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Environmental Impact Assessment for the Expansion of HKIA into a Three-Runway System

Public Forum

Airport Authority Hong Kong

28 June 2014

3RS Key Milestones

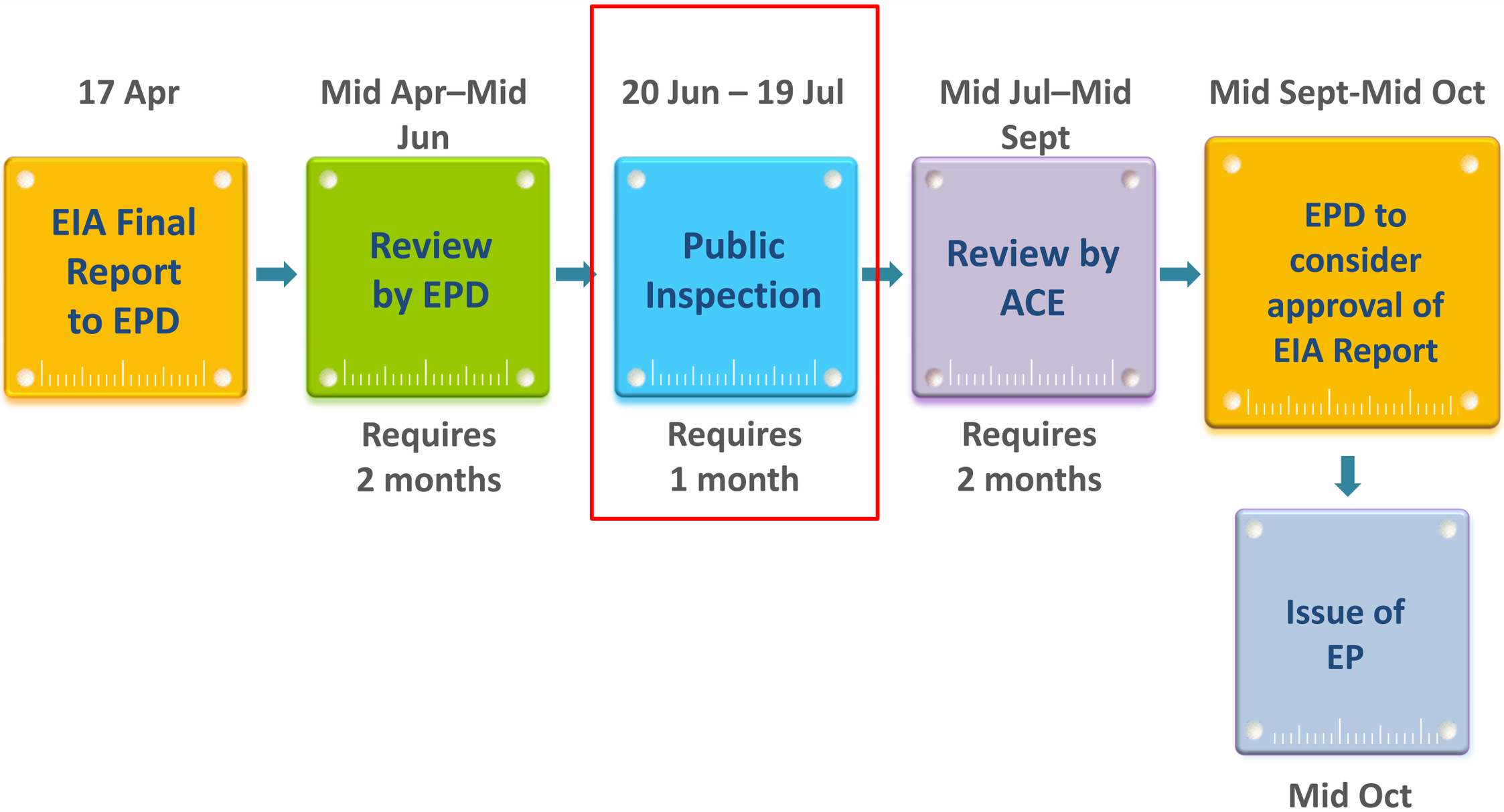
2008-2010	Preliminary study and compilation of HKIA Master Plan 2030
Jun 2011	Release of MP2030 and start of a 3-month public consultation
Dec 2011	Release of results of public questionnaire, compiled and analysed by SSRC of HKU. 73% of respondents preferred the 3RS option
Mar 2012	Government's in-principle approval for AAHK to adopt, for planning purposes, 3RS as the future development direction
Aug 2012	Receive EIA Study Brief from the Director of Environmental Protection
Aug 2012 to Apr 2014	• Conduct the EIA study • Engage and communicate with stakeholders on EIA • Develop scheme designs for 3RS
Apr 2014	• EIA Report submission to EPD

Target to Commission 3RS in 2023

Planning	Approval	Implementation
• Environmental Impact Assessment studies • Associated designs/details	• Environmental permit • Project cost updates and funding options • Other statutory requirements	• Detailed designs/contract documentation • Land formation • Construction of related facilities
Nearly Completed	**2014-2015***	**2016-2023***

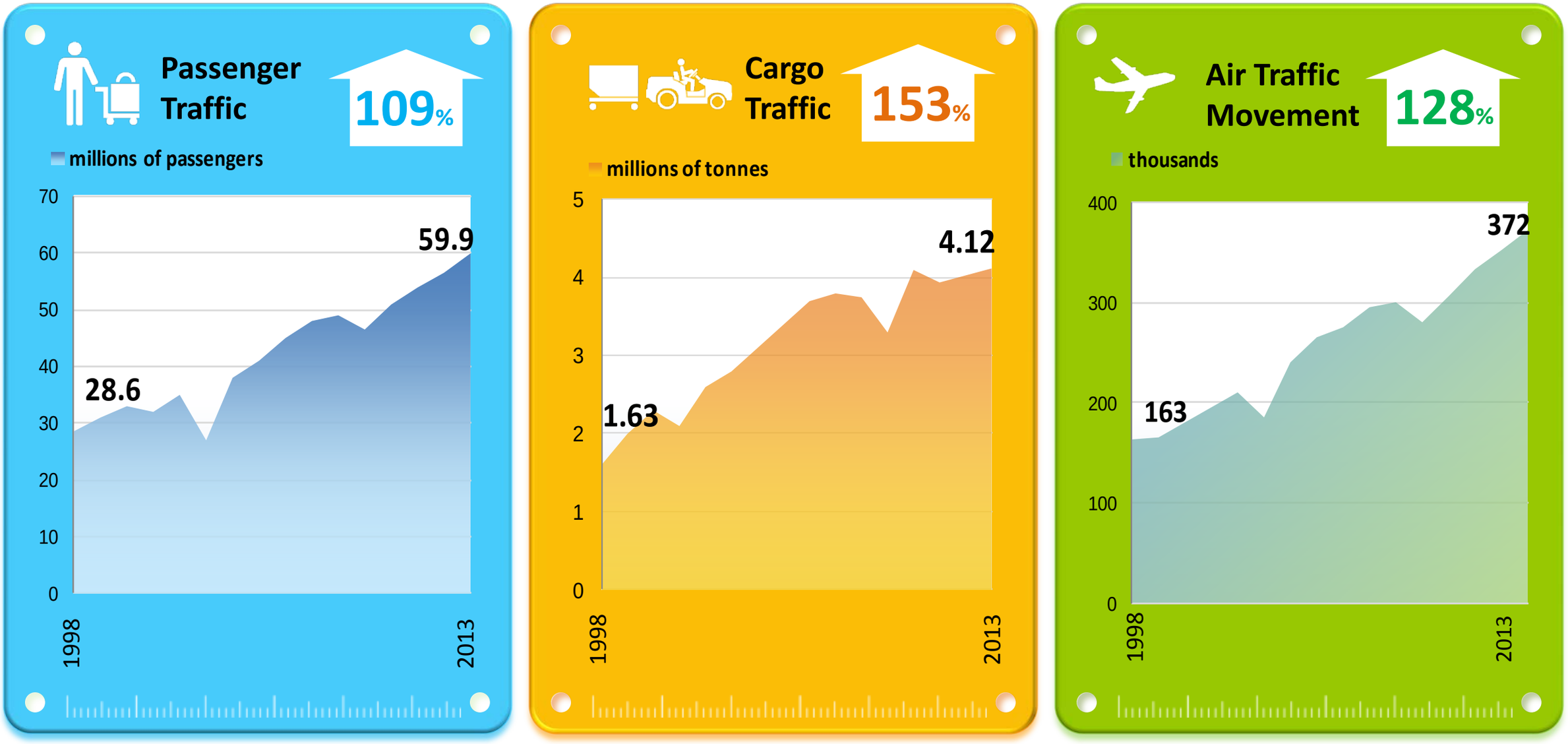
*Indicative timeline that is subject to change

Statutory Process to be completed within 2014



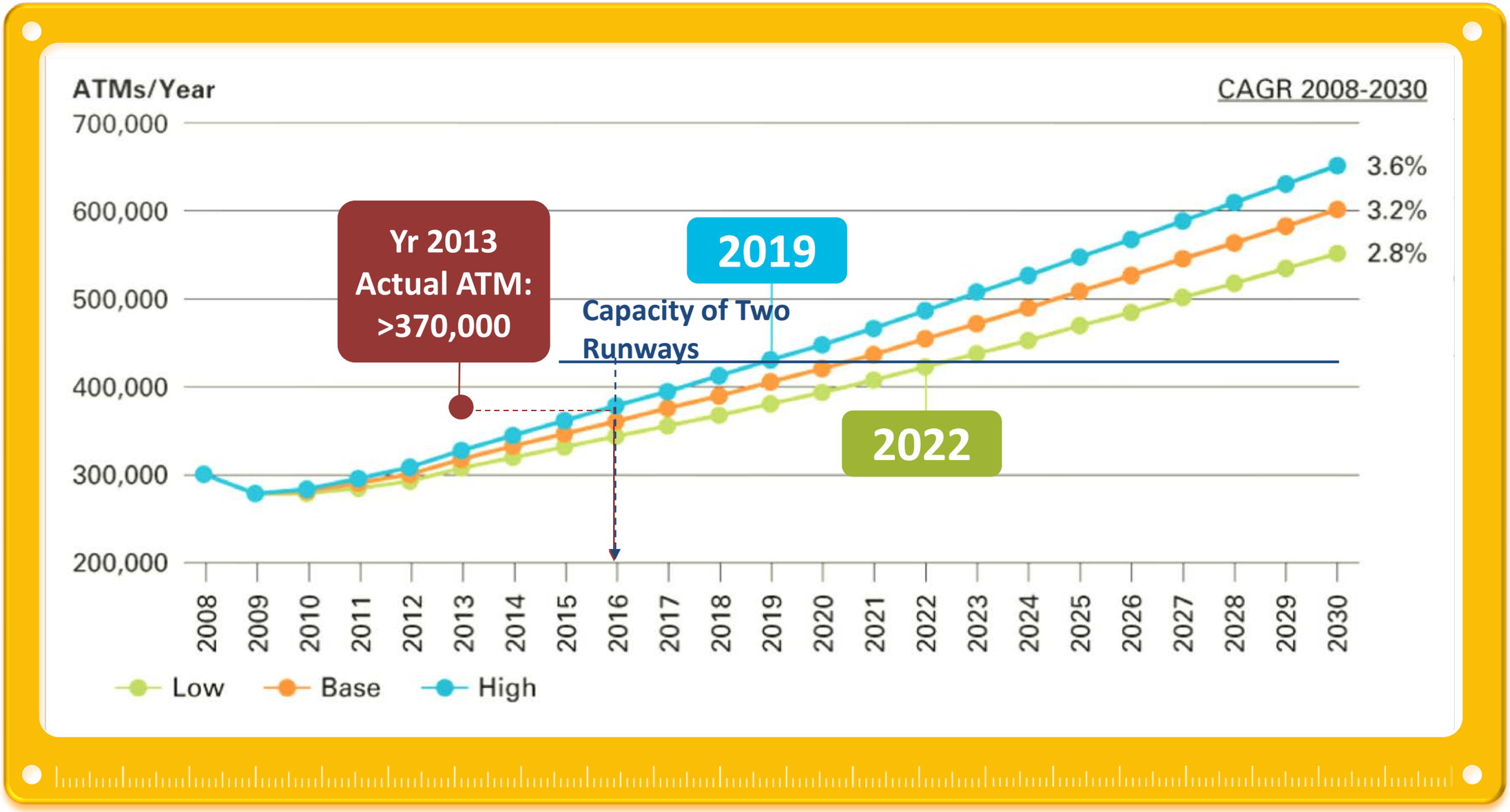
Growth of Air Traffic faster than expected

In the past 12 months, airport passenger throughput, cargo volume and flight movement saw annual growth of 7.2%, 4.1% and 6.4%, respectively



Two-runway system will reach maximum handling capacity earlier

Comparison between MP2030 aircraft movement forecast against 2013 actual figures



Consequences of NOT developing 3RS

- No new flights can be added by airlines
- Fewer choices of airlines and destinations
- More expensive airfares
- Less ability in dealing with contingency
- Less attractive as a hub airport

HK's aviation status and long term competitiveness will be undermined

A three-runway system will bring enormous economic benefit to Hong Kong

GDP

Generate **HK$167 billion** in economic value*, equivalent to **4.6%** of HK's GDP forecast in 2030

JOBS

Create **141,000** direct jobs and **199,000** indirect and induced jobs in 2030

CONSTRUCTION JOBS

Create **97,000** jobs during construction phase

*Direct, indirect and induced value added
Source: Enright, Scott & Associates Ltd. Analysis (2011)

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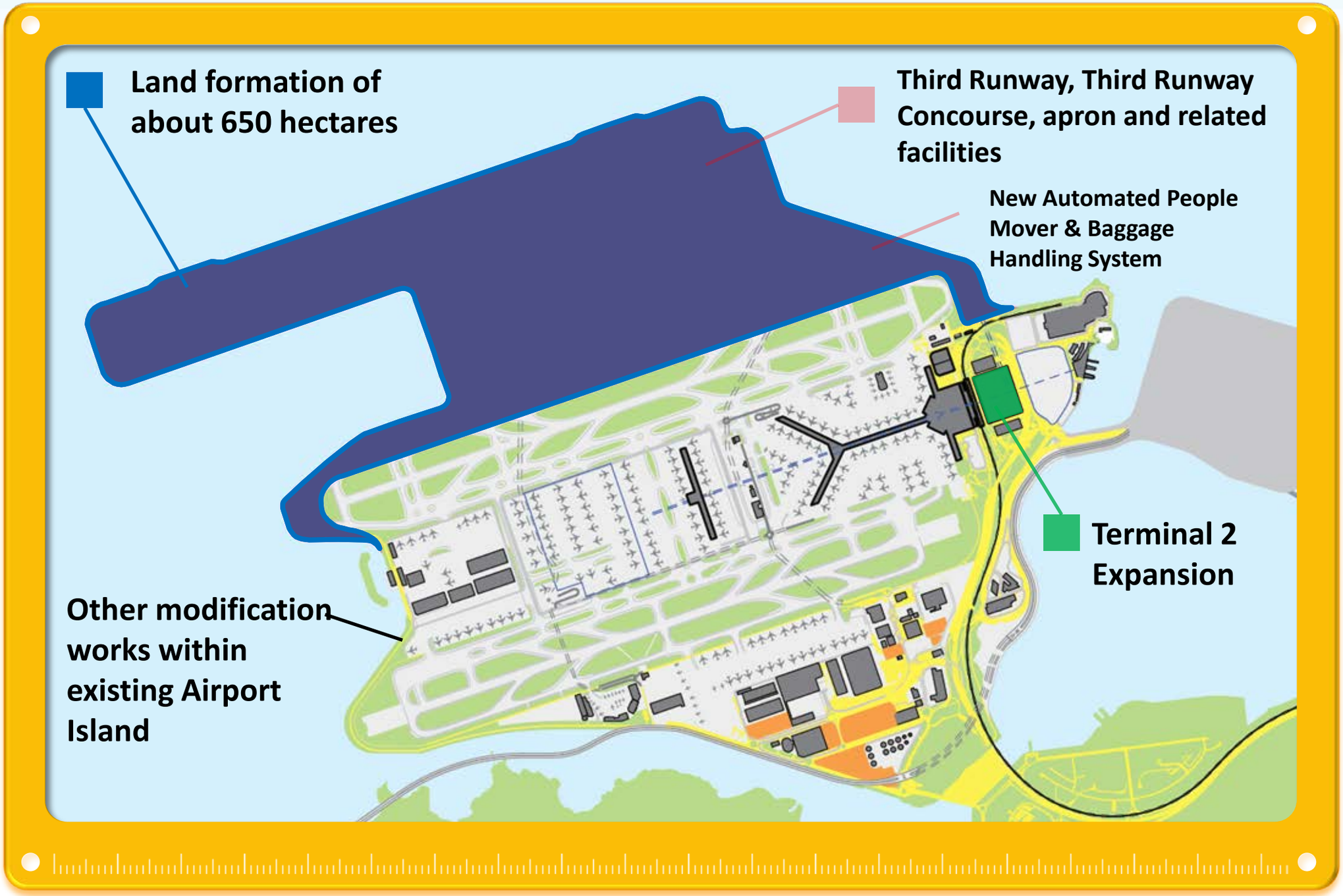
3RS is much more than building a new runway



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Comprehensive 3RS EIA Study Brief Covering 12 Environmental Aspects

- **Air Quality**
- **Noise**
- **Health Impact Assessment**
  (Air Emissions and Aircraft Noise)
- **Ecology**
  (Terrestrial and Marine Ecology, including Chinese White Dolphins)
- **Fisheries**
- **Hazard to Human Life**
- **Water Quality**
- **Sewerage and Sewage Treatment**
- **Waste Management**
- **Land Contamination**
- **Landscape and Visual**
- **Cultural Heritage**

Experienced EIA Team with Local and International Experts

Airport Authority

EIA Review Consultant
ERM

EIA Lead Consultant
Mott MacDonald

Air Quality Consultant
Arup

Aircraft Noise Consultant
URS

Health Impact Experts
Prof Wong Tze Wai and Bernard Berry

Chinese White Dolphin Experts
Dr Bernd Würsig & Dr Tom Jefferson

All 12 Aspects assessed and fully complied with the requirements of the EIAO Technical Memorandum and the Study Brief to be "environmentally acceptable"

Environmental Aspect	Construction Phase With Mitigation where applicable	Operation Phase With Mitigation where applicable
Air Quality	Acceptable	Acceptable
Hazards to Human Life	Acceptable	As Low As Reasonably Practicable
Noise	Acceptable	Acceptable
Water Quality	Acceptable	Acceptable
Sewerage and Sewage Treatment	N/A	Acceptable
Waste Management	Acceptable	Acceptable
Land Contamination	Acceptable	N/A
Terrestrial & Marine Ecology	Acceptable	Acceptable
Fisheries	Acceptable	Acceptable
Landscape and Visual	Acceptable	Acceptable
Cultural Heritage	Acceptable	Acceptable
Health	N/A	Acceptable

Over 250 initiatives formulated under the EIA to address the environmental issues

Concerns that 3RS will drive Chinese White Dolphins (CWD) out of HK Waters

1. **Will the 3RS lead to the extinction of CWD in HK waters?**
2. **Why are you confident in sustaining the CWD population in Hong Kong?**
3. **It is said that not all of the experts' suggestions are adopted and reflected in the EIA report. Is this true?**

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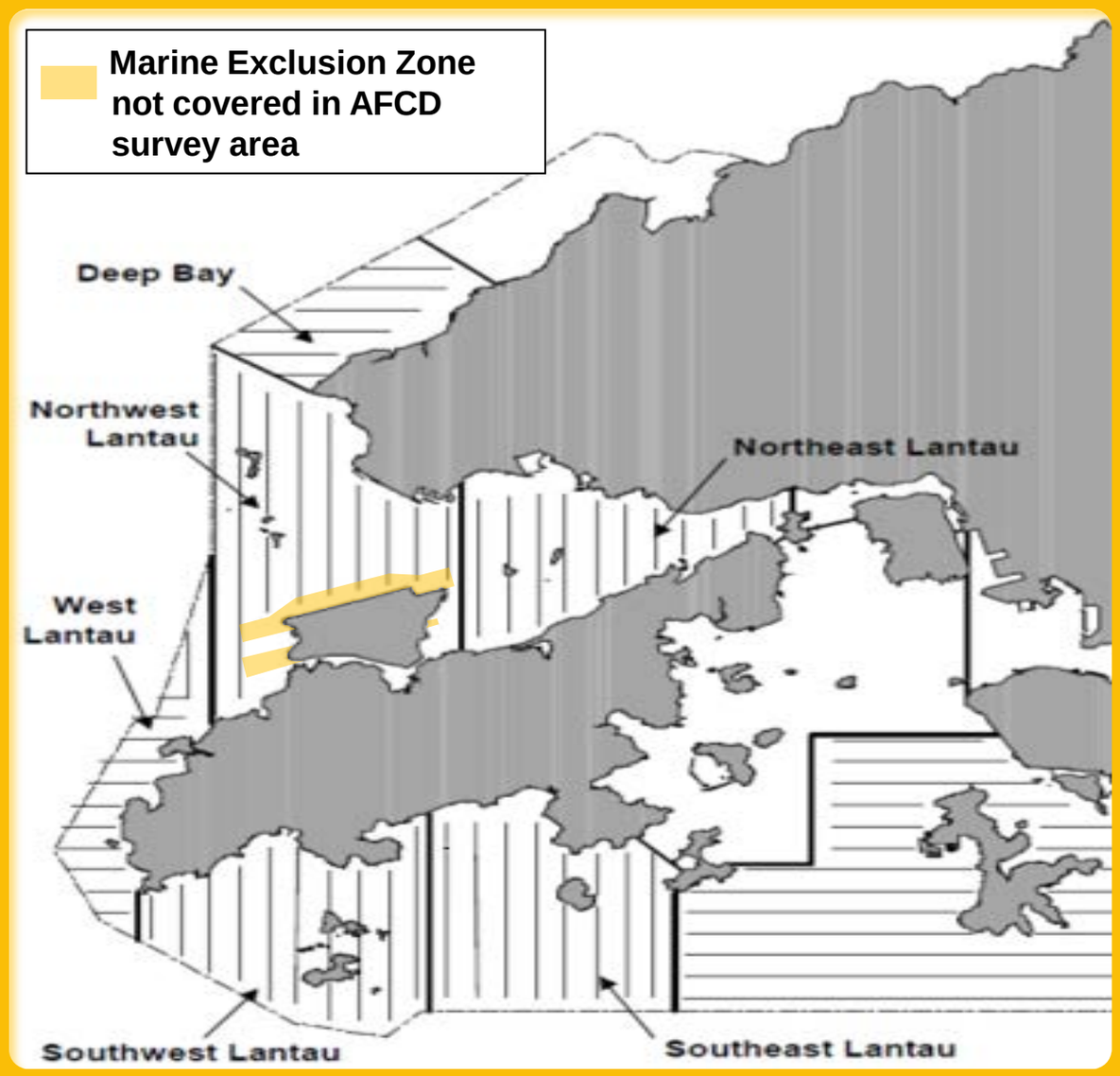
Chinese White Dolphins (CWDs)

Chinese White Dolphins (CWDs) – AFCD Survey Area (Year 1996-2013)



Map extracted from AFCD Monitoring of Marine Mammals in Hong Kong Waters (Final Report)

Comprehensive Chinese White Dolphins Surveys

Vessel Line Transect Surveys: (Oct 2012 – Nov 2013)

- **Distribution**
- **Density/abundance**
- **Behaviour / movements (photo-ID, focal follows)**

Land-Based Theodolite Tracking: (Oct 2012 – Nov 2013)

- **Behaviour / activities**
- **Vessel responses**
- **Travel patterns**

Passive Acoustic Monitoring: (Dec 2012 – Dec 2013)

- **Diurnal behavioural patterns**
- **Noise characteristics of environment**

Moderate to Low CWD abundance in the proposed Project Area

Comparison of Recent Density and Abundance Parameters between the Survey Area and other Waters in Hong Kong

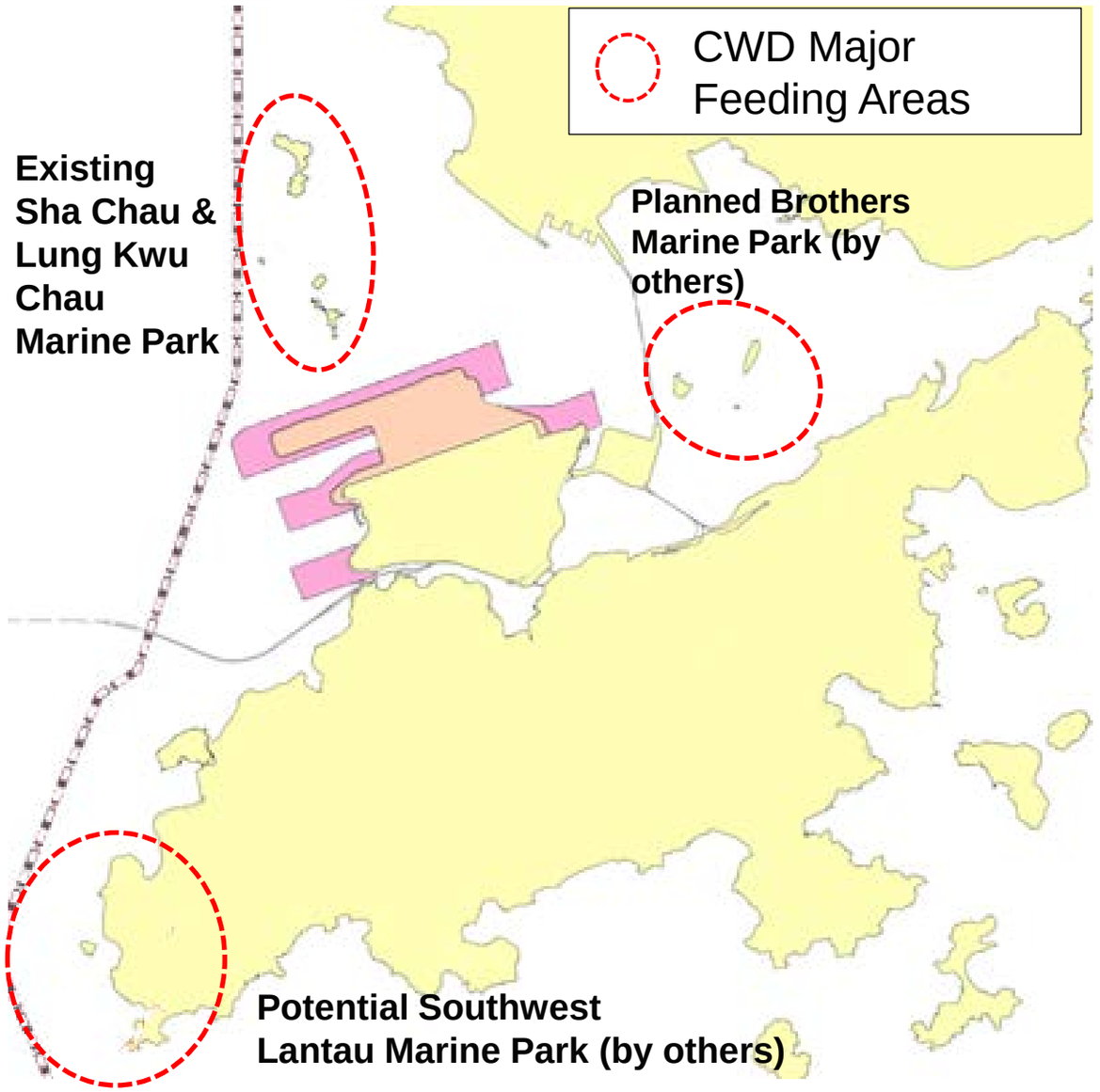
Area	Year(s) (All Seasons)	Average Group Size	Sighting Rate (No./100km)	Density (No./100km^2)	Abundance	CV[(1)]	Source
Airport North	2012/2013	4.1	2.05	14.48	3	52	This Study
Airport West	2012/2013	4.5	3.99	13.01	1	64	This Study
Northeast Lantau	2012	2.8	2.99	12.33	7	25	AFCD Dataset
Northwest Lantau	2012	3.4	7.39	44.10	38	13	AFCD Dataset
West Lantau	2012	3.2	13.73	67.41	19	17	AFCD Dataset
Southwest Lantau	2012	2.2	3.49	13.99	9	36	AFCD Dataset

Note[(1)]: CV is the coefficient of variation, a measure of variance.

★ Abundance is a 'snapshot' of average numbers of CWD in area during a time period

● Densities of survey areas appear to be moderate/low

CWD Travel Corridors / Areas



- **The waters between Northwest Lantau, West Lantau and The Brothers mainly used as travel corridors / areas**
- **Photo-ID and focal follows survey findings indicate dolphins move across the study area between the North and West Lantau regions**
- **CWDs use the study area / proposed 3RS works area between The Brothers and West Lantau areas mainly for travelling and do not appear to use it as much for other critical activities (e.g. feeding and social behavior)**

Key Mitigation Measures to Minimise Impact to CWD during Planning / Construction Phase

Use of Horizontal Directional Drilling (HDD) Construction Methods to avoid disturbance to seabed

Field joint location outside the existing marine park area to avoid disturbance to marine park

Re-routing of SkyPier ferries to/from Zhuhai & Macau

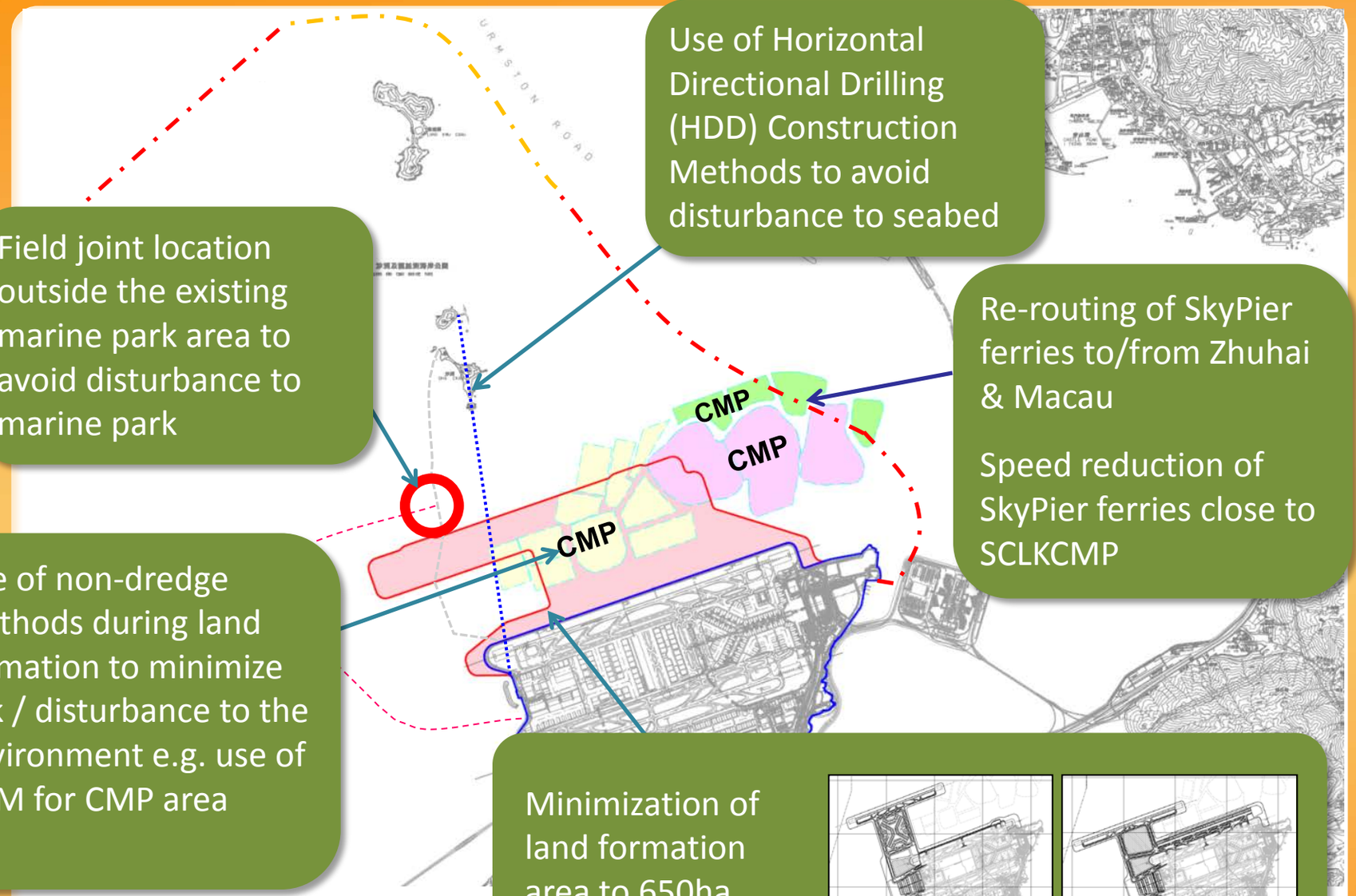
Speed reduction of SkyPier ferries close to SCLKCMP

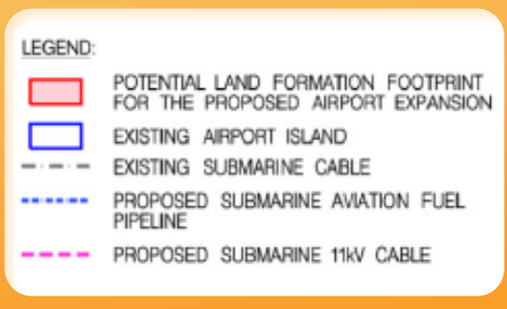
Use of non-dredge methods during land formation to minimize risk / disturbance to the environment e.g. use of DCM for CMP area

Minimization of land formation area to 650ha and consideration of alternative layout options

Other mitigation measures include:

- Avoidance of peak calving season for CWDs during bored piling
- Implementation of water quality mitigation measures (filling behind seawall, good construction site practices and silt curtains)
- Control the speed (<10 knots) of construction vessels within works area
- Establishment of 250hm dolphin exclusion zones





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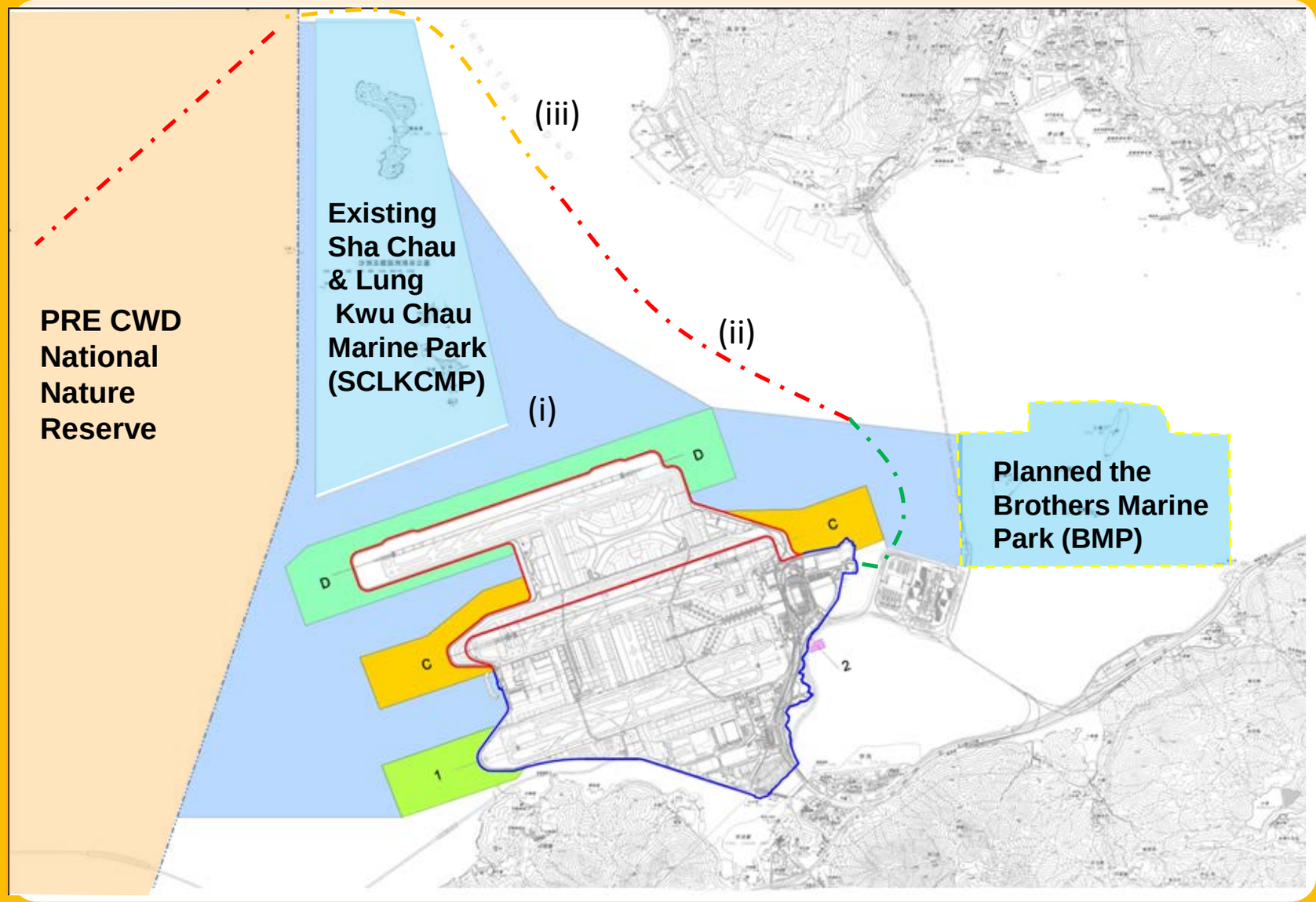
Mitigation Measures for CWD during Operation Phase



Mitigation Measures

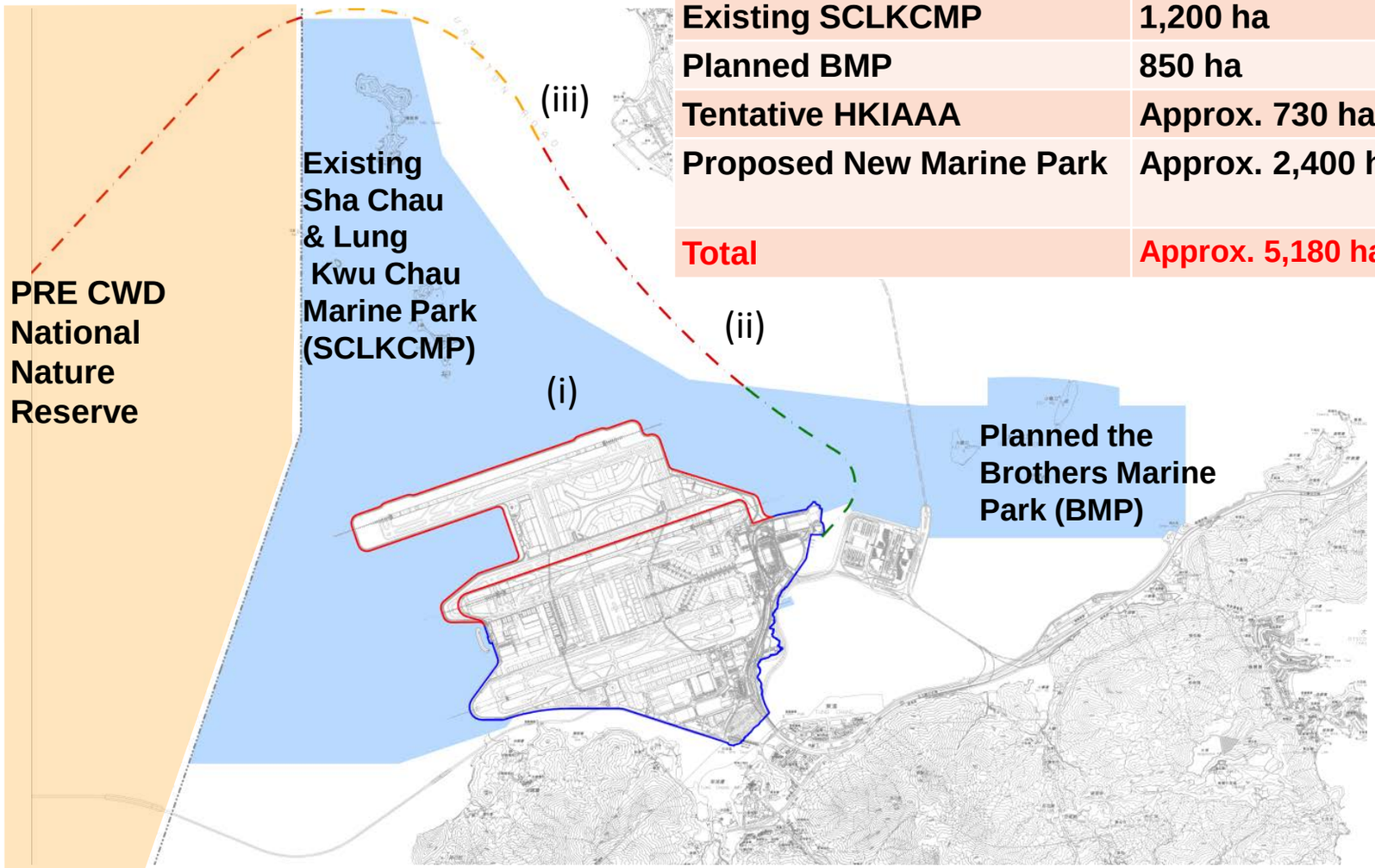
(i) Designation of 2,400 ha of marine park;

(ii) Re-routing of SkyPier ferries; and

(iii) Speed reduction of SkyPier ferries close to SCLKCMP

Note: The boundary of the proposed marine park is indicative only and subject to the draft map published in the Gazette under Marine Parks Ordinance.

Mitigation Measures for CWD during Operation Phase



Marine Protected Area	Area
Existing SCLKCMP	1,200 ha
Planned BMP	850 ha
Tentative HKIAAA	Approx. 730 ha
Proposed New Marine Park	Approx. 2,400 ha
Total	Approx. 5,180 ha

Mitigation Measures

(i) Designation of 2,400 ha of marine park;

(ii) Re-routing of SkyPier ferries; and

(iii) Speed reduction of SkyPier ferries close to SCLKCMP

Note: The boundary of the proposed marine park is indicative only and subject to the draft map published in the Gazette under Marine Parks Ordinance.

The proposed Marine Park area is about the total size of all existing Marine Parks in Hong Kong

Designated Marine Park (Existing)	Size (ha)
Hoi Ha Wan Marine Park	260
Yan Chau Tong Marine Park	680
Sha Chau and Lung Kwu Chau Marine Park	1,200
Tung Ping Chau Marine Park	270
Sub-Total	2,410
Cape D'Aguilar Marine Reserve	20
Total	2,430
Proposed 3RS Marine Park	**Approx. 2,400**

Dolphins and porpoises can rebound after large scale habitat disturbance

Area Influenced	Impact Removed or Lessened
Northwest Chek Lap Kok waters, end 1992 to 1998	Construction of the existing Chek Lap Kok airport and associated facilities Dolphin declined from end 1995 (earliest time when dolphin survey data was available) to 1998, but rebounded in 1999 to similar levels in end 1995/1996 Sha Chau & Lung Kwu Chau Marine Park established as a mitigation measure – currently a CWD major feeding area
San Francisco Bay, 1930's – 1980's	Dredging, underwater explosions, shore-side reclamation, large scale military concrete walls *Bottlenose dolphins and harbour porpoises returned in 1990's and 2008, respectively*
Galveston Bay, Galveston Ship Channel, TX, 1905 - Present	Shipping, pollution, oil and gas piers, massive artificial island (1,350ha) built by 1915. Less than 10% of coastline "natural" *Bottlenose dolphins returned to artificial island almost immediately after construction, and returning to areas further north as noise and pollution aspects are improving*

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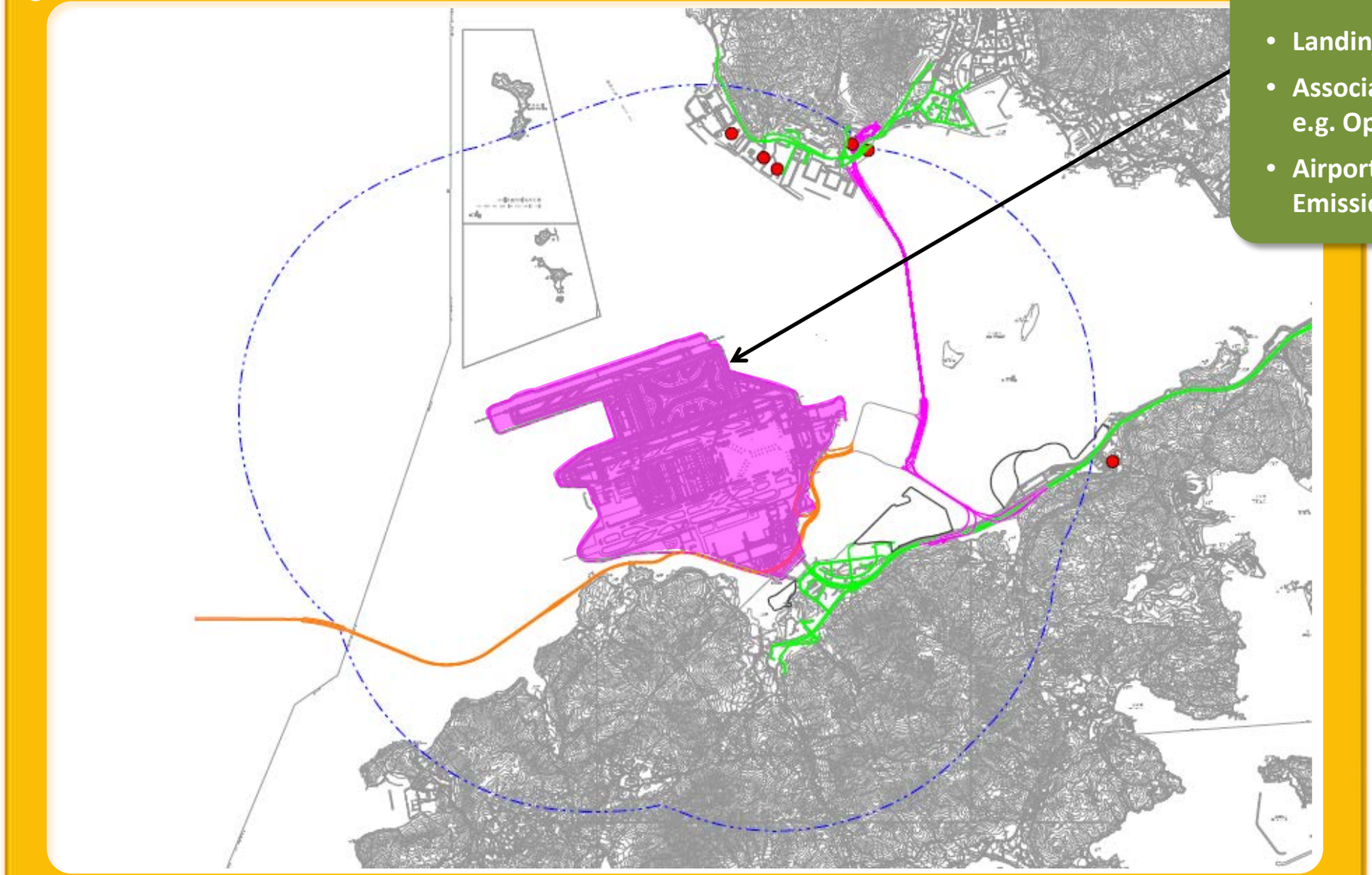
Air Quality

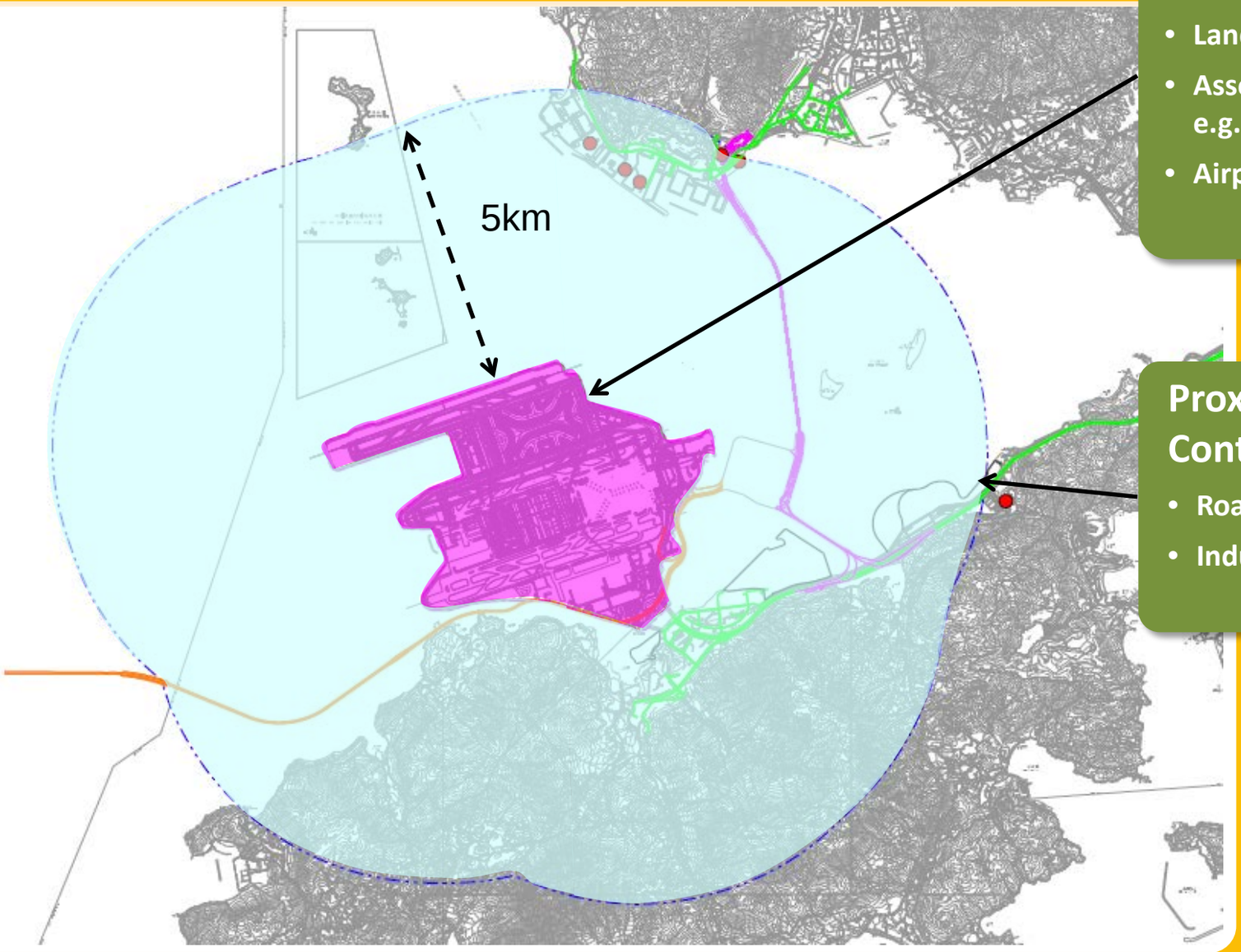
Assessed Potential Cumulative Air Quality Impact



Airport Operation Contribution

- Landing/ Take-off Activities
- Associated Activities e.g. Operation of GSE
- Airport Island Vehicular Emissions

Assessed Potential Cumulative Air Quality Impact



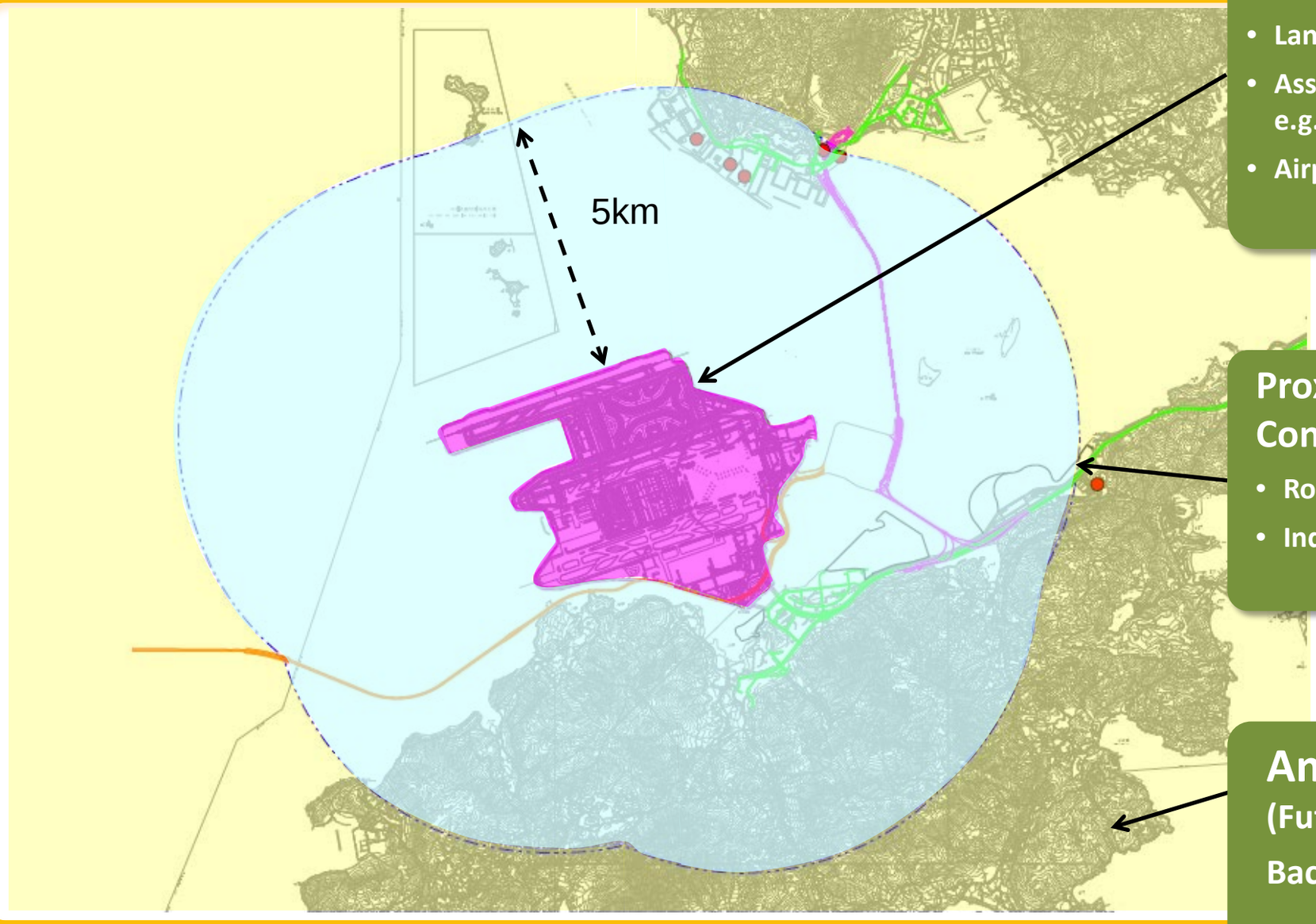
Airport Operation Contribution

- Landing/ Take-off Activities
- Associated Activities e.g. Operation of GSE
- Airport Island Vehicular Emissions

Proximity Infrastructure Contribution

- Road and Marine Traffic Emissions
- Industrial Activities

Assessed Potential Cumulative Air Quality Impact



Airport Operation Contribution

- Landing/ Take-off Activities
- Associated Activities
  e.g. Operation of GSE
- Airport Island Vehicular Emissions

+

Proximity Infrastructure Contribution

- Road and Marine Traffic Emissions
- Industrial Activities

+

Ambient Contribution

(Future Air Quality Background)

- HK Activities
- PRD Activities

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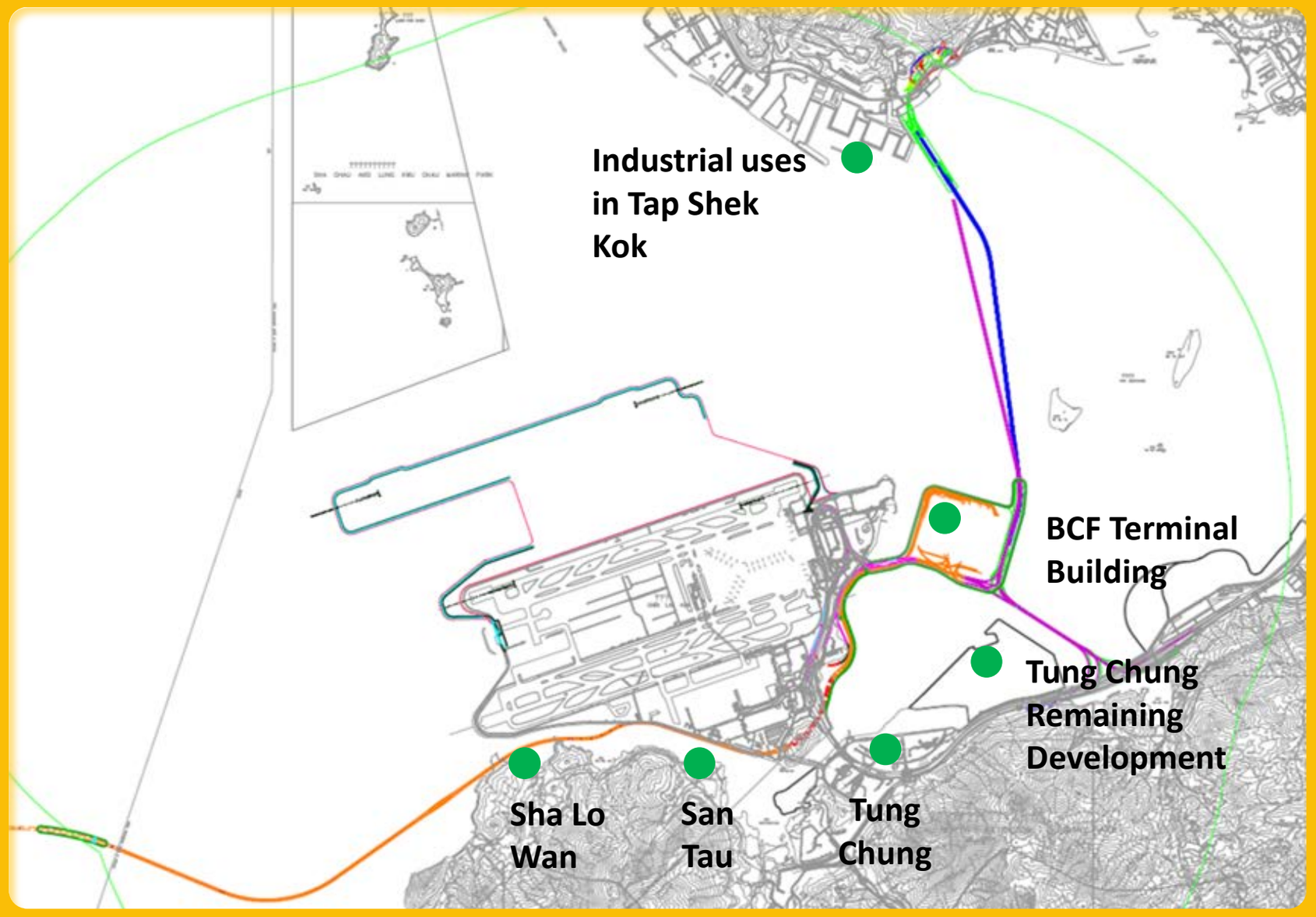
Assessed All Major Air Sensitive Receivers (ASRs) within 5km from the Project Boundary



Full Compliance with the AQO for all ASRs within Study Area

Minor Contribution of Emissions from HKIA to annual NO_2 concentrations at Tung Chung and Tuen Mun

Annual NO_2 Concentration Breakdown at Representative Areas

Area	AQO for Annual NO_2 (ug/m^3)	Cumulative Impact (ug/m^3)	Ambient Contribution (ug/m^3)	Proximity Infrastructure Contribution (ug/m^3)	Airport Contribution (ug/m^3)	Airport Contribution
BCF	40	**39**	24	11	4	**10%**
Tung Chung	40	**33**	22	9	2	**6%**
Tung Chung West	40	**30**	22	6	2	**7%**
Tung Chung East	40	**28**	22	4	2	**7%**
Sha Lo Wan	40	**36**	20	4	12	**33%**
Tuen Mun	40	**38**	27	9	2[1]	**5%**

Note: [1] Airport related emissions are included as ambient in PATH model for Tuen Mun area.

Ongoing Commitment to Reduce Emissions

Implemented measures:
Banned all idling vehicle engines on the airside since 2008, except for certain vehicles that are exempted

By end 2014: Ban the use of APU for all aircraft at frontal stands

Now: Around 80% airlines are using fixed ground power and pre-conditioned air systems

By end 2017: ALL airside saloon vehicles as electric vehicles

Now: 52 electric vehicles (EVs)

By end 2018: Total of 290 charging stations for EVs and electric ground support equipment

Now: 54 charging stations

New Generation of Aircraft with Less Noise and Emissions

Boeing 747-8 Freighter

- **17%** more fuel efficient
- **52%** below relevant limits for NOx
- **30%** smaller noise footprint

- **40%** below relevant limits for Nox
- **25%** lower fuel burn and CO_2 emissions
- **14 EPNdB** cumulative noise margin below Chapter 4 standard
  - Lighter airframe
  - Optimized efficient wings
  - Latest generation engines

Airbus A350-900

Aircraft Noise

HK Adopts Stringent Aircraft Noise Figures

- **Most international airports, including Hong Kong, have adopted cumulative average noise energy metrics for noise planning**
- **A lower figures reflects a more stringent standard**

Regions / Airports	Noise Metric	Criteria	Corresponding NEF Value
UK	$L_{eq\ (16hr)}$	57	22
Chek Lap Kok	NEF	25	25
Australia	ANEF	20	26
Kai Tak	NEF	30	30
Canada	NEF_{can}	30	26
US	L_{dn}	65	30
Switzerland	NNI	45	35
Singapore	NEF	35	35

Remark: NEF – Noise Exposure Forecast

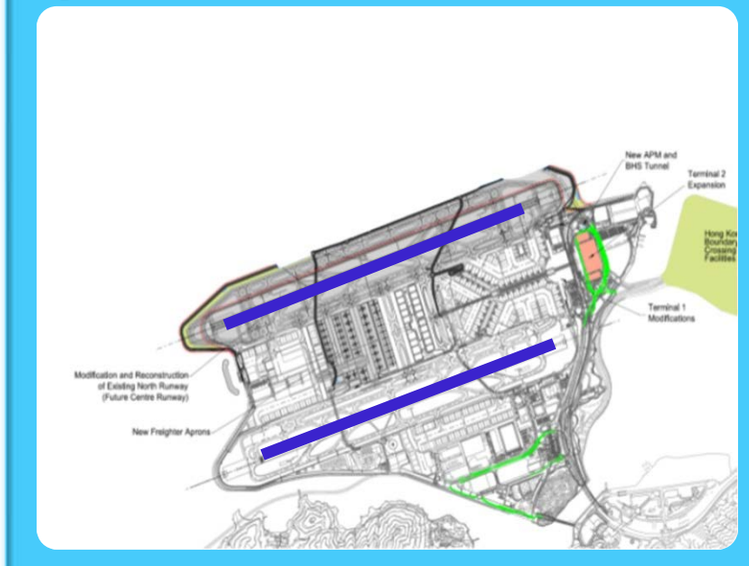
Aircraft Noise Assessment Scenarios

The EIA has examined the following scenarios specified in the EIA Study Brief:

Prevailing Aircraft Noise Environment:

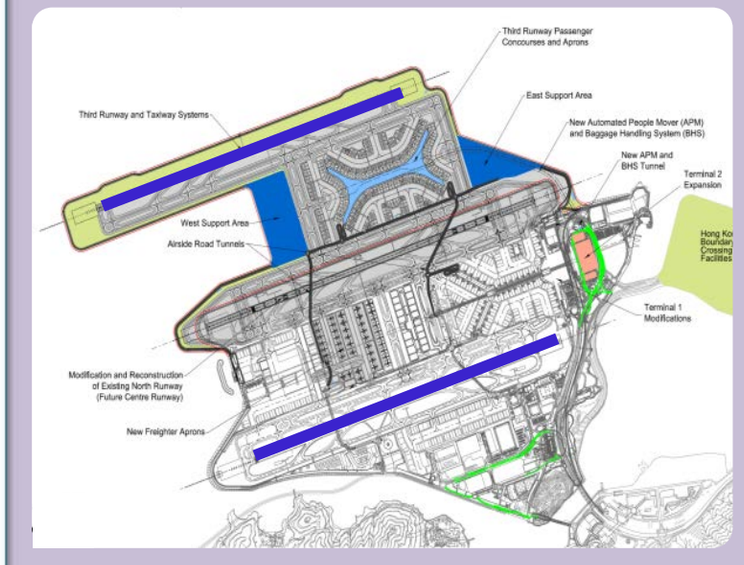
- Year 2011 (Annual ATM: 333,806)

-2011 is the full year data available when EIA process started in year 2012



Interim Phase Operation Mode:

- Year 2021 (Annual ATM: 420,000)

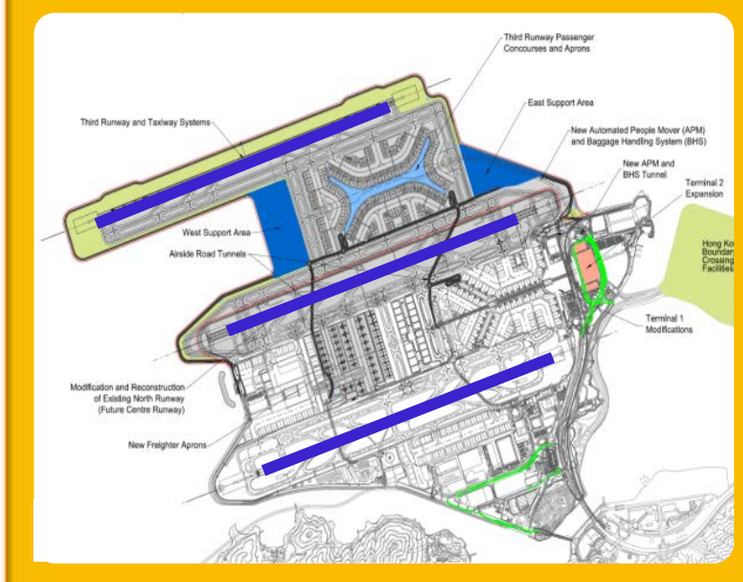


Worst Operation Mode

- Year 2030 (Annual ATM: 607,480)

Full Operation Mode at Design Capacity

- Year 2032 (Annual ATM: 620,000)



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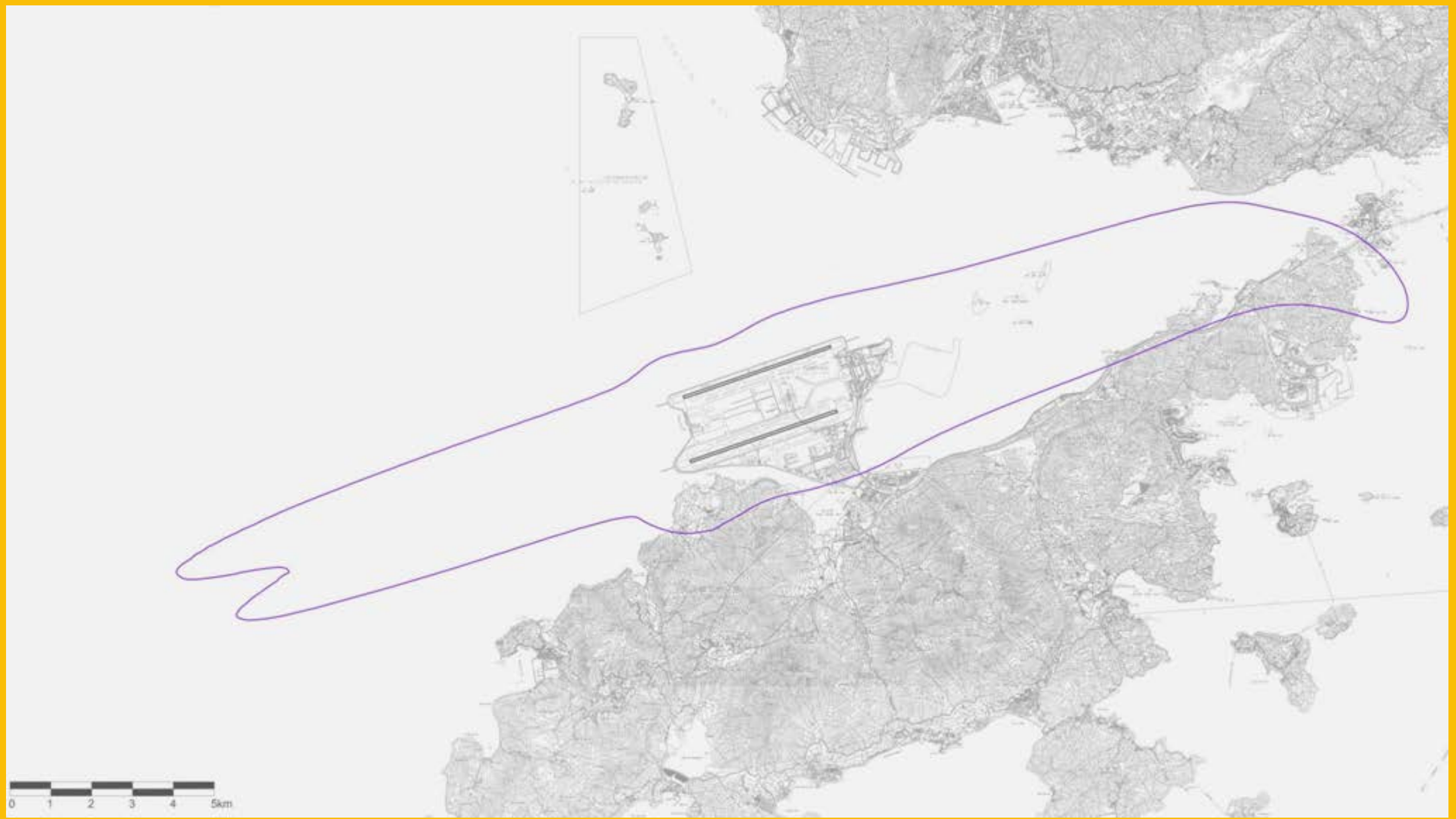
NEF25 Contour - Prevailing Year



Short-term Noise Mitigation Measures for 2RS

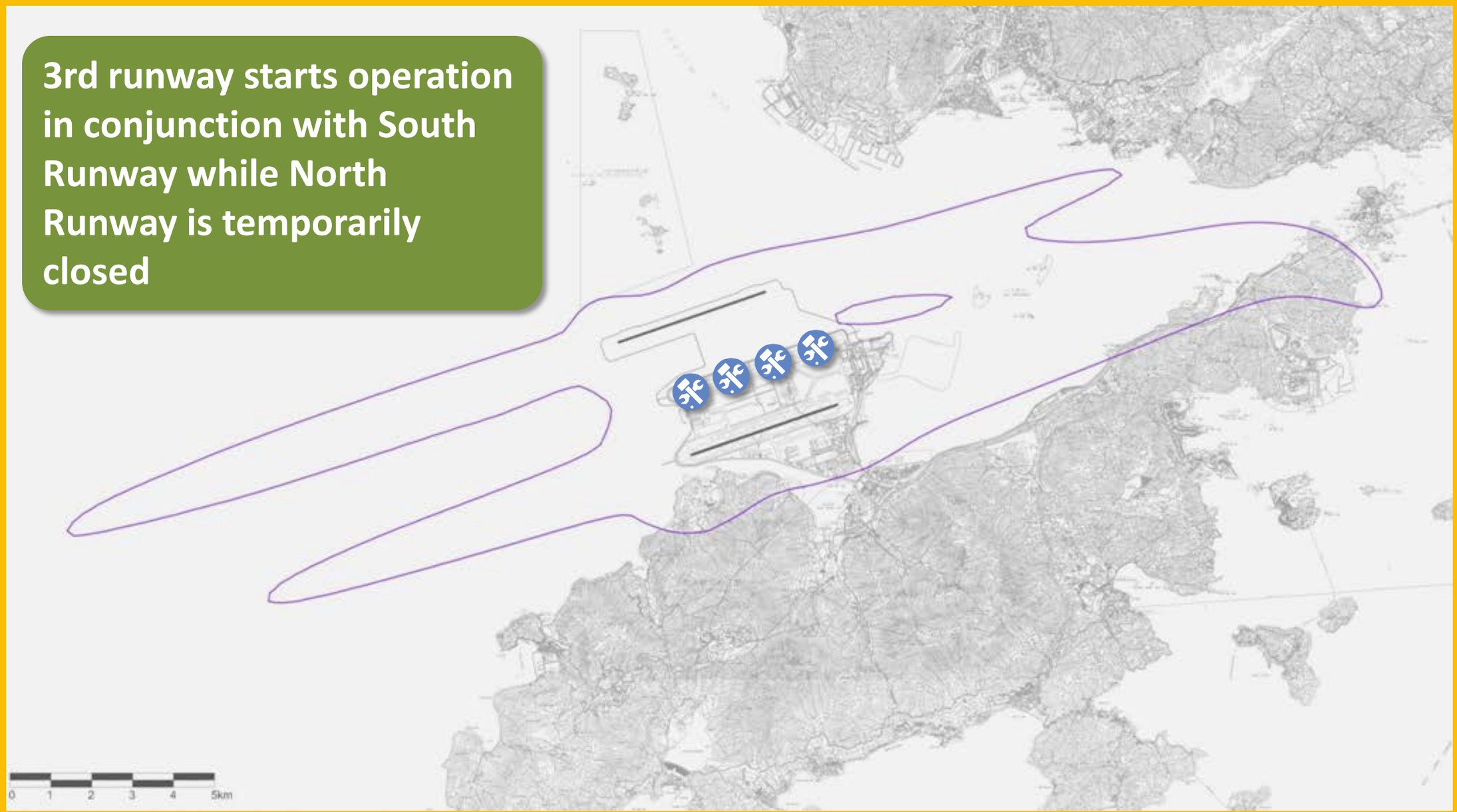
1. With effect from end of March 2014, Marginally Compliant Chapter 3 (MCC3) Aircraft have been banned for landing and take-off by Civil Aviation Department (CAD) at night between 2300 and 0659 (MCC3-Prohibited Period)

2. CAD has planned to extend the MCC3-Prohibited Period to cover the whole day for the existing two-runway operation from late October 2014

3. Airport Authority (AAHK) will develop an environmental charges/ incentives scheme to encourage airlines to use quieter aircraft

4. Introduce administrative management of night flights demand to ensure noise contour would not expand into new NSRs

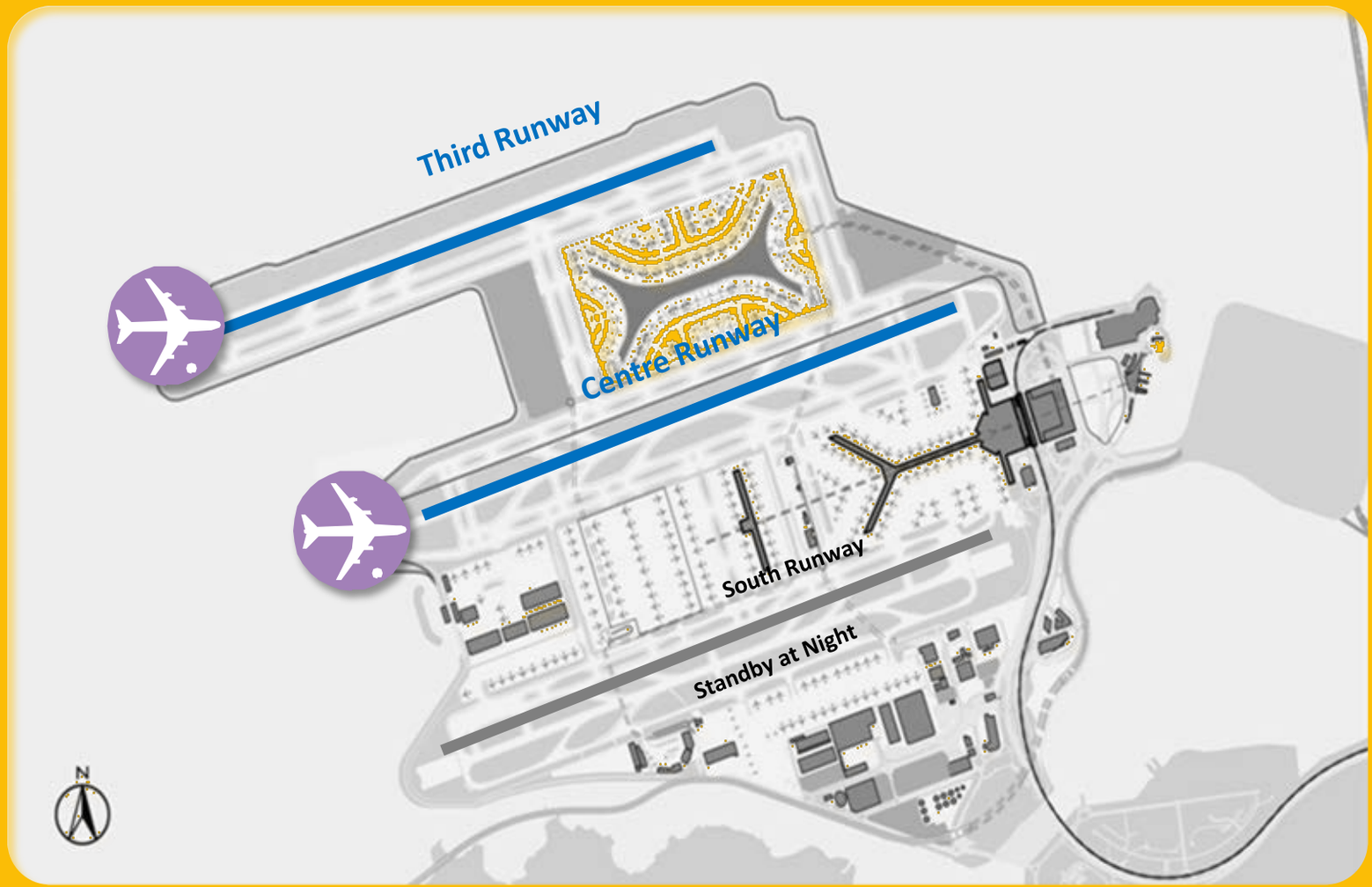
NEF25 Contour – Interim Phase Operation Mode (2021)



Runway closed for modification during interim phase.

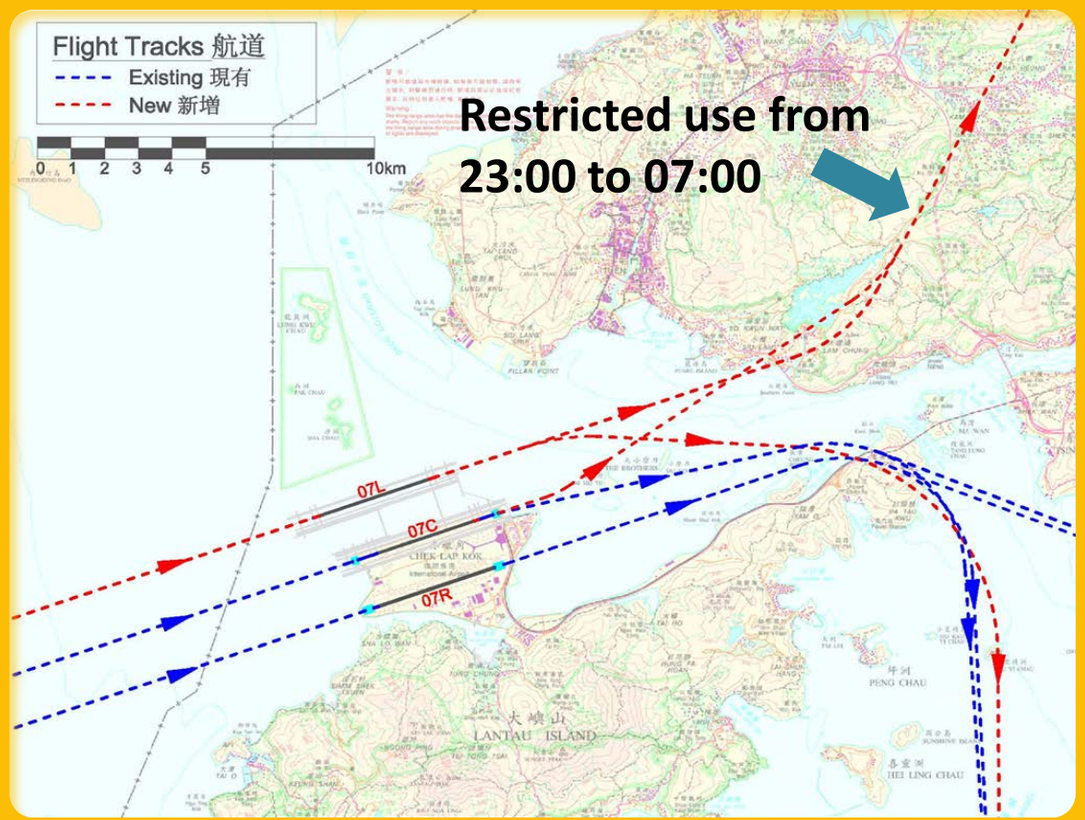
1. South Runway On Standby at Night

When practical, south runway will remain on standby at night to minimise impact on North Lantau

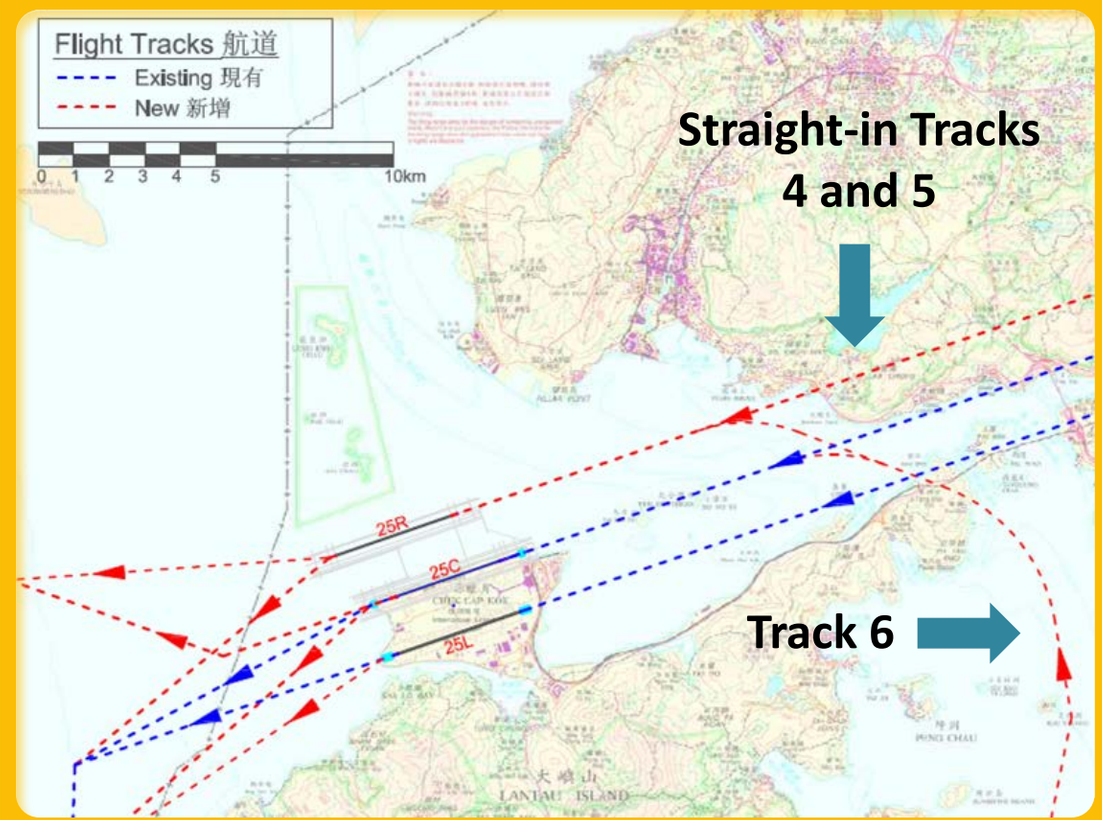


2. Adjust Flight Paths to Avoid Populated Areas at Night

East Flow Flight Tracks



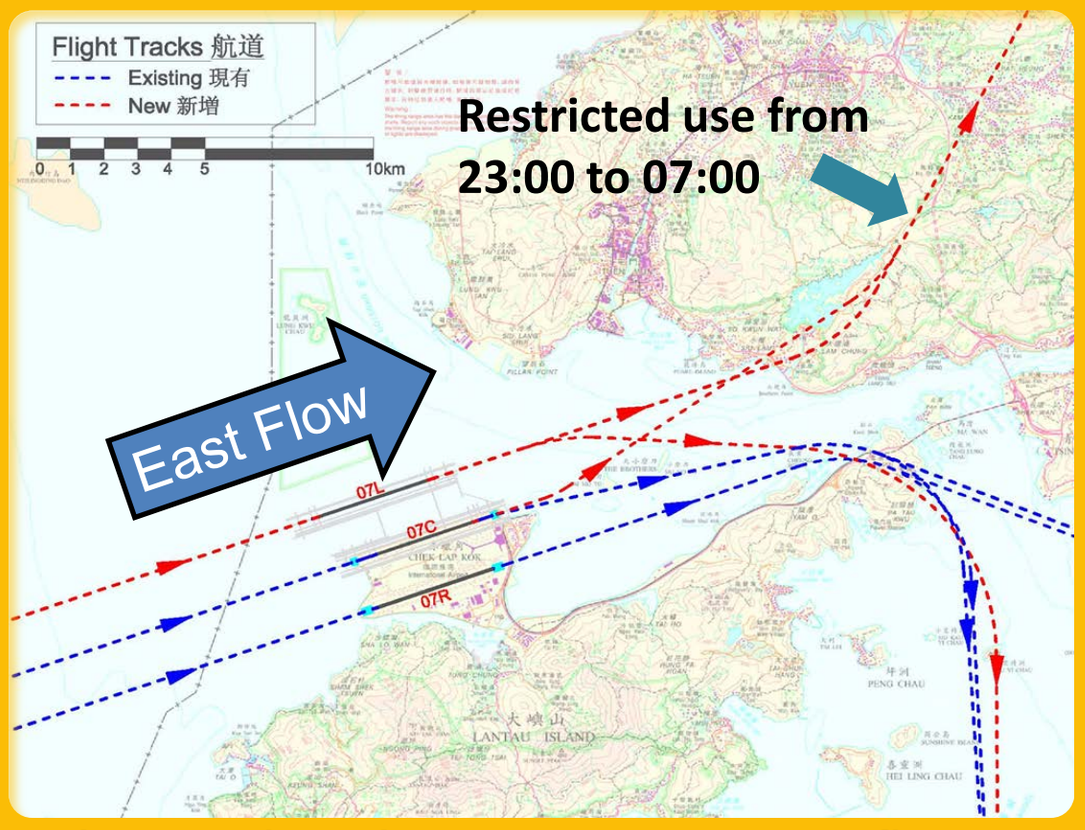
West Flow Flight Tracks



Note: Track 6 will be used to the extent practicable at night

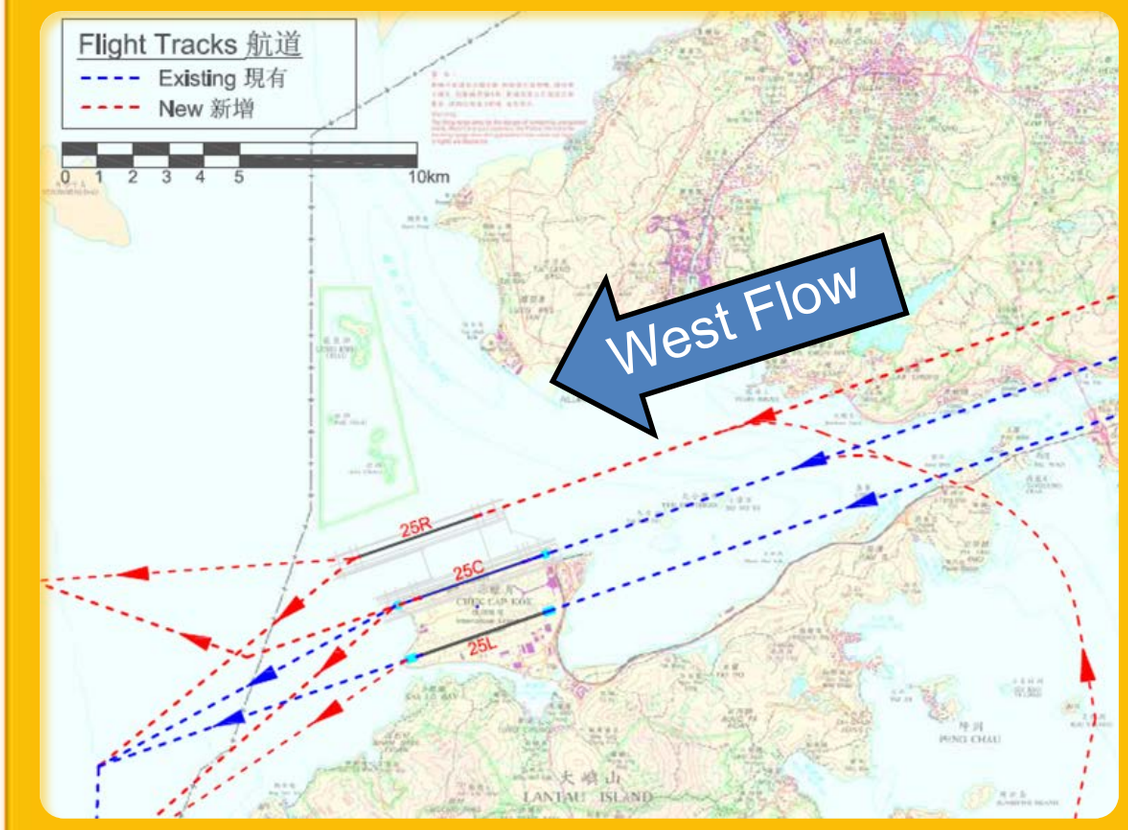
3. Managing Night-time Runway Directions to Minimise Noise

East Flow Flight Tracks



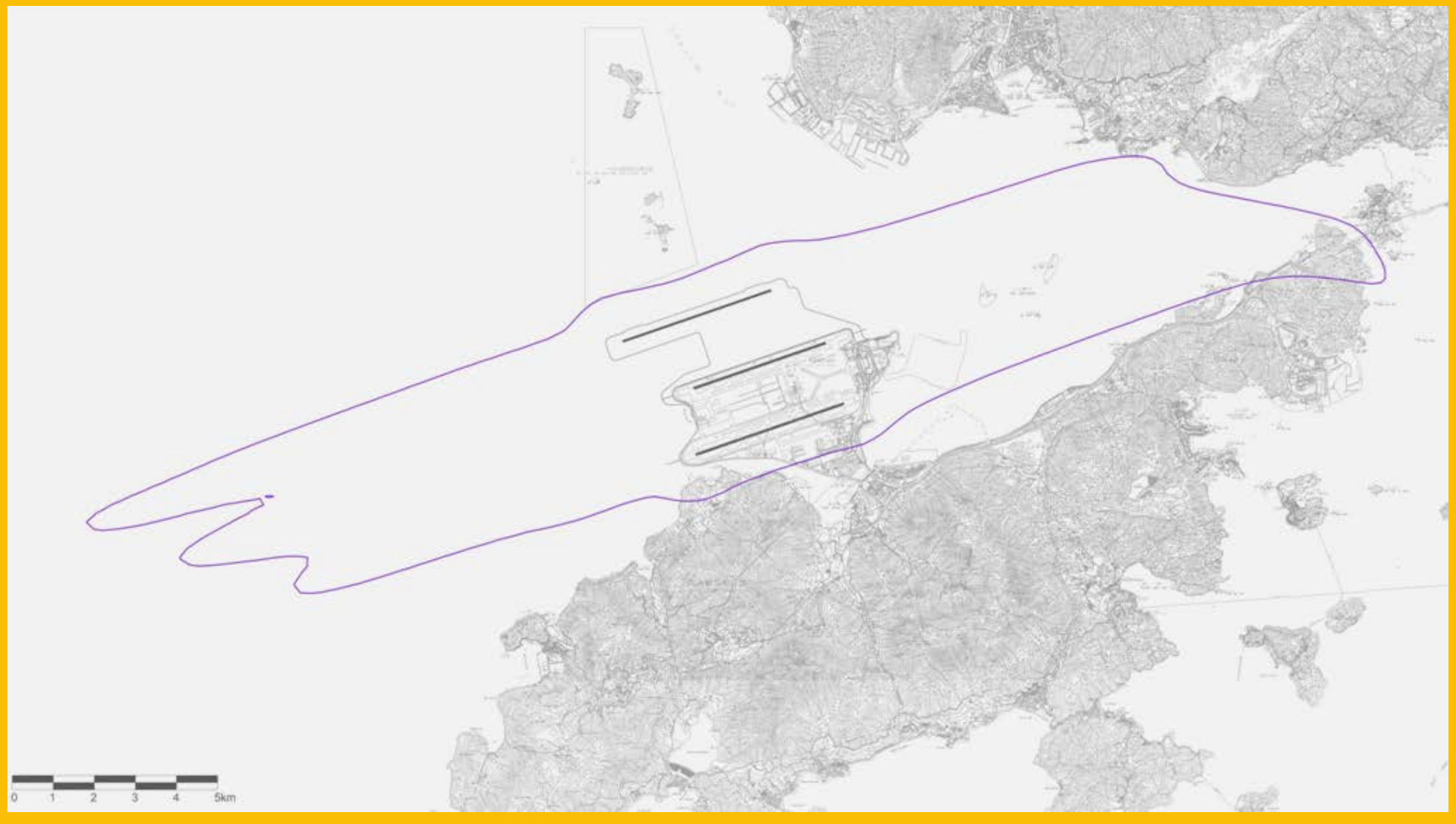
When wind conditions permit, use east flow at night where there are more landing than take-offs

West Flow Flight Tracks

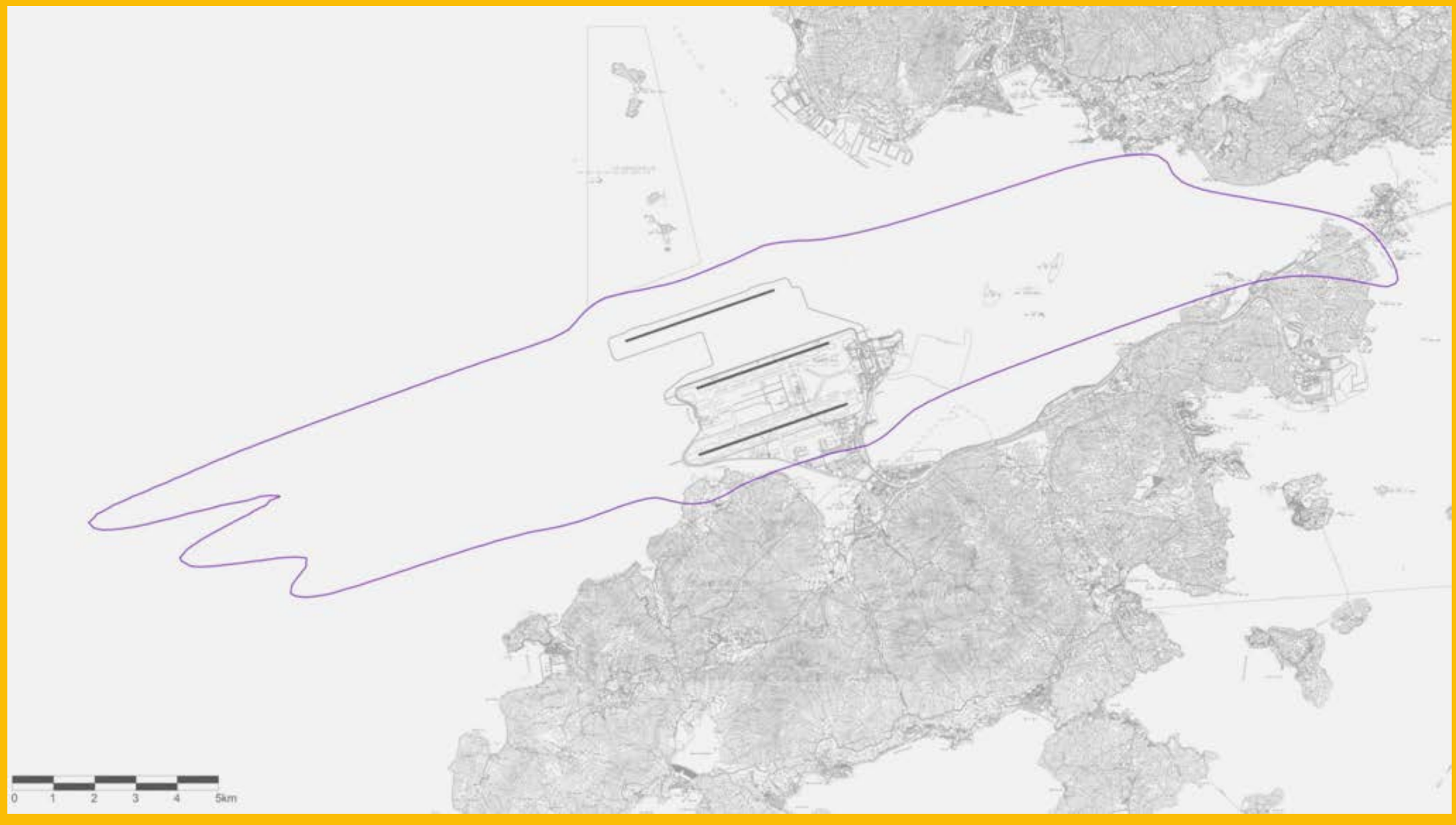


When wind conditions permit, use west flow at night when there are more take-offs than landing

In 2030, the NEF25 contour will shift northward, further away from Tung Chung and the North Lantau areas



In 2032, with continuing improvement in aircraft technology, the NEF25 contour will be similar to that of 2030



Proposed Aircraft Noise EM&A Arrangement

- **Conduct a prediction verification exercise when first full-year operation data of third runway is available**

- **Prepare an Annual Review Report to review statistics of noise related operation data and compliance status**

- **Prepare Noise Contour Report every five years**

- **Continue to proactively engage stakeholders to gauge views on aircraft noise**

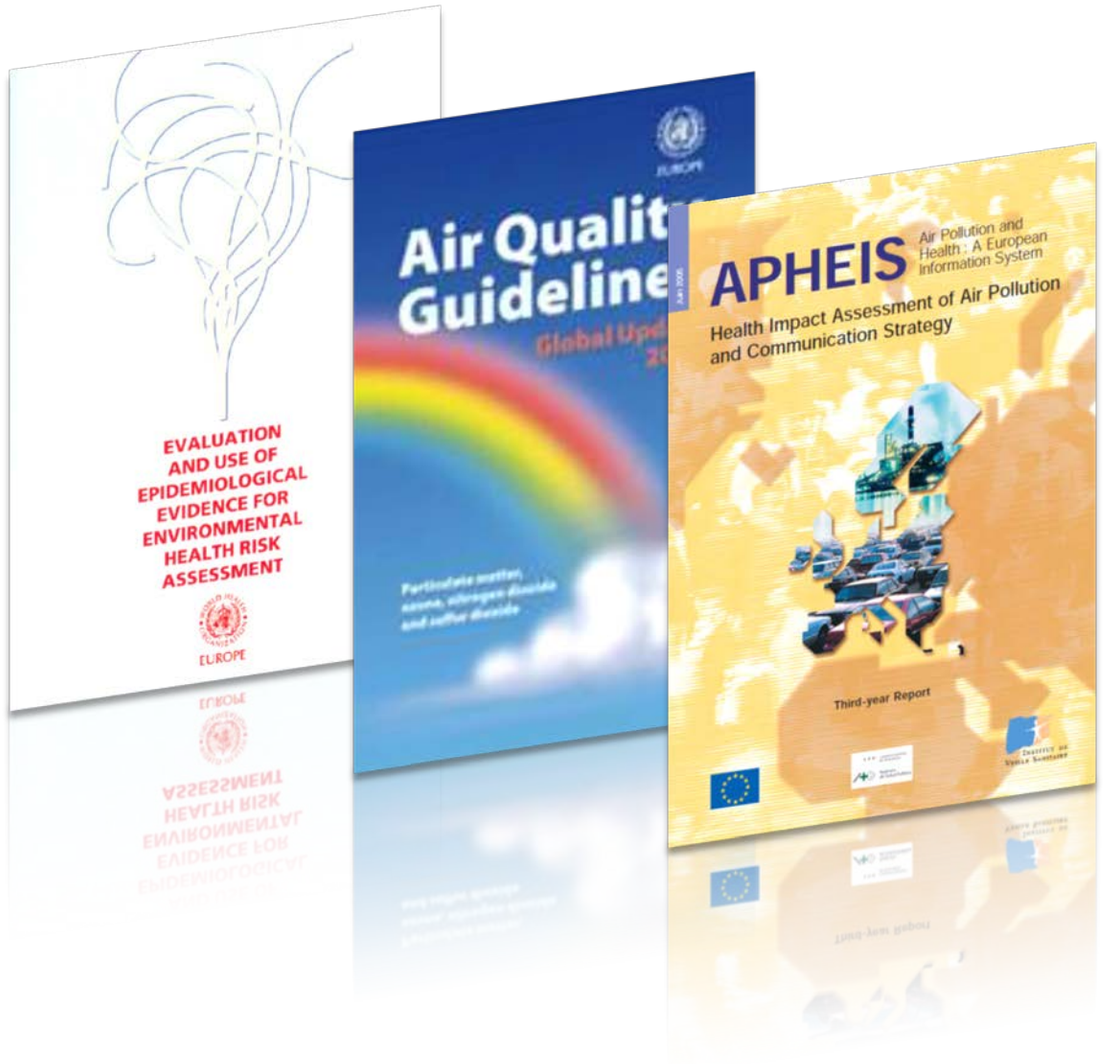
Health Impact Assessment

Air Quality and Aircraft Noise

Literature Review for Air Quality HIA

Reviewed 2 decades (since 1993) of relevant literatures including:

- **World Health Organization (WHO) publications**
- **United States Environmental Protection Agency (USEPA) publications**
- **International Air Transport Association (IATA), Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO) publications**
- **Public domain websites e.g. USEPA IRIS, USEPA SPECIATE Data Brower, OEHHA – Hot Spots Guidelines**



Air Quality Health Impact Assessment

Assessment covered both:

Toxic Air Pollutants (TAP)

- **Cancer Health Risk**
- **Non-cancer Health Risk**

AQO Air Pollutants

- **Short Term Risk**
- **Long Term Risk**

Reviewed 120 TAPs and shortlisted more than 30 relevant ones for assessment

TAP considered for short listing include more than 120 species.
Examples TAP are as follows:

- 1,3-Butadiene
- Acrolein
- Acetaldehyde
- Benzene
- Chrysene
- Diesel Particulate Matters
- Ethylbenzene
- Formaldehyde
- Naphthalene
- Propionaldehyde
- Toluene
- Xylene
- Phenol (carbolic acid)
- Benzo(a)pyrene
- Benz(a)anthracene
- Benzo(bk)fluoranthene
- 1,2,3-trimethylbenzene
- 1,2,4-trimethylbenzene
- 1,3,5-trimethylbenzene
- Isopropylbenzene
- n-Hexane
- Propylene
- Styrene
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium VI
- Cobalt
- Copper
- Mercury
- Manganese

Modelling Scenarios

The **increase in risk level** established by comparing the with-project and without-project scenarios:

Scenario	Description	Assessment Year
1	**Highest aircraft emission scenario as per the EIA Study Brief**	**Year 2031**
2	**Without project scenario**	**Same year as Scenario 1, but based on a two-runway system**

A comparison of Scenarios 1 & 2 allows determination of the **cancer risk** due to the Project

Incremental Cancer and Non-cancer Health Risks are Considered Acceptable

1. Toxic Air Pollutants (TAP)

Cancer Health Risk

- **maximum incremental risk due to 3RS is around 1.14 in hundred thousand (about 1/10 of USEPA recommended criteria of 1 in ten thousand)**

Non-cancer Health Risk

- **short-term (1-hr / 24hr) and long-term (annual) TAP concentrations due to 3RS would comply with criteria**

Incremental Short-term and Long-term Risks are Considered Acceptable

2. AQO Air Pollutants

Short -term Risk

- short-term concentrations of CO, NO_2 and SO_2 are below the respective AQO

Long-term Risk

- incremental change in annual concentrations of NO_2, RSP, FSP and SO_2 is less than 3%

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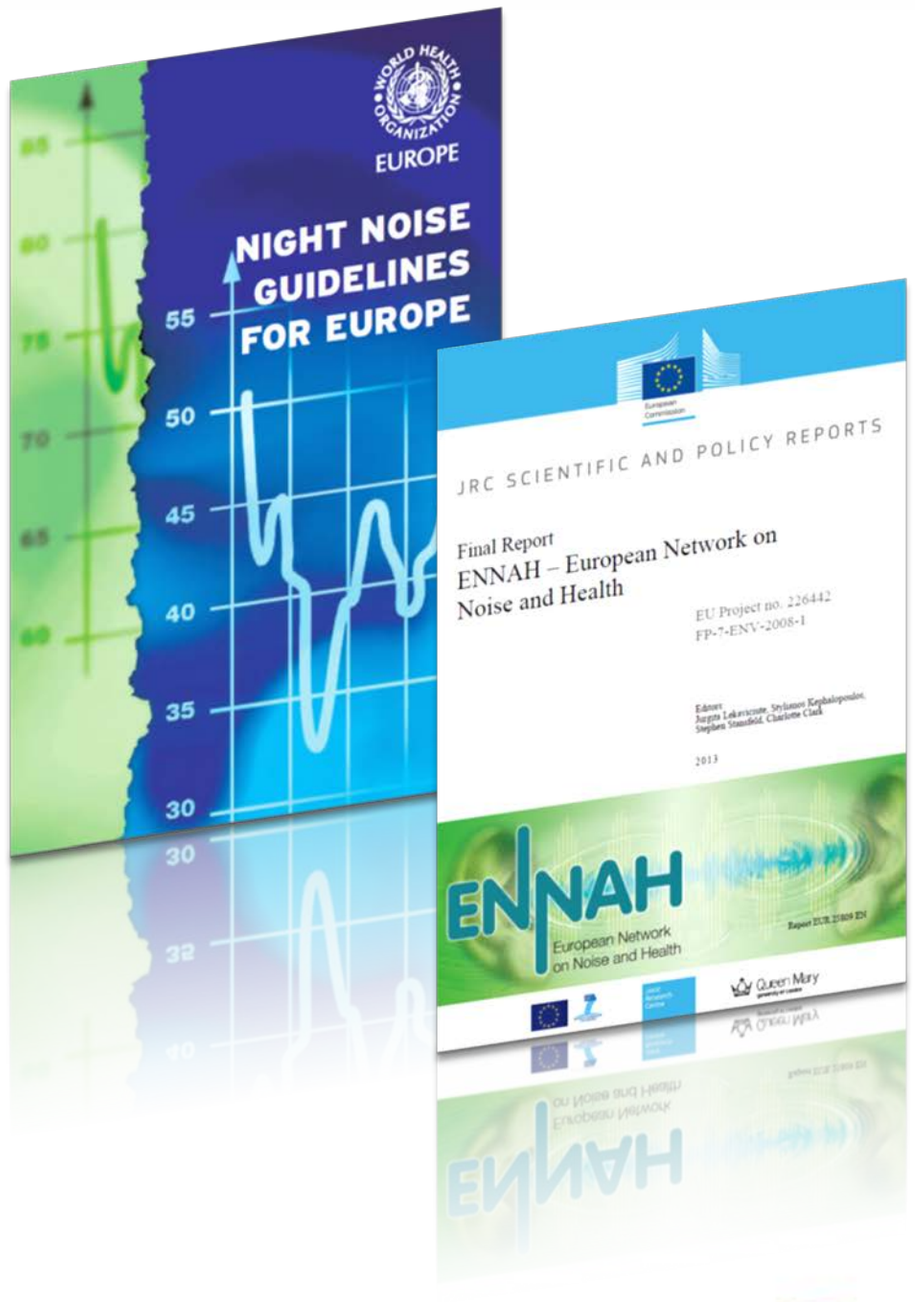
Literature Review for Aircraft Noise HIA

The study team reviewed all relevant local and overseas reports, guidance documents and published papers including:

- **World Health Organization**
- **European Environmental Agency**
- **Hong Kong Environmental Protection Department**



Aircraft Noise Health Impact Assessment

After literature review process, principal health impacts for assessment include:

- **Annoyance**
- **Sleep Disturbance**

Study Area for Aircraft Noise HIA

Covered the noise sensitive residential districts/regions located adjacent to the NEF25 contour in Year 2030

Analysis Findings

Aircraft noise mitigation measures include:

- Putting south runway on standby during nighttime
- Adjust flight paths to avoid populated areas at night
- Management of runway directions to minimise nighttime noise impact

With the implementation of 3RS compared to the 2RS in year 2030, within the study area, the assessment findings on aircraft noise HIA shows:

- The highly annoyed population will be reduced by about 10%
- The highly sleep disturbed population will be reduced by about 50%

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Thank you