Agreement No. CE 53/2008 (CE)

PLANNING AND ENGINEERING STUDY ON DEVELOPMENT OF LOK MA CHAU LOOP - INVESTIGATION

Sediment Sampling and Testing Plan

March 2011

CEDD 土木工程拓展署 Civil Engineering and Development Department

規劃署 Planning Department

ARUP

Planning Department and Civil Engineering and Development Department

Agreement No. CE 53 / 2008 (CE)

Planning and Engineering Study on Development of Lok Ma Chau Loop - Investigation

Sediment Sampling and Testing Plan

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1 Introduction

1.1 Project Background

In the Chief Executive's 2007 Policy Address, the development at Lok Ma Chau Loop (LMC Loop) is one of the ten major infrastructure projects for economic growth of the Hong Kong Special Administrative Region (HKSAR). The HKSAR Government would work with the Shenzhen authorities to tap the land resources of the LMC Loop to meet future development needs and consolidate the strategic position of Hong Kong and Shenzhen in the Pan-Pearl River Delta region.

Public engagement exercise on the possible future land uses of the LMC Loop was carried out in Hong Kong and Shenzhen between June and July 2008. The findings revealed that among the proposed land uses, higher education, research and development of new high technology and cultural and creative industries were preferred by both sides.

On 26 May 2009, Planning Department (PlanD) in association with Civil Engineering and Development Department (CEDD) commissioned Ove Arup & Partners Hong Kong Limited (Arup) as the Consultant for the "Planning and Engineering Study on Development of Lok Ma Chau Loop – Investigation" (the Study) to formulate a comprehensive plan for the development of the LMC Loop and the associated infrastructure in the LMC Loop.

1.2 Project Environment and Potential Dredging Works

The LMC Loop is an area of about 87 ha situated south of the Shenzhen River enveloped by a meander loop (**Figure 1.1**). As part of the preliminary study to generate development options for the LMC Loop, it is proposed that main road access to the development would be connecting the western and eastern part of the LMC Loop (Western Connection Road and Eastern Connection Road) spanning over the old Shenzhen River meander. After the evaluation of several alignment options, two were selected for further investigation for each of the connection roads: Option 1 and 3 for the Western Connection Road (**Figure 1.2**) and Option E1 and E2 for the Eastern Connection Road (**Figure 1.3**).

At this preliminary engineering design phase, bridge structure across the meander is considered for the connection roads, and a small scale river bed dredging would be required for the construction of the bridge foundations. Based on the preliminary engineering proposal presented in the preliminary EIA study, the proposed dredging works would generate approximately 400m^3 of sediment. In view of the minor quantity of sediment generated, on-site reuse is recommended and off-site disposal is not anticipated.

1.3 Scope of the Sediment Sampling and Testing Plan

In accordance with Clause 3.4.8.2 (iii) of the EIA Study Brief (No. ESB-201/2008), it is necessary to identify and quantify the dredging/excavation, transportation and impact due to dredging of sediment/mud. This Sediment Sampling and Testing Plan (SSTP) is prepared to seek agreement from EPD on the procedures of sediment sampling and testing including the proposed sampling locations and schedule, as well as the specification of chemical test and biological toxicity test of the sediment samples. Findings of the sediment quality assessment would be used to assess the waste implications associated with dredging and excavating the sediment.

2 Legislative Requirements

2.1 Legislation and Guidelines

The Environment, Transport and Works Bureau Technical Circular (Works) No. 34/2002 "Management of Dredged / Excavated Sediment" (ETWB TC(W) No. 34/2002) sets out the procedure for seeking approval to dredge/ excavate sediment and the management framework for marine disposal of such sediment. It outlines the requirements for sediment quality assessment and provides guidelines for the classification of sediment based on their contaminant levels. It also explains the disposal arrangement for the classified sediment.

2.2 Methodology for Sediment Quality Assessment

The management framework of dredged/excavated sediment in Hong Kong is implemented under a three-tiered approach as illustrated in **Appendix A** in accordance with the ETWB TC(W) No. 34/2002, which also sets out the guidelines for the assessment, sampling, testing and classification of sediment. **Table 2.1** summarised the sediment quality criteria for sediment classification under ETWB TC(W) No. 34/2002.

Table 2.1 Sediment quality criteria for classification of sediment under ETWB TC(W) No. 34/2002

Contaminants	Lower Chemical Exceedance Level (LCEL)	Upper Chemical Exceedance Level (UCEL)
Metals (mg/kg dry wt.)		
Cadmium (Cd)	1.5	4
Chromium (Cr)	80	160
Copper (Cu)	65	110
Mercury (Hg)	0.5	1
Nickel (Ni)(1)	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg/kg dry wt.)		
Arsenic (As)	12	42
Organic-PAHs (µg/kg dry wt.)		
Low Molecular Weight PAHs High Molecular Weight PAHs	550 1700	3160 9600
Organic-non-PAHs (µg/kg dry wt.)		
Total PCBs	23	180
Organometallics (µg TBT/L in Interstitial water)		
Tributyltin (1)	0.15	0.15

Note:

(1) The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.

Sediment is classified into 3 categories based on its contaminant levels:

- Category L — Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level (LCEL). The material must be dredged, transported and disposed of in a manner which minimises the loss of contaminants either into solution or by resuspension.
- Category M — Sediment with any one or more contaminant levels exceeding the Lower Chemical Exceedance Level (LCEL) and none exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with care, and must be effectively isolated from the environment upon the final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment.
- Category H — Sediment with any one or more contaminant levels exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with great care, and must be effectively isolated from the environment upon the final disposal.

Tier I Screening is a desktop screening process to review the available information and determine whether the sediment of concern belonging to Category L material is suitable for open sea disposal. If there is insufficient information to arrive at such conclusion, Tier II chemical screening shall be proceeded accordingly.

Tier II Screening is a chemical screening process to categorise sediment based on its chemical contaminant levels and to determine whether the sediment is suitable for open sea disposal without further testing. Upon Type II screening, the sediment shall be classified as Category L, M or H material. There are three types of disposal options: namely Type 1 for open sea disposal, Type 2 for confined marine disposal and Type 3 for special treatment/disposal respectively. Category L material is suitable for open sea disposal, but Categories M and H will require Tier III screening to further determine the disposal option.

Tier III Screening is a biological screening process to identify the most appropriate disposal option for Category M (either Type 1 or 2) and certain Category H sediment (either Type 2 or 3). Sediment classified as Category M shall be subjected to the following three toxicity tests:

(1) A 10-day burrowing amphipod toxicity test;

(2) A 20-day burrowing polychaete toxicity test;

(3) A 48-96 hour larvae (bivalve or echinoderm) toxicity test.

Table 2.2 summarises the details of the test endpoints and failure criteria of the three toxicity tests. Sediment classified as Category H and with one or more contaminant levels exceeding 10 times LCEL shall also be subjected to the above three toxicity tests but in a diluted manner (dilution test). In case failure of

biological test on Categories M material, Type 2 disposal will be required. Similarly, Type 3 disposal will be required for Category H material if biological test is failed.

Table 2.2 Test endpoints and decision criteria for Tier III biological screening under ETWB TC(W) No. 34/2002

Toxicity Test	**Endpoints Measured**	**Test Methods**	**Failure Criteria**
10-day amphipod	Survival	USEPA Standard Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods	Mean survival in test sediment is significantly different ($p \leq 0.05$)(1) from mean survival in reference sediment **and** mean survival in test sediment <80% of mean survival in reference sediment.
20-day polychaete worm	Dry Weight(2)	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Juvenile Polychaete Sediment Bioassay, 1995	Mean dry weight in test sediment is significantly different ($p \leq 0.05$)(1) from mean dry weight in reference sediment **and** mean dry weight in test sediment <90% of mean dry weight in reference sediment.
48-96 hour larvae (bivalve or echinoderm)	Normality Survival(3)	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Bivalve Larvae Sediment Bioassay, 1995	Mean normality survival in test sediment is significantly different ($p \leq 0.05$)(1) from mean normality survival in reference sediment **and** mean normality survival in test sediment <80% of mean normality survival in reference sediment.

Note:
(1) Statistically significant differences should be determined using appropriate two-sample comparisons (e.g., *t*-tests) at a probability of $p \leq 0.05$;
(2) Dry weight means total dry weight after deducting dead and missing worms;
(3) Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number.

3 Review of Existing Information

Since no sediment quality and sediment depth data of the meander is available, the existing data from Shenzhen River is considered the best reference information as the meander was originally connected to the Shenzhen River before the training works. The results from the studies below are considered a worst-case scenario and provide a conservative assumption of the sediment quality and sediment depth in the meander.

3.1 Bench-scale Biochemical Treatment Testing for Shenzhen River Polluted Sediments

As part of the Shenzhen River Contaminated Sediment Remediation Strategy Joint Study, the Shenzhen Graduate School of Harbin Institute of Technology (HITSZ) has undertaken a bench-scale treatability test of sediment biochemical treatment on sediment samples collected from the Shenzhen River in 2010. The purpose of the study was to investigate the preferred biochemical treatment for *in situ* remediation of the polluted sediments in the Shenzhen River.

In the study, two samples (1# and 2#) were collected from the Shenzhen River and analysed for their concentrations of heavy metals prior to biochemical treatment. The test results are presented in **Table 3.1**.

Table 3.1 Shenzhen River sediment quality data from the bench-scale biochemical treatment testing study

Metals/ Metalloid (mg/kg)	Chemical Exceedance Level (1)		Sediment Sample		Classification under ETWB TC(W) No. 34/2002 (Category L/M/H)	
	Lower (LCEL)	Upper (UCEL)	1#	2#	1#	2#
Arsenic (As)	12	42	9.65	8.51	L	L
Cadmium (Cd)	1.5	4	8.75	9.00	H	H
Chromium (Cr)	80	160	213.99	203.36	H	H
Copper (Cu)	65	110	217.85	128.95	H	H
Mercury (Hg)	0.5	1	2.68	0.74	H	M
Nickel (Ni)	40	40	26.36	16.56	L	L
Lead (Pb)	75	110	3.02	3.03	L	L
Silver (Ag)	1	2	3.09	2.55	H	H
Zinc (Zn)	200	270	444.65	350.82	H	H

Note:

(1) Sediment Quality Criteria for the Classification of Sediment under ETWB TC(W) No. 34/2002

The test results were compared against the sediment quality criteria for classification of the sediment in accordance with ETWB TC(W) No. 34/2002. Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Zinc (Zn), and Silver (Ag) were found to exceed the UCEL. The results indicated that both sediment samples were Category H sediments.

3.2 Sediment Depth of Shenzhen River

Information regarding to the sediment depth of the Shenzhen River was obtained from a report（深圳河水下地形 2009 年度汛后测量技术报告）published by 深圳市水务规划设计院 in 2009. In the study, average sediment depth was measured at 95 transects placed at regular interval along the river course. Summary of the data is provided in **Table 3.2** and the detailed data extracted from the report is presented in **Appendix B (**深圳河水下地形 2009 年度汛后测量技术报告 – 深圳河淤泥计算表**)**. With reference to the total average sediment depth (2.76m) and the average sediment depth of two transects situated at either end of the old Shenzhen River meander (4+100 and 5+400) (**Figure 3.1**), it is estimated that the average sediment depth in the meander would be approximately 3m.

Table 3.2 Shenzhen River sediment depth data extracted from a report published by 深圳市水务规划设计院 (深圳河水下地形 2009 年度汛后测量技术报告)

Transect No.	Average Sediment Depth (m)
4+100	3.13
5+400	2.82
Overall	
Range	2.29-3.21
Total Average	2.76

4 Proposed River Sediment Sampling

4.1 Sampling Locations

In order to gain a better understanding of the river sediment quality of the old Shenzhen River meander where dredging works are anticipated, further sediment sampling and testing is proposed.

A total of 11 sampling points are proposed and placed along the western and eastern sections of the meander which cover the potential dredging area to cater for the potential design changes. Sampling grid of 50m x 50m will be adopted to obtain more representative samples. A summary of the proposed sampling locations and co-ordinates is given in **Table 4.1** and illustrated in **Figures 4.1** and **4.2** together with the alignment options of the connection roads. In addition, a reference sediment sample will also be collected in Port Shelter (PS6, E850234, N820057).

Table 4.1 Proposed river sediment sampling locations

Sample ID	Proposed Sampling Locations' Co-ordinates	
	Easting	Northing
GR1	825667	841979
GR2	825701	841942
GR3	825735	841905
GR4	825769	841868
GR5	826756	842372
GR6	826784	842419
GR7	826807	842465
GR8	826829	842511
GR9	826844	842567
GR10	826837	842625
GR11	826822	842674
PS6(1)	850234	820057

Note:

(1) Reference sample at Port Shelter

4.2 Sample Collection

Based on the existing sediment depth data described in **Section 3.2**, the average sediment depth in the old Shenzhen meander is estimated to be around 3m. Because of the relatively shallow river sediment layer, grab sampling is proposed in this plan. In addition, reference sample will also be collected by grab sampling.

Modified Van Veen grab (or equivalent) of capacity ~2L will be deployed from vessel for sample collection. Approximately 7 litre of sediment will be collected for chemical testing and Tier III biological testing (if required) based on the requirement of ETWB TC(W) No. 34/2002 as shown in **Table 4.2**.

Table 4.2 Sample size required with reference to ETWB TC(W) No. 34/2002

Parameters to be tested	Sample Size
Metals and Metalloids	0.5 litre
Organics	0.5 litre
Biological Response	6 litre
Total	7 litre

The samples for biological testing (if required) may comprise composite samples prepared from up to 5 samples of the same category (Category M or H according to the classification under ETWB TC(W) No. 34/2002) which are continuous in vertical or horizontal profile.

4.3 Sediment Quality Assessment

Sediment quality will be assessed through laboratory analyses of sediment samples for the chemical and/or biological parameters. The reference sediment (clean sample) will also be tested for comparison. Based on the chemical contaminant levels, sediment will be classified into either Category L, M or H sediment according to the criteria stated in ETWB TC(W) No. 34/2002. Tier III biological screening test will only be implemented for Category M sediment. Sediment classified as Category H and with one or more contaminant levels exceeding LCEL will also undergo the biological screening test but in a diluted manner (dilution test). The chemical and biological screening parameters are summarised in **Tables 4.3** and **4.4** respectively and the preparation method for the dilution test is presented in **Table 4.5**.

Table 4.3 Chemical screening parameters for sediment quality assessment

Parameters	Instrumentation	Analytical Method	Reporting Limit
Cadmium (Cd)	ICP-MS	U.S. EPA 6020A	0.2 mg/kg
Chromium (Cr)	ICP-MS	U.S. EPA 6020A	8 mg/kg
Copper (Cu)	ICP-MS	U.S. EPA 6020A	7 mg/kg
Mercury (Hg)	ICP-MS	U.S. EPA 6020A	0.05 mg/kg
Nickel (Ni)	ICP-MS	U.S. EPA 6020A	4 mg/kg
Lead (Pb)	ICP-MS	U.S. EPA 6020A	8 mg/kg
Silver (Ag)	ICP-MS	U.S. EPA 6020A	0.1 mg/kg
Zinc (Zn)	ICP-MS	U.S. EPA 6020A	20 mg/kg
Arsenic (As)	ICP-MS	U.S. EPA 6020A	1 mg/kg
PAHs (Low MW)	GC-MSD	U.S. EPA 8270C	55 µg/kg
PAHs (High MW)	GC-MSD	U.S. EPA 8270C	170 µg/kg
Total PCBs	GC-MSD	U.S. EPA 8082	3 µg/kg

Parameters	Instrumentation	Analytical Method	Reporting Limit
Tributyltin (1) (TBT)	GC-MSD	UNEP/IOC/IAEA	0.015 µg/L

Note:

(1) In interstitial water

Table 4.4 Biological screening* parameters for sediment quality assessment

Toxicity Test	Test Method	Endpoints Measured	Failure Criteria
10-day amphipod	USEPA Standard Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods	Survival	Mean survival in test sediment is significantly different ($p \leq 0.05$)** from mean survival in reference sediment and mean survival in test sediment < 80% of mean survival in reference sediment.
20-day polychaete worm	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Juvenile Polychaete Sediment Bioassay, 1995	Dry weight***	Mean dry weight in test sediment is significantly different ($p \leq 0.05$)** from mean dry weight in reference sediment and mean dry weight in test sediment <90% of mean dry weight in reference sediment.
48-96 hour larvae (bivalve or echinoderm)	PSEP Standard Recommended Guidelines for Conducting Laboratory Bioassays on the Puget Sound Sediments – Bivalve Larvae Sediment Bioassay, 1995	Normality survival****	Mean normality survival in test sediment is significantly different ($p \leq 0.05$)** from mean normality survival in reference sediment and mean normality survival in test sediment <80% of mean normality survival in reference sediment.

Note:

* Ancillary testing parameters to be analysed for all sediment samples include moisture content, grain size (<63 µm) and total organic carbon; as well as salinity and ammonia (as mgN/L) in pore water.

** Statistically significantly differences should be determined using appropriate two-sample composite (e.g. *t*-tests) at a probability of $p \leq 0.05$.

*** Dry weight means total dry weight after deducting dead and missing worms.

**** Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number.

Table 4.5 Preparation method of dilution test

Sediment Characteristics	Preparation Method
Category H sediment (> 10 x LCEL)	Sample to be mixed with 9 portion of reference sediment
Category M sediment or Category H sediment (> 10 x LCEL) suspected of ammonia contamination	Additional set of sample (after dilution for Cat. H sediment) to be purged# for ammonia removal (for amphipod test only).

Note:

If the ammonia concentration in the overlaying water of the test system is ≥20mg/L, purging of sediment is required. This is performed by replacing the overlying water at a rate of 6 volume replacement / 24 h for 24 hours, and repeated once only if the ammonia level still exceeds 20mg/L.

4.4 Sample Handling and Storage

All sediment samples will be stored at 4^{o}C during transportation and at the laboratory prior to testing. The sampling bottle and pre-treatment methods will follow the recommendation stipulated in ETWB TC(W) No. 34/2002. Sediment samples will be extracted in the laboratory and placed in the appropriate containers directly after the sampling. All samples will be double-bagged and labeled internally and externally with indelible ink. Samples for biological testing (if any) will be stored in the same manner as described above (including for ancillary parameters).

Samples for chemical testing will be extracted and analysed within 2 weeks to ensure a Tier III Biological Testing Programme (where required) can be developed and commenced within 8 weeks from the date of sampling.

4.5 Reference Sample

Modified Van Veen grab (or equivalent) of capacity ~2L will be deployed from vessel and reference sediment (surface grab) of ~7L will be collected at Port Shelter (PS6, E850234, N820057). Individual grabs will be composited on-site and split into portions for packing, of which ~0.5L for metals and metalloid testing, ~0.5L for organic testing, and ~6L for biological testing respectively. Sediment sample will be stored at 4^{o}C during transportation and at the laboratory prior to testing.

4.6 QA/QC Requirements

Field logs and site diary will be maintained for all on-site sampling works with date, equipment used, site activities and observations, undertaken as far as possible. Any deviation from the standard procedures and reasons will be recorded in the logs.

Laboratory QA/QC requirements, including analyses by HOKLAS accredited laboratory, certified reference materials, spike recovery, blank samples, duplicate samples (for every 20 samples), negative/positive control for biological test, etc. will be strictly complied.

Figures

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Shenzhen

Lok Ma Chau Loop

Lok Ma Chau Station

Legend

- Lok Ma Chau Loop
- Old Shenzhen River Meander
- Existing Shenzhen River

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Location of LMC Loop

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Figure 1.1

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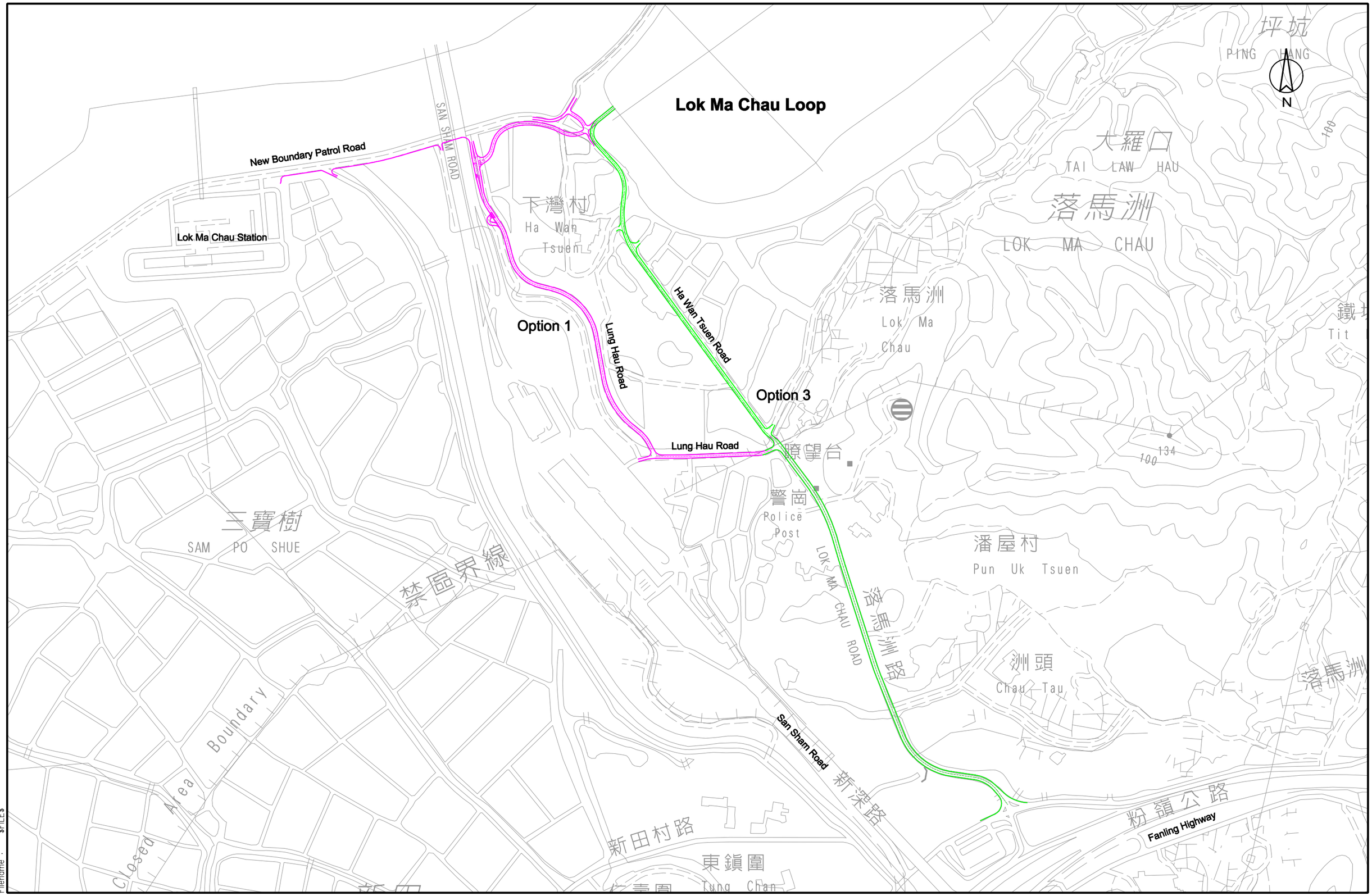

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Western Connection Road Alignment Options

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Figure 1.2

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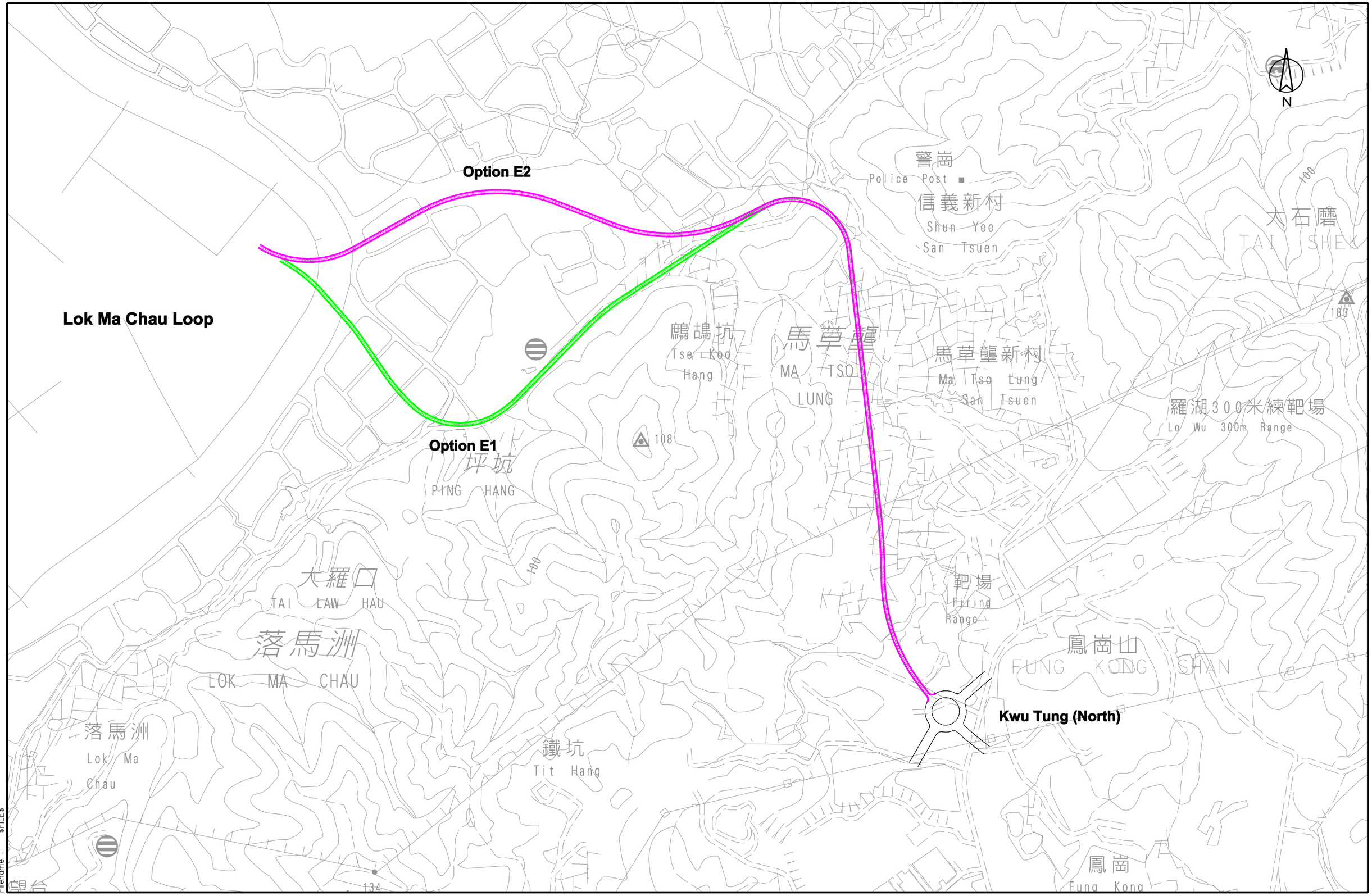

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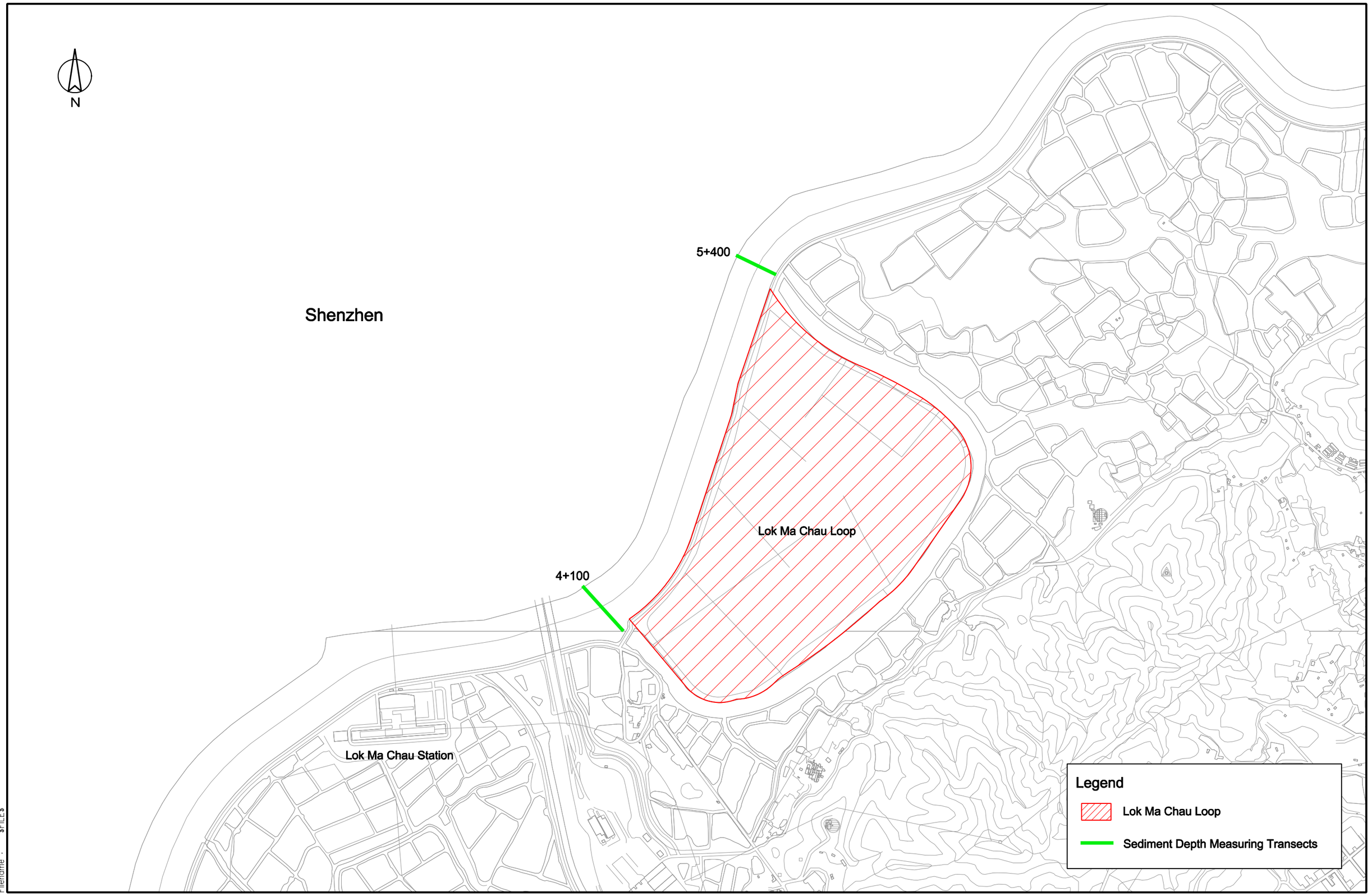

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Drawing Title
Locations of the Sediment Depth Measuring Transects across Shenzhen River

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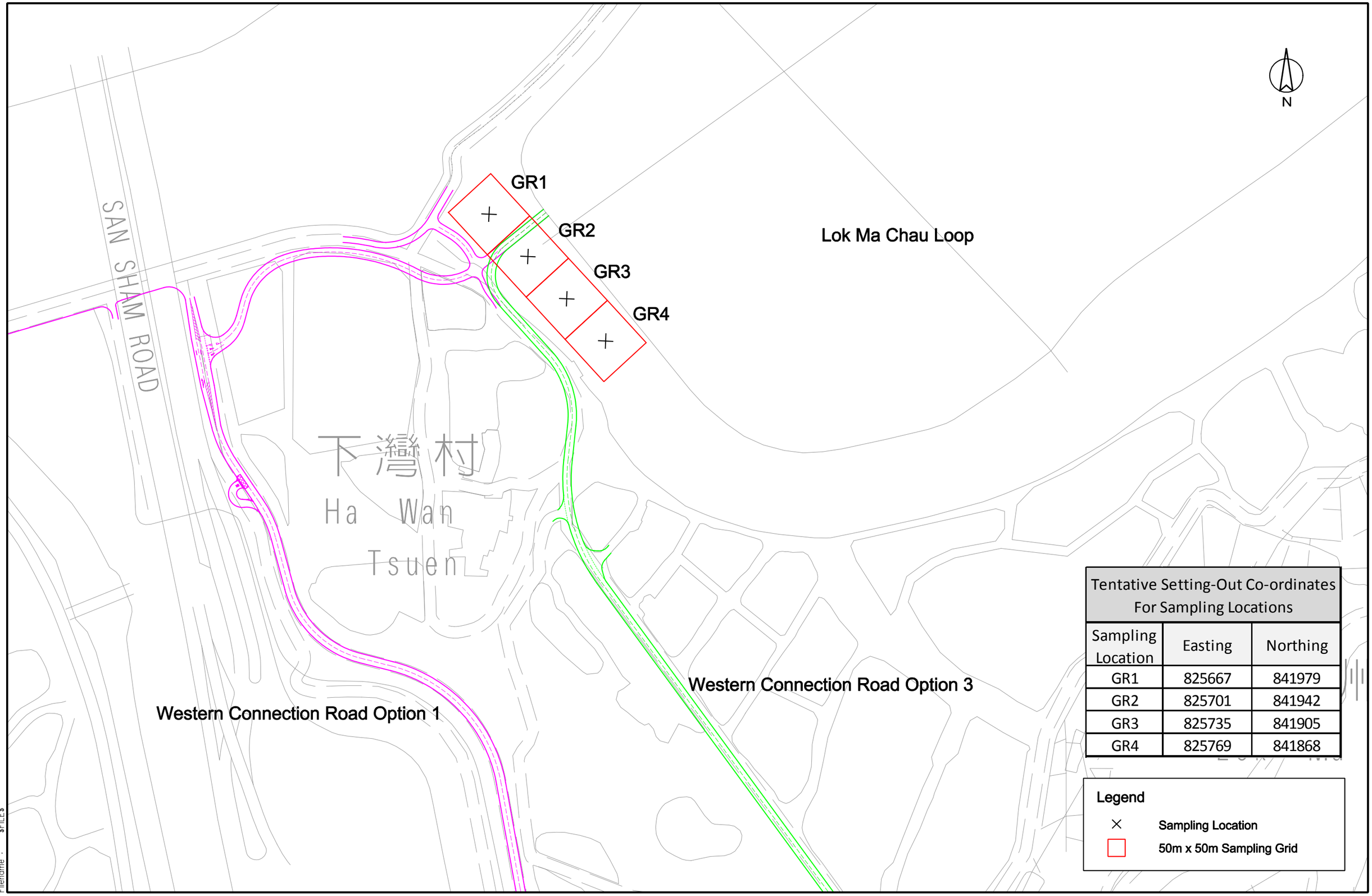

Tentative Setting-Out Co-ordinates For Sampling Locations		
Sampling Location	Easting	Northing
GR1	825667	841979
GR2	825701	841942
GR3	825735	841905
GR4	825769	841868

Legend

× Sampling Location

50m x 50m Sampling Grid

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Eastern Connection Road Option E2

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GR11

GR10

GR9

Lok Ma Chau Loop

GR8

GR7

GR6

GR5

Eastern Connection Road Option E1

鹧鸪坑

坪坑

PING HANG

Tentative Setting-Out Co-ordinates For Sampling Locations		
Sampling Location	Easting	Northing
GR5	826756	842372
GR6	826784	842419
GR7	826807	842465
GR8	826829	842511
GR9	826844	842567
GR10	826837	842625
GR11	826822	824674

Legend

× Sampling Location

50m x 50m Sampling Grid

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Drawing No.: **Figure 4.2**

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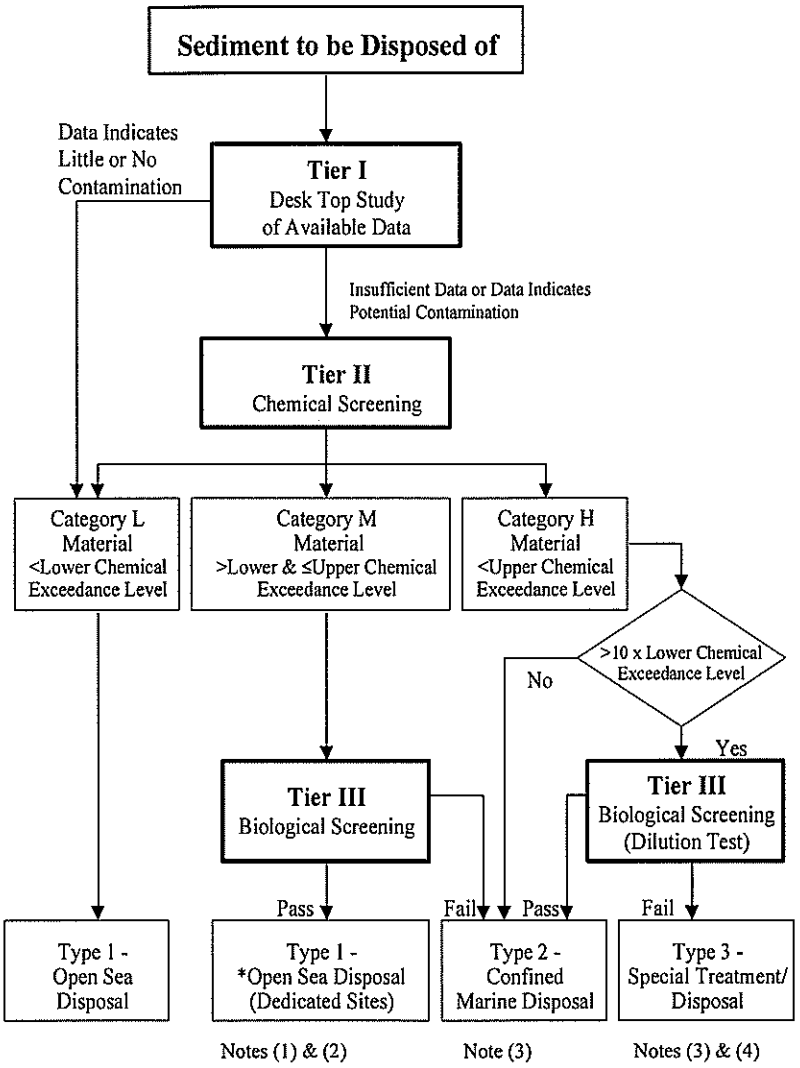
Appendix A

Management Framework for Dredged/Excavated Sediment

Management Framework for Dredged/Excavated Sediment



Notes

(1) Most open sea disposal sites are multi-user facilities and as a consequence their management involves a flexibility to accommodate varying and unpredictable circumstances. Contract documents should include provisions to allow the same degree of flexibility should it be necessary to divert from one disposal site to another during the construction period of a contract.

(2) Dedicated Sites will be monitored to confirm that there is no adverse impact.

(3) For sediment requiring Type 2 or Type 3 disposal, contract documents shall state the allocation conditions of MFC and Director of Environmental Protection (DEP). At present, East Sha Chau mud pits are designated for confined marine disposal.

(4) If any sediment suitable for Type 3 disposal (Category H sediment failing the biological dilution test) is identified, it is the responsibility of the project proponent, in consultation with DEP, to identify and agree with him/her, the most appropriate treatment and/or disposal arrangement. Such a proposal is likely to be very site and project specific and therefore cannot be prescribed. This will not preclude treatment of this sediment to render it suitable for confined marine disposal.

(5) The allocation of disposal space may carry a requirement for the project proponent to arrange for chemical analysis of the sediment sampled from 5% of the vessels en-route to the disposal site. For Category M and certain Category H sediment, the chemical tests will be augmented by biological tests. Vessel sampling will normally entail mixing five samples to form a composite sample from the vessel and undertaking laboratory tests on this composite sample. All marine disposal sites will be monitored under the general direction of the Civil Engineering Department. However, exceptionally large allocations might require some additional disposal site monitoring. These will be stipulated at the time of allocation.

(6) Trailer suction hopper dredgers disposing of sediment at East Sha Chau mustuse a down-a-pipe disposal method, the design of which must be approved in advance by DCE. The dredging contractor must provide equipment for such disposal.

Appendix B

深圳河水下地形 2009 年度汛后测量技术报告–深圳河淤泥计算表

深圳河淤泥量计算表（0+000～9+400）

附表 2

断面号	2009 汛后河底平均高程(m)	规划河底高程（ m ）	淤泥平均厚度（ m ）	截面面积（ m^2 ）	淤泥量（ m^3 ）
0+000	-2.150	-5.000	2.850	402.290	
0+100	-2.020	-4.990	2.970	413.055	40766.066
0+200	-1.930	-4.980	3.050	421.280	41716.074
0+300	-1.760	-4.970	3.210	433.965	42760.682
0+400	-1.950	-4.960	3.010	409.868	42185.914
0+500	-1.820	-4.950	3.130	398.842	40434.247
0+600	-1.940	-4.940	3.000	392.426	39562.966
0+700	-1.740	-4.930	3.190	421.307	40678.105
0+800	-1.960	-4.920	2.960	407.546	41440.746
0+900	-2.040	-4.910	2.870	387.486	39747.381
1+000	-2.210	-4.900	2.690	401.228	39433.705
1+100	-2.190	-4.890	2.700	411.652	40642.886
1+200	-2.020	-4.880	2.860	446.121	42877.103
1+300	-2.120	-4.870	2.750	440.237	44317.574
1+400	-2.210	-4.860	2.650	439.704	43997.047
1+500	-2.330	-4.850	2.520	412.175	42586.535
1+600	-1.930	-4.840	2.910	402.340	40724.760
1+700	-1.790	-4.830	3.040	377.169	38968.675
1+800	-1.870	-4.820	2.950	364.906	37102.061
1+900	-1.930	-4.810	2.880	357.451	36117.209
2+000	-1.940	-4.800	2.860	353.970	35570.908
2+100	-2.080	-4.790	2.710	345.175	34956.328
2+200	-2.050	-4.780	2.730	358.190	35166.243
2+300	-2.110	-4.770	2.660	361.394	35979.081
2+400	-2.230	-4.760	2.530	357.056	35922.282
2+500	-1.890	-4.750	2.860	361.720	35938.548
2+600	-1.880	-4.740	2.860	353.220	35746.158
2+700	-2.020	-4.730	2.710	347.643	35042.780
2+800	-2.280	-4.720	2.440	350.001	34882.134
2+900	-1.990	-4.710	2.720	341.479	34573.125
3+000	-2.210	-4.700	2.490	345.032	34325.397
3+100	-2.020	-4.690	2.670	338.466	34174.374
3+200	-1.870	-4.680	2.810	349.850	34414.231
3+300	-1.850	-4.670	2.820	349.913	34988.150
3+400	-1.950	-4.660	2.710	336.390	34312.929
3+500	-1.790	-4.650	2.860	389.328	36253.677
3+600	-1.850	-4.640	2.790	330.715	35962.324
3+700	-1.860	-4.630	2.770	315.978	32331.851
3+800	-2.000	-4.620	2.620	308.084	31202.268
3+900	-2.090	-4.610	2.520	289.366	29867.612
4+000	-1.820	-4.600	2.780	348.970	31870.320
4+100	-1.460	-4.590	3.130	453.682	40018.274
4+200	-1.600	-4.580	2.980	338.697	39479.161

深圳河淤泥量计算表（0+000～9+400）

附表 2

断面号	2009 汛后河底平均高程(m)	规划河底高程（ m ）	淤泥平均厚度（ m ）	截面面积（ m^2 ）	淤泥量（ m^3 ）
4+300	-1.610	-4.570	2.960	326.017	33233.684
4+400	-1.580	-4.560	2.980	333.610	32980.622
4+500	-1.520	-4.550	3.030	334.459	33403.441
4+600	-1.630	-4.540	2.910	322.867	32864.596
4+700	-1.680	-4.530	2.850	307.795	31530.098
4+800	-1.690	-4.520	2.830	310.456	30912.455
4+900	-1.770	-4.510	2.740	298.330	30437.287
5+000	-1.790	-4.500	2.710	281.556	28990.256
5+100	-1.850	-4.490	2.640	275.789	27866.753
5+200	-1.700	-4.480	2.780	302.803	28919.084
5+300	-1.680	-4.470	2.790	285.280	29399.798
5+400	-1.640	-4.460	2.820	295.482	29036.606
5+500	-1.690	-4.450	2.760	292.355	29391.711
5+600	-1.590	-4.440	2.850	311.548	30190.066
5+700	-1.820	-4.430	2.610	371.362	34101.758
5+800	-1.760	-4.420	2.660	371.005	37118.349
5+900	-2.080	-4.410	2.330	311.070	34059.777
6+000	-1.620	-4.400	2.780	289.786	30036.515
6+100	-1.450	-4.390	2.940	304.364	29704.519
6+200	-1.500	-4.380	2.880	289.297	29679.863
6+300	-1.600	-4.370	2.770	265.707	27741.841
6+400	-1.600	-4.360	2.760	259.168	26243.071
6+500	-1.660	-4.350	2.690	253.217	25618.674
6+600	-1.620	-4.340	2.720	251.738	25247.714
6+700	-1.560	-4.330	2.770	264.181	25793.449
6+800	-1.610	-4.320	2.710	249.987	25705.134
6+900	-1.540	-4.310	2.770	268.413	25914.540
7+000	-1.500	-4.300	2.800	267.981	26819.697
7+100	-1.530	-4.290	2.760	254.933	26142.986
7+200	-1.630	-4.280	2.650	241.604	24823.868
7+300	-1.650	-4.270	2.620	233.114	23734.635
7+400	-1.580	-4.260	2.680	237.214	23516.102
7+500	-1.570	-4.260	2.690	238.076	23764.487
7+600	-1.470	-4.240	2.770	248.827	24343.172
7+700	-1.470	-4.230	2.760	298.614	27334.239
7+800	-1.660	-4.220	2.560	273.735	28608.434
7+900	-1.470	-4.210	2.740	288.746	28120.711
8+000	-1.450	-4.200	2.750	285.815	28727.925
8+100	-1.570	-4.190	2.620	222.503	25349.930
8+200	-1.550	-4.180	2.630	231.830	22715.054
8+300	-1.560	-4.170	2.610	229.201	23051.425
8+400	-1.420	-4.160	2.740	229.305	22925.300
8+500	-1.020	-4.150	3.130	278.975	25373.454
8+600	-1.570	-4.130	2.560	180.104	22774.396
8+700	-1.500	-4.120	2.620	173.136	17660.854
8+800	-1.500	-4.110	2.610	165.869	16948.952
8+900	-1.770	-4.090	2.320	147.719	15670.639
9+000	-1.630	-4.070	2.440	156.763	15221.861
9+100	-1.590	-4.050	2.460	154.546	15565.318
9+200	-1.610	-4.030	2.420	152.455	15349.931
9+300	-1.720	-4.010	2.290	139.770	14606.659

深圳河淤泥量计算表（0+000～9+400）

附表 2

断面号	2009 汛后河底平均高程（m）	规划河底高程（m）	淤泥平均厚度（m）	截面面积（m^2）	淤泥量（m^3）
9+400	-1.700	-3.990	2.290	141.871	14081.919
合计	总淤泥平均厚度=2.76m		总淤泥量=2938391.5（m^3）		

制表:曹梦成　　检查:李庆平

深圳河 2B 段淤泥量计算表（0+000~4+000）

附表 3

断面号	2009 汛后河底平均高程（m）	规划河底高程（m）	淤泥平均厚度（m）	截面面积（m^2）	淤泥量（m^3）
0+000	-2.150	-5.000	2.850	402.290	
0+100	-2.020	-4.990	2.970	413.055	40766.066
0+200	-1.930	-4.980	3.050	421.280	41716.074
0+300	-1.760	-4.970	3.210	433.965	42760.682
0+400	-1.950	-4.960	3.010	409.868	42185.914
0+500	-1.820	-4.950	3.130	398.842	40434.247
0+600	-1.940	-4.940	3.000	392.426	39562.966
0+700	-1.740	-4.930	3.190	421.307	40678.105
0+800	-1.960	-4.920	2.960	407.546	41440.746
0+900	-2.040	-4.910	2.870	387.486	39747.381
1+000	-2.210	-4.900	2.690	401.228	39433.705
1+100	-2.190	-4.890	2.700	411.652	40642.886
1+200	-2.020	-4.880	2.860	446.121	42877.103
1+300	-2.120	-4.870	2.750	440.237	44317.574
1+400	-2.210	-4.860	2.650	439.704	43997.047
1+500	-2.330	-4.850	2.520	412.175	42586.535
1+600	-1.930	-4.840	2.910	402.340	40724.760
1+700	-1.790	-4.830	3.040	377.169	38968.675
1+800	-1.870	-4.820	2.950	364.906	37102.061
1+900	-1.930	-4.810	2.880	357.451	36117.209
2+000	-1.940	-4.800	2.860	353.970	35570.908
2+100	-2.080	-4.790	2.710	345.175	34956.328
2+200	-2.050	-4.780	2.730	358.190	35166.243
2+300	-2.110	-4.770	2.660	361.394	35979.081
2+400	-2.230	-4.760	2.530	357.056	35922.282
2+500	-1.890	-4.750	2.860	361.720	35938.548
2+600	-1.880	-4.740	2.860	353.220	35746.158
2+700	-2.020	-4.730	2.710	347.643	35042.780
2+800	-2.280	-4.720	2.440	350.001	34882.134
2+900	-1.990	-4.710	2.720	341.479	34573.125
3+000	-2.210	-4.700	2.490	345.032	34325.397
3+100	-2.020	-4.690	2.670	338.466	34174.374
3+200	-1.870	-4.680	2.810	349.850	34414.231
3+300	-1.850	-4.670	2.820	349.913	34988.150
3+400	-1.950	-4.660	2.710	336.390	34312.929