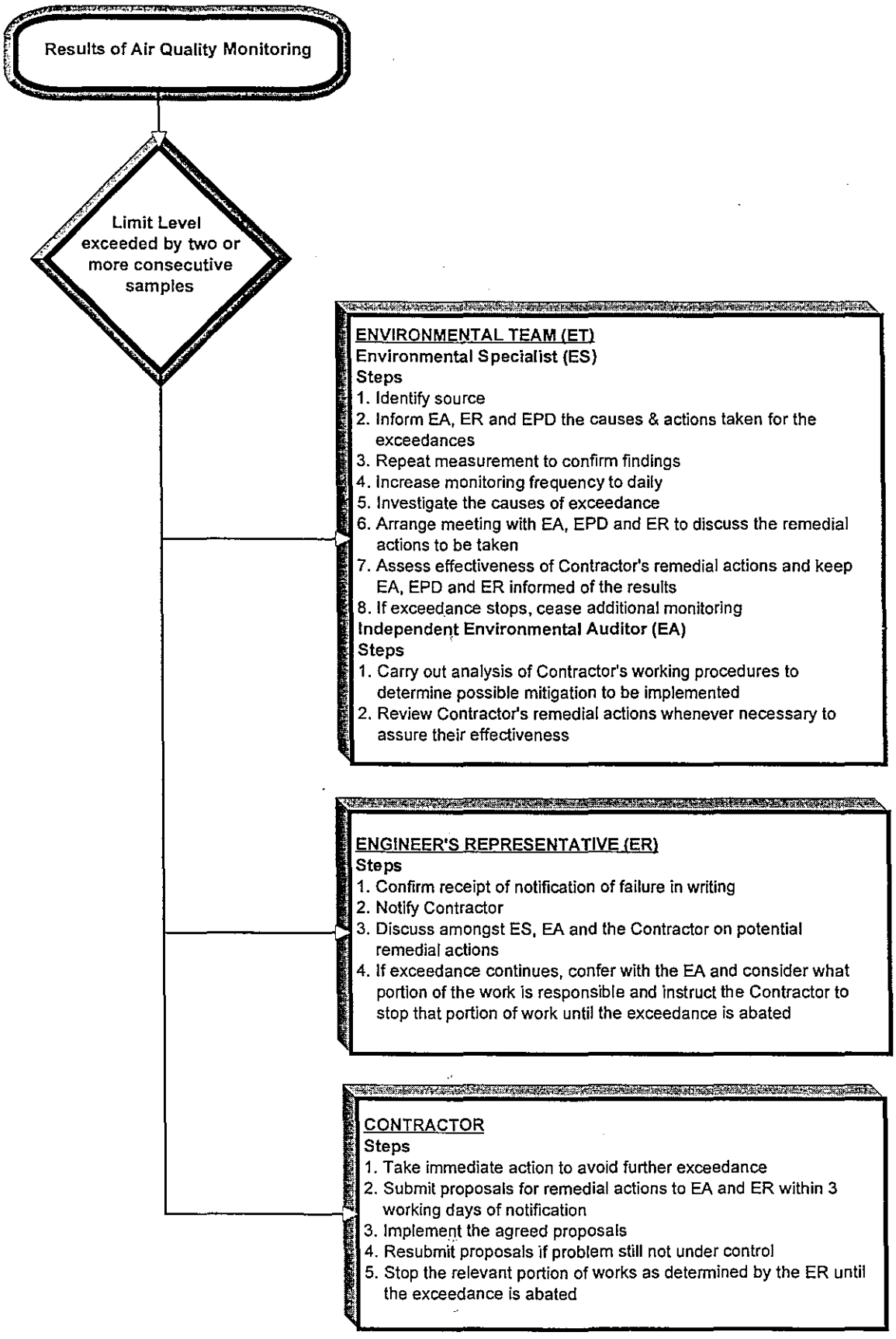
Figure No. 9.3c



Event and Action Plan for Air Monitoring Limit Level Exceeded by Two or More Consecutive Samples

Mouchel

Figure No. 9.3d

Figure 9.4: Noise Monitoring Field Record Sheet

Monitoring Location:		
Description of Location:		
Date of Monitoring:		
Measurement Start Time (hh:mm):		
Measurement Time Length (min.):		
Noise Meter Model/Identification:		
Calibrator Model/Identification:		
Measurement Results	L_{90} (dB(A)):	
	L_{10} (dB(A)):	
	Leq (dB(A)):	
Major Construction Noise Source(s) During Monitoring:		
Other Noise Source(s) During Monitoring:		
Remarks:		

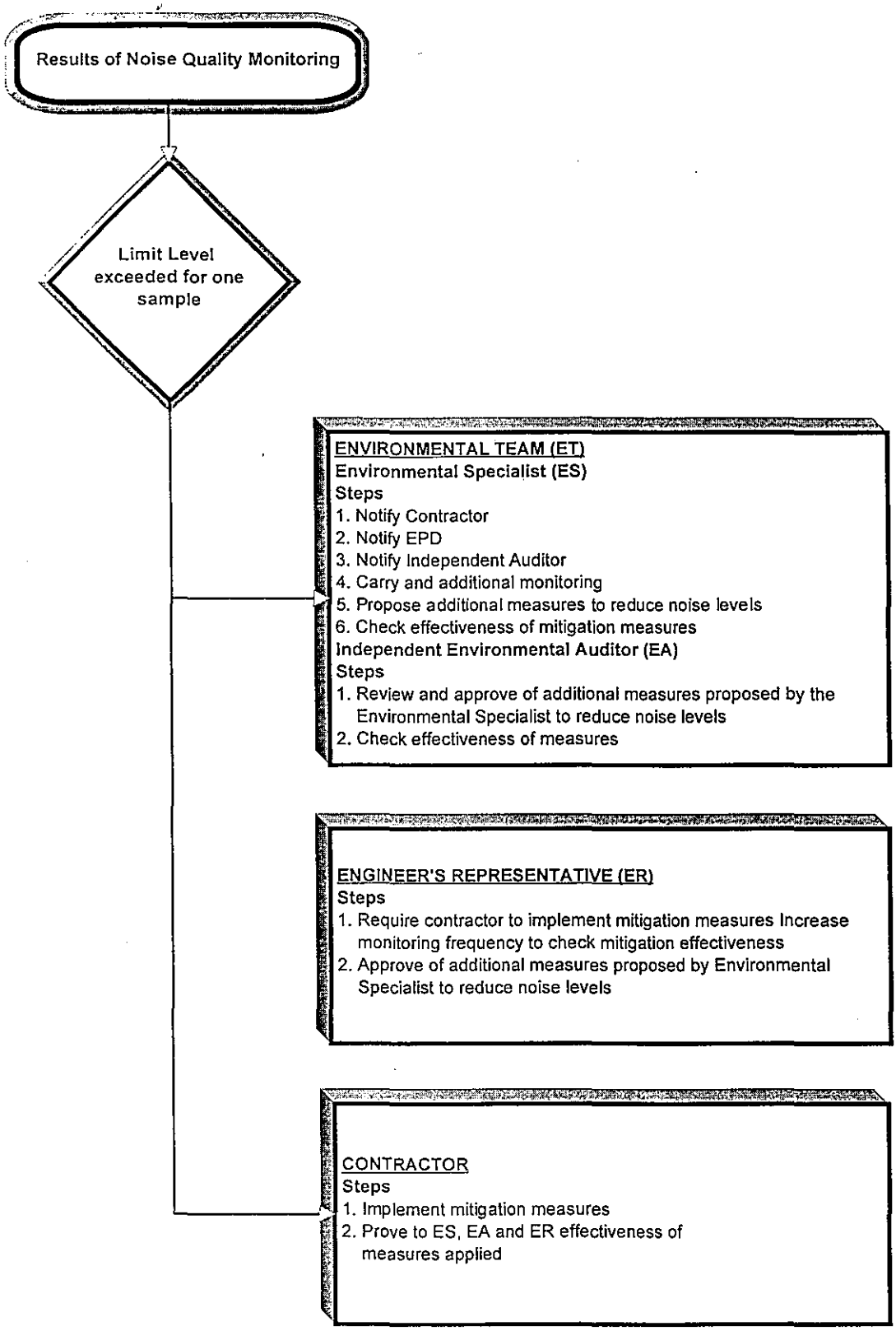
	Name & Designation	Signature	Date
Recorded By :	_____	_____	_____
Checked By :	_____	_____	_____

▲ Noise Monitoring Location

Noise Sensitive Receivers and Monitoring Locations

Mouchel

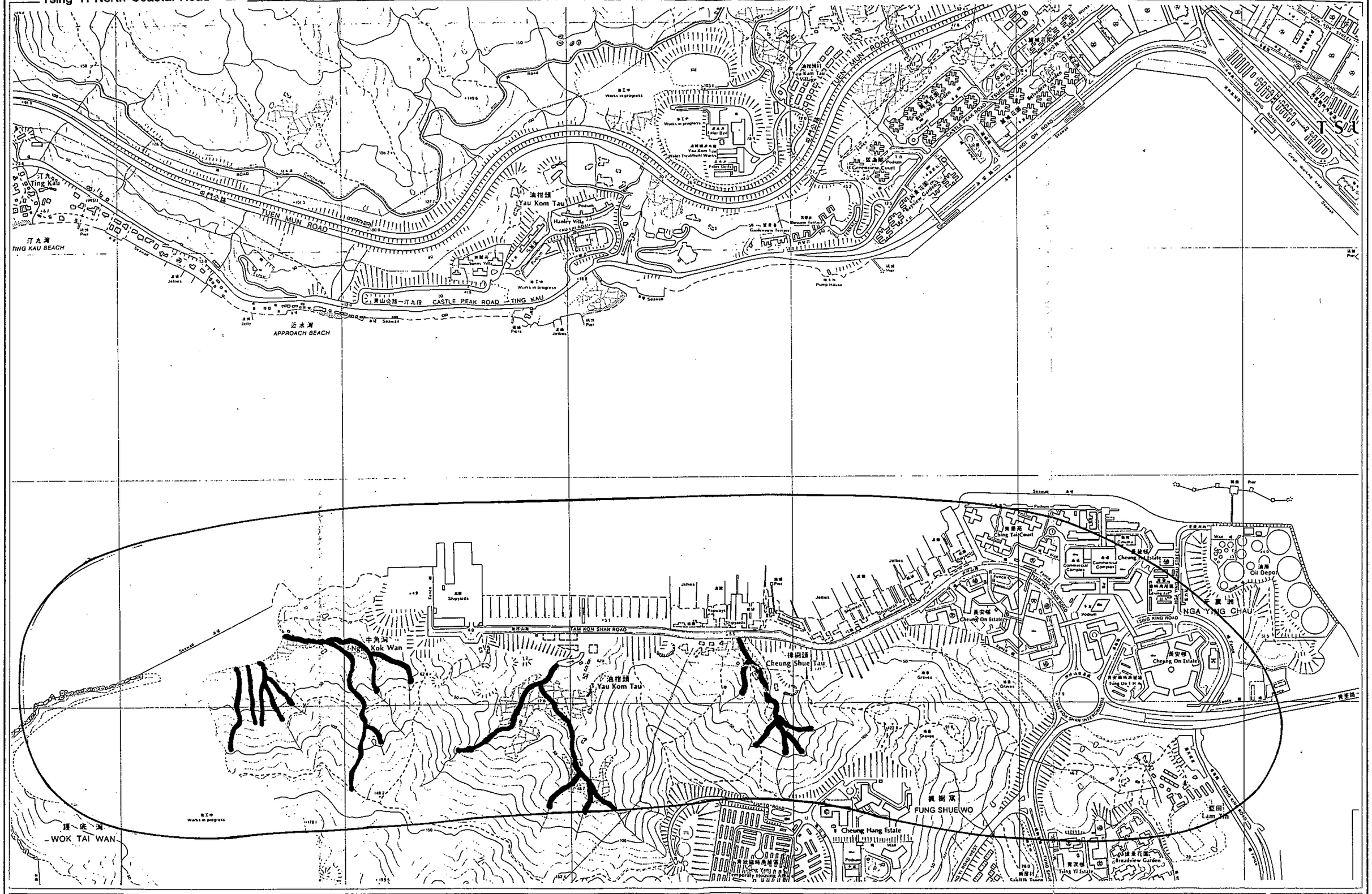
Figure No. 9.5



Event and Action Plan for Noise Monitoring Limit Level Exceeded for One Sample

Mouchel

Figure No. 9.6



Stream Monitoring Locations

Mouchel

Figure No. 9.7

Figure 9.8 Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

Location Plan

Prepared by : _____

Designation : _____

Signature : _____

Date : _____

10.0 TRAFFIC IMPACT ASSESSMENT

10.1 Existing Traffic Conditions

The performance of the Tam Kon Shan roundabout was assessed using the ARCADY computer program. Based on the existing traffic flows shown in Figure 2.3, the roundabout reaches congestion levels during the morning peak hour with a volume to capacity ratio (V/C ratio) of 1.2. The roundabout operates during the evening peak hour with a V/C ratio of 0.9.

10.2 Traffic Impact of Construction Traffic

Construction traffic has been estimated to be about 30 pcus/hr/direction based on the schedule of construction equipment discussed in Section 2.2. This volume is very insignificant compared to the total traffic of more than 2,000 pcus/hr/direction forecast to pass through the Tam Kon Shan roundabout via Tsing Tuen Road. As such, the impact of construction traffic will be insignificant. V/C ratios will remain the same for the 'without' and 'with' construction traffic scenarios.

10.3 Traffic Impact - Year 2001

The Tsing Yi North Coastal Road is scheduled to open in 2001. The peak hour traffic forecasts for year 2001 with the TYNCR in place are shown in Fig. 10.1. Based on these volumes, the highest V/C ratios for the junctions within the study area are as follows:

Table 10.1 : Highest V/C Ratios (2001)

Junction	AM	PM
Tam Kon Shan Roundabout	1.0	1.0
Link Road A	0.1	0.1
Nga Ying Chau/Tsing King Road	0.6	0.3

10.4 Traffic Impact - Year 2016

Assuming a capacity of 1,800 pcus/hr/lane, the Tsing Yi North Coastal Road will have an AM peak hour link V/C ratio of 0.54 in the peak direction in year 2016. The same link V/C ratio of 0.54 is forecast for the evening peak.

For junctions, the calculated V/C ratios based on the estimated 2016 peak hour traffic volumes presented in Figures 2.4 and 2.5 are as follows:

Table 10.2 : Highest V/C Ratios (2016)

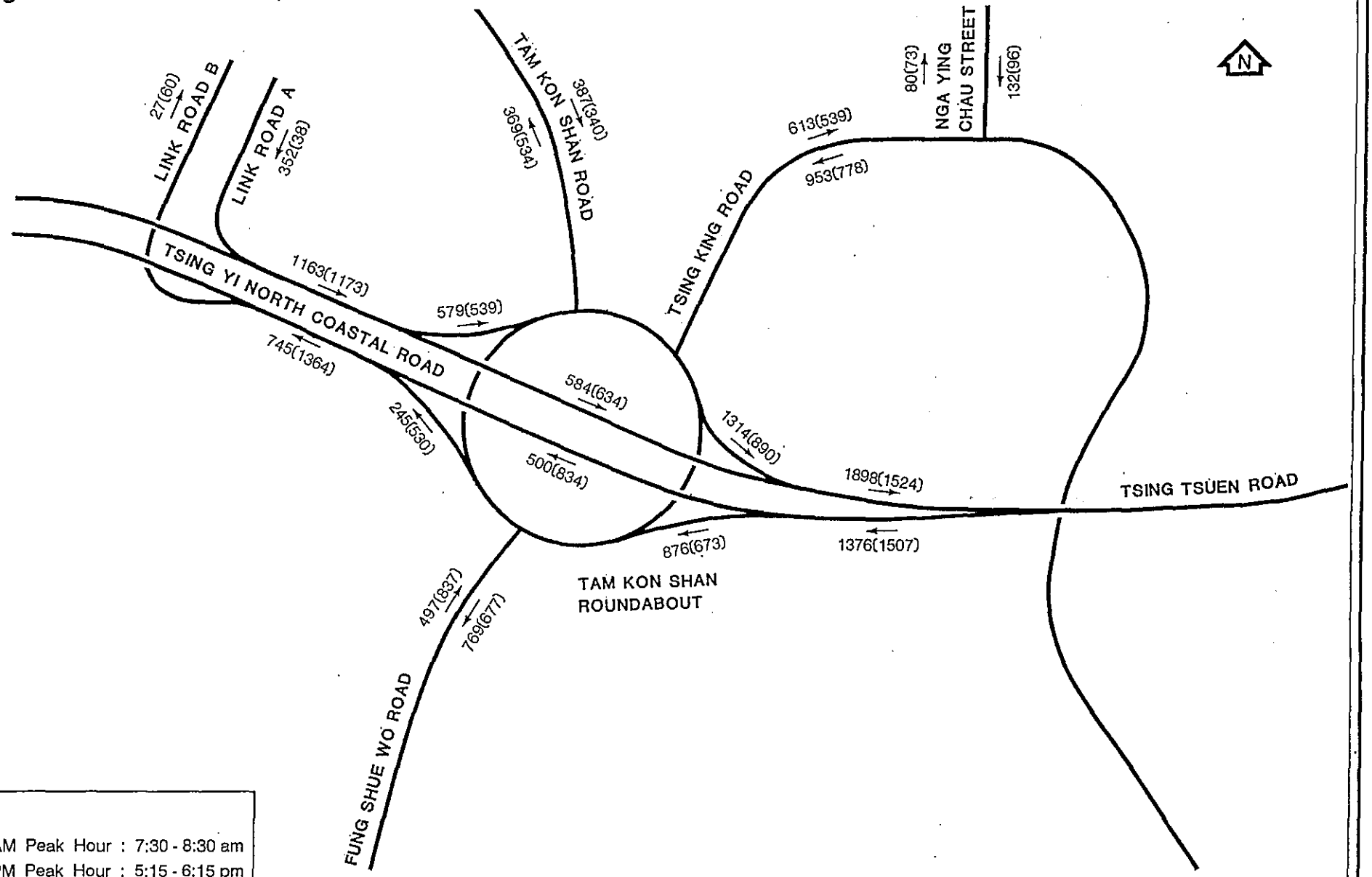
Junction	AM	PM
Tam Kon Shan Roundabout	1.3	1.0
Link Road A	0.1	0.1
Nga Ying Chau/Tsing King Road	0.8	0.4

From the above table, the Tam Kon Shan roundabout is forecast to be overloaded with a V/C ratio of 1.3.

Figure 10.2 shows the original roundabout layout based on Scheme Layout NH22020. It is proposed to improve the geometrics of the roundabout by widening the entry point at Arms A, B, C and E by increasing the flare, flare length and radius. Details of the proposed improvements to the roundabout are shown in Figure 10.3.

The improvements will reduce the V/C ratio from 1.3 to 0.85 in the 2016 morning peak and from 1.00 to 0.74 in the 2016 evening peak.

It should be emphasised that the proposed improvement measures are for conceptual purposes only since 2016 is too far ahead in the future. It is therefore recommended that the improvement measures be finalised at some year closer to 2016 with updated traffic forecasts.



2001 AM(PM) PEAK HOUR TRAFFIC VOLUMES (VEH/HR)

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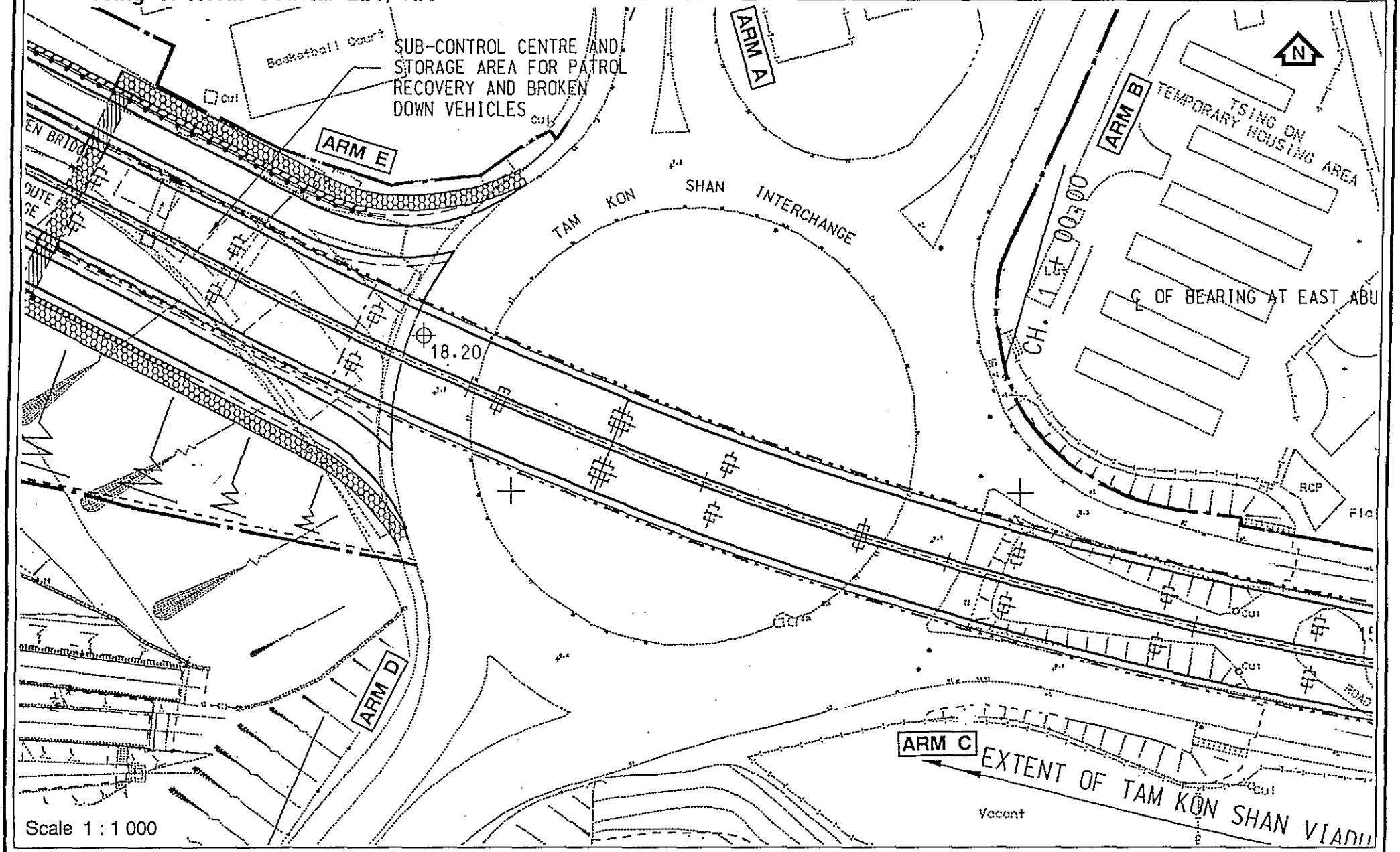
Figure No. : 10.1

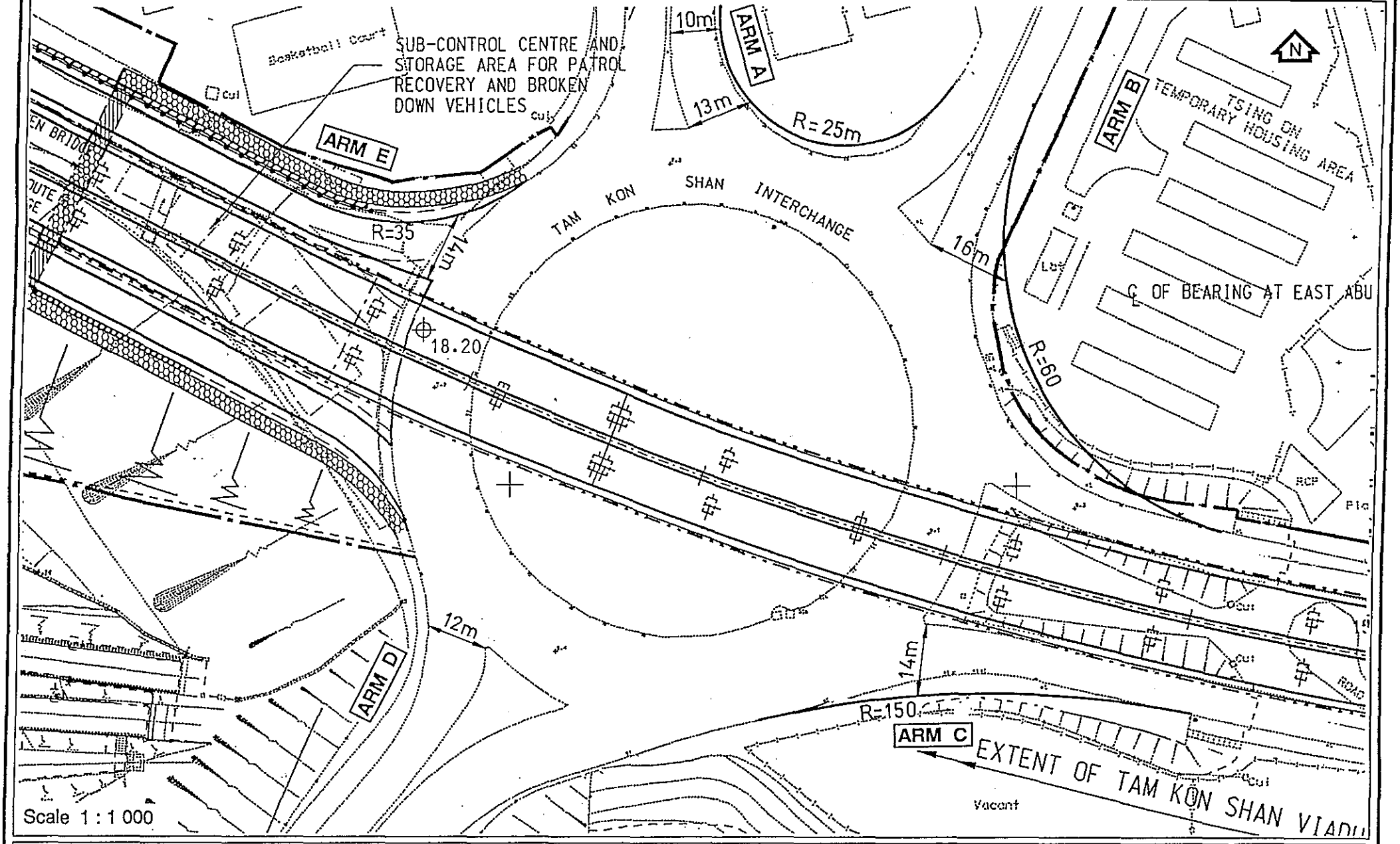


ORIGINAL ROUNDABOUT LAYOUT

(Based on Scheme Layout NH22020)

Mouchel

Figure No.: 10.2



PROPOSED IMPROVEMENTS TO THE ROUNDABOUT

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Figure No.: 10.3

11.0 VISUAL IMPACT ASSESSMENT

11.1 Introduction

The Consultancy brief requires that the construction of the proposed Tsing Yi North Coastal Road (TYNCR) takes into account the importance of the landscape and visual impact of the project as well as mitigation measures. This chapter summarises the preliminary findings of a visual impact assessment (VIA) of the proposed road based on the preliminary design plans developed by HyD (Drawing No. NH20326) and will form part of the overall Environmental Impact Assessment (EIA).

In the more natural areas of the Territory, landscape and visual impacts are closely related. The western section of the proposed road alignment creates a new road connection across a previously undisturbed hillside to link with the new strategic infrastructure network which connects the urban areas to the new airport and other developments of North Lantau. For this more natural section, the visual and landscape impacts will both be reviewed. Along the eastern section of the alignment, the road will connect to an existing local infrastructure network adjacent to existing public housing estates. This study will therefore limit itself to consideration of the visual impacts of the TYNCR for this section of the proposed road.

The objective of the VIA is to identify the most affected views and recommend mitigation measures which should be incorporated into the detailed design and construction stages of the project. The aim will be for implementation of the project to take place without incurring unacceptable landscape and visual impacts.

This chapter is presented in seven sections:

1. The introduction summarises the background to the project and outlines the aims and objectives of the VIA.

2. This section defines the assessment methodology and technical terms used throughout this chapter.

3. In this section, a visual envelope is established and the baseline condition is reviewed. Sensitive viewpoints are identified. The main features of the proposed development are also described.

4. This section describes how the development features previously described are likely to change the baseline condition and affect the sensitive viewpoints. The most affected views are identified.

5. Design features are proposed in this section which would mitigate any identified impacts and effects.

6. This section assesses the nature of the residual landscape and visual impacts; their significance and acceptability are also evaluated.

7. The conclusions of the VIA are summarised in this section.

This chapter will be presented to ACABAS for review and comment as required in the Brief.

11.2 Assessment Methodology

11.2.1 *Methodology*

The methodology developed for this VIA comprises four stages: a baseline study, impact assessment, a mitigation measures study, and the assessment of residual landscape and visual impacts. The methodology is illustrated by a flow diagram, which is included as Figure 11.1.

Baseline Study

The overall visual envelope (zone of visual influence) is identified. The existing and future landscape and visual resources within the visual envelope are described and assessed to establish the baseline condition. Sensitive viewpoints are identified. The characteristics of the proposed TYNCR which would affect the baseline condition and sensitive viewpoints are described.

Impact Assessment

An assessment is undertaken of the likely changes to the baseline condition, as well as impacts on the sensitive viewpoints arising from construction and operation of the TYNCR. The most affected views are identified. This section gives an indication of the impacts of the TYNCR if no mitigation measures were implemented. This section is illustrated by photomontages and sections along the route of the proposed road.

Mitigation Measures Study

This evaluation identifies design features which should be incorporated into the proposed development to reduce the extent of the predicted changes to the baseline condition as well as the most affected views and landscape resources.

Assessment of the residual landscape and visual impacts

This assessment describes the impacts of the TYNCR, if all mitigation measures are implemented. It also indicates the overall acceptability and significance of the Project. Particular importance is placed on the assessment of visual impact which is based on a viewpoint analysis approach and relies on a balance between objective and subjective professional opinion.

11.2.2 Technical Terms

Landscape impact is a direct physical change to existing landscape features such as vegetation, topography, open space and recreation facilities as well as buildings and structures. By mapping the extent and location of these features, any loss or change can be objectively assessed. Landscape impact would also include any fundamental changes to the overall character and quality of the existing landscape.

Visual impact is a change to the appearance of the landscape and its subsequent effect on sensitive viewpoints.

Sensitive viewpoints are considered to have varying degrees of "sensitivity" to changes in the view based on the land use at each viewpoint: The Environmental Guidelines for Planning in Hong Kong define sensitive users as "land uses which, by virtue of the nature of the activities thereon or resources therein, are susceptible to the influence of residuals or physical changes generated by polluting uses". It should be noted that, unlike the "harder" environmental impacts, visual impact does not usually result in direct physical changes to the users of an area, as would possible damage to health from air or noise pollution.

Highly sensitive viewpoints are views from high rise or low rise residential developments and buildings which are considered highly sensitive as the users (the residents) would be particularly aware of any visual changes. Residents are likely to care about the views from their homes as this is where they are likely to spend their leisure time. In addition, residents are likely to have a financial interest in the property (either ownership or rental) and a change in the appearance of the surroundings could have a significant financial implication on property values leading to public objections.

Moderately sensitive viewpoints are views from commercial developments, schools, public open spaces including beaches and scenic transport corridors which are considered moderately sensitive. In the case of schools and offices, while users may be at these viewpoints regularly, they are primarily there for another reason i.e. for study or work. In the case of open spaces, beaches and certain transport corridors, these are likely to be visited for shorter periods of time and there would be an element of control or choice in their use. A change in the view from these land uses would have a less significant impact.

Low sensitivity viewpoints are views from industrial areas and most transport corridors which are considered to have low sensitivity. In industrial areas, user expectations of visual quality are low; the users are there primarily for another reason i.e. to work. Users of certain transport corridors are subject to changes in a view for a relative short period of time. A change in the view would therefore have an insignificant effect on the overall quality of life from such view points.

11.3 Baseline Study

11.3.1 Study Area

The Study Area for the EIA has been defined by extending a three hundred metres grid in every direction from the proposed alignment of the road, and is included on Figure 11.3. It extends from the Tsing Tsuen Road/Tsing Yi North Bridge in the east, to the Route 3 construction site at Wok Tai Wan in the west; a distance of approximately 2.7 kilometres. It includes the Cheung On Estate, part of the Ching Tai and Cheung Fat Estates as well as the shipyards, industrial areas and villages along the north Tsing Yi coastline.

The residential areas and beaches west of Tsuen Wan on the northern side of the

Rambler Channel are not included within the Study Area. However, these clearly fall within the visual envelope of the TYNCR. This VIA will therefore extend the Study Area to include the whole of the Visual Envelope as illustrated in Figure 11.2.

11.3.2 Existing and future landscape and visual resources

The eastern section of the Study Area, north of the major Tam Kon Shan Interchange and Tsing Tsuen Road, is an existing residential area with dense, high-rise public housing blocks of the Cheung On Estate, Cheung Fat Estate and Ching Tai Court. All have associated commercial and school developments. The area has an urban character set against a backdrop of the north east Tsing Yi hillsides to the south. The urban area is defined to the north by the Rambler Channel shore.

The east Tsing Yi tunnel portal of the Lantau and Airport Railway is currently under construction west of the Tam Kon Shan Interchange. The rail lines cross Fung Shue Wo Road on elevated viaduct structures before disappearing into the hillside. The rail run-off siding, a track on elevated structure, is being cut into the existing hill side south of the Cheung On Estate West.

The landform within the western section of the Study Area comprises a series of coastal hills and saddles up to approximately 150 metres above sea level, incised by small valleys with a northerly aspect. These valleys have small freshwater streams, and have created a number of prominent ridges along the length of the coastline (refer to Figure 2.1). Footpaths and trails run along the ridgelines affording spectacular, panoramic views.

The hills are covered with a variety of vegetation, including low and tall scrub, grassland, orchards and plantation woodland. Typical of Hong Kong, pockets of lush dark green woodland occupy the incised valleys contrasting strongly with the light green grassland on the more exposed upper hill slopes which have a thinner soil layer. This textual and colour contrast is particularly noticeable in the drier winter and autumn seasons.

The Tsing Yi Outline Zoning Plan (OZP) identifies the hillsides in the western section as Green Belt. The aim of a Green Belt zoning is to define the limit of development on the fringes of the existing and proposed urban areas, with the aim of conserving natural features and, where possible, enhancing its landscape and amenity value. This area of Green Belt contributes substantially to the amenity of Tsing Yi's north coast as well as its wider setting.

At the lower elevations, construction of the Tam Kon Shan Road extension, between Cheung On Estate and Ngau Kok Wan, has cut into the lower parts of the hillside. Here the natural vegetation gives way to stabilised cut slopes and exposed rock caused by road construction. South of the Tam Kon Shan Road, small villages of Yau Kam Tau and Cheung Shue Tau have developed up the vegetated valleys.

North of the Tam Kon Shan Road, the coastline is reclaimed and occupied by shipyards and industrial land uses such as the Hong Kong Cement factory. These are all relatively small scale and low-rise.

Currently, there is a short section of undisturbed coastline between Ngau Kok Wan and the Route 3 construction site to the west. The Tsing Yi OZP shows the Tam Kon Shan Road extended beyond the cement works. It can be assumed that similar cut slopes would be formed together with an extension of the existing land use types.

At the western limit of the Study Area, the Route 3/Lantau Fixed Crossing/Ting Kau Bridge construction area is currently characterised by extensive, exposed earthworks, stabilised rock cut slopes and engineering activities. On completion of the engineering works, the slopes will be planted and vegetation will be restored. The major landscape features are illustrated in Figure 11.3.

The landscape character of the western section of the Study Area is strongly influenced by the relationship between the hills, incised valleys and the existing and planned man-made developments on the waterfront. The coastal hills of Tsing Yi are relatively free of disturbance and their scale dominates the industrial land uses along the waterfront. The north Tsing Yi hillsides are an important and highly visible landscape feature and create an important green backdrop to the Rambler Channel shoreline.

North of the Study Area but still clearly within the visual envelope, are the high-rise private residential developments on the north side of the Rambler Channel, off Castle Peak Road. These are set against the dramatic natural backdrop of the Tai Lam Country Park. Public beaches are located along the shoreline. The beaches remain popular despite poor water quality and disturbance by the Ting Kau Bridge construction works.

When viewed from the north side of Rambler Channel, the Tsing Ma bridge between Ma Wan Island and Tsing Yi is a dominant manmade element, although its scale and importance is reduced by distance and intermediate topography. The new Ting Kau Bridge will be extremely prominent, and the views towards Ma Wan will be considerably changed.

11.3.3 Baseline condition and sensitive viewpoints

The baseline condition in the western part of the Study Area will change over the next few years as several large scale engineering projects approach completion. The Tsing Ma and Ting Kau bridges, Route 3 and the LAR will introduce significant man-made elements into an area currently dominated by the backdrop of large-scale natural hillsides. This will substantially modify the character of the Rambler Channel and its relationship with its surroundings.

The following sensitive viewpoints have been identified within the visual envelope (refer Figure 11.4):

Highly sensitive viewpoints

- Residents of the Cheung On Estate West (plan ref. 1), particularly On Kong House (plan ref. 1A) and On Tao House (plan ref. 1B) which are within 10-15 metres of the alignment;
- Residents of the Cheung On Estate East (plan ref. 2) particularly On Chiu House (plan ref. 2A);

- Residents of the Cheung Fat Estate (plan ref. 3);
- Residents of Ching Tai Court with views to the south (plan ref. 4);
- Residents of the villages of Yau Kam Tau (plan ref. 5) and Chung Shue Tau (plan ref. 6), south of Tam Kon Shan Road;
- Walkers using the footpaths and trails along the hills north of the alignment;
- Residents of the private residential developments on the north side of Rambler Channel (plan ref. 7) including Green View Terrace.

Moderately sensitive viewpoints

- Users of Ting Kau Beach and Approach Beach on the north side of the Rambler Channel;

Low Sensitive Receivers

- Workers at the shipyards on Kam Ton Shan Road;
- Motorists on Castle Peak Road;
- Motorists on Tam Kon Shan Interchange and Road and Tsing Tsuen Road;
- Passengers on the LAR.

11.3.4 Project description

The proposed TYNCR is a dual carriageway road which connects the Tsing Tsuen Road at the Tam Kon Shan Interchange with the Lantau Fixed Crossing. It will be constructed on viaduct structure for most of its alignment except for areas of cut where the alignment crosses an existing ridge line. The elevation of the road will gradually rise from *15* mPD the Tsing Tsuen Road/Tsing Yi North Bridge in the east to *60* mPD at its connection with the strategic road network in the west. Slip roads on embankment will provide connections to Tam Kon Shan Interchange. This is illustrated in the Key Plan (Figure 11.5) and sections (Figures 11.6 to 11.7) as well as the photomontage (Figure 11.12).

The completed project will include the carriageway, embankments, cut slopes and two sections of viaduct as well as ancillary structures such as lighting, traffic signs and gantries. From the findings of the noise impact assessment, the whole of the eastern alignment of the TYNCR will require to be covered with a noise semi-enclosure; closed on the side of the residential estates. Noise semi-enclosure will also be required along the northern slip road to the Kam Ton Shan Interchange. The location of the noise mitigation measures are also indicated on Figure 11.3.

Haul roads will be required to access the site and works areas will be required during the construction stages. The working area will be defined by fencing and hoarding.

11.4 Assessment of Landscape and Visual Impacts

This section summarises the broad impacts of the TYNCR and the key landscape and visual impacts. As it is assumed that mitigation measures will be adopted in whole or part, the residual impacts are considered in more detail in Section 6 of this chapter.

11.4.1 Construction Phase

Construction activity, which tends to be visually untidy and cluttered, will occur along the alignment and will be highly visible from all sensitive viewpoints. The level of the impact of the TYNCR construction will be largely related to the extent of disturbance during construction.

Construction operations will be at and above grade and will be highly visible from the sensitive viewpoints in this area. Impacts will be highly significant from the Cheung On Estate (west) blocks particularly On Kong House and On Tao House where construction will be taking place within 10 metres of their windows. Construction work at the Tam Kon Shan Interchange will also be highly visible from these blocks as well as the Ching Tai Court and the Cheung On Estate (east) particularly On Chiu House.

Because of the nature of the overall topography of the working area and the elevation of the road, all groups of sensitive viewpoints would have views of the construction activity. A familiar landscape largely unaffected by human activity will be disturbed. Depending on the programme for the proposed development, the sensitive viewpoints may also be affected at the same time by the construction of the Ting Kau bridge and at the western end by the LAR.

During the construction phase, existing vegetation would be removed along the proposed alignment especially in the areas around embankments, viaduct piers, haul roads and works areas. The associated earthworks are likely to result in the loss of plantation woodland, orchards and natural grass and scrubland. In the short term, earthworks will scar the landscape by exposing areas of soil and rock. The freshwater streams would be affected, potentially changing surface water patterns.

In summary, the predicted changes to the baseline condition and subsequent effects on views from sensitive viewpoints are as follows:

1. Construction work will be highly visible from all the highly sensitive residential viewpoints at Cheung On and Ching Tai Court.

2. An area of currently undisturbed hillside, zoned Green Belt, will be disturbed;

3. Existing trees and shrubs within the Study Area will be removed;

4. The impacts of construction on the freshwater streams could affect the growth pattern of the lush darker vegetation of the scrub at the base of the valleys thereby adversely affecting the natural vegetation patterns;

5. New earthwork scars will be highly visible from the private residential developments along Castle Peak Road on the northern side of the Rambler Channel. The impact will be directly related to the level of disturbance on the hillside.

11.4.2 Operation Phase

Once construction of the roadwork's are complete and the completed TYNCR is opened and operational, the main visual and landscape impacts will relate to its finished appearance. At the eastern section of the alignment, the noise semi-enclosure will be the dominant feature of the road and slip roads. Its scale will effectively triple the size of the road structure; giving the impression more of long linear building than road corridor. The appearance of this structure will be important to all the residents in the eastern section, particularly On Chiu House, On Tao House and On Kong House where it will dominate views from windows on the lower floors.

In the western section of the alignment, the main impacts will relate to the appearance of the elevated road as it crosses the hillside from the more distant viewpoints on Castle Peak Road. In this section, the overall relationship between the hillsides and the road structure will be important to the dominance of the TYNCR from these viewpoints.

On completion the earthworks scars will start to heal. Soil surfaces will be capable of revegetation which will also stabilise the slopes. Although the viaduct is relatively high above the ground in most parts of the alignment, the areas under the viaduct will now be more shaded from direct rain and light. The area below the viaduct will not be completely dry as it will receive run-off from higher ground. The area below the viaduct will be capable of vegetation however there will be effects on the natural vegetation patterns. Hard cut slopes will be more visible and take longer to weather to a more natural appearance. In some cases, stabilisation of slopes with shotcrete may be necessary. The bright reflective colour of these smooth surfaces would be highly visible from distant viewpoints.

11.5 Proposed Mitigation Measures

11.5.1 General Considerations

A number of design features should be included into the detailed design of the proposed scheme to mitigate the predicted changes to the baseline condition and the subsequent impacts on sensitive viewpoints. Broad mitigation objectives are established for each section. The design features concentrate on minimising physical disturbance to the baseline condition and minimising changes with practical and feasible recommendations. Recommendations are also made for construction methods and contract arrangements.

11.5.2 Eastern Section

In the eastern section, the mitigation objectives are:

1. To minimise visual impact of the TYNCR noise mitigation structures particularly form the Cheung On Estate;

2. To minimise visual impacts during construction.

Appearance of the noise semi-enclosure

The 450 metre long noise semi-enclosure (NSE), from the Tsing Tsuen Road/Tsing Yi North Bridge interface, across the Tam Kon Shan Interchange to the Cheung On Estate as well as the slip road, will be the most dominant and visible feature of the TYNCR in the urban, eastern section of the alignment. At the Cheung On Estate (west) the slip road will be 15 metres from the closest residential block. The viaduct and NSE structure will be viewed against the backdrop of the LAR viaduct and the densely vegetated hillsides beyond. The NSE will be opened on one side (away from the residential developments). The basic dimensional requirements of the structure are illustrated in Figure 11.13. The NSE is to be lined with tinted glass panels. Such panels would be solid, completely enclosing the structure thereby screening traffic from "outside" but also lowering light levels on the road. The panels would be supported on concrete parapet wall of 1.1m high to reduce glare from vehicle headlights at night.

The scale of the structure will be similar to that of a low, linear building. Considerable attention should be given to the appearance of this structure at the detailed design stage. As the structure is required because of the new viaduct structure, the NSE should be designed as an integral part of that structure. The parapets should be strengthened to support the additional loading. (An independently supported structure would require significant structures at grade in order to span the roads at the Tam Kon Shan Interchange; these would add to the overall visual impact) Attention should be given particularly to the solid sides and roof of the structure which will be highly visible from the side and above. As the sides of the structure will dominate views from some windows in the On Kong House, On Tao House, On Chiu House of the Cheung On Estate, attention should be given to the detail and colour of the structure in this area. Due to the relative height of the ground level in this area there will be little opportunity to screen the structure with vegetation. Climbing plants over the structure are not considered appropriate due to the difficulties of ongoing maintenance. Every opportunity to soften and screen the structure with vegetation on the slopes adjacent to the structure should be pursued. The design of the noise semi-enclosure are illustrated in Figure 11.14.

Figue 11.14 has been proposed by HyD (Structures Division). This simple structure will be more building-like in form. Its more traditional appearance may be more acceptable from the closest viewpoints. Window-like features could be included on the exterior of the structure to introduce a more human scale to the structure. This could be achieved by using different coloured tinted glass panels.

It is recommended that a further detailed submission is made to ACABAS. This submission should include cross-sections through the structure and elevations at the Cheung On Estate (west).

Soften and screen the structure with trees

Wherever possible, the viaduct/NSE structure should be softened with plant material. Opportunities are likely to be limited to Tsing Yi North Bridge approaches, the Tam Kon Shan Interchange and restricted areas adjacent to the slip roads at the Cheung On Estate. Trees should be included wherever possible to reduce the apparent scale of the structure. In all the possible planting areas, sight lines are also likely to be a consideration thereby reducing opportunities to plant trees and tall shrubs.

Retaining structures adjacent to the Cheung On Estate (west)

The TYNCR will be constructed extremely close to the residential blocks of the Cheung On Estate (west). It is possible that retaining structures will be required in this area at the detailed design stage. Walls should be designed to be stepped back and include plant material wherever possible. A typical cross-section is illustrated in Figure 11.13.

Location of Contractors Works Areas

To minimise the visual impacts of construction in this highly visible section, contractor's works areas should be located out of sight of the main sensitive receivers.

11.5.3 Western Section

In the western section, the mitigation objectives are:

1. To minimise disturbance to the natural hillsides;
2. To integrate the elevated road structure into its context as effectively as possible.

The following recommendations are made and illustrated on the cross sections (Figures 11.6 to 11.11):

Review the vertical alignment

It is understood that there is little opportunity to alter the vertical alignment of the TYNCR as there are fixed points at the east and west interfaces of the project. There are also restrictions on the gradient of the road. The vertical alignment should nevertheless be reviewed with the aim of reducing the elevation of the road. At a lower elevation on the slope, the road would relate more closely to the development at the waterfront level and limit disturbance to the overall green backdrop. It would be more effectively screened by development and vegetation at the lower levels.

Minimise the Project Area

To minimise disturbance to the hillside and the resultant visual impacts, the Project Area should be limited to the minimum feasible size. The boundaries of the Project Area should be clearly defined. Encroachment outside this area should be viewed seriously; provision could be made in the contract documents for the contractor to be liable for financial penalties should he disturb additional areas. All vegetation adjacent to construction area should be protected by robust temporary fencing.

Minimise earthworks

The extent of earthworks should be minimised, particularly the extent of cut slopes. The soil cover on the Tsing Yi slopes is relatively thin therefore cut slopes are likely to be formed into rock. A review of the rock cut slopes alongside the Tam Kon Shan Road suggests that rock slopes would require additional stabilisation with shotcrete. This should be avoided wherever possible due the high visibility of such slopes from distant viewpoints. Where shotcrete is unavoidable, careful use of concrete pigments

in a colour similar to the natural geology is recommended to reduce impacts in the short term. The use of wire mesh covering the slopes is preferred.

Earthworks to respond to natural topography

Earthworks will be required where the TYNCR alignment passes across an existing ridge or topographic feature. Wherever possible, the final earthworks should be designed to blend into the natural surroundings by rounding the edges of cut slopes rather than creating hard engineered edges.

Minimise the visual dominance of drainage channels

Drainage channels will be required as part of this project. Straight, horizontal concrete U channels and J channels are usually constructed in Hong Kong as well as vertical stepped U channels and cascades. These will appear unnatural and be highly visible on such a prominent hillside which is dominated by low scrub grassland vegetation. Consideration should be given to their appearance and alternative, more natural approaches should be considered. Drainage channels with a more natural form, that respond the natural drainage patterns of the area should be considered. When viewed from below, U channels are preferred as they are more readily screened by low vegetation. Stone facing should be considered for vertical cascades to minimise their visual dominance. Channels should be designed such that the protrusion above ground level of the channel edge is minimised.

Freshwater streams

In the design and construction process, existing drainage patterns should be retained wherever possible. During construction, excavated material should be kept free of stream edges and alignments.

Revegetation to respond to natural vegetation patterns and screen

All disturbed soft slopes above the alignment should be planted to respond to and reflect the natural vegetation patterns. Wherever feasible below the alignment, trees should be planted to minimise the apparent scale and linearity of the structure, soften the foreground and screen views from the villages of Yau Kom Tau and Chung Shue Tau. This will also assist in compensating for vegetation removed as a result of construction. Under viaducts, new shade tolerant species should be introduced into the existing vegetation. The areas around the viaduct columns should be reinstated with species suited to the micro-climate and compatible with adjacent planting.

Construction techniques to minimise disturbance

Construction techniques that will minimise land disturbance should be employed. The TYNCR will be constructed as an elevated structure, so it would be possible to construct the road sections as a pre-cast structure and incrementally launch each section from the piled and formed columns. In this case, in-situ formwork would not be required thereby minimising disturbance to the hillsides. This construction method is recommended.

Appearance of the viaduct structure

On completion and following the establishment of vegetation on cut slopes, the viaduct structure will be the only prominently visible evidence of man-made disturbance on the hillsides. Consideration has been given to the appearance of the structure. The structure will be formed from pre-cast sections comprising architectural features into the form and finishes. The viaduct will be designed with a smooth, shallow profile to minimise the concrete cross-section and shadow lines. Support columns be rounded to reduce shadows and have a more natural form. The detailed design will examine surface texture so that reflectivity is minimised. The apparent height of the columns, up to 30 metres in some locations, will be minimised by planting trees and shrubs in front of the structure. A standard aluminium edge parapet is recommended because of its light and unobtrusive feature. This will minimize the width of the viaduct cross-section and disturbance at grade as no in-situ formwork will be required. If, for other technical reasons, the adoption of aluminium parapet becomes less favourable, consideration should be given to concrete profiled edge parapet with an appropriate surface finish to enhance texture.

Minimise Haul Roads

Haul roads for access to the hillside construction area will be required. These can disturb the slopes almost as much as if the road was at-grade. These should be designed sensitively to minimise earthworks and removal of vegetation. Highways Department letter dated 29 May 1996 (Ref: HNT 54/CM/125A) indicates likely access points. The construction access should be included in the detailed design to meet the objectives stated herein. Alternatively, these objectives should be clearly stated in the contract documents. Immediately after formation of the haul roads, temporary earthworks should be hydroseeded to minimise the visual impact during construction and to assist with dust suppression. As far as possible, haul roads should be removed following construction. The natural hillside topography should be restored and revegetated on completion. Any access tracks required for ongoing maintenance should be kept to a minimum. These should be designed sensitively to blend with the final topography.

11.5.4 Implementation Recommendation

In both sections of the alignment, the visual appearance of the structure and control of the construction activities will be crucial to minimising the visual impacts of the TYNCR. For these reasons, it is not recommended that the next stages of this contract are let as Design and Build. To control aesthetics and construction methods effectively, these should be comprehensively detailed and restrictions/penalties included in the contract documents.

11.6 Assessment of Residual Landscape and Visual Impacts

11.6.1 Construction Phase

If the mitigation measures described in Section 11.5 are adopted, the following residual landscape and visual impacts are anticipated during construction.

Landscape impact

The recommended mitigation measures would minimise the disturbance, for a fixed period during construction, land along the proposed road alignment would be substantially disturbed and considerable vegetation removed. While it is not considered to exceed the threshold of unacceptability, the landscape impact is expected to be high.

Visual impacts

During construction, the proposed alignment would be highly visible from the sensitive viewpoints particularly in the eastern section of the alignment. As the road is elevated and the sensitive viewpoints will look down on the construction area, effective mitigation measures are not possible. Visual impact is predicted to be high during the construction period.

11.6.2 Operational Phase

After the proposed TYNCR has been completed, no further long-term change to the baseline condition of the landscape resource is expected. The road will permanently alter landscape character of the hillsides zoned Green Belt and create a man-made intrusion into a previously undisturbed hillside; one of the few in the area. The mitigation measures should be incorporated into the scheme and would minimise any potential long term, direct physical effects. The overall landscape impact is therefore expected to be moderate.

Visual impact

The change to the baseline condition of the visual resource after completion is considered to be substantial. The level of visual impact will vary from the sensitive viewpoints and would be dependant on:

- Proximity of sensitive viewpoint to the proposed development;
- Number of at that sensitive viewpoint;
- Frequency and length of the view of the proposed development;
- Activity of the viewer (for example, sleeping, morning exercises);
- Light, air and general weather conditions (hazy conditions, which prevail in Hong Kong during the summer months, reduce contrasts within the visual environment);
- Scale of the proposed works in relation to the overall view (the impact would be less significant if part of a wide or panoramic view).

Using these criteria, the sensitive viewpoint likely to be most affected by visual impact is that of the residents of Cheung On Estate (west) due to the proximity to the development. They will overlook the proposed development and will have permanent views of the new road and the NSE. The lower views will have their views obscured. The visual impact on these highly sensitive viewpoints is considered to be substantial and is likely to be unacceptable. This issue will require further consideration although there are no apparent opportunities to modify the alignment to minimise impacts.

Residents of Yau Kam Tau and Chung Shue Tau will be significantly affected. The road would be constructed on viaduct over the villages representing a permanent and considerable visual intrusion. The amenity of the villages will be substantially diminished, and the level of visual impact may exceed the threshold of acceptability. This issue will require further consideration although there are no apparent opportunities to modify the alignment to minimise impacts.

The sensitive viewpoints affected to a lesser extent would be Ching Tai Court and Cheung Fat estates, students at Queen's College Secondary School, and the footpaths overlooking the proposed development. Generally, these viewpoints are further from the proposed road which is slightly less dominant in the field of view. The road will be highly visible but would not be visually intrusive. The visual impact is therefore considered to be high, but not substantial.

The sensitive viewpoints also affected to a lesser extent, would be locations on the north side of the Rambler Channel. Residents living in private developments have views over the Channel towards the Tsing Yi coastal hills. The proposed development would appear as a noticeable linear man-made feature contrasting strongly with a prominent green backdrop. While it would not be visually dominant owing to its distant location, the familiar and interesting view would be permanently changed from a highly sensitive viewpoint and the visual impact is therefore considered to be moderate.

The sensitive viewpoints least affected would be the beaches along the northern coastline of the Rambler Channel. The appearance of the proposed development will be similar to that experienced by residents, except that the duration of the view is limited to very short periods, and the future Ting Kau bridge will dominate the landscape. For these reasons the visual impact is considered to be moderate to low.

11.6.3 Proposed scheme without design features

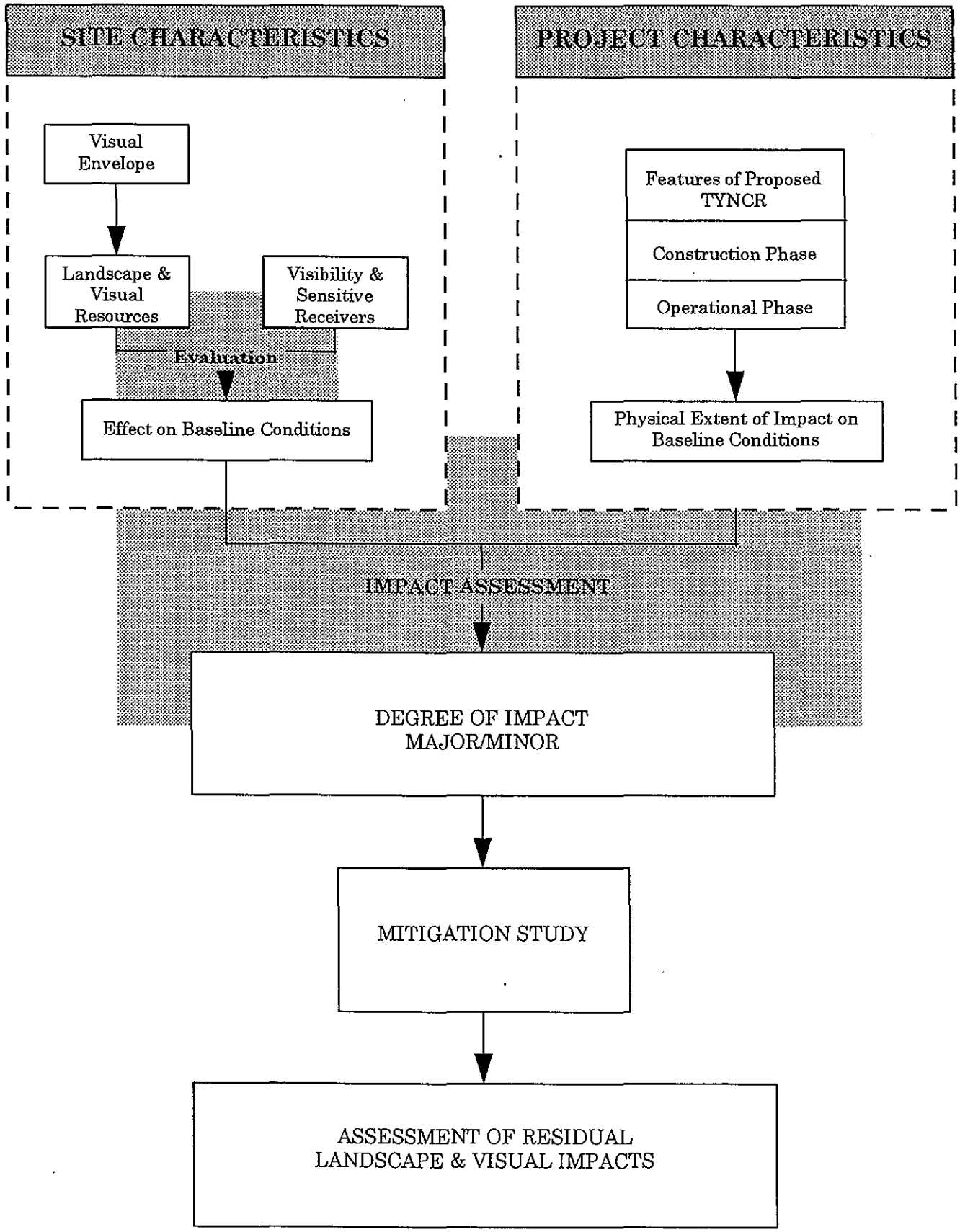
The assessment of residual landscape and visual impacts has assumed that design features recommended in the mitigation study are incorporated into the scheme. Should these features not be incorporated, or only be partly incorporated, the landscape and visual impacts are likely to be unacceptable.

11.7 Conclusions

The draft VIA has led to the following conclusions:

- The proposed development should incorporate design features recommended in Section 11.5.
- The detailed design of viaduct and noise mitigation structures should give particular attention to their appearance. A detailed submission should be made to ACABAS;
- Control of the construction area and construction practices is required to minimise landscape and visual impacts in the western section of the alignment;
- Design and Build contract arrangements are not recommended;
- It is strongly recommended that the TYNCR should demarcate the extent of any further modification to the Tsing Yi coastal hills, and the remainder of the natural

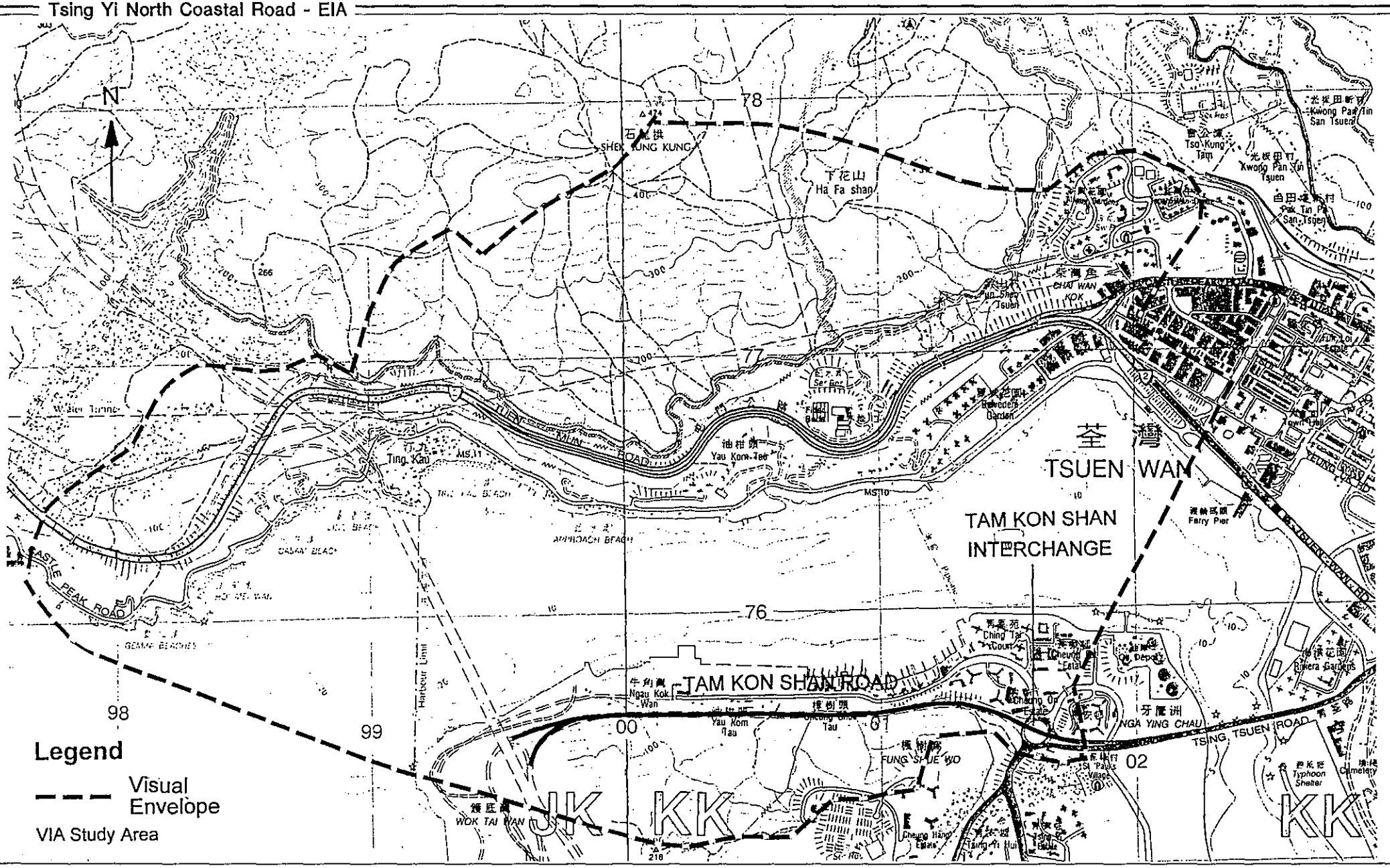
backdrop be maintained in perpetuity.



Methodology Flow Diagram

Mouchel

Figure No. 11.1



Visual Impact Assessment Study Area

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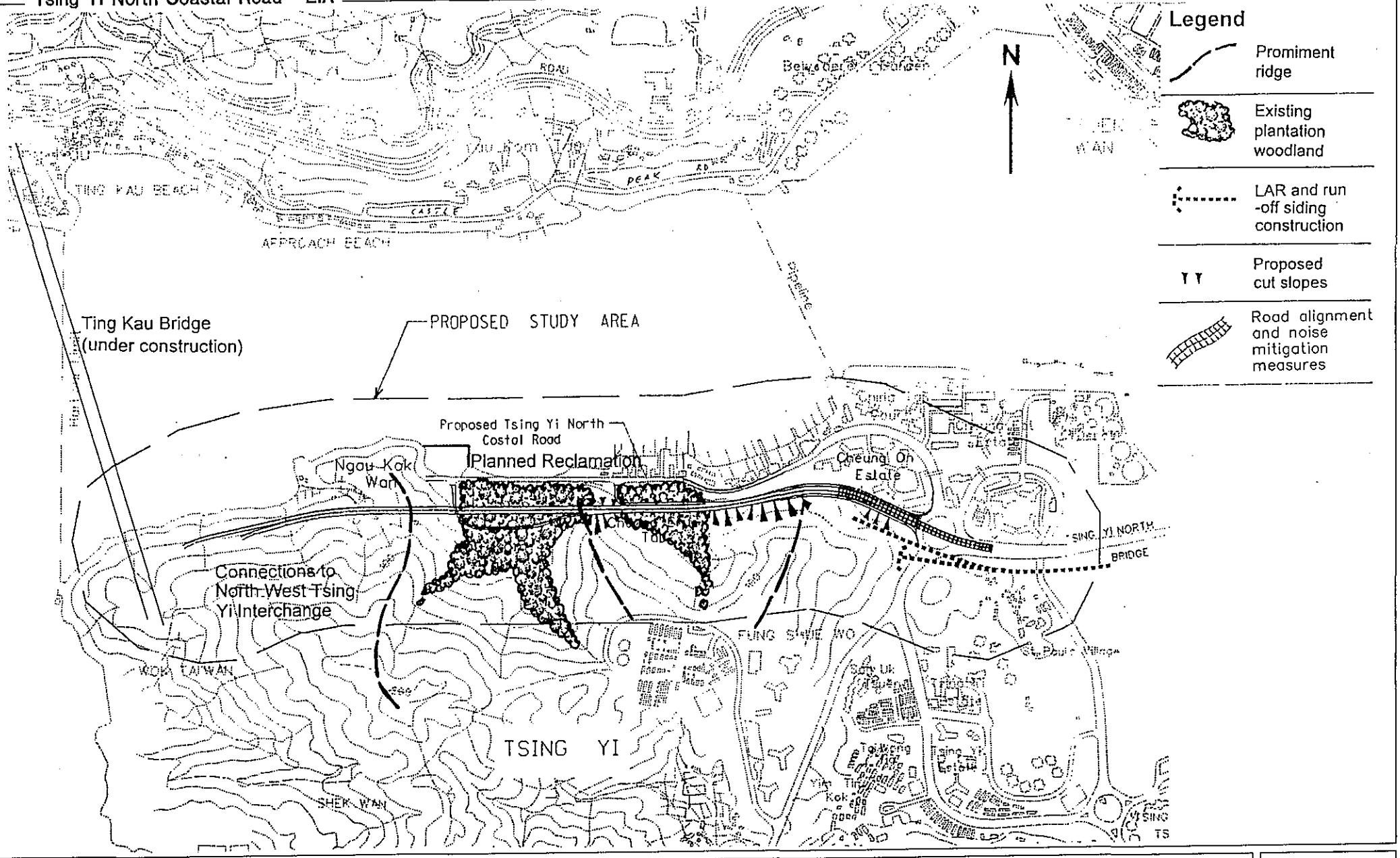
Drawing No. 11.2



Project and Landscape Features

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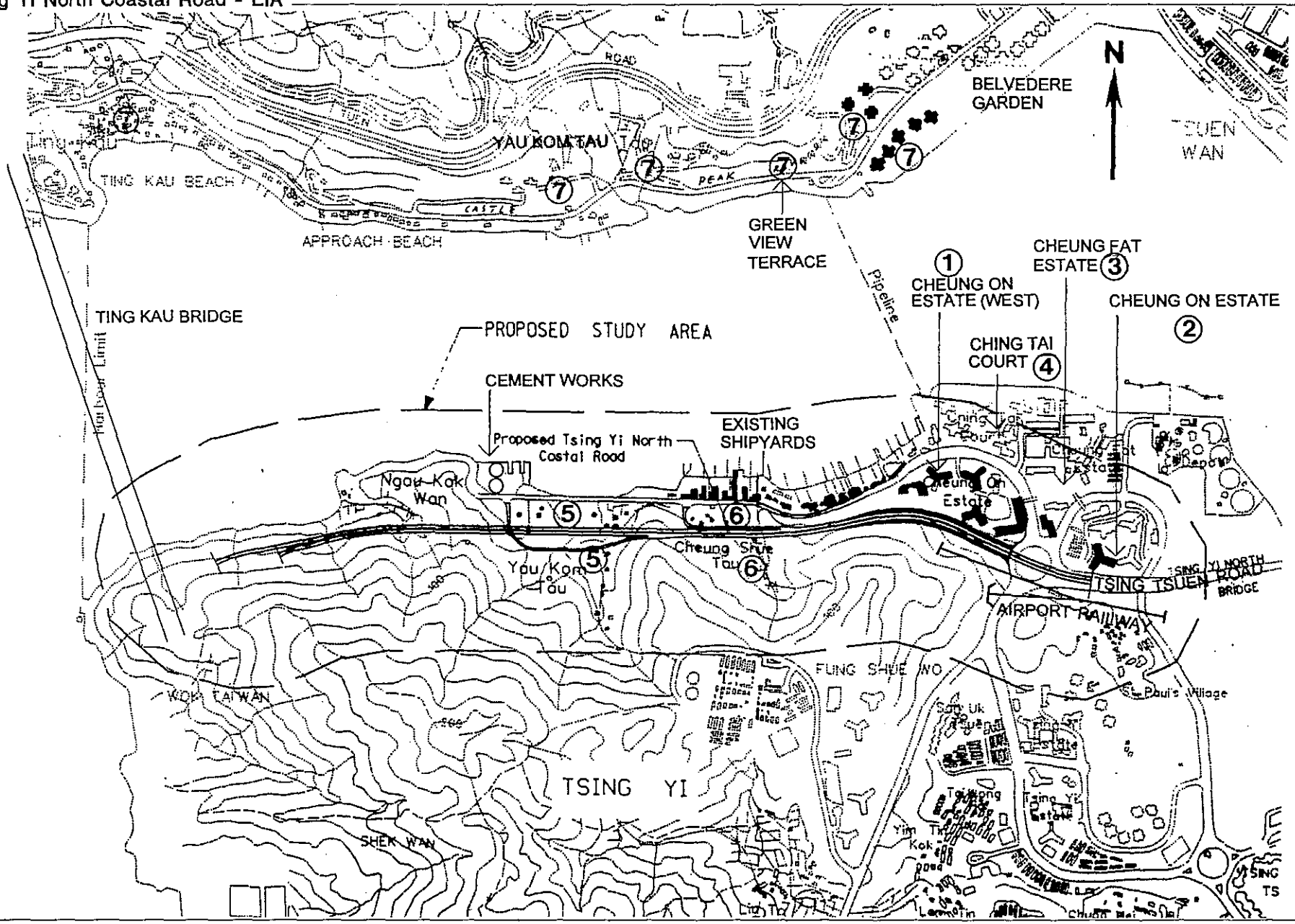

Sensitive Viewpoints

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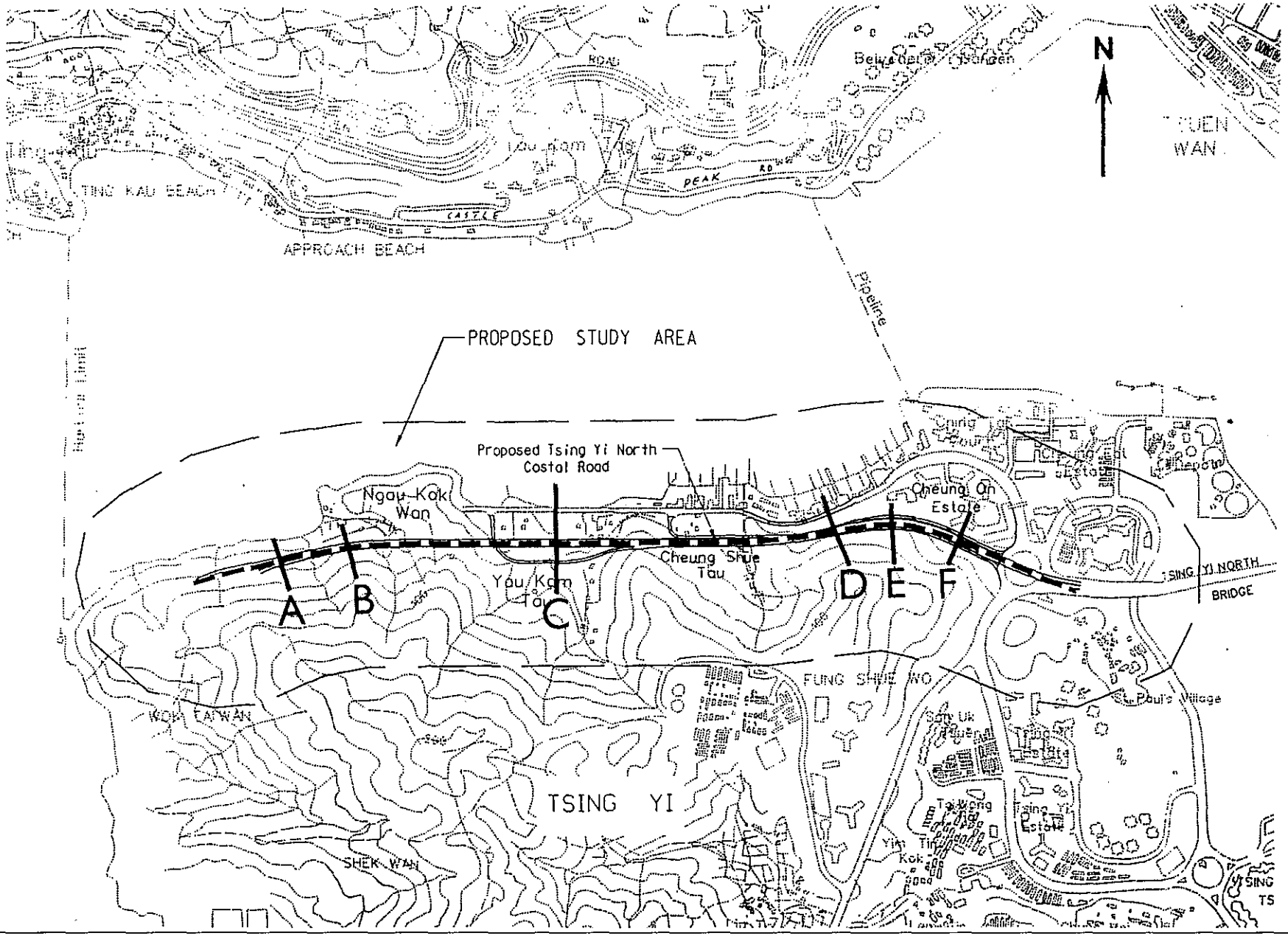

Cross - section : Key Plan

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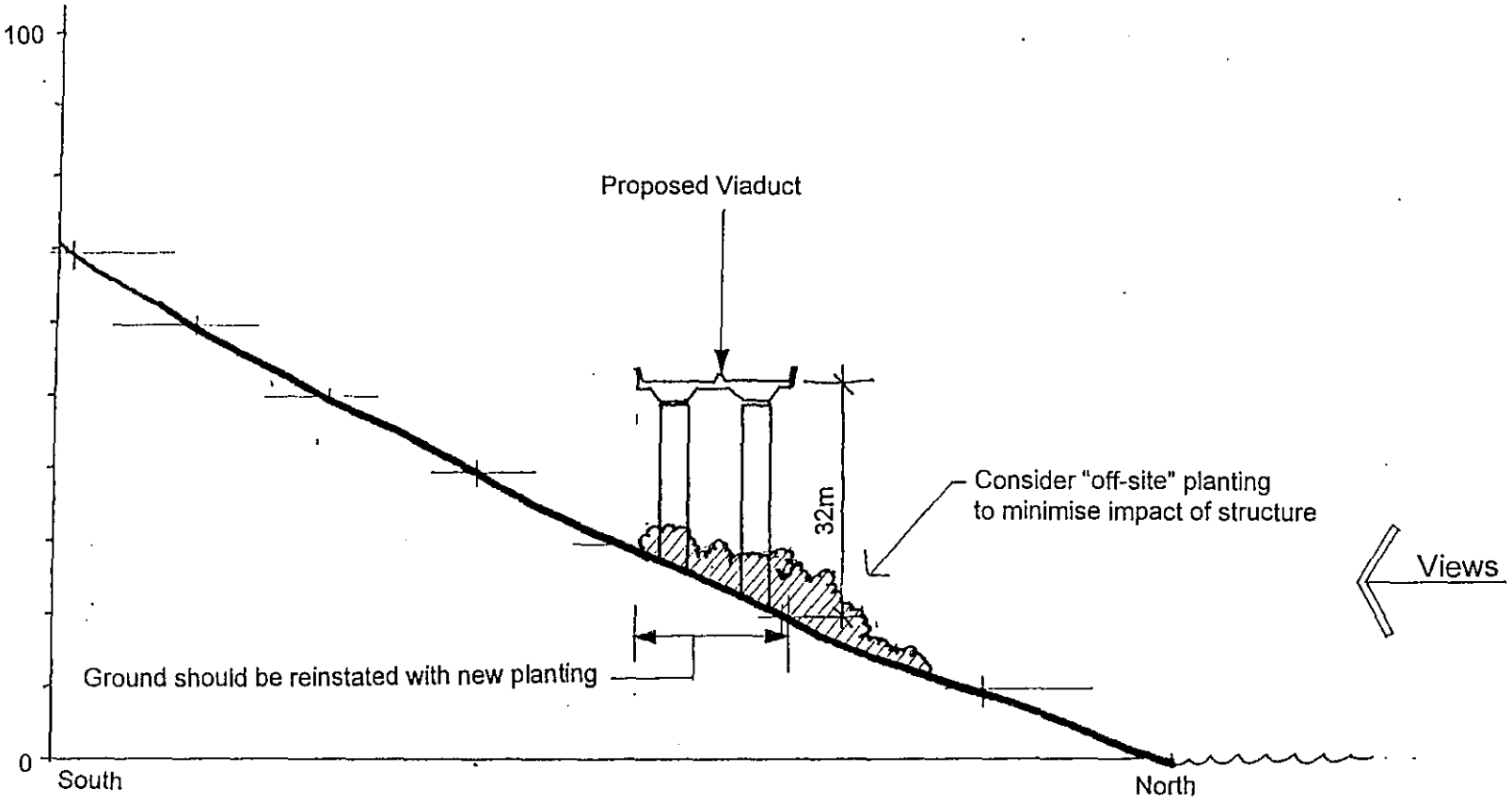
Drawing No. 11.5



SECTION A

Scale 1 : 1000 (V & H)

Viaduct Cross - section A

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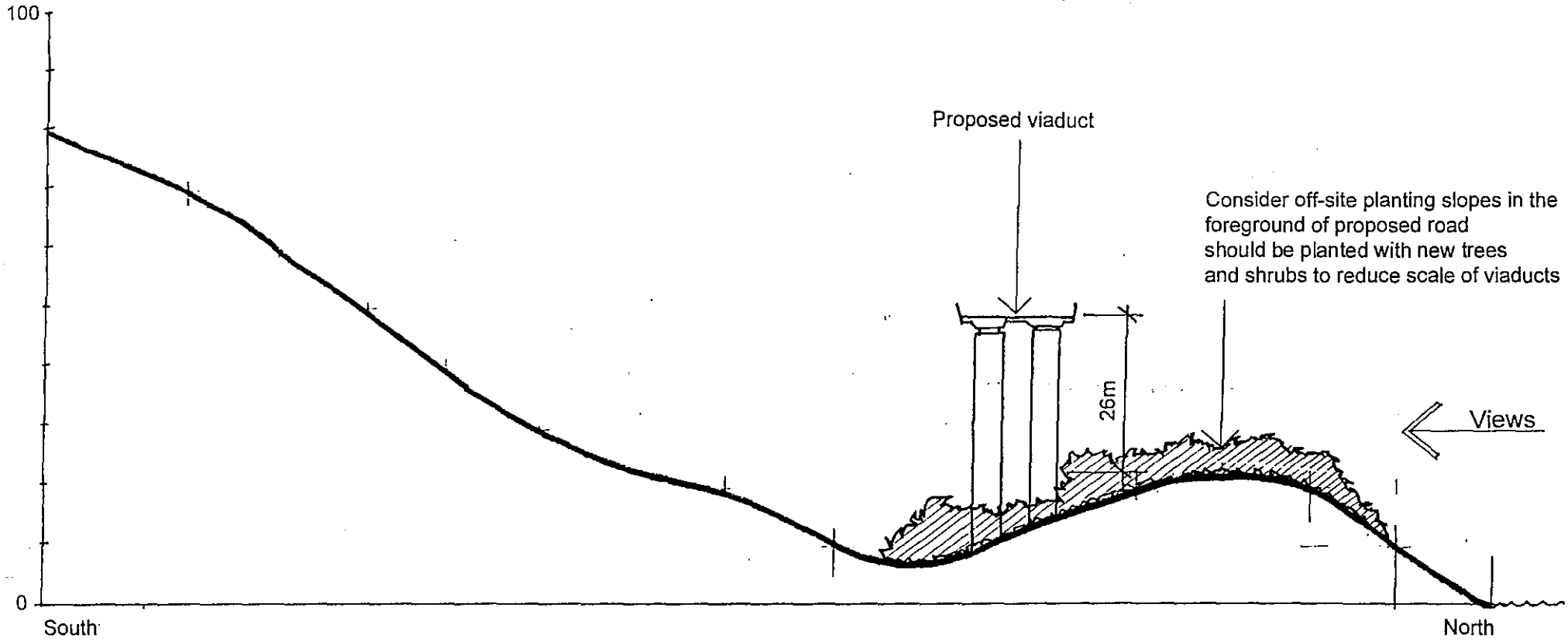
Drawing No. 11.6



SECTION B

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Viaduct Cross - section B

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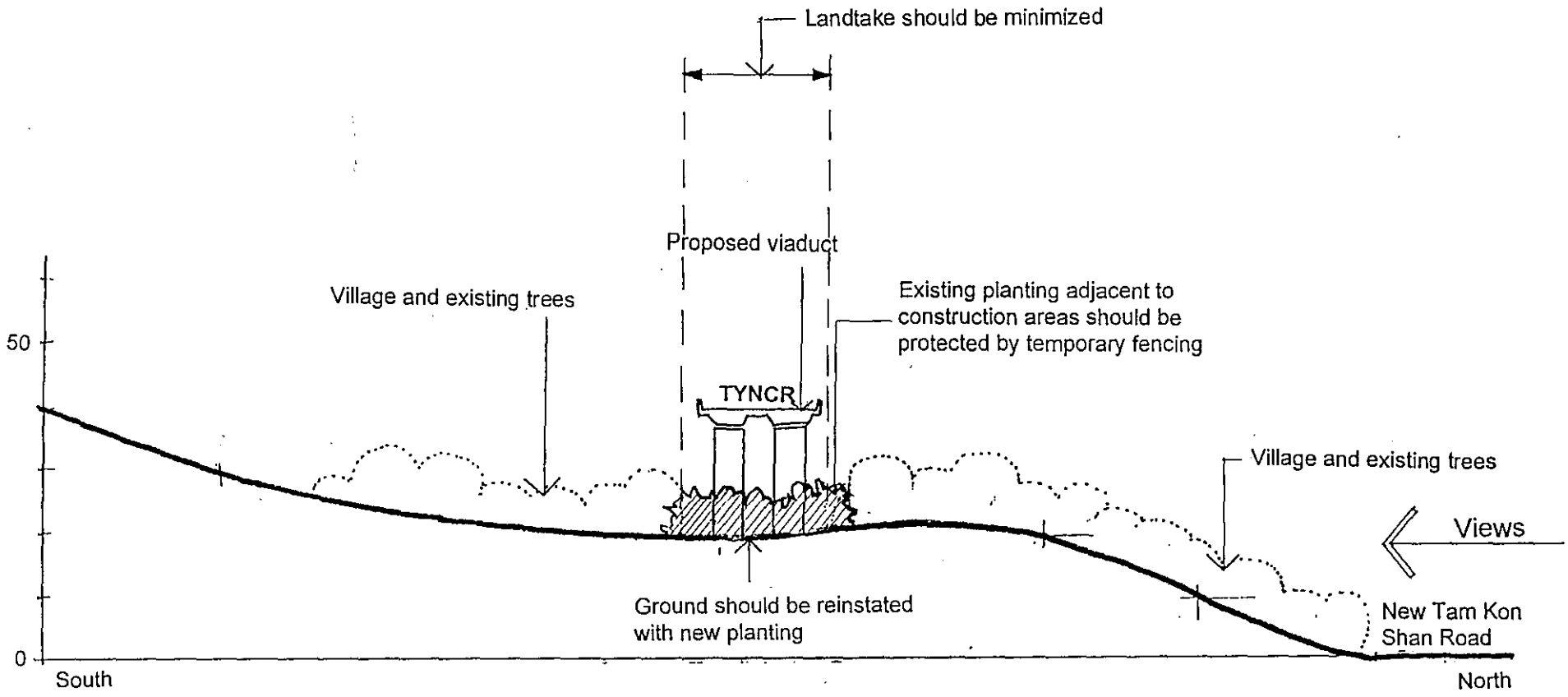
Drawing No. 11.7



SECTION C
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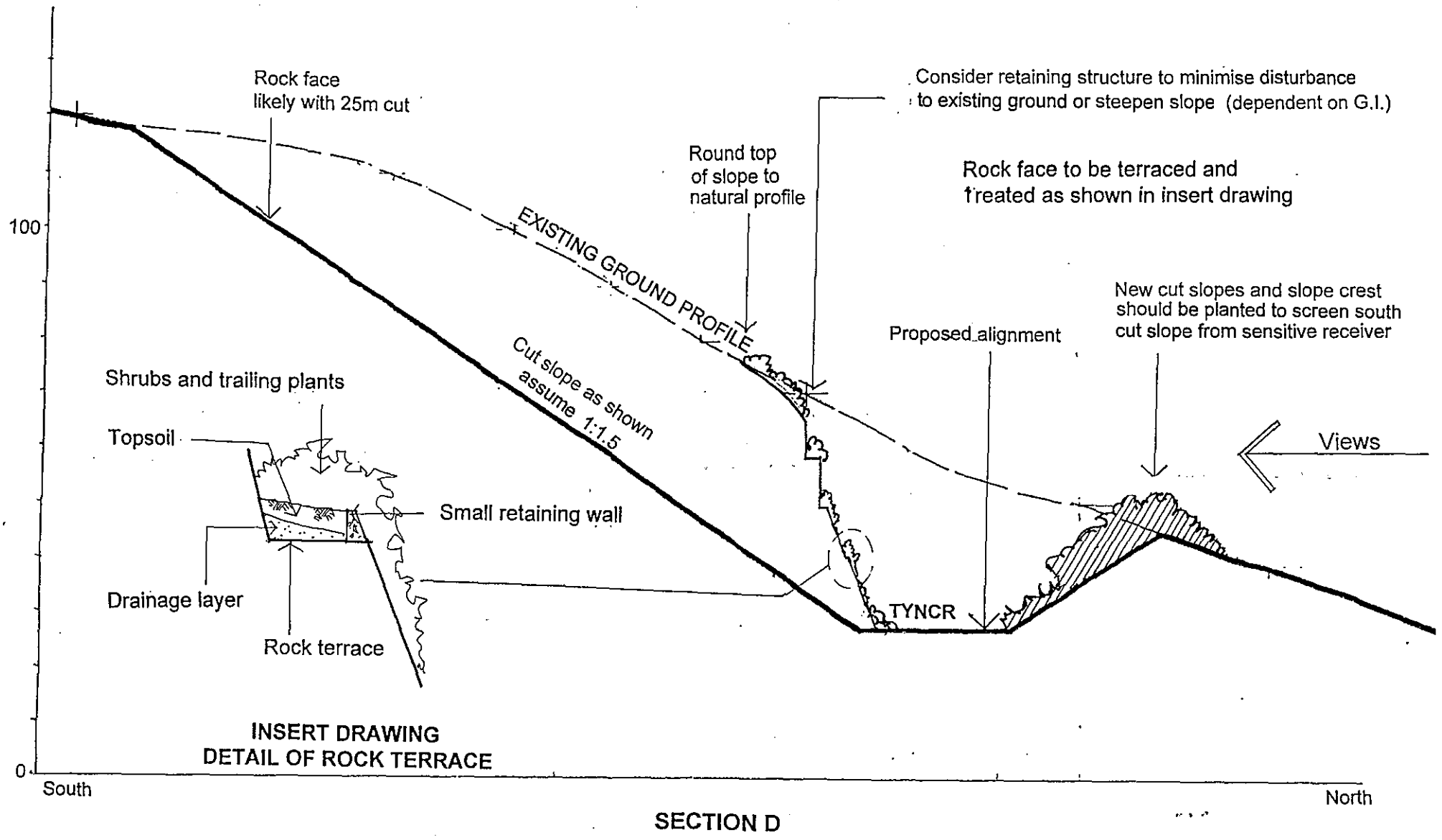
Viaduct Cross - section C

Mouchel

Drawing No. 11.8



Viaduct Cross - section D

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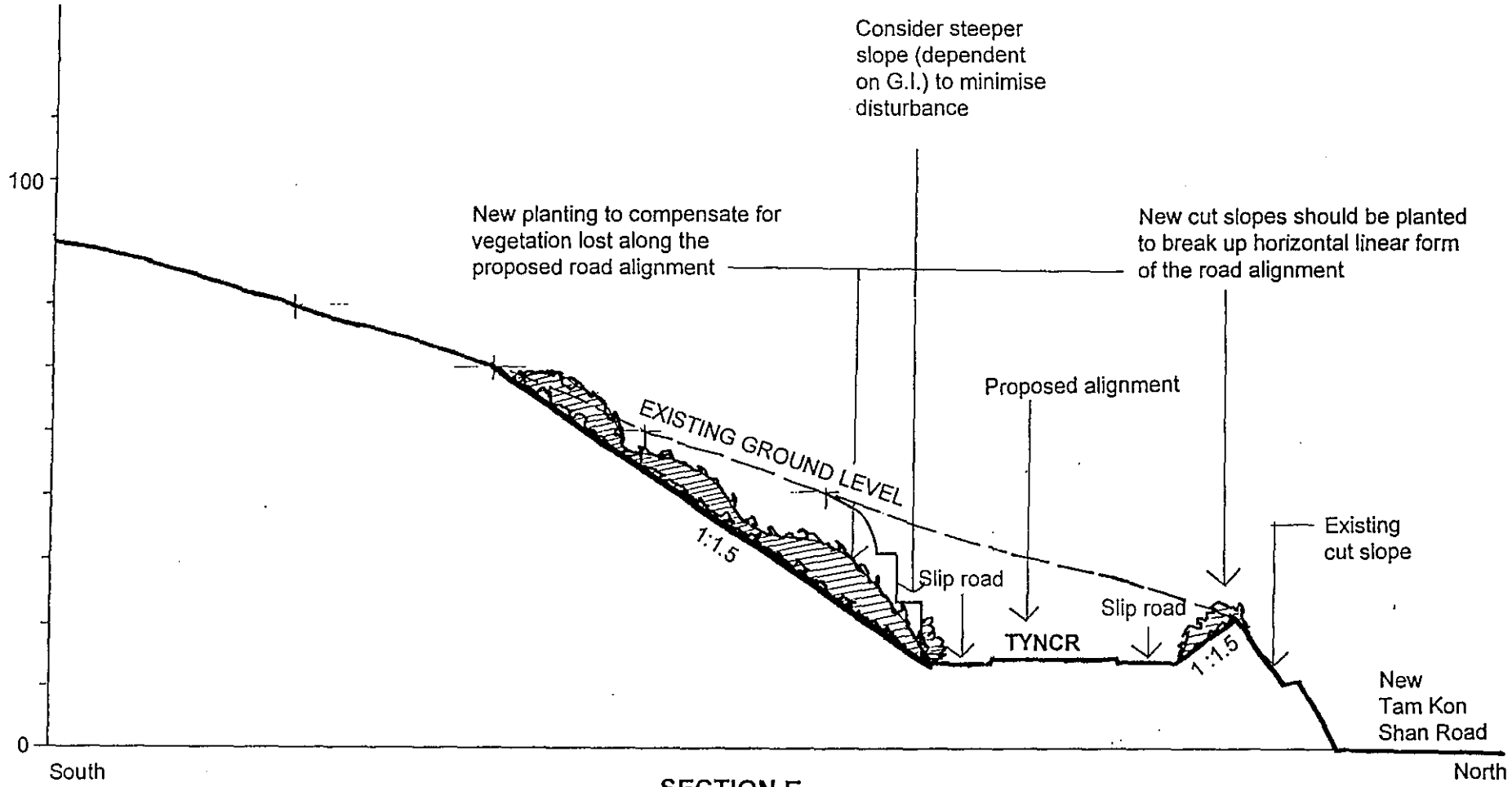
Drawing No. 11.9



SECTION E

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Viaduct Cross - section E

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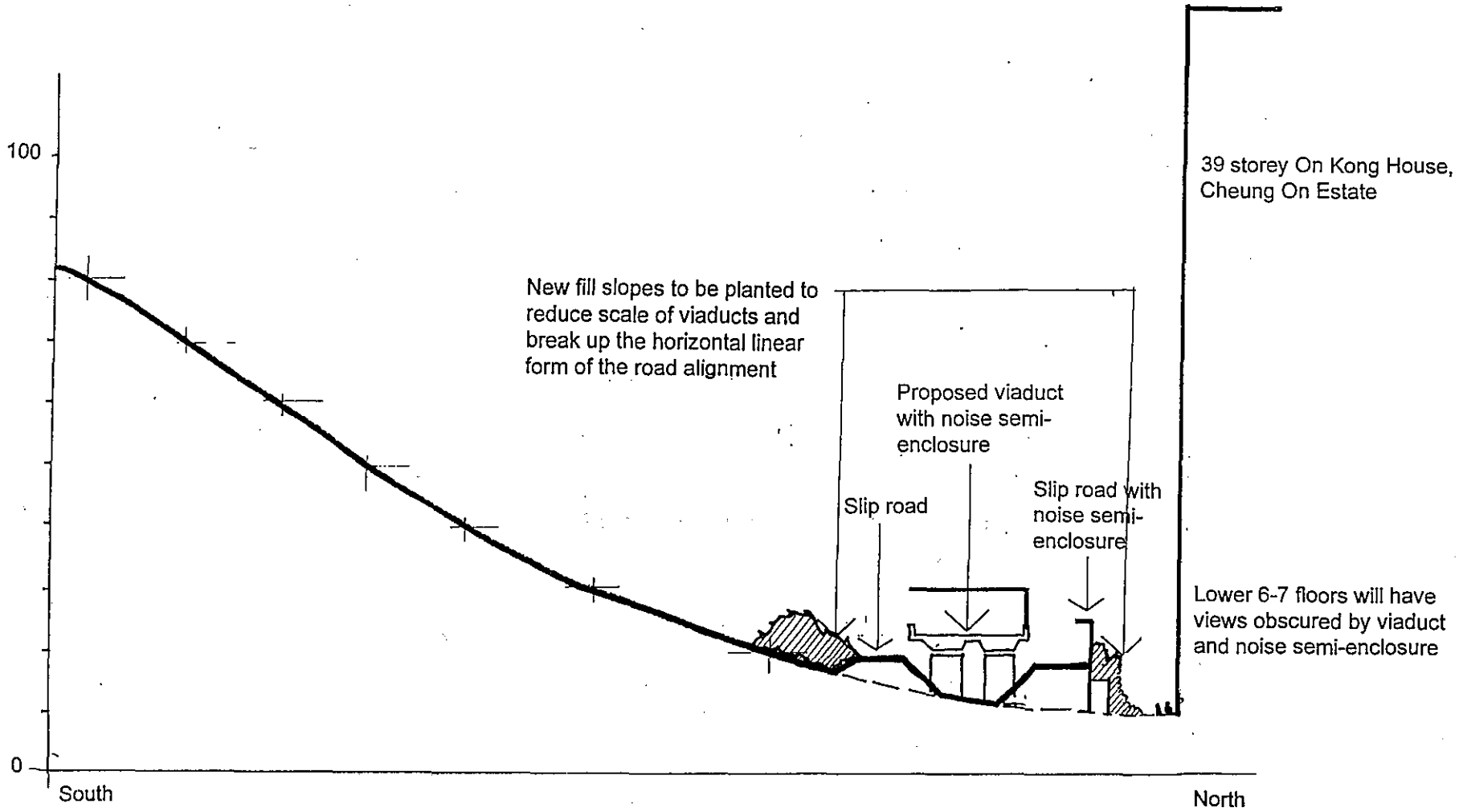
Drawing No. 11.10



SECTION F

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Viaduct Cross - section F

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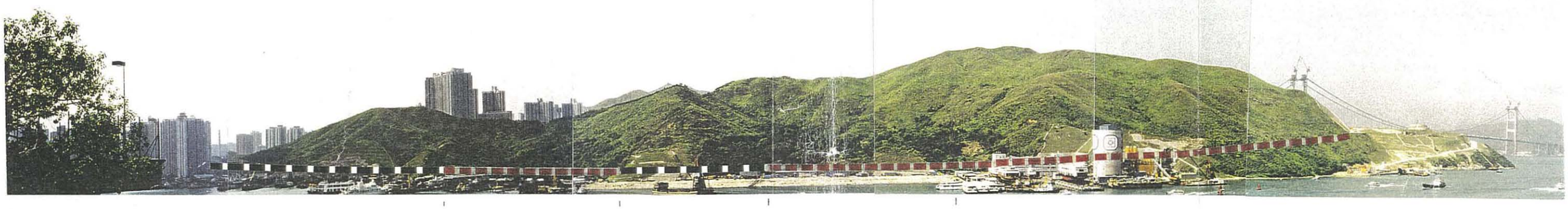
Drawing No. 11.11

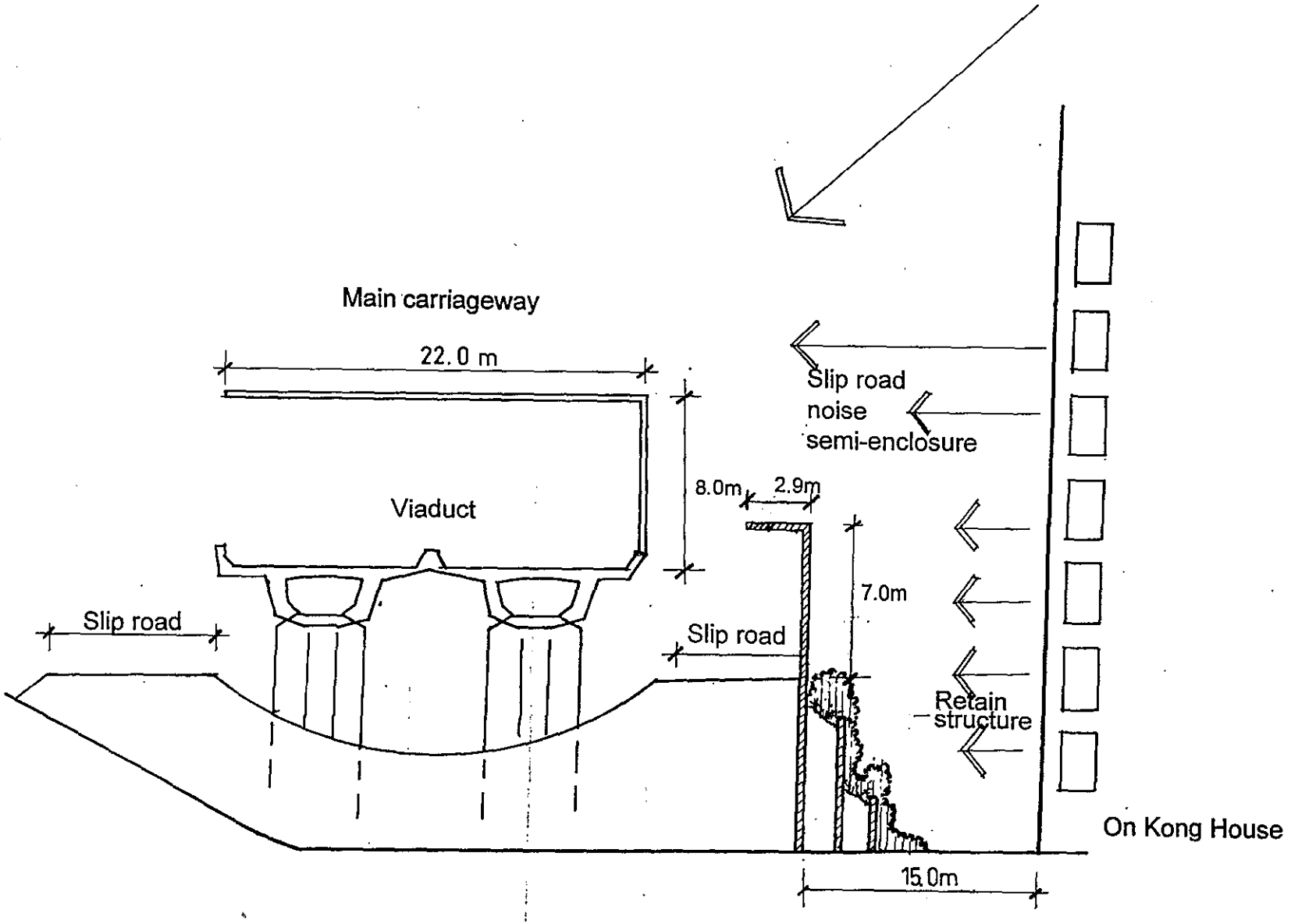


On grade | Viaduct | On grade | Viaduct

Photomontage : Western Section of Alignment

Mouchel

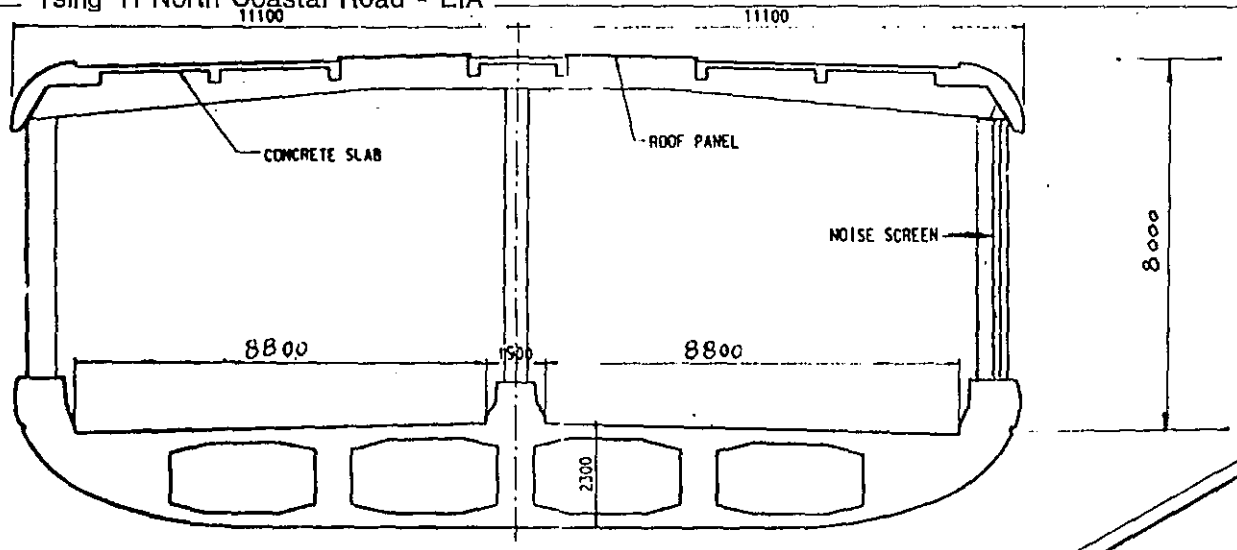
Drawing No. 11.12



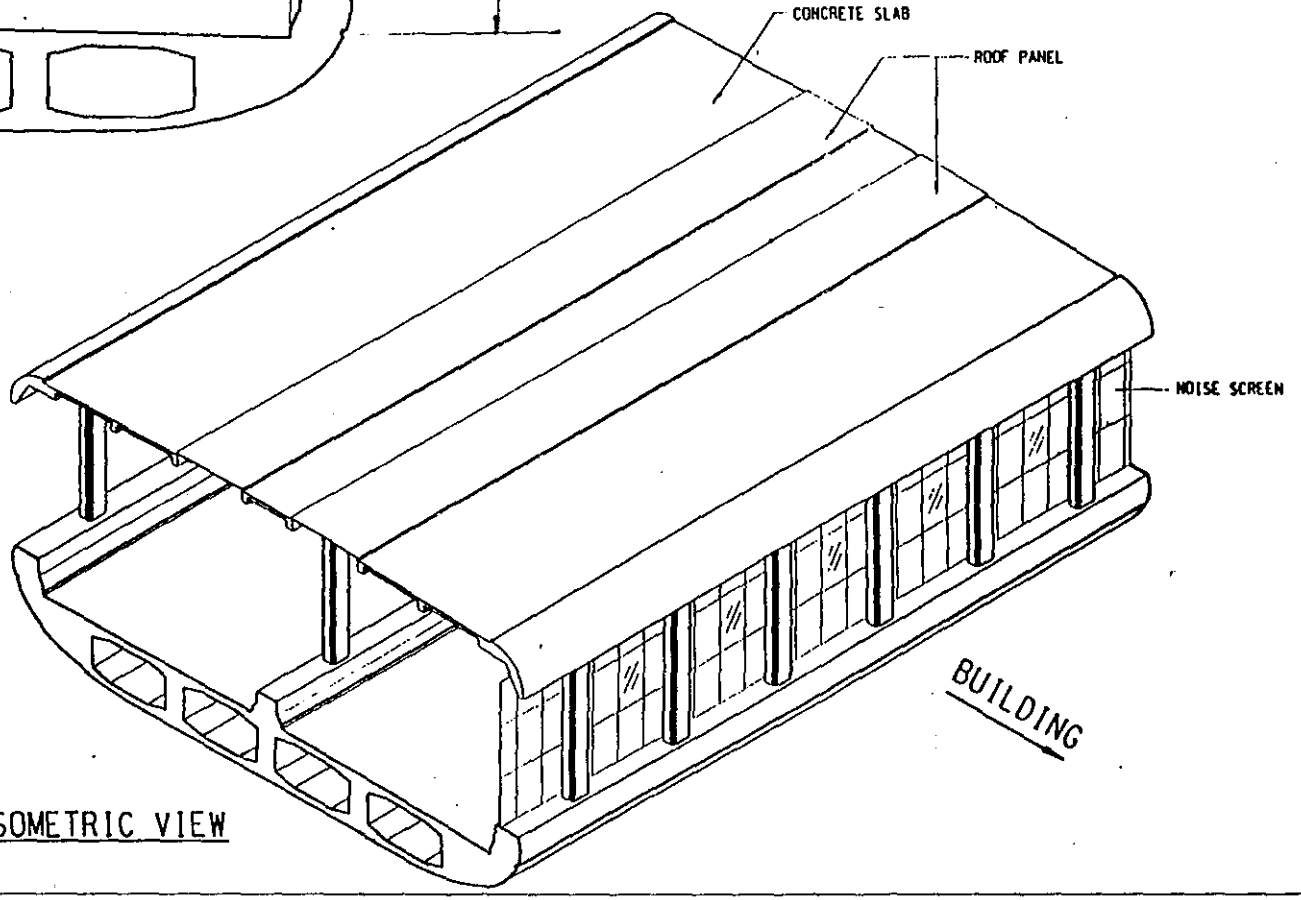
Typical Cross - section at On Kong House

Mouchel

Drawing No. 11.13



CROSS SECTION



ISOMETRIC VIEW

Typical Cross - section of the Noise Semi-enclosure

Mouchel

Drawing No. 11.14

12.0 CONCLUSIONS AND RECOMMENDATIONS

This Environmental Impact Assessment Report assesses the potential environmental impacts associated with the construction and operation of the proposed Tsing Yi North Coastal Road.

Environmental and Visual Impact mitigation measures have been incorporated into the Preliminary Design as far as engineering and site constraints allowed to minimise potential environmental impacts.

The acoustic design is described as below :-

Noise Reducing Highway Surfacing

The new main carriageway, including the existing section of Tsing Tsuen Bridge which has been constructed but not yet opened to traffic will be covered with Noise Reducing Highway Surfacing. The detailed extent of the proposed Noise Reducing Highway Surfacing is shown on Figure 4.2.

Semi-enclosure on Main Carriageway

A semi-enclosure approximately 8 metres high and approximately 22 metres wide open on the side away from the Noise Sensitive Receivers (NSRs) will be required on the main carriageway. The length of the semi-enclosure will be around 450 metres. The location of the semi-enclosure is shown on Figure 4.2 and starts at Ch.0+450 and ends at Ch.0+000. The minimum Transmission Loss (T.L.) for the panel of the semi-enclosure are 29 dB at 125 Hz and 27 dB at 250 Hz.

Acoustic Barrier on Slip Road

An acoustic barrier approximately 7 metres high and approximately 2.9m wide open on the side away from the Noise Sensitive Receivers (NSRs) will be required on the curbside of the northern slip road (slip road A) from the carriageway. The location of the acoustic barrier is shown on Figure 4.2 and starts at Ch.0+600 and ends at Ch.0+203. The minimum Transmission Loss (T.L.) for the panel of the acoustic barrier are 29 dB at 125 Hz and 27 dB at 250 Hz.

Noise

The findings of the report indicate that the recommended mitigation measures will minimise the noise impacts from the operation of the proposed roads. Some of the Noise Sensitive Receivers (NSRs) exceed the noise standards of Hong Kong Planning Standards and Guidelines. However, none of the noise sensitive receivers were found to be eligible for provision of window insulation.

It is recommended that the construction activities should be carried out only in the day time period (08:00 - 19:00) to minimise the noise impacts at the nearest residents. Apart from those mitigation measures recommended in Section 4.4, appropriate standard pollution control clauses would be incorporated into the works contract to minimize the noise impacts during construction phase.

Air Quality

The air impacts at the Air Sensitive Receivers during operation phase are within the standards of the Air Quality Objectives.

Regular watering should also be carried out during construction phase in order to minimise the dust impacts at the nearest residents.

Water Quality

Water quality impacts are expected to be limited to short term increases in suspended solids in the surface waters during the construction phase. Mitigation measures proposed for both construction and operational phases should enable impacts to be kept to within acceptable limits.

Waste Management

There will be no spoil disposal or waste management issues during the operation of the project. Waste handling measures only applies to the activities during construction phase. These include excavated materials suitable for reclamation and fill, general construction waste, demolition waste, chemical waste, general refuse and sewage.

Ecology

The ecological impacts will arise during the construction phase of the project. Much of the proposed road is on elevated structure and will not impact greatly on the existing vegetation. Most of the scheme passes through or over existing habitats which have been assessed as of low ecological interest. Impacts in these areas will be minimal.

Small sections of the proposed road impact areas of local ecological interest. These are the proposed road works located on small areas of natural tall scrub and the impacts on a limited number of small freshwater streams.

The link road from the proposed new carriageway to the Tam Kon Shan Road would also impact on habitats of local importance.

Mitigation measures have been suggested for these sections. Providing these mitigation measures are adopted, the project should not cause unacceptable residual impacts. No part of the proposed scheme is considered to impact on areas of high ecological interest.

Visual Impact

The proposed development should incorporate the following design features:

- use of non-opaque panels on sound enclosures to reduce headlight glare
- screening of sound enclosures with natural vegetation
- walls stepped back to include natural plants
- drainage channels should incorporate natural materials in the vertical faces
- revegetation with native environment tolerant species should be carried out

The detailed design of viaduct and noise mitigation structures should give particular attention to their appearance. A detailed submission should be made to ACABAS;

Control of the construction area and construction practices is required to minimise landscape and visual impacts in the western section of the alignment;

Design and Build contract arrangements are not recommended;

It is strongly recommended that the TYNCR should demarcate the extent of any further modification to the Tsing Yi coastal hills, and the remainder of the natural backdrop be maintained in perpetuity.

Appendix A

Ecological References of particular relevance to the Road Construction Projects in Hong Kong

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Ecological References of particular relevance to the Road Construction Projects in Hong Kong

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Appendix B

Legislation and Guidelines relating to habitats and species in Hong Kong of direct relevance to the Tsing Yi North Coastal Road Project

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Legislation and guidelines relating to habitats and species in Hong Kong of direct relevance to the Tsing Yi North Coastal Road Project

HONG KONG LEGISLATION

With regard to the Hong Kong legislation, protection of animals and plants is provided by:

- Forests and Countryside Ordinance,
- Wild Animals Protection Ordinance
- Animals and Plants (Protection of Endangered Species) Ordinance.

Protection for habitats is provided by:

- Country Parks Ordinance (covering Country Parks and Special Areas)
- Wild Animals Protection Ordinance (covering Restricted Areas)
- Waterworks Ordinance (covering Water Gathering Grounds)
- Town Planning Ordinance which provides for the designation and protection through the planning process of coastal protection areas, Sites of Special Scientific Interest, green belts and other specified uses which promote conservation or the protection of the environment.
- The currently proposed Environmental Impact Assessment (EIA) Bill and its draft Technical Memorandum Annexes 8 and 16 (February 1996 version as latest available) will, if adopted, have a major influence "across the board".

Hong Kong Ordinances Protecting Animals and Plants

Forests and Countryside Ordinance (Cap. 96) of the Revised Edition 1984

The Forests and Countryside Ordinance (Cap 96) prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on government land, which includes the mangroves in Deep Bay. Its subsidiary Regulations prohibit the picking, felling or possession of listed rare and protected plant species.

The list of protected species in Hong Kong which comes under the Forestry Regulations was last amended on 11th June 1993 under the Forestry (Amendment) Regulation 1993 made under section 3 of the Forests and Countryside Ordinance (Cap. 96).

Wild Animals Protection Ordinance (Cap 170) of the Revised Edition 1980

Under the Wild Animals Protection Ordinance, designated all wild animals are protected from hunting, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals, except some domestic pests are protected under this Ordinance. Prior approval from the Director of Agriculture and Fisheries is required for permission to destroy any of the protected wild animals listed in the Ordinance.

The Second Schedule of the Ordinance which lists all the animals protected was last revised in June 1992.

Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187) of the Revised Edition 1989.

The Animals and Plants (Protection of Endangered Species) Ordinance controls the local possession of any endangered species of animals and plants listed in its schedules.

It is designed to control trade in endangered species and restricting the local possession of them.

Hong Kong Ordinances Protecting Habitats

Country Parks Ordinance (Cap 208) of the Revised Edition 1986 (covering Country Parks and Special Areas)

Country Parks and Special Areas are designated under the Country Parks Ordinance and managed by the Agriculture and Fisheries Department on the advice of the Country Parks Board. At present there are 21 Country Parks and 14 Special Areas, 11 of which are in the Country Parks. Country Parks are designation for the purposed of nature conservation, countryside recreation and education; Special Areas are areas of government lands with special interest and importance by reason of their flora, fauna, geological, cultural or archaeological features.

Special Areas within Country Parks receive no additional legal protection but the extra status does serve to highlight areas of particular conservation significance.

Wild Animals Protection Ordinance (Cap 170) of the Revised Edition 1980

The Wild Animals Protection Ordinance restricts access to designation areas of wildlife habitat. The Sixth Schedule lists areas in which entry or presence is restricted. Currently only two areas are listed both of which are in the northern New Territories.

Water Gathering Grounds (Waterworks Ordinance Cap 102)

Water Gathering Grounds comprise areas which are conserved for use as water catchment. There are four broad categories which may warrant different controls on use and development. These are:

- Direct Gathering Grounds;
- Indirect Gathering Grounds;
- Minor Supply Gathering Grounds; and
- Flood Pumping Gathering Grounds.

The Water Supplies Department (WSD) has specific requirement to control or restrict development and land use in water gathering grounds. For planning and management in water gathering grounds, WSD should be consulted.

Whilst this Ordinance is not designed explicitly to protect habitats and species, by conserving the areas for water gathering grounds and protecting them from development and other adverse land uses, they are often protected indirectly.

Town Planning Ordinance (Cap 131)

The recently amended Town Planning Ordinance provide for the designation of " ..... coastal protection areas, Sites of Special Scientific Interest (SSSIs), green belts or other specified uses that promote conservation or protection of the environment e.g.Conservation Areas.

Where SSSIs are covered by statutory town plans, the land uses therein are controlled by the provision of the Town Planning Ordinance.

The authority responsible for administering the Town Planning Ordinance is the Town Planning Board (Planning Department).

OTHER EXISTING OR PROPOSED MECHANISMS OF PROTECTION IN HONG KONG

Hong Kong Planning Standards and Guidelines

The new revised Chapter 10 of the Hong Kong Planning Standards and Guidelines (HKPSG) covers "Landscape and Conservation". Chapter 9 of the same document covers the "Environment". This section details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The Appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government Departments involved in Conservation.

Sites of Special Scientific Interest in Hong Kong

Sites of Special Scientific Interest are identified by the Agriculture and Fisheries Department as a planning measure to ensure that government departments are aware of the scientific importance of such sites so that consideration are given to conservation when developments in or near such sites are proposed. Where SSSIs are covered by statutory plans, the land uses therein are controlled by the provision of the Town Planning Ordinance.

SSSIs may be land based or marine sites which are of special interest because of their flora, fauna, geographical, geological or physiographic features. The Planning Department maintains a register of the SSSIs. Once identified, SSSIs are shown on statutory and departmental plans prepared by the Planning Department.

Some 58 SSSIs have been identified and listed in the Register kept by the Planning Department. Approximately half of the SSSIs which fall inside the Country Parks and Special areas, are maintained by AFD.

Water Control Zones

Water Control zones are gazetted under the Water Pollution Control Ordinance Cap. 358 with the intention of controlling discharges.

Appendix C

Recommended Native Trees And Shrubs

Appendix C

SELECTED NATIVE TREES AND SHRUBS WHICH ARE ATTRACTIVE TO WILDLIFE AND ARE GENERALLY RECOMMENDED FOR PLANTING ON THE TSING YI NORTH COASTAL ROAD SITE

TREES

Abarema clypearia
Acronychia pedunculata
Aporusa chinensis
Aquilaria sinensis
Bridelia monoica
Castanopsis fabri
Castanopsis fissa
Castanopsis tribloides
Celtis sinensis
Cinnamomum camphora
Cinnamomum parthenoxylon
Cratoxylon ligustrinum
Diospyros morrisiana
Diospyros eriantha
Endospermum chinense
Evodia spp.
Ficus microcarpa
Ficus subulata
Ficus variegata
Garcinia oblongifolia
Gordonia axillaris
Ilex cinerea
Itea chinensis
Liquidamber formosana
Litsea cubeba
Litsea glutinosa
Litsea monopetala
Litsea rotundifolia
Machilus breviflora
Machilus oreophila
Machilus thunbergii
Machilus velutina
Mallotus paniculatus
Morus alba
Myrica rubra
Ormosia spp.
Pentaphylax euryoides
Prunus phaeosticta
Quercus glauca
Quercus myrsinaefolia

Quercus championi
Quercus bambusaefolia
Reevesia thyrsoidea
Rhodoleia championi
Sapium discolor
Sapium sebiferum
Schefflera octophylla
Schima spuerba
Sterculia lanceolata
Symplocos glauca
Symplocos lanceolata
Symplocos laurina
Symplocos crassifolia
Symplocos glauca
Symplocos paniculata
Syzygium buxifolium
Syzygium hancei
Syzygium levinei
Syzygium jambos
Viburnum odoratissimum
Viburnum sempervirens

SHRUBS

Callicarpa pedunculata
Clerodendrum spp
Eurya chinensis
Eurya japonica
Ilex asprella
Ilex pubescens
Ilex rotunda
Ligustrum sinense
Melastoma candidum
Melastoma sanginium
Microcos paniculata
Mussaeanda pubescens
Psychotria rubra
Raphiolepis indica
Rhamnus chinensis
Rhododendron simsii
Rhodomyrtus tomentosa
Vitex negundo
Wickstroemia indica
Wickstroemia nutans

Note 1 Many of the trees and shrubs on this list have already been recorded on this site or in the surrounding areas.

Note 2 Some of the species may not be available in local nurseries.

Note 3 Some of the species listed require sheltered locations and reasonable soil condiitions and would not be suitable for planting on the exposed cut slopes formed by the proposed road.