

Appendix 4.1 Ecological Survey Methodology (Terrestrial and Aquatic)

1 Introduction

The ecological surveys were mainly conducted during the wet season from June 2008 to November 2009 in accordance with the EIAO Guidance Note No. 10/2004 and 11/2004 on “Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys” and “Methodologies for Marine Ecological Baseline Surveys” (AFCD and EPD, 2004a and 2004b). The bird surveys for ardeid night roost were conducted from August 2008 to July 2009 to collect one year data. The dry season survey gave additional information on seasonal pattern of the bird species for potential habitats.

The Assessment Area for terrestrial ecology is defined as the area within 500 m distance from the proposed alignment and the area likely to be impacted by the Project, while the Assessment Area for the aquatic ecology cover the Victoria Harbour, Western Buffer, Southern Water and Southern Supplementary Water Control Zones (WCZs), water gathering ground, existing and new drainage system. The Assessment Area for terrestrial ecology covers also the area within 500m from the proposed barging points and explosive magazine site at Chung Hom Shan for the project. Relevant literature within the Assessment Area was reviewed to identify information gaps relating to the ecological characteristics of the aquatic and terrestrial environment. Ecological field surveys were conducted in both wet and dry seasons of the period June 2008 to November 2009, to fill the information gaps identified during the desktop study, with special attention paid to the ecologically sensitive areas.

Terrestrial ecological field surveys were focused on the above-ground areas which may be impacted by the project and where ecological impacts are possible. The proposed transect counting routes for terrestrial and aquatic fauna which covers the sites of conservation importance including Aberdeen Country Park, the Sites of Special Scientific Interest (SSSI) at Nam Fung Road and ecological sensitive habitats (natural woodlands and stream courses) in representative areas in and adjacent to the alignments, slope enhancement works, works sites options and other associated works area including magazine sites are shown in **Figures A1-A10**.

2 Habitat and Vegetation

Field surveys for existing habitat and vegetation were conducted in the wet season to generate the ecological profile of the Study Area. Habitat map were produced based on updated aerial photos and field ground truthing. Representative areas of each habitat were surveyed by direct observation on foot. Habitats to be affected by the proposed development were identified and mitigation measures were proposed for the loss of habitats. Photographs of habitats (terrestrial and aquatic) and ecological features of special importance were taken.

Plant species and their relative abundance have been recorded with special attention to rare, protected and threatened species and other species of conservation concern. Nomenclature of plant species follows AFCD (2002) and conservation status follows Xing *et al.* (2000), Siu (2000) and Wu and Lee (2000).

3 Mammal Survey

Surveys of mammals were conducted by active searching at natural stream, freshwater marsh, woodlands and plantation habitats during daytime and at night as well as ad hoc records of all sightings, tracks, and signs of mammals observe. Mammal surveys were performed in line with herpetofauna survey in wet season. Bat survey was carried out by direct counting at possible roost sites during daytime surveys. Direct

counting of bats was done just after sunset around the suspected foraging and drinking sites (e.g. Wong Chuk Hang nullah). Night surveys for nocturnal mammals were conducted twice in wet season. Species, abundance and their feeding/foraging behaviours were identified and recorded. Nomenclature for mammals follows Shek (2006).

4 Bird Survey

Bird communities of woodland, plantation, freshwater marsh, natural stream and nullah habitats within the Assessment Area were surveyed using the walk over transect count method. All birds seen or heard at either sides of the transects were identified and counted. Signs showing breeding (e.g. nests, recently fledged juveniles) within the Assessment Area were included. Bird species encountered away from the transects but within the Assessment Area were also recorded to produce a complete species list. Bird surveys were carried out once a month including both the wet and dry seasons. Ornithological nomenclature and status follow Carey *et al.* (2001) and Viney *et al.* (2005) respectively.

Ardeid night roost surveys were conducted once per month from August 2008 to July 2009 to investigate the night roosting behaviour of egrets and herons at Wong Chuk Hang Nullah. Direct observation was made from an advance point at Heung Yip Road. Species, abundance, time of return and flight direction were recorded. Specific trees on which the egrets and heron largely aggregated were located and identified.

5 Herpetofauna Survey

Surveys of herpetofauna within the Assessment Area were conducted through active searching and by detection of the mating calls for frogs and toads at their potential breeding sites during daytime and at night. Surveyed areas included natural stream, nullah, freshwater marsh, woodlands and plantation habitats. Daytime surveys for herpetofauna were carried out in line with mammal and insect surveys in wet season. Night surveys were carried out for two times during wet season when this fauna group is most active to cover those nocturnal species. Nomenclature for amphibians and reptiles follow Chan *et al.* (2005) and Karsen *et al.* (1998) respectively.

6 Dragonflies and Butterflies Survey

Dragonflies and butterflies of natural streams, nullah, freshwater marsh, woodland and plantation habitats within the Assessment Area were carried out using the same transect route as for bird survey.

Dragonflies and butterflies surveys were conducted in accordance with the EIAO GN No. 10/2004, species within 5m from the transect route were identified and counted. Dragonflies and butterflies encountered away from transects but within the Assessment Area were also recorded in order to produce a complete species list. Surveys for dragonflies and butterflies were performed four times in wet season. Nomenclature for dragonfly follows Wilson *et al.* (2003) and nomenclature for butterflies follows Lo *et al.* (2004).

7 Stream Fauna Survey

Aquatic fauna surveys (including stream fishes and stream invertebrates) were undertaken four times in wet season. Surveys were conducted along the natural stream at Nam Fung Road Woodland SSSI and Wong Chuk Hang Nullah, by direct observation, active searching and sample collection using hand nets. All stream fauna species observed and collected were identified in the field, and their abundances were noted.

8 Intertidal Community Survey

Intertidal habitats surveys were conducted twice in both wet and dry seasons at rocky shore and artificial seawalls along the Shek Pai Wan and Aberdeen Channel by line transect method (**Figure 3.2**). Six transect
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lines (two at rocky shore, two at artificial seawall with rubble mount and two along the vertical artificial seawall) were set from high tide mark and perpendicular to the shore down to the low tide mark. Quadrats of size 0.5m×0.5m were placed at 1m intervals. All flora and fauna found within the quadrat were identified and counted. For sessile organisms, the percentages covered within the quadrat were estimated. A walk through survey was conducted along the shoreline of the study area to describe the general ecological attribute of the intertidal community. The coastal area was actively searched for suitable habitats for various wildlife groups on the inter-tidal shore. Nomenclature for intertidal fauna follows Lai *et al.* (2006).

At Telegraph Bay barging point qualitative walk through and qualitative transect method were used to survey the intertidal community once per wet and dry season. All the survey were conducted at a considerably low tide period (<1m C.D.) when a larger area of intertidal habitat are exposed during low tide period. During the walk through survey, the community attribute was recorded through direct sighting. All epi-fauna and static fauna was identified and recorded with their relative abundance to establish an ecological profile of the intertidal community of the project area. During the transect survey, a line transect of 100m in length was deployed horizontally along the shoreline at the low tide mark at <1m C.D. and repeated at the middle and high tide mark, i.e. one transect at low tide, one at middle tide and another one at high tide (locations refer to **Figure B2**). Along the horizontal transects, 10 quadrates (0.5m x 0.5m) were placed randomly. All epi-fauna and static fauna observed within the quadrat were identified and counted to determine the species density. For sessile organisms such as oysters, barnacles and algae, the percentage cover within the quadrat was estimated. Other intertidal fauna found outside the quadrat were recorded qualitatively to establish a species checklist for the habitat.

9 Marine Benthic Community Survey

Three sites along the Aberdeen Channel, as shown in **Figure B1**, were chosen to assess the benthic community structure using grab sampling. The sites are within a 500 m distance from the proposed works area.

At each site, three grabs of 0.05m² were collected using a modified van Veen Grab. Collected samples were sieved by 0.5mm and 1.0mm mesh-size sieve and then stained in 5% borate-buffered formalin with Rose Bengal for staining. Organisms were sorted from the sediments and preserved in 70% ethanol solution. Benthic organisms were identified to the lowest practicable taxonomic level by marine benthic specialists.

Species composition, abundance and biomass were recorded. Diversity index, evenness index, Abundance/Biomass Comparison (ABC) plots were provided for evaluating and ranking the ecological values.

10 Coral Community Survey

Dive Survey - Rapid Ecological Assessment

Spot checks were conducted at Aberdeen Channel and Telegraph Bay at where direct impact will be result such as the pier location for the proposed bridge. Locations of the dive survey are shown in **Figures B1** and **B2**.

Assessment of substrate and ecological attributes using a semi-quantitative, Rapid Ecological Assessment (REA) method were conducted at where hard corals are found which depends on the result of spot check.

At each site, REA survey were performed along a 50m transect parallel to the coastline. Two REA transects were counted at Aberdeen Channel while three were conducted at Telegraph Bay barging point. The benthic cover, taxon abundance, and ecological attributes along the transects were recorded in a swathe of 2m wide, 1m either side of the transect (subject to the underwater visibility).

The locations of the REA transects were recorded on site using GPS (Garmin GPS 60CS). Pictures of representative taxa along the transects were taken during the surveys. Two types of information were recorded:

- (1) Cover of the major benthic groups;
- (2) Inventory of sessile benthic taxa.

These were performed according to Tier I and Tier II levels of information.

Tier I: Categorization of ecological (benthic cover) and environmental variables.

To describe the benthic cover, six substrate and seven ecological attributes (**Table 1a**) were assigned. Each attribute were given a rank, from 0 to 6 (**Table 1b**) based on the overall cover along the survey area.

Tier II: Taxonomic inventories to define types of benthic communities.

An inventory of benthic taxa was compiled during each swim. Taxa were identified either in situ or with the aid of photos to confirm identification afterward.

Hard corals (Order Scleractinia) – to genus and species level where possible;

Octocorals (Subclass Octocorallia) – to genus level where possible;

Other benthos (such as sponges zoanths, bryozoans, macroalgae etc) – to genus level where possible or phylum with growth form;

Each taxon in the inventory was given a rank (0 to 5) on the basis of its abundance in the community at the site (**Table 1c**). These broad categories rank the taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.

Table 1: Categories of a) benthic attributes, b) ordinal ranks of percentage cover of substrate, and (c) ordinal ranks of taxa abundance

a) Benthic attributes		b) Percentage Cover		c) Taxon abundance	
Substrate	Ecological	Rank	Percentage Cover	Rank	Abundance
Bedrock	Hard Corals	0	Not recorded	0	Absent
Boulders (diameter >50cm)	Dead Coral Skeleton	1	1-5%	1	Sparse
Cobbles (diameter < 50cm)	Soft Corals	2	6-10%	2	Uncommon
Rubble (dead corals)	Sea anemone beds	3	11-30%	3	Common
Sand with gravel	Encrusting Algae	4	31-50%	4	Abundant
Mud & Silt	Coralline Algae	5	51-75%	5	Dominant
	Erect Macroalgae	6	76-100%		

11 Reference

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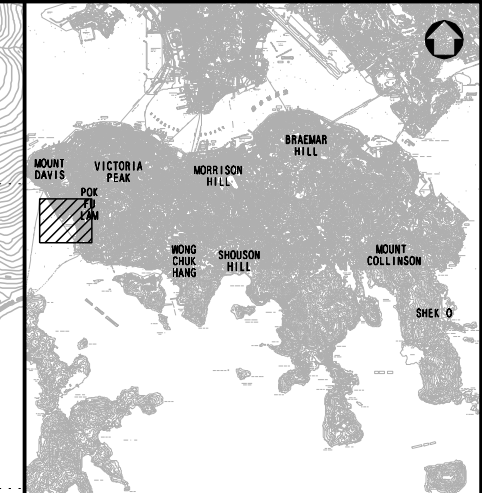
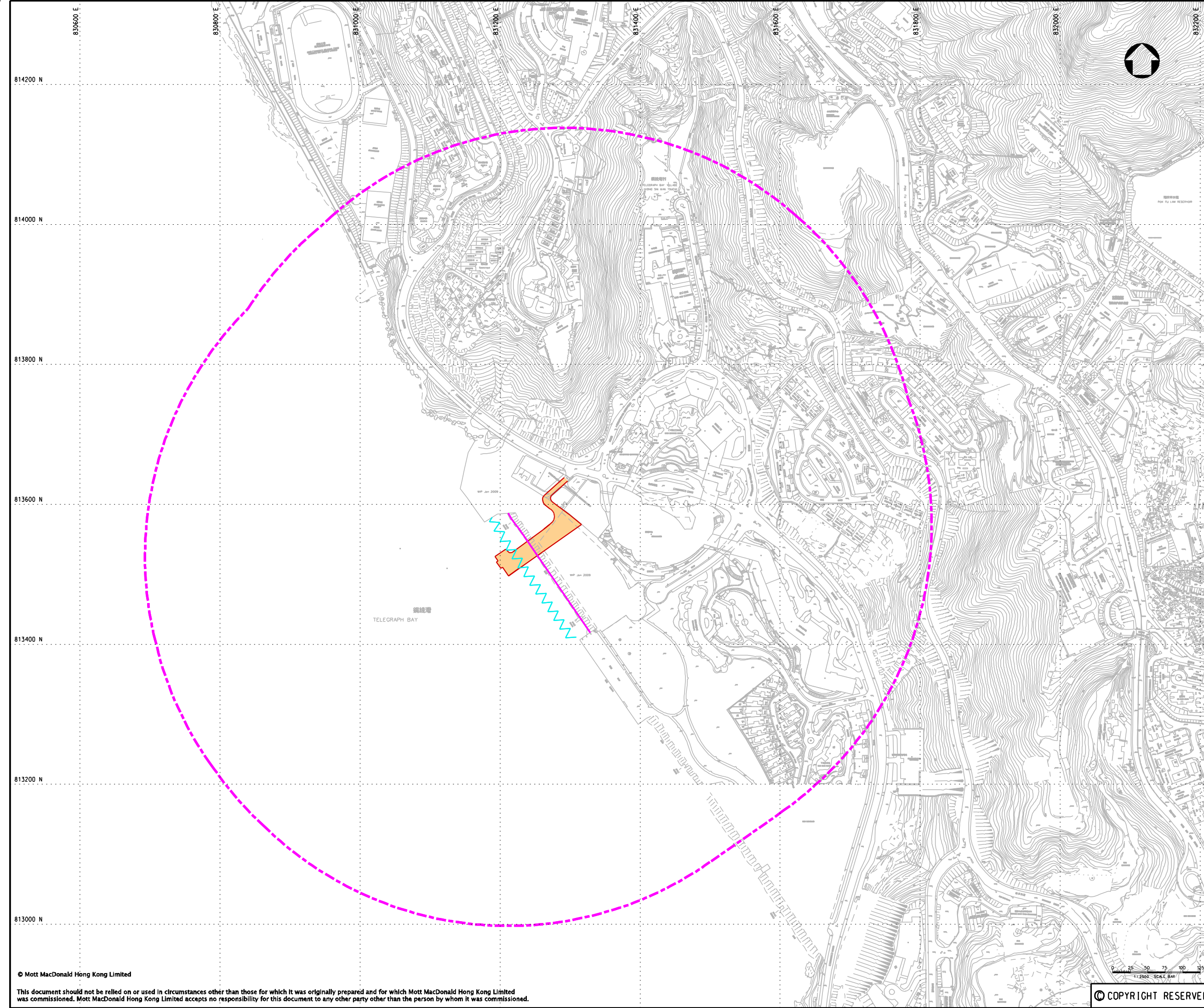
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KEY PLAN

- LEGEND:**
-  500m ASSESSMENT AREA
 -  BARGING AREA (TELEGRAPH BAY)
 -  PROPOSED WORKS AREA (GROUND LEVEL)
 -  INTERTIDAL SURVEY
 -  DIVE SURVEY

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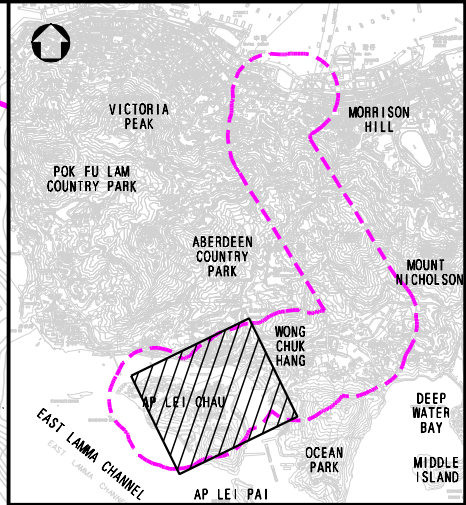
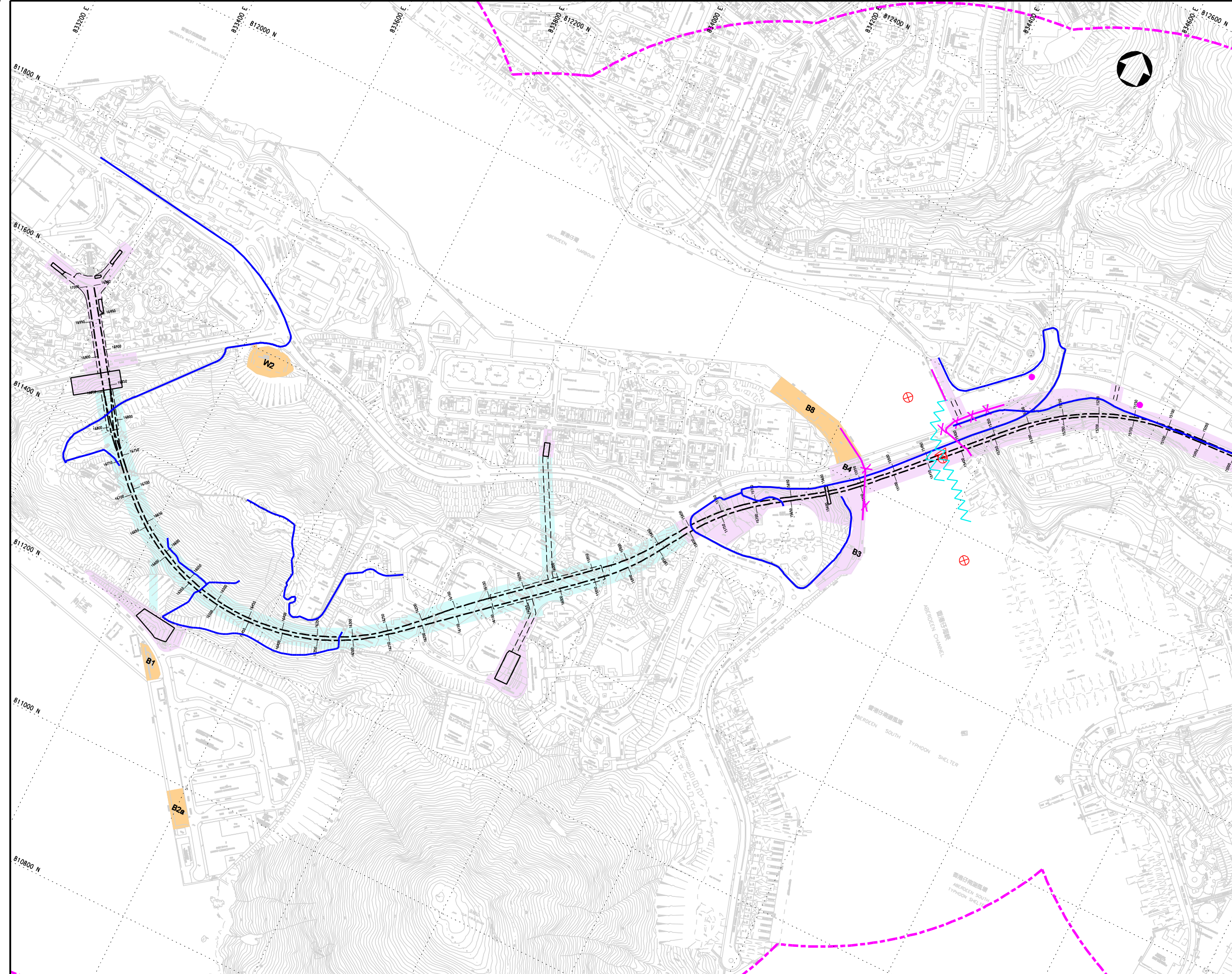
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FIGURE A1

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KEY PLAN

LEGEND:

- 500m ASSESSMENT AREA
- B3** BARGING AREA
- W2** WORKS AREA
- PROPOSED WORKS SITE (GROUND LEVEL AND UNDERGROUND)
- PROPOSED WORKS SITE (UNDERGROUND)
- PROPOSED WORKS AREA (GROUND LEVEL)
- TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFUNA SURVEY
- INTERTIDAL WALK THROUGH SURVEY
- X INTERTIDAL TRANSECT SURVEY
- AQUATIC FAUNA SURVEY
- ⊕ MARINE BENTHIC SURVEY
- ~ DIVE LOCATION
- △ LOCATION OF THE PIER FOR THE PROPOSED BRIDGE

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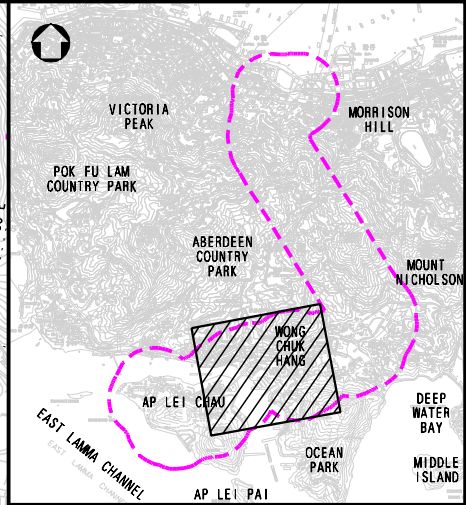
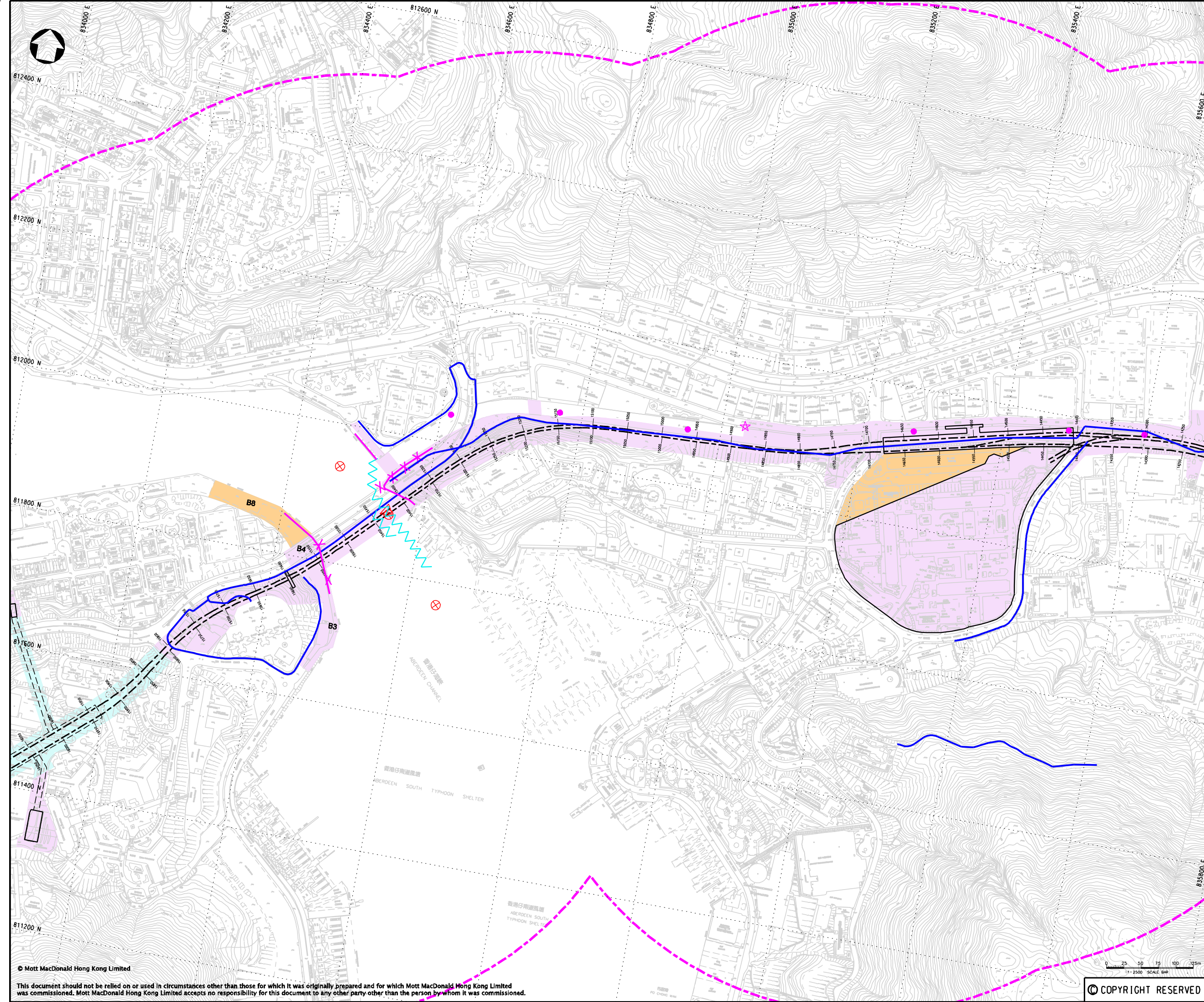
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KEY PLAN

NOTE:
THE MASTER LAYOUT PLAN (MLP) ON WONG CHUK HANG DEPOT (WCH) AND OCEAN PARK (OCP) ARE TENTATIVE, SUBJECT TO REVISE IN THE FUTURE.

- LEGEND:**
- 500m ASSESSMENT AREA
 - B3** BARGING AREA
 - PROPOSED WORKS SITE (GROUND LEVEL AND UNDERGROUND)
 - PROPOSED WORKS SITE (UNDERGROUND)
 - PROPOSED WORKS AREA (GROUND LEVEL)
 - TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFUNA SURVEY
 - INTERTIDAL WALK THROUGH SURVEY
 - INTERTIDAL TRANSECT SURVEY
 - AQUATIC FAUNA SURVEY
 - ARDEID NIGHT ROOST OBSERVATION POINT
 - MARINE BENTHIC SURVEY
 - DIVE LOCATION
 - LOCATION OF THE PIER FOR THE PROPOSED BRIDGE

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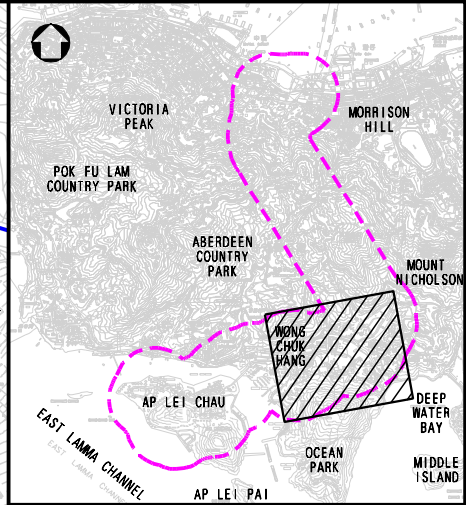
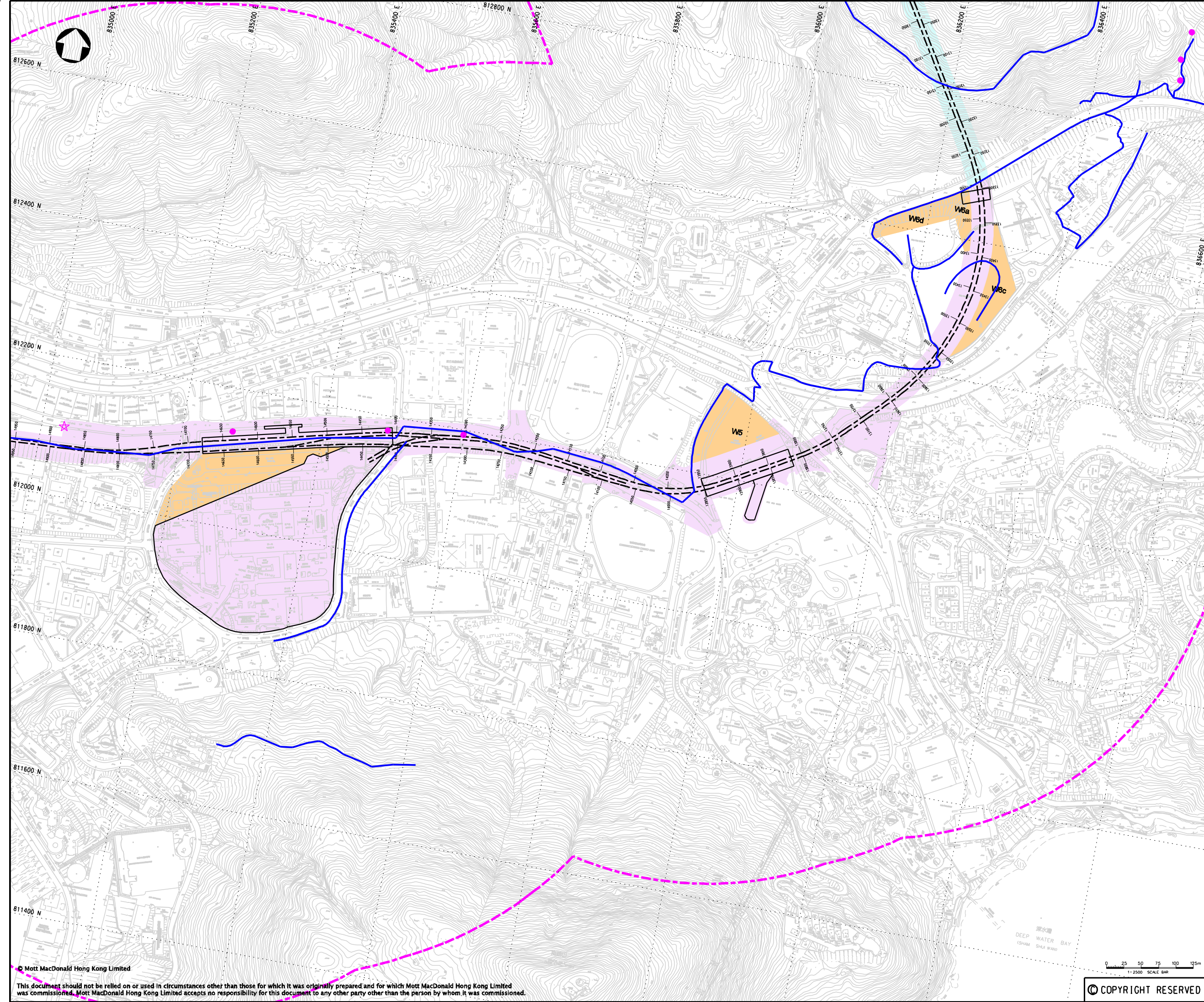
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FIGURE A3

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KEY PLAN

NOTE:
THE MASTER LAYOUT PLAN (MLP) ON WONG CHUK HANG DEPOT (WCH) AND OCEAN PARK (OCP) ARE TENTATIVE. SUBJECT TO REVISE IN THE FUTURE.

LEGEND:

- 500m ASSESSMENT AREA
- W5** WORKS AREA
- PROPOSED WORKS SITE (GROUND LEVEL AND UNDERGROUND)
- PROPOSED WORKS SITE (UNDERGROUND)
- PROPOSED WORKS AREA (GROUND LEVEL)
- TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFAUNA SURVEY
- AQUATIC FAUNA SURVEY
- ★ ARDEID NIGHT ROOST OBSERVATION POINT

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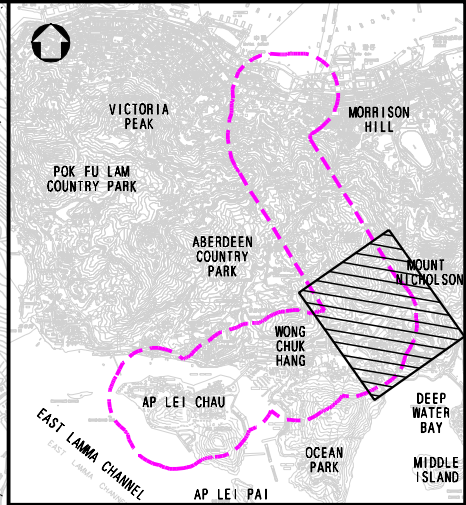
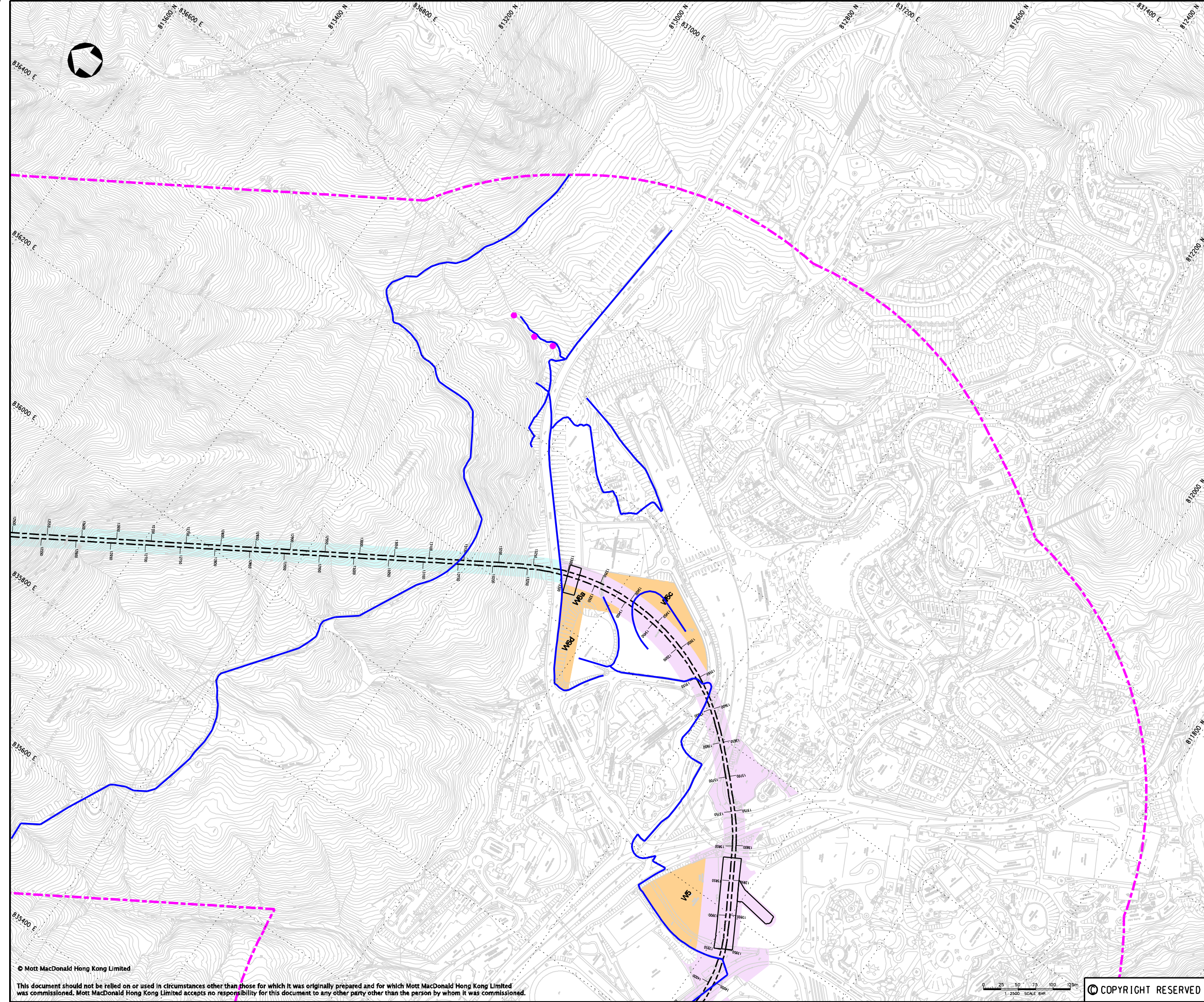
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KEY PLAN

LEGEND:

- 500m ASSESSMENT AREA
- W5** WORKS AREA
- PROPOSED WORKS SITE (GROUND LEVEL AND UNDERGROUND)
- PROPOSED WORKS SITE (UNDERGROUND)
- PROPOSED WORKS AREA (GROUND LEVEL)
- TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFAUNA SURVEY
- AQUATIC FAUNA SURVEY

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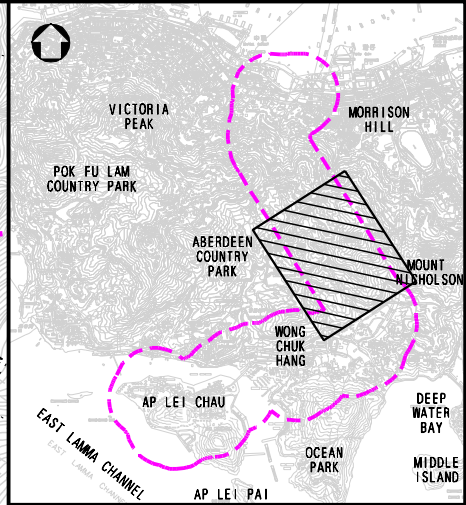
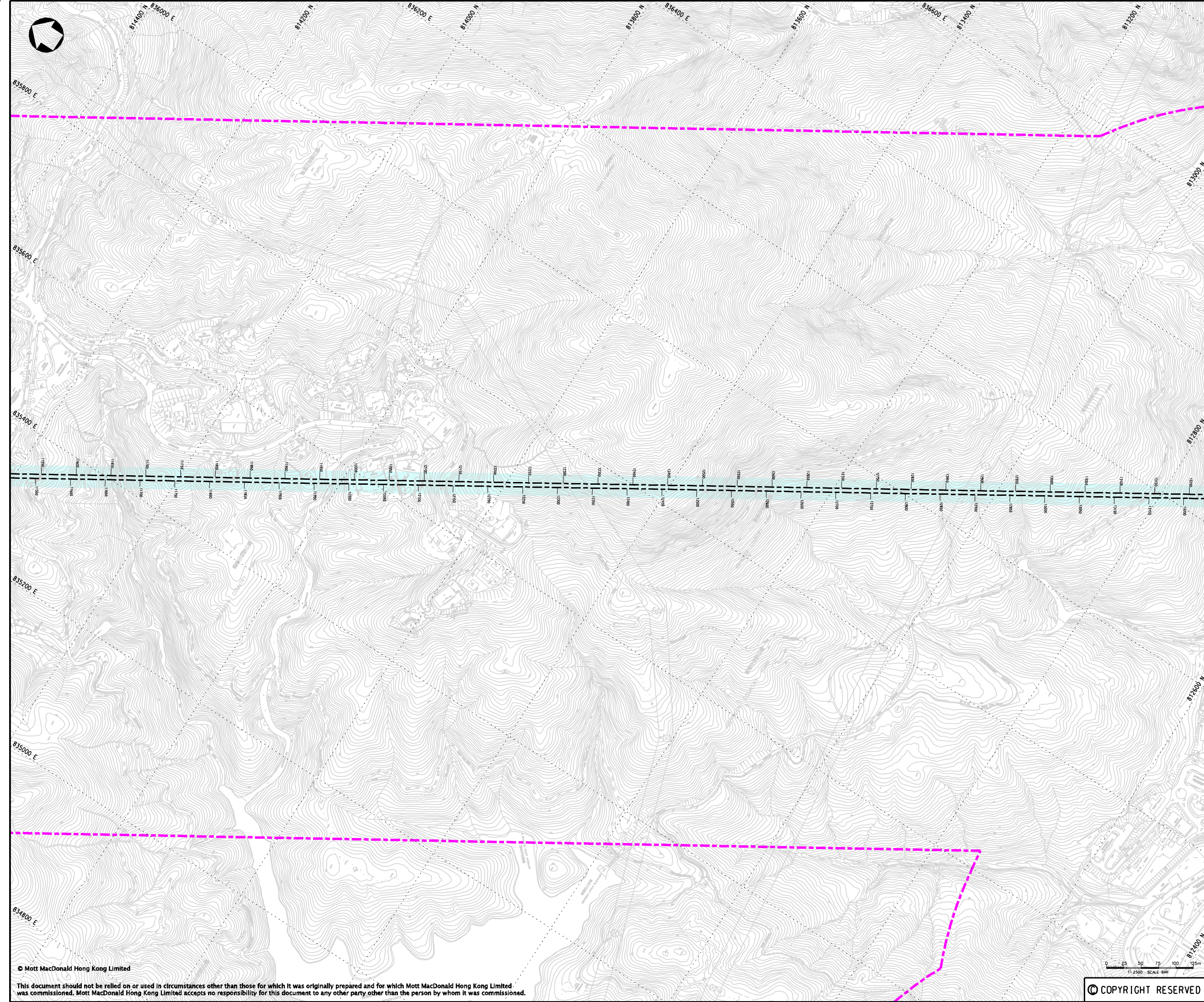
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KEY PLAN

LEGEND:

- 500m ASSESSMENT AREA
- PROPOSED WORKS SITE (UNDERGROUND)

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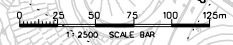
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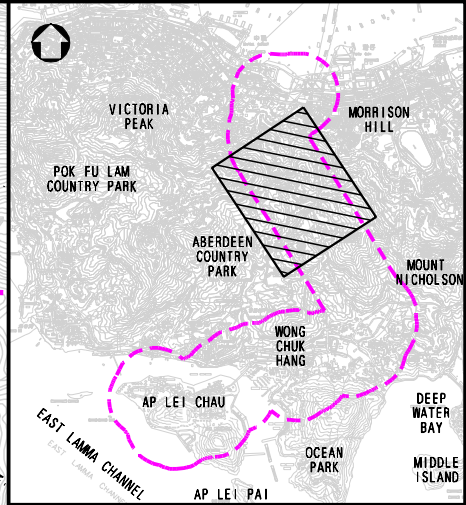
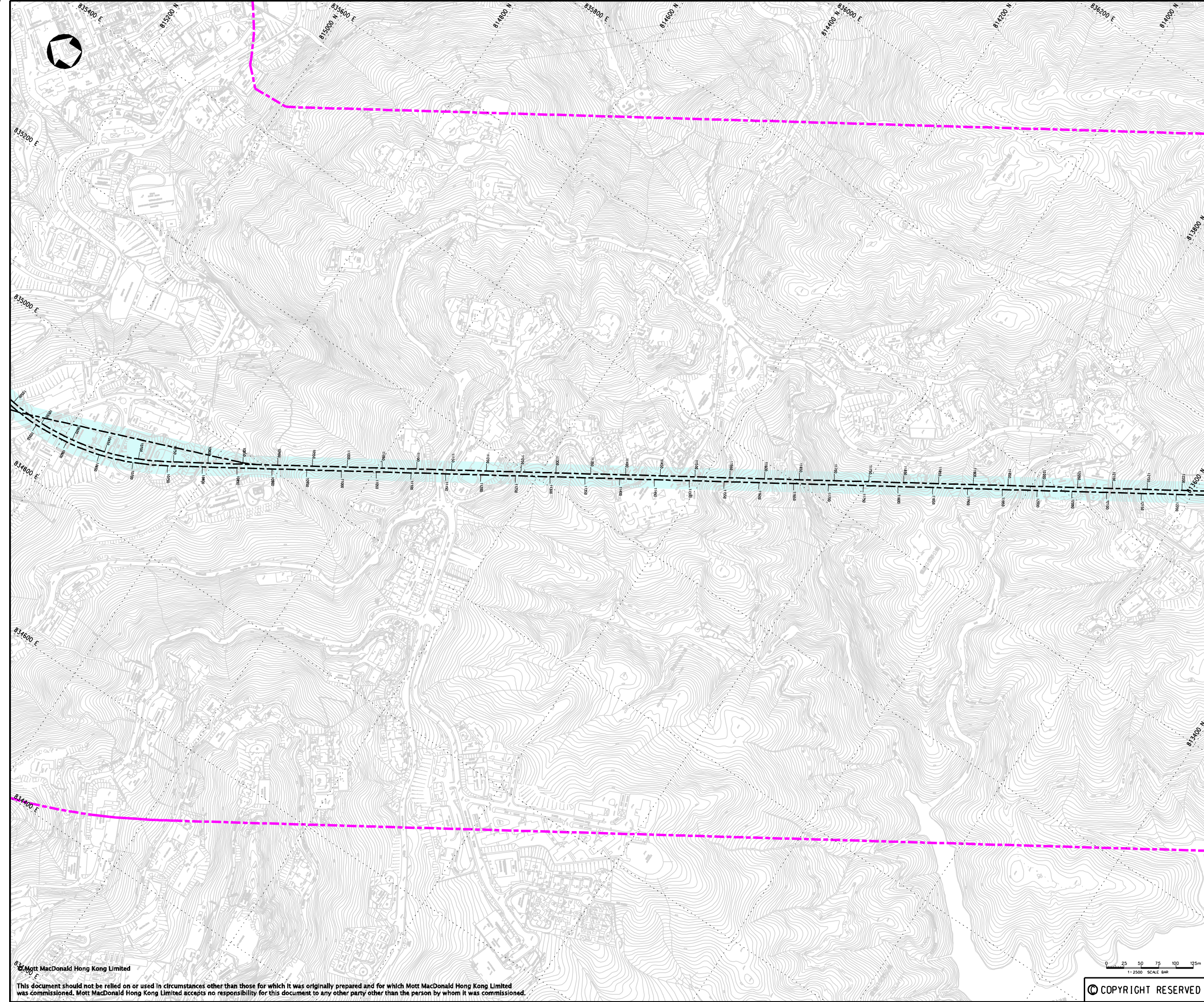
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KEY PLAN

LEGEND:

- 500m ASSESSMENT AREA
- PROPOSED WORKS SITE (UNDERGROUND)

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Project
CONSULTANCY AGREEMENT NO. NEX/2301
SOUTH ISLAND LINE (EAST)
ENVIRONMENTAL IMPACT ASSESSMENT

Title

ECOLOGICAL SURVEY LOCATIONS
 (SHEET 7 OF 10)

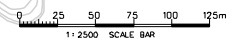
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Drawn	MING	Coordination	FY
Dwg.Chk.	JC	Approved	AFK

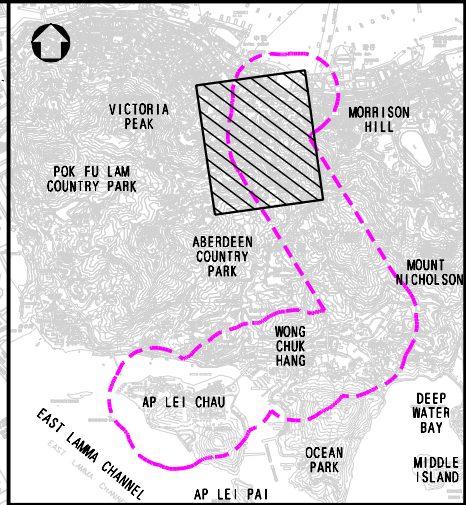
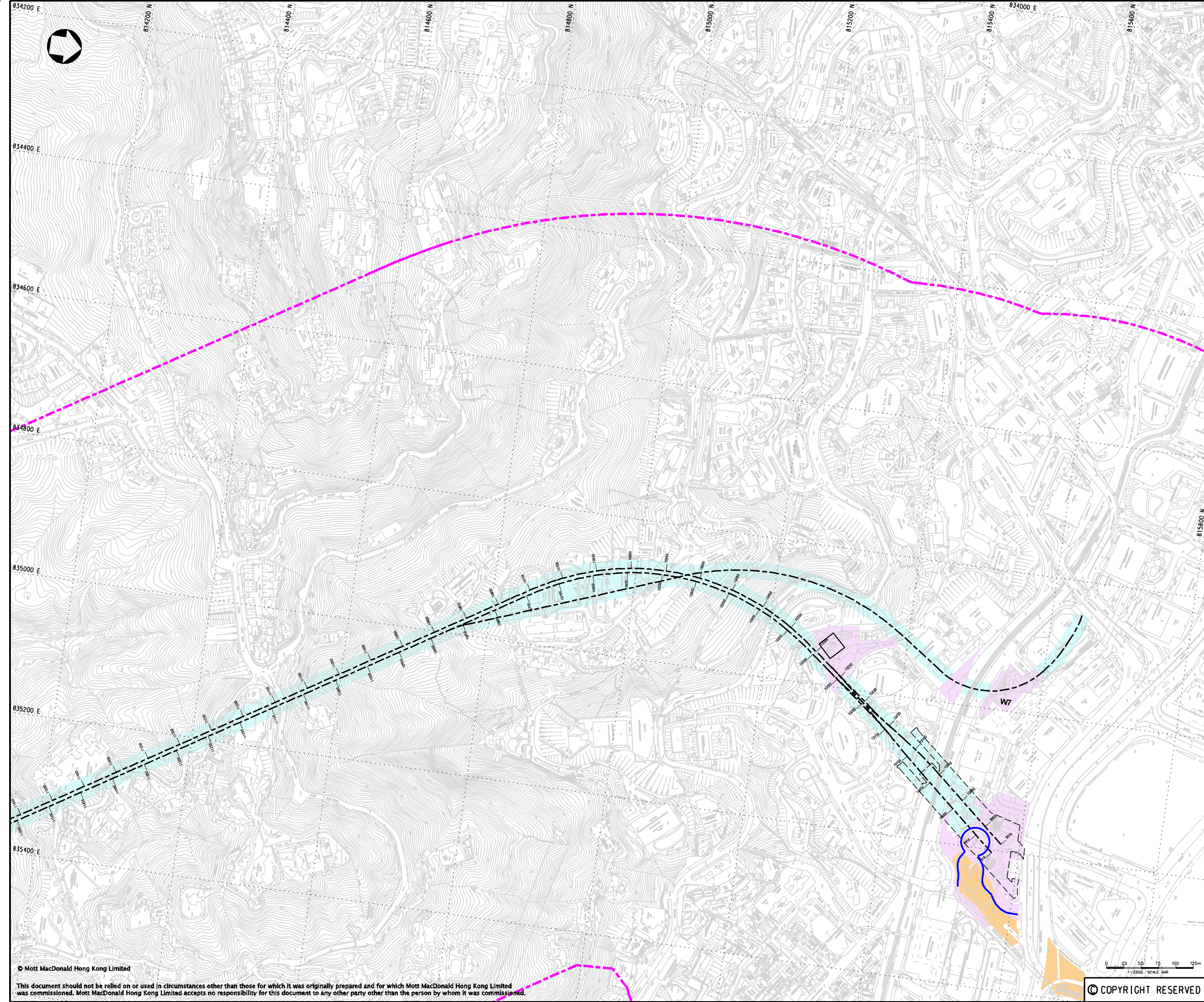
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Drawing No.	Figure	Rev
	FIGURE A7	P2

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KEY PLAN

LEGEND:

- 500m ASSESSMENT AREA
- PROPOSED WORKS SITE (GROUND LEVEL AND UNDERGROUND)
- PROPOSED WORKS SITE (UNDERGROUND)
- PROPOSED WORKS AREA (GROUND LEVEL)
- TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFAUNA SURVEY

P2	NOV 09	MING	ISSUE TO MTRC & EPD	GC	AFK
P1	APR 09	MING	ISSUE TO MTRC	GC	AFK
Rev	Date	Drawn	Description	Ch'kd/App'd	

Client




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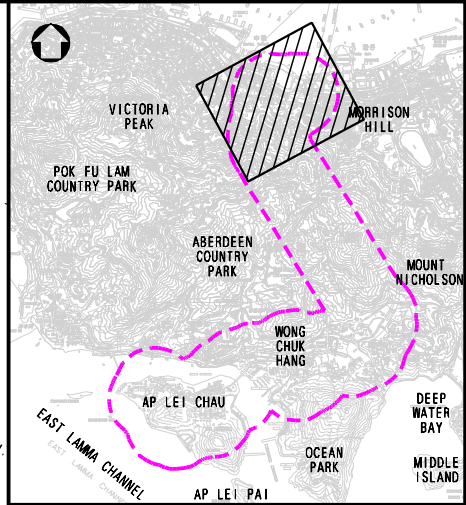
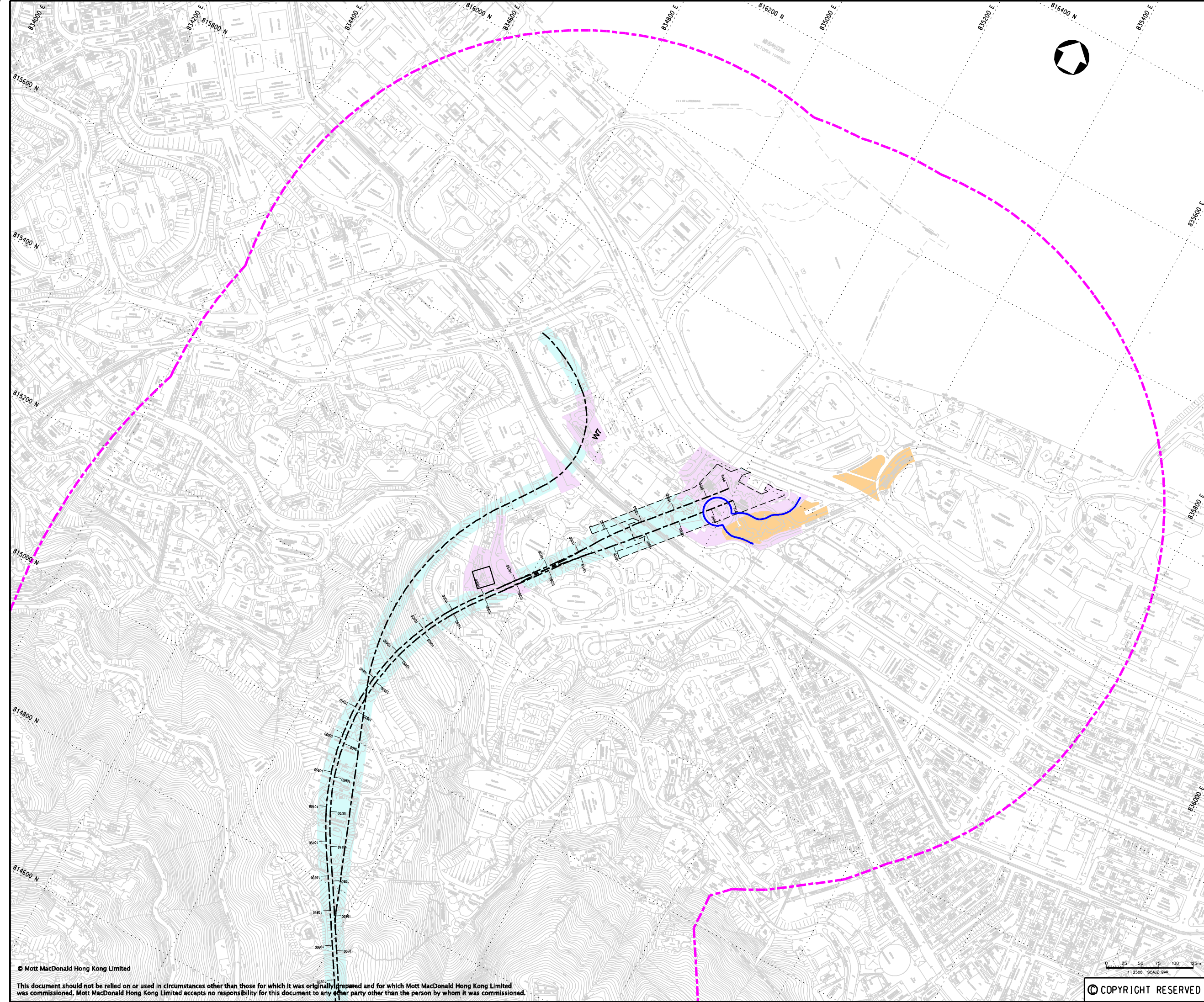
Project
**CONSULTANCY AGREEMENT NO. NEX/2301
SOUTH ISLAND LINE (EAST)
ENVIRONMENTAL IMPACT ASSESSMENT**

Title
**ECOLOGICAL SURVEY LOCATIONS
(SHEET 8 OF 10)**

Designed	JC	Eng.Chk.	FY
Drawn	MING	Coordination	FY
Dwg.Chk.	JC	Approved	AFK

Scale	Project	Status
1:2500@A1	248137	PRE
	CAD File	Rev
	K:\248137\report\env\elo_109020\app4\FIGURE_A8.dgn	P2

Drawing No. **FIGURE A8**



KEY PLAN

LEGEND:

- 500m ASSESSMENT AREA
- PROPOSED WORKS SITE (GROUND LEVEL AND UNDERGROUND)
- PROPOSED WORKS SITE (UNDERGROUND)
- PROPOSED WORKS AREA (GROUND LEVEL)
- TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFAUNA SURVEY

Rev	Date	Drawn	Description	Ch'kd	App'd
P2	NOV 09	MING	ISSUE TO MTRC & EPD	GC	AFK
P1	APR 09	MING	ISSUE TO MTRC	GC	AFK

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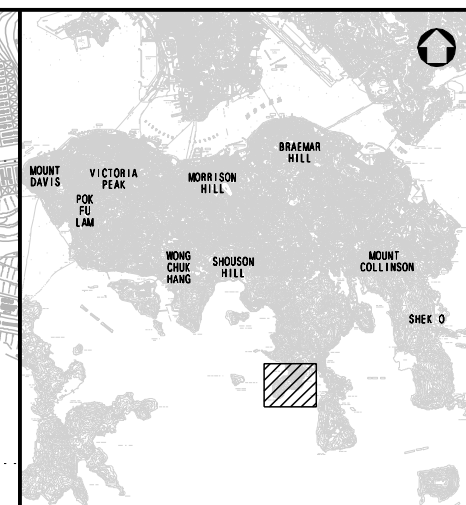
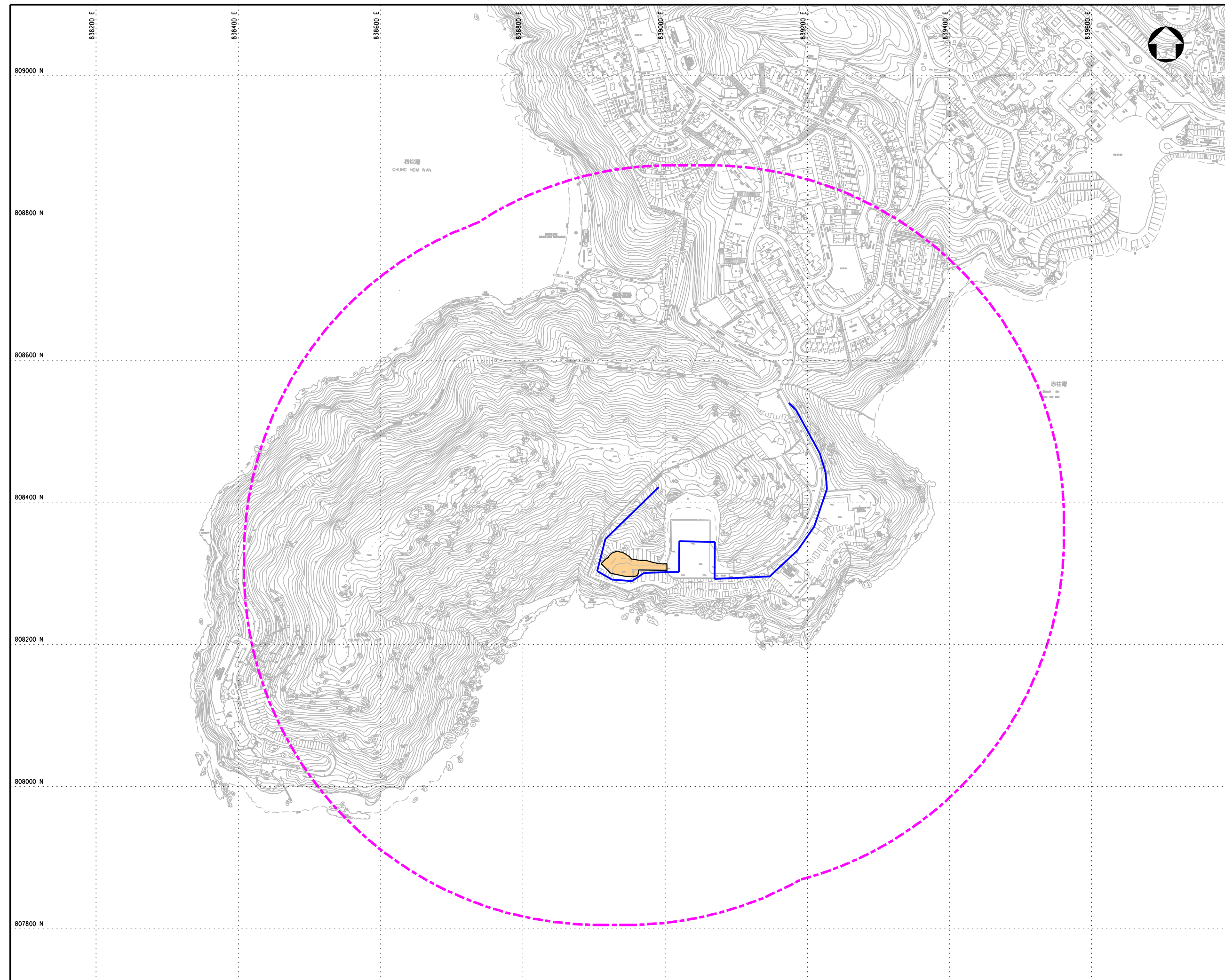
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Project
**CONSULTANCY AGREEMENT NO. NEX/2301
SOUTH ISLAND LINE (EAST)
ENVIRONMENTAL IMPACT ASSESSMENT**




Title
**ECOLOGICAL SURVEY LOCATIONS
(SHEET 9 OF 10)**

Designed	JC	Eng.Chk.	FY	Status	PRE
Drawn	MING	Coordination	FY	Rev	P2
Dwg.Chk.	JC	Approved	AFK		
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Drawing No.	FIGURE A9	CAD File	\\1248137\rsport\env\elo_1090201\app\FIGURE_A9.dgn		

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KEY PLAN

- LEGEND:**
-  500m ASSESSMENT AREA
 -  PROPOSED MAGAZINE SITE (CHUNG HOM SHAN)
 -  TRANSECT ROUTE FOR BIRDS, MAMMALS, INSECTS AND HERPETOFAUNA SURVEY

P2	NOV 09	MING	ISSUE TO MTRC & EPD	GC	AFK
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Rev	Date	Drawn	Description	Ch'kd	App'd



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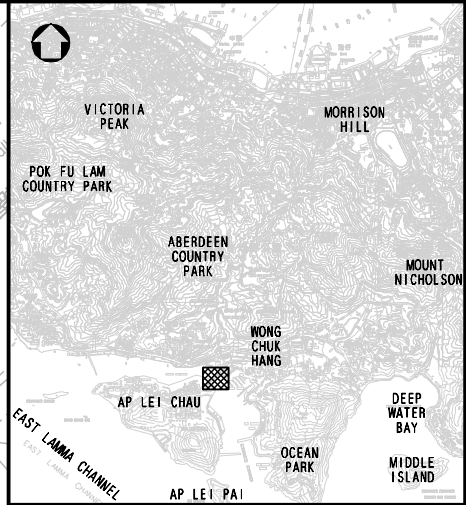
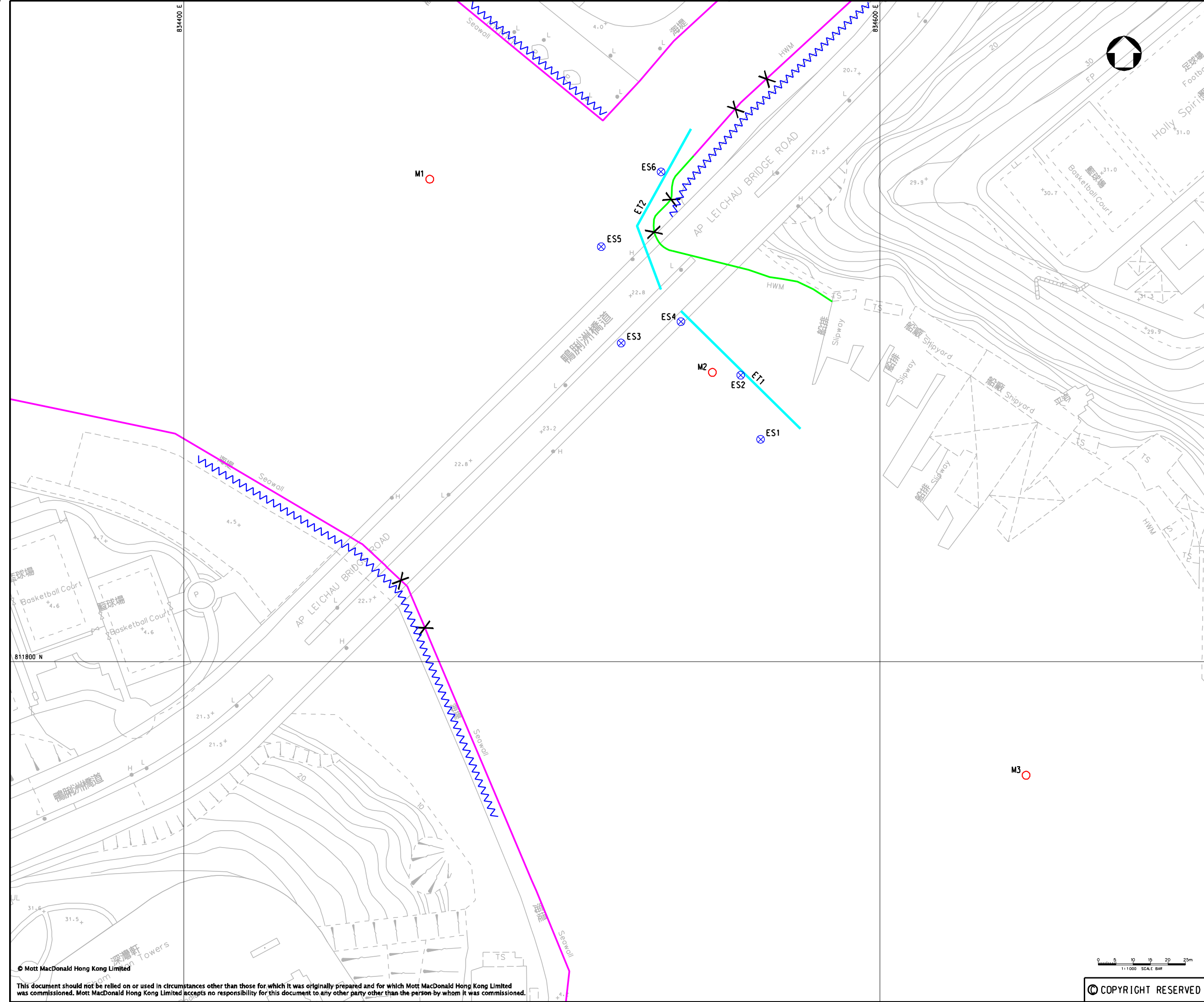
**CONSULTANCY AGREEMENT NO. NEX/2301
 SOUTH ISLAND LINE (EAST)
 ENVIRONMENTAL IMPACT ASSESSMENT**

Title

**ECOLOGICAL SURVEY LOCATIONS
 (SHEET 10 OF 10)**

Designed	JC	Eng.Chk.	FY
Drawn	MING	Coordination	FY
Dwg.Chk.	JC	Approved	AFK
Scale	1:2500@A1	Project	248137
Drawing No.	FIGURE A10	Status	PRE
		Rev	P2

0 25 50 75 100 125m
 1:2500 SCALE BAR
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KEY PLAN

LEGEND:

- ARTIFICIAL SEAWALL
- BOULDER SHORE
- RAPID ECOLOGICAL ASSESSMENT SURVEY
- ⊗ INTERTIDAL WALK THROUGH SURVEY
- ⊗ SPOT DIVE SURVEY
- BENTHIC GRAB SAMPLING LOCATIONS
- X INTERTIDAL SURVEY - TRANSECT LINE

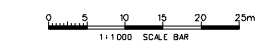
Rev	Date	Drawn	Description	Ch'kd/App'd
P2	NOV 09	MING	ISSUE TO MTRC & EPD	GC / AFK
P1	APR 09	MING	ISSUE TO MTRC	GC / AFK



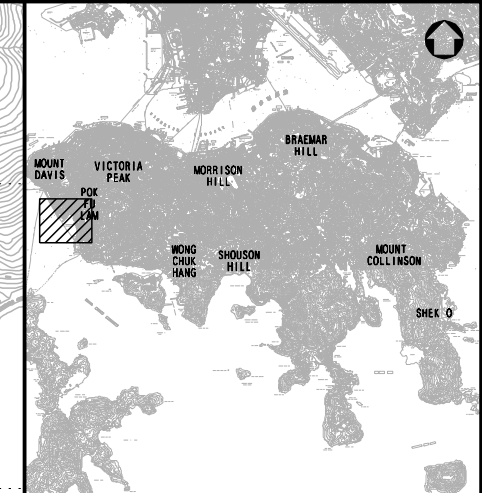
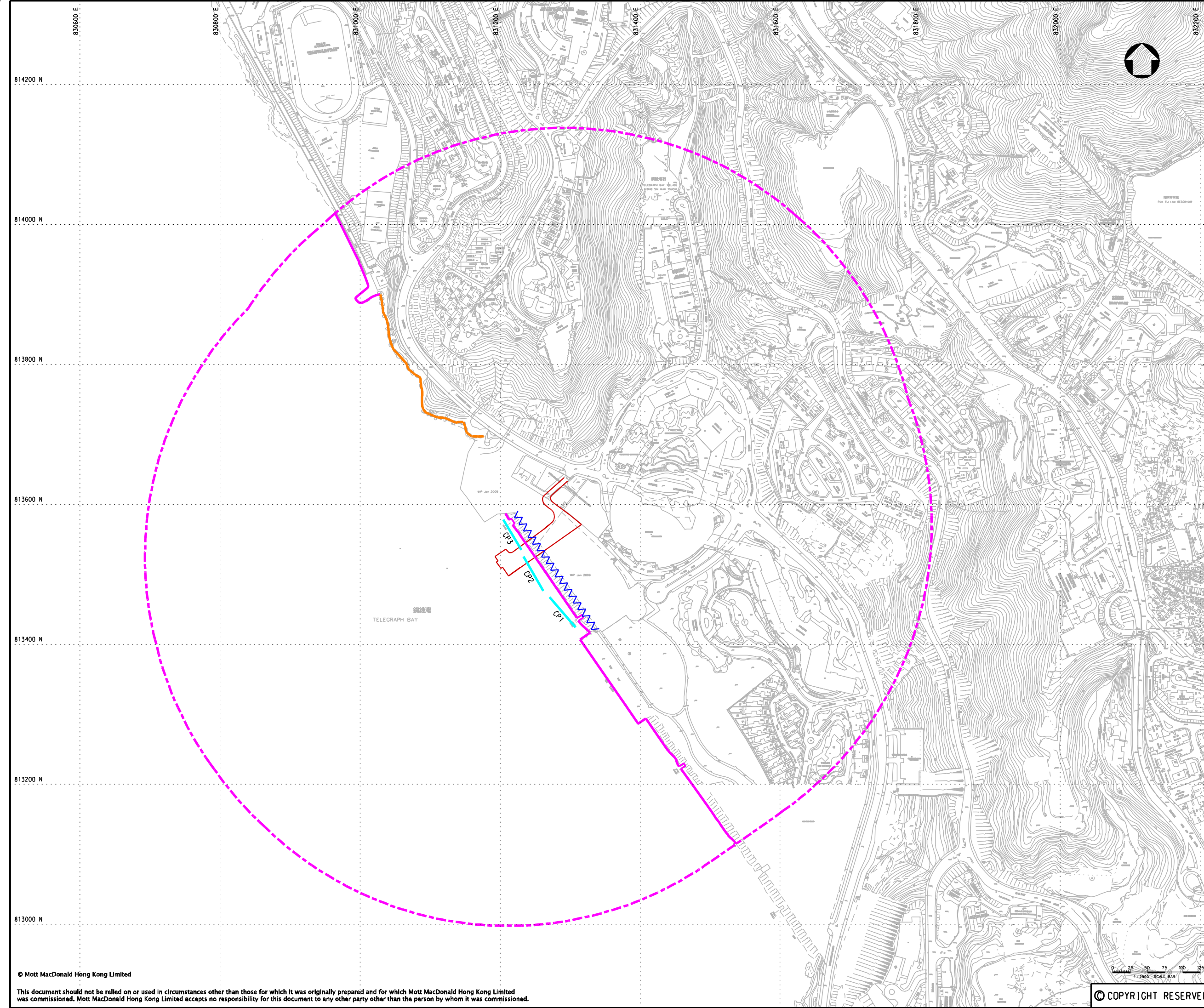
Project
CONSULTANCY AGREEMENT NO. NEX/2301
SOUTH ISLAND LINE (EAST)
ENVIRONMENTAL IMPACT ASSESSMENT

Title
SURVEYS FOR MARINE RESOURCES
AT WONG CHUK HANG

Designed	HC	Eng.Chk.	FY
Drawn	MING	Coordination	FY
Dwg.Chk.	GC	Approved	AFK
Scale	1:1000	Project	248137
Drawing No.	FIGURE B1	Status	PRE
		Rev	P2



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KEY PLAN

- LEGEND:**
- 500m ASSESSMENT AREA
 - ARTIFICIAL SEAWALL
 - ROCKY SHORE
 - RAPID ECOLOGICAL ASSESSMENT SURVEY
 - ~ INTERTIDAL WALK THROUGH SURVEY

Rev	Date	Drawn/Description	Ch'k'd/App'd
P2	DEC 09	MING ISSUE TO MTRC & EPD	GC AFK
P1	APR 09	MING ISSUE TO MTRC	GC AFK

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Project
CONSULTANCY AGREEMENT NO. NEX/2301
SOUTH ISLAND LINE (EAST)
ENVIRONMENTAL IMPACT ASSESSMENT

Title

SURVEYS FOR MARINE RESOURCES
AT TELEGRAPH BAY

Designed	HC	Eng.Chk.	FY
Drawn	MING	Coordination	FY
Dwg.Chk.	GC	Approved	AFK

Scale	1:2500@A1	Project	248137	Status	PRE
Drawing No.		CAD File	\\248137\rsport1\env\elo_1092301\app4\FIGURE_B2.dgn	Rev	P2