

Calculations for Cumulative Sediment Release

1. Sediment Loss from Concurrent Projects

Taking into account the worst case years to be modelled for the construction phase for this project, the following concurrent projects with potential contribution of sediment release have been identified and have been assessed for cumulative impacts during construction phase:

- Hong Kong-Zhuhai-Macao Bridge (HKZMB) Hong Kong Boundary Crossing Facilities (HKBCF);
- HKZMB Hong Kong Link Road (HKLR);
- New Contaminated Mud Marine Disposal Facility at Airport East / East Sha Chau Area;
- Lantau Logistics Park.
- Providing sufficient water depth at Kwai Tsing Container Basin;
- Maintenance Dredging for Tonggu Channel; and
- Outlying Islands Sewerage Stage 2 upgrading of Cheung Chau and Tai O sewage collection, Treatment and Disposal Facilities (Upgrading of Tai O Sewage Collection, Treatment and Disposal Facilities).

The programmes and activities for these concurrent projects have been reviewed, and are discussed in the subsequent sections of this appendix.

It is recognized that the Tung Chung New Town Extension is also a concurrent project located in close proximity to this project, however, based on communications with the project proponent in September and December 2013, there is insufficient information on construction plants and working methods available at this stage with which to base a quantitative assessment. Consequently, the potential contribution of sediment release from the Tung Chung New Town Extension cannot be incorporated into the cumulative impact assessment for the third runway project. It should be noted that construction of the Tung Chung New Town Extension is anticipated to commence in 2018, which is after substantial completion of the seawall for the third runway land formation (and is outside the periods of the worst case scenarios identified under this project). Given that the marine construction activities for the project from Year 2018 onwards would be substantially enclosed with only two small seawall openings remaining (as shown in **Appendix 8.4**) and mitigation measures applied (as indicated in Annex C of **Appendix 8.9**), the potential SS contribution from the third runway project to cumulative impacts in Year 2018 is unlikely to be significant.

A summary status of the concurrent projects for construction phase water quality assessment can be found in **Table B.1** below.



Table B.1: Status of Potential Concurrent Projects

Concurrent Project	Construction Schedule	Target Commencement of Operation Phase	Construction Phase Cumulative Impact	Information Source
HKZMB – Hong Kong Link Road	Under construction	By 2016	Sediment loss due to marine piling activities	Based on communication with project proponent in August 2013. Details referred from approved EIA Report
HKZMB – Hong Kong Boundary Crossing Facilities	Under construction	Ву 2016	Sediment loss due to reclamation	Based on communication with project proponent in August 2013. Details referred from approved EIA Report and latest VEP (<u>EP-353/2009/G</u>)
New Contaminated Mud Marine Disposal Facility at Airport East / East Sha Chau Area	Disposal of contaminated marine mud at South Brothers from mid 2013 to early 2016. Disposal of contaminated marine mud at CMP Vb to start after completion of filling at South Brothers	Capping of Va from early 2014 to late 2015. Capping of South Brothers to be completed by end 2016 / early 2017	Sediment loss due to marine disposal / capping activities	Updated information provided by project proponent in October 2013
Lantau Logistics Park Development	Not yet available	Not yet available	Sediment loss due to seawall construction	Information provided by project proponent in January and September 2013
Providing sufficient water depth at Kwai Tsing Container Basin	Scheduled to commence in end 2013	By 2016	Sediment loss due to dredging	Based on communication with project proponent in January 2013. Details referred from approved EIA Report
Outlying Islands Sewerage Stage 2 – upgrading of Cheung Chau and Tai O sewage collection, Treatment and Disposal Facilities (Upgrading of Tai O Sewage Collection, Treatment and Disposal Facilities)	Scheduled to commence in mid 2015 (Tai O marine works)	By 2019	Sediment loss due to dredging	Information provided by project proponent in August 2013



Concurrent Project	Construction Schedule	Target Commencement of Operation Phase	Construction Phase Cumulative Impact	Information Source
Maintenance Dredging for Tonggu Channel	Completed	In operation	Sediment loss due to dredging	Details referred from HKBCF EIA Report



Hong Kong – Zhuhai – Macao Bridge (HKZMB) Projects

Based on the original programme in the approved EIAs for HKBCF, HKLR and TM-CLKL, all marine works will be completed by early 2014. For the TM-CLKL project, the original programme as stated in the EIA appears to remain largely valid, consequently, the TM-CLKL would not constitute a concurrent project from a water quality perspective. However, the programme for HKBCF and HKLR has been significantly delayed due to the Judicial Review process. Subsequent communication with Highways Department in February 2013 identified that all marine works would be completed by 2016. A review of the original programme for marine works as stated in the approved EIAs (taking into account the delayed commencement date) suggests that all marine works would be completed by mid 2015. The HKBCF and HKLR projects are thus not expected to be concurrent with the third runway project in terms of marine works, Nevertheless, to allow for possible delays to the construction programme of HKBCF and HKLR project, it is assumed that concurrent construction of the last marine works item for each of these projects will coincide with the construction programme for the third runway project. The following construction activities were thus considered for cumulative water quality impact:

HKBCF

 Reclamation filling for Portion C2 behind a substantially completed seawall (300m gap retained for marine access)

HKLR

Dredging for piling and pile cap construction for Portion C

 Table B.2 summarises the sediment loss rates from HKBCF and HKLR incorporated into the sediment plume modelling.

	HKE	HKBCF			
Activity	Filling	Filling	Bored piling		
Plant	Hopper barge with grab dumping	Hopper barge	Grab dredger		
No. of Plant	2	1	35		
Working Rate (m3/day)	4,500	21,000	24		
Loss Rate (kg/m3)	5% of 25% fines	5% of 5% fines	1		
Reduction due to seawalls	80%	80%	-		
No. of Barge events per day	8	21	-		
Total Losses (kg/day) – all plant	42,750	17,640	836		
Material	Public fill	Sand fill	-		
Sediment Loss Rate (kg/s) - per event	0.37	0.31	4.15E-04		
Frequency	continuous	0.7 mins	Continuous		
Duration of each Operation	240 mins	45 mins	-		

Table B.2:	Summarv	of cumulative sediment loss rates modelled for HKBCF and HKLB
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Source: Environmental Review for Variation of EP for HKBCF (June 2010 and October 2012)





Figure B.1: Portion C2 of Hong Kong Boundary Crossing Facilities (HKBCF)



Note: other portions of marine works for the HKBCF are assumed to be completed and will not be assessed for cumulative impacts with the third runway project.





Figure B.2: Portion C of Hong Kong Link Road (HKLR)

Source: Highways Department, EIA Report for Hong Kong Link Road (AEIAR-144/2009)



Construction Phase of Concern

Note: other portions of marine works for the HKLR are assumed to be completed and will not be assessed for cumulative impacts with the third runway project.

For the Mainland sections of the HKZMB, artificial islands and an immersed tube tunnel will be constructed outside the HKSAR boundary. However, given that the construction activities are located outside the water quality study area boundary for the third runway project, and construction of the marine works for Mainland sections of the HKZMB are anticipated to be completed by end of 2014 (as stated in Appendix 9D5 of the HKBCF EIA), they are not considered to be concurrent activities with the third runway project, and hence will not be assessed for cumulative impacts.



New Contaminated Mud Marine Disposal Facility (MDF) at Airport East / East Sha Chau Area

Based on the programme obtained from CEDD in January 2013 and subsequent clarifications in March and August 2013, activities that are likely to coincide with the project will include capping of contaminated sediment at the CMP Pit 1 of the South of The Brothers site, and disposal of contaminated sediment at CMP Pit Vb at East Sha Chau. While capping of CMP Va may also occur at around the same time, it is understood that this is of low priority for CEDD, and would occur infrequently and at a much lower rate than the other activities, hence it is not considered to be a significant source of water quality impact. Based on this information, the concurrent activities incorporated into the worst case scenarios for this project are as follows:

Year 2016 – assumes that capping of CMP Pit 1 at South of The Brothers is underway, and disposal at CMP Pit Vb at East Sha Chau has commenced

Year 2017 – assumes that capping of CMP Pit 1 at South of The Brothers is still ongoing, and disposal at CMP Pit Vb at East Sha Chau is ongoing



Figure B.3: Disposal at CMP Vb (Pit B) at East Sha Chau

Source: Environmental Protection Department, Figure 1 of EP-312/2008/A



Construction Phase of Concern

Note: based on communication with CEDD, capping of Pit A is expected to be completed by late 2015. The implementation programme for Pit B depends on the completion of the filling activities at South of The Brothers, and it is assumed that disposal of contaminated mud at Pit B will coincide with construction phase for the third runway project. The programme for CMP Pit C and Pit D in the East of Sha Chau usable area are not yet available and will depend on the rate of contaminated mud disposal at Pit B. Given that it is unlikely that the remaining CMPs in the East Sha Chau area will become active at the same time that Pit B is being filled, the remaining CMPs are assumed to be inactive for the purpose of this study and are not included in the cumulative impact assessment.





Figure B.4: Capping of CMP Pit 1 at South of The Brothers

Source: Environmental Protection Department, Figure 1 of EP-427/2011/A



Construction Phase of Concern

Note: based on communication with CEDD, CMP Pit 2 will be filled first, and upon completion of disposal at Pit 2, disposal at Pit 1 will commence. As the current programme provided by CEDD is for Pit 2 to start receiving contaminated mud in mid 2013, and for disposal at South of The Brothers to be completed by early 2016, it is considered reasonable to assume that Pit 2 will be filled and capped before commencement of construction the third runway project. Therefore, only Pit 1 is considered to be active during construction phase for the third runway project, and will be assessed for cumulative sediment loss.

As specified in the Environmental Permit for the captioned project (EP-427/2011/A), both the backfilling and capping operations (individually) shall not exceed a disposal rate of 26,700 m³/day. Based on communication with CEDD, disposal / capping is carried out using barges with 650 m³ capacity. Assuming a dry density of materials of 750 kg/m³, and a loss rate to suspension from barge bottom dumping of 3 %, there would be 14,625 kg/s. For this cumulative assessment, it is assumed that the method for capping is the same as the method for disposal. **Table B.3** summarises the sediment loss rates from disposal / capping activities incorporated into the sediment plume modelling.



Daily Disposal / Capping Operations	Sediment Loss	No. of Events	Frequency	Total Loss	Duration	Water column distribution
	kg / event	per day	minutes	kg/day		
By Barge	14,625	41	34	599,625	instantaneous	evenly distributed

Table B.3: Summary of cumulative sediment loss rates modelled for disposal / capping at CMPs

Source: MDF EIA and communication with CEDD in October 2013

Lantau Logistics Park (LLP)

Based on the communication with the project proponent in September 2013, it is understood that there is no implementation programme available for this study at this stage. However, a feasibility study containing a preliminary construction sequence and marine plant inventory was prepared in 2008 for the LLP reclamation. According to the feasibility study, construction of the LLP will be carried out in stages as follows:

Stage I – dredging and construction of the new seawall and removal of rock armour at the existing seawall.

Stage II – installation of vertical drains and marine sand filling behind completed seawall (except for 100m width gap) followed by public filling to surcharge level at areas 1A and 1B. Sand blanket laying and vertical drain installation at area 1C.

Stage III – filling at area 1C and surcharge removal at areas 1A and 1B.

Stage IV – surcharge removal at area 1C.

Given that bulk filling will only commence in Stage II after completion of the seawall, with only a 100m wide marine access gap retained, the highest sediment loss will occur during Stage I, due to dredging and seawall construction. To account for the worst case whereby the LLP construction programme overlaps that of the third runway project, it is assumed that the LLP Stage I construction coincides with the Year 2016 and Year 2017 worst case scenarios for the third runway project.

The feasibility study proposed that the seawall construction will start from both eastern and western ends, with up to 2 grab dredgers and 1 pelican barge at each end. The sediment loss rates specified in the feasibility study is summarised in **Table B.4**.

Table B.4:	Summary of cu	mulative sediment	loss rates m	odelled for LLP
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Construction of Seawall	Dredging	Filling
No. Plant	4 Close Grab Dredgers	2 Pelican Barges
Working rate per plant	4,900 m ³ /day	800 m ³ /hr or 0.22 m ³ /s
Loss rate (kg/m ³)	17	10% of 10% fines
Density of fill material (kg/m ³)	-	1680
Operation time per day (hours)	12 (continuous)	12 (continuous) ¹
Peak factor	1.5	1
Sediment Loss Rate per plant (kg/s)	2.892	3.733
Efficiency of silt curtain	80% (cage type)	45% (double silt curtain)
Sediment Loss Rate after silt curtain per plant (kg/s)	0.578	2.053

Source: Lantau Logistics Park Development - Feasibility Study 2008

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Location of Filling



Note: 1. Assumes conveyor belt is adopted for sand transportation in pelican barge, therefore filling in continuous mode.



Figure B.5: Dredging and Filling at Lantau Logistics Park

Note: the feasibility study specified that the seawall construction will start from both eastern and western ends, and due to physical and site constraints, there would be a minumum distance of 200m between vessels. The four simultaneous dredging locations are thus located 'in advance of' the two filling locations by 200 m intervals, to represent the cumulative sediment loss in the water quality model.

Providing sufficient water depth at Kwai Tsing Container Basin (KTCB)

Based on the communication with the project proponent in January 2013, it is understood that the current programme for dredging works is for commencement in end 2013 for completion by 2016. To allow for possible delays in the programme, it is assumed that the same activities will be in place during the year 2017.

As specified in the Environmental Permit for the captioned project (EP-426/2011/A), a maximum of three closed grab dredgers (or one cutter suction dredger with two closed grab dredgers) can operate



simultaneously. Each grab dredger has a maximum dredging rate of 4,000 m³/day, while the cutter suction dredger (for removal of hard material at the north part of the project boundary) has a maximum dredging rate of 8,400 m³/day based on a twelve-hour-operation per day (with a maximum dredging rate of 700 m³ in 30 minutes in any given hour).

The actual working locations of the maximum three nos. of grab dredgers during 2016 is not yet known, as the construction sequence is subject to the future dredging contractor. To account for the worst case scenario relative to the WSRs for the third runway project, the three possible simultaneous dredging locations (within the confines of the various zones stated in the approved EIA) located nearest to the third runway project are chosen to represent the cumulative sediment loss in the water quality model. This is equivalent to Scenario 5 in the approved EIA. **Table B.5** summarises the sediment loss rates from KTCB incorporated into the sediment plume modelling.

Construction Information	Location A	Location B	Location C
Subzone to be modelled	Z2C3	Z8	Z12
Plant	Closed grab dredger	Closed grab dredger	Closed grab dredger
No. of Plant	1	1	1
Working Rate (m ³ /day)	2,750 (dry season) 4,000 (wet season)	4,000	4,000
Loss Rate (kg/m ³)	20	20	20
Sediment Loss Rate (kg/s)	0.99 (dry season) ¹ 1.44 (wet season)	1.44	1.44
Duration ²	20 hrs/day	20 hrs/day	20 hrs/day

Table B.5: Summary of cumulative sediment loss rates modelled for KTCB

Source: KTCB EIA and KTCB EP-426/2011/A

¹ Calculated on a 'pro-rata' basis relative to the sediment loss rate adopted for wet season.

² Based on a peak productivity of 25 grabs per hour and 8m³ per grab, the daily limit of 4,000 m³ would be reached in 20 hours.





Figure B.6: Dredging at Kwai Tsing Container Basin

Source: Civil Engineering and Development Department, EIA Report for Providing Sufficient Water Depth for Kwai Tsing Container Basin and its Approach Channel (AEIAR-156/2010)

Location of Construction Activity

Note: the three possible simultaneous dredging locations (within the confines of the various zones stated in the approved EIA) located nearest to the third runway project are chosen to represent the cumulative sediment loss in the water quality model.



Maintenance Dredging for Tonggu Channel

Information on the maintenance dredging requirements for the Tonggu Channel has been referred from the approved EIAs for HKBCF, HKLR and TM-CLKL. The Tonggu Channel has been divided into three zones. Zone I is only permitted to be dredged during flood tide, and Zone II is only permitted to be dredged during ebb tide. No restrictions on tidal conditions are imposed on Zone III. Maintenance dredging is expected to take place for a period of not more than 12 weeks each year, and up to two TSHDs will operate simultaneously.

Figure B.7: Maintenance Dredging for Tonggu Channel



Source: Highways Department, EIA Report for Hong Kong Boundary Crossing Facility (AEIAR-145/2009)

Location of Construction Activity

Note: the location of the construction activity is assumed based on nearest distance to the third runway project.



 Table B.6 summarises the sediment loss rates to be incorporated into the sediment plume modelling.

Table B.6:Summary of cumulative sediment loss rates modelled for Maintenance Dredging for Tonggu Channel

Construction Information	Zone I	Zone II	Zone III
Plant	TSHD	TSHD	TSHD
No. of Plant	1 (flood tide only)	1 (ebb tide only)	1
Production Rate (m ³ /min)	125	125	104
Loss Rate (kg/m ³)	7	7	7 (first 55 mins) 15 (last 5 mins)
Sediment Loss Rate (kg/s)	14.6	14.6	12.1 (first 55 mins) 26.0 (last 5 mins)
Duration of Dredging (mins)	35	35	60
Intervals between dredging cycles (mins)	188	205	282

Source: HKBCF EIA

As adopted in the HKBCF EIA, it is assumed that dredging at all three Zones will be ongoing with dredging at Zones I and II alternating according to the tidal conditions. One flood tide dredging cycle is simulated for Zone I and two dredging cycles are simulated in each of Zones II (ebb tide only) and III on a daily basis (based on the required daily production rate for each zone as specified in the HKBCF EIA). Dredging locations nearest to the third runway project are selected.

Outlying Islands Sewerage Stage 2 - upgrading of Cheung Chau and Tai O sewage collection, Treatment and Disposal Facilities (Upgrading of Tai O Sewage Collection, Treatment and Disposal Facilities)

Based on communications with the project proponent in December 2012 and subsequent communications with their project consultant in August 2013, it is understood that the construction activities for the marine works will take place between 2015 and 2019. Construction of this project has thus been taken into account for both the Year 2016 and 2017 worst case scenarios under the third runway project.

A non-dredge method has been proposed for the reclamation of the sewage treatment works site, while a fully dredged method is required for construction of the twin 300 mm diameter submarine outfall of approx. 130 m in length. As communicated by the project consultant, the dredging works associated with construction of the submarine outfall represents a worst case sediment release scenario, as filling activities for the reclamation will be conducted behind an enclosed area / partially completed seawall. Dredging works for construction of the submarine outfall is based on one grab dredger operating at a rate of 500 m³/day for eight hours each day. A sediment loss of 20 kg/m³ is assumed for grab dredgers, which is consistent with past approved EIAs. **Table B.7** summarises the sediment loss rates incorporated into the sediment plume modelling.

Table B.7. Summary of cumulative sediment loss rates modelled for the submarine outrain						
Plant		Production Rate	Duration	Sediment Loss	Sediment Loss Rate	Water column distribution
		m³/day	per day	kg/m ³	kg/s	
Grab Dredge	er (x1)	500	8 hours	20	0.35	evenly distributed

Table B.7: Summary of cumulative sediment loss rates modelled for the submarine outfall

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Figure B.8: Dredging for Submarine Outfall Construction at Tai O



Source: Email communication with project consultant for Agreement No. CE 15/2010 dated August 2013

Location of Construction Activity

Note: the location of the construction activity is assumed based on nearest distance to the third runway project.