

## Appendix 5.3 Key Assumptions for Compiling Pollution Loading to Deep Bay WCZ from Unsewered Developments

This appendix summarizes the key assumptions adopted for estimating the sewage flow and loading (from unsewered population) generated in the areas to be redeveloped under this Project for the existing and likely future conditions (without this Project). Project areas that will not be disturbed / developed under the Project (e.g. green belt and existing “V” areas) are excluded in this loading estimation.

### Existing Condition (Without this Project)

The Enhanced 2011-based Territorial Population and Employment Data Matrices (TPEDM) are the latest projected population and employment data provided by Planning Department. The population breakdown by Planning Vision and Strategy (PVS) zones for Year 2016 available from the Enhanced 2011-based TPEDM was used to compile the pollution loads.

Based on the review of DSD’s Sewerage Records, the portion or percentage (%) of unsewered area within each PVS zone was identified. This percentage was then applied to the TPEDM data to identify the unsewered population number in each PVS zone. However, the layout of PVS zone is different from the areas to be developed under the Project. The unsewered population in the areas to be developed under the Project was estimated by overlaying the PVS zones on top of these areas. Pro-rata method was used to allocate the estimated unsewered population to these areas according to the share of the PVS zone area accounted by the areas to be developed under the Project. The resulted unsewered population is given in **Table A5.3-1** below. It should be highlighted that the unsewered population estimated in **Table A5.3-1** below is solely for EIA purpose to illustrate the likely magnitude of unsewered loading in the areas. The actual unsewered population could be deviated from those presented in **Table A5.3-1** subject to further studies and detailed surveys.

**Table A5.3-1 Estimation of 2016 Unsewered Population in Areas to be Developed under the Project**

	Land Usual Residents	Mobile Residents	Full-Time School Places	Total Employment	Total Employees in Commercial Sector <sup>(1)</sup>
Population	5,739	194	0	1,132	644

Note: Number of employees in Commercial Sector = S3+S4+S6+S7+S8+S9+S10+S11+S17+S18, where, S1-S19 refer to the 19 employment types as classified in TPEDM

Relevant per head flow and load was assigned to unsewered population to obtain the quantity and quality of total untreated wastewater. **Tables A5.3-2 and 5.3-3** below show the adopted flow and load factors.

**Table A5.3-2 Domestic Flow and Load Factors for Resident Population**

	Flow <sup>(1)</sup> (m <sup>3</sup> /d/head)	SS <sup>(2)</sup>	BOD <sup>(2)</sup>	TKN <sup>(2)</sup>	NH <sub>3</sub> -N <sup>(2)</sup>	TP <sup>(3)</sup>	<i>E.coli</i> <sup>(2)</sup>
		(all in g/d/head except <i>E.coli</i> in no./d/head)					
Land Usual Residents	0.23	40	42	8.5	5	1.33	4.3 x10 <sup>10</sup>
Mobile Residents	0.19						

Note: <sup>(1)</sup> Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005

<sup>(2)</sup> DSD Sewerage Manual

<sup>(3)</sup> EPD Update Study

**Table A5.3-3 Flow and Load Factors for Transient Population and Commercial Activities**

	Flow <sup>(1)</sup> (m <sup>3</sup> /d/employee)	SS <sup>(2)</sup>	BOD <sup>(2)</sup>	TKN <sup>(2)</sup>	NH <sub>3</sub> -N <sup>(2)</sup>	TP <sup>(3)</sup>	E.coli <sup>(2)</sup>
		(all in g/d/head except E.coli in no./d/head)					
Students	0.04	34	34	6.7	4	1.06	3.5 x10 <sup>10</sup>
Employed Population	0.08	34	34	6.7	4	1.06	3.5 x10 <sup>10</sup>
Electricity Gas & Water (S3)	0.25	25	53	2.5	0.8	0.53	
Transport, Storage & Communication (S8 & S11)	0.1	25	53	2.5	0.8	0.53	
Wholesale & Retail (S6 & S7)	0.2	25	53	2.5	0.8	0.53	
Construction (S4)	0.15	25	53	2.5	0.8	0.53	
Restaurants & Hotels (S9 & S10)	1.5	25	53	2.5	0.8	0.53	
Community, Social & Personal Services (S17 & S18)	0.2	25	53	2.5	0.8	0.53	

Note: <sup>(1)</sup> Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (Version 1.0), EPD, March 2005

<sup>(2)</sup> DSD Sewerage Manual

<sup>(3)</sup> EPD Update Study

Wastewater generated from the unsewered population would be discharged septic tanks and soakaway facilities. **Table A5.3-4** below show the typical removal efficiency of septic tanks. The typical efficiency was applied to the untreated wastewater to estimate the residual pollution loading from the unsewered areas to the Deep Bay water. Further load reduction due to the soakaway facilities is not considered in the loading estimation for conservative assessment. With consideration of the soakaway facilities, the actual loading to Deep Bay would be smaller than that estimated in this EIA.

**Table A5.3-4 Typical Removal Efficiency of Septic Tanks**

Loading Type	Removal Efficiency	
	Range	Typical
SS	66% - 75%	70%
BOD	40% - 52%	45%
Total N	20% - 29%	24%
E.coli	3 log - 4 log	3 log
	Increase in Concentration *	
Loading Type	Range	Typical
NH <sub>3</sub> -N	178% - 223%	200%

Information source: Table 6.8 of EIA Report EIA-190/2010 for "Liantang / Heung Yuen Wai Boundary Control Point and Associated Works"

[http://www.epd.gov.hk/eia/register/report/eiareport/eia\\_1902010/EIA/HTML/Ch%206%20Sewage/EIA\\_Ch6%20Sewage\\_html.htm#T08](http://www.epd.gov.hk/eia/register/report/eiareport/eia_1902010/EIA/HTML/Ch%206%20Sewage/EIA_Ch6%20Sewage_html.htm#T08)

\* The amount of NH<sub>3</sub>-N in the effluent of septic tank will be increased after the biological reactions within the septic tank but it will not exceed the amount of Total N in the effluent of septic tank as  
 TN = TKN + Nitrate N + Nitrite N; and  
 TKN = NH<sub>3</sub>-N + Organic N

#### Likely Future Condition (Without this Project)

Year 2036 is selected as the year horizon for estimation of the likely future loading to Deep Bay (without this Project). With reference to the fact sheets published in 2005 available from the website of the Census and Statistics Department, the overall population in Hong Kong grew at an average annual rate of 0.8% during the period from 2010 to 2014. This annual growth rate of 0.8% was applied to the existing Year 2016 sewage loading to Deep Bay (as discussed above) to project the likely future loading in Year 2036.