

Civil Engineering and Development
Department

**Site Investigation Works for Pier
Improvement at Lai Chi Wo**

Project Profile

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1 Basic Information

1.1 Project Title

- 1.1.1 Site investigation (SI) works for pier improvement at Lai Chi Wo (hereinafter referred to as the “Project”)

1.2 Purpose and Nature of the Project

- 1.2.1 The Project is to carry out SI works to collate necessary engineering and sediment quality information for the “Study for Pier Improvement at Lai Chi Wo and Tung Ping Chau – Investigation” under Agreement No. CE2/2018 (CE) by the Civil Engineering and Development Department (CEDD). An Environmental Impact Assessment (EIA Study Brief No.: ESB-305/2017) will be conducted.
- 1.2.2 This Project Profile (PP) is prepared to establish the environmental acceptability of the Project, and to seek permission from the Director of Environmental Protection to apply directly for an environmental permit for the construction of the Project under Section 5(11) of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499).

1.3 Background Information

- 1.3.1 A detailed search from the Digital Geotechnical Information Unit (DGIU) of CEDD revealed that there are no existing SI records at the area around Lai Chi Wo Pier. There is considerable uncertainty regarding the ground conditions within the area and the ground conditions have significant influences on the design and construction of the proposed pier improvement work, as well as the long-term performance of the pier. In view of the uncertainty and risk associated with this matter, project-specific SI works are inevitable to facilitate the development of a reliable model representing the ground condition for the pier improvement works.
- 1.3.2 In addition, according to the Appendix E – Requirements for Assessment of Waste Management Implications of the Environmental Impact Assessment (EIA) Study Brief (ESB-305/2017) for Pier Improvement at Lai Chi Wo, field investigation, sampling and chemical and biological laboratory tests shall be conducted to characterise and quantify the collected sediment, if any, and incorporated into the EIA Report for approval by the Director of Environmental Protection. Since no SI work/environmental sampling in the vicinity of the pier could be identified, there is a lack of sediment information for estimation of sediment quality and quantity. SI work is considered inevitable to meet the requirements in Section 3 (ii) of Appendix D and Section 3(i) of Appendix E in the EIA Study Brief (ESB-305/2017). The following three major items in the Sediment Sampling and Testing Plan to fulfill the requirements of ESB-305/2017 would be separately submitted to seek agreement from EPD on 1) the proposed locations and schedule of marine sediment sampling; 2) the specification of chemical test and biological toxicity test of marine sediment samples for the evaluation of waste management under the EIAO process; and 3) the specification of elutriate test and pore water test of marine sediment samples for water quality assessment under the EIAO process.

- 1.3.3 The Project will be carried out in the vicinity of Lai Chi Wo Pier within the Yan Chau Tong Marine Park and it falls within the environmentally sensitive areas listed in Item Q.1, Part I of Schedule 2 of the EIAO. EPD advised that statutory procedure to obtain permission for the direct Environmental Permit (EP) under section 5(1)(b) of EIAO should be followed.
- 1.3.4 Relevant details of the Project were submitted to Agriculture, Fisheries and Conservation Department (AFCD) in October 2018 and there was no adverse comment. However, The Project Proponent / Contractor was required to apply for Marine Parks Permit for SI works including vertical boreholes and vibrocores sediment sampling.

1.4 Name of Project Proponent

- 1.4.1 The Project Proponent is the Pier Improvement Unit (PIU), Civil Engineering Office, Civil Engineering and Development Department (CEDD) of the Government of the Hong Kong Special Administrative Region.

1.5 Location and Scale of Project and History of Site

- 1.5.1 The Project will be carried out in the vicinity of Lai Chi Wo Pier within the Yan Chau Tong Marine Park. The pier has a relatively narrow access and only one primitive berth. At low tide, there is inadequate water depth and berthing of vessels are difficult. The pier is inadequate to meet the current operational needs. Therefore, extension of the length and widening of the catwalk and pier head is being considered. Vertical boreholes and vibrocores are proposed under the Project to obtain the necessary geotechnical and environmental information to confirm if the preliminary design proposal for the pier improvement work is feasible.
- 1.5.2 A total of 3 nos. of vertical boreholes and 2 nos. of vibrocores are proposed under the Project. Borehole Nos. LCW/BH1 – BH3 are proposed to obtain geotechnical data for the design of pier improvement work, and vibrocore nos. LCW/VC1 and VC2 are proposed to collect geo-environmental data for sediment quality assessment. The proposed work locations of the Project are shown in **Figure 1.1**.
- 1.5.3 The drilling of borehole nos. LCW/BH1 - BH3 (3 nos. in total) and sediment sampling of vibrocore nos. LCW/VC1 and VC2 (2 nos. in total) will be carried out on a small jack-up barge. When there is adequate water depth, the barge (approximately 10m by 20m) will be towed by tug boats to the proposed work location. The barge will then be jacked up to above the high tide level by extending its four supporting legs onto the seabed. To avoid affecting any ecological features at the surrounding area, dive survey had already been performed at the proposed work locations in Oct 2018 and no ecological features were found.
- 1.5.4 Illustrative diagram of the setup of a vertical borehole drilling rig on the barge is shown in Plate 1 of **Appendix A**. An outer casing shall be first placed on the seabed level to avoid spillage of sediment and water containing suspended solids (SS) during drilling work. Throughout the drilling process, a rotary core with a drill bit is advanced inside the outer casing to the seabed and the soil sampler cuts and collects the sediment cores. After that, an inner casing (around 168mm dia.) is

advanced to the drill bit tip level to support the ground and seal off the open fissures. The drill bit with the sampler will then be brought to the barge and the soil samples would be collected for further laboratory tests. After removal of the sample, the rotary core with the drill bit will be once again returned to the base of the hole for subsequent sampling works.

1.5.5 Illustrative photos of the setup of a typical vibrocore sampling equipment are shown in Plate 2 of **Appendix A**. Similarly, an outer casing will first placed from the barge to the seabed level. A sampler barrel (around 115mm dia.) which clamped a PVC liner pipe will be driven into the seabed to collect samples by vibratory motion. The sampler barrel together with a filled PVC liner pipe is then retrieved, a new PVC liner pipe will be installed and returned to the base of the core for subsequent sampling works. The process is repeated until the termination depth is reached or upon refusal. Sediment samples will not be in direct contact with the open sea throughout the sampling process.

1.5.6 **Table 1.1** below presented a comparison between the proposed SI works and piling work under another Pier Improvement Work (Reconstruction of Sharp Island Pier).

Table 1.1 Comparison between proposed SI work and piling work

Item Details	Proposed SI Work		Piling Work (Socketed steel H-pile)
	Drilling for Vertical Boreholes	Vibrocore sampling	
Total duration of Work including setting up of barge and equipment	45 days	15 days	274 days
Total Depth of work	60m (3 nos. x 20m each)	30m (2 nos. x 15m each)	546m (26 nos. x 21m each)
Extent of works area	10m x 20m = 200m ² (For each SI location)		600m ²
Diameter of Piles / Boreholes /Vibrocores	168mm dia.	115mm dia.	610mm dia.
Total Volume of Material Collected	1.33 m ³	0.31 m ³	159.57 m ³

Note: The figures in the table above are estimates and are subject to change due to actual site conditions and programme of works

1.5.7 The Project would definitely cover shorter works period, smaller works area with lesser material collected and thus the impact to the surrounding environment would be minimal compared with a typical piling work for Pier Improvement Work.

Good Site Practices

1.5.8 The Contractor will observe and obey the guidelines stipulated under the Marine Parks Ordinance Cap 476 and the Marine Parks and Marine Reserves Regulation Cap 476A, including the restriction on vessel speed limits, restriction on anchoring or mooring outside the designated Mooring Sites and obstructing, polluting the water body or discharge of waste, etc.

Further SI Works

- 1.5.9 There shall be no additional SI under this stage of the Project. Should there be any follow-up SI works of similar nature and scale in the future, similar methods as described in the this project profile would be adopted.

1.6 Number and Type of Designated Project

- 1.6.1 The proposed SI works will be undertaken within the Yan Chau Tong Marine Park. In conjunction with Section 4.1.2 of Technical Circular (Works) No. 13/2003 - Guidelines and Procedures for Environmental Impact Assessment of Government Projects and Proposals promulgated by Environment, Transport and Works Bureau, the proposed SI work may be classified as a Designated Project (DP) if it falls within the environmentally sensitive areas listed in Item Q.1, Part I of Schedule 2 of the EIAO and does not fall into any exception works under Item Q.1. Therefore, the Project becomes a DP.

- *Item Q.1 - All projects including new access roads, railways, sewers, sewage treatment facilities, earthworks, dredging works and other building works partly or wholly in an existing or gazetted proposed country park or special area, a conservation area, an existing or gazetted proposed marine park or marine reserve, a site of cultural heritage, and a site of special scientific interest*

- 1.6.2 The Project shall meet the requirement of Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO) with implementation of mitigation measures / good site practices, hence, the environmental impact of the DP is unlikely to be adverse. This Project Profile is prepared in accordance with Annex 1 of the Technical Memorandum on Environmental Impact Assessment Process under Section 16 of EIAO to seek permission to apply directly for an EP for the Project under Section 5(11) of the EIAO.

1.7 Name and Telephone Number of Contact Person

- 1.7.1 All enquiries regarding the Project can be addressed to:

Pier Improvement Unit, Civil Engineering Office
Civil Engineering and Development Department
4/F, Civil Engineering and Development Building, Homantin,
101 Prince Margaret Road
Kowloon,
Hong Kong

Mr. YUNG Chung-bun, Thomas, Deputy Project Team Leader
Tel.: 2762 5576
Fax: 2714 2054

2 Outline of Planning and Implementation Programme

2.1 Planning and Implementation

- 2.1.1 The Project Proponent will engage the Consultant to undertake the direct application of EP for the Project under Section 5(1)(b) of the EIAO and the Project will be carried out by the term Contractor within the department of Project Proponent.

2.2 Project Timetable

- 2.2.1 Subject to the weather conditions, the Project is expected to be completed in 2 months upon the issue of Environmental Permit. Notification to the locals and related authorities has been carried out and no objection was received at the time of preparing this Project Profile.

2.3 Potential Interface with Other Projects

- 2.3.1 There is only one committed project, named “Signature Project Scheme (North District) – Improvement of Trails and Provision of Facilities in Sha Tau Kok”, on the landside of Lai Chi Wo that is within 500m assessment area of the Project. Given that the works within 500m assessment area of the Project mainly to refurbish the signage boards in Lai Chi Wo and possible adverse environmental impact is not anticipated, cumulative impact with the Project is not expected.

3 Major Elements of the Surrounding Environment

3.1 Air Quality

Air Sensitive Receivers

3.1.1 Air Sensitive Receivers (ASRs) are identified in accordance with Annex 1 and Annex 12 of the TM-EIAO.

3.1.2 ASRs that may be affected by the Project are listed in **Table 3.1** and presented in **Figure 3.1**.

Table 3.1 Representative air sensitive receivers

ASR	Description	Uses ^[1]	Nearest distance from the Project
A1	Hip Tin Temple & Hok Shan Monastery	W	430m
A2	Lai Chi Wo	R/H ^[2]	460m
A3	Planned Geoheritage-cum-ecological Education Centre	G/IC	380m

Notes:

[1] R – Residential, W – Public Place of Worship; H – Hotel; G/IC – Government, Institution and Community

[2] The proposed hotel use (Planning Application No. A/NE-LCW/2) is located within Lai Chi Wo

Existing Ambient Air Quality Conditions

3.1.3 The Project is located at Yan Chau Tong Marine Park to the northeast of Lai Chi Wo Village. The existing ambient air quality could be referred to the EPD's Tap Mun Air Quality Monitoring Station, which represents the air quality of rural areas in Hong Kong. The latest air quality monitoring data (available up to 2017) of various air pollutants monitored at Tap Mun AQMS is presented in **Table 3.2** and compared with the Air Quality Objectives (AQOs).

Table 3.2 Air quality monitoring data (Tap Mun AQMS, 2013-2017)

Pollutant	Parameter	Concentrations, $\mu\text{g}/\text{m}^3$						AQO, $\mu\text{g}/\text{m}^3$
		2013	2014	2015	2016	2017	5-year mean	
SO ₂	4 th highest 10-minute	N/A	51	50	45	34	46 [9%]	500 (3)
	4 th highest 24-hour	29	24	14	15	14	19 [15%]	125 (3)
NO ₂	19 th highest 1-hour	79	61	51	58	52	60 [30%]	200 (18)
	Annual	11	10	10	13	10	11 [28%]	40
CO	Max. 1-hour	1,530	1,370	2,140	1,470	1,770	1,656 [6%]	30,000

Pollutant	Parameter	Concentrations, $\mu\text{g}/\text{m}^3$						AQO, $\mu\text{g}/\text{m}^3$
		2013	2014	2015	2016	2017	5-year mean	
	Max. 8-hour	1,441	1,329	1,351	1,453	1,543	1,423 [14%]	10,000
O ₃	10 th highest 8-hour	180	181	182	169	192	181 [113%]	160 (9)
RSP	10 th highest 24-hour	119	102	86	68	74	90 [90%]	100 (9)
	Annual	49	44	35	30	35	39 [78%]	50
FSP	10 th highest 24-hour	84	65	66	43	43	60 [80%]	75 (9)
	Annual	30	27	24	19	20	24 [69%]	35

Notes:

- [1] Number of exceedance allowed under the AQO is shown in (), % of the AQO is shown in []. The 5-year mean is the average of the yearly maximum.
 [2] Monitoring results exceeding the AQO are in **bold**.
 [3] Monitoring data for 10-min SO₂ for Years 2013 are not available.

- 3.1.4 It can be seen from **Table 3.2** that there was a decreasing trend for the 19th highest 1-hour NO₂ concentration and the range was from 79 $\mu\text{g}/\text{m}^3$ in 2013 to 51 $\mu\text{g}/\text{m}^3$ in 2015, all complying with the AQO of 200 $\mu\text{g}/\text{m}^3$. There is a steady trend of low annual NO₂ concentration, which ranged between 10 $\mu\text{g}/\text{m}^3$ and 13 $\mu\text{g}/\text{m}^3$ in the past 5 years, well within the AQO of 40 $\mu\text{g}/\text{m}^3$.
- 3.1.5 A decreasing trend of RSP concentration was observed from 2013 to 2016. The 10th highest daily RSP concentration records exceeded the AQO in 2013 and 2014. The annual RSP concentrations ranged from 30 $\mu\text{g}/\text{m}^3$ in 2016 to 49 $\mu\text{g}/\text{m}^3$ in 2013, complying with the AQO of 50 $\mu\text{g}/\text{m}^3$.
- 3.1.6 A decreasing trend was observed for FSP from Year 2013 to 2017. The 10th highest daily FSP concentrations decreased from 84 $\mu\text{g}/\text{m}^3$ to 43 $\mu\text{g}/\text{m}^3$, where exceedance of AQO was found in 2013. The annual FSP concentrations were in the range of 19 $\mu\text{g}/\text{m}^3$ to 30 $\mu\text{g}/\text{m}^3$, complying with the AQO of 35 $\mu\text{g}/\text{m}^3$.
- 3.1.7 The 10th highest 8-hour averaged O₃ concentrations exceeded the AQO of 160 $\mu\text{g}/\text{m}^3$ during the 5-year period, ranging from 169 $\mu\text{g}/\text{m}^3$ in 2016 to 192 $\mu\text{g}/\text{m}^3$ in 2017. According to EPD's *Air Quality in Hong Kong 2016* report, O₃ is not a pollutant directly emitted from man-made sources but formed by photochemical reactions of primary pollutants such as NO_x and volatile organic compounds (VOCs) under sunlight. As it takes several hours for these photochemical reactions to take place, O₃ recorded in one place could be attributed to VOC and NO_x emissions from places afar. Hence, O₃ is more a regional air pollution problem.
- 3.1.8 Monitoring records of SO₂ and CO indicated that these two pollutants were in relatively low levels. Both pollutants were well within the AQOs.

3.2 Noise

Noise Sensitive Receivers

- 3.2.1 Noise Sensitive Receiver (NSR) is identified in accordance with Annex 1 and Annex 13 of the TM-EIAO.
- 3.2.2 There is no residential premise or educational institution within 300m assessment area and only the Plover Cove Country Park is present near the Project. Detail of this NSR is listed in **Table 3.3** and presented in **Figure 3.2**.

Table 3.3 Representative noise sensitive receiver

NSR	Description	Uses ^[1]	Nearest distance from the Project
N1	Plover Cove Country Park	CP	75m

Note:

[1] CP – Country Park

3.3 Water Quality

Water Sensitive Receivers

- 3.3.1 Water Sensitive Receivers (WSRs) are identified in accordance with Annex 1 and Annex 14 of the TM-EIAO.
- 3.3.2 WSRs that may be affected by the Project are listed in **Table 3.4** and presented in **Figure 3.3**.

Table 3.4 Representative water sensitive receivers

WSR	Description	Nearest distance from the Project (m)
W1	Lai Chi Wo Beach SSSI	170m
W2	Fish culture zone at Sai Lau Kong	2,150m
W3	Aquatic ecological habitats for marine organism of ecological importance at/near the existing pier at Lai Chi Wo and Yan Chau Tong Marine Park	In close proximity

3.4 Waste

- 3.4.1 No waste handling or treatment facility is present in the vicinity of the Project.

3.5 Ecology

- 3.5.1 Lai Chi Wo is located in the western portion of Yan Chau Tong Marine Park. As there is no literature review previously conducted to confirm the distribution of coral communities at the coastal area of Lai Chi Wo, a separate diver survey was carried out in October 2018 to check the presence of existing coral colonies around the proposed work locations of the Project, and the works area of the jack-up barges. No noticeable rock or hard substrate, which formed the substrate for coral

colonization, was found during the survey. No coral was found and only sand and silt were found at the substrate at the survey area.

3.6 Landscape and Visual

- 3.6.1 The Project is located within the Yan Chau Tong Marine Park, which is an intertidal coast landscape area with limited man-made amenities. The Project is located approximately 430m away from the existing village of Lai Chi Wo and the major visual sensitive receivers (VSRs) would be tourists and local villagers at Lai Chi Wo.

3.7 Cultural Heritage

- 3.7.1 No known site of archaeological interest, declared monument or graded historic building is located within the 100m assessment area. According to the information obtained from Marine Department Electronic Navigation Chart, the navigation chart reveals that a total of 58 shipwrecks have been charted in Hong Kong and none of them are located near Lai Chi Wo. In addition, a geophysical survey will be conducted around the proposed work locations under the Project prior to the commencement of the works to identify any sign of archaeological potential. The findings obtained from geophysical survey will be reviewed prior to ascertaining the actual work locations. Should there be suspected archaeological material or antiquities during the SI works, AMO should be immediately informed and agreement from AMO should be sought on the necessary follow-up actions.

4 Possible Impact on the Environment

4.1 General

- 4.1.1 All the prevailing statutory requirements will be considered to assess the possible environment impacts.

4.2 Air Quality

- 4.2.1 As the Project only involves underwater sampling and no excavation work will be carried out, dust emission is not anticipated. Furthermore, there will be deployed only one small jack-up barge under the Project, and limited number of boat trips will be induced per day to transport construction workers to and from the nearest pier in other district and the project site, significant increase of marine emission is not expected.

4.3 Noise

- 4.3.1 Potential noise generated from the Project during the sampling works would be the noise generated by the Powered Mechanical Equipment (PME) such as the generator and the jack-up barge with drilling rig/ vibrocore, with a sound power level of 108 dB(A) and 104 dB(A) respectively. Only one small jack-up barge will be deployed to carry the work at any one time and the Project is expected to be completed within 2 months (i.e. approximately 45 days for drilling of vertical boreholes and 15 days for vibrocores sediment sampling). There is no residential premise or educational institution within 300m assessment area and only the Plover Cove Country Park, with limited transient hikers, is present at approximately 75m away from the nearest proposed sampling points. As no work will be carried out during restricted hours (i.e. 19:00 to 07:00) and on Sundays and Public Holidays, and most of the sampling works would be carried out under water, adverse noise impact due to the Project is not anticipated.

4.4 Water Quality

- 4.4.1 Before sampling, the jack-up barge will be fixed in position by extending its 4 legs into the seabed, and the barge will be jacked up until the barge bottom is elevated above the high tide level. Minimal disturbance of existing seabed level during positioning may be resulted and significant dispersion of suspended solid is not expected.
- 4.4.2 Before commencement of rotary drilling works, all drill rig, re-circulation tank and equipment shall be thoroughly cleaned off-site. An outer casing shall be first placed on the seabed level to avoid the spillage of sediment and water containing suspended solids during drilling works. Throughout the drilling process, seawater shall be used as drilling fluid for lubricating the drill bit, no lubricants or other additives shall be introduced. The drilling fluid shall be circulated within the system through the re-circulation tank, where the recycled fluid with small amount of sediment will be settled and collected in the tank. The inner casing shall be

advanced to the rockhead by rotary core drilling and shall be cleaned by the re-circulated flushing water before extraction. Thereafter, the inner and outer casings shall then be extracted slowly to the barge deck. The sediment collected in the tank during the drilling process shall be delivered to the depot of the Contractor. No sediment within the borehole will be made in direct contact with the open sea water and sediment disposal under the Project is not anticipated.

4.4.3 For vibrocores sediment sampling, as no water medium is necessary during the sampling process and all the equipment shall be thoroughly cleaned off-site, adverse water quality impact is not expected.

4.4.4 Moreover, portable toilets will be installed on the jack-up barges, sewage or wastewater should not be allowed to discharge into the surrounding environment. Together with the subsequent proper handling, potential adverse water quality impact is not anticipated.

4.5 Waste

4.5.1 No solid waste, including inert and non-inert construction and demolition (C&D) materials is expected to be generated from the Project. Limited general refuse consists of food waste from on-site workers shall be kept in the refuse bin on the jack-up barges and disposed off by workers daily after work. Sediment disposal under the Project is not anticipated.

4.6 Ecology

4.6.1 One small jack-up barge with individual size of approx. 10m by 20m shall be deployed for the Project and it will create a temporary loss of 0.04ha marine water, with low ecological value, close to the Lai Chi Wo Pier. As mentioned in **Section 3.5**, dive survey has been carried out around the proposed work locations of the Project, no coral community was identified.

4.6.2 In addition, as the the proposed work locations of the Project fall outside Plover Cove Country Park, no significant ecological impacts (both direct and indirect impacts) on the Country Park are anticipated.

4.7 Landscape and Visual

4.7.1 The Project only involves a very short period (i.e. 2 months) of marine-based sampling works with no permanent loss of intertidal coast landscape area. In addition, the nearest VSR is located over 400m away from the Project and the jack-up barges will be fixed close to the existing pier, no isolated, intrusive or massive structure will be observed in the marine water, as such insignificant landscape and visual impact is expected.

4.8 Cultural Heritage

4.8.1 No cultural heritage impact induced from the Project is anticipated.

5 Environmental Protection Measures to be Incorporated in the Design and Any Further Environmental Implications

5.1 Air Quality

5.1.1 Although significant increase of marine emission due to the Project is not expected, the Contractor is still advised to minimise the number of boat trips as far as practicable by appropriate planning to maximise the utilisation of each trip traveling to and from the nearest pier in other district and the Project site.

5.2 Noise

5.2.1 Even though adverse noise impact due to the Project is not anticipated at the nearby NSRs, the following good site practices shall still be implemented during the sampling works.

- The number of PME operating shall be kept to a minimum. Only well-maintained plant shall be used;
- Regular maintenance shall be provided to all plant and equipment;
- Equipment that may be in intermittent use shall be shut down or throttled down to a minimum between work periods;
- No construction activities would be allowed during 7pm to 7am, and on Sundays and public holidays; and
- Recommended Pollution Control Clauses for Construction Contracts shall be adopted to undertake environmental protection measures to reduce the environmental impacts arising from the execution of the works as necessary

5.3 Water Quality

5.3.1 The Contractor shall observe and obey the Marine Parks Ordinance Cap 476 and the Marine Parks and Marine Reserves Regulation Cap 476A. The Contractor shall apply for Marine Parks Permit for SI works including vertical boreholes and vibrocores sediment sampling. The protection measures to be incorporated during SI works are listed as below.

- The power driven vessel shall not exceed a speed of 10 knots at any time inside the marine park;
- Restrict to anchor or moor except under and in accordance with a permit or at mooring sites provided by the Authority;
- Obstruct or pollute the water body or discharge of waste; and
- Restrict to collect any marine life and resources in or from the marine park.

5.3.2 The Contractor shall also ensure all geotechnical and environmental samples will be collected within the casing without any contact with the surrounding waterbodies. Before commencement of rotary drilling works, all drill rig, re-circulation tank and equipment shall be thoroughly cleaned off-site. An outer casing shall be first placed on the seabed level to avoid the spillage of sediment and water containing suspended solids during drilling works. Throughout the drilling process, seawater shall be used as drilling fluid for lubricating the drilling bit, no lubricant or other additives shall be introduced. The drilling fluid shall be circulated within the system through the re-circulation tank, where the recycled fluid with small amount of sediment will be settled and collected in the tank. The inner casing shall be advanced to the rockhead by rotary core drilling and shall be cleaned by the re-circulated flushing water before extraction. The inner and outer casing shall then be extracted slowly to the barge deck. The sediment collected in the tank during the drilling process shall be delivered to the depot of the Contractor. No sediment within the borehole will be made in direct contact with the open sea water and sediment disposal under the Project is not anticipated.

5.3.3 For vibrocores sediment sampling, no water medium is necessary during the sampling process and all the equipment shall be thoroughly cleaned off-site, thus adverse water quality impact is not expected.

5.4 Waste

5.4.1 Refuse bins shall be provided on the jack-up barges for effective collection of general refuse from on-site workers. To avoid unnecessary cumulation of refuse on the jack-up barge, the refuse shall be disposed off site by workers daily after work. The general refuse such as waste paper, empty cans, garbage etc. will also be recycled as much as practicable prior to disposal.

5.5 Ecology

5.5.1 The protection measures and sampling procedures as mentioned in **Section 5.3** shall also be implemented to minimise potential impacts on the general environment. The Contractor shall apply for Marine Park Permit for SI works including vertical boreholes and vibrocores sediment sampling.

5.6 Landscape and Visual

5.6.1 Night-time sampling works shall be prohibited to prevent light overspill to the nearby VSRs.

5.7 Cultural Heritage

- 5.7.1 No adverse impact on the aspect of cultural heritage due to the Project is anticipated and hence no mitigation measures are required.

5.8 Environmental Monitoring and Audit

- 5.8.1 Adverse environmental impact is not anticipated, therefore specific environmental monitoring is not required. Nevertheless, an independent environmental checker will be designated to ensure implementation of all preventive/ mitigation measures recommended in the Project Profile to avoid any potential environmental impacts.

5.9 Severity, Distribution and Duration of Environmental Effects and Further Implications

- 5.9.1 In view of the nature of the Project, the associated environmental impacts would be small scale, localized and short-term. With the implementation of the recommended mitigation measures and good site practices, no adverse residual impact would be anticipated.
- 5.9.2 As mentioned in **Section 2.2**, notification to the locals and related authorities about the Project has been carried out and no objection was received at the time of preparing this Project Profile.

6 Summary of Potential Environmental Impacts and Mitigation Measures

6.1.1 The potential environmental impacts and proposed mitigation measures to be incorporated during construction stage of the Project are summarized in **Table 6.1**, which would be included in the construction contract document. The project proponent would supervise and monitor the implementation of these measures by the Contractor.

Table 6.1 Summary of potential environmental impacts and mitigation measures/ good site practices

Potential Environmental Impacts	Mitigation Measures/ Good Site Practices	Implementation Agent	Relevant Section in PP
Air Quality	<ul style="list-style-type: none"> Minimization of boat trips as far as practicable 	Contractor	5.1
Noise	<ul style="list-style-type: none"> The number of PME operating shall be kept to a minimum. Only well-maintained plant shall be used; Regular maintenance shall be provided to all plant and equipment; Equipment that may be in intermittent use shall be shut down or throttled down to a minimum between work periods; No construction activities would be allowed during 7pm to 7am, and on Sundays and public holidays; and Recommended Pollution Control Clauses for Construction Contracts shall be adopted to undertake environmental protection measures to reduce the environmental impacts arising from the execution of the Works as necessary 	Contractor	5.2
Water Quality	<ul style="list-style-type: none"> To observe and obey the guidelines stipulated under the Marine Parks Ordinance Cap 476 and the Marine Parks and Marine Reserves Regulation Cap 476A; The power driven vessel shall not exceed a speed of 10 knots at any time inside the marine park; Restrict to anchor or moor except under and in accordance with a permit or at mooring sites provided by the Authority; Obstruct or pollute the water body or discharge of waste; Restrict to collect any marine life and resources in or from the marine 	Contractor	5.3

Potential Environmental Impacts	Mitigation Measures/ Good Site Practices	Implementation Agent	Relevant Section in PP
	<p>park;</p> <ul style="list-style-type: none"> • Before commencement of drilling works, all drill rig, re-circulation tank and equipment shall be thoroughly cleaned off-site; • Throughout the drilling process, seawater shall be used for flushing medium and no lubricant, hydraulic fluid or other additives shall be introduced; • The drilling fluid shall be circulated within the system through the re-circulation tank, where the recycled fluid with small amount of sediment shall be settled and collected in the tank.; • Prior to actual sampling, an outer casing shall be placed on the seabed level to avoid the spillage of sediment and water containing SS; • After the completion of sampling work, casing shall be cleaned by the recycled water and collected back to the re-circulation tank. The inner and outer casing shall then be extracted slowly to the barge deck and the sediment collected in the tank during the drilling process shall be delivered to the depot of the Contractor. • To ensure all geotechnical and environmental samples will be collected within the casing without any contact with the surrounding waterbodies; and • Portable toilets shall be installed on the jack-up barges, sewage or wastewater should not be allowed to discharge into the surrounding environment. 		
Waste	<ul style="list-style-type: none"> • Refuse bins shall be provided on the jack-up barges for effective collection of general refuse from on-site workers. • Disposal shall also be maintained and carried out by the workers daily after work to avoid unnecessary cumulation of refuse on barges. 	Contractor	5.4
Ecology	<ul style="list-style-type: none"> • Good site practices and mitigation measures to reduce water pollution shall also be implemented to minimise potential impacts on the general environment 	Contractor	5.5

Potential Environmental Impacts	Mitigation Measures/ Good Site Practices	Implementation Agent	Relevant Section in PP
Landscape and Visual	<ul style="list-style-type: none">Night-time sampling works shall be prohibited to prevent light overspill to the nearby VSRs	Contractor	5.6
Cultural Heritage	<ul style="list-style-type: none">Not Required	Contractor	5.7

7 Use of Previously Approved EIA Reports/ Direct EP Applications

- 7.1.1 There is no similar / referenced approved EIA Report / Direct EP Application with similar nature as the Project, i.e. relating to SI works for the purpose of establishing the feasibility of a designated project and the SI works fall within the environmentally sensitive areas as listed in Item Q.1, Part I of Schedule 2 of the EIAO.

8 Conclusion

- 8.1.1 The predicted environmental impacts from the Project are unlikely to be adverse and the mitigation measures / good site practices described in this PP meet the requirements of the Technical Memorandum on Environmental Impact Assessment Process.
- 8.1.2 This Project Profile has been prepared to seek permission from the Director of Environmental Protection under Section 5(11) of the EIAO to apply directly for an Environmental Permit.

Figures

Vertical Borehole / Vibrocore No.	Tentative Coordinates	
	Easting	Northing
LCW/BH1	845242	843322
LCW/BH2	845219	843320
LCW/BH3	845177	843325
LCW/VC1	845235	843313
LCW/VC2	845196	843321



LEGEND

- PROPOSED BOREHOLE
- PROPOSED VIBROCORE
- MARINE PARK
- COUNTRY PARK
- SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)

Rev	Description	By	Date
B	SECOND ISSUE	GL	02/19
A	FIRST ISSUE	GL	11/18

Consultant
ARUP

Project title
Site Investigation Works for Pier Improvement at Lai Chi Wo

Drawing title
LOCATION OF PROJECT

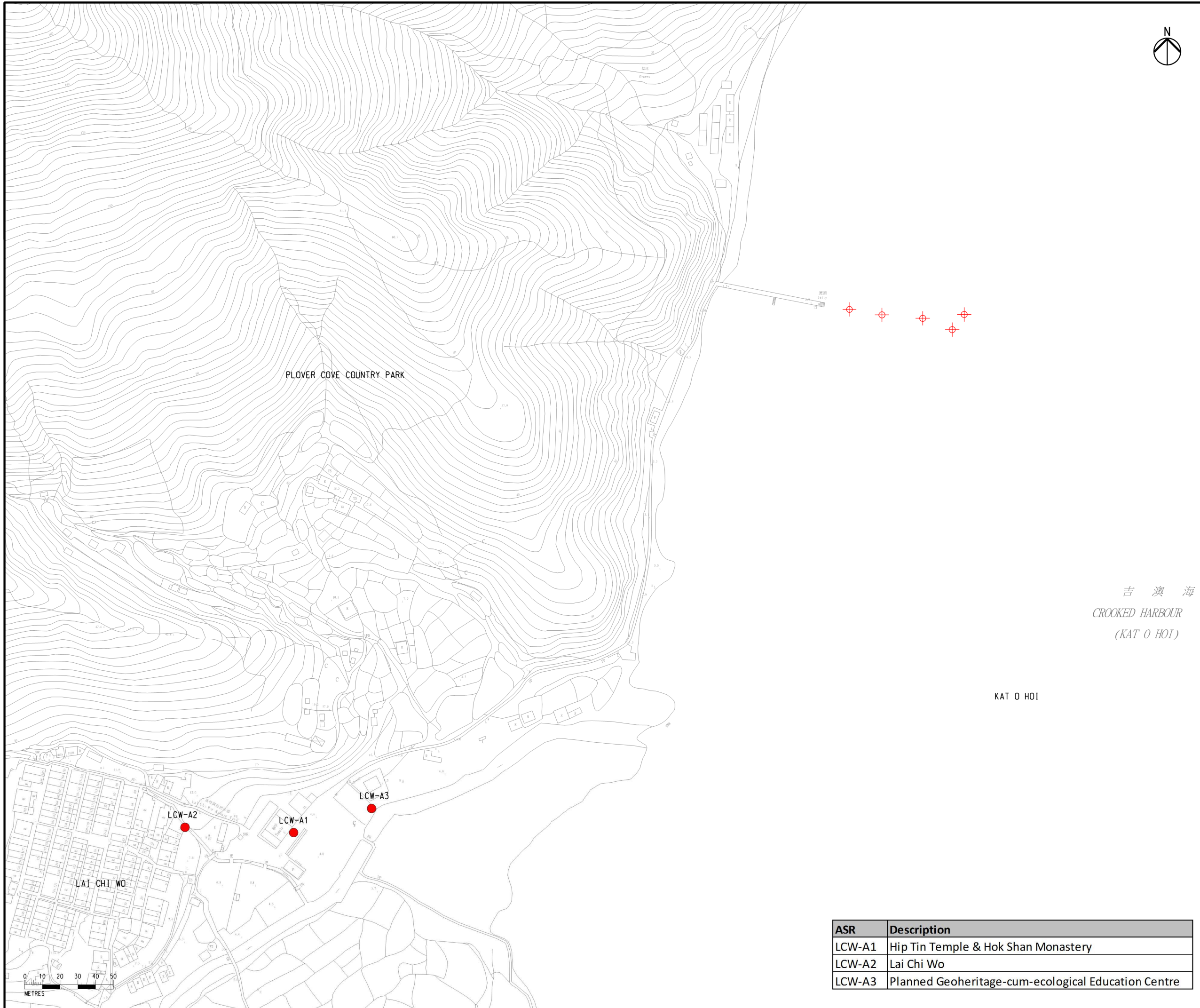
Drawing no. FIGURE 1.1		Rev. B	
Drawn GL	Date 02/19	Checked LK	Approved FC
Scale 1:1000 @ A3		Status PRELIMINARY	

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- LEGEND**
- PROPOSED BOREHOLE / VIBROCORE
 - REPRESENTATIVE AIR SENSITIVE RECEIVER

吉 澳 海
CROOKED HARBOUR
(KAT O HOI)

KAT O HOI

Rev	Description	By	Date
B	SECOND ISSUE	GL	03/19
A	FIRST ISSUE	GL	11/18

Consultant
ARUP

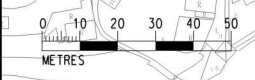
Project title
Site Investigation Works for
Pier Improvement at Lai Chi Wo

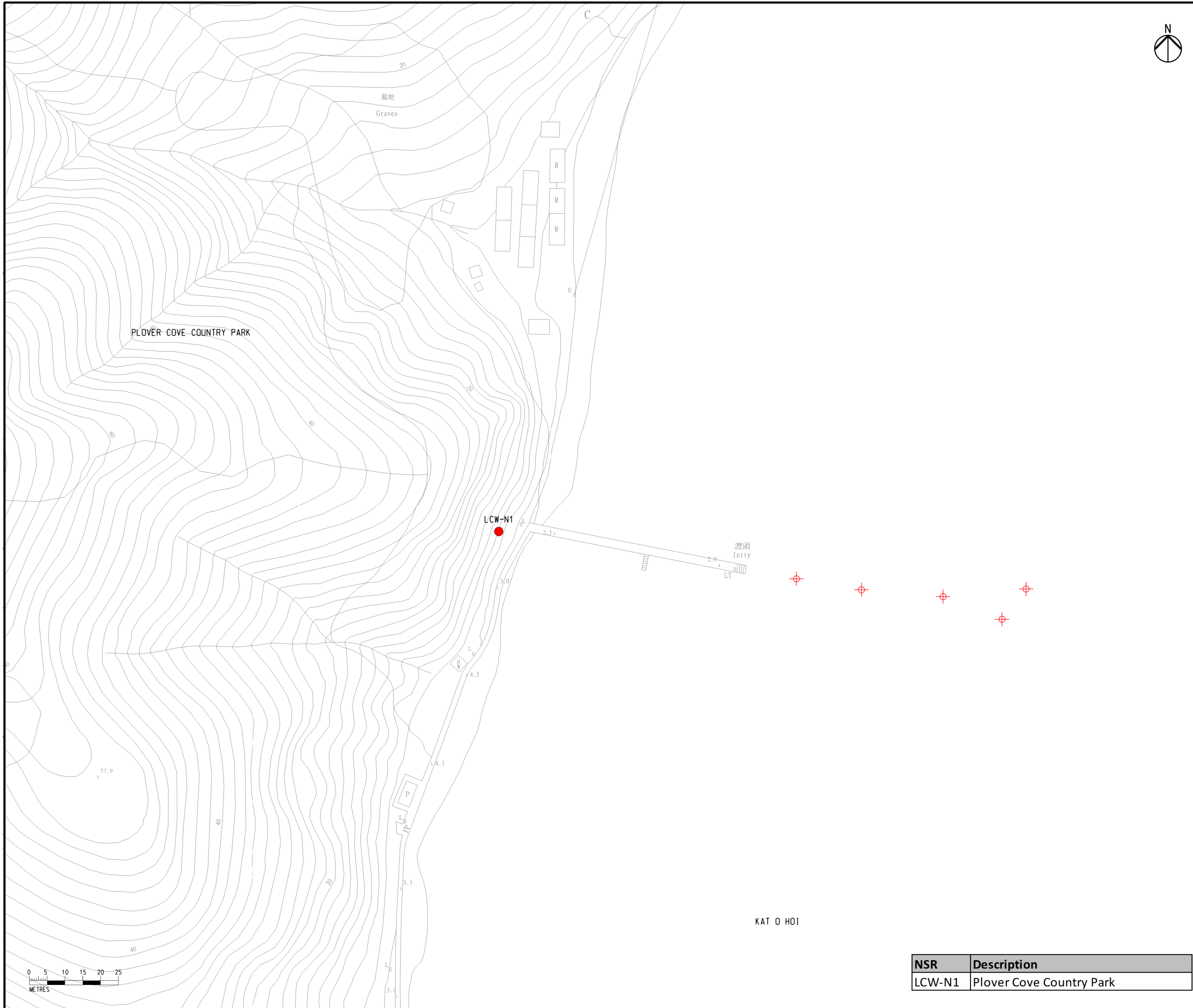
Drawing title
**LOCATIONS OF REPRESENTATIVE
AIR SENSITIVE RECEIVERS**



Drawing no.		Rev.	
FIGURE 3.1		B	
Drawn	Date	Checked	Approved
GL	03/19	LK	FC
Scale	Status		
1:2000 @ A3	PRELIMINARY		

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ASR	Description
LCW-A1	Hip Tin Temple & Hok Shan Monastery
LCW-A2	Lai Chi Wo
LCW-A3	Planned Geoheritage-cum-ecological Education Centre





- LEGEND
-  PROPOSED BOREHOLE / VIBROCORE
 -  REPRESENTATIVE NOISE SENSITIVE RECEIVER

Rev	Description	By	Date
B	SECOND ISSUE	XX	03/19
A	FIRST ISSUE	GL	11/18

Consultant
ARUP

Project title
Site Investigation Works for Pier Improvement at Lai Chi Wo

Drawing title
LOCATION OF REPRESENTATIVE NOISE SENSITIVE RECEIVER

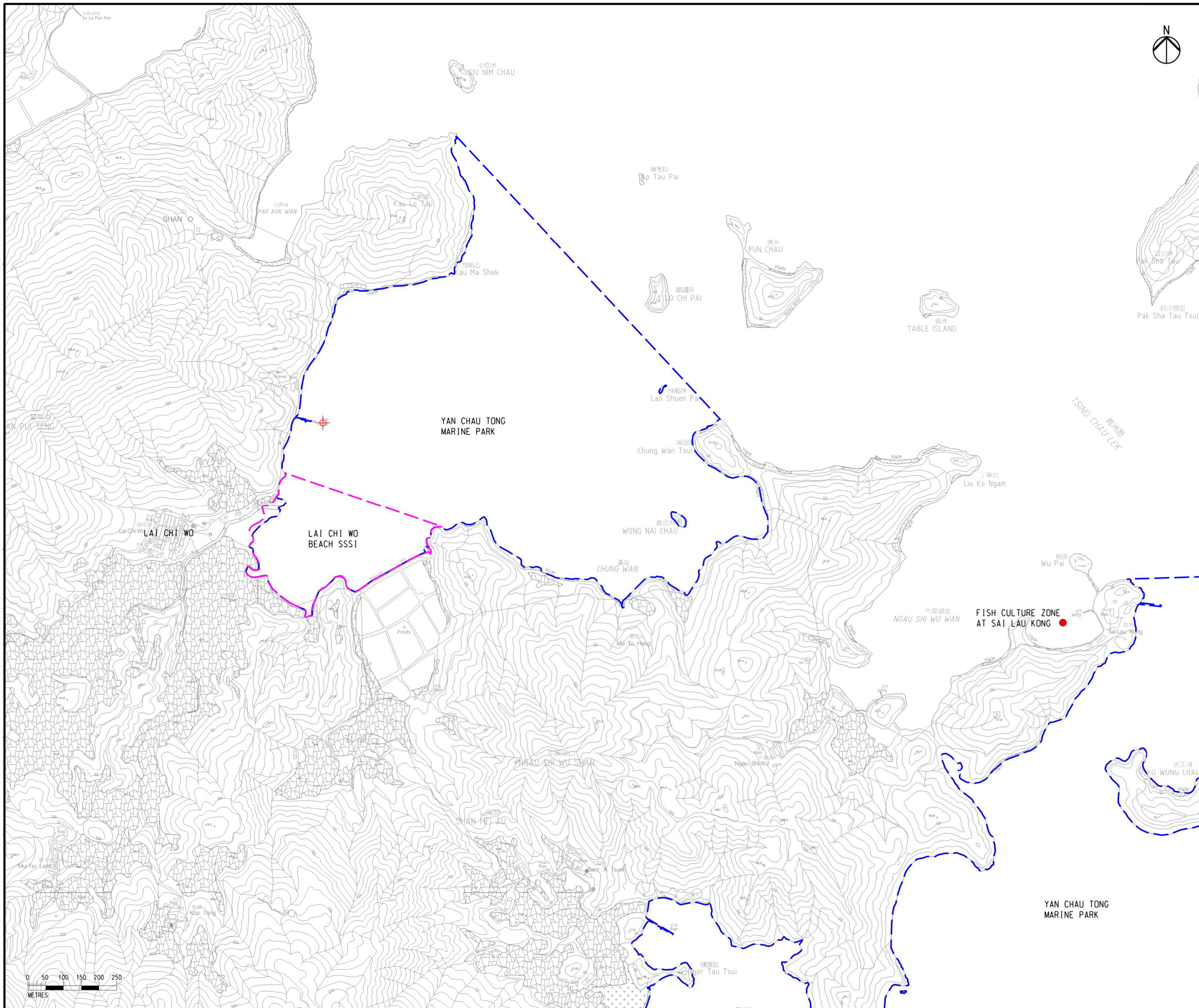
Drawing no. FIGURE 3.2		Rev. B	
Drawn GL	Date 03/19	Checked LK	Approved FC
Scale 1:500 @ A3		Status PRELIMINARY	






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NSR	Description
LCW-N1	Plover Cove Country Park



- LEGEND**
-  PROPOSED BOREHOLE / VIBROCORE
 -  WATER SENSITIVE RECEIVER
 -  MARINE PARK
 -  SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)
 -  FISH CULTURE ZONE

Rev	Description	By	Date
B	SECOND ISSUE	GL	03/19
A	FIRST ISSUE	GL	11/18

Consultant
ARUP

Project title
Site Investigation Works for
Pier Improvement at Lai Chi Wo

Drawing title
**LOCATIONS OF REPRESENTATIVE
WATER SENSITIVE RECEIVERS**

Drawing no. FIGURE 3.3		Rev. B	
Drawn GL	Date 03/19	Checked LK	Approved FC
Scale 1:10000 @ A3		Status PRELIMINARY	

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Appendix A

Photos and Diagram of Vertical
Borehole and Vibrocore

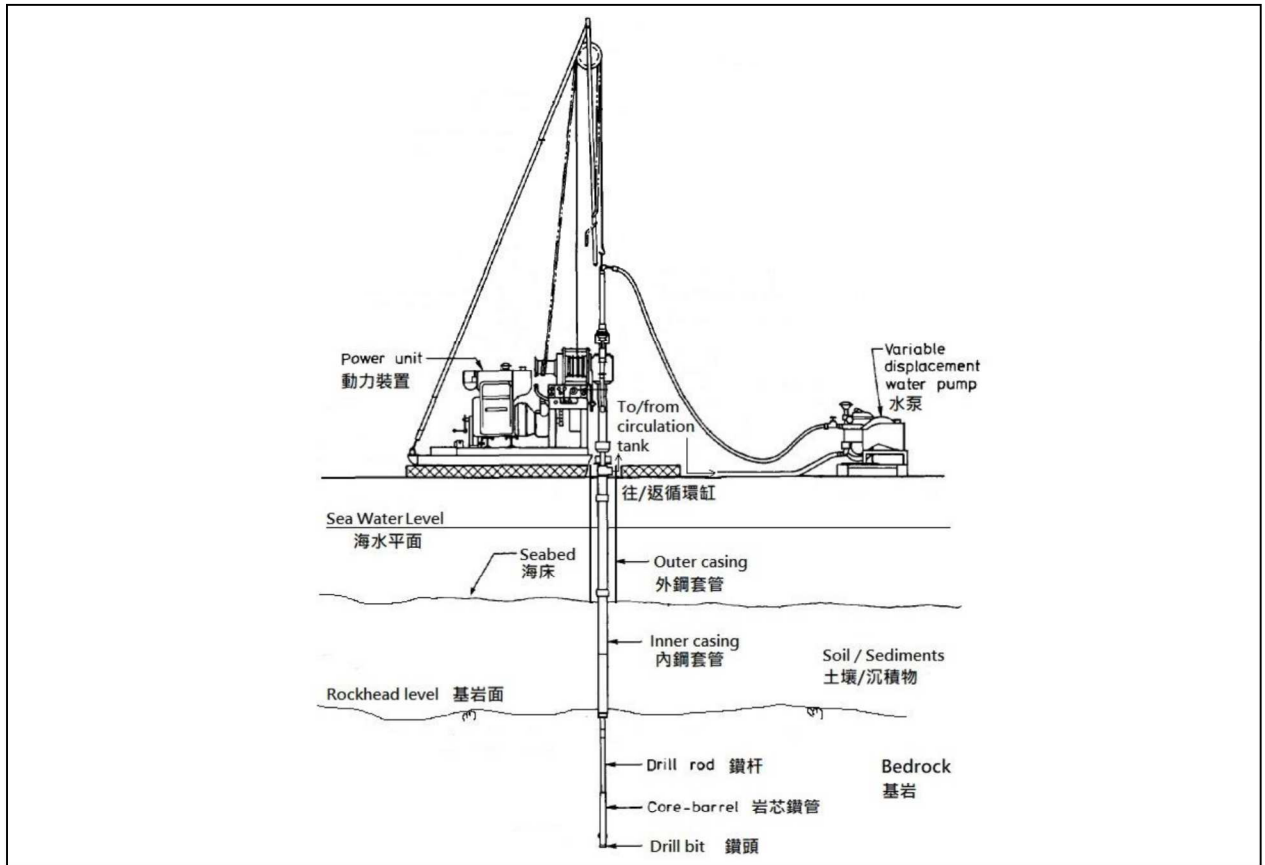


Plate 1 - Illustrative Diagram of Vertical Boreholes (Rotary Drilling Rig)



Plate 2 - Illustrative Photos of the Operation of a Typical Vibrocore sampling equipments