Pollution Loading Inventory

The pollution loading inventory (PLI) is a compilation of all major wastewater discharges into the marine environment. It includes effluent from sewage treatment works as well as stormwater outfalls and other significant discharge sources. For this study, the PLI was prepared with reference to the methodology of compiling PLI from the HATS Stage 2A EIA report (AEIAR-121/2008), and cross-referenced against the PLI adopted in the HKBCF EIA report (AEIAR-145/2009). The pollution loads adopted in the HKBCF PLI is considered to be relevant as the location of this Project is at close proximity to the HKBCF project, and the committed land formation projects around the North Lantau Island, Western Lantau Island, Tsing Yi, Shek Kwu Chau and Western New Territories were adopted with the latest available information.

Literature[1] was reviewed to determine if any updates are needed for the values used in the HATS Stage 2A EIA report for calculation of the pollution loads. Various government departments, such as Drainage Service Department, would be contacted for information regarding any potential changes in pollution sources, such as sewage outfalls. Pollution loads generated by this Project during operation phase will be based on engineering scheme design information for this Project and will form part of the pollution loading inventory to the adopted in the water quality model. The locations of the discharge / pollution source points on the current pollution loading inventory are shown in **Figure D.1**.

1.1 Storm Outfalls

The key sources of water pollution in storm outfalls include:

- Pollution due to sewage from unsewered developments (dry weather load);
- Pollution due to expedient connections from trade and residential premises, and integrity problems of aged drainage and sewerage systems (dry weather load);
- Pollution due to livestock waste (dry weather load); and
- Rainfall related load.

The total pollution load discharged via the storm system would cover the dry weather load and rainfall related load.

1.1.1 Dry Weather Load

Domestic, commercial and industrial activities are the principle sources of dry weather load in storm drains. Total pollution loads generated from these activities were compiled by catchment areas as shown in **Figure D.2** with reference to the projected population and employment data provided by the Planning Department (PlanD) in the 2009-based Territorial Population and Employment Data Matrix (TPEDM). Details of these planning data and the methodology for calculating the pollution loads from domestic commercial and industrial activities are given in **Section 1.3**.

It was assumed that a portion of total effluent load generated within a catchment would be lost to the storm system whilst the rest of the flow would be diverted to the sewerage system.

[1] Guidelines for for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005, DSD Sewerage Manual, EPD update study

In the HATS 2A EIA report, the land area within Hong Kong Boundary has been assigned to different catchments and a percentage of effluent load in the storm system within each catchment was determined. Based on the HATS 2A percentage of effluent load in the storm system, the percentage of effluent load was updated to align with the catchments in the current study and the updated sewerage networks being taken into account.

After updates, it was observed that the percentage of effluent load at Cheung Chau and Yuen Long will be less than 10%. On a more conservative approach, 10% effluent load was assumed for Cheung Chau and Yuen Long. The assumed percentages of pollution load discharged into the storm system for different catchments are presented in **Table D.1**.

Table D.1: Assumed percentage of effluent load in the storm system for 2026

Catchment	Catchment ID	Assumed % Effluent Load in the Storm System	Foul Interception to:
Hong Kong Island			
Central and Western	1	10%	SCISTW
Wan Chai	2	10%	SCISTW
Eastern	3	10%	SCISTW
Southern	4.1	10%	SCISTW
Stanley	4.2	10%	Stanley STW
Shek O	4.3	10%	Shek O STW
Kowloon			
Yau Tsim Mong	5	10%	SCISTW
Sham Shui Po	6	10%	SCISTW
Kowloon City	7	10%	SCISTW
Wong Tai Sin	8	10%	SCISTW
Kwun Tong	9	10%	SCISTW
New Territories			
Kwai Tsing	10	10%	SCISTW
Tsuen Wan	11.1	10%	SCISTW
Sham Tseng	11.2	10%	Sham Tseng STW
Tuen Mun	12	10%	Pilliar Point STW
Yuen Long W	13.1	10%	San Wai STW
Yuen Long E	13.2	10%	Yuen Long STW

North NT	14.1	45%	Shek Wo Hui STW
Sha Tau Kok	14.2	10%	Sha Tau Kok STW
Tai Po	15	10%	Tai Po STW
Sha Tin	16	10%	Sha Tin STW
Tseung Kwan O	17.1	5%	Tseung Kwan O Preliminary Treatment Facilities
Po Toi O	17.2	50%	Po Toi O STW
Sai Kung	17.3	30%	Sai Kung STW
North Lantau	18.1	10%	Siu Ho Wan STW
Mui Wo	18.2	10%	Mui Wo STW
South Lantau	18.3	45%	Ngong Ping STW/ Shek Pik STW /Tai O STW /San Shek Wan STW
Hei Ling Chau/Peng Chau	18.4	30%	Hei Ling Chau STW/ Peng Chau STW
HKBCF	19	0%	HKBCF STW
Cheung Chau	20	10%	Cheung Chau STW
Lamma Island	21	30%	Sok Kwu Wan STW/Yung Shue Wan STW
Po Tol Island	22	100%	N/A

Note: No effluent load is assumed in the storm systems for the proposed new developments.

The percentage interceptions assumed in **Table D.1** were based on the implementation schedule for sewerage improvement projects for HATS Stage 2A, HKBCF and various DSD STW upgrading works.

The pollution loading in the storm system contributed from domestic, commercial and industrial activities was compiled to the catchment levels shown in **Figure D.2**. The pollution loading compiled for each catchment was distributed to appropriate discharge points (i.e. storm culverts / outfalls, rivers and nullahs). It was assumed that these storm pollutions would be evenly distributed amongst the major storm water discharge points within the catchment.

The livestock waste load discharged via rivers / streams within the assessment area and adopted under the HATS Stage 2A EIA as shown in **Table D.2** was directly applied in this study for the year 2026.

Table D.2: Assumed livestock waste load for 2026

Catchment	River Name	Flow (m^3/d)	SS (kg/d)	TKN (kg/d)	NH_3-N (kg/d)	TP (kg/d)	*E.coli* (counts/d)
Sheung Shui and Fanling	Shenzhen River	3,216	363	41	22	18	9.28E+14

Catchment	River Name	Flow (m^3/d)	SS (kg/d)	TKN (kg/d)	NH_3-N (kg/d)	TP (kg/d)	*E.coli* (counts/d)
Yuen Long, Tin Shui Wai and Kam Tin	Shan Pui Ho River	5,034	568	65	34	28	1.45E+15
	Tin Shui Wai Nullah	4,190	473	54	28	24	1.21E+15
Deep Bay	Sheung Pak Nai Stream	97	11	1	1	1	2.79E+13
	Ha Pak Nai Stream	677	76	9	5	4	1.95E+14

Source: HATS Stage 2A EIA report (AEIAR-121/2008)

In summary, the total dry weather load in the storm outfall would include the loading contributed from domestic, commercial and industrial activities and the loading from livestock discharges (if any) as shown in **Table D.1.**

1.1.2 Rainfall Related Load

For the purpose of calculating runoff percentage and daily runoff value, the rainfall data from May to September will represent the values for wet season, and those from November to March represent the values for dry season. The runoff percentage of wet (93 %) and dry (70 %) season calculated in the HATS Stage 2A EIA report has been adopted for use.

The updated thirty-year long term average rainfall data (1981 to 2010) was used to determine the daily runoff value as shown below:

Daily runoff value (m/day) = thirty-year long term average daily rainfall data x runoff percentage

Thus, the runoff value was calculated as 0.01150 m/day and 0.00105 m/day for wet and dry seasons respectively.

As permeable lands will also generate discharge after a certain amount of rainfall, permeable runoff percentage has been used for calculating the runoff that is generated from the permeable lands during heavy rainfalls. For assessment purposes, daily average rainfall over 10mm is considered as heavy rainfall. Daily extract of meteorological observations for Hong Kong from 2003 to 2012 were used to calculate the permeable runoff percentage, which is shown below:

Permeable runoff percentage (PRP) = no. of days over 10 mm / total no. of days x 100

The calculated permeable runoff percentages are 10.5 % and 1.3 % for wet and dry seasons respectively.

The amount of rainfall related load that would be discharged into the sea depends on the amount of area within each catchment. It was assumed that all urbanized/developed areas within the catchment would be impermeable and rural areas as permeable. The daily volume of runoff generated within each catchment was estimated as shown below:

DVC = (DRV x IA) + (DRV (m/day) x PA x PRP)

DVC = daily volume of runoff in each catchment (m^3/day)

DRV = daily runoff value (m/day)
IA = impermeable area within each catchment (m^2)
PA = permeable area within each catchment(m^2)
PRP = Permeable runoff percentage

The daily volume of runoff estimated for each catchment was multiplied with the runoff concentrations to derive the rainfall related loading. The assumed runoff concentrations are shown in **Table D.3**.

Table D.3: Event Mean Concentrations for Stormwater Runoff

TSS (g/m^3)	BOD5 (g/m^3)	NH3N (g/m^3)	Cu (g/m^3)	TP (g/m^3)	OrthoP (g/m^3)	Silicate (g/m^3)	TON (g/m^3)	TKN (g/m^3)	TSS (g/m^3)
43.25	22.48	0.20	0.01	0.20	0.04	3.28	0.40	1.40	43.25

Source: EPD Pilot Study of Storm Pollution

The rainfall related loading was compiled to the catchment levels shown in **Figure D.2**. The pollution loading compiled for each catchment was distributed to appropriate discharge points (i.e. culverts, outfalls, rivers and nullahs). It was assumed that the rainfall related loading was evenly distributed amongst the major storm water discharge points within the catchment.

For the additional stormwater discharge that will arise due to the Project, it is currently envisaged by the project scheme design engineers that there will be six drainage catchment areas within the airport expansion area, and surface runoff from each catchment area will be distributed to individual storm outfalls shown in **Drawing No. MCL/P132/EIA/8-008**. It is assumed that runoff from the Project area will be primarily comprised of rainfall related load. The discharge rate for the Project is estimated based on the area of the sections and the permeability per paved and grass area of individual section. A summary of the area of each section is presented in **Table D.4**. For assessment purpose, a 90% permeability rate will be assumed for the grass area.

Table D.4: Areas of Different Drainage Catchment Area of the Project

	Area (m^3)					
Ground Type	1	2	3	4	5	6
Grass	201,000	220,000	236,250	124,000	220,000	90,000
Paved	804,000	880,000	1,338,750	1,116,000	660,000	810,000

1.2 Sewage Outfalls

A portion of the total loads from domestic, commercial and industrial activities generated in each catchment was allocated to the sewerage system according to the percentage of storm interception shown in **Table D.1**. The remaining portion of the total load in each catchment was distributed to the storm system.

Besides the pollution loads from domestic, commercial and industrial activities, the sewerage system would also receive pollution loads from landfills and beaches as most of the landfill sites and beach facilities would be connected to the sewerage system. **Table D.5 and Table D.6** show the pollution load of relevant landfills and beaches adopted under the HATS Stage 2A EIA within the assessment area. As these pollution loads are not anticipated to change significantly with time, the same loads are adopted for the year 2026. Due to the expansion of the WENT landfills, the WPCO discharge license limits for relevant parameters were adopted for a worst case scenario. The beach loading was included for the wet season

simulations only. Loading from landfills and beaches that would not be connected to the STW is given in **Section 1.6**.

Pollution loads from ingress of storm water due to pipe defects and misconnections are also anticipated in the sewerage system. The flow of ingress per catchment was estimated based on catchment inflow factor from the *Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning* (GESF) by EPD, as shown in **Table D.7**. After the flow rate was estimated, the loads per catchment were calculated by multiplying the flow rate with the runoff concentrations shown in **Table D.3**. Flow rates and loads for the discharge from SCISTW, PPSTW, SHWSTW, SWSTW, YLSTW, SHTSTW, SWHSTW and BCFSTW used for water quality modeling are further discussed in **Section 1.4**.

Table D.5: Pollution Flows and Loads from Landfills

Discharge Location		Flow (m^3/d)	SS (kg/d)	TKN (kg/d)	NH_3-N (kg/d)	TP (kg/d)	*E.coli* (no./d)	*Cu* (g/d)
NEW STRATEGIC LANDFILLS								
WENT	Foul sewer to NWNT sewage outfall	2,600	1,440	1,440	190	1,690	4.97E+06	1,800
SENT	Foul sewer to SCISTW	523	30	131	26	1	3.64E+06	10
NENT	Foul sewer to Shek Wu Hui STW	541	11	53	22	1	3.76E+06	11
NWNT LANDFILLS								
Pillar Point Valley	Foul sewer to Pillar Point STW	3,283	3,165	822	389	2,511	2.28E+07	66
Ngau Tam Mei	Foul sewer to SCISTW	200	193	50	24	153	1.39E+06	4
Siu Lang Shui								
Gin Drinkers Drinkers								
Ma Tso Lung								
URBAN LANDFILLS								
Jordan Valley	Foul sewer to SCISTW	638	615	160	76	488	4.44E+06	13
Ma Yau Tong Central								
Sai Tso Wan								
Ma Yau Tong West								
Ngau Chi Wan								
TKO LANDFILLS								
TKO I	Foul sewer to HATS	69	66	32	8	52	4.77E+05	1

Source: HATS Stage 2A EIA report (AEIAR-121/2008)

Table D.6: Pollution Flows and Loads from Beaches

Gazetted Beach	Discharge Location	Flow (m^3/d)	BOD (g/day)	SS (g/day)	Org-N (g/day)	NH_3-N (g/day)	*E.coli* (g/day)	*TP* (no./d)	OrthoP (g/day)
Big Wave Bay	Shek O STW	3	788	657	432	985	1.04E+13	224	133
Hairpin		1	334	278	183	417	4.41E+12	95	57
Shek O		20	4,895	4,079	2,685	6,118	6.46E+13	1,393	829
Deep Water Bay	Aberdeen STW before HATS Stage 2A and SCISTW after HATS Stage 2A	22	5,436	4,530	2,982	6,795	7.17E+13	1,547	921
Middle Bay		3	667	556	366	833	8.80E+12	190	113
Repulse Bay		44	10,968	9,140	6,017	13,710	1.45E+14	3,121	1,858
South Bay		2	584	487	321	730	7.71E+12	166	99
Chung Hom Kok	Stanley STW	1	225	187	123	281	2.96E+12	64	38
St. Stephen's		4	875	729	480	1,094	1.15E+13	249	148
Stanley Main		6	1,504	1,254	825	1,880	1.98E+13	428	255
Turtle Cove		1	268	223	147	334	3.53E+12	76	45
Silvermine Bay	Mui Wo STW	0	112	93	61	140	1.47E+12	32	19
Hung Shing Yeh	Yung Shue Wan STW	1	308	256	169	384	4.06E+12	88	52
Lo So Shing		0	68	57	37	85	8.99E+11	19	12
Kwun Yau Wan	Cheung Chau STW	0	94	78	52	117	1.24E+12	27	16
Tung Wan, Cheung Chau		4	1,089	908	598	1,362	1.44E+13	310	185
Silverstrand	Sai Kung STW	18	4,556	3,797	2,500	5,695	6.01E+13	1,297	772
Anglers'	Sham Tseng STW	0	87	73	48	109	1.15E+12	25	15
Approach		0	77	64	42	96	1.02E+12	22	13
Casam		0	63	53	35	79	8.36E+11	18	11
Gemini		0	41	34	23	52	5.44E+11	12	7
Hoi Mei Wan		0	85	71	47	107	1.13E+12	24	14
Lido		3	662	552	363	828	8.74E+12	188	112
Ting Kau		0	26	22	14	32	3.42E+11	7	4
Butterfly	Pillar Point STW	17	4,248	3,540	2,331	5,310	5.61E+13	1,209	720
Castle Peak		2	605	504	332	756	7.98E+12	172	102
Kadoorie		22	5,561	4,634	3,051	6,951	7.34E+13	1,582	942
New Cafeteria		8	2,045	1,704	1,122	2,556	2.70E+13	582	346
Old Cafeteria		3	732	610	401	915	9.65E+12	208	124
Golden Beach		22	5,505	4,587	3,020	6,881	7.26E+13	1,566	932
Big Wave Bay	Shek O STW	3	788	657	432	985	1.04E+13	224	133

Source: HATS Stage 2A EIA report (AEIAR-121/2008)

Table D.7: Catchment Inflow Factors from the GESF

Catchment	Catchment Inflow Factor
Central, North Point, Sandy Bay, Wan Chai, Wah Fu, Central Kowloon, Stanley, Yuen Long, San Wai, North District, Tai Po, North Lantau, Mui Wo	1.00
Chai Wan, Kwai Chung, Tsing Yi, East Kowloon, Tuen Mun	1.10

Catchment	Catchment Inflow Factor
Sha Tin	1.15
Tseung Kwan O	1.20
Shau Kei Wan	1.25
Aberdeen, Ap Lei Chau, Northwest Kowloon, Sai Kung	1.30
Cheung Chau, Shek O	1.50

Source: EPD, March 2005, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (version 1.0)

The total load generated in the sewerage system would be reduced after the treatment processes. **Table D.8** shows the treatment processes for STW around Hong Kong It should be noted that Stonecutters Island Sewage Treatment Works (SCISTW), Pillar Point Sewage Treatment Works (PPSTW), Siu Ho Wan Sewage Treatment Works (SHWSTW), San Wai Sewage Treatment Works (SWSTW), Yuen Long Sewage Treatment Works (YLSTW), Sham Tseng Sewage treatment Works (SHTSTW), Shek Wu Hui Sewage Treatment Works (SWHSTW) and HKBCF Sewage Treatment Works (BCFSTW) are not included in the calculations sewage loads as the methodologies for compiling the loading discharged from these STWs are discussed separately in **Section 1.4**.. The treatment efficiencies for different treatment processes are given in **Table D.9** for reference. As the programme for implementation of HATS Stage 2B is not yet available, it is assumed that in the year 2026, only HATS Stage 2A is completed.

Table D.8: Summary of Major Sewage Treatment Works and the Corresponding Treatment Levels

	Treatment Level	
STW	**2013**	**2026**
Stanley	Secondary treatment with disinfection	Secondary treatment with disinfection
Shek O	Preliminary treatment	Preliminary treatment
Tai O	Preliminary treatment	Secondary Treatment
Cheung Chau	Primary treatment	Secondary treatment (yet to be confirmed)
Mui Wo	Secondary treatment with disinfection	Secondary treatment with disinfection
Peng Chau	Secondary treatment with disinfection	Secondary treatment with disinfection
Shek Wu Hui	Secondary treatment with disinfection	Secondary treatment with disinfection
Sha Tau Kok	Secondary treatment with disinfection	Secondary treatment with disinfection
Sai Kung	Secondary treatment with disinfection	Secondary treatment with disinfection
Yung Shue Wan	Secondary treatment with disinfection	Secondary treatment with disinfection
Sok Kwu Wan	Secondary treatment with disinfection	Secondary treatment with disinfection
Hei Ling Chau	Secondary treatment with disinfection	Secondary treatment with disinfection
Shek Pik	Secondary treatment with disinfection	Secondary treatment with disinfection
Cyber Port	Chemically enhanced primary treatment	See Note
Siu Ho Wan	Chemically enhanced primary treatment	Chemically enhanced primary treatment
SCISTW (HATS 2A)	Chemically enhanced primary treatment	Secondary treatment with disinfection
Shatin	Secondary Treatment	Secondary Treatment
Yuen Long	Secondary Treatment	Tertiary treatment
San Shek Wan	N/A	Secondary treatment with disinfection
Po Toi O	N/A	Secondary treatment with disinfection
Ngong Ping	Tertiary treatment	Tertiary treatment
Shatin	Secondary treatment	Secondary treatment

STW	Treatment Level 2013	2026
Tai Po	Secondary treatment	Secondary treatment
Yuen Long	Secondary treatment	Secondary treatment with disinfection
San Shek Wan	N/A	Secondary treatment with disinfection

Source:

1. HATS Stage 2A EIA report (AEIAR-121/2008)
2. Upgrading of Cheung Chau Sewage Collection, Treatment and Disposal Facilities Project Profile (PP-407/2009)
3. Upgrading of Tai O Sewage Collection, Treatment and Disposal Facilities Project Profile (PP-406/2009)
4. Expansion of Sha Tau Kok Sewage Treatment Works Project Profile (PP-474/2012)
5. Port Shelter Sewerage, Stage3 - Sewerage Works at Po Toi O Project Profile (PP-458/2012)
6. Effluent Polishing Scheme at Yuen Long Sewage Treatment Works Project Profile (PP-458/2012)

Note: Effluent from Cyberport STW would be discharged to the SCISTW under HATS Stage 2A by 2014.

Table D.9: Treatment Efficiency for Treatment Works

Types of Treatment Plant	BOD_5	TSS	NH_3-N	Org-N	OrthoP	TP	Cu	*E.coli*
Screening Plants[1]	0%	0%	0%	0%	0%	0%	0%	0%
Primary Treatment (no disinfection)	32.50%	55%	0%	15%	0%	15%	26%	50%
Primary Treatment (with disinfection)	32.50%	55%	0%	15%	0%	15%	26%	99.95%
Chemical Enhanced Primary Treatment (with no disinfection)[2]	55%	70%	10%	45%[3]	60%	60%	80%	50%
Chemical Enhanced Primary Treatment (with disinfection)[2]	55%	70%	10%	45%[3]	60%	60%	80%	99.95%
Secondary Treatment (no disinfection)	85%	90%	75%	80%	35%	50%	74%	94%
Secondary Treatment (with disinfection)	85%	90%	75%	80%	35%	50%	74%	99.97%
Tertiary treatment	95%	99%	89%	95%	70%	85%	89%	100%

Source:

1. HATS Stage 2A EIA report (AEIAR-121/2008)
2. Ngong Ping Sewage Treatment Works and Sewerage EIA report (AEIAR-065/2002)

Note:

1. It is assumed that the reduction of the pollution parameters is insignificant in screening plants. Therefore, the removal rates for these parameters were all assumed zero.
2. Based on estimation from the SSDS EIA Study: Technical Note 1 (Revised) Wastewater Flows and Loads and Effluent Characteristics.
3. The removal rate of org-N is calculated from the removal rates of NH_3-N and total N (10% and 25% respectively) assuming that NH_3-N contributes about 57% of total N in raw sewage.

1.3 Pollution Loads From Domestic, Commercial and Industrial Activities

1.3.1 Time Aspect

Territorial Population and Employment Data Matrix (TPEDM) for population and employment provided by the Planning Department (PlanD) was used to compile the pollution loads from domestic, commercial and industrial activities for the operation Year 2026. The latest available TPEDM is the 2011-based version, and the previous version is 2009-based. A decrease in the usual resident population for the 2026 forecast is observed in the latest 2011-based Territorial Population and Employment Data Matrix (TPEDM) by about

3% when compared with the 2009-based TPEDM. Since the population data would govern the total sewage load, it is anticipated that the total sewage load generated from 2009-based TPEDM will be greater than that from 2011-based TPEDM. For a more conservation approach, the 2009-based TPEDM was adopted for use.

1.3.2 Spatial Aspect

To facilitate the estimation of pollution loading, the population and employment data are required to be presented at the level of catchment areas shown in **Figure D.2**.

1.3.3 Data Manipulation

The planning data provide the number of usual residents, mobile residents and school places within the territory at PVS zones. Employment population is divided by 12 job types as listed below:

- J1 Manufacture
- J2 Electricity, gas & water
- J3 Transport, storage & communication
- J4 Wholesale and retail
- J5 Import & export
- J6 Financial, insurance, real estate & business services
- J7 Agriculture & fishery
- J8 Mining & quarrying
- J9 Construction
- J10 Restaurants, hotels & boarding houses
- J11 Community, social & personal services
- J12 Public administration

The population data were manipulated and presented in the following categories:

- Residential population (by usual residents and mobile residents)
- Transient Population (by total employment number and total school places), where total employment =J1+J2+J3+J4+J5+J6+J7+J8+J9+J10+J11+J12
- Number of employees in commercial sector (by J2, J3, J4, J9, J10 & J11)

The domestic pollution load to be generated from a catchment would be affected by the number of resident population, transient population and the total employee number within the catchment. It is considered that

commercial effluents are contributed from job J2 to J4 and J9 to J11. Industrial effluents are contributed from job type J1.

1.3.4 Unit Flow and Load Factors

Relevant per head flow and load were assigned to residential, transient, commercial and industrial population to obtain the quantity and quality of total untreated wastewater by individual catchment areas. If the catchment falls under more than one category, then the category that will provide the highest load will be adopted. **Table D.10** to **Table D.14** shows the flow and load factors.

Table D.10: Domestic Flow and Load Factors for Resident Population

Description	Flow[1]	SS[2]	BOD_5[2]	TKN[2]	NH_3-N[2]	TP[3]	Cu[3]	*E.coli*[2]
	m^3/d/head	g/d/head	g/d/head	g/d/head	g/d/head	g/d/head	g/d/head	no./d/head
Usual residents								
Sandy Bay	0.35	40	42	8.5	5	1.33	0.0065	4.30E+10
Stanley, Discovery Bay	0.29	40	42	8.5	5	1.33	0.0065	4.30E+10
Shek O	0.35	40	42	8.5	5	1.33	0.0065	4.30E+10
Outlying Island, Sai Kung	0.27	40	42	8.5	5	1.33	0.0065	4.30E+10
Yuen Long, Mui Wo	0.25	40	42	8.5	5	1.33	0.0065	4.30E+10
Aberdeen, Wan Chai, North Lantau	0.23	40	42	8.5	5	1.33	0.0065	4.30E+10
Sha Tin, Tai Po	0.22	40	42	8.5	5	1.33	0.0065	4.30E+10
San Wai	0.23	40	42	8.5	5	1.33	0.0065	4.30E+10
Wah Fu, Shek Wu Hui	0.21	40	42	8.5	5	1.33	0.0065	4.30E+10
Northwest Kowloon, Tuen Mun, Central, North Point	0.20	40	42	8.5	5	1.33	0.0065	4.30E+10
Ap Lei Chau, Chai Wan, Shau Kei Wan, Central Kowloon, East Kowloon, Kwai Chung, Tsing Yi, Tseung Kwan O	0.19	40	42	8.5	5	1.33	0.0065	4.30E+10
Mobile residents	0.19	40	42	8.5	5	1.33	0.0065	4.30E+10

Source:

1. EPD, March 2005, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (version 1.0)
2. DSD Sewerage Manual
3. EPD Update Study

Table D.11: Domestic Flow and Load Factors for Transiet Population

Description	Flow[1]	SS[2]	BOD_5[2]	TKN[2]	NH_3-N[2]	TP[3]	Cu[3]	*E.coli*[2]
	m^3/d/head	g/d/head	g/d/head	g/d/head	g/d/head	g/d/head	g/d/head	no./d/head
Employed population	0.08	34	34	6.7	4	1.06	0.0052	3.50E+10
Students	0.04	34	34	6.7	4	1.06	0.0052	3.50E+10

Source:

1. EPD, March 2005, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (version 1.0)
2. DSD Sewerage Manual
3. EPD Update Study

Table D.12: Domestic Flow and Load Factors for Transient Population

ID	Description	Flow[1]	SS[2]	BOD_5[2]	TKN[2]	NH_3-N[2]	TP[3]	*E.coli*[2]
		m^3/d/employee	g/d/head	g/d/head	g/d/head	g/d/head	g/d/head	no./d/head
J2	Electricity Gas & Water	0.25	25	53	2.5	0.8	0.53	0
J3	Transport, Storage & Communication	0.10	25	53	2.5	0.8	0.53	0
J4	Wholesale & Retail	0.20	25	53	2.5	0.8	0.53	0
J9	Construction	0.15	25	53	2.5	0.8	0.53	0
J10	Restaurants & Hotels	1.50	25	53	2.5	0.8	0.53	0
J11	Community, Social & Personal Services	0.20	25	53	2.5	0.8	0.53	0

Source:

1. EPD, March 2005, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (version 1.0)
2. DSD Sewerage Manual
3. EPD Update Study

Table D.13: Flow Factors for Industrial Activities

Catchment	Flow[1]
	m^3/d/employee
J1 Manufacturing	
Hong Kong Island (except Aberdeen & Ap Lei Chau), San Po Kong	0.25
North West Kowloon	0.45
East Kowloon, Sha Tin, Lantau Island (except Mui Wo)	0.45
Central Kowloon, North District, Aberdeen, Ap Lei Chau	0.55
Tsuen Wan, Kwai Chung	0.65
Tai Po	0.75
Tuen Mun, Tseung Kwan O, Yau Tong, Cheung Chau, Mui Wo	1
Tsing Yi	1.5
Sai Kung, Yuen Long	2

Source: EPD, March 2005, Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (version 1.0)

Table D.14: Load Factors for Industrial Activities

Category	SS[2]	BOD_5[2]	TKN[2]	NH_3-N[2]	Cu[3]	*E.coli*[2]
	g/d/head	g/d/head	g/d/head	g/d/head	g/d/head	no./d/head
J1 Manufacturing						
Food	502	713	39	0	0	0
Textiles	2,095	3,680	67	0	4.4	0
Leather	115	115	29	7	0.1	0
Paper	2,228	2,150	33	0	0	0
Manufacturing	355	931	0	0	2.4	0
Machinery	40	90	29	22	0.9	0

Source: EPD Update Study

Note: * The maximum load parameter for the six categories of manufacturing was adopted for use.

Pollution load generation factors for OrthoP and silica are not available. The following assumptions were adopted for calculating OrthoP and silica loading in raw sewage.

- TP to OrthoP is 1.68 based on the HATS 2A EIA report.
- The silica content is approximately 9 mg/L based on the HATS 2A EIA report.

1.4 Concurrent Discharges from Other Major STW

Effluent discharges from the key STW within the modelling areas were considered separately. These key discharges include the effluent flow from SCISTW, PPSTW, SHWSTW, SWSTW, YLSTW, SHTSTW, SWHSTW and BCFSTW. The effluent concentrations assumed for these STWs are based on the information from recent studies, WPCO discharge license limits and actual measurements. The design flow rates were adopted for these major STW as shown in **Table D.15**.

Table D.15: Model Parameters for major STWs

STW	Flow	SS	BOD5	TKN	NH3-N	TP	Cu	E.coli	OrthoP	silica
	m^3/s	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	cfu /m^3	mg/L	mg/L
*Pillar Point STW[1,4]	6.46	240.00	360.00	50.00	40.00	7.00	0.03	2.00E+08	2.00	9.00
*San Wai STW[1,4]	2.85	240.00	360.00	50.00	40.00	7.00	0.03	2.00E+08	2.00	9.00
*Sham Tseng STW[1,4]	0.20	240.00	360.00	50.00	40.00	7.00	0.03	2.00E+08	2.00	9.00
*Siu Ho Wan STW[1,4]	2.08	240.00	360.00	50.00	40.00	7.00	0.03	2.00E+08	2.00	9.00
*SCISTW [1,4]	28.36	114.00	170.00	50.00	40.00	7.00	0.03	2.00E+09	2.00	9.00
*Yuen Long STW[1,3,4]	3.47	60.00	40.00	50.00	40.00	7.00	0.03	2.00E+08	2.00	9.00
*Shek Wu Hui STW[1,4]	1.08	60.00	40.00	24.00	4.00	7.00	0.03	1.00E+06	2.00	9.00
*BCFSTW[1,2]	0.02	30.00	20.00	10.00	40.00	7.00	0.03	1.00E+07	2.00	9.00

Source:

1. HATS Stage 2A EIA report (AEIAR-121/2008)
2. HKBCF EIA report (AEIAR-145/2009)
3. Effluent Polishing Scheme at Yuen Long Sewage Treatment Works Project Profile (PP-458/2012)
4. DSD Effluent Quality of Major Treatment Works, http://www.dsd.gov.hk/EN/Files/sewerage/our_sewage_treatment_facilities/effluent_quality_of_8_major_works/2013/DSD_8STW_effluent_Jun%2013.pdf

Note: * The maximum load parameter was adopted for use if no information is available. An exception was the *E.coli* parameter, where the Siu Ho Wan STW discharge limit was adopted.

1.5 Point Source Pollution Loads

The pollution loads from typhoon shelters and marine culture zones used in this study are based on the HATS Stage 2A EIA, and are summarized in **Table D.16** and **Table D.17**. These pollution loads were included in the water quality model 2026 for cumulative assessment. Loading from beaches within the assessment area that would not be connected to the STW is also included in the water quality model 2026 and is summarized in **Table D.18**.

Table D.16: Pollution Flows and Loads from Typhoon Shelter

Typhoon Shelters	Flow	BOD	SS	Org-N	NH_3-N	*E.coli*	Cu	TP	OrthoP	Silicate
	m^3/d	g/d	g/d	g/d	g/d	no./d	g/d	g/d	g/d	g/d
Shau Kei Wan	149	41,670	39,686	3,473	4,961	4.27E+14	6	1,320	785	1,279
Sam Ka Tsuen	39	10,803	10,289	900	1,286	1.11E+13	2	342	204	332
Kwun Tong	22	6,055	5,766	505	721	6.20E+12	1	192	114	186
Causeway Bay	179	50,099	47,714	4,175	5,964	5.13E+13	8	1,586	944	1,538
Yau Ma Tei	184	51,643	49,183	4,304	6,148	5.29E+13	8	1,635	973	1,586
Rambler Channel	36	10,032	9,554	836	1,194	1.03E+13	2	318	189	308
Aberdeen	388	108,746	103,568	9,062	12,946	1.11E+14	17	3,444	2,050	3,339
Tuen Mun	138	38,643	36,803	3,220	4,600	3.96E+13	6	1,224	728	1,186
Cheung Chau	166	46,597	44,378	3,883	5,547	4.77E+13	7	1,476	878	1,431
Chai Wan	44	12,347	11,759	1,029	1,470	1.26E+13	2	391	233	379
To Kwa Wan	53	14,840	14,133	1,237	1,767	1.52E+13	2	470	280	456

Source: HATS Stage 2A EIA report (AEIAR-121/2008)

Table D.17: Pollution Flows and Loads from Marine Culture Zone

Typhoon Shelters	BOD	SS	Org-N	NH_3-N	TP	OrthoP
	g/d	g/d	g/d	g/d	g/d	g/d
Sham Wan	42,948	125,333	10,604	38,202	2,045	1,600
Kai Lung Wan	6,432	18,769	1,588	5,721	306	240
Ma Nam Wat	9,536	27,829	2,355	8,482	454	355
Po Toi O	9,084	26,510	2,243	8,080	432	339
Po Toi	33,579	97,990	8,291	29,868	1,599	1,251
Sok Kwu Wan	25,969	75,783	6,412	23,099	1,236	968
Lo Tik Wan	11,011	32,131	2,719	9,794	524	410
Ma Wan	50,939	148,650	12,577	45,310	2,425	1,898
Cheung Sha Wan	19,025	55,518	4,697	16,922	906	709
Tung Lung Chau	18,996	55,518	2,358	16,992	640	562

Source: HATS Stage 2A EIA report (AEIAR-121/2008)

Table D.18: Pollution Flows and Loads from Beaches

Gazetted Beach	Flow	BOD	SS	Org-N	NH_3-N	*E.coli*	TP	OrthoP
	m^3/d	g/d	g/d	g/d	g/d	no./d	g/d	g/d
Cheung Sha Lower	1	245	204	135	307	3.24E+12	70	42
Cheung Sha Upper	0	95	79	52	118	1.25E+12	27	16
Pui O	1	152	126	83	190	2.00E+12	43	26
Tong Fuk	1	188	156	103	234	2.48E+12	53	32
Tung Wan, Ma Wan	2	485	404	266	607	6.40E+12	138	82
Clear Water Bay 2nd	46	11,385	9,487	6,246	14,231	1.50E+14	3,240	1,928

Source: HATS Stage 2A EIA report (AEIAR-121/2008)

References

1. Drainage Service Department, *DSD Sewerage Manual*

2. Environmental Protection Department, *Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0)*, March 2005

3. Highways Department, *EIA Report (ref. EIA-173/2009) for Hong Kong Boundary Crossing Facilities*.

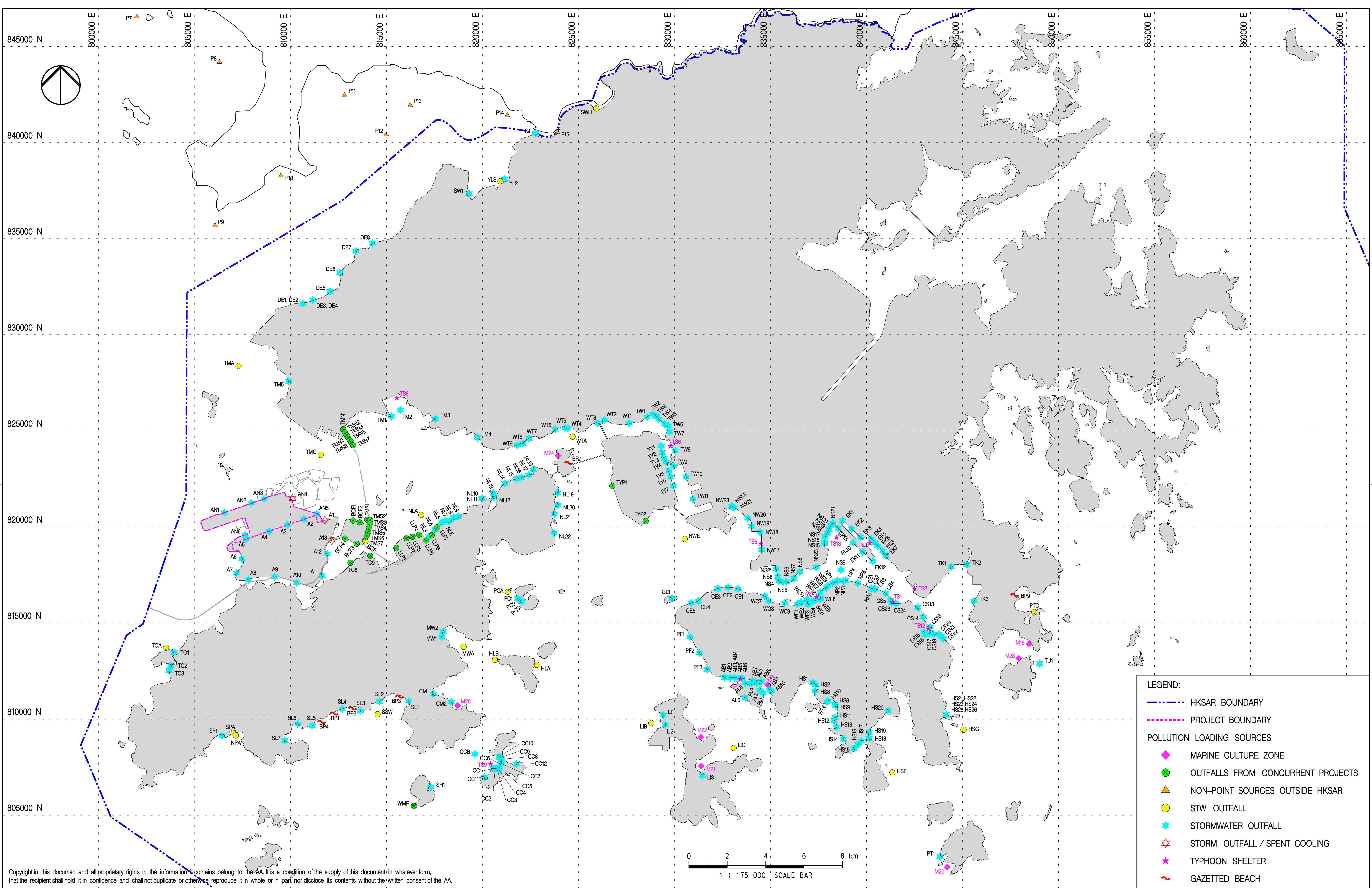
4. Highways Department, *EIA Report* (*ref. EIA-174/2009*) *for Tuen Mun - Chek Lap Kok Link*

5. Highways Department, *EIA Report (ref. EIA-172/2009*) *for Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road*

6. Drainage Service Department, *EIA Report (ref. EIA-148/2008*) *for Harbour Area Treatment Scheme (HATS) Stage 2A*

7. HKSAR Government website*, Administrative Map*

Figure D.1 Location of Pollution Loading Inventory Input Points



Copyright in this document and all proprietary rights in the information it contains belong to the AA. It is a condition of the supply of this document, in whatever form, that the recipient shall hold it in confidence and shall not duplicate or otherwise reproduce it in whole or in part, nor disclose its contents without the written consent of the AA.

Rev.	Date	Description	Checked
A	20JAN14	FIRST ISSUE	FK
B	28FEB14	GENERAL REVISION	FK

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

Airport Authority HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong Tel: (852) 2188 7111 Fax: (852) 2824 0717

Mott MacDonald
In association with

ARUP
Atkins China Limited
Clymene Enterprises

Deltares
Ecosystems Limited
SDA Marine Limited

Urbis Limited
URS Limited

Title

LOCATION OF POLLUTION INVENTORY LOADING INPUT POINTS

Consultant's Signatures for Approval		Date
Design	FK	20JAN14
Checkers	FK	20JAN14
Design Supervisor		
Authorised Representative		

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE–RUNWAY SYSTEM

Drawing No.

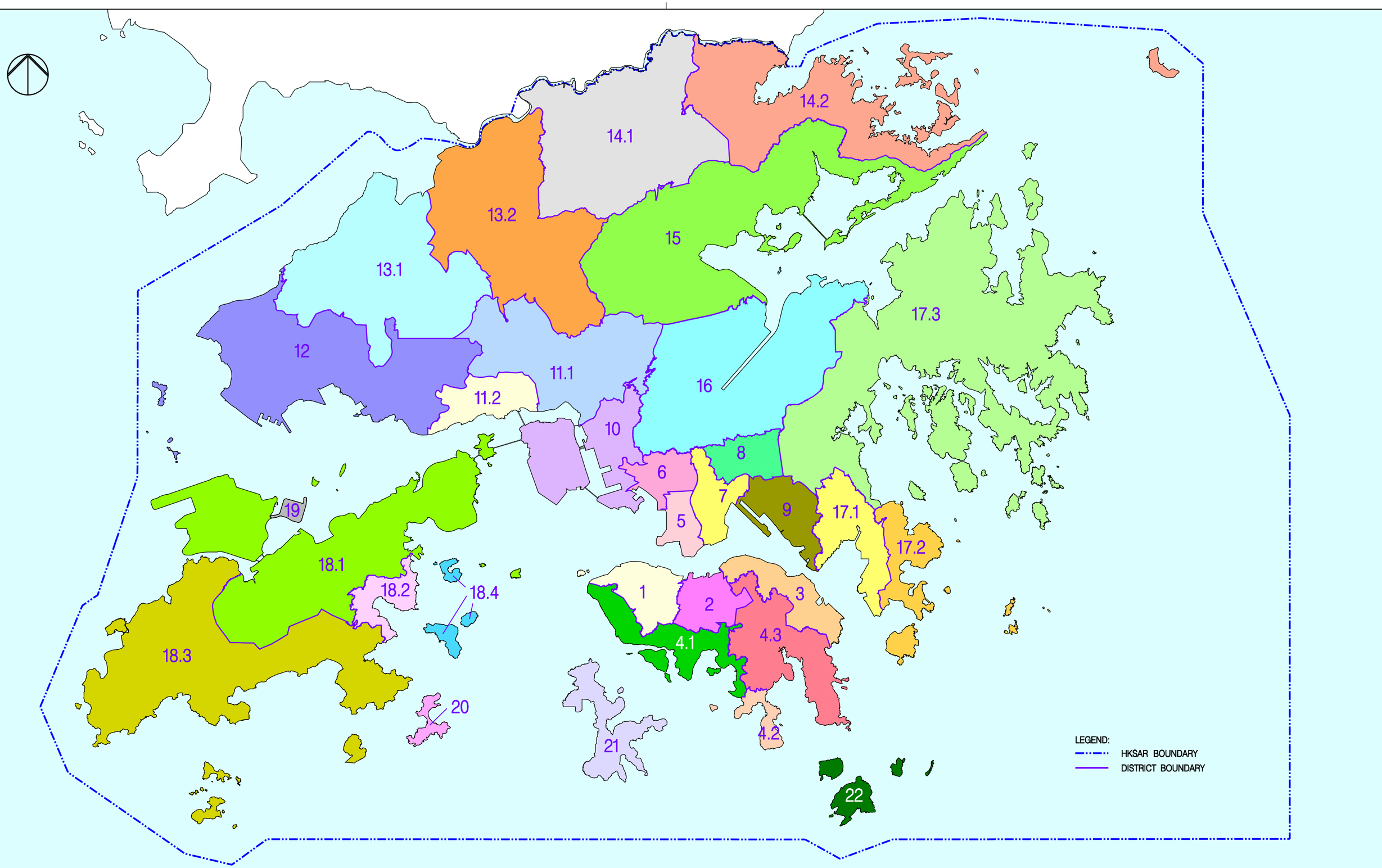
FIGURE D.1

Scale at A3
1 : 175000

Rev.
B

Filename: J:\308875\REPORT\ENV\EIA\140227\FIG D-1.dgn
User name: yim42169
Plote Date: 28/02/2014 Time: 11:40:31

Figure D.2 Sewage Catchment Boundaries



Copyright in this document and all proprietary rights in the information it contains belong to the AA. It is a condition of the supply of this document, in whatever form, that the recipient shall hold it in confidence and shall not duplicate or otherwise reproduce it in whole or in part, nor disclose its contents without the written consent of the AA.

Rev.	Date	Description	Checked
A	20JAN14	FIRST ISSUE	FK

香港國際機場 HONG KONG INTERNATIONAL AIRPORT
Airport Authority HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong
Tel : (852) 2188 7111 Fax : (852) 2824 0717

Mott MacDonald
In association with
ARUP
Atkins China Limited
Clymene Enterprises
Deltares
Ecosystems Limited
SDA Marine Limited
Urbis Limited
URS Limited

Title

SEWAGE CATCHMENT BOUNDARIES

Consultant's Signatures for Approval		Date
Design	FK	20JAN14
Checkers	FK	20JAN14
Design Supervisor		
Authorised Representative		

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. FIGURE D.2

Scale at A3 1:200000

Rev. A

Filename: J:\308875\REPORT\ENV\EIA\140106\FIG D-2.dgn

User name: yim42169

Plote Date: 20/01/2014 Time: 09:40:29