ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1. INTRODUCTION

An Environmental Impact Assessment (EIA) has been prepared to provide information on the nature of environmental impacts likely to arise from the proposed Cyberport Development. The EIA has also assessed the acceptability of the identified environmental impacts on representative sensitive receivers following the implementation of proposed mitigation measures. Details of the findings are given in the EIA Report which has been submitted in accordance with the Environmental Impact Assessment Ordinance.

The proposed Cyberport Development is location at Kong Sin Wan (also known as Telegraph Bay) as shown in Figure 1. For the purpose of Section 16 Planning Application, the detailed noise and air quality impact assessments have been undertaken based on the latest layout plan as shown in Figure 2.

2. NOISE IMPACT ASSESSMENT

2.1 Assessment Criteria

Road traffic noise impact at sensitive facades has been assessed against the noise standard of L_{10} (1 hour) 70 dB(A) as stipulated in the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM). Sensitive facades are those incorporating windows that are necessary for room ventilation.

For the site larger than 9 hectares, at least 96% of the residential units are required to comply with the noise standard according to the EPD Practice Note for Professional Persons ProPECC PN 1/97.

2.2 Assessment Methodology

A computer model has been used to calculate noise levels generated from road traffic according to the procedures in the U.K. Department of Transport's (DOT) *Calculation of Road Traffic Noise (1988)*. Results are given in terms of L_{10} (1 hour) dB(A) noise levels.

The noise assessment has been based on peak-hour road traffic flows predicted for the year 2022 on the major roads nearby as shown in Figure 3.

2.3 Impact Assessment

Road traffic noise calculations have been carried out based on the traffic flow figures for the major concerned roads. Predicted noise levels at representative noise sensitive facades (see Figure 4) resulting from 2022 traffic flows are presented in Table 1. It should be noted that the predicted noise levels in Table 1 have already included a positive 2.5 dB(A) facade correction.

Most of the dwellings are expected to experience noise levels exceeding the noise criterion. Noise levels at sensitive

facades of Phase RIII development (NSRs 1-5) facing Southern Access Road are predicted to exceed the noise criterion by 1-6 dB(A), while noise levels at NSR 6 facing road D1 are predicted to exceed the noise criterion by 1 dB(A). Higher noise levels at facades (NSRs 7-13) of Phase RIV development facing Southern Access Road are predicted to exceed the noise criteria by 1-8 dB(A) due to its close proximity to the Southern Access Road and Route 7. Noise levels at facades (NSRs 14-19) of Phase RI are predicted to exceed the noise criterion by 1-7 dB(A). The noise exceedances at NSRs 14 & 16 are mainly attributed to Route 7, while the exccedance of noise levels at other NSRs are attributed to Road D1. Noise levels at NSR 20 are all in compliance with the noise criterion in view of the sufficient building setback from Road D1. Noise levels at sensitive facades of Phase RV development (NSRs 30-37) facing Road D1 are predicted to exceed noise criterion by 1 – 6 dB(A).

While the predicted noise levels at first floor of houses facing Route 7 except NSR 27 meet the noise criterion taking into account the topographical screening effect, those facades at second floor exceed the noise criterion by 1-4 dB(A). For NSR 29 facing Road D2, the predicted noise levels would exceed the noise criterion by up to 7 dB(A).

2.4 Noise Mitigation Measures

In order to alleviate the road traffic noise impacts, the following noise mitigation measures have been proposed for the proposed development taking into account the layout and forms of sensitive buildings. The proposed noise mitigation measures are also depicted in Figure 5. Absorptive panels would be provided to all noise screening structures shown in Figure 5.

- Cantilevered barrier of 5.5m high and 200m long with a 2.5m cantilever inclined at 30° to screen mid/high-rise residential buildings along Southern Access Road. The barrier would be erected at the edge of the road kerb.
- Partial enclosure of 5.5m high and 360m long with a 6m cantilever inclined at 90° to screen mid/high-rise residential buildings along Southern Access Road. The partial enclosure would be erected at the verge of the road.
- Cantilevered barrier of 5.5m high and 100m long with a 3.5m cantilever inclined at 45° along Southern Access Road to screen the "ridge houses". The barrier would be erected at the verge of the road.
- Cantilevered barrier of 5.5m high and 185m long with a 2.5m cantilever inclined at 30° to screen mid/high-rise residential buildings along Road D1. The barrier would be erected at the verge of the road.
- 1.5m high vertical barrier of 280m long and 2m high vertical barrier of 45m long along Route 7 to screen the houses alongside. These barriers would be located at +10.0 mPD in the buffer zone on the verge of Route 7.
- 2.5m high vertical barrier of 30m long at roundabout to screen the houses facing the roundabout. The barrier would be erected at +10.0 mPD along the edge of the roundabout in order to prevent sightline problem.
- 4m high vertical barrier of 100m long along Road D2 to screen the houses facing Road D2. The barrier would be erected at the verge of the road.

- Cantilevered barrier of 5.5m high and 760m long with a 3.5m cantilever inclined at 45° along Route 7 to screen the high-rise buildings.
- Cantilevered barrier of 5.5m high and 570m long with a 3.5m cantilever inclined at 45° along the central divider of Route 7.
- Two segments of 4m high vertical barriers of total 245m long along the central divider of Route 7.
- Low noise surface measures on Route 7 and its associated slip roads, the level section of Road D1, and a short section of Southern Access Road.

With the above mitigation measures in place, full compliance with the noise criterion would be achieved. The noise levels are in the range of 59 to 70 dB(A). The road traffic noise exposure compliance of the proposed development is considered to be within Zone I (i.e. Acceptable Performance) according to the ProPECC PN 1/97. The mitigated road traffic noise levels are shown in Table 2.

A comparison of the environmental performance, in terms of compliance rate, between the approved EIA Study and this Section 16 Application is shown in Table 3.

In both schemes, while about 81% of the total number of residential flats will be exposed to noise levels in the range of 65 to 70 dB(A), the remaining 19% of the flats will experience the noise level of below 65 dB(A). However, it should be noted that more dwellings (i.e. 9.4% of the total number of flats) would have a better living environment in terms of noise impact (i.e. equal to or below 60 dB(A)) under the scheme of Section 16 Application. In other words, the environmental performance requirements in the approved EIA Study would be further improved by implementing the above-mentioned noise mitigation measures.

Table 3 Comparison of Compliance Rate

Noise Level Range, dB(A)	Compliance Rate (% of the total number of flats)	
	EIA Report	S.16 Application
≤ 60	5.5	9.4
61 – 62	7.5	3.6
63 – 64	6.4	6.4
65 – 66	14.0	16.6
67 – 68	32.1	31.9
69 - 70	34.5	32.1

2.5 Conclusions

Traffic noise will be a key environmental issue during the operation phase of the proposed development. Noise mitigation measures including vertical barriers, partial enclosure and cantilevered barriers of various lengths, will be required to alleviate the adverse noise impacts. Also, low noise surfacing material will be required on Route 7, part of Road D1 and a short section of Southern Access Road. It has been predicted that the noise levels at all representative noise sensitive facades would comply with the noise standard with the proposed mitigation measures in place.

Table 1 Road Traffic Noise Levels in year 2022 (Unmitigated)

Mid / High Rise Residential

Sensitive Facade	Facade Noise Level at Storey, dB(A) L_{10} (1-hr)				
	1	10	20	30	Top Floor
1	75.5	73.8	72.2	-	72.0
2	76.2	74.2	72.5	-	72.2
3	75.4	73.7	72.1	-	71.5
4	73.6	72.3	71.0	-	70.0
5	71.5	70.8	69.9	-	69.0
6	71.4	70.8	70.1	-	70.0
7	74.9	74.1	72.3	70.9	69.9
8	77.2	74.9	73.4	72.3	71.6
9	74.6	75.1	73.8	72.9	72.0
10	77.3	76.1	75.0	74.2	73.2
11	76.6	76.1	75.0	74.1	72.9
12	77.6	76.3	75.0	74.1	72.9
13	74.1	74.7	74.4	73.6	72.8
14	77.6	76.3	74.9	73.7	72.2
15	74.9	72.9	71.4	70.5	69.1
16	74.8	74.6	73.4	72.4	71.0
17	75.0	72.9	71.6	70.7	69.5
18	74.7	73.0	71.8	70.9	69.9
19	73.7	72.3	71.3	70.6	69.8
20	70.0	69.5	69.4	68.8	68.5

Houses

Sensitive Facade	Facade Noise Level at Storey, dB(A) L_{10} (1-hr)	
	1	2
21	69.0	72.4
22	68.8	72.2
23	68.7	72.0
24	69.3	72.6
25	69.5	72.5
26	68.5	71.4
27	70.6	73.7
28	70.0	72.4
29	74.9	76.5

"Ridge House"

Sensitive Facade	Facade Noise Level at Storey, dB(A) L_{10} (1-hr)		
	1	3	5
30	75.4	76.3	76.2
31	75.9	76.0	75.8
32	74.5	74.7	74.6
33	73.5	73.6	73.6
34	72.1	72.4	72.4
35	71.7	72.3	72.3
36	70.9	71.8	72.0
37	71.3	72.0	72.1

Note: **Figures in boldface represent noise exceedance of 70 dB(A).**

Table 2 Road Traffic Noise Levels in year 2022 (Mitigated)

Mid / High Rise Residential

Sensitive Facade	Facade Noise Level at Storey, dB(A) L_{10} (1-hr)				
	1	10	20	30	Top Floor
1	65.4	67.0	68.3	-	68.5
2	65.3	67.4	69.2	-	69.5
3	64.9	66.4	68.1	-	68.4
4	62.2	65.4	65.6	-	66.3
5	58.5	64.5	64.8	-	64.4
6	68.4	67.7	67.0	-	66.9
7	63.5	66.4	67.8	67.7	67.8
8	66.7	69.5	69.5	69.3	69.0
9	66.0	68.5	68.9	69.1	68.9
10	68.1	69.6	69.9	69.7	69.4
11	67.3	69.0	69.2	69.2	68.9
12	69.9	69.9	69.5	69.1	68.6
13	65.8	67.6	68.4	68.1	68.0
14	68.7	68.6	68.4	68.3	68.3
15	65.3	69.0	68.5	67.7	66.5
16	65.7	66.3	66.7	66.5	66.4
17	63.2	69.0	68.8	68.2	67.1
18	63.9	68.6	69.0	68.4	67.6
19	66.8	67.1	68.5	68.3	67.8
20	66.6	66.2	66.7	66.6	66.4

Houses

Sensitive Facade	Facade Noise Level at Storey, dB(A) L_{10} (1-hr)	
	1	2
21	64.0	66.6
22	64.6	67.6
23	65.2	68.6
24	66.0	69.6
25	65.8	69.6
26	65.2	68.5
27	66.4	70.2
28	66.6	69.6
29	68.8	70.0

"Ridge House"

Sensitive Facade	Facade Noise Level at Storey, dB(A) L_{10} (1-hr)		
	1	3	5
30	64.2	64.9	65.6
31	66.9	68.5	69.6
32	68.8	69.7	70.4
33	68.8	68.9	69.2
34	67.8	68.4	68.5
35	68.0	68.4	68.5
36	69.1	69.1	68.9
37	70.4	70.0	69.7

3. AIR QUALITY IMAPCT ASSESSMENT

3.1 Assessment Criteria

The main air quality issue during the operation phase of the site is vehicle emissions from the nearby roads. Air pollutants come under the control of the Air Pollution Control Ordinance, which requires for compliance with a set of health-related air quality objectives (AQO) for seven pollutants, of which NO_2 and RSP are the major concern. Compliance with the concentration levels shown below in Table 3 is required.

3.2 Assessment Methodology

Line Source Dispersion Model

The US EPA CALINE4 model which is based on the Gaussian diffusion equation to characterise pollutant dispersion over the roadway has been used to model air quality at the Air Sensitive Receivers (ASRs). The model uses as input the vehicle emissions from the traffic forecasts for 2022. As the air pollutants of prime concern from vehicle emissions are Respirable Suspended Particulate (RSP) and Nitrogen Dioxide (NO_2), the model has been employed to predict concentrations of these two parameters. In the calculations, RSP has been modelled as particulate while NO_2 has been modelled as inert gas.

Table 3 Air Quality Objectives

Parameter	Maximum Permitted Average Concentration ($\mu g/m^3$)		
	1 hour	24 hours	Yearly
RSP	--	180	55
NO_2	300	150	80

Notes:
- All criteria are Hong Kong Air Quality Objectives.
- Hourly criterion for NO_2 not to be exceeded more than three times per year.
- 24-hour criteria not to be exceeded more than once per year.
- Expressed at the reference condition of 298K and 101.325 KPa.

Meteorological Conditions

The following assumed meteorological conditions have been used in the air quality modelling using the CALINE4 model:

Mixing height: 500m
Surface Roughness: 1.0 m
Height of Emissions: Ground Level
Wind speed: 1m/s
Stability Class: "D" for daytime & "F" for nighttime
Wind Direction: worst case
Directional Variability: 12° for daytime & 5° for nighttime

Emission Factors

The EPD's Fleet Average Emission Factors contain emission factors for various types of vehicles in different years of operation. Under the current emission controls, emissions

from vehicles will be reduced as a result of more vehicles being fitted with catalytic converters. In view of the decreasing emission rates of the pollutants, it is likely that the predicted concentration would be reduced with time in spite of the increased traffic flows. Therefore, the Fleet Average Emission Factors for 2011 being applied to the morning peak hours 2022 traffic composition is considered to represent the worst long-term scenario and is thus adopted for this assessment. The traffic figures and the vehicle composition have been included in Annex A.

Background Pollutant Concentrations

Background pollutant concentrations have been derived from EPD's Air Quality Monitoring Station at Central/Western. According to "Air Quality in Hong Kong, 1997" published by the EPD, the annual average concentrations of RSP and NO_2 are :

RSP = 56 $\mu g/m^3$
NO_2 = 58 $\mu g/m^3$

In the absence of in-situ monitoring data, the above figures have been used as the background concentration for the impact assessment.

3.3 Impact Assessment

The RSP and NO_2 concentrations resulting from the use of Road D1, Road D2, Northern Access Road, Southern Access Road and Route 7 have been predicted using the CALINE4 model and the Fleet Average Emission Factors described above. Representative air sensitive receivers as shown in Figure 6 have been designated to determine the air quality impact, and the results are shown in Table 4. The background RSP and NO_2 concentrations have been included. It should be noted that the side-effects of the proposed noise mitigation measures have been taken into account.

Table 4 1-Hour NO_2 and 24-Hour RSP Concentrations at 1.5m Above Ground Level

ASR	Concentrations in $\mu g/m^3$ at 1.5m Above Ground Level	
	1-hour NO_2	24-hour RSP
1	140	102
2	126	94
3	213	129
4	198	125
5	116	88
6	246	151
7	208	131
8	222	138
9	143	99

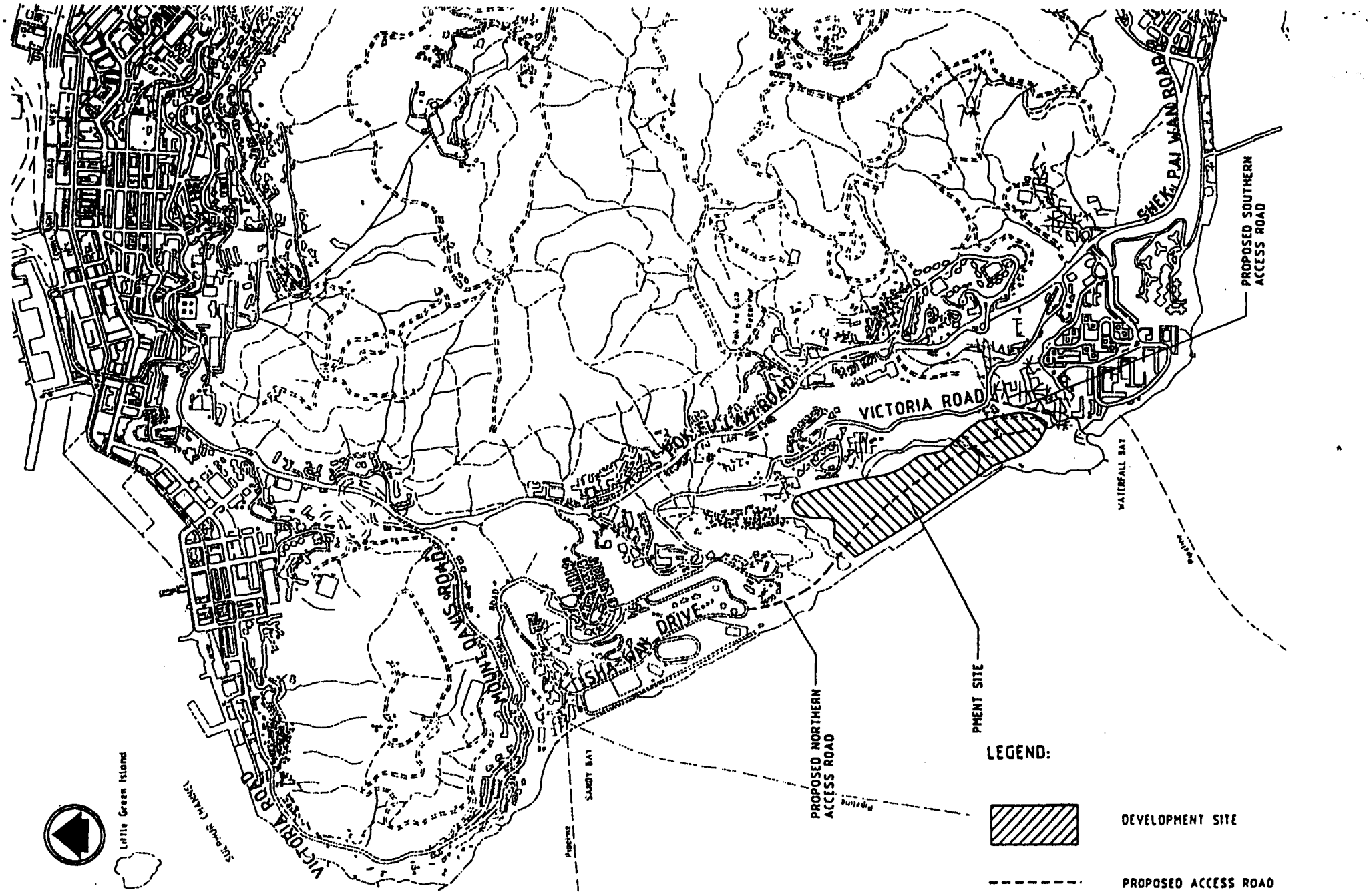
As shown in the table, concentrations of 1-hour NO_2 and 24-hour RSP are predicted to be within the AQO of 300 $\mu g/m^3$ and 180 $\mu g/m^3$ respectively at 1.5m above ground level (i.e. breathing level). Therefore, no mitigation measures are required.

3.4 Conclusions

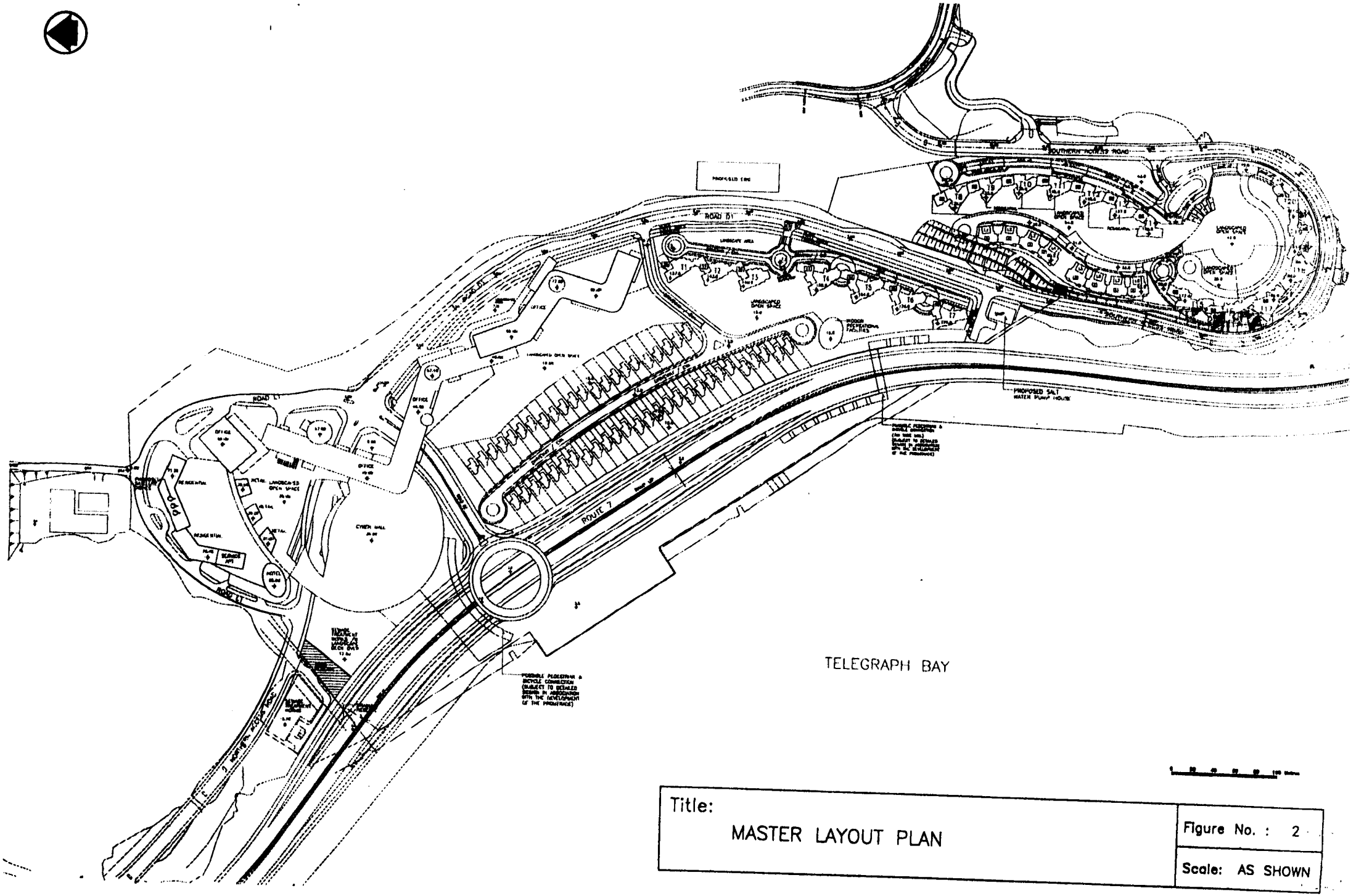
The assessment has considered the impact of vehicular emissions on the proposed development. It should be noted that the side-effects of the proposed noise mitigation measures have been taken into account. The results indicate that the predicted 24-hour RSP and 1-hour NO_2 concentrations from vehicular emissions are within the Air Quality Objectives. As such, no mitigation measures are required.

Annex A Projected Traffic Flows for Morning Peak Hours in Year 2022 together with Emission Factors for Year 2011

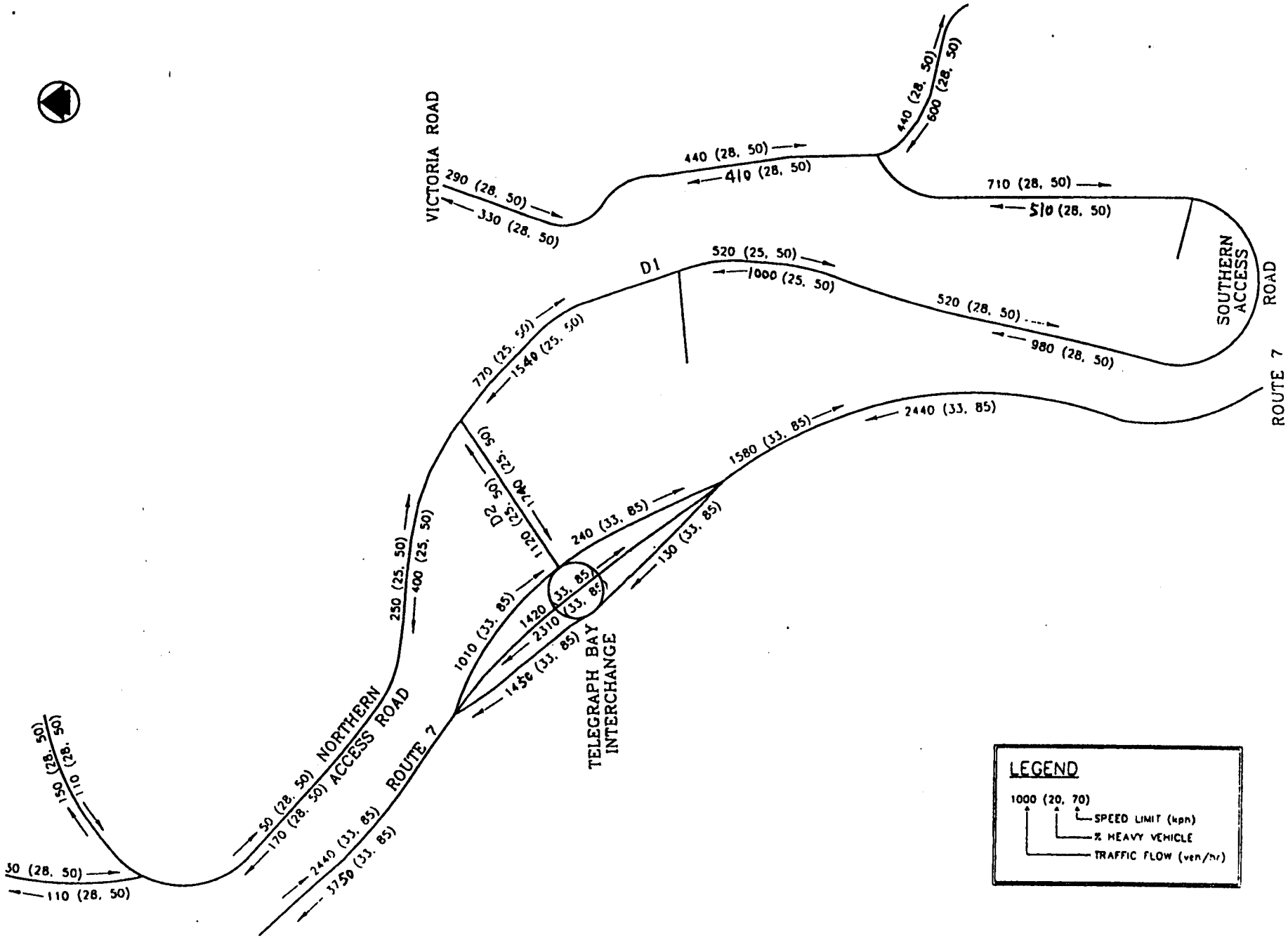
Year 2022 A.M.														Emission Factor for NO_x in gm/km (2011)						NO_x E.F.	Emission Factor for RSP in gm/km (2011)						RSP E.F.
Roads		Traffic Breakdown						Number of vehicles						car	taxi	LGV	GV/HG	SPB	PT	(g/mile-veh)	car	taxi	LGV	GV/HG	SPB	PT	(g/mile-veh)
														0.71	0.73	1.23	3.84	5.54	6.8		0.03	0.01	0.11	0.53	0.5	0.69	
	Q	car	taxi	LGV	GV/HG	SPB	PT	car	taxi	LGV	GV/HG	SPB	PT	car	taxi	LGV	GV/HG	SPB	PT		car	taxi	LGV	GV/HG	SPB	PT	
VR	290	0.54	0.11	0.06	0.08	0.13	0.07	157	32	17	23	38	20	237.7	49.8	45.8	190.5	446.5	295.1	328.442	10.044	0.682	4.092	26.288	40.300	29.946	0.289
VR	330	0.54	0.11	0.06	0.08	0.13	0.07	178	36	20	26	43	23														
VR	440	0.54	0.11	0.06	0.08	0.13	0.07	238	48	26	35	57	31	322.1	67.5	62.0	258.0	605.0	399.8	328.442	13.608	0.924	5.544	35.616	54.600	40.572	0.289
VR	400	0.54	0.11	0.06	0.08	0.13	0.07	216	44	24	32	52	28														
VR	440	0.54	0.11	0.06	0.08	0.13	0.07	238	48	26	35	57	31	398.7	83.5	76.8	319.5	749.0	495.0	328.442	16.848	1.144	6.864	44.096	67.600	50.232	0.289
VR	600	0.54	0.11	0.06	0.08	0.13	0.07	324	66	36	48	78	42														
SAR	710	0.54	0.11	0.06	0.08	0.13	0.07	383	78	43	57	92	50	463.9	97.2	89.3	371.7	871.4	576.0	328.442	19.602	1.331	7.986	51.304	78.650	58.443	0.289
SAR	500	0.54	0.11	0.06	0.08	0.13	0.07	270	55	30	40	65	35														
SAR	520	0.54	0.11	0.06	0.08	0.13	0.07	281	57	31	42	68	36	575.1	120.5	110.7	460.8	1080.3	714.0	328.442	24.300	1.650	9.900	63.600	97.500	72.450	0.289
SAR	980	0.54	0.11	0.06	0.08	0.13	0.07	529	108	59	78	127	69														
D1	520	0.57	0.11	0.06	0.05	0.13	0.07	296	57	31	26	68	36	607.1	120.5	110.7	288.0	1080.3	714.0	313.331	25.650	1.650	9.900	39.750	97.500	72.450	0.265
D1	980	0.57	0.11	0.06	0.05	0.13	0.07	559	108	59	49	127	69														
D1	770	0.57	0.11	0.06	0.05	0.13	0.07	439	85	46	39	100	54	922.7	183.1	166.3	437.8	1642.1	1085.3	313.331	38.988	2.508	15.048	60.420	148.200	110.124	0.265
D1	1510	0.57	0.11	0.06	0.05	0.13	0.07	861	166	91	76	196	106														
D1	250	0.57	0.11	0.06	0.05	0.13	0.07	143	28	15	13	33	18	263.1	52.2	48.0	124.8	468.1	309.4	313.331	11.115	0.715	4.290	17.225	42.250	31.395	0.265
D1	400	0.57	0.11	0.06	0.05	0.13	0.07	228	44	24	20	52	28														
NAR	250	0.54	0.11	0.06	0.08	0.13	0.07	135	28	15	20	33	18	249.2	52.2	48.0	199.7	468.1	309.4	328.442	10.530	0.715	4.290	27.560	42.250	31.395	0.289
NAR	400	0.54	0.11	0.06	0.08	0.13	0.07	216	44	24	32	52	28														
NAR	50	0.54	0.11	0.06	0.08	0.13	0.07	27	6	3	4	7	4	84.3	17.7	16.2	67.6	158.4	104.7	328.442	3.564	0.242	1.452	9.328	14.300	10.628	0.289
NAR	170	0.54	0.11	0.06	0.08	0.13	0.07	92	19	10	14	22	12														
NAR	110	0.54	0.11	0.06	0.08	0.13	0.07	59	12	7	9	14	8	99.7	20.9	19.2	79.9	187.3	123.8	328.442	4.212	0.286	1.716	11.024	16.900	12.558	0.289
NAR	150	0.54	0.11	0.06	0.08	0.13	0.07	81	17	9	12	20	11														
NAR	30	0.54	0.11	0.06	0.08	0.13	0.07	16	3	2	2	4	2	53.7	11.2	10.3	43.0	100.8	66.6	328.442	2.268	0.154	0.924	5.936	9.100	6.762	0.289
NAR	110	0.54	0.11	0.06	0.08	0.13	0.07	59	12	7	9	14	8														
D2	1710	0.57	0.11	0.06	0.05	0.13	0.07	975	188	103	86	222	120	1145.3	227.2	208.9	543.4	2038.2	1347.1	313.331	48.393	3.113	18.678	74.995	183.950	136.689	0.265
D2	1120	0.57	0.11	0.06	0.05	0.13	0.07	638	123	67	56	146	78														
R7	2440	0.45	0.17	0.05	0.05	0.19	0.09	1098	415	122	122	464	220	1968.1	764.5	378.8	1182.7	6484.0	3769.9	380.068	83.160	10.472	33.880	163.240	585.200	382.536	0.329
R7	3720	0.45	0.17	0.05	0.05	0.19	0.09	1674	632	186	186	707	335														
R7	1010	0.45	0.17	0.05	0.05	0.19	0.09	455	172	51	51	192	91	322.7	125.3	62.1	193.9	1063.1	618.1	380.068	13.635	1.717	5.555	26.765	95.950	62.721	0.329
R7	1420	0.45	0.17	0.05	0.05	0.19	0.09	639	241	71	71	270	128	453.7	176.2	87.3	272.6	1494.7	869.0	380.068	19.170	2.414	7.810	37.630	134.900	88.182	0.329
R7	1420	0.45	0.17	0.05	0.05	0.19	0.09	639	241	71	71	270	128	1191.7	462.9	229.4	716.2	3926.2	2282.8	380.068	50.355	6.341	20.515	98.845	354.350	231.633	0.329
R7	2310	0.45	0.17	0.05	0.05	0.19	0.09	1040	393	116	116	439	208														
R7	240	0.45	0.17	0.05	0.05	0.19	0.09	108	41	12	12	46	22	76.7	29.8	14.8	46.1	252.6	146.9	380.068	3.240	0.408	1.320	6.360	22.800	14.904	0.329
R7	130	0.45	0.17	0.05	0.05	0.19	0.09	59	22	7	7	25	12	41.5	16.1	8.0	25.0	136.8	79.6	380.068	1.755	0.221	0.715	3.445	12.350	8.073	0.329
R7	1580	0.45	0.17	0.05	0.05	0.19	0.09	711	269	79	79	300	142	1284.4	498.9	247.2	771.8	4231.5	2460.2	380.068	54.270	6.834	22.110	106.530	381.900	249.642	0.329
R7	2440	0.45	0.17	0.05	0.05	0.19	0.09	1098	415	122	122	464	220														



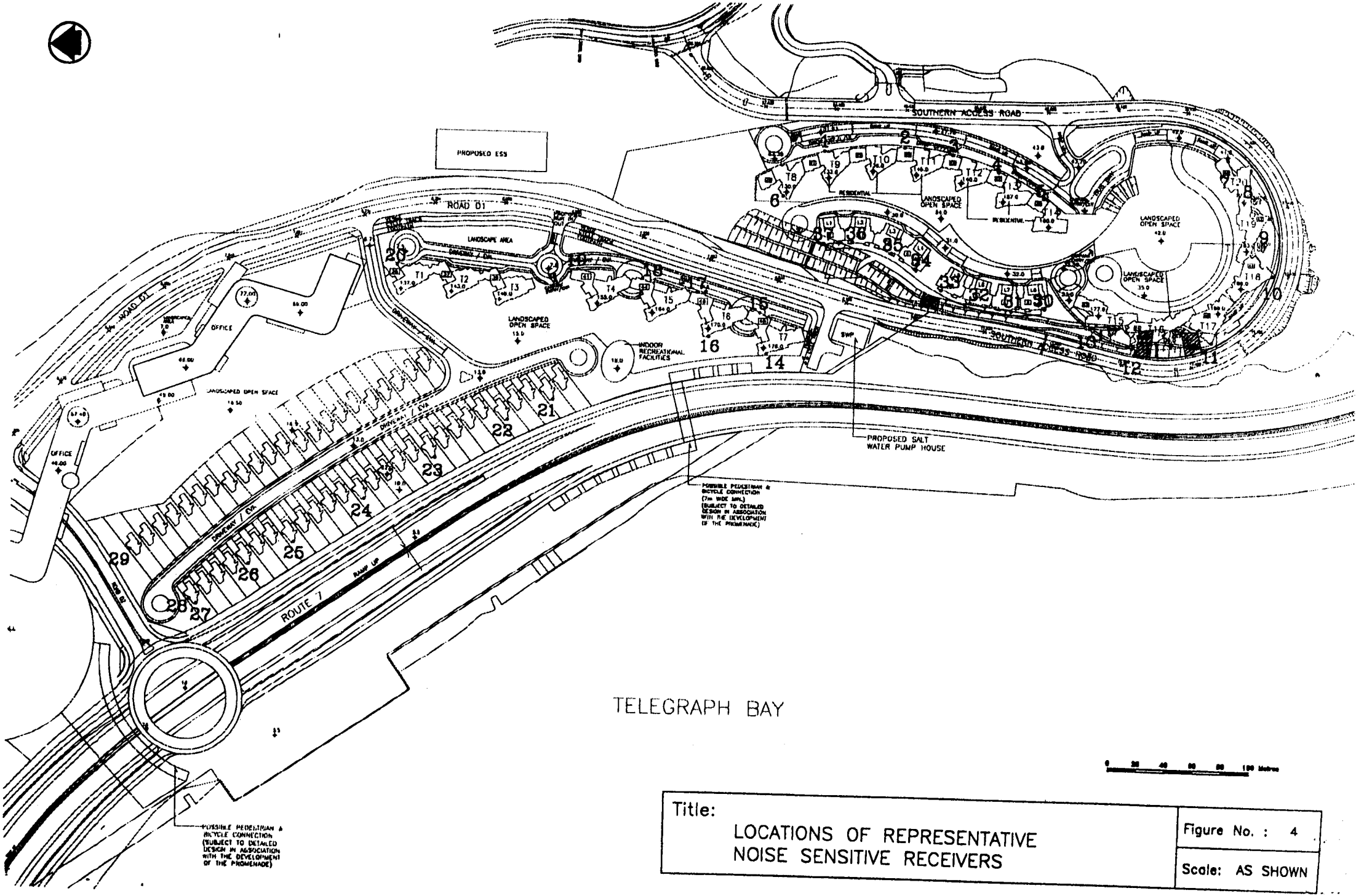
Title: LOCATION OF SITE	Figure No. : 1
	Scale: N. T. S.



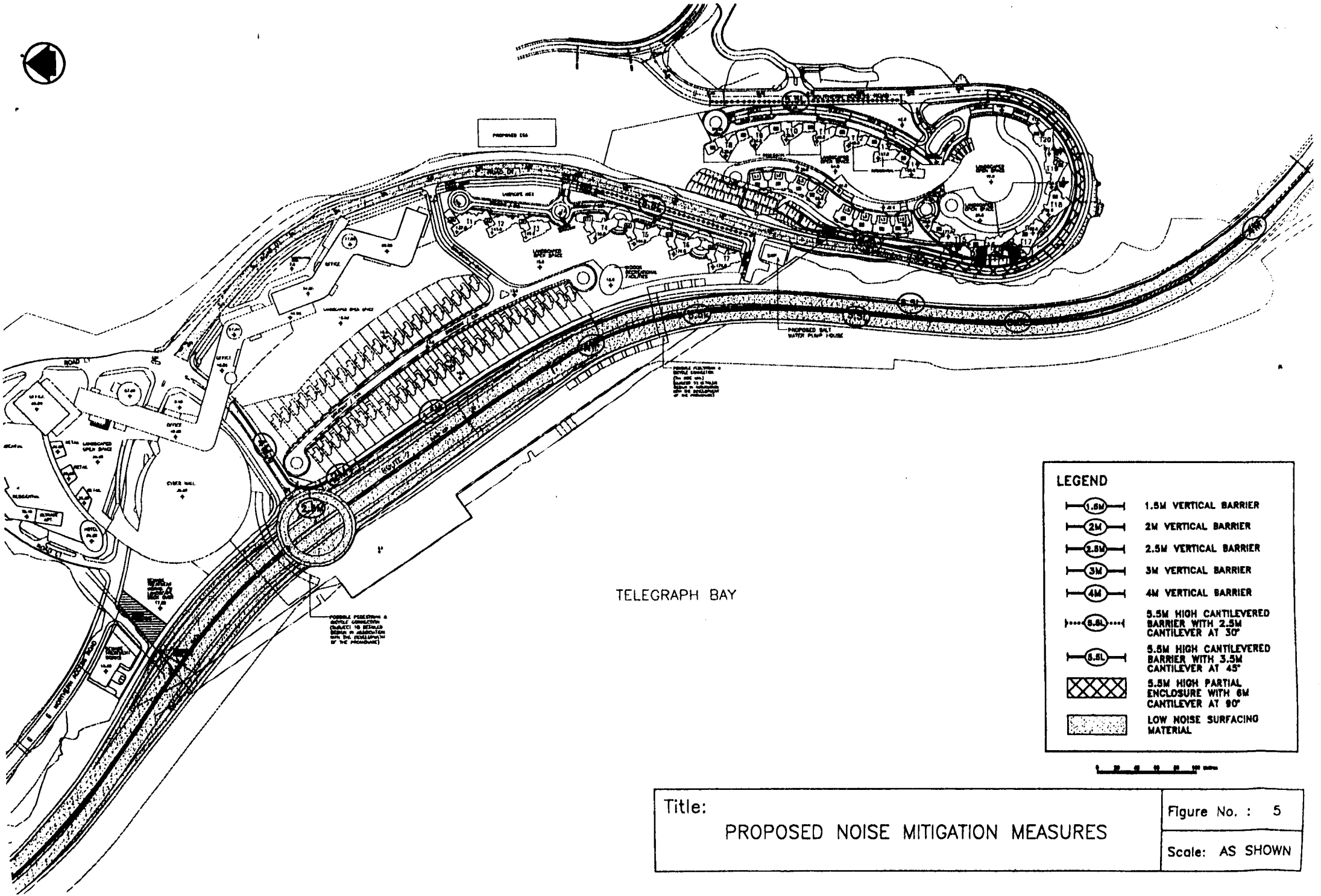
Title: MASTER LAYOUT PLAN	Figure No. : 2
	Scale: AS SHOWN



Title: PROJECTED TRAFFIC FLOWS FOR MORNING PEAK HOURS IN YEAR 2022	Figure No. : 3
	Scale: N. T. S.



Title: LOCATIONS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS	Figure No. : 4
	Scale: AS SHOWN

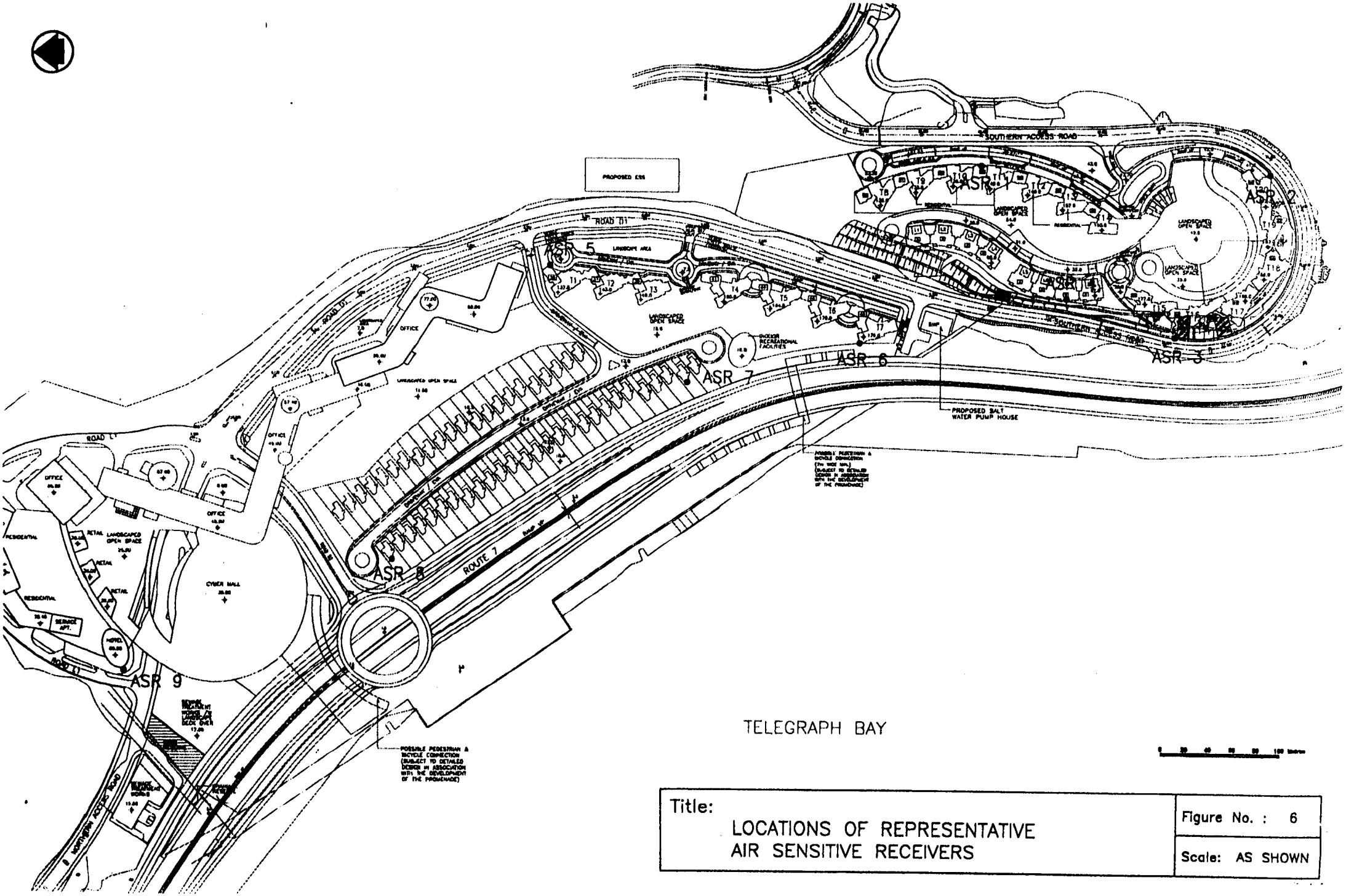


Title:

PROPOSED NOISE MITIGATION MEASURES

Figure No. : 5

Scale: AS SHOWN



Title: LOCATIONS OF REPRESENTATIVE AIR SENSITIVE RECEIVERS	Figure No. : 6
	Scale: AS SHOWN