4-2-1

Section 12A Application No. Y/I-DB/2

To Amend Discovery Bay Outline Zoning Plan

For rezoning the permissible use from staff quarters to flats

At Area 6f, Discovery Bay

Response to Comments

October 2016

MASTERPLAN LIMITED
Planning and Development Advisors
領賢規劃顧問有限公司

Your Ref: Y/I-DB/2

26 October 2016

The Secretariat
Town Planning Board
15/F, North Point Government Offices
333 Java Road, North Point
Hong Kong

By Hand

Dear Sir,

Section 12A Application No.Y/I-DB/2
For rezoning the permissible use from staff quarters to flats at Area 6f, Discovery Bay
Response to Comments

I refer to the abovementioned application which is currently being processed, and the departmental comments on the application made available by District Planning Office on 25 and 28 July 2016.

In response to the departmental comments, please find the enclosure for your consideration. Specifically, we also supplement with the following information:

Revised Concept Plan

The Concept Plan has been revised to contain minor adjustments to the building disposition in relation to the access road to address departmental comments. The adjustments will not have significant impact on the findings in the original submission. Specifically, please find the photomontages for the revised scheme in **Annex H**, showing the negligible effect and that the previously submitted Visual Impact Assessment remains relevant.

Approach to the water supply and sewerage treatment

In addition to the response to Water Supplies Department and Environmental Protection Department in the enclosure, we hereby clarify the approach to the water supply and sewerage treatment for the proposed development at Area 6f below:

1. The applicant is ready and willing to provide a Water Treatment Plant to use the Discovery Bay reservoir fresh water, and an on-site Sewerage Treatment Plant where necessary. Technical assessments reports have been submitted to demonstrate the adequacy of this approach in terms of their capacity and their capability to meet the relevant standards. The applicant is familiar and experienced in this approach, which has been the case prior to the commissioning and connection to Siu Ho Wan facilities.

2. Water supply and sewerage treatment as fundamental infrastructure provision in Hong Kong is engineering matters that can be resolved. It is considered that technicalities of water supply and sewerage treatment for Area 6f should not prevent an approval for the rezoning application, as they are capable of being easily resolved.

3. There is a decommissioned Water Treatment Plant around the Discovery Bay reservoir, and suitable land area within Area 6f for an on-site Sewerage Treatment Plant. This application

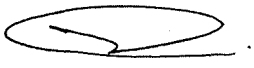
Room 3516B, 35/F, China Merchants Tower, Shun Tak Centre, 200 Connaught Road Central, Hong Kong.
Tel: (852) 2418 2880 Fax: (852) 2587 7068 Email: info@masterplan.com.hk

does not rely on the concurrent rezoning application at Area 10b. As such, it can standalone, and can be determined on its own merit.

4. As there are various on-going new developments at North Lantau and Airport, Water Supplies Department and Environmental Protection Department may consider for expansion of the Siu Ho Wan water and sewerage treatment facilities in order to provide extra water supply and sewage treatment capacity should the spare capacity for the current facility is not adequate. The Applicant believes that, should WSD and EPD plans for infrastructure expansion, all proposed future developments in the vicinity areas, including those in the Discovery Bay, should be considered on equal and fair basis. In addition, the proposal for Area 6f is moderate in scale, the demand on the overall Government infrastructure would be insignificant. Therefore, the Applicant requests WSD and EPD to take into account the proposed development should they consider for future expansion of the Sui Ho Wan facilities.

This information clarifies and supplements the application, and does not constitute a material change identified in Town Planning Board's Guideline No.32. It is consistent with the Guideline.

Yours faithfully,



Cynthia Chan
For and on behalf of
Masterplan Limited

Enc

cc. DPO/SKI (Attn: Helena Pang) Email
Client & Consultants

MASTERPLAN LIMITED
Room 3516B, 35/F, China Merchants Tower, Shun Tak Centre, 200 Connaught Road Central, Hong Kong.
Tel: (852) 2418 2880 Fax: (852) 2587 7068 Email: info@masterplan.com.hk

Section 12A Application No.Y/I-DB/2 for rezoning the permissible use from staff quarters to flats at Area 6f
Applicant's response to the departmental comments made available by District Planning Office on 25 and 28 July 2016

AFCD's comment	Applicant's response
According to the previous submission, 118 numbers of trees are proposed to be felled. It is noted from the FI that an extra 20 trees, i.e. 70 trees in total, would be planted as compensation due to limited planting space on site. The applicant should demonstrate efforts to achieve a 1:1 ratio in quantity of compensatory planting as far as practicable. In any event, the extent of tree felling should first be avoided/minimized as far as possible.	The Concept Plan has been revised to address departmental comments (**Annex A**). The proposed tree treatments and landscape area layout have also been adjusted as a result. The number of trees to be felled remains the same. The extent of tree felling has already been minimized and only the trees that will be affected by the proposed development footprint, proposed communal open space or construction works are proposed to be felled. However, in the revised Landscape Design Proposal, 148 nos. of compensatory trees will be planted within the proposed development site, as shown in **Annex B**.
DSD's comment	
Annex D, Environmental Study, Section 6.3.1.3 – Should the proposal of conveying sewage along Discovery Valley Road and Discovery Bay Road to Area 10b is adopted, please consult relevant departments/ parties for carrying out detailed traffic impact assessment as appropriate.	The option in conveying sewage to Area 10b is no longer exists. On-site sewage treatment plant with capacity of about 440m^3/day at Area 6f is proposed to achieve all statutory requirement for effluent standards. Section 6.3.1.2 has been updated as follows. "*...Therefore, it is proposed to build a small separate sewage treatment work within Area 6f. The design flow rate of the proposed sewage treatment work would be around 440 m^3 per day (i.e. based on a total population of 1,190 for Area 6f and each has a flow rate of 370L/day (ADWF) as per EPD's Technical Paper Report No. EPD/TP1/05-Guidelines for Estimating Sewage Infrastructure Planning (GESF)) and the treated effluent will be discharged to a gravity sewage pipe, which will be eventually discharged to the neighbouring marine waters without the need of a marine outfall. The peaking factor would be 8 according to table T5 of GESF. Therefore, during peak hour, the hourly flow rate would be approximately 40.8 L/s.*"
EPD's comment	**Applicant's response**
Please find below our noise, waste management, sewerage infrastructure and water quality comments on the relevant document (i.e. the R-t-C and the revised Environmental Study where applicable) in the FI. Please ask the applicant to revise the ES (and other submissions where appropriate), in particular on water quality related chapters, and submit an adequately rectified version for our vetting. Our comments on the air quality part will be provided to you once available.	Noted. The ES incorporating the revisions addressing Government Departmental comments is provided in **Annex C**, with amendments highlighted. Paragraph 6.2 ii and iii of the Planning Statement have been revised to read as follow and replacement provided in **Annex D**. *ii EPD advised in May 2015 that the design capacity of the SHWSTW has been allocated for the treatment of the sewage arising from the development of the Expansion of Hong Kong International Airport into a Three Runway System, the new town development under Tung Chung New Town Expansion and the Penny's Bay Phase 2 development, etc. Therefore, SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development and the Sewerage Authority has no plan to increase the design capacity of the SHWSTW in the short and medium terms* *iii Provision of a new STW at Area 6f is proposed to cater for the additional flow generated from the potential development at Area 6f.* *The Applicant believes that, should WSD and EPD plan for infrastructure expansion, all proposed future developments in the vicinity areas, including those in the Discovery Bay, should be considered on equal and fair basis. In addition, the proposal for Area 6f is moderate in scale, the demand on the overall Government infrastructure would be insignificant. Therefore, the Applicant requests WSD and EPD to take into account the proposed development should they consider for future expansion of the Sui Ho Wan facilities.*
A. Water Quality	
General	
1. The consultants stated that the purpose of these Environmental Study (ES) Reports are to demonstrate land use compatibility of the proposed development. We would like to add that, in order to support the subject rezoning, the reports should provide necessary information, findings and conclusions so as to demonstrate the acceptability of the proposed development from environmental planning point of view. The water quality assessment in the current ES reports is inadequate to meet our requirements for the reasons as detailed in comments.	Noted. A supplementary water quality assessment has been conducted and the results have been included in **Section 6.3.1.4** and **6.3.1.5** of Environmental Study (ES) Report as follows. In addition, a Technical Note on water quality has been provided in **Annex E** of this response submission. "*...According to the preliminary water quality impact assessment conducted for the proposed sewage treatment works in Area 6f (see **Annex E** of this response submission), the effluent discharge standards from the sewage treatment works could meet the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) for Inland Waters.* *In addition, the preliminary water quality impact assessment indicates that the water quality in the vicinity of the marine-based WSRs would be in compliance with Water Quality Objectives (WQOs) in suspended solid, E. coli and unionised ammonia. Although exceedance of Total Inorganic Nitrogen (TIN) under WQO is observed, the contribution of the high TIN level is due to the background from Pearl River estuary. The computed N:P ratio concluded that the possibility of having red tide is still low. Any emergency discharge can be readily mitigated by implementing suitable standby measures and back-up retention facilities to be developed during detailed design stage.*"
2. Also, it was found that there are too many sections in the ES reports stating the various assessment would be required in the subsequent statutory EIA, in particular in the water quality chapter. The need to carry out an EIA under EIAO should NOT be regarded as a reason for us to support the rezoning application without adequate assessment. Please remove such misleading statements in the ES reports. As an alternative, please use a new section to summarize the EIAO implication of the proposed development.	Area 6f would not constitute a DP. For Area 10b, it is under separate submission and a section summarizing EIAO implication will be provided separately.
Specific Comments	
3. The consultants should carry out a preliminary assessment to identify the potential water quality impacts of the proposed developments (e.g. possible extent, duration and environmental effects on the nearby water sensitive receivers, particularly any ecologically sensitive receivers and the marina nearby) and elaborate on specific mitigation measures in sufficient details, particularly the proposed new sewage treatment plant and the outfall during operational phase so as to demonstrate that such measures are effective and technically feasible to mitigate the impact. The technical viability and implication of the proposed mitigation measures should also be elaborated.	As discussed in **Section 6.3.1.2**, a new STW will be established to receive and treat the sewage generated from the additional population from Area 6f. The maximum daily sewage flow rate is approximately 440 m^3/day. The project proponent will be responsible for the design, operation and maintenance of the STW and the effluent treatment level can be designed to any necessary standards so as to comply with the requirements in WPCO (marine water and inland water) and TM-EIAO where applicable. For example, the treatment level could be designed for nitrogen removal and disinfection as necessary. The treated effluent would be discharged to a gravity sewage pipe, leading to sea near Discovery Bay Plaza and it is away from the Fish Culture Zones at Ma Wan and Cheung Sha Wan located at 6.5km and 6km away respectively and hence are not adversely affected. A supplementary water quality assessment has been conducted and the results has been included in the **Section 6.3.1.4** and **6.3.1.5** of the Environmental Study (ES) Report. A Technical Note on water quality is provided in **Annex E** of this response submission. It addresses other WSRs include the Tai Pak Wan Beach and Tai Pak Tsui Peninsula CPA has been included as well.

4. <u>Executive Summary (Water Quality), S2.1.1.4, S6.4.1.1 and S8.1.2.1</u> The statement (indicating that sewage generated during operational phase will be conveyed to a sewage system) does not tally with the description in the revised statement in S6.3.1.1 (indicating that the sewage generated from the proposed project would not be conveyed to the SHWSTW). Please amend to read "... comply with the relevant standards for effluent discharge for inland waters or inshore waters ...".	Noted. Relevant text has been amended accordingly. **Executive Summary (Water Quality)** "*...Sewerage generated during operational phase will be treated in a small on-site sewage treatment work that complying with the relevant standards for effluent discharge for inland waters and inshore waters accordingly. The treated effluent would then be discharged into a gravity sewage pipe, leading to sea near Discovery Bay Plaza....*" **Section 2.1.1.4** "*...For sewerage system, as discussed in the Study on Sewerage Systems accompanying this planning application, the sewage would be treated by a small on-site sewage treatment works (~440m^3/day) and the treated effluent will be discharged into a gravity sewage pipe, leading to the sea near Discovery Bay Plaza, without the need for a marine outfall. A discharge license will be obtained under the EPCO prior to discharge of the treated effluent...*" **Section 6.4.1.1** "*...During operational phase, sewage generated will be treated in a small on-site sewage treatment work, which designed to comply with the relevant standards for effluent discharge for inland waters and inshore waters accordingly...*" **Section 8.1.2.1** "*...Sewage generated during operational phase will be treated in a small on-site sewage treatment work, which designed to comply with the relevant standards for effluent discharge in inland waters and inshore waters accordingly. The treated effluent will be discharged into a gravity sewage pipe, leading to the sea near Discovery Bay Plaza. According to the results from the supplementary water quality assessment, most of the pollution concentrations would comply with relevant criteria. For TIN, the background concentration has exceeded the WQO already. The discharge concentration has therefore been reduced as much as practicable to ensure that the increase in TIN and TP are minimised. With the discharge standard, the N to P ratio is maintained greater than 15:1. Hence the occurrence of red tides will be unlikely. Apart from that, a discharge license will be obtained under the WPCO prior to discharge of the treated effluent....*"
5. <u>S2.2.1.1</u> Please provide details on the construction methods for laying the new sewerage works and the new marine outfall and assess the potential water quality impacts of the foregoing works together with the appropriate mitigation measures in relevant sections.	The sewerage works will be constructed by typical open-cut approaches, i.e. excavating down to designed depth, following by installation of pipework and then back filling. Good site practices such as perimeter cut-off strains, earth bunds can remediate any water quality from these land based activity. The current option with a proposed STW at Area 6f and the sewage will be discharged to *a gravity sewage pipe* without a new marine outfall. Hence, construction of a new marine outfall is not expected. **Section 2.2.1.1** has been updated as follows for clarification. "*...Sewage generated during operational phase will be treated in a small on-site sewage treatment work, which designed to comply with the relevant standards for effluent discharge in inland waters and inshore waters accordingly...*"
6. <u>S2.1.1.4, S6.3.1.2 and S6.3.1.3</u> The consultants proposed only one proposal for the discharge of treated effluent in S2.1.1.4 but there are 2 proposals proposed by the consultant in S6.3.1.2 and S6.3.1.3 respectively. Please clarify. For the proposal of conveying sewage from Area 6f to the proposed sewage treatment work in Area 10b, please review and clarify whether this option would constitute Schedule 2 Designated Projects under the EIAO.	Please refer to the responses for DSD's comment and EPD's comment (4).
7. <u>S6.3.1.2 and S6.3.1.3</u> Please provide details on the proposed new sewage treatment plant to demonstrate that the treated effluent would not result in water quality impact into the receiving waters of the study area, e.g. justification on the estimation of treatment capacity, the treatment technology to be adopted, proposed effluent standards, measures to prevent emergency bypass, etc. Please advise the capacity of sewage pumping station of both proposals.	According to the Study on Sewage System, the capacity of the new STW / sewage pumping station to be established, operated and maintained by the project proponent will be approximately 440 m^3/day. A suitable treatment level could be adopted as necessary, and where required, with nitrogen removal and disinfection capacity as well. The effluent standards will meet WPCO (marine water and inland water) and TM-EIAO as necessary. For contingency measures, an emergency overflow gravity sewer will convey the sewage from the STW during emergency condition to the existing sewage pumping station 1 (SPS1) at the junction of Discovery Bay Road and Discovery Valley Road and the SPS1 will further pump the sewage to existing Siu Ho Wan STW. **Section 6.3.1.2** has been updated as follows, whereas **Section 6.3.1.3** that referred to the dropped option of having a sewage treatment works in Area 10b has been deleted. "*...Therefore, it is proposed to build a small separate sewage treatment work within Area 6f. The design flow rate of the proposed sewage treatment work would be around 440 m^3 per day and the treated effluent will be discharged to a gravity sewage pipe, which will be eventually discharged to the neighbouring marine waters without the need of a marine outfall...*"
8. <u>S6.3.1.2</u> Please indicate the discharge location to the nullah and the neighbouring marine waters in relevant figure.	The sewage generated by Area 6f is now proposed to be discharged via gravity sewage pipe then to marine waters near Discovery Bay Plaza. The tentative pipe alignment and discharge location have been indicated in Figure 6.1. Moreover, the current tentative alignment for the gravity sewage pipe has considered the worst case scenario especially during dry seasons. During the subsequent detailed design, it is recommended to conduct further analysis to establish any base flow along the spillway and hence the feasibility of discharging the treated effluent into the nullah and box culvert directly.
9. <u>S2.1.1.4 and S8.1.2.1</u> Please add "A discharge license will be obtained under the WPCO prior to discharge".	Noted. The statement has been added to **Section 2.1.1.4** and **8.1.2.1.**

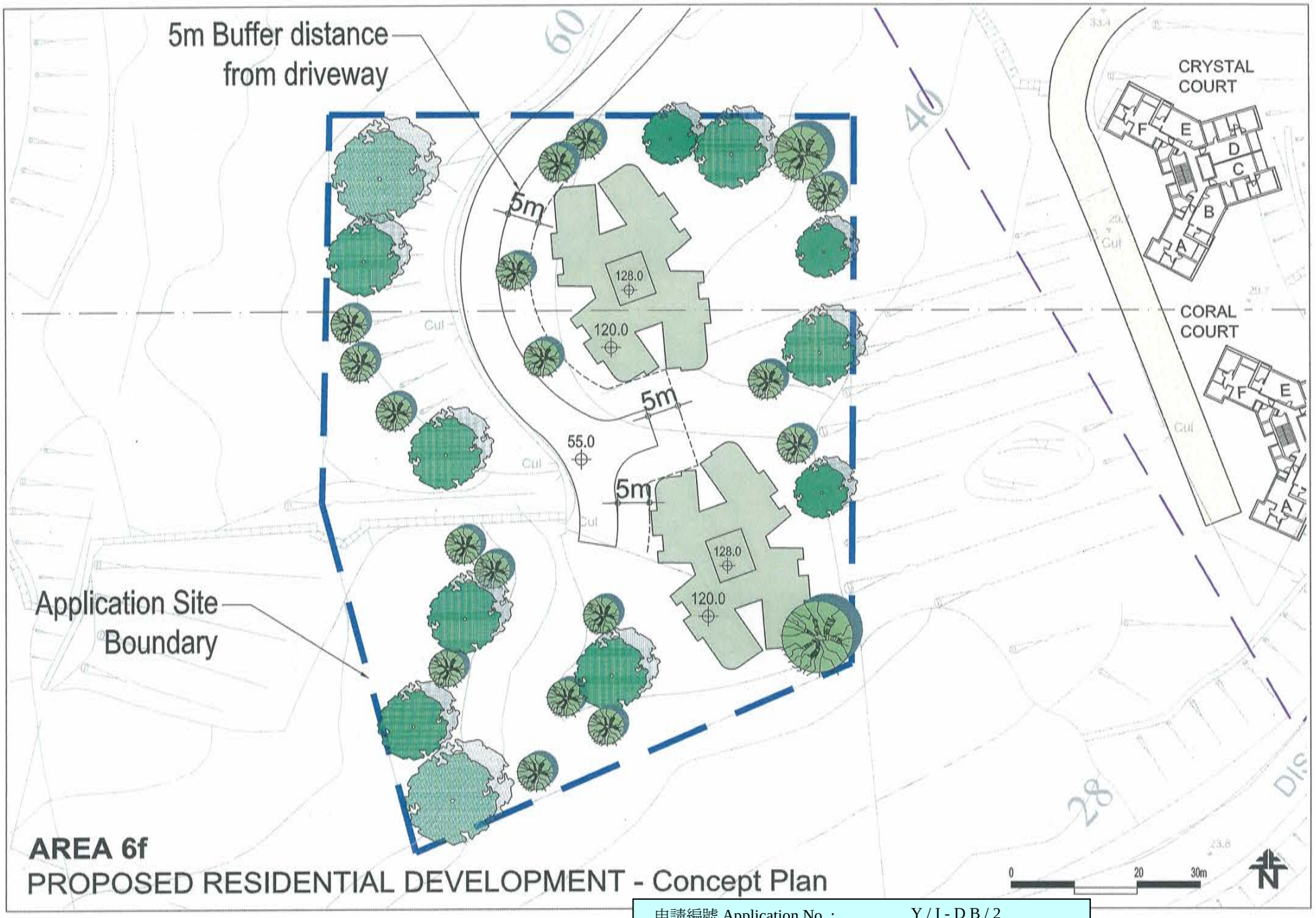
B. Waste Management	
To demonstrate that the waste generation due to the development is in a manageable scale with regular arrangement under the relevant regulations and requirements, the applicant should address the types of waste to be generated due to the proposal and their magnitude. The applicant should also clarify that they will fulfil the respective regulations and requirements.	Noted. A new section has been added to **Section 7.1** as follows to discuss the implication of waste management. "*...As mentioned in **Section 2**, the potential development at Area 6f of Discovery Bay include residential premises together with the necessary infrastructure and landscaping elements. A small sewage treatment work with daily capacity of around 440 m^3/day may also be required.* *Although the construction methodologies are yet to be developed in subsequent detail design stage, the construction and reclamation work will adopt an environmentally friendly approach. With the implementation of good site practices and waste reduction measures, the quantity of construction and demolition waste is estimated to be around 5,000 m^3...*" The applicant will fulfil the respective regulations and requirements.
C. Sewerage Infrastructure	
Please note that our previous comments are still valid. The applicant should provide adequate information and make adequate rectifications in the submission to address our comments.	Please refer to the above response to comment items (5), (6) and (7) on water quality.
D. Air Quality	
1. Rtc item c Please mark the internal access road on the map.	Noted. Internal access road has been marked on **Figure 4-1**.
2. Rtc item d and S4.2.2.4 If Parkvale Drive is a LD, please ensure that buffer distance requirement under HKPSG has been met. In the response, it mentioned that the residential premises will be located at least 5m above the ground level. Please be reminded that according to HKPSG the buffer distance should be the horizontal distance instead of vertical or slant distance. Please revise.	Noted. At least 5m buffer distance has been provided to ensure compliance of HKPSG's requirement, as shown in the revised Concept Plan in **Annex A** of this response submission.
3. Rtc item e Separation distance between ASRs and roads has not been marked on the map.	Noted. The separation distance between ASRs and roads has been provided on **Figure 4-1**.
4. Figure 4-1 Please clarify why there is buffer zone on one side of the road near A6f-01 and A6f-02 but not the other side of the same road.	Noted. The buffer zone has been added to **Figure 4-1**.
5. Rtc item g Please include the response into the report.	Noted: **Section 4.2.3.1** has been updated as follows. "*...Site surveys conducted in May and June 2014 revealed that there is no existing chimney within 500m assessment area. In consideration of there is no change of the existing environment and no major development within 500m assessment area, the finding of the site visits in 2014 are still considered valid. As such, it is concluded that no cumulative air quality impact from industrial emission is anticipated...*"
6. Rtc item h Please clarify if there will be any new STW. If yes, the potential air quality impact should be addressed.	A small STW will be installed for Area 6f. The STW will be accommodated in a dedicated plant room to be installed with sufficient odour removal measures, such as negative pressure system and activated carbon filter. Therefore, adverse odour impact is not anticipated.
7. S4.2.2.2 Please clarify the road type of Parkvale and discuss if sufficient buffer distance has been provided.	Parkvale is a local road. A 5m buffer distance is provided between the road and the proposed development. **Section 4.2.2.4** has been revised as follows for clarification. "*...For the new access road extended from Parkvale, similar to the Parkvale, due to the low traffic flow of the access road, adverse air quality impact is not anticipated. In addition, a 5m buffer is provided to the residential premises. Thus, the air quality impact to the residential premises could be further reduced...*"
8. S4.2.2.2 and S4.2.2.3 Please clarify how the separation distance is measured (e.g. 45m, 80m, etc.).	The separation distance has been shown in the **Figure 4-1.**
9. Regarding the calculation spreadsheet, the calculation of max. 8-hr RSP, which subsequently be used for heavy metal impact estimation from fireworks, was calculated as 1/8 of max. 1-hr RSP output from ISC model. Please clarify and provide justifications for adopting such method instead of using running average of 8 1-hr concentrations.	Since there is only 1 firework show last for less than 60 minutes per day, the heavy metal contribution of firework will be equal to 0 for other 23 hours. In addition, it is either 1 show or no show every 8 hour running period. Therefore, the maximum running 8 hour average will be equal to maximum 1 hour divided by 8. For example, assume the maximum contribution from firework = x_n, where n is the hour for firework display. As the firework show is started at 8pm, there are no shown before or after 7 hour of the show. Therefore, the maximum running 8-hour average $= \sum_{n=1}^{8} \frac{x_n}{8}$ $= \frac{(x+0+0+0+0+0+0+0)}{8}$ $= \frac{x}{8}$

LandsD's comment	Applicant's response
2. The application site falls on private lot known as Lot No. 385 R.P. in D.D. 352 & the Extensions thereto ("the Lot") and is held under New Grant No. 6122 as extended by three Extension Letters in 1979, 1980 and 1981 ("the New Grant"). Pursuant to S.C. (6) of the New Grant, the Lot shall be developed in accordance with the Master Plan ("MP") approved by the then Secretary for the New Territories (now being exercised by D of Lands) under lease.	Noted
3. According to the prevailing MP 6.0E7h(a) approved under S.C. (6) of the New Grant, Area 6f, having a gross site area of about 8,300 m^2, is designated as "Staff Quarters" with maximum Gross Building Area ("GBA") of 170m^2 and plot ratio ("PR") of 0.02.	Noted
4. The proposed residential development with maximum Gross Floor Area of 21,600m^2 and PR of 2.83 does not conform with the approved MP 6.0E7h(a).	A revised Master Plan will be submitted for Lands Department approval subsequent to this planning application approval.
5. The Applicant is required to provide various public recreation facilities in Discovery Bay under MP 6.0E7h(a), which includes hiking trails with a total length of 3,770m. It is noted that one of the existing hiking trails would be affected by the proposal and the Applicant shall revise their scheme to avoid affecting the existing hiking trail.	According to the demarcation plan of the Public Recreation Facilities ('PRF') – drawing no. PRF-001_C submitted to District Lands Office on 14 Jan 2016, the hiking trails designated as PRF do not encroach onto the application site. PRF demarcation plan overlaid with the application site boundary is provided in Figure 1 **in Annex F**.
6. The Principal Deed of Mutual Covenant ("PDMC") dated 30.9.1982 has notionally divided the Lot into 250,000 undivided shares. The Applicant shall prove that there are sufficient undivided shares retained by them for allocation to the proposed development.	This is commercially sensitive information. The applicant has responded to District Lands Office directly via HKR's letter to DLO dated 3 Aug 2016.
7. Area 6f is designated for staff quarters under the Section "Public Works" in the approved MP 6.0E7h(a). The Applicant is required to clarify if "staff quarters" in the approved MP 6.0E7h(a) forms part of either the "City Common Areas" or the "City Retained Areas" in the PDMC. Pursuant to Clause 7 under Section I of the PDMC, every Owner (as defined in the PDMC) has the right and liberty to go pass and repass over and along and use the "City Common Areas" for all purposes connected with the proper use and enjoyment of the same subject to the City Rules (as defined in the PDMC). The Applicant is required to substantiate its right / capacity to develop the application site without prejudicing the provisions in the PDMC.	Proposed staff quarters in Area 6f have never been built. The subject site is "City Retained Areas" as defined in the PDMC. In our response to comment item 6 above sent to District Lands Office direct, it is clearly demonstrated that the undivided shares of Area 6f are held by the applicant and have never been assigned to any other party. (Full set of all DMC, Sub-DMCs and Sub-sub-DMCs have been provided for District Lands Office's reference directly via HKR's letter to DLO dated 3 Aug 2016.). Therefore, the applicant is the sole land owner of Area 6f and has absolute right to develop the application site.
8. The Lot is subject to the height control restriction stipulated in the Deed of Restrictive Covenant dated 10.12.1999 entered into between the Government of the Hong Kong Special Administrative Region and Hong Kong International Theme Parks Limited ("DRC"). Any proposed development shall comply with the DRC. Detail examination will be conducted upon receipt of formal application (if any) with relevant site co-ordinates for revision of MP.	The proposed development at 128mPD complies with the DRC, as shown in Figure no. DRC-6f10b-001 in **Annex F** which permits up to 130mPD.
9. The existing fresh water and sewer main outside the subject lot boundary are covered by separate short term tenancies ("STTs"). It is revealed that the alignments of the fresh water and sewer main shown in the proposal slightly differ from our tenancy records.	Noted. The revised Figures are included in the revised Study on Drainage, Sewerage and Water Supply in **Annex G**.
10. The Audit Commission in 2004 recommended that the D of Lands should seek ExCo's endorsement before approving any major changes to the concept of a development if the concept has been approved by ExCo when approving the land grant.	Noted.
11. Should the Town Planning Board approve the re-zoning application and the proposed amendment to the OZP has successfully gone through the usual town planning procedures, then the owner of the application site will have to apply to Lands D for approval to amend the MP so as to implement the proposed development. Upon receipt of such application, Lands D will process the proposed approval according to the established practice and seek necessary approvals, including endorsement of ExCo if it is decided that the proposal would result in a change of the development concept of the Lot. The Applicant is required to prove that they are the legal owner of the application site and has the capacity to execute the approval letter with the Government. The proposed approval, if approved by Lands D acting in the capacity as the landlord at its discretion, will be subject to such terms and conditions, including payment of	Noted.

premium and administrative fee, as imposed by Lands D.	
WSD's comment	**Applicant's Response**
It is noted that the applicant did not address our concerns in the RtC. Our previous comments are still valid (recapped below): It is noted that this s12A application involving Area 6f is related to another s12A application involving Area 10b. This application for Area 6f proposes an addition of 476 flats (1,190 residents), while the application for Area 10b proposes an addition of 1125 flats (2,813 residents). Apparently, the applicant has adopted a figure of 2.5 persons per flat. Nevertheless, according to DLO's letter dated 11.9.2014 to HKRCL commenting on the proposed Discovery Bay Master Plan 7.0B, it was stated that "based on the latest information of 2011 Census, the average household size is 2.7 in Discovery Bay. The applicant should justify the assumption of 2.5 persons per flat in this case. This issue needs to be addressed, as the household size affects the population figure and thus the estimation of demands on infrastructure. If the average household size is 2.7, even the 10,000 flats previously proposed in the draft Discovery Bay Master Plan 7.0E (developer's another submission) will mean a population of 27,000, which will already exceed the maximum population of 25,000 in the Discovery Bay OZP. It should be noted that the existing water supply system is based on a maximum population of 25000 in Discovery Bay, which is the population ceiling in the approved OZP in force. In Table 6.6 of the applicant's Planning Statement (Jan 2016), it is obvious that the applicant's intention is to exceed the 25,000 population by an addition of 403 persons (1,190 in this application + 2,813 in another application), and the water demand by an addition of 1722 cu.m./day (512+1210). It is noted that the general planning intention of the approved OZP is for a total population of 25,000 persons for the Discovery Bay development, and infrastructural capacities were considerations. Whilst the applicant has proposed an alternative water supply arrangement to provide private water supply by using the raw water stored in the private Discovery bay Reservoir and building a private water treatment works to make a private water supply exclusively to the additional 4,000 persons in their rezoning areas, we have reservation on the rationality of this arrangement in the context of public perception, water quality control, etc. considering that the existing and planned residents (25,000) in Discovery bay are provided with WSDs fresh water supply. The applicant is required to submit further information on this alternative water supply arrangement for consideration.	According to City Management's latest record (property management company of all Discovery Bay residential units), there are about 19,585 persons living in 8,326 units, equivalent to 2.35 persons per unit. It covers all the residential units and is therefore complete and accurate. In contrary, Government census surveyed only occupied units with occupants responding to census staff that is about 4,000+ units. The Working Group on Population Distribution Projections indicate an average 2.2 persons per domestic household for Discovery Bay (and the surrounding area, in Tertiary Planning Units 932 and 934) for 2013-2021. Development under the approved Master Plan 6.0E7h(a) is for 8,731 residential units. OZP only states maximum population for 25,000 persons. The number of household was not mentioned although it is understood that the rationale is to allow for maximum 10,000 nos of residential units i.e. 2.5 persons per unit. Accordingly, the proposed Concept Plans at Area 6f and Area 10b creating about 1,601 units for 4,003 persons in total, equivalent to 2.5 persons per unit is considered reasonable. The water quality control standard for the proposed local water treatment works (WTW) adopts the same standard as the WSD's WTW. This will control the water quality provided from the local WTW to the same quality as from the WSD's fresh water supply. Potable water in Discovery Bay had been sourced from Discovery Bay reservoir and filtration plant for about 20 years before year 2000. Discovery Bay residents were used to this arrangement and there was never any concern raised on water quality. Hence it is not anticipated to be perception concern if some villages have potable water supply sourced from WSD's WTW while others from Discovery Bay reservoir. As there are various on-going new developments at North Lantau and Airport, Water Supplies Department and Environmental Protection Department may consider for expansion of the Siu Ho Wan water and sewerage treatment facilities in order to provide extra water supply and sewage treatment capacity should the spare capacity for the current facility is not adequate. The Applicant believes that, should WSD and EPD plans for infrastructure expansion, all proposed future developments in the vicinity areas, including those in the Discovery Bay, should be considered on equal and fair basis. In addition, the proposal for Area 6f is moderate in scale, the demand on the overall Government infrastructure would be insignificant. Therefore, the Applicant requests WSD and EPD to take into account the proposed development should they consider for future expansion of the Sui Ho Wan facilities. A revised Study on Drainage, Sewerage and Water Supply incorporating the above is provided in **Annex G**.

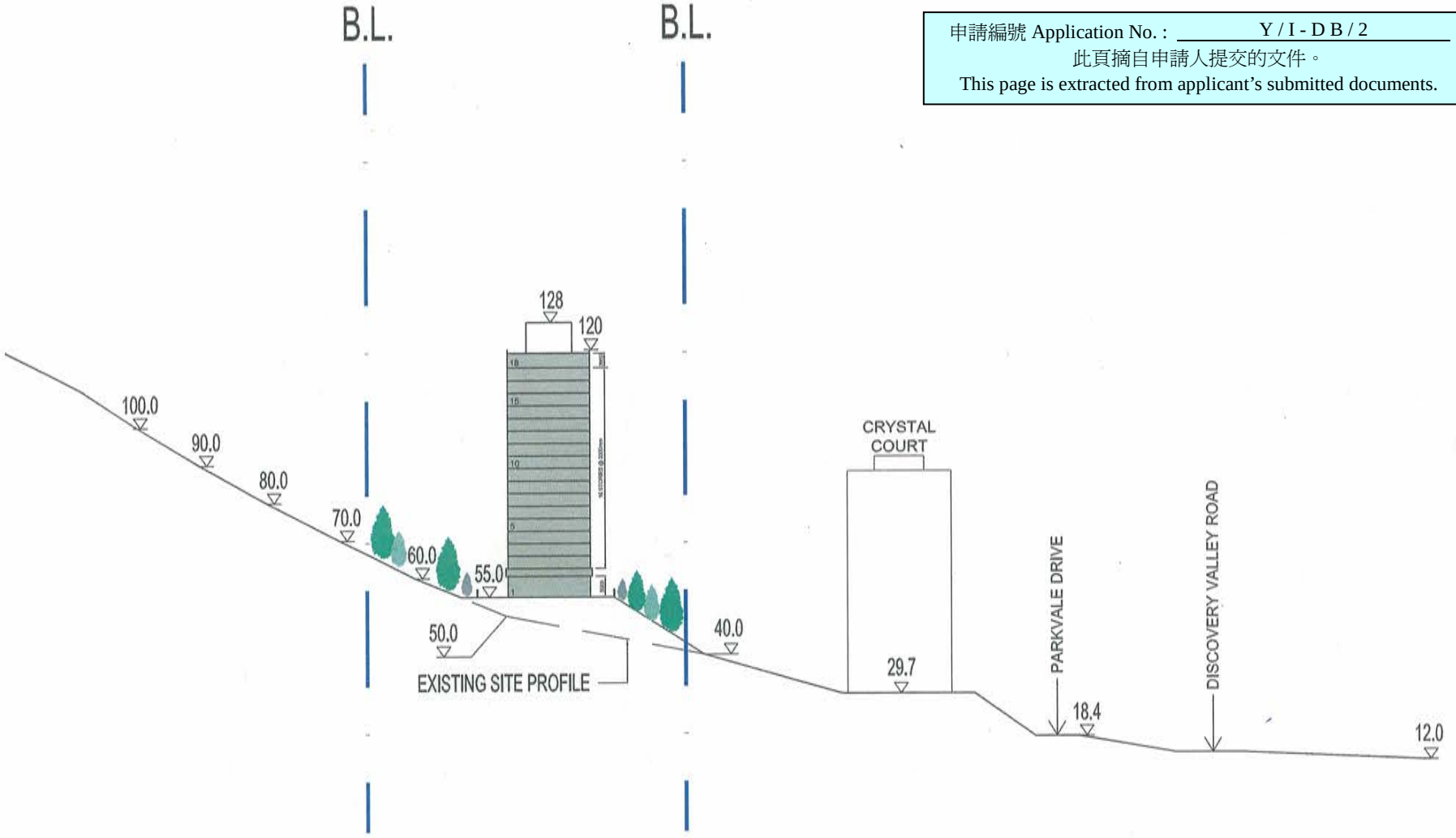
Annex A

Revised Concept Plan



AREA 6f

PROPOSED RESIDENTIAL DEVELOPMENT - Concept Plan



AREA 6f

PROPOSED RESIDENTIAL DEVELOPMENT

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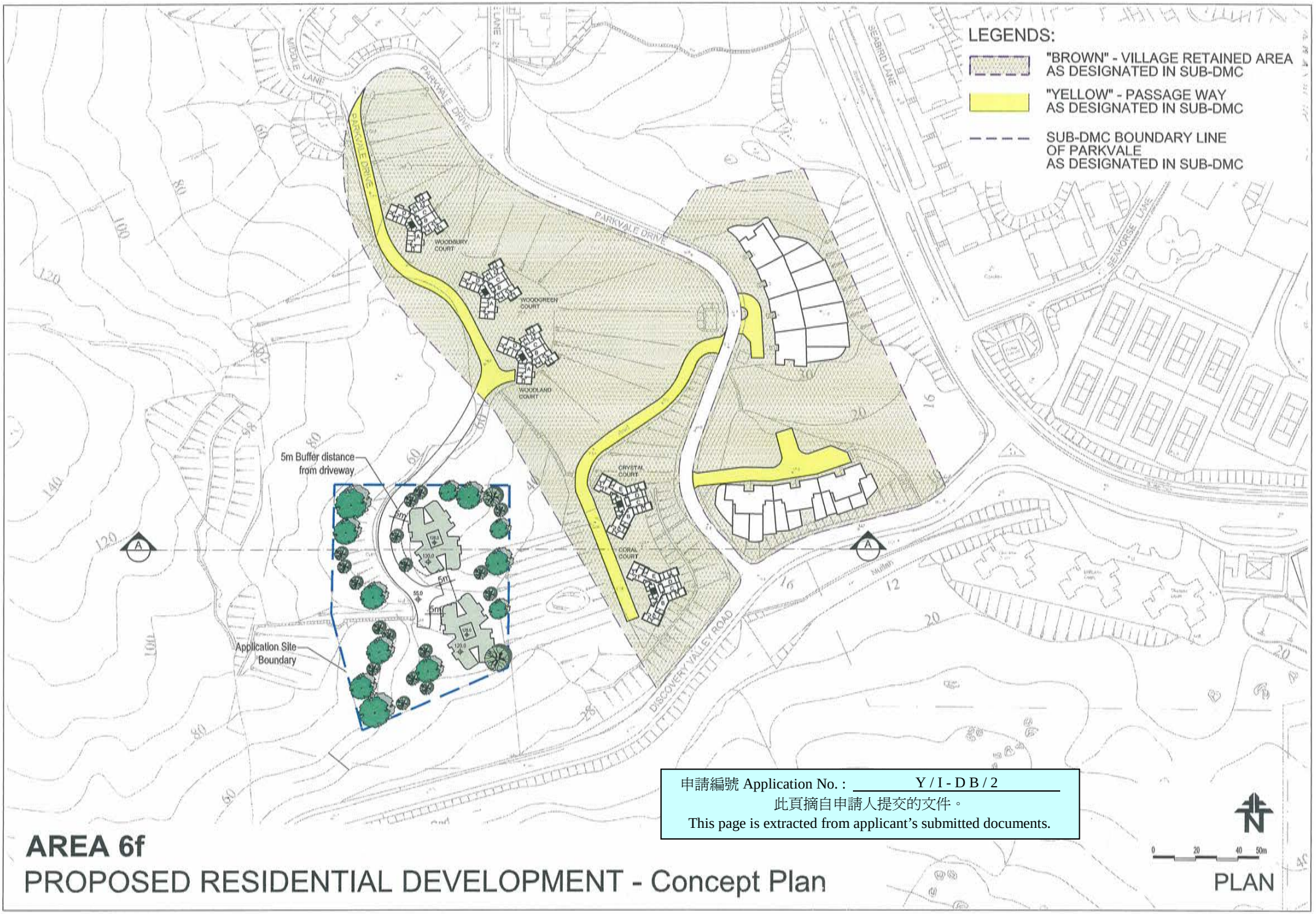
SECTION A-A


LEGENDS:
"BROWN" - VILLAGE RETAINED AREA AS DESIGNATED IN SUB-DMC
"YELLOW" - PASSAGE WAY AS DESIGNATED IN SUB-DMC
SUB-DMC BOUNDARY LINE OF PARKVALE AS DESIGNATED IN SUB-DMC
PARKVALE DRIVE
MIDDLE LANE
LANE 2
SEABIRD LANE
SEAHORSE LANE
WOODBURY COURT
WOODGREEN COURT
WOODLAND COURT
CRYSTAL COURT
CORAL COURT
DISCOVERY VALLEY ROAD
5m Buffer distance from driveway
Application Site Boundary
申請編號 Application No. : Y / I - D B / 2
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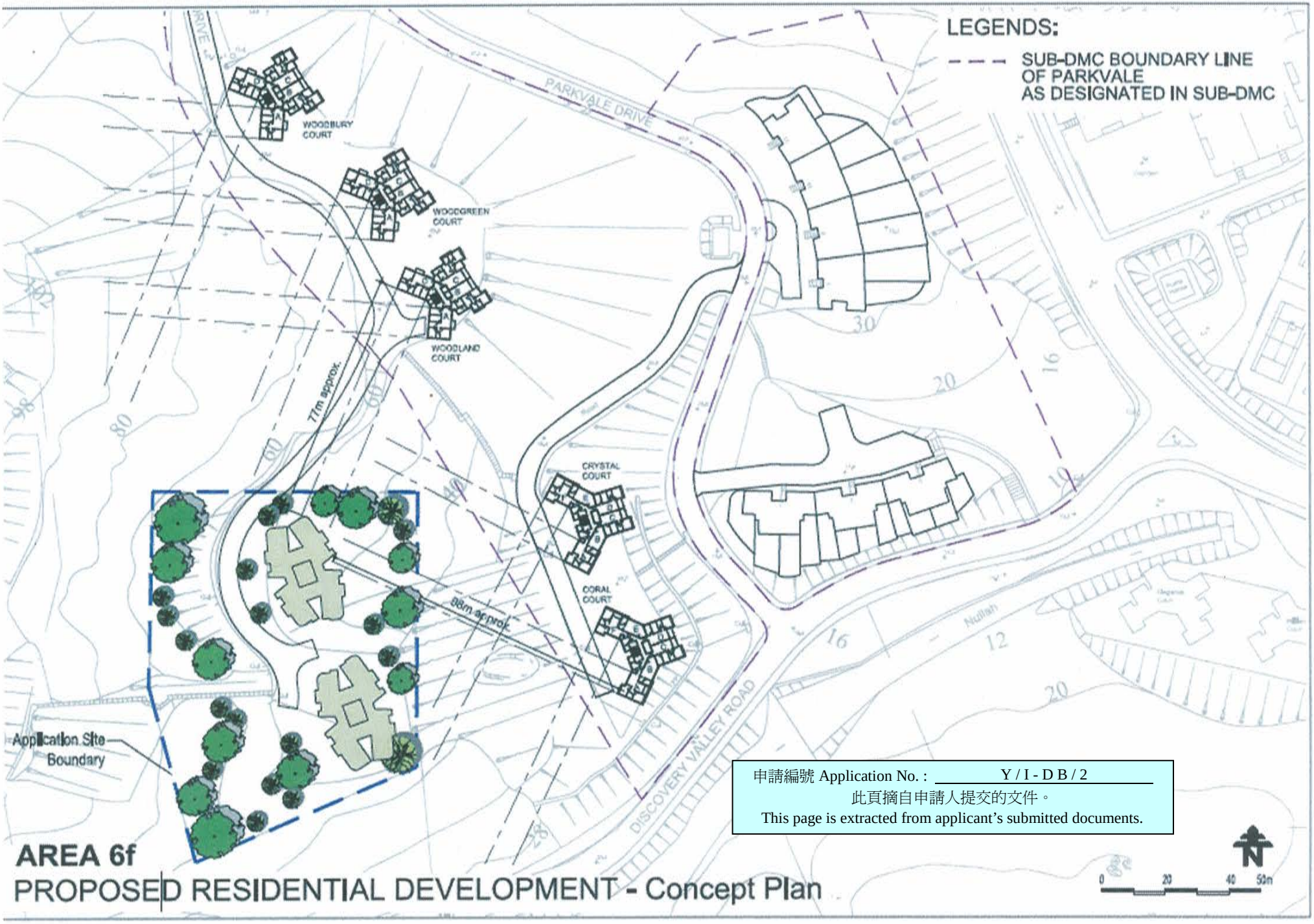
AREA 6f
PROPOSED RESIDENTIAL DEVELOPMENT - Concept Plan
PLAN



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Annex B

Revised Landscape Design Proposal (extract)

A.4.3 *Compensatory Planting Proposal*

Compensatory trees will consist of heavy-standard trees with a minimum size of 100mm DBH. Total aggregate girth of the **118** existing trees to be felled within this Application Site is **46.40m.** To compensate the number of trees felled by equivalent aggregate girth with heavy standard planting would require **148***no.* trees of **46.47m** aggregate girth. **148**nos. of compensatory trees will be planted within the proposed development boundary. Please refer to Figure B.1 Landscape Master Plan for the locations of the compensatory trees.

The tree species to be planted are outlined in the Landscape Design section later in this report.

A.5 LANDSCAPE DESIGN

A.5.1 The Landscape Design has been developed to:

(i) Create landscape spaces appropriate to the specific site conditions of the Proposed Development serving the future residents;
(ii) To ensure the landscape character is consistent with the overall design language and aesthetic of the architectural elements;
(iii) To ensure the Proposed Development is sensitively integrated into the surrounding areas via naturalistic interface treatments;
(iv) To minimise the visual impact of the Proposed Development through sensitive landscape treatment;
(v) To create suitable outdoor spaces for passive recreational activities; and
(vi) To promote the use of indigenous plant species throughout the landscape where possible to promote ecological diversity and sustainability; and
(vii) To introduce exotic ornamental species to feature areas as appropriate to enhance amenity.

A.5.2 General Concept Design

A.5.2.1 **Proposed Residential Development** - The general concept is to:

(i) Preserve as much existing vegetation on surrounding slopes as possible and plant disturbed or new slopes created due to site formation works with native or naturalised species in order to integrate the site with the surroundings;
(ii) Provide landscaped passive amenity spaces for the future residents around the base of the towers;
(iii) Create a welcoming entrance to the development from the extended Parkvale Drive.
(iv) The planting scheme for the entry areas will create an attractive landscape for the development while also blending it in with the surrounding area. Evergreen shrubs and tree species will be planted along the driveway leading up to the main entrance of the residential blocks. The main entry will be defined by feature paving and a row of ornamental trees and flowering shrubs, which then leads to an open plaza and a grand cascade water feature. Pedestrian walkways will be added to connect all the buildings along Parkvale Drive and within the Proposed Development. Two pocket gardens in front of the residential towers with ornamental planting and small plazas will provide areas for passive activities. The overall design of the residential landscape is to maximize greenery while providing designed spaces to facilitate different activities.

A.5.3 Major Landscape Elements [Refer to Landscape Master Plan shown in Annex B.1]

A.5.3.1 **Landscape at Main Access** – The vehicle access of the development will be an extension of the existing Parkvale Drive serving the residential towers to the north. Indigenous trees and ornamental shrub planting along the main entrance from Parkvale Drive will enhance the appearance of the slope to the west of the driveway. The access road will lead to a central entry court between the two towers. This will have feature paving, ornamental trees and flowering shrub planting.

A.5.3.2 **Recreational Facilities and Central Communal Garden** – Landscaped amenity spaces are sited on the

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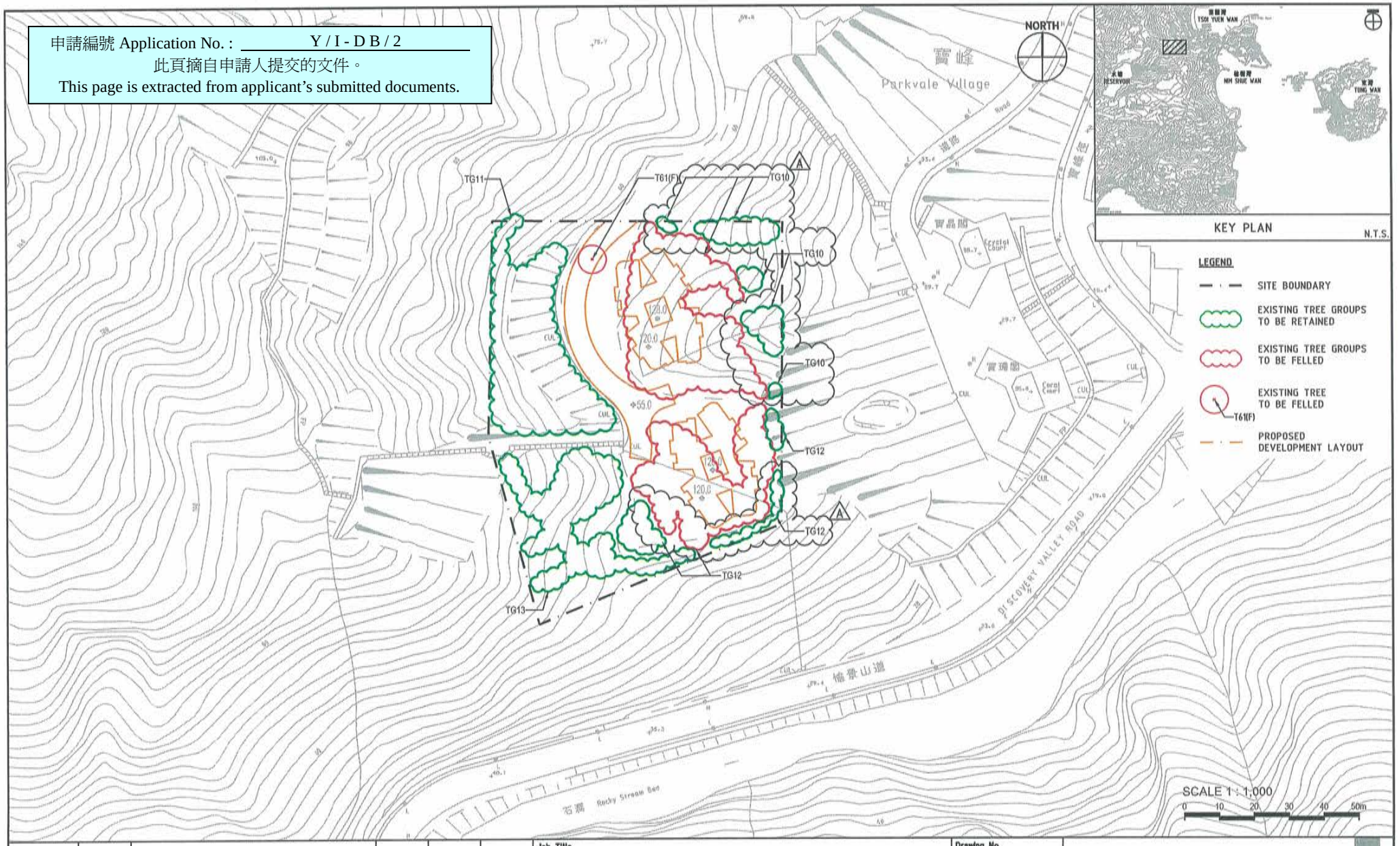

Revision	Date	Description	Drawn by	Checked by	Approved by
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Job Title: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F

Drawing Title: TREE TREATMENT PLAN

Drawing No.: PT30/6F/P/TS02

Scale: 1:1000 (A3)

Drawn by EI | Checked by DK | Approved by TO | Date NOV 2015 | Job. No. PT30

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8862

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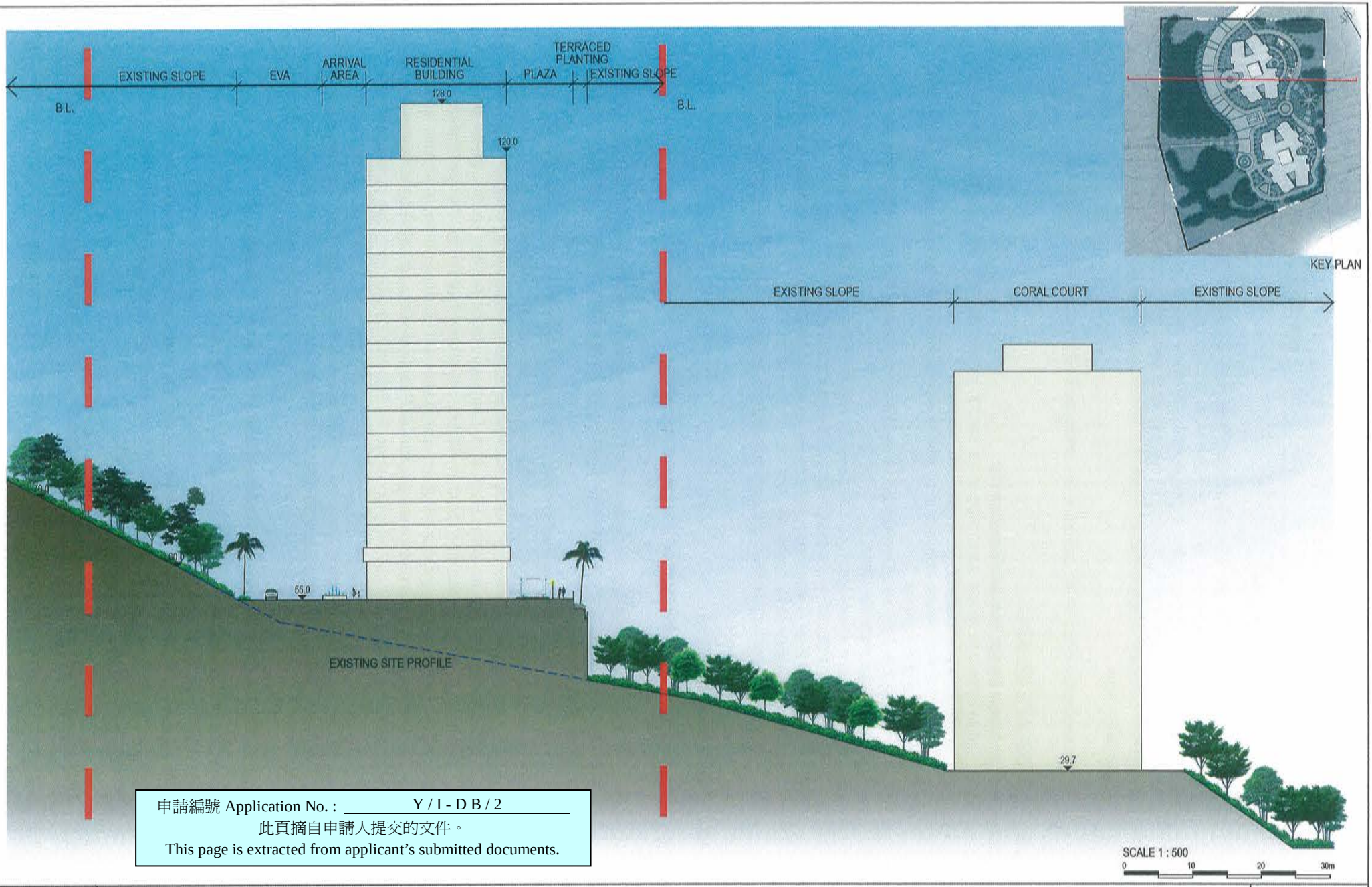
TITLE : **LANDSCAPE MASTER PLAN**

REV. B
OCTOBER 2016

FIGURE: **B.1**

PROJECT : DISCOVERY BAY OPTIMIZATION OF LAND USE - AREA 6F



申請編號 Application No. : Y / I - D B / 2

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TITLE :

SECTION A-A

REV. A
OCTOBER 2016

FIGURE:
B.2

PROJECT :

DISCOVERY BAY OPTIMIZATION OF LAND USE - AREA 6F

Annex C

Revised Environmental Study

Hong Kong Resort Company Limited

Optimization of Land Use in Discovery Bay

Environmental Study (Area 6f)

235928

Final | October 2016

Job number 235928

Ove Arup & Partners Ltd
Level 5 Festival Walk
80 Tat Chee Avenue
Kowloon Tong
Kowloon
Hong Kong
www.arup.com

ARUP

Document Verification

ARUP

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			Prepared by	Checked by	Approved by
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				Issue Document Verification with Document	✓

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Appendix 4.3
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Appendix 5.3
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Executive Summary

The Hong Kong Resort Company Limited (HKRCL) has been considering the feasibility of implementing additional development areas within the existing boundary of Discovery Bay to provide additional housing supply. A planning statement, titled "Optimisation of Land Use in Discovery Bay" was submitted to Planning Department (PlanD) in July 2013. A round of comments from various government departments was received on December 2013 (ref PlanD.'s letter ()L1/L/DBNC/352-17 dated 17 December 2013). Another round of submission was made on August 2014 and the corresponding set of comments was received from various government departments on December 2014 (ref PlanD.'s letter ()L1/L/DBNS/352-17(CR) dated 23 December 2014). Subsequently, another round of submission was made in March 2015 and comments were received from various government departments. In order to address those comments, the development proposal has been refined accordingly.

This Environmental Study only refers to Area 6f. The potential development area is included in the latest approved Discovery Bay Outline Zoning Plan as "Other Specified Uses (Staff Quarters)", despite the fact that some of their development parameters are proposed to be amended.

An Environmental Study for Area 6f has been conducted on the latest development proposal to demonstrate land use compatibility. The issues considered in this Environmental Study include noise, air quality, water quality, land contamination and ecology. Those relating to sewerage and drainage, and water supply are separately presented in another report.

Air Quality

All the relevant air emission sources in the vicinity that would have air quality impacts on the proposed developments have been identified and assessed. Key air emission source include the fireworks at Disney Theme Park. A literature review on best available information including Environmental Protection Department (EPD)'s publications, approved Environmental Impact Assessment (EIA) Reports and has been conducted to establish the emission strengths of these air emission sources. These emission strengths are then included in EPD's approved air quality dispersion models to simulate air quality impacts on both existing and planned air sensitive receivers. Results indicate that the predicted air quality impacts would not exceed the relevant Air Quality Objectives. At the same time, the separation distance between the road and the proposed development has fulfilled the requirement stipulated in the Hong Kong Planning and Standard

Guideline. Given that the relatively low traffic volume within Discovery Bay, the proposed land uses would not be subject to insurmountable air quality impacts. In case a small separate sewage treatment work is required, it will be designed to contain any odour that may be generated.

Noise

All the relevant noise sources in the vicinity that would have noise impacts on the proposed developments have been identified and assessed. The noise sources include the traffic along nearby road network and the firework at Disney Theme Park. Where practicable, noise measurements have been conducted to establish the noise caused by these noise sources. These measurement data is then used to assess the noise impacts on planned noise sensitive receivers, taking into account of a number of parameters including but not limited to the separation distance, operational schedule, screening effects etc. Results indicate that the predicted noise impacts would not exceed the relevant noise limits and hence the proposed land uses at Area 6f would not be subject to adverse noise impacts and hence mitigation measures are not required. In case a small separate sewage treatment work is required, sufficient noise attenuation measures shall be implemented to alleviate the noise generated from the operation to ensure compliance with the statutory noise requirements.

Water Quality

During the construction phase, site runoff and sewage can be readily alleviated by implementing good site practice. Sewerage generated during operational phase will be treated in a small on-site sewage treatment work that complying with the relevant standards for effluent discharge for inland waters and inshore waters accordingly. The treated effluent would then be discharged into a gravity sewage pipe, leading to sea near Discovery Bay Plaza. A water quality assessment has been conducted to demonstrate that most of the pollution concentrations would comply with relevant criteria. For Total Inorganic Nitrogen (TIN), the background concentration has exceeded the Water Quality Objective (WQO) already. The discharge concentration has therefore been reduced as much as practicable to ensure that the increase in TIN and Total Particulates (TP) are minimised. With the discharge standard, the Nitrogen (N) to Phosphorus (P) ratio is maintained greater than 18:1. Hence the occurrence of red tides will be unlikely. Nevertheless, a discharge licence will be obtained under the Water Pollution Control Ordinance (WPCO) prior to discharge of treated effluent.

Other aspects

Site inspection and review of historical photos have revealed that the area within the potential development area have low potential of land contamination. Also, adverse ecological impacts are not anticipated.

1 Introduction

1.1 Background

1.1.1.1 The Hong Kong Resort Company Limited (HKRCL) has been considering the feasibility of implementing additional development areas within the existing boundary of Discovery Bay to provide additional housing supply. A planning statement, titled "Optimization of Land Use in Discovery Bay" was submitted to Planning Department (PlanD) in July 2013. A round of comments from various government departments was received on December 2013 (ref PlanD.'s letter ()L1/L/DBNC/352-17 dated 17 December 2013).

1.1.1.2 Another round of submission was made on August 2014 and the corresponding set of comments was received from various government departments on December 2014 (ref PlanD.'s letter ()L1/L/DBNS/352-17(CR) dated 23 December 2014). Subsequently, another round of submission was made on March 2015 and comments were received from various government departments.

1.1.1.3 Ove Arup & Partners HK Ltd (Arup) has been appointed by HKRCL to conduct assessments to address those comments relating to environmental aspects including noise, air quality, water quality, land contamination, ecology, sewerage and drainage, and water supply.

1.1.1.4 This report addresses those comments relating to noise, air quality, water quality, land contamination and ecology for Area 6f. Those relating to sewerage and drainage, and water supply are separately presented in another report.

1.2 Key Objectives of this Environmental Study

1.2.1.1 This Environmental Study aims to address the key comments mentioned by various government departments, in support of a rezoning application for Area 6f to demonstrate land use compatibility. This key objectives for this Environmental Report are given below:

- Summarise the relevant regulations and regulations that are applicable;
- Establish the baseline environmental conditions;
- Identify the representative environmental sensitive receivers that may be affected by the proposed development;

- Present the assessment methodologies applicable to various environmental aspects;
- Summarise the key findings for those relevant environmental aspects; and
- Propose mitigation measures where needed.

2 Project Description

2.1 Land uses

2.1.1.1 The current land use for the area include "Other Specified Use (OU) (Staff Quarters)". Once the proposed development in the area is implemented, they would be changed from the current land uses to the proposed land uses of residential apartment buildings. The following table summarises both the current and proposed land uses for all the potential development area. **Figure 2-1** illustrates respective location of Area 6f.

Table 2.1: Current and proposed land uses

Area	Land uses	
	Existing [1]	**Proposed**
Area 6f	"OU (Staff quarters)"	Residential apartment buildings

[1] – As shown in OZP S/I-DB/4 - Discovery Bay

2.1.1.2 Area 6f is located west of Parkvale Village around Discovery Valley Road and Parkvale Drive. Site observation reveals that the site has partly been previously formed and cleared, and is mainly occupied by grassland. Within Area 6f, it is proposed to have residential buildings, together with the necessary infrastructure and landscaping elements.

2.1.1.3 The total site area for potential development area is about 0.83 ha and would accommodate a total of about 1,190 additional population.

2.1.1.4 The key elements for the development of Area 6f include the site formation work, access road, superstructure for buildings and various utilities. For sewerage system, as discussed in the Study on Sewerage Systems accompanying this planning application, the sewage would be treated by a small on-site sewage treatment works (~440m^3/day) and the treated effluent will be discharged into a gravity sewage pipe, leading to the sea near Discovery Bay Plaza, without the need for a marine outfall. A discharge licence will be obtained under the WPCO prior to discharge of the treated effluent.

2.1.1.5 For fresh water, it would either be supplied from Siu Ho Wan Water Treatment Work, or supplied from Discovery Bay Reservoir, in which case the previous treatment facilities would be re-commissioned.

2.2 Possible Construction Methodologies

2.2.1.1 The construction methodologies are yet to be developed in the subsequent stages. Sewage generated during operational phase will be treated in a small on-site sewage treatment work, which will be designed to comply with the relevant standards for effluent discharge in inland waters and inshore waters accordingly.

2.3 Tentative Implementation Programme

2.3.1.1 According to the latest design, the tentative time for the occupation of the potential development area would be beyond 2020 and this actual date would be reviewed throughout the design process.

2.4 Concurrent Projects

2.4.1.1 A review has been conducted to collate the information on potential concurrent projects that are available from the public domain. These potential concurrent projects are discussed in the following sections to evaluate if there are potential for cumulative impacts during the construction and operation phase of the proposed development in Discovery Bay.

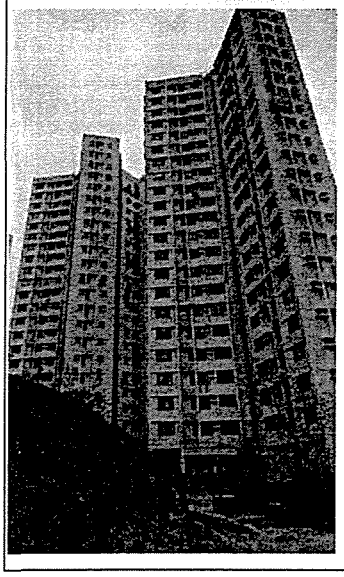
2.4.1.2 This is a strategic study initiated by the Government to study the feasibility of implementing artificial islands in the water to the east of Discovery Bay to support the longer term development of Hong Kong. At the time of preparing this report, there are neither development options nor confirmed development programme. Hence, this is not considered as a concurrent project for the purpose of this Environmental Study.

2.4.1.3 Residential development is also being considered in Area 10b within Discovery Bay. Given that Area 10b is located at more than 700m away, adverse cumulative impacts are unlikely.

3 Site Inspection

3.1.1.1 Several site visits were carried out in April – June 2014 to identify potential sources of environmental impact and sensitive receivers in the vicinity of the potential development area. **Section 2** has briefly described the general context of these and the following table present the images for the potential development area.

Table 3.1: Existing environment conditions

Viewpoint 1: Existing nearby residential buildings	Viewpoint 2: Area 6f occupied by grassland and trees
	

4 Air Quality Assessment

4.1 Air Sensitive Receivers

4.1.1.1 Representative Air Sensitive Receivers (ASRs) [1] within the potential development area have been identified in **Table 4.1** and illustrated in **Figure 4-1.** Moreover, a number of existing ASRs are also identified. The representative existing ASRs are summarized in **Table 4.2** and illustrated in **Figure 4-1.**

Table 4.1: Representative ASRs for air quality assessment

ASR ID	Description	Land use	Number of Storey	Building Hgt Above Local Ground (approx.) (m)
A6f-01	Planned high rise building	Residential	18	65
A6f-02	Planned high rise building	Residential	18	65

Table 4.2: Representative Existing ASRs

ASR ID	Description	Land use	Approximate Distance from the Site Boundary
A6f-03	Woodland Court	Residential	45m
A6f-04	Crystal Court	Residential	45m

4.1.1.2 The relevant legislations and standards applicable to these ASRs are summarized in **Appendix 4.1**.

4.2 Air Pollution Sources

4.2.1 Construction Activities

Construction Dust

4.2.1.1 During construction phase, construction dust will be generated from the construction activities including site formation, foundation and

[1] In accordance to Annex 12 of the TM-EIAO, Air Sensitive Receivers (ASRs) include any domestic premises, hotel, hostel, hospital, clinic, nursery, temporary housing accommodation, school, educational institution, office, factory, shop, shopping centre, place of public worship, library, court of law, sports stadium or performing arts centre. Any other premises or places with which, in terms of duration or number of people affected, have a similar sensitivity to the air pollutant as the aforelisted premises and places would also be considered as a sensitive receiver.

superstructure works. In consideration of small scale development at Area 6f (i.e. two residential buildings only), construction dust emission from construction works is considered not significant provided that relevant mitigation measures recommended in the Air Pollution Control (Construction Dust) Regulation are implemented to control the dust emissions. Therefore, adverse construction dust impact is considered unlikely.

4.2.1.2 The following dust suppression measures given in the Air Pollution Control (Construction Dust) Regulation should be incorporated by the Contractor to control the dust nuisance throughout the construction phase:

- Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or sprayed with water to maintain the entire surface wet and then removed or backfilled or reinstated where practicable within 24 hours of the excavation or unloading;
- Any dusty material remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads;
- A stockpile of dusty material should not extend beyond the pedestrian barriers, fencing or traffic cones;
- The load of dusty materials on a vehicle leaving a construction site should be covered entirely by impervious sheeting to ensure that the dusty materials do not leak form the vehicle;
- Where practicable, vehicles washing facilities including a high pressure water jet should be provided at every discernible or designated vehicle exit point. The area where vehicle washing takes place and the road section between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;
- When there are open excavation and reinstatement works, hoarding of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period;
- The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials;
- Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously;
- Every stock of more than 20 bags of cement or dry pulverised fuel

ash (PFA) should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the three sides;

- Immediately before leaving a construction site, every vehicle shall be washed to remove any dusty materials from its body and wheels;
- Cement or dry PFA delivered in bulk should be stored in a closed silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed; and
- Exposed earth should be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shortcrete or other suitable surface stabiliser within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies.

Emission from Fuel Combustion Equipment to be used during Construction Works

4.2.1.3 Fuel combustion from the use of Powered Mechanical Equipment (PME) during construction works could be a source of NO_2, SO_2 and CO. To improve air quality and protect public health, EPD has introduced the Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation, which came in operation on 1 June 2015, to regulate emissions from machines and non-road vehicles. Starting from 1 December 2015, only approved or exempted non-road mobile machinery are allowed to be used in construction sites. Hence, with the effect of the Regulation, the emissions from PMEs are considered relatively small and will not cause adverse air quality impact.

4.2.2 Vehicular Emission

4.2.2.1 The Hong Kong Panning Standards and Guidelines (HKPSG) has specified the minimum setback distances between ASRs and different categories of roads, including trunk road and primary distributor, district distributor and local distributor. Since all the roads within Discovery Bay are local distributors or internal access roads, a 5m setback requirement is adopted as recommended in the HKPSG.

4.2.2.2 According to the current development layout as shown in **Figure 4-1**, the separation distance between the Discovery Valley Road and proposed development is about 50m which is larger than 5m. Besides, as advised by the Traffic Impact Assessment accompanying this planning statement, the peak traffic flows of the major local road, Discovery Valley Road, would be only approximately 85 veh/ hr with

all the developments (i.e. Area 6f and Area 10b) in place. Hence, it is anticipated that the relatively low traffic volume on Discovery Valley Road together with its separation distance would not induce significant cumulative air quality impact.

4.2.2.3 For the Parkvale, it is a local distributor with separation distance of 55m from the development. Due to the low traffic flow of Parkvale, adverse air quality impact is not anticipated.

4.2.2.4 For the new access road extended from Parkvale, similar to the Parkvale, due to the low traffic flow of the access road, adverse air quality impact is not anticipated. In addition, a minimum of 5m buffer is provided to the residential premises. Thus, the air quality impact to the residential premises could be further reduced.

4.2.3 Industrial Emission

4.2.3.1 Site surveys conducted in May and June 2014 revealed that there is no existing chimney within 500m assessment area. In consideration of there is no change of the existing environment and no major development within 500m assessment area, the finding of the site visits in 2014 are still valid. As such, it is concluded that no cumulative air quality impact from industrial emission is anticipated.

4.2.4 Marine Vessels Emission

4.2.4.1 No marine vessels activities were identified within the 500m assessment area of Area 6f. Hence, no cumulative air quality impact from marine vessels emission is anticipated.

4.2.5 Fireworks Displays Emission

4.2.5.1 Disneyland Theme Park is located at approximately 3.5 km north-east of Discovery Bay. There are fireworks displays every night, including weekdays and weekends. Fireworks launching location is illustrated in **Figure 4-2.** According to the schedule in Disneyland's website, fireworks displays will be conducted from 8:00 pm for a duration of about 15 minutes. According to the Theme Park EIA, firework displays in the Disneyland Park would emit RSP and heavy metals. However, emission of gaseous pollutants due to combustion of small amount of black powder is not anticipated according to Section 3.5.14 of the approved Theme Park EIA.

4.2.5.2 Hence, for the purpose of this report, assessments on the RSP and heavy metals emissions from fireworks displays are included in the near-field model. The latest Environmental Permits (EPs) (EP-01/059/2000/A, EP-01/059/2000/B and EP-01/059/2000/C) of the Disneyland Park has also been reviewed and site survey has been conducted to verify the assumptions, including types of heavy metals prohibited to be used in fireworks displays and bursting heights of fireworks.

4.2.5.3 Potential odour impact has also been considered in the approved EIA study, and it is predicted that the odour level contributed by the firework displays on Discovery Bay is only 0.05 OU, which is well below the criteria of 5 OU as stipulated in the Annex 4 of the EIAO-TM. Since there is no major odour source within the assessment area, adverse odour impact is not anticipated and quantitative assessment is not required.

4.2.6 Potential Sewage Treatment Work

4.2.6.1 In case a small separate sewage treatment work is required for Area 6f, the operation of the STW may generate some odour. Good design and practices for the STW, such as covering the sedimentation tanks, scrubbers and etc, would be sufficient to contain the dispersion of odour from the STW. A separate study will be conducted in later stage if necessary.

4.3 Operational Phase Air Quality Assessment on Fireworks Displays

4.3.1.1 A review on the Theme Park EIA and the fireworks displays schedule from the operator has been conducted. Site surveys were also conducted to supplement information. Details methodology of the air quality assessment on fireworks displays is summarized in **Appendix 4.2**.

4.3.1.2 The cumulative RSP and FSP concentrations at each representative ASRs have been assessed. All the predicted pollutant concentrations of representative ASRs would comply with the relevant AQOs. Summary of the maximum predicted concentrations at ASRs among all assessment heights are presented in **Table 4.2** and assessment results at all assessment heights are detailed in **Appendix 4.3**. It is observed that all the air sensitive receivers would comply with the

respective AQOs criteria. Hence, no adverse air quality impact is anticipated.

Table 4.2: Cumulative RSP and FSP concentrations at ASRs

ASR ID	Concentration (µg/m³)			
	RSP		FSP	
	10th highest 24-hour	Annual	10th highest 24-hour	Annual
A6f-01	76	39	57	28
A6f-02	76	39	57	28
AQOs	**100**	**50**	**75**	**35**

4.3.1.3 In addition, the heavy metals concentrations at all representative ASRs also comply with the respective assessment criteria. The maximum predicted concentrations at ASRs among all assessment heights are presented in **Table 4.3** to **Table 4.5** below and assessment results at all assessment heights are detailed in **Appendix 4.3**. All the assessment results would comply with the relevant criteria.

Table 4.3: Maximum 1-hour heavy metals concentrations at ASRs

ASR ID	Max. 1-hour Concentration (µg/m³)					
	Aluminium	Antimony	Barium	Strontium	Copper	Titanium
A6f-01	2.111	0.836	2.015	1.072	0.690	0.261
A6f-02	1.606	0.616	1.487	0.789	0.532	0.192
Criteria	--	--	--	--	**100**	--

Table 4.4: Maximum 8-hour heavy metals concentrations at ASRs

ASR ID	Max. 8-hour Concentration (µg/m³)					
	Aluminium	Antimony	Barium	Strontium	Copper	Titanium
A6f-01	0.435	0.105	0.265	0.134	0.164	0.033
A6f-02	0.372	0.077	0.199	0.099	0.144	0.024
Criteria	--	--	**500**	--	--	--

Table 4.5: Annual-average heavy metals concentrations at ASRs

ASR ID	Annual Concentration (µg/m³)					
	Aluminium	Antimony	Barium	Strontium	Copper	Titanium
A6f-01	0.196	<0.001	0.015	<0.001	0.089	<0.001
A6f-02	0.196	<0.001	0.015	<0.001	0.089	<0.001
Criteria	**100**	**5**	**5**	--	**2.4**	**100**

4.4 Recommended Mitigation Measures

4.4.1.1 The key air pollutants (i.e. RSP, FSP and heavy metals) at all representative ASRs would comply with AQOs and relevant assessment criteria. No adverse air quality impact is therefore anticipated and hence no mitigation measures are required.

4.4.1.2 For any small sewage treatment work that may be required, good design and practices such as the use of negative pressure system and the use of activated carbon filter would be sufficient to ensure that there is no adverse odour impacts on the neighbouring receivers.

4.5 Conclusion

4.5.1.1 All the relevant air emission sources, including firework emission at the Disneyland Theme Park that would have air quality impacts on the proposed developments have been identified and assessed.

4.5.1.2 The current development layout fulfills the 5m setback requirement in HKPSG between the air sensitive receivers and local road (i.e. local distributors). In consideration of the tight control of vehicles entering the Discovery Bay, comparatively low local traffic volume and separation distance from Discovery Valley Road, adverse cumulative air quality impact on the proposed development is not anticipated.

4.5.1.3 Quantitative air quality assessment, taking into account the fireworks displays at Disneyland Theme Park, has been conducted. It is concluded that the predicted cumulative air quality impacts on all air sensitive uses would comply with the AQOs and relevant assessment criteria. Hence, adverse air quality impact on the proposed development is not anticipated.

5 Noise Assessment

5.1 Description of the Environment

5.1.1.1 The entire Discovery Bay has a relatively tranquil environment without any major noise sources that would impose adverse noise impacts on the neighbouring community. All the existing roads within Discovery Bay are local roads on which only licenced vehicles such as golf cars, shuttle buses and services vehicles are allowed to use. As observed on site, all the shuttle buses are Euro IV buses.

5.2 Noise Sensitive Receivers

5.2.1.1 Several site visits were carried out in April 2014 to identify potential sources of environmental impact and sensitive receivers in the vicinity of the site. Photographs taken on site and the neighbouring area are shown in **Section 3** to illustrate the existing context. Some general descriptions in terms of the noise environment have been described in **Section 5.1**.

5.2.1.2 Area 6f (see **Figure 5-1**) will accommodate 2 towers of residential blocks and a local access road leading from Parkvale Drive, and located near Discovery Valley Drive, and overlooking onto Yi Pak Wan. Relevant legislation that are applicable to noise impact is given in **Appendix 5.1**.

5.2.1.3 The nearest road is Discovery Valley Road which connects the developments located between the upper and lower part of Discovery Bay. Discovery Valley Road is also a local road and the separation distance between Discovery Valley Road and the nearest residential premises in Area 6f is more than 45m.

5.2.1.4 Representative Noise Sensitive Receivers (NSRs) within the potential development area have been identified in **Table 5.1** and illustrated in **Figure 5-1.**

Table 5.1: Representative NSRs for noise assessment

NSR ID	Description	Land use	Number of Storey	Building Hgt Above Local Ground (approx.) (m)
N6f-01	Planned high rise building	Residential	18	65
N6f-02	Planned high rise building	Residential	18	65

5.3 Road Traffic Noise Assessment

5.3.1.1 As discussed in **Section 5.1**, unlike the situations in other urban areas, all the shuttle buses operating within Discovery Bay are Euro IV type vehicles. Only licensed vehicles are allowed using the Discovery Bay Tunnel to access various parts of Discovery Bay. Besides, vans are prohibited after 6pm even if they have been issued with the license to use the Discovery Bay Tunnel.

5.3.1.2 With all the proposed developments in place, the traffic flow would only be approximately 85 veh / hr for Discovery Valley Road (with a 45m separation distance to the nearest planned residential premises at Area 6f), which are categorized as local roads. Hence, given that relatively low traffic flows and large separation distance, adverse road traffic noise impacts are not anticipated and mitigation measures are not required.

5.4 Fixed Noise Assessment

5.4.1.1 In case the previous water treatment facilities needs to be re-commissioned, they would generate some noise during its operation. However, it is located at more than 300m away and screened by the hilly terrains between area 6f and the water treatment work. Hence, adverse fixed noise impact is not anticipated.

5.4.1.2 Besides, in case a small separate sewage treatment work is required, suitable noise mitigation measures would be required to control the noise emitting from the plant.

5.5 Firework Display Noise Assessment

5.5.1 On-site firework display noise measurements were conducted at two locations (#F1 and #F2) to determine background noise level and 15-minute equivalent noise level ($L_{eq\ (15\ min)}$) during firework display period. The firework display noise measurement locations are summarized in **Table 5.1** and illustrated in **Appendix 5.2**.

Table 5.1 Possible noise source from Disneyland

Measurement locations	Description
#F1	At the existing Lookout Point
#F2	At the existing breakwater

5.5.2 For each noise measurement, ambient measurements were taken immediately before and after the firework display to establish the Background Noise Level (BNL). Measured Noise level (MNL) was

also taken for the 15-minute timeframe during firework display. Based on these measurements, the Corrected Noise Level (CNL) was calculated and compared against the noise criterion as discussed in **Appendix 5.1**.

5.5.3 Assessment Results

5.5.3.1 The predicted firework display noise levels at the two measurement locations are summarized in **Table 5.2**. Detailed calculation of firework display noise results is shown in **Appendix 5.3**.

Table 5.2: Summary of firework display noise assessment results

Noise Level	Noise Impacts, $L_{eq\ (15\ min)}$, dB(A)	
	F1	F2
Corrected Noise Level	52	53
Noise Criterion	55	
Exceedance	-	-

Note:
[1] Facade correction has been considered in noise calculation.

5.5.3.2 Two firework display noise measurement at F1 and F2 are approximately located at 3.9 km and 2.7 km from Disneyland and are within the noise criterion of $L_{eq\ (15\ min)}$ 55 dB(A). The proposed layouts of Area 6f will be located further away from Disneyland than the distance between F2 from Disneyland. Hence, the existing firework display at Disneyland is not anticipated to generate adverse noise impacts.

5.6 Recommended Mitigation Measures

5.6.1.1 The noise assessments results have shown that noise impact due to road traffic and fireworks are not anticipated, mitigation measures are therefore not required. In case a small separate sewage treatment work is required, mitigation measures including silencers would be required at the vents/louvres to ensure compliance with the statutory requirements.

5.7 Conclusion

5.7.1.1 A noise impact assessment has been conducted to evaluate the operational impacts based on the current layout.

5.7.1.2 Road traffic noise impact has been reviewed. Results indicate that the road traffic noise impact would not be anticipated.

5.7.1.3 A preliminary assessment has been conducted for firework display noise impact on site measurement and observation. Results indicate that the firework display noise would not cause adverse impact.

6 Water Quality Assessment

6.1 Description of the Environment

6.1.1 Existing Water Environment

6.1.1.1 The project sites fall within the Southern WCZ and are located at Discovery Valley at east Lantau, downstream of Lo Fu Tau and Discovery Bay Reservoir. Tai Pak Wan, a non-gazetted beach, is within the boundary of Discovery Bay. Besides, a Coastal Protection Area is located at the northern edge of Tai Pak Tsui Peninsula to conserve the natural coastline.

6.1.1.2 Area 6f is located at left bank of Discovery Bay Reservoir Spillway. It is within the catchment leading to the tributaries of the Discovery Bay Reservoir Spillway and the runoff would be discharged to Tsoi Yuen Wan near ferry pier ultimately.

6.1.2 Existing Sewerage System

6.1.2.1 Discovery Bay has been implemented with a sewerage system to collect all the sewage and wastewater generated from daily activities. All the existing sewage and wastewater collected from the sewerage system is diverted to Siu Ho Wan Sewage Treatment Works (SHWSTW) via pumping stations and the outfall is located at north Lantau which is far away from Discovery Bay.

6.1.3 Water Quality Sensitive Receivers

6.1.3.1 A review has been conducted to identify the Water Quality Sensitive Receivers (WSRs) in the vicinity that may be impacted by the potential development area. The following table summarizes these WSRs and they are illustrated in **Figure 6-1**. Reference is made to the relevant legislations and standards relating to water quality which are summarised in **Appendix 6.1**.

Table 6.3 Water quality sensitive receivers

Water Sensitive Receivers [1]	Description
WSR01 – Discovery Bay Reservoir	Primary reservoir for flushing, located upstream of the potential development areas
WSR 02 – Discovery Bay	Spillway from Discovery Bay Reservoir and the tributaries,

Water Sensitive Receivers [1]	Description
Reservoir Spillway and Tributaries	chainage runs along Discovery Valley Road and downstream to Tsoi Yuen Wan
WSR03 – Nim Shue Wan Stream	Natural stream downstream from the existing golf course to Nim Shue Wan
WSR04 – Tai Pak Wan	Non-gazetted beach downstream to Discovery Bay Reservoir Spillway
WSR05 – Hai Tei Wan Marina	Marina at Hai Tei Wan next to Discovery Bay Road
WSR 06 – Nim Shue Wan	Nim Shue Wan
WSR07 – Tai Pak Tsui Peninsula Coastal Protection Area (CPA)	Protected natural shoreline at north of Tai Pak Tsui Peninsula

Note:
[1] The nearest water gathering ground is located at 4.8 km away

6.2 Identification and Evaluation of Environmental Impacts during Construction Phase

6.2.1 Pollution Sources

Site Runoff

6.2.1.1 During rainstorm events, construction site runoff would come from all over the works site. These surface runoff might be polluted by:

- Runoff and erosion from site surfaces, earth working areas and stockpiles;
- Wash water from dust suppression sprays and wheel washing facilities; and
- Chemicals spillage such as fuel, oil, solvents and lubricants from maintenance of construction machinery and equipment.

6.2.1.2 Construction runoff may cause physical, biological and chemical effects. The physical effects include potential blockage of drainage channels and increase of suspended solid levels in the Southern WCZ. Runoff containing significant amounts of concrete and cement-derived material may cause primary chemical effects such as increasing turbidity and discoloration, elevation in pH, and accretion of solids. A number of secondary effects may also result in toxic effects to water biota due to elevated pH values, and reduced decay rates of faecal micro-organisms and photosynthetic rate due to the decreased light penetration. All the best practices will be implemented to reduce and minimise the generation of construction run-off.

Sewage from Workforce

6.2.1.3 Sewage effluents will arise from the sanitary facilities provided for the on-site construction workforce. According to Table T-2 of Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, the unit flow is 0.15 m^3/day/employed population. The characteristics of sewage would include high levels of BOD_5, Ammonia and *E. coli* counts. Since sufficient portable chemical toilets and sewage holding tanks will be provided, no adverse water quality impact is anticipated.

6.2.2 Mitigation Measures

6.2.2.1 Given the relatively small amount of site formation work for Area 6f, adverse water quality impacts during construction phase is not anticipated. Nevertheless, standard good site practices such as perimeter cut off drains, silt removal facilities, temporary toilet etc. would still be required. A comprehensive list of those good site practices is given in **Appendix 6.2**.

6.3 Identification and Evaluation of Environmental Impacts during Operational Phase

6.3.1 Potential Impacts

6.3.1.1 EPD advised in May 2015 that the design capacity of the SHWSTW has been allocated for the treatment of the sewage arising from the development of the Expansion of Hong Kong International Airport into a Three Runway System, the new town development under Tung Chung New Town Expansion and the Penny's Bay Phase 2 development, etc. Therefore, SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development and the Sewerage Authority has no plan to increase the design capacity of the SHWSTW in the short and medium terms.

6.3.1.2 Therefore, it is proposed to build a small separate sewage treatment work within Area 6f. The design flow rate of the proposed sewage treatment work would be around 440 m^3 per day (i.e. based on a total population of 1,190 for Area 6f and each has a flow rate of 370L/day (ADWF) as per EPD's Technical Paper Report No. EPD/TP1/05- Guidelines for Estimating Sewage Infrastructure Planning (GESF)) and the treated effluent will be discharged to a gravity sewage pipe, which will be eventually discharged to the neighbouring marine

waters near Discovery Bay Plaza without the need of a marine outfall. The peaking factor would be 8 according to table T5 of GESF. Therefore, during peak hour, the hourly flow rate would be approximately 40.8 L/s. A two stages of nitrification and de-nitrification process will be implemented for nitrogen removal in the sewage treatment.

6.3.1.3 The design of STW shall ensure that the relevant standards for effluent discharges are complied with, including the following:

- Standards for Effluent Discharged into Group D Inland Waters (Note: the nullah to be discharged to is not for abstraction for potable water supply, irrigation and pond fish culture).
- Standard for Effluent Discharged into Inshore Water of Southern Water Control Zone

6.3.1.4 According to the preliminary water quality impact assessment conducted for the proposed sewage treatment works in Area 6f (see **Annex E** of the response to comment submission dated October 2016), the effluent discharge standards from the sewage treatment works could meet the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) for Inland Waters.

6.3.1.5 In addition, the preliminary water quality impact assessment indicates that the water quality in the vicinity of the marine-based WSRs would be in compliance with Water Quality Objectives (WQOs) in suspended solid, *E. coli* and unionised ammonia. Although exceedance of Total Inorganic Nitrogen (TIN) under WQO is observed, the contribution of the high TIN level is due to the background from Pearl River estuary. The computed N:P ratio concluded that the possibility of having red tide is still low. Any emergency discharge can be readily mitigated by implementing suitable standby measures and contingency measures to be developed during detailed design stage.

6.3.1.6 Moreover, the operation of the STW shall also apply for a discharge licence from the relevant authority before the operation of the STW. The proposed location of the sewage treatment work and pumping station is indicated in **Figure 6.1**.

6.3.1.7 The current tentative alignment for the gravity sewage pipe has considered the worst case scenario especially during dry seasons.

During the subsequent detailed design, it is recommended to conduct further analysis to establish any base flow along the spillway and hence the feasibility of discharging the treated effluent into the nullah and box culvert directly.

6.3.2 Mitigation Measures

6.3.2.1 For the protection of water sensitive receivers of Tai Pak Wan beach and Tai Pak Tsui Peninsula CPA, the following contingency measures are proposed for the new sewage treatment works.

- Provision of emergency overflow pipe from the STW at Area 6f to the existing sewage pumping station no. 1 (SPS1) located at the junction of Discovery Day Road and Discovery Day Valley Road, so that the emergency sewage overflow from the proposed STW can be conveyed to the existing Discovery Day sewerage system by gravity and eventually to Siu Ho Wan STW;
- Dual feed power supply for the STW;
- Provision of sewage tanker vehicles with typically 12 m^3 by transporting the sewage from the Area 6f STW to the existing Siu Ho Wan STW for emergency situation (the flow is small at 440 m^3/day.

6.3.2.2 With the implemented contingency measures, emergency sewage overflow to Tai Pak Wan from the proposed STW is not anticipated.

6.4 Conclusion

6.4.1.1 The potential issues that may arise during both the construction and operational phases have been identified. Construction phase impacts are not anticipated to be significant, site runoff and sewage can be readily alleviated by implementing good site practice. During operational phase, sewage generated will be treated in a small on-site sewage treatment work, according to the results from the water quality assessment, most of the pollution concentrations would comply with relevant criteria. For TIN, the background concentration has exceeded the WQO already. The discharge concentration has therefore been reduced as much as practicable to ensure that the increase in TIN and TP are minimised. With the discharge standard, the N to P ratio is maintained greater than 18:1. Hence the occurrence of red tides will be unlikely. With the implemented contingency measures, emergency sewage overflow to nearby stream and Tai Pak Wan from the proposed SPSs and STW is not anticipated.

7 Other Aspects

7.1 Review of Waste Management Issues

7.1.1.1 As mentioned in **Section 2**, the potential development at Area 6f of Discovery Bay includes residential premises together with the necessary infrastructure and landscaping elements.

7.1.1.2 Although the construction methodologies are yet to be developed in subsequent detail design stage, the construction works would adopt an environmentally friendly approach. With the implementation of good site practices and waste reduction measures, the quantity of construction and demolition waste is estimated to be around 5,000 m^3.

7.2 Review on Land Contamination Issues

7.2.1.1 A desktop review has been conducted by studying the previous aerial photos for the concerned areas for the potential development area. These photos have provided useful information to ascertain any historical land uses that may have potential for land contamination. The relevant legislation and standards relating to land contamination is given in **Appendix 7.1** and the related historic aerial photos is given in **Appendix 7.2**. The following table summarises these findings.

Table 7.1 Summary of historical aerial photographs for Discovery Bay

Year	Description
1973	• Mainly nature terrain and coastline with a number of villages scattering around. • No signs for industrial developments
1982	• Some of the residential area near Yi Pak Wan and the reservoir were completed. • Other land based site formation work were in progress
1993	• Most of the site formation work and reclamation works had been completed.
2012	• Not much difference to that in 1993 except the scale of the marina was larger than that in the 90's.

7.2.1.2 Site surveys were conducted between May and June of 2014 to ground truth the findings from desktop review to identify any land uses within the potential development area that may have the potential for contamination in soil and groundwater. Photos taken during the site inspection showing the land uses within each of the area are given in **Section 3**.

7.2.1.3 The area within Area 6f comprises of mainly grassland. There has been no evidence that there had been activities causing contamination issues in the past. Hence, it is considered that the contamination potential for Area 6f is unlikely.

7.2.1.4 An initial land contamination appraisal has been conducted to identify any locations within the potential development area that may have the potential for contamination in soil and groundwater. The appraisal mainly includes a review of the desktop information and supplemented with site surveys.

7.2.1.5 Based on the findings at this stage, no area with potential land contamination is identified.

7.3 Review on Ecological Issues

7.3.1.1 As discussed in **Section 1**, Area 6f has been included in the approved Discovery Bay OZP as "OU (Staff Quarters)", despite the fact that some of the planning parameters would need to be amended. Site clearance and formation work could be commenced to implement the development parameters in the approved OZP.

7.3.1.2 Site inspection reveals that Area 6f has previously been formed and disturbed and there is currently a wooded area formed within Area 6f. As revealed from historical aerial photographs, the wooded area was likely to be developed through plantation in around 20 years ago. According to the current design, out of 0.67ha of wooded area in Area 6f, roughly 66% (0.44 ha) of the wooded area would be retained. Only 34% (0.23 ha) of the total wooded area within Area 6f would be affected by the proposed development. The wooded area to be lost from the proposed development is summarised in **Table 7.2**.

Table 7.2 Summary of wooded area in Area 6f

Item	Area (ha)
Disturbed area within Area 6f	0.15
Wooded area within Area 6f	0.67
Total area of Area 6f	**0.82**
Disturbed area to be affected	0.15 (about 100% of total disturbed area)
Wooded area to be affected	0.23 (about 34% of total wooded area)
Area to be developed	**0.38**

7.3.1.3 In addition, a recent vegetation survey undertaken in the area shows

that the wooded area to be cleared consists of both exotic and native species such as *Macaranga tanarius* and *Pinus elliottii* respectively. All the species found within the development area are common species and neither protected nor of conservation concern. As such, the ecological impact associated within the site clearance are expected to be minimal. Moreover, good site practices, including dust suppression measures such as water spraying and the use of noise mitigation measures, would be implemented to mimise the indirect impacts during the construction stage. Therefore, it is considered that the impact on the surrounding ecology would be minimal.

7.3.1.4 As discussed in **Section 6.3.1.2**, a new STW will be established to receive and treat the sewage generated from the additional population from Area 6f. During operational phase, sewage generated will be treated in a small on-site sewage treatment work and would be discharged to a gravity sewage pipe leading to the sea near Discovery Bay Plaza. According to the results from the supplementary water quality assessment, most of the pollution concentrations would comply with relevant criteria. For TIN, the background concentration has exceeded the WQO already. The discharge concentration has therefore been reduced as much as practicable to ensure that the increase in TIN and TP are minimised. With the discharge standard, the N to P ratio is maintained greater than 18:1. Hence the occurrence of red tides will be unlikely. On this basis, it is considered that the effluent discharge would not cause adverse impacts on the nearest ecological sensitive receivers, including the CPA at Tai Pak Tsui Peninsula.

7.3.1.5 In addition, the discharge is away from the Fish Culture Zones at Ma Wan and Cheung Sha Wan located at 6.5km and 6km away respectively and hence are not adversely affected.

8 Conclusion

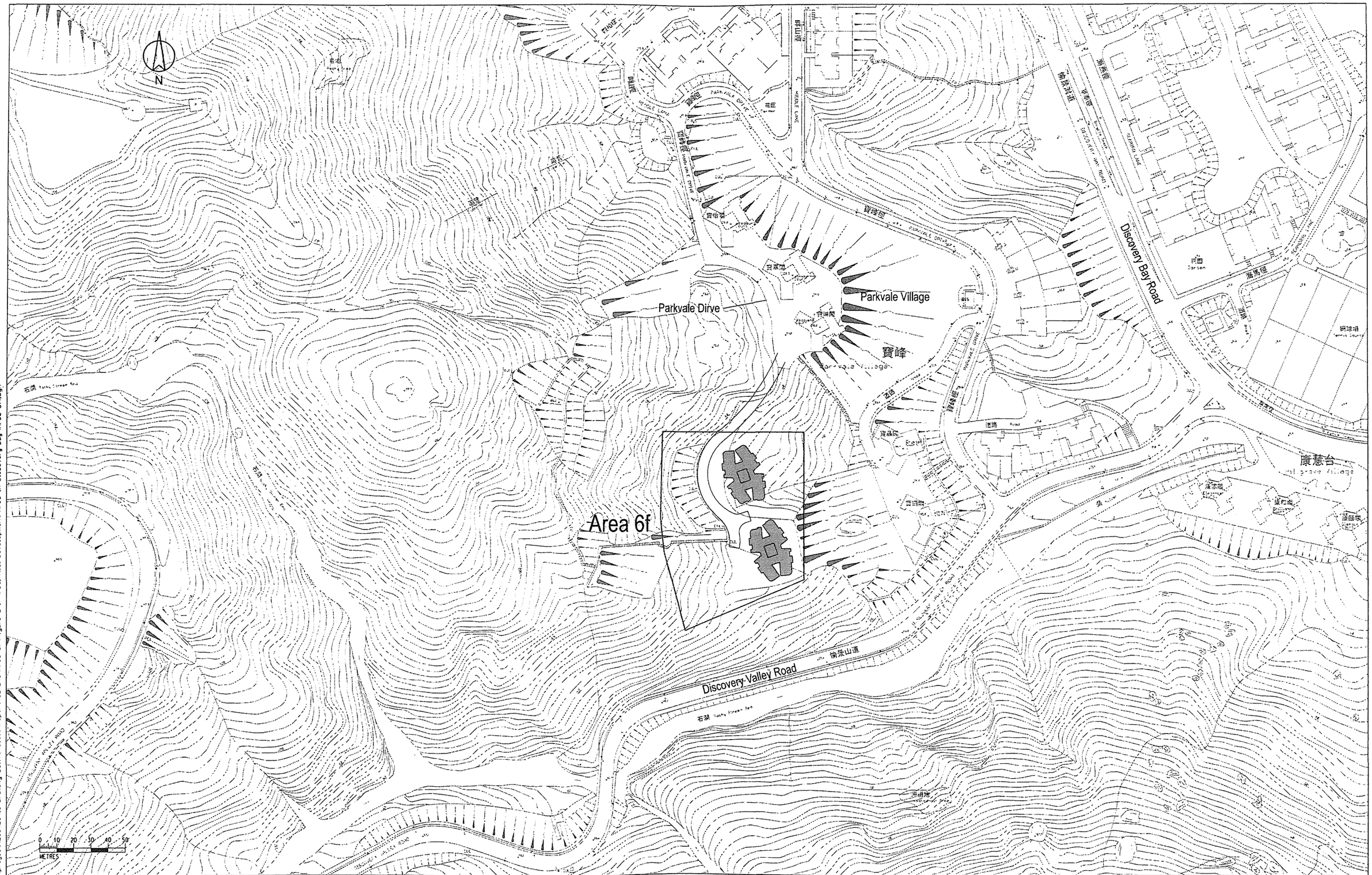
8.1.1 An environmental assessment has been conducted to review Area 6f for Discovery Bay. Key aspects that have been assessed include air quality, noise and water quality. Potential issues on land contamination and ecology have also been reviewed. Those relating to sewerage and drainage, and water supply are separately presented in another report.

8.1.2 All the relevant noise and air quality emission sources in the vicinity that would have impacts on the proposed developments have been identified and assessed. The strength of these sources have been established by measurement or from best available information and subsequently included in the assessment. Results indicate that the noise and air quality impacts on planned developments would comply with the relevant noise criteria and hence mitigation measures are not required.

8.1.2.1 Potential site runoff and sewage from workforce during construction can be alleviated by the implementation of standard good site practices. Sewage generated during operational phase will be treated in a small on-site sewage treatment work and discharged into a sewage pipe leading to the sea near Discovery Bay Plaza. According to the results from the supplementary water quality assessment, most of the pollution concentrations would comply with relevant criteria. For TIN, the background concentration has exceeded the WQO already. The discharge concentration has therefore been reduced as much as practicable to ensure that the increase in TIN and TP are minimised. With the discharge standard, the N to P ratio is maintained greater than 18:1. Hence the occurrence of red tides will be unlikely. Apart from that, a discharge licence will be obtained under the WPCO prior to discharge of the treated effluent. With the implemented contingency measures, emergency sewage overflow to nearby stream and Tai Pak Wan from the proposed SPSs and STW is not anticipated. Ecological impacts have been minimized as much as practicable.

8.1.2.2 Assessment reveals that the development at Area 6f is unlikely to cause issue on land contamination and ecological issue.

Figures



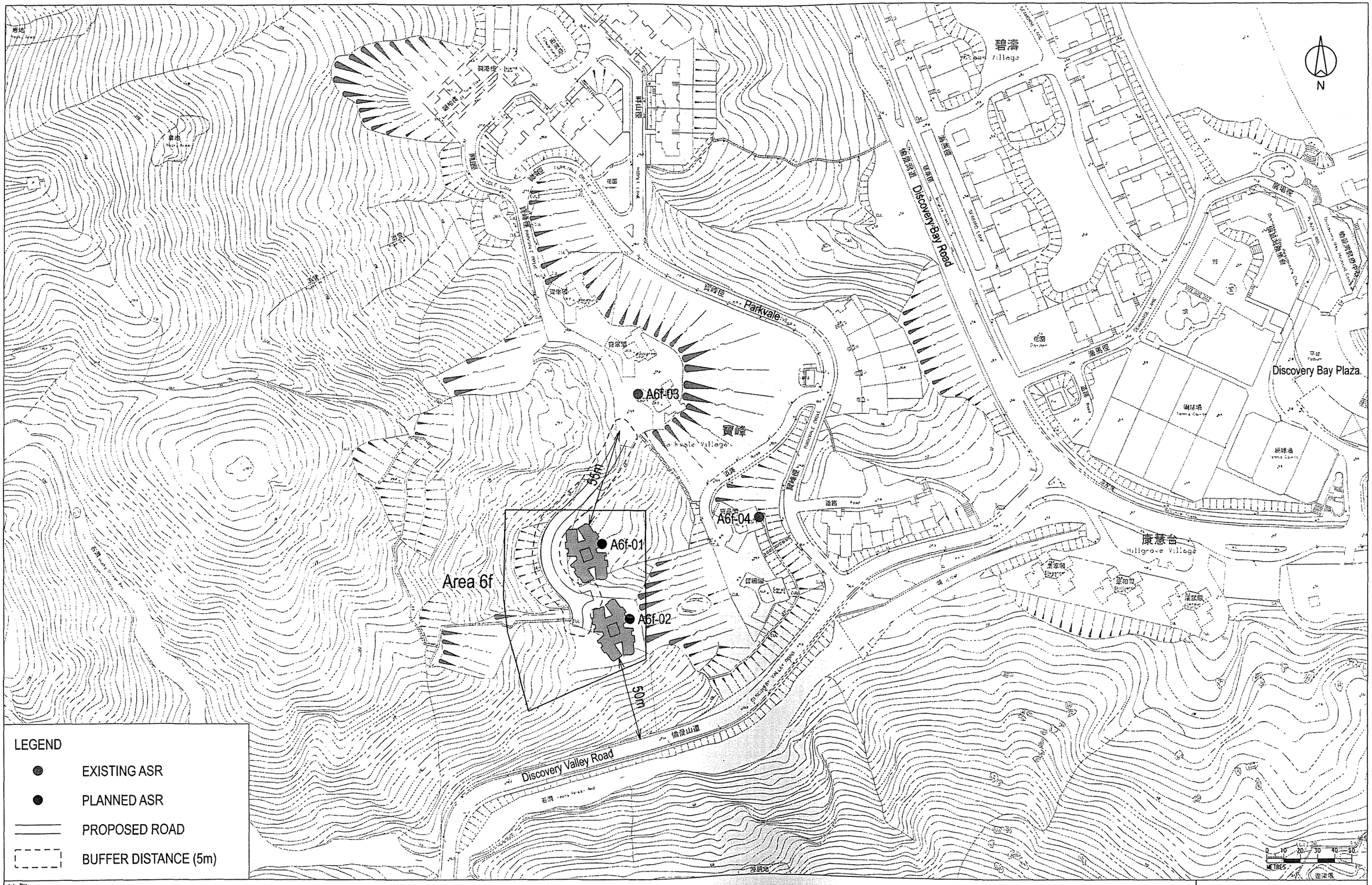
\\HKGNTS22\acoustic\env\project\235928\13 Drawing Deliverables\report\02-EIA\Area 6f\Figure 2-1 - Potential Development Area in Discovery Bay (Area 6f).dgn

Job Title
DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 2-1

Date	Scale	Drawing Title
SEP 16	1 : 2000	POTENTIAL DEVELOPMENT AREA IN DISCOVERY BAY (AREA 6f)
Drawn	Job No.	
MW	235928	

ARUP



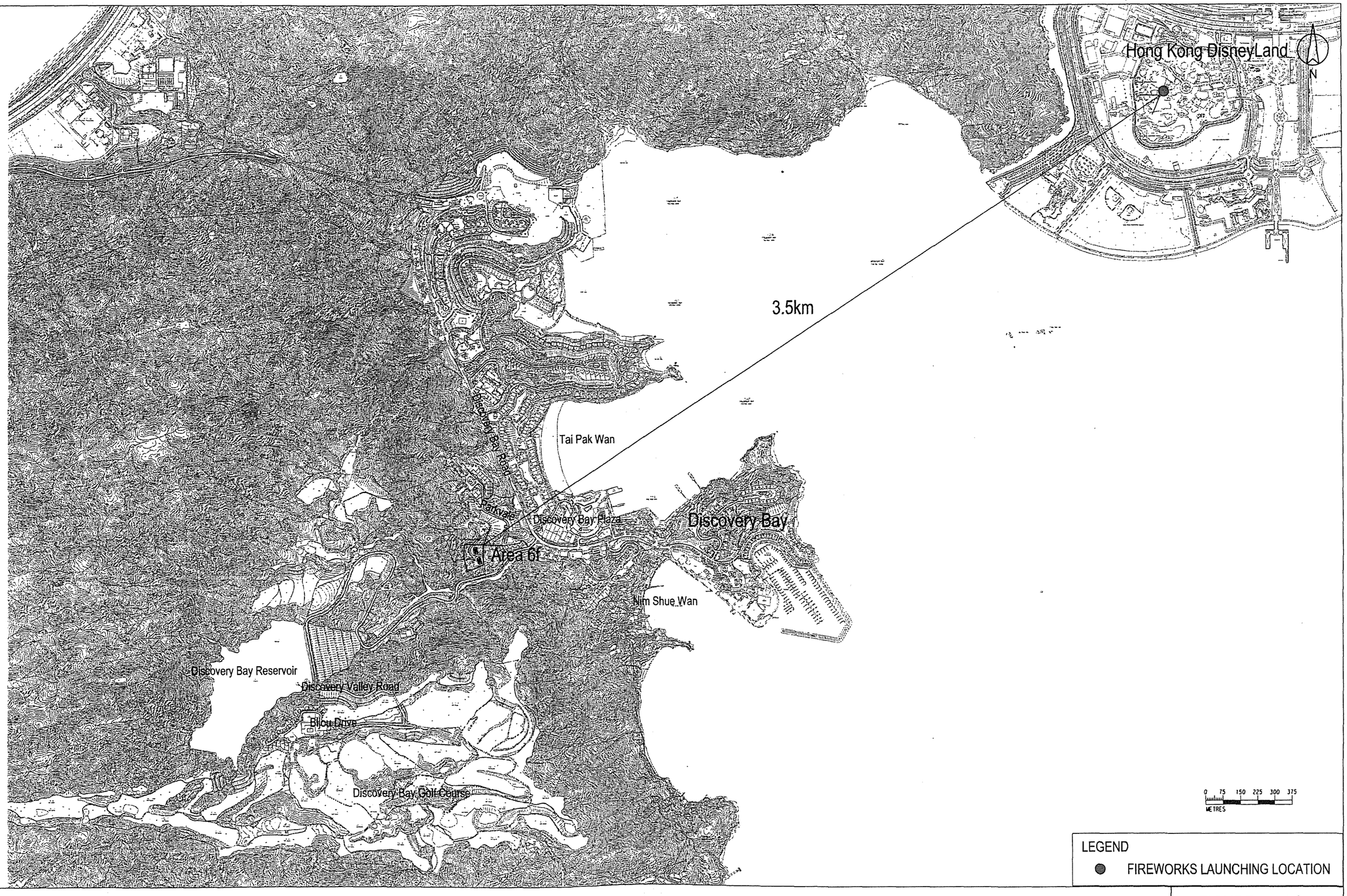
G:\env\projects\235928\13 Drawing Deliverables\report\02-EAS\Area 6f\Figure 4-1 - Location of Representative ASR.dgn

Job Title
DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 4-1

Date	Scale	Drawing Title
SEP 16	1:2000	LOCATION OF REPRESENTATIVE ASR
Drawn	Job No.	
MW	235928	

ARUP



Job Title

DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 4-2

Date	Scale	Drawing Title
SEP 16	AS SHOWN	Fireworks Launching Location
Drawn	Job No.	
MW	235928	

ARUP

G:\env\project\235928\13 Drawing Deliverables\report\02-EAS\Area 6f\Figure 4-2 - Fireworks Launching Location.dgn

N

Tai Pak Wan

Discovery Bay Road

Parkvale

Discovery Bay Plaza

N6f-01

N6f-02

Area 6f

Discovery Valley Road

Nim Shue V

LEGEND

300M ASSESSMENT AREA

PLANNED NSR

0 25 50 75 100 125

METRES

G:\env\project\235928\13 Drawing Deliverables\report\02-EIA\Area 6f\Figure 5-1 - Location of Representative NSRs.dgn

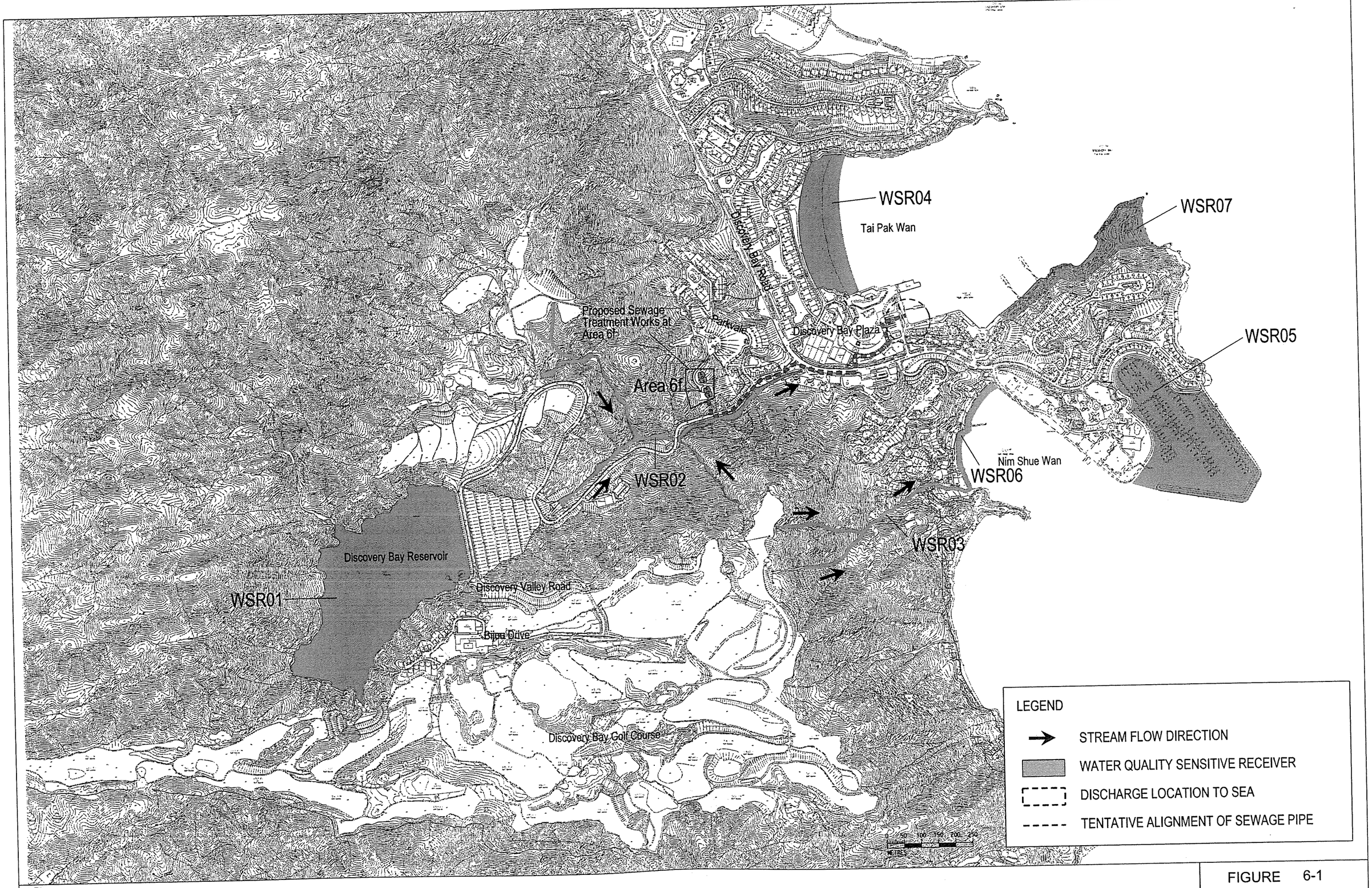
Job Title

DISCOVERY BAY - OPTIMIZATION OF LAND USE

Date	Scale	Drawing Title
SEP 16	1:5000	LOCATION OF REPRESENTATIVE NSR
Drawn	Job No.	
MW	235928	

FIGURE 5-1

ARUP



Job Title
DISCOVERY BAY - OPTIMIZATION OF LAND USE

Date	Scale	Drawing Title
OCT 16	1:10000	Water Quality Sensitive Receivers
Drawn	Job No.	
GL	235928	

FIGURE 6-1

ARUP

$FILE$

Appendix 4.1

Legislation and Standards for Air Quality Impact Assessment

Legislation and Standards for Air Quality Impact Assessment

AQO Pollutants

In accordance with the Air Quality Objectives (AQOs) under Air Pollution Control Ordinance (APCO), the relevant AQOs applicable for this environmental assessment are given in **Table A4.1a** below.

Table A4.1a: Hong Kong Air Quality Objectives

Pollutant	Limits on Concentration, $\mu g/m^3$ [1] (Number of Exceedance per year allowed in brackets)				
	10-min	1-hr	8-hr	24-hr [2]	Annual [2]
Sulphur Dioxide (SO_2)	500 (3)			125 (3)	
Respirable Suspended Particulates (RSP, or PM_{10}) [3]				100 (9)	50 (0)
Fine Suspended Particulates (FSP, or $PM_{2.5}$) [4]				75 (9)	35 (0)
Carbon Monoxide (CO)		30,000 (0)	10,000 (0)		
Nitrogen Dioxide (NO_2)		200 (18)			40 (0)
Photochemical Oxidants (as ozone, O_3)			160 (9)		
Lead (Pb)					0.5 (0)

Note:
[1] Measured at 293K and 101.325 kPa.
[2] Arithmetic mean.
[3] Respirable suspended particulates (RSP) means suspended particulates in air with a nominal aerodynamic diameter of 10 micrometres or smaller.
[4] Fine suspended particulates (FSP) means suspended particulates in air with a nominal aerodynamic diameter of 2.5 micrometres or smaller.

Non-AQOs Pollutants

According to the approved EIA study "*Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures – Environmental Impact Assessment*" (AEIAR-032/2000), hereafter called "Theme Park EIA", a total of six heavy metals, including aluminium, antimony, barium, strontium,

copper and titanium, was identified as the major pollutants emitted during fireworks displays at Disneyland Park.

There are no statutory criteria for these non-AQO pollutants. Hence, international guidelines from World Health Organization (WHO), and toxicity data from Integrated Risk information System (IRIS) of USEPA and from Office of Environmental Health Hazard Assessment (OEHHA) of California Environmental Protection Agency have been reviewed. Besides, the criteria that adopted in the Theme Park EIA have also been compared. The proposed assessment criteria for non-AQO pollutants to be adopted in this assessment are summarized in **Table A4.1b** below.

Table A4.1b: Assessment criteria for non-AQO pollutants

Pollutant	Limit on Concentration, $\mu g/m^3$[5]				
	WHO [1]	USEPA [2]	OEHHA [3]	Theme Park EIA[4]	Adopted for this Study
Acute (1-hour average)					
Aluminium	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA
Strontium	NA	NA	NA	NA	NA
Copper	NA	NA	100	NA	100
Titanium	NA	NA	NA	NA	NA
Chronic (Annual average, or otherwise specified)					
Aluminium	NA	NA	NA	100[6]	100
Antimony	NA	NA	NA	5[7]	5
Barium	500 (8-hr average)	NA	NA	5[7]	500 (8-hr average) 5 (Annual average)
Strontium	NA	NA	NA	NA	NA
Copper	NA	NA	2.4	2.4[8]	2.4
Titanium	NA	NA	NA	100[6]	100

Note:

[1] WHO – "Barium and Barium Compounds". World Health Organization (Geneva, 2001)

[2] USEPA – Integrated Risk information System of USEPA

[3] OEHHA – Office of Environmental Health Hazard Assessment of California Environmental Protection Agency

[4] Theme Park EIA – Table 3.5n of the approved EIA study "*Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures – Environmental Impact Assessment*" (AEIAR-032/2000)

[5] NA - Not applicable

[6] Reference to "*Occupational Exposure Limits*" published by UK Health & Safety Executive with a safety factor of 100 applied for conversing time-weight-average value to long term exposure limit and to allow for variability in human response to chemicals.

[7] Reference to "A Reference Note on Occupational Exposure Limits for Chemical Substances in the Work Environment" published by Hong Kong Labour Department with a safety factor of 100

applied for conversing time-weight-average value to long term exposure limit and to allow for variability in human response to chemicals.

[8] Reference to California Air Resources Board (CARB).

Appendix 4.2

Methodology of Air Quality Assessment on Fireworks Displays

Methodology of Air Quality Assessment on Fireworks Displays

Emission from Fireworks Displays

According to the Theme Park EIA, 42% of the total mass of the fireworks is emitted to the atmosphere and it is assumed that all of these mass will be turned into RSP as worst case scenario (i.e. 2.6kg for low-level shows and 14.7kg for mid-level shows). Details and the calculations are given in **Annex A4.2-1**.

In the EIA, two mid-level and three low-levels were modelled at the same hour every night as a worst case scenario and the shows were modelled as separate volume sources, 27,000m^3 (i.e. 30 x 30 x 30m) and 8,000m^3 (i.e. 20 x 20 x 20m) for mid-level and low-level shows, respectively. The same assumptions are also adopted in this Study with the latest fireworks displays schedule obtained from the Disneyland Park's website.

There is no information on the modelling bursting heights of the fireworks in the Theme Park EIA. A site survey has been conducted to estimate the bursting height of the fireworks. It was found that there are mainly two levels of fireworks bursting at height of about 150 mPD and 120 mPD, which are considered within the EPs' conditions that the bursting height limit of the fireworks displays in Disneyland Park is 150 mPD. Therefore, the bursting heights of 150 mPD and 120 mPD for mid-level shows and low-level shows are assumed for modelling purpose, respectively.

There is no conversion factor from RSP to FSP emission from fireworks displays. Therefore, the FSP emission from fireworks is assumed to be the same as the RSP emission for worst case assessment.

Besides, the Theme Park EIA had also considered the impacts due to heavy metals in which their concentrations were estimated by the percentage composition of heavy metal compounds within the mass of the particulate emission. The maximum 1-hour concentration, maximum 8-hour concentration and annual concentration of the heavy metals at ASRs are therefore estimated from RSP concentrations using the conversion factors in this approved EIA as presented in **Table A4.2a** below.

Table A4.2a: Conversion factors from RSP assessment results to heavy metals concentration

Heavy Metal	Percentage Composition in the pyrotechnics products	Conversion from RSP assessment results (without background) to heavy metals concentration
Aluminium	2.93%	RSP x 0.0293
Antimony	1.28%	RSP x 0.0128

Heavy Metal	Percentage Composition in the pyrotechnics products	Conversion from RSP assessment results (without background) to heavy metals concentration
Barium	3.06%	RSP x 0.0306
Strontium	1.64%	RSP x 0.0164
Copper	0.92%	RSP x 0.0092
Titanium	0.40%	RSP x 0.0040

Note:
[1] The percentage compositions of heavy metals in the pyrotechnics used for fireworks displays in Disneyland Theme Park are referenced to Section 3.5.75 of the approved EIA Study "*Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures – Environmental Impact Assessment*" (AEIAR-032/2000)

Dispersion Modelling Approach

The USEPA approved model, Industrial Source Complex - Short Term 3 (ISCST3), has been adopted to model the fireworks displays emission. The modelling parameters are listed in **Table A4.2b**.

Table A4.2b: Modelling parameters for ISCST3

Parameter	Input
Modelling mode	Rural with terrain effect
Meteorological data	Year 2010 MM5 data extracted from PATH model
Stability Class	Estimation from PCRAMMET model
Mixing Height	Year 2010 MM5 data extracted from PATH model and is capped to 121m as per the real metrological data recoded by Hong Kong Observatory in Year 2010

For the treatment of calm hours, the approach recommended in the "*Guideline on Air Quality on Air Quality Models Version 05 (USEPA"* is adopted.

According to **Table 4.1** in the main text, the highest building of the proposed development is 66.5m above ground. Therefore, the impacts on the ASRs are assessed at height of 1.5m, 5m, 10m, 20m, 30m, 40m, 50m, 60m and 70m above local ground.

Cumulative Impact of Criteria Air Pollutants

As mentioned in **Section 2.3.1.1**, the population intake year of the development will be tentatively beyond Year 2020, the PATH model hourly outputs based on Year 2020 emission inventories is therefore used directly as the future background air quality for AQO pollutants. Far-field emission sources (i.e. all those outside 500m assessment area) including roads, marine, airports, power plants and industries within the Pearl River Delta Economic Zone and Hong Kong were considered in the PATH model. Details of the PATH Model and related emission inventory can be found in EPD's web site.

It is understood that there is no hourly FSP concentrations available form PATH model. According to EPD's "*Guidelines on the Estimation of PM2.5 for Air Quality Assessment in Hong Kong*", the conservative corrections from RSP concentrations to FSP concentrations are shown in the **Table A4.2c**.

Table A4.2c: Conversion factors for RSP/FSP

Annual ($\mu g/m^3$)	Daily ($\mu g/m^3$)
FSP = 0.71 x RSP	FSP = 0.75 x RSP

The cumulative operational air quality is a combination of the emission impacts contributed from the near-field and far field sources (i.e. at local scale and background air quality impact from other concurrent and regional sources) on hourly basis.

In consideration of the number of exceedance allowance of the hourly and daily AQO, the pollutant concentrations after the AQO's allowance limits (e.g. 10th highest 24-hour RSP/ FSP concentrations) are determined at each ASR. The annual predicted concentrations are also assessed and all predicted levels are then compared with the AQOs.

For heavy metals, there is no background concentration available in the PATH model. Therefore, the average of the annual monitoring concentrations of aluminium, barium and copper for the latest 5 available years (i.e. Year 2010 – Year 2014) at Tung Chung Station, the nearest station to the proposed development, are adopted as their corresponding background concentrations (**Table A4.2d**). For antimony, strontium and titanium, there is no monitoring data and their background concentrations are assumed as 0 $\mu g/m^3$.

Table A4.2d: Annual monitoring heavy metal concentration at Tung Chung Station (i.e. Year 2010 – Year 2014)

Year	Annual average concentration ($\mu g/m^3$)		
	Aluminium	Barium	Copper
2010	0.196	0.016	0.056
2011	0.226	0.016	0.060
2012	0.171	0.014	0.047
2013	0.208	0.015	0.132
2014	0.179	0.013	0.150
5 years average	0.196	0.015	0.089

Appendix A4.2-1

Calculation of Fireworks Displays Emissions

According to Section 3.5.30 of approved EIA Study "*Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures – Environmental Impact Assessment* " (AEIAR-032/2000) , it is assumed that 2.6 kg and 14.7 kg RSP will be emitted for one low-level show and one mid-level show respectively.
As all the shows are modeled at the same hour as a worst case scenario, the adopted RSP emission rates:

RSP emission rate for low-level show (per show)	=	2.6	kg/hr
		7.22E-01	g/s
RSP emission rate for mid-level show (per show)	=	14.7	kg/hr
		4.08E+00	g/s

As there is no FSP emission rate available from the approved EIA study, RSP emission rates are adopted as FSP emission as a worst case scenario. Therefore, the FSP emission rates:

FSP emission rate for low-level show (per show)	=	7.22E-01	g/s
FSP emission rate for mid-level show (per show)	=	4.08E+00	g/s

Model Input Parameters for Fireworks Works Displays

Source	Source ID	Type	X	Y	Release Height [1]	Lateral Dim. (Sy)	Vertical Dim. (Sz)	Hourly RSP/FSP Emission Rate (g/s)[2]	
			(m)	(m)	(m)	(m)	(m)	Hour 21	Other Hours
Low-level show 1	LL01	Volume	822274	819292	120	4.65	4.65	7.22E-01	0.00E+00
Low-level show 2	LL02	Volume	822274	819292	120	4.65	4.65	7.22E-01	0.00E+00
Low-level show 3	LL03	Volume	822274	819292	120	4.65	4.65	7.22E-01	0.00E+00
Mid-level show 1	ML01	Volume	822274	819292	150	6.98	6.98	4.08E+00	0.00E+00
Mid-level show 2	ML02	Volume	822274	819292	150	6.98	6.98	4.08E+00	0.00E+00

Note:

[1] The release heights are observed by site survey.

[2] The fireworks displays shows are started at 20:00 (Hour 21) and last for about 15 minutes based on site survey. Therefore, there is no emission during all hours except Hour 21.

Appendix 4.3

Summary of Air Quality Assessment Results

Result Summary of Cumulative RSP Concentration for all ASRs at Various Heights above Ground

Area	ASR	10th highest 24-hour RSP Concentration (µg/m3) (AQO = 100 µg/m3)									Annual RSP Concentration (µg/m3) (AQO = 50 µg/m3)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	76	76	76	76	76	76	76	76	76	39	39	39	39	39	39	39	39	39
	A6f-02	76	76	76	76	76	76	76	76	76	39	39	39	39	39	39	39	39	39

Note: [1] The Annual RSP background of Area 6f (Grid 17_26) = 39.4 µg/m3

Result Summary of Cumulative FSP Concentration for all ASRs at Various Heights above Ground

Area	ASR	10th highest 24-hour FSP Concentration (µg/m3) (AQO = 75 µg/m3)									Annual FSP Concentration (µg/m3) (AQO = 35 µg/m3)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	57	57	57	57	57	57	57	57	57	28	28	28	28	28	28	28	28	28
	A6f-02	57	57	57	57	57	57	57	57	57	28	28	28	28	28	28	28	28	28

Note: [1] The Annual FSP background of Area 6f (Grid 17_26) = 28.0 µg/m3

Result Summary of Aluminum Concentration for all ASRs at Various Heights above Ground

Area	ASR	Max 1-hour Aluminum Concentration (µg/m³) (No Criteria)									Max 8-hour Aluminum Concentration (µg/m³) (No Criteria)									Annual Aluminum Concentration (µg/m³) (Criteria = 100 µg/m³)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	0.576	0.580	0.592	0.637	0.707	0.987	1.350	1.746	2.111	0.244	0.244	0.245	0.251	0.260	0.295	0.340	0.390	0.435	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
	A6f-02	0.557	0.560	0.571	0.614	0.680	0.778	1.045	1.337	1.606	0.241	0.242	0.243	0.248	0.256	0.269	0.302	0.339	0.372	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196

Result Summary of Antimony Concentration for all ASRs at Various Heights above Ground

Area	ASR	Max 1-hour Antimony Concentration (µg/m³) (No Criteria)									Max 8-hour Antimony Concentration (µg/m³) (No Criteria)									Annual Antimony Concentration (µg/m³) (Criteria = 5 µg/m³)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	0.166	0.168	0.173	0.193	0.223	0.346	0.504	0.677	0.836	0.021	0.021	0.022	0.024	0.028	0.043	0.063	0.085	0.105	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	A6f-02	0.158	0.159	0.164	0.183	0.211	0.254	0.371	0.498	0.616	0.020	0.020	0.020	0.023	0.026	0.032	0.046	0.062	0.077	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Result Summary of Barium Concentration for all ASRs at Various Heights above Ground

Area	ASR	Max 1-hour Barium Concentration (µg/m³) (No Criteria)									Max 8-hour Barium Concentration (µg/m³) (Criteria = 500 µg/m³)									Annual Barium Concentration (µg/m³) (Criteria = 5 µg/m³)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	0.412	0.416	0.428	0.476	0.548	0.841	1.220	1.634	2.015	0.065	0.065	0.067	0.073	0.082	0.118	0.166	0.217	0.265	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	A6f-02	0.392	0.395	0.407	0.451	0.520	0.623	0.902	1.206	1.487	0.062	0.063	0.064	0.070	0.078	0.091	0.126	0.164	0.199	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015

Result Summary of Strontium Concentration for all ASRs at Various Heights above Ground

Area	ASR	Max 1-hour Strontium Concentration (µg/m³) (No Criteria)									Max 8-hour Strontium Concentration (µg/m³) (No Criteria)									Annual Strontium Concentration (µg/m³) (No Criteria)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	0.213	0.215	0.221	0.247	0.286	0.443	0.646	0.867	1.072	0.027	0.027	0.028	0.031	0.036	0.055	0.081	0.108	0.134	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	A6f-02	0.202	0.204	0.210	0.234	0.271	0.326	0.475	0.638	0.789	0.025	0.025	0.026	0.029	0.034	0.041	0.059	0.080	0.099	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Result Summary of Copper Concentration for all ASRs at Various Heights above Ground

Area	ASR	Max 1-hour Copper Concentration (µg/m³) (Criteria = 100 µg/m³)									Max 8-hour Copper Concentration (µg/m³) (No Criteria)									Annual Copper Concentration (µg/m³) (Criteria = 2.4 µg/m³)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	0.208	0.210	0.213	0.227	0.249	0.337	0.451	0.576	0.690	0.104	0.104	0.105	0.106	0.109	0.120	0.134	0.150	0.164	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089
	A6f-02	0.202	0.203	0.207	0.220	0.241	0.272	0.356	0.447	0.532	0.103	0.103	0.104	0.105	0.108	0.112	0.122	0.134	0.144	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089	0.089

Result Summary of Titanium Concentration for all ASRs at Various Heights above Ground

Area	ASR	Max 1-hour Titanium Concentration (µg/m³) (No Criteria)									Max 8-hour Titanium Concentration (µg/m³) (No Criteria)									Annual Titanium Concentration (µg/m³) (Criteria = 100 µg/m³)								
		1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m	1.5m	5m	10m	20m	30m	40m	50m	60m	70m
Area 6f	A6f-01	0.052	0.052	0.054	0.060	0.070	0.108	0.157	0.212	0.261	0.006	0.007	0.007	0.008	0.009	0.013	0.020	0.026	0.033	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	A6f-02	0.049	0.050	0.051	0.057	0.066	0.079	0.116	0.156	0.192	0.006	0.006	0.006	0.007	0.008	0.010	0.014	0.019	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Appendix 5.1

Legislation and Standards for Noise Assessment

Legislation and Standards for Noise Assessment

The relevant legislation and associated guidance applicable to present the study for the assessment of noise impacts include:

- TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places); and
- Hong Kong Planning Standard and Guidelines (HKPSG).

Road Traffic Noise

In accordance with the HKPSG, the maximum permissible hourly noise level (L_{10}) at the external facades of domestic premises is 70dB(A). This criterion applies to domestic premises relying on open windows as a primary means for ventilation.

Fixed Noise

The HKPSG stipulates that in order to plan for a better environment, all fixed noise sources should be located and designed so that when assessed in accordance with the TM-Places, the level of the intruding noise at the facade of the nearest sensitive use should be at least 5 dB(A) below the appropriate Acceptable Noise Limit (ANL) as stipulated in TM-Places or, in the case of the background being 5 dB(A) lower than the ANL, should not be higher than the background. The following table presents the ANL for various Area Sensitivity Ratings (ASR).

Table A5.1: ANLs for fixed noise sources

Time Period	ANL, dB(A)		
	ASR A	ASR B	ASR C
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

Note:
[1] ASR – Area Sensitivity Rating

However, as discussed in **Section 2**, the present project is to plan for a residential development which differs from planning a fixed noise source, albeit that some of the existing noise sources would need to be slightly relocated to suit the development plan, and it would not aggravate the ambient noise condition and result in a high future background level. Hence it is proposed to adopt a noise limit of ANL - 5 dB(A).

For Discovery Bay in particular, it comprises of a combination of both high-rise and low-rise residential and commercial developments, and landscaping areas distributing

within the development boundary. Hence, it is considered appropriate to be described as "Low density residential area consisting of low-rise or isolated high-rise developments" as defined in Table 1 of TM-Places. Besides, there are no influencing factors such as industrial areas, major road with daily flow exceeding 30,000 vehicles per day in the vicinity. Hence, it is appropriate to adopt an ASR of "A". As such, the ANL-5 criteria would be 55dB(A) for daytime and evening periods (7:00 to 23:00) and 45dB(A) for night-time period (23:00 to 7:00).

Similar to road traffic noise assessment, all these criteria only apply to NSRs relying on opened windows for ventilation.

Firework Display Noise from Disneyland

The Disneyland Theme Park is located at approximately 3.5km north-east of Area 6f. This theme park is a Designated Project (DP) under the EIAO and an EIA Report was submitted to EPD and approved under the EIAO (ref AEIAR – 0323/2000). Hence, the operation of theme park is governed by the noise criteria stipulated under TM-Places and TM-EIAO.

Firework events at Disneyland are organized at 8pm every night. According to its approved EIA Report, a noise criterion of $L_{eq\ (15\ min)}$ 55 dB(A) is recommended for assessing the noise impacts due to fireworks. Hence, this $L_{eq\ (15\ min)}$ 55 dB(A) is still adopted in this assessment.

Similar to road traffic noise assessment, all these criteria only apply to NSRs relying on opened windows for ventilation.

Construction Noise

It is considered the development is in a preliminary stage, there is no construction programme or construction plant inventory for this development at this moment. In consideration of small scale development at Area 6f (i.e. two residential buildings only), construction noise impacts at existing sensitive receiver are considered not anticipated. Given that temporary noise barrier, quiet plant, good site practice would be adopted during construction of Area 6f, insurmountable construction noise impacts are not anticipated.

Appendix 5.2

Firework Display Noise Measurement Location

N

#F1
(at the Existing
Lookout Point)

Parkvale Drive

Area 6f

Discovery Bay Plaza

Tai Pak Wan

#F2
(at the Existing
Breakwater)

Nim Shue Wan

Nim Shue Wan

LEGEND

FIREWORKS NOISE MEASUREMENT
(7PM - 9PM ON 23rd APRIL, 2014)

0 25 50 75 100 125
METRES

\\HKGNTS22\acoustic\env\project\235928\13 Drawing Deliverables\report\02-EAS\Area 6f\Appendix 5.1 - Firework Display Noise Measurement Locations.dgn

Appendix 5.3

Firework Display Noise Result Summary

Project : Discovery Bay EAS
Job No.: 235928
Title: Firework Display Noise Assessment
Subtitle: Firework Display Noise Measurement Results

Noise Level	Location F1	Location F2
Measured Noise Level, Leq (15 min) , dB(A) [3]	52	53
Background Noise Level (Before firework display), Leq (15 min) , dB(A) [1]	50	50
Background Noise Level (After firework display), Leq (15 min) , dB(A) [2]	48	50
Average Background Noise Level, dB(A) [3]	49	50
Facade correction [4]	3	
Corrected Noise Level, Leq (15 min) , dB(A)	**52**	**53**
Noise Criterion [5]	**55**	
Exceedance, dB(A)	**-**	**-**

Note:
[1] Background noise level was measured 15 minutes before the firework display.
[2] Background noise level was measured 15 minutes after the firework display.
[3] Logarithmic average of [1] and [2]
[4] Facade correction has been considered in noise calculation.
[5] The firework display noise criteria is referenced to Environmental Impact Assessment - Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures (AEIAR – 0323/2000) and Hong Kong International Theme Parks Limited - Air Quality and Noise Monitoring During Fireworks Dress Rehearsal: Monitoring Report.

Appendix 6.1

Legislation and Standards for Water Quality Assessment

Legislation and Standards for Water Quality Assessment

The relevant legislations, standards and guidelines applicable to present study for the assessment of water quality impacts include:

- Water Pollution Control Ordinance (WPCO) CAP 358;
- Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems Inland and Coastal Waters (TM-DSS);
- Hong Kong Planning Standards and Guidelines (HKPSG); and
- ProPECC PN 1/94 "Construction Site Drainage"

Water Pollution Control Ordinance, CAP 358

The Project is located in the Southern Water Control Zone (WCZ) under the Water Pollution Control Ordinance (WPCO) (CAP 358) and the corresponding WQOs are summarised in below table.

Table A6.1: Water quality objectives for Southern Water Control Zones

Parameters	Objectives	Sub-Zone
Aesthetic Appearance	Waste discharges shall cause no objectionable odours or discolouration of the water.	Whole zone
	Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substance should be absent.	
	Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam.	
	There should be no recognisable sewage-derived debris.	
	Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent.	
	Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits.	
Bacteria	*Escherichia coli* < 610/100 mL, geometric mean in one calendar year.	Secondary Contact, Recreation Subzones and Fish Culture Subzones
	Escherichia coli < 180/100 mL, geometric mean from March to October inclusive in one calendar year. Samples at least 3 times in a calendar month at intervals of between 3 and 14 days.	Bathing Beach Subzones
Dissolved Oxygen	> 4 mg/L at depth-averaged for 90% of the samples > 2 mg/L within 2m of the seabed for 90% of the	Marine waters excepting Fish Culture

Parameters	Objectives	Sub-Zone
	samples	Subzones
	> 5 mg/L at depth averaged for 90% of the samples > 2 mg/L within 2 metres of the seabed for 90% of the sample.	Fish Culture Subzones
	> 4 mg/L	Inland waters of the Zone
pH	In the range of 6.5 – 8.5 Change due to waste discharge < 0.2	Marine waters excepting Bathing Beach Subzones; Mui Wo (A), Mui Wo (B), Miu Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
	In the range of 6.0 – 9.0 Change due to waste discharge < 0.2	Mui Wo (D) Sub-zone and other inland waters.
	In the range of 6.0 – 9.0 for 90% of samples Change due to waste discharge < 0.5	Bathing Beach Subzones.
Temperature	Change due to waste discharge < 2.0 degC	Whole zone
Salinity	Change due to waste discharges < 10% of ambient levels	Whole zone
Suspended solids	Change due to waste discharge < 30% of ambient levels	Marine waters
	< 20 mg/L, annual median	Mui Wo (A), Mui Wo (B), Mui Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
	< 25 mg/L, annual median	Mui Wo (D) Subzone and other inland waters.
Unionized Ammonia (UIA)	< 0.021 mg/L, annual arithmetic mean	Whole zone
Nutrient	Shall not cause excessive or nuisance algal growth Total inorganic nitrogen (TIN) < 0.1 mg/L, annual mean of depth averaged	Marine waters
5-Day Biochemical Oxygen Demand (BOD_5)	< 5 mg/L	Inland waters of the Zone
Chemical Oxygen Demand (COD)	< 30mg/L	Inland waters of the Zone
Dangerous Substances	Waste discharges shall not cause the concentrations of dangerous substances in marine waters to attain such levels as to produce significant toxic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other.	Whole zone

Parameters	Objectives	Sub-Zone
	Waste discharges of dangerous substances shall not put a risk to any beneficial uses of the aquatic environment.	Whole zone

Technical Memorandum for Effluents Discharge into Drainage and Sewerage Systems, Inland & Coastal Waters

Apart from the WQOs, Annex 1 of CAP358AK also specifies the limits to control the physical, chemical and microbial parameters for effluent discharges into drainage and sewage system at both inland and coastal waters under the TM-DSS. The discharge limits vary with the effluent flowrates and the sewage from the Project (treated after sewage treatment works) should comply with the standards for effluent discharged into marine water. The effluent discharge standards are presented in tables below.

Table A6.2: Standards for effluents discharged into the marine waters of Southern WCZ (in mg/L unless otherwise indicated)

Parameter	Flow rate (m^3/day)											
	≤ 10	>10 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (degC)	45	45	45	45	45	45	45	45	45	45	45	45
Colour (lovibond units) (25mm cell length)	4	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	500	500	500	300	200	200	100	100	50	50	40	30
BOD	500	500	500	300	200	200	100	100	50	50	40	30
COD	1000	1000	1000	700	500	400	300	200	150	100	80	80
Oil & Grease	50	50	50	30	25	20	20	20	20	20	20	20
Iron	20	15	13	10	7	6	4	3	2	1.5	1.2	1
Boron	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Barium	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Mercury	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	2	1.5	1.2	0.8	0.6	0.5	0.32	0.24	0.16	0.12	0.1	0.1
Total toxic metals	4	3	2.4	1.6	1.2	1	0.64	0.48	0.32	0.24	0.2	0.14
Cyanide	1	0.5	0.5	0.5	0.4	0.3	0.2	0.15	0.1	0.08	0.06	0.04

Parameter	Flow rate (m^3/day)											
	≤ 10	>10 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.13	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	80	80	80	80	50	50	50	50	50	50
Total phosphorus	10	10	8	8	8	8	5	5	5	5	5	5
Surfactants (total)	30	20	20	20	15	15	15	15	15	15	15	15
E. coli (count/100ml)	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000

Note:
[1] All units in mg/L unless otherwise stated

Table A6.3: Standards for effluents discharged into the Group D Inland Waters

Parameter	Flow rate (m^3/day)							
	≤ 200	> 200 and ≤400	> 400 and ≤ 600	> 600 and ≤ 800	> 800 and ≤ 1000	> 1000 and ≤ 1500	> 1500 and ≤ 2000	> 2000 and ≤ 3000
pH (pH units)	6–10	6–10	6–10	6–10	6–10	6–10	6–10	6–10
Temperature (°C)	30	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & Grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	2.7	2	1.3
Boron	5	4	3.5	2.5	2	1.5	1	0.7
Barium	5	4	3.5	2.5	2	1.5	1	0.7
Mercury	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.8	0.5	0.5	0.2	0.2
Total Toxic metals	2	2	1.6	1.6	1	1	0.5	0.4
Cyanide	0.4	0.4	0.3	0.3	0.21	0.1	0.1	0.05
Phenols	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Sulphide	1	1	1	1	1	1	1	1
Sulphate	800	600	600	600	600	400	400	400
Chloride	1000	800	800	800	600	600	400	400
Fluoride	10	8	8	8	5	5	3	3
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	20	20	20	20	20	20	20	10

Parameter	Flow rate (m^3/day)							
	≤ 200	> 200 and ≤400	> 400 and ≤ 600	> 600 and ≤ 800	> 800 and ≤ 1000	> 1000 and ≤ 1500	> 1500 and ≤ 2000	> 2000 and ≤ 3000
Nitrate + nitrite nitrogen	50	50	50	30	30	30	30	20
Surfactants (total)	15	15	15	15	15	15	15	15
E. coli (cfu/100ml)	1000	1000	1000	1000	1000	1000	1000	1000

Note:
[1] All units in mg/L unless otherwise stated

Hong Kong Planning Standards and Guidelines

Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG) outlines the environmental requirements that need to be considered in land use planning. The recommended guidelines, standards and guidance cover the selection of suitable locations for the developments and sensitive uses, provision of environmental facilities, and design, layout, phasing and operational controls to minimise adverse environmental impacts. It also lists out environmental factors that influence land use planning and recommends buffer distances for land uses.

ProPECC PN 1/94 "Construction Site Drainage"

The Practice Note for Professional Persons (ProPECC Note PN1/94) on Construction Site Drainage provides guidelines for the handling and disposal of construction discharges. It is applicable to this study for the control of site runoff and wastewater generated during the construction phase. The types of discharges from construction sites outlined in the ProPECC Note PN1/94 include:

- Surface runoff;
- Groundwater;
- Boring and drilling water;
- Wastewater from concrete batching plant;
- Wheel washing water;
- Bentonite slurries;
- Water for testing and sterilization of water retaining structures and water pipes;
- Wastewater from building construction and site facilities; and
- Acid cleaning, etching and pickling wastewater.

Appendix 6.2

Standard Practice for Site Drainage

Standard Practice for Site Drainage

Site Runoff

In accordance with the Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94), best management practices should be implemented as far as practicable as below:

- At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works. Channels (both temporary and permanent drainage pipes and culverts), earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities.
- The dikes or embankments for flood protection should be implemented around the boundaries of earthwork areas. Temporary ditches should be provided to facilitate the runoff discharge into an appropriate watercourse, through a silt/sediment trap. The silt/sediment traps should be incorporated in the permanent drainage channels to enhance deposition rates.
- The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC PN 1/94. The detailed design of the sand/silt traps should be undertaken by the contractor prior to the commencement of construction.
- The design of temporary on-site drainage should prevent runoff going through site surface, construction machinery and equipment in order to avoid or minimize polluted runoff. Sedimentation tanks with sufficient capacity, constructed from pre-formed individual cells of approximately 6 to 8 m3 capacities, are recommended as a general mitigation measure which can be used for settling surface runoff prior to disposal. The system capacity shall be flexible and able to handle multiple inputs from a variety of sources and suited to applications where the influent is pumped.
- Construction works should be programmed to minimize surface excavation works during the rainy seasons (April to September). All exposed earth areas should be completed and vegetated as soon as possible after earthworks have been completed. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means.
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas.
- All open stockpiles of construction materials (for example, aggregates, sand and fill material) should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.
- Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or

debris being washed into the drainage system and storm runoff being directed into foul sewers.

- Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after rainstorms are summarized in Appendix A2 of ProPECC PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events.
- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facilities should be provided at every construction site exit where practicable. Wash-water should have sand and silt settled out and removed at least on a weekly basis to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains.
- Oil interceptors should be provided in the drainage system downstream of any oil/fuel pollution sources. The oil interceptors should be emptied and cleaned regularly to prevent the release of oil and grease into the storm water drainage system after accidental spillage. A bypass should be provided for the oil interceptors to prevent flushing during heavy rain.
- Construction solid waste, debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts.
- All fuel tanks and storage areas should be provided with locks and sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching water sensitive receivers nearby.
- Regular environmental audit on the construction site should be carried out in order to prevent any malpractices. Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the water bodies, marsh and ponds.

By adopting the best management practices, it is anticipated that the impacts of general site operation will be reduced to acceptable levels before discharges. The details of best management practices will be highly dependent to actual site condition and Contractor shall apply for a discharge license under WPCO.

Sewage from Workforce

Mitigation measures to manage the sewage from workforce include the following:

- Portable chemical toilets and sewage holding tanks should be provided for handling the construction sewage generated by the workforce.
- A licensed contractor should be employed to provide appropriate and adequate portable toilets to cater 0.15m3/day/employed population and be responsible for appropriate disposal and maintenance.

- Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the Project.
- Regular environmental audit on the construction site should be conducted in order to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site.

Appendix 7.1

Legislation and Standards for Land Contamination Assessment

Legislation and Standards for Land Contamination Assessment

The relevant legislation, standards and guidelines applicable to the present study for the assessment of land contamination include:

- Annex 19 of the Technical Memorandum on Environmental Impact Assessment Ordinance (TM-EIAO), Guidelines for Assessment of Impact Assessment Process (TM-EIA), Guidelines for Assessment of Impact On Sites of Cultural Heritage and Other Impacts (Section 3: Potential Contaminated Land Issues), Environmental Protection Department (EPD), 1997;
- Guidance Note for Contaminated Land Assessment and Remediation EPD 2007;
- Guidance Manual for Use of Risk-Based Remediation Goals (RBRGs) for Contaminated Land Management, EPD, 2007; and
- Practice Guide for Investigation and Remediation of Contaminated Land, EPD, 2011.

Under Annex 19 of the TM-EIAO, a number of potentially contaminating historical land uses should be considered, including oil installations, gas works, metal workshops, car repair and dismantling workshops, which have the potential to cause or have caused land contamination.

In accordance with EPD's *Guidance Note for Contamination Land Assessment and Remediation*, a contamination assessment evaluation should:

- provide a clear and detailed account of the present land-use and the relevant past land history, in relation to possible land contamination;
- identify areas of potential contamination and associated impacts, risks or hazards; and
- submit a plan to evaluate the actual contamination conditions for soil and/or groundwater, if required.

The *Guidance Manual for Use of Risk-Based Remediation Goals (RBRGs) for Contaminated Land Management* introduces the risk based approach in land contamination assessment and present instructions for comparison of soil and groundwater data to the Risk-Based Remediation Goals (RBRGs) for 54 chemicals of concern commonly found in Hong Kong. The RBRGs were derived to suit Hong Kong conditions by following the international practice of adopting a risk-based methodology for contaminated land assessment and remediation and were designed to protect the health of people who could potentially be exposed to land impacted by chemicals under

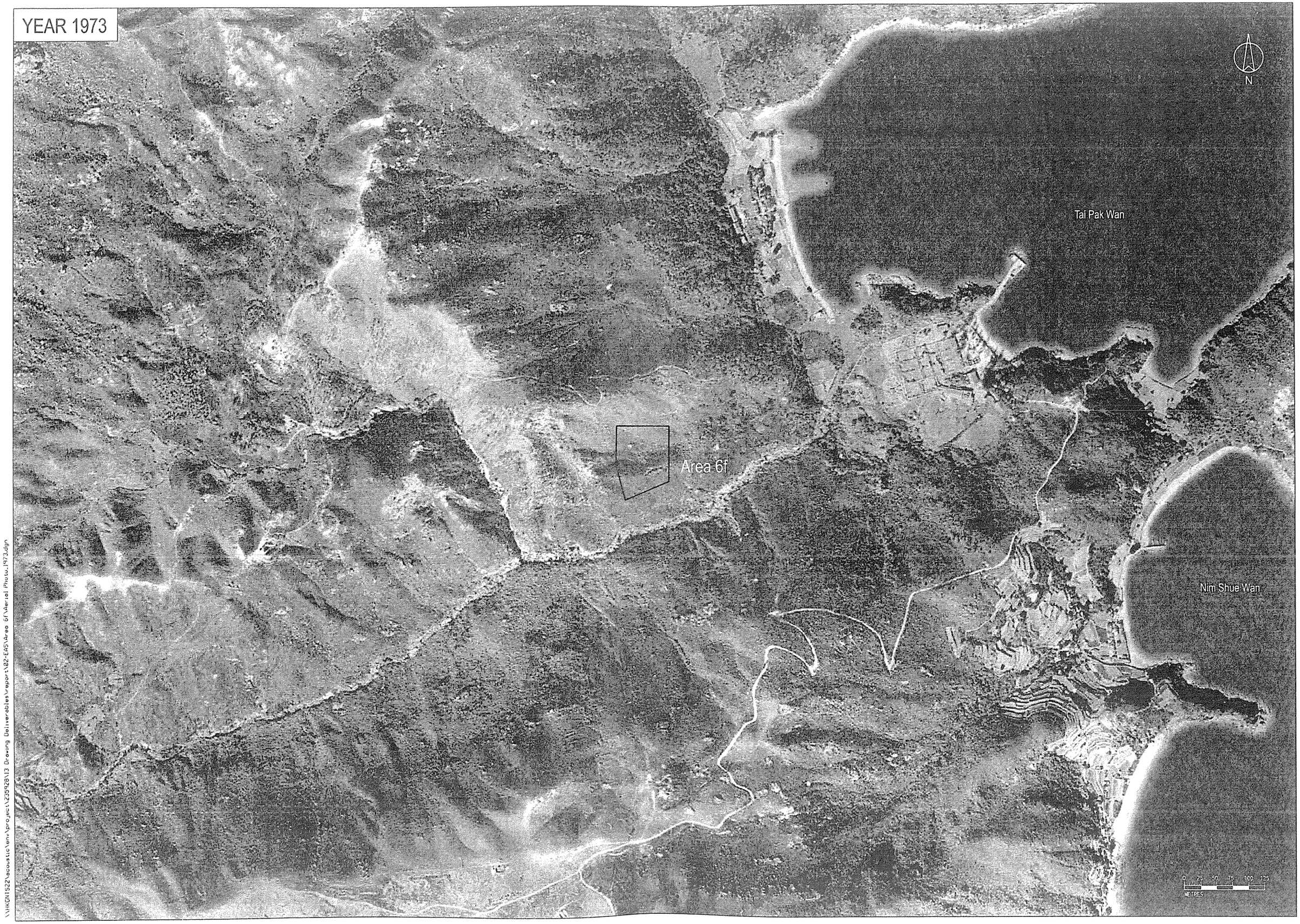
four broad post restoration land use categories. The RBRGs also serve as the remediation targets if remediation is necessary.

The EPD's *Practice Guide for Investigation and Remediation of Contaminated Land* includes a summary of the general steps of a contamination assessment study, which include site appraisal, site investigation and remediation.

Appendix 7.2

Historical Aerial Photos for Area 6f

YEAR 1973



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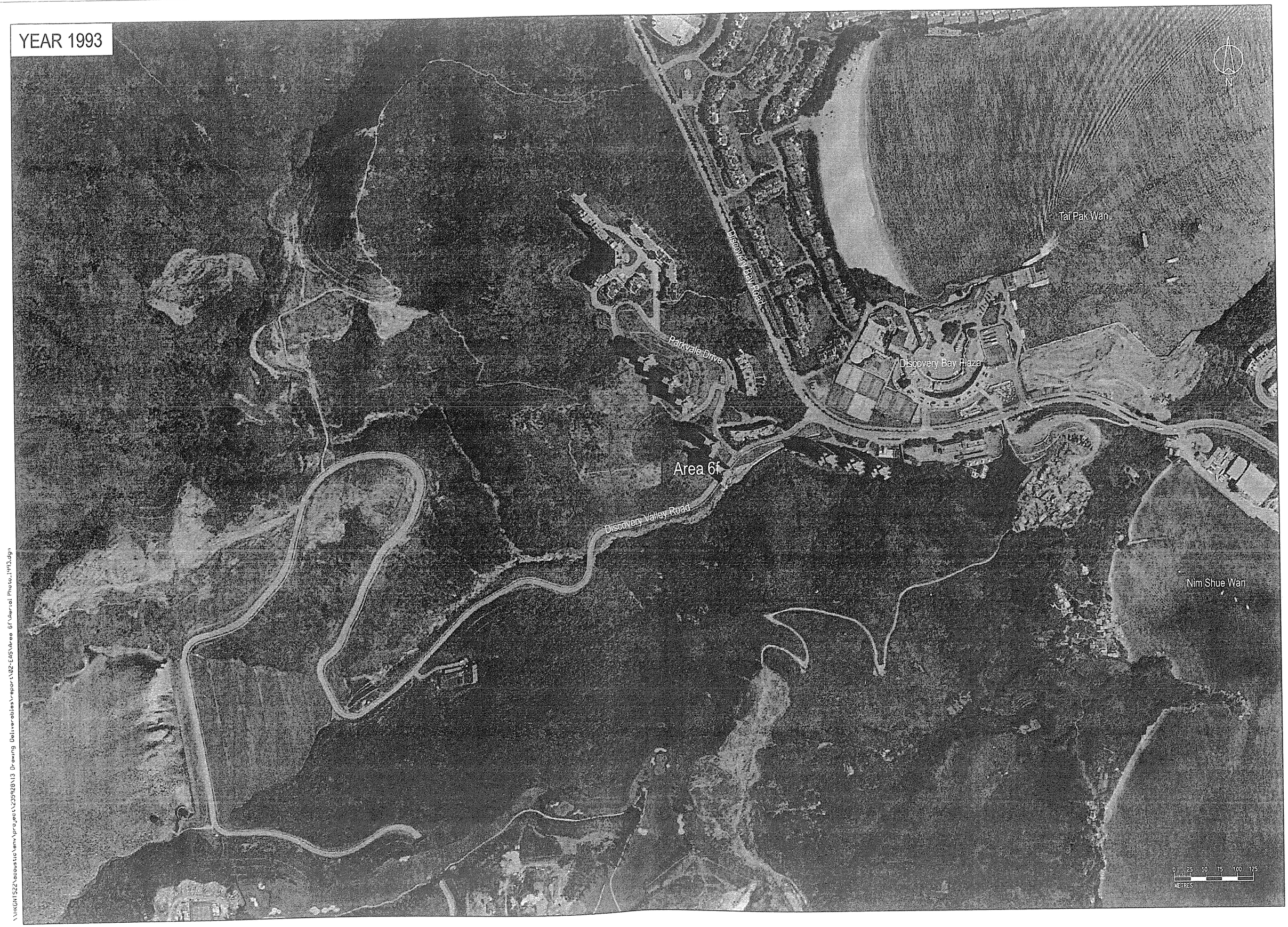
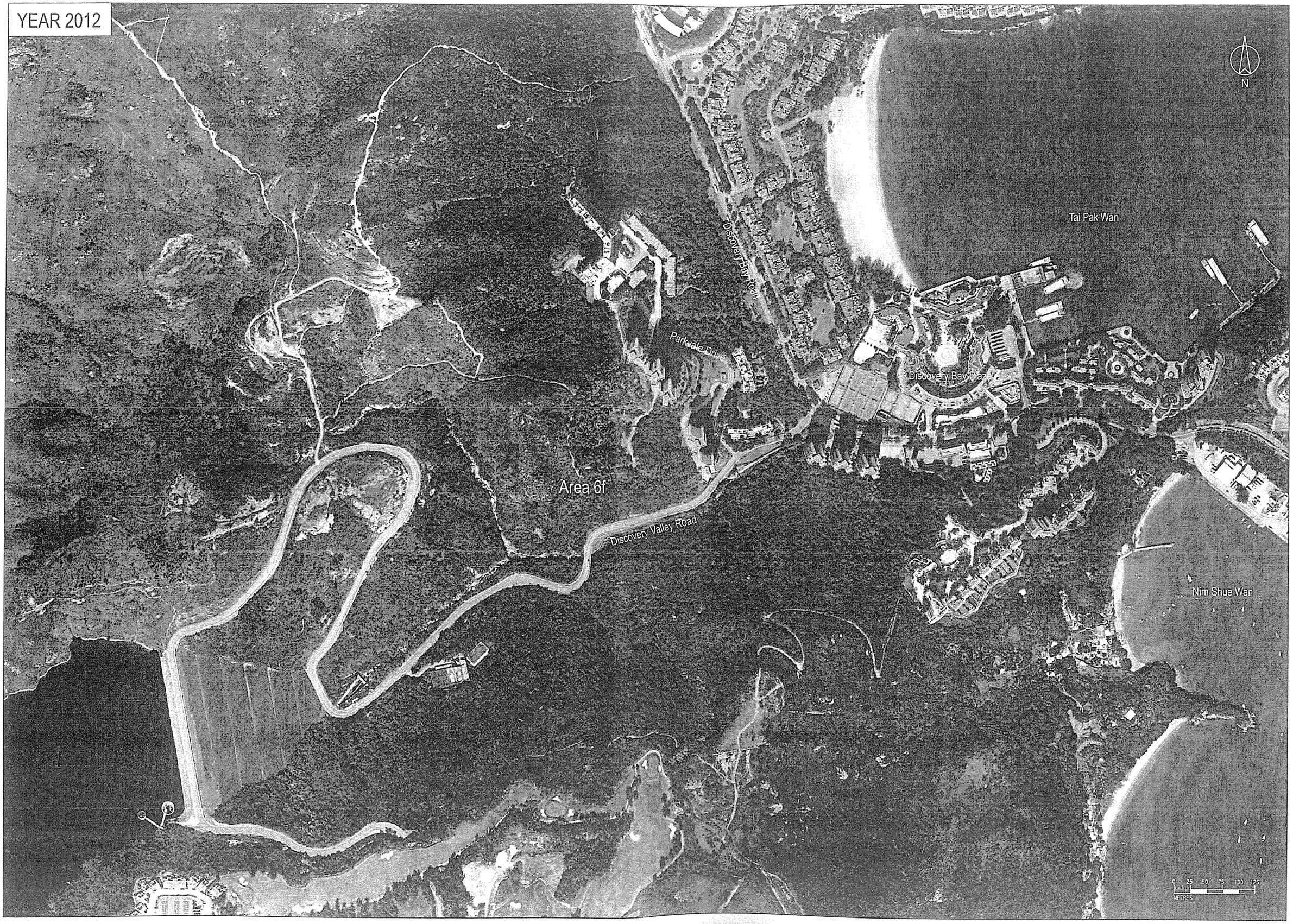
YEAR 1982

\\HKGNTS22\acoustic\env\project\23592613 Drawing Deliverables\report\02-EAS\Area 6f\Aerial Photo.1982.dgn

YEAR 1993



YEAR 2012



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Annex D

Revised Planning Statement (extract)

6. Engineering Studies

6.1 The Concept Plan is supported by engineering studies quantifying the infrastructure requirement. The Studies on Drainage, Sewerage and Water Supply Systems (**Appendix A**) and Traffic Impact Assessment (**Appendix B**) find that, subject to upgrade works where required, the infrastructure is capable of accommodating the proposed population increase at Discovery Bay. The studies have been previously submitted to Government Departments for preliminary review, and have taken account of their comments.

Study on Drainage, Sewerage and Water Supply Systems for Area 6f

6.2 The Drainage, Sewerage and Water Supply Studies are based on an estimated 476 flats and 1,190 persons increase at Area 6f. The studies conclude the following:

Stormwater

i. The existing box culverts are capable of catering for the increased surface runoff at Area 6f, which will be drained to them via the existing stream.

Sewage

ii. EPD advised in May 2015 that the design capacity of the SHWSTW has been allocated for the treatment of the sewage arising from the development of the Expansion of Hong Kong International Airport into a Three Runway System, the new town development under Tung Chung New Town Expansion and the Penny's Bay Phase 2 development, etc. Therefore, SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development and the Sewerage Authority has no plan to increase the design capacity of the SHWSTW in the short and medium terms

iii. Provision of a new STW at Area 6f is proposed to cater for the additional flow generated from the potential development at Area 6f.

Water supply

iv. Siu Ho Wan Water Treatment Works (SHWWTW) and its planned expansion works will be able to cater for the increased water demand as a result of the proposal accounting for only around 0.17% of the total upgraded capacity of SHWWTW.

v. Siu Ho Wan Fresh Water Pumping Station (SHWFWPS) requires upgrade works to cater for the existing and concurrent developments, irrespective of the proposed developments at Discovery Bay.

vi. Should the government not upgrade SHWWTW and SHWFWPS in time for this proposal, alternative water supply is possible from the existing Discovery Bay Reservoir, which has adequate storage for the increased fresh and flushing water demand, together with a new water treatment works, and new fresh water and flushing water mains.

The Applicant believes that, should WSD and EPD plan for infrastructure expansion, all proposed future developments in the vicinity areas, including those in the Discovery Bay, should be considered on equal and fair basis. In addition, the proposal for Area 6f is moderate in scale, the demand on the overall Government infrastructure would be insignificant. Therefore, the Applicant requests WSD and EPD to take into account the proposed development should they consider for future expansion of the Sui Ho Wan facilities.

Annex E

Technical Note on Water Quality

1 Introduction

1.1.1.1 This technical note is prepared for supporting the Section 12A Application No. A/I-DB/2 of rezoning the permissible use from Other Specified Use to Residential (Group C) at Area 6f. It summarises the results of preliminary water quality impact assessment for the proposed sewage treatment works (STW) in Area 6f to the water sensitive receivers during operational phase.

1.1.1.2 The proposed STW will be established to receive and treat the sewage generated from Area 6f which will accommodate a total of approximately 1,190 additional population. The maximum daily sewage flow rate of the proposed STW is approximately 440 m^3/day. Nitrogen removal and disinfection will be implemented into the proposed STW. In order to cater for the worst case scenarios, especially during dry season, the treated effluent from the proposed STW would be discharged to a gravity sewage pipe that runs along Discovery Valley Road, Discovery Bay Road, Plaza Lane, and eventually leading to sea near Discovery Bay Plaza. The alignment shall avoid buildings and any major features as necessary. The discharge effluent shall meet the criteria of Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems Inland and Coastal Waters (TM-DSS). Mitigation measures will be proposed as necessary to achieve compliance of Water Quality Objectives (WQOs).

2 Baseline Condition

2.1 Marine Water Quality

2.1.1.1 The WQOs include various parameters, which describe the physical, chemical and biological properties of the marine environment. **Table 2.1** summarises the key baseline conditions of SS (suspended solids), *E. coli*, UIA (Un-ionized Ammonia Nitrogen), TIN (Total Inorganic Nitrogen) and TP (Total Phosphorus) at EPD's marine monitoring location SM10 from year 2005 to 2014. The annual average of the baseline condition at SM10 from year 2005 to 2014 is presented in **Appendix A**. It should be noted that the baseline TIN level (0.35 mg/L) already exceeds the WQO of 0.1 mg/L in Southern Water Control Zone (WCZ), due to high TIN level in background from Pearl River estuary[1].

[1] EPD Marine Water Quality in Hong Kong in 2014.

Table 2.1 Baseline condition [1] of EPD's marine monitoring station SM10 from year 2005 to 2014

SS (mg/L)	*E. coli* (counts/100ml)	UIA (mg/L)	TIN (mg/L)	TP (mg/L)	PO_4 (mg/L)
6.92	8	0.0042	<u>0.35</u>	0.04	0.017

Notes:

[1] Unless otherwise specified, data presented are depth averaged and are the annual arithmetic mean except for *E. coli* which is in geometric mean.

[2] Underlined indicates occurrence of non-compliance with that parameter of WQO.

3 Water Sensitive Receivers

3.1.1.1 Water sensitive receivers (WSRs) have been identified and shown in **Figure 3.1**. The treated effluent from the STW in Area 6f would be discharged into to a gravity sewage pipe and eventually sea off Discovery Bay Plaza.

3.1.1.2 The distances between the discharge point at sea and WSRs are listed in **Table 3.1**. The nearest WSR is Tai Pak Tsui Peninsula CPA (WSR 07) at 270m.

Table 3.1 Description of water sensitive receivers within 2500 meters

WSR	Name	Description	Distance from the discharge location (m)
WSR01	Discovery Bay Reservoir	Primary reservoir for flushing, located upstream of the potential development areas	-[1][2]
WSR02	Discovery Bay Reservoir Spillway and Tributaries	Spillway from Discovery Bay Reservoir and the tributaries, drainage runs along Discovery Valley Road and downstream to Tsoi Yuen Wan	-[1][2]
WSR03	Nim Shue Wan Stream	Natural stream downstream from the existing golf course to Nim Shue Wan	-[1]
WSR04	Tai Pak Wan	Non-gazetted beach downstream to Discovery Bay Reservoir Spillway	280
WSR05	Hai Tei Wan Marina	Marina at Hai Tei Wan next to Discovery Bay Road	1,250
WSR06	Nim Shue Wan	Nim Shue Wan Beach	2,500
WSR07	Tai Pak Tsui Peninsula Coastal Protection Area (CPA)	Protected natural shoreline at north of Tai Pak Tsui Peninsula	270

Note:
[1] Inland WSR.
[2] Upstream of STW at Area 6f.

4 Assessment Methodology

4.1 TM-DSS for Inland Waters and Effluent Standards

4.1.1.1 **Table 4.1** shows the comparison of TM-DSS for Group D inland waters and the effluent discharge standards of the proposed STW. The effluent discharge standards meet the discharge criteria for inland waters and therefore no further assessment would be required.

Table 4.1 Comparison of inland waters criteria and the effluent discharge standards of the proposed STW

Parameters	Group D Inland water (Flow rate: 400 – 600 m^3/day)	Discharge standard provided by sub-contractor (Flow rate estimated as 690 m^3/day)
pH	6-10	6-10
Temperature	30°C	< 30°C
Colour	1 lovibond units (25mm cell length)	< 1 lovibond units
Suspended Solids (SS)	30 mg/L	30 mg/L
5-Day Biochemical Oxygen Demand (BOD_5)	20 mg/L	20 mg/L
Chemical Oxygen Demand (COD)	80 mg/L	< 80 mg/L
Oil & Grease	10 mg/L	< 10 mg/L
Total phosphorus	10 mg/L	2 mg/L
Ammonia Nitrogen	20 mg/L	8 mg/L
Nitrate + nitrite nitrogen	50 mg/L	12 mg/L
Surfactants	15 mg/L	< 15 mg/L
E. coli	1000 count/100ml	10 count/100ml

Note:
[1] Mercury, Cadmium, Cyanide, Phenols, Sulphide, Sulphate, Chloride, Fluoride, Iron, Boron, Barium and other toxic metals are not the major pollutants for the domestic sewage and excluded in the comparison.

4.2 WQOs in Southern WCZ

4.2.1.1 **Table 4.2** shows the criteria for SS, *E. coli*, UIA and TIN under WQOs in Southern Water Control Zone. As discussed in **Section 2**, the baseline TIN level already exceeds the WQO criterion of 0.1 mg/L.

Table 4.2 Criteria from WQOs in Southern WCZ

SS [2] (mg/L)	*E. coli* (counts/100ml)	UIA (mg/L)	TIN (mg/L)
8.99	180/610[1]	0.021	0.1

Note:
[1] The criteria for *E. coli* are 610 counts/100ml for Secondary Contact Recreational Subzones, and 180 counts/100ml for bathing beaches in wet season.
[2] SS criteria is established based on WQO that water discharge shall not cause the natural ambient level to be raised by 30% for marine water WCZ.

4.3 Modelling Scenario

4.3.1.1 The effluent dispersion scenarios are simulated by a near-field model, CORMIX. The key inputs to the CORMIX include outfall configuration, ambient current speed, vertical density profile and effluent flow rate.

4.3.1.2 Based on the approved Delft 3D modelling results from HATS Stage 2A EIA (AEIAR-121/2008) and presented in **Appendix B**, the maximum ambient velocity and average ambient velocity is 0.02 m/s and 0.01 m/s respectively.

4.3.1.3 To cater for the different tidal conditions, the following scenarios have been modelled under CORMIX:

- The maximum ambient velocity of 0.02 m/s. Under this scenario, the effluent discharge flow is in the same direction as the ambient flow (co-flow situation). The pollutant plume is then flowing towards the WSR by the ambient flow.
- Average ambient velocity of 0.01 m/s. Under this scenario, the ambient velocity is near stagnant. The dispersion of the plume is dominated by diffusion.

4.3.1.4 **Table 4.3** presents the modelling parameters of the worst case scenario for ambient in co-flow situation.

Table 4.3 Modelling scenario and corresponding parameters for the model

Parameter		Scenario	
Season		Dry	Wet
Effluent Discharge Parameters	Total Discharge Flow Rate at Discharge Point	1 m/s[1], 440m³/day	
	Concentration of Effluent at Peak Flow	NH_3-N: 8 mg/L (UIA[2]: 0.424 mg/L) SS: 30 mg/L *E. coli*: 10 counts/100ml TIN[3]: 12 + 8 mg/L TP: 2 mg/L, PO4[8]: 1.77 mg/L	
	Effluent Density	1000 kg/m[3]	
	Discharge height above bottom	2.52 m[4]	
Ambient Conditions	Ambient Velocity	Ambient flow of 0.01, 0.02 m/s (See **Appendix B**) in co-flow condition	
	Ambient Density[5]	Surface 1,022 kg/m³; Bottom 1,022 kg/m³	Surface 1,017 kg/m³; Bottom 1,017.7 kg/m³
	Water Depth	2.6 m [6]	
	Wind speed	2 m/s [7]	

Note:

[1] Reference to the designed effluent velocity at box culvert discharging to sea.

[2] UIA is estimated by multiplying a percentage factor to NH3-N. This factor depends on temperature and pH. The average temp and pH from EPD water quality monitoring stations in Southern WCZ are 23.8°C and 8.0 respectively. According to the "Aqueous Ammonia Equilibrium - Tabulation of Percent Unionized Ammonia" from USEPA, the conversion factor is 5.3%.

[3] TIN concentration is the sum of the concentration of NH_3-N, NO_2-N and NO_3-N (see **Table 4.1**).

[4] The discharge is near the water surface due to lower density of the effluent.

[5] Ambient density is estimated from the EPD water quality monitoring station SM10 from year 2005-2014.

[6] Water depth at Discovery Bay are obtained from nautical chart in Hong Kong, published by the Hydrographic Office, Marine Department of HKSAR Government (**Appendix C**).

[7] CORMIX's recommended value for conservative design condition.

[8] The level of orthophosphate phosphorus (PO_4) is estimated based on the ratio of TP:PO_4 of 1.13:1 for secondary treatment of STWs from HATS Stage 2A EIA

5 Evaluation of Impacts

5.1.1.1 As shown in **Section 4.1**, the effluent discharge standards comply with the discharge criteria for inland waters.

5.1.1.2 **Table 5.1** shows the dilution factors for SS and UIA required to meet the WQOs in marine waters. Since the *E. coli* level of treated effluent has already met the WQO criteria, it is not included in the assessment. The calculation of dilution factor is based on **Equation 5.1**. The WQO criteria can be complied if the predicted dilution factor at the WSRs is higher than the required dilution factor presented in **Table 5.1**.

Table 5.1 Dilution factors for SS and UIA to meet the WQO criteria

	SS (mg/L)	UIA (mg/L)	Remark
Criteria/Target Limit of Conc. ($C_{criteria}$)	8.99	0.021	See **Table 4.2**
Baseline Conc. ($C_{baseline}$)	6.92	0.004	See **Table 2.1**
Effluent Discharge Conc. ($C_{effluent}$)	30	0.424	See **Table 4.3**
Dilution Factor to Meet the Criteria	11	25	Calculation based on **Equation 5.1**

Note:
As a sample calculation, the required dilution factor for the SS criterion would be (30.00 – 6.92)/(8.99 – 6.92) ≈ 11.

$$DF = \frac{C_{effluent} - C_{baseline}}{C_{criteria} - C_{baseline}} \qquad \textbf{Equation 5.1}$$

where

$C_{effluent}$ is the effluent concentration at the discharge point.
$C_{baseline}$ is the baseline concentration at the WSR.
$C_{criteria}$ is the criteria/ target limit of concentration.

5.1.1.3 **Table 5.2** shows the dilution factor for the simulated scenario at 270 m of the closest WSR (WSR 07 Tai Pak Tsui Peninsula CPA). The details of CORMIX outputs are presented in **Appendix D**. The lowest predicted dilution factor can be achieved is 209.

Table 5.2 Predicted dilution factors at the WSR07 (i.e. 270 m from discharge point)

Season	Ambient flow in co-flow condition (m/s)	Dilution Factor
Dry	0.02	209
	0.01	375
Wet	0.02	242
	0.01	377

5.1.1.4 Since the predicted dilution factor at the nearest WSR is higher than the required dilution presented in **Table 5.1**, it is anticipated that SS and UIA level would comply with the WQO criteria at all the marine based WSRs. The summary of compliance for different water quality parameters is presented in **Table 5.3**.

5.1.1.5 The predicted SS is 7.03 mg/L at the WSR 07 Tai Pak Tsui Peninsula CPA in the worst scenario of dilution factor 209. Since the predicted SS complies with the water quality criteria (8.99mg/L) at the WSR 07, hence impact on the ecological sensitive receiver/ coral at WSR 07 is not anticipated.

Table 5.3 Summary of compliance for different water quality parameters

Season	Ambient flow in co-flow condition (m/s)	SS (mg/L)	*E.coli* (mg/L)	UIA (mg/L)	TIN (mg/L)
Dry	0.02	Yes	Yes	Yes	No [1]
	0.01	Yes	Yes	Yes	No [1]
Wet	0.02	Yes	Yes	Yes	No [1]
	0.01	Yes	Yes	Yes	No [1]

Note:
[1] Baseline TIN level already exceeds the WQO criterion.

5.1.1.6 Using **Equation 5.1** and the effluent standards in **Section 4.1**, the predicted levels of total inorganic nitrogen (TIN) and PO_4 with predicted dilution factors are presented in **Table 5.4**.

Table 5.4 Predicted nitrogen and phosphorus levels at the nearest WSR

Season	Ambient flow in co-flow condition (m/s)	TIN (mg/L)	PO_4 (mg/L)[1]	TIN:PO_4
Dry	0.02	0.444	0.025	18:1
	0.01	0.402	0.022	19:1
Wet	0.02	0.431	0.024	18:1
	0.01	0.402	0.022	19:1

Note:
[1] Background level has been included

5.1.1.7 The predicted value of TIN exceeds the baseline value of 0.35 mg/L at the nearest WSR 07 (Tai Pak Tsui Peninsula CPA), however it is below the maximum value of 0.7 mg/L in 2014. The contribution is due to high TIN level in background from Pearl River estuary. TIN is a source for the formation of red tide. According to the literature[2], the nitrogen and phosphorus (N:P) ratio for red tide growth is 7:1 by weight. As shown from EPD monitoring data, the N:P ratio (TIN/PO_4) from the baseline data at SM10 is 21:1. Phosphorus would be the limiting nutrient for the algae growth. Based on **Table 5.4**, the predicted N:P ratio in the operational phase is in the range of 18:1 to 19:1. Hence, the possibility of red tide occurrence is still low.

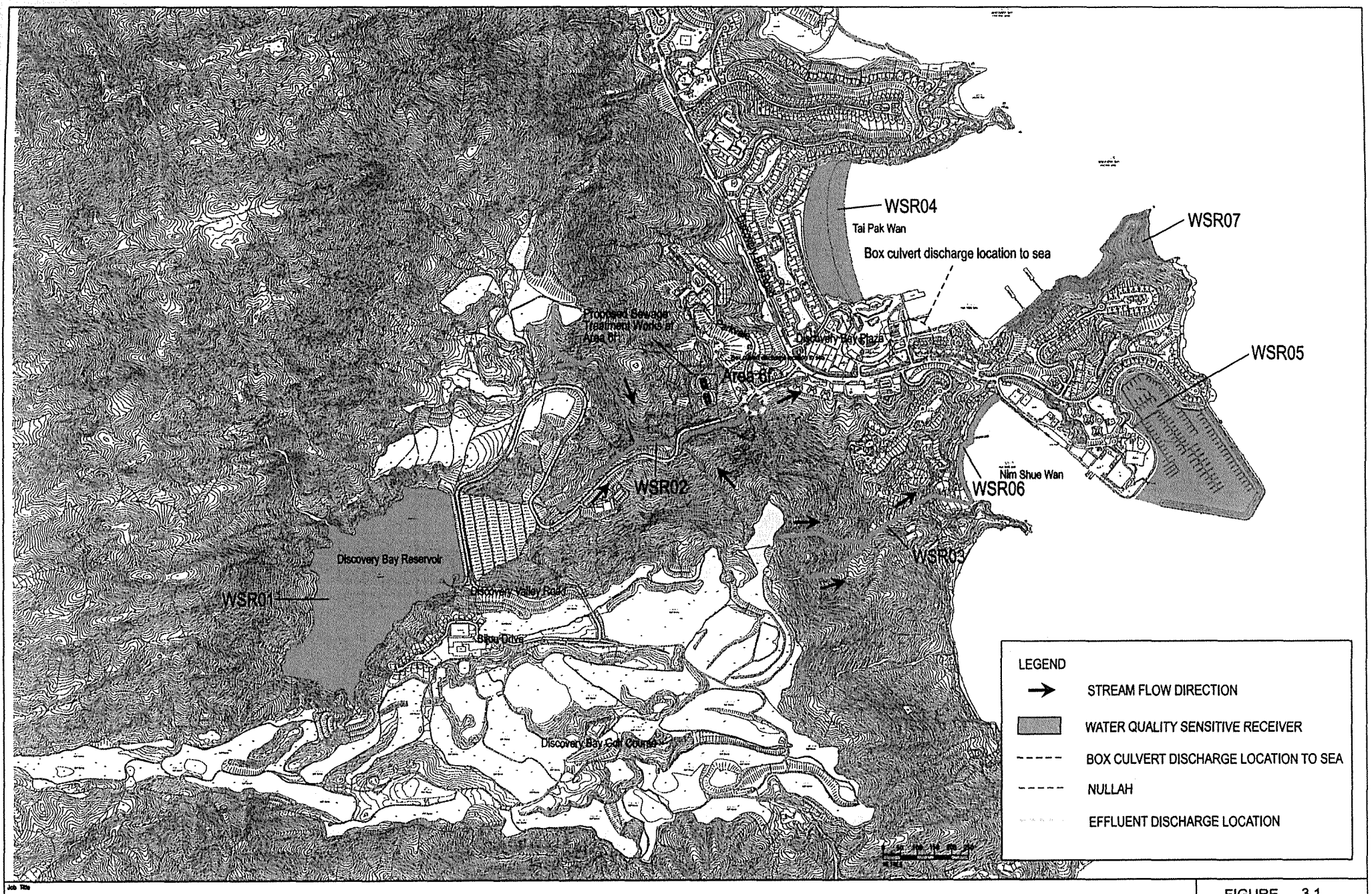
[2] Redfield A.C., On the proportions of organic derivations in seawater and their relation to the composition of plankton. In James Johnson Memorial Volume (ed. R.J. Daniel). University Press of Liverpool, pp.177-192, 1934.

6 Conclusion

6.1.1.1 The preliminary water quality impact assessment of the proposed sewage treatment works in Area 6f to the water sensitive receivers during operational phase has be conducted. The effluent discharge standards meet the TM-DSS for Inland Waters. The modelling result indicates that the water quality in the vicinity of marine-based WSRs would be in compliance with WQOs in SS, *E. coli* and UIA. Exceedance of TIN under WQO is observed. However the contribution is due to high TIN level in background from Pearl River estuary. According to the computed N:P ratio, the possibility of having red tide is still low.

6.1.1.2 The current tentative alignment for the gravity sewage pipe has considered the worst case scenario especially during dry seasons. During the subsequent detailed design, it is recommended to conduct further analysis to establish any base flow along the spillway and hence the feasibility of discharging the treated effluent into the nullah and box culvert directly.

Figures



DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 3.1

Date	Scale	Drawing Title
Sept 06	1:10000	Water Quality Sensitive Receivers
Drawn GL	Job No. 235928	

ARUP

Appendix A

EPD Marine Water Quality Monitoring Data

Figure A1 Locations of the Environmental Protection Department's marine monitoring measurement sites, captured from the EPD's marine water reports 2014

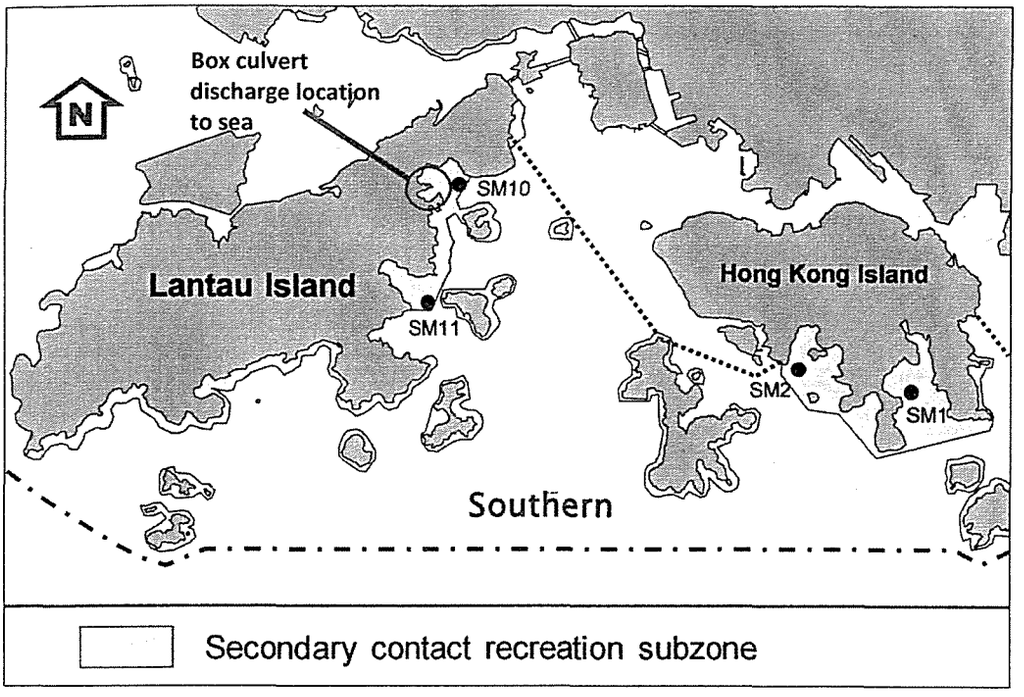


Table A1 Annual average of the water quality parameters at EPD's marine monitoring site SM10

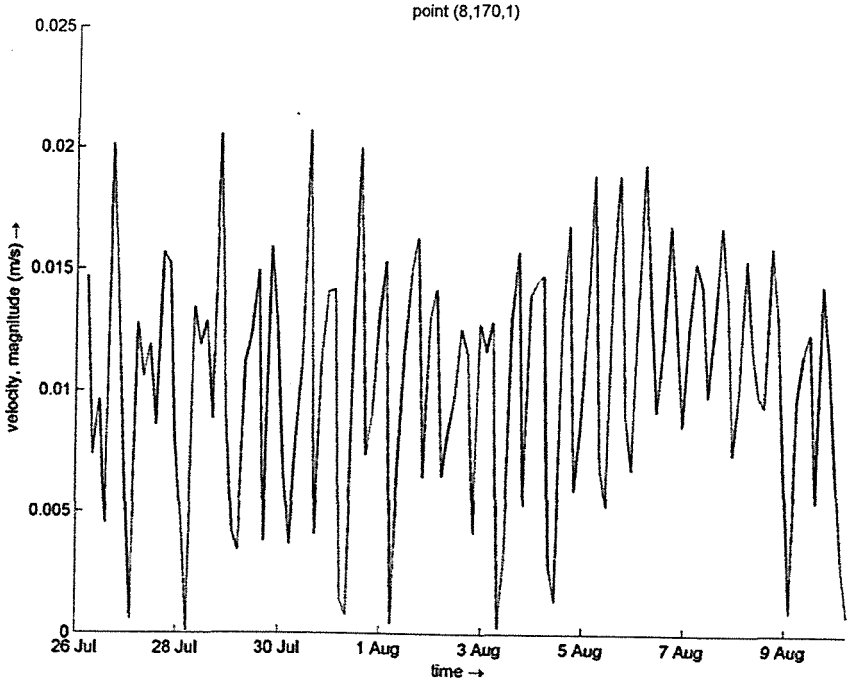
Year	Total Inorganic Nitrogen (mg/L)	*E. coli* [1] (cfu/100mL)	Suspended Solids (mg/L)	Unionised Ammonia (mg/L)	Total Phosphorus (mg/L)
2005	0.35	9.44	7.10	0.005	0.038
2006	0.32	19.04	9.06	0.006	0.044
2007	0.32	11.28	8.15	0.006	0.046
2008	0.37	14.59	7.33	0.005	0.041
2009	0.28	10.51	8.28	0.003	0.037
2010	0.33	5.00	5.46	0.003	0.035
2011	0.36	2.37	7.12	0.003	0.039
2012	0.42	2.82	7.20	0.003	0.038
2013	0.35	2.78	3.92	0.003	0.039
2014	0.30	4.30	4.68	0.004	0.045

Note:
[1] According to WQO, the criterion for *E. coli* should be calculated as annual geometric mean of its concentration, instead of the annual arithmetic mean.

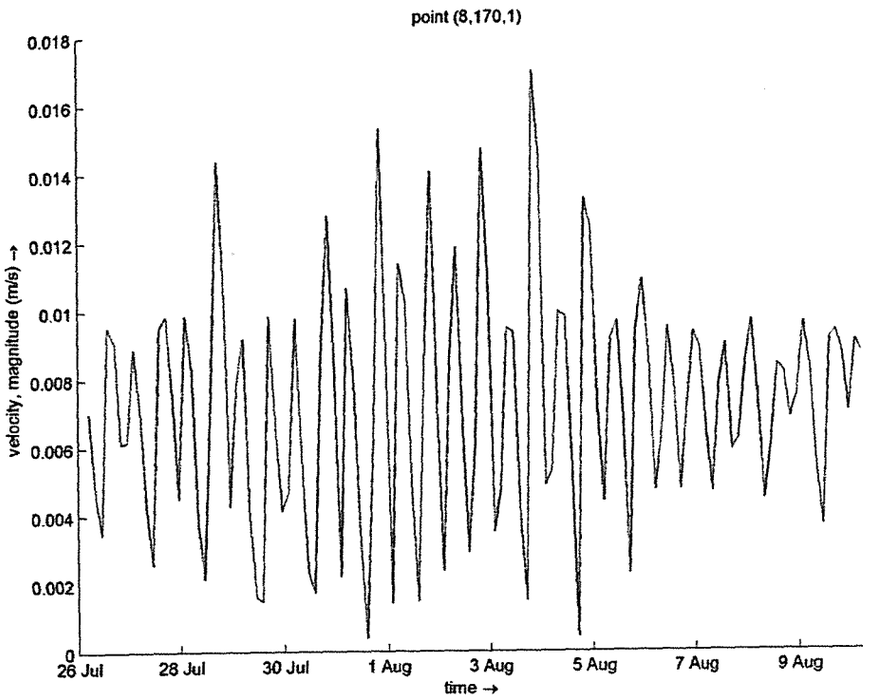
Appendix B

Ambient flow in Tai Bak Wan
(Extracted from Delft 3D
Modelling Result)

Time series of ambient velocity from approved Delft 3D modelling result
Wet season

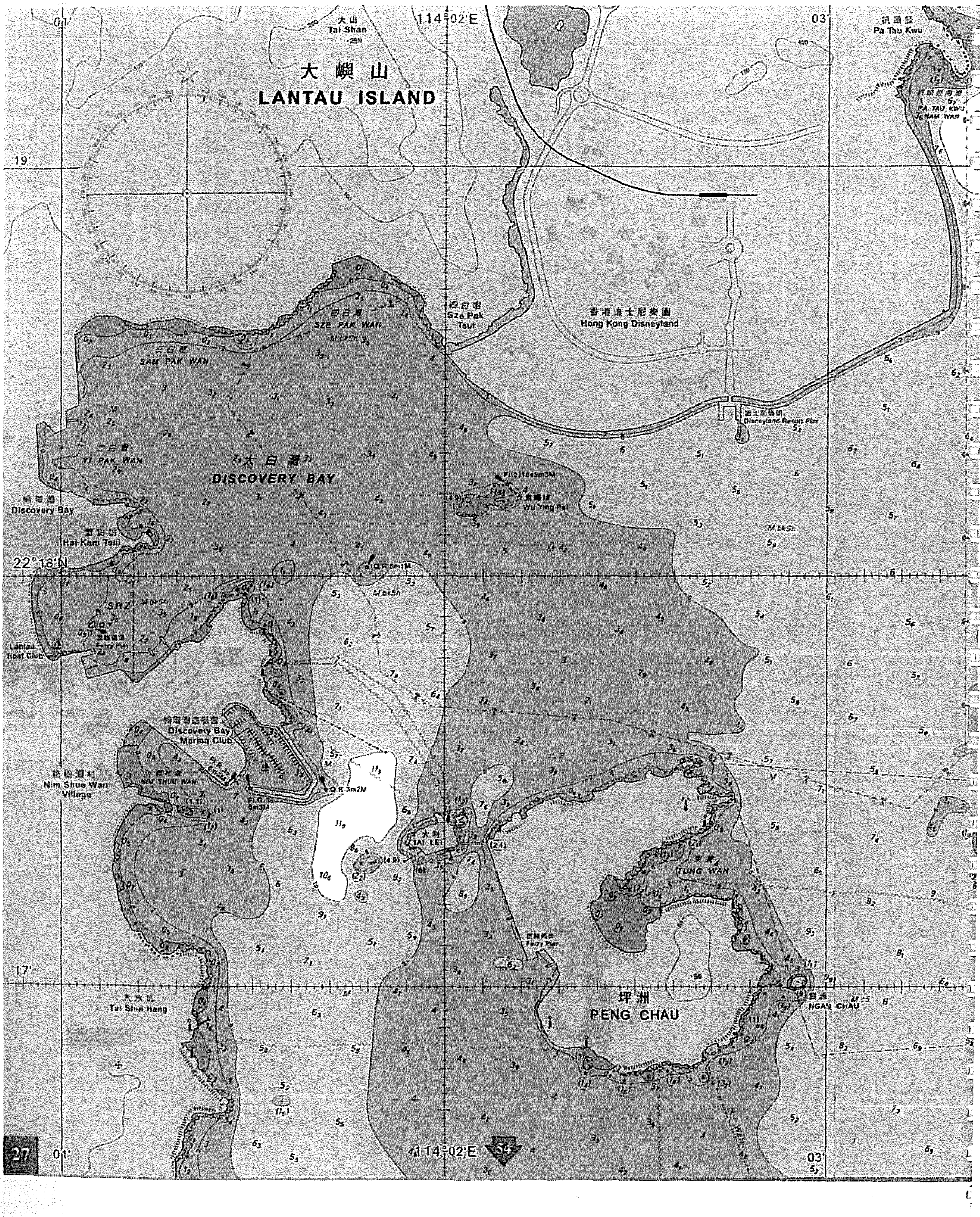


Dry season


point (8,170,1)
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
velocity, magnitude (m/s) →
26 Jul
28 Jul
30 Jul
1 Aug
3 Aug
5 Aug
7 Aug
9 Aug
time →

Appendix C

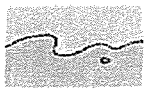
Bathymetry of Discovery Bay (Extracted from Nautical Map in Hong Kong)

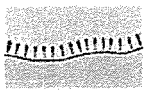

大嶼山
LANTAU ISLAND
大山
Tai Shan
114°02'E
01'
03'
Pa Tau Kwu
19'
22°18'N
17'
四白灣
SZE PAK WAN
二白灣
SAM PAK WAN
二白灣
YI PAK WAN
大白灣
DISCOVERY BAY
Discovery Bay
Hai Kam Tsui
Sze Pak
Tsui
香港迪士尼樂園
Hong Kong Disneyland
Disneyland Resort Pier
Wu Ying Pei
Lantau
Boat Club
Ferry Pier
Discovery Bay
Marina Club
Nim Shue Wan
Village
NIM SHUE WAN
TAI LEI
TUNG WAN
坪洲
PENG CHAU
NGAN CHAU
Tai Shui Hang
54

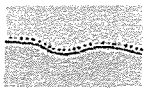
圖例

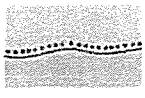
地貌 TOPOGRAPHY

自然地貌 Natural Features

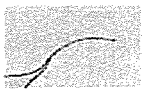

海岸線(已測量)
Coastline, surveyed


陡岸
Steep coast

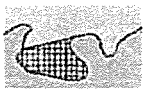

沙質岸
Sandy shore


石質岸
Stony shore

等高線(附數值)及高程點
Contour lines with values and spot height


河流、溪澗
River, Stream


水庫、塘
Reservoir, Pond


鹽田
Salt pans

沼林
Mangrove

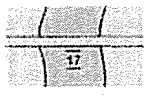

沼澤
Marsh

人工地貌 Cultural Features

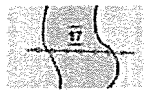

市區
Urban area


道路
Road


機場
Airport, Airfield



最高天文潮至橋底的垂直淨空
Vertical clearance above the Highest Astronomical Tide

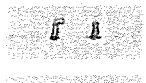


架空索道，附垂直淨空
Overhead transporter, Aerial cableway with vertical clearance

陸地標記 Landmarks


廟宇
Temple


塔
Tower


煙囪、紀念碑
Chimney, Monument


風力發電機、旗杆
Wind turbine, Flagstaff

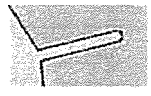

無線電桅、無線電塔
Radio mast, Radio tower

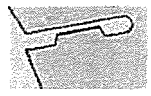

碟形天線
Dish aerial

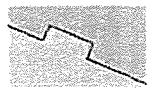

貯存庫
Tanks

港口 Ports


海堤
Seawall

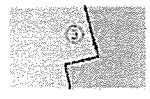

防波堤
Breakwater

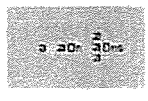

突堤(附泊位設施)
Mole
(with berthing facilities)


順岸碼頭
Quay, Wharf

突堤式碼頭
Pier, Jetty

浮碼頭、登岸梯級
Pontoon, Landing steps


泊位編號
Designation of berth


繫船柱
Dolphin


船台滑道
Slipway

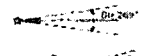

浮塢
Floating dock

輔航設備 NAVIGATION AIDS

燈標、立標 Lights, Beacons


主燈標
Major light


導燈
Leading lights


定向燈
Direction light

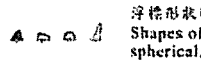

扇形燈
Sector light

設燈標誌
Lighted marks

一般立標
Beacon in general


電纜登陸點的立標
Cable landing beacon

浮標 Buoys


浮標形狀(錐形、罐形、球形、柱形)
Shapes of buoys (conical, can, spherical, pillar)

繫泊浮標
Mooring buoy

方位浮標(北、東、南、西)
Cardinal buoys (North, East, South, West)

孤立危險物浮標
Isolated danger buoy

安全水域浮標
Safe water buoys

特殊浮標
Special buoys

霧號、雷達 Fog Signal, Radar

燈立標上的霧角
(響號一次，周期15秒)
Lighted beacon, with horn giving a single blast every 15 seconds

雷達應答器
Radar transponder beacon

自動識別系統發射機
Automatic Identification System transmitter

一般信號站
Signal station in general

航道走向
Direction of buoyage

LEGEND

海道測量及服務 HYDROGRAPHY & SERVICES

深度 Depths

實際位置的水深
Soundings in true position

乾出高度
Drying heights

疏浚航道或區域(附維護深度)
Dredged channel or area with maintained depth

等深線
Depth contours

礁石區
Rocky area, which covers and uncovers

底質 Nature of the Seabed

S	沙	*Sand*
M	泥	*Mud*
Cy	黏土	*Clay*
Si	淤泥	*Silt*
St	石	*Stones*
G	沙礫	*Gravel*
P	小卵石	*Pebbles*
Co	鵝卵石	*Cobbles*
R	礁石	*Rock*
Co	珊瑚	*Coral*
Sh	貝殼	*Shells*
S/M	雙層底質，例如上沙下泥	*Two layers, e.g. Sand over Mud*
fS M Sh	混合底質，先註主要成份，例如幼沙混合泥、貝殼，	*The main constituent is given first for mixtures, e.g. fine sand with mud and shells*

礁石 Rocks

危險線
Danger line

乾出礁(高度在海圖基準以上)
Rock which covers and uncovers, height above Chart Datum

過潮礁(在海圖基準面)
Rock awash at the level of Chart Datum

危險暗礁(深度不明)
Dangerous underwater rock of uncertain depth

危險暗礁(已知深度)
Dangerous underwater rock of known depth

非危險暗礁(已知深度)
Non-dangerous rock, depth known

浪花
Breakers

沉船、障礙物 Wrecks, Obstructions

部份船體露出海圖基準面的沉船
Wreck showing any portion of hull at level of chart datum

僅桅杆露出海圖基準面的沉船
Wreck of which the mast(s) only are visible at Chart Datum

已知最小深度的沉船
Wreck, least depth known by sounding only

最小深度不明的沉船，對航行有潛在危險
Wreck, least depth unknown, considered to be potentially dangerous to some surface vessels.

礁區，對航行無危險，但應避免拋錨、拖網等，
Foul ground, not dangerous to surface navigation but to be avoided by vessels anchoring, trawling etc.

已知最小深度的障礙物
Obstruction, least depth known by sounding only

魚礁(附最小深度)
Fish haven with minimum depth

海產養殖場
Marine farm

近岸設施 Offshore Installations

海底電纜
Submarine cable

海底電纜區
Submarine cable area

海底輸電纜
Submarine power cable

海底輸電纜區
Submarine power cable area

停用海底電纜
Disused submarine cable

供應管道
Supply pipeline

排放管道
Outfall and Intake

停用管道
Disused pipeline/outfall

服務 Services

領港員登船站
Pilot boarding place

遊艇會
Marina

指定供給燃料區
Designated bunkering area

航路 Tracks, Routes

導航線(實線為應遵循的航路)
Leading line (firm line is the track to be followed)

沒有固定導航標誌的建議航路
Recommended tracks not based on a system of fixed marks

規定航向
Established direction of traffic flow

無線電報告點
Radio reporting points

航路分隔措施(附例)：
Examples of Routeing Measures :

① 分道航行制(以分隔帶/線隔開)
Traffic Separation Scheme, traffic separated by separation zone/line

② 警戒區
Precautionary area

③ 沿岸航行區
Inshore traffic zone

區域、界線 Areas, Limits

限制區
Restricted area

禁區界線(不准進入)
Limit of area into which entry is prohibited

錨地
Anchorage area

禁止錨泊區
Anchoring prohibited area

禁止捕魚區
Fishing prohibited area

鳥類保育區
Bird sanctuary

海岸保護區
Marine Reserve

SRZ
航速限制區
Speed Restricted Zone

Harbour Limit
海港界線
Harbour limit

香港特別行政區陸界
Boundary of the Hong Kong Special Administrative Region

Appendix D

CORMIX model output

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                        CORMIX MIXING ZONE EXPERT SYSTEM
                            CORMIX Version 5.0GT
                         HYDRO1:Version-5.0.1.0  December,2007
SITE NAME/LABEL:
  DESIGN CASE:
  FILE NAME:                        C:\Documents and
Settings\aac.sas.GLOBAL\Desktop\235928\cormix\Area6f\H2.6\Dry U50 H2.6.prd
  Using subsystem CORMIX1:      Single Port Discharges
  Start of session:              09/29/2016--17:12:16
*********************************************************************************
SUMMARY OF INPUT DATA:
---------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                              = unbounded
  Average depth                    HA        = 2.6 m
  Depth at discharge               HD        = 2.6 m
  Ambient velocity                 UA        = 0.01 m/s
  Darcy-Weisbach friction factor   F         = 0.0228
    Calculated from Manning's n              = 0.02
  Wind velocity                    UW        = 2 m/s
  Stratification Type              STRCND    = U
  Surface density                  RHOAS     = 1022 kg/m^3
  Bottom density                   RHOAB     = 1022 kg/m^3
---------------------------------------------------------------------------------
DISCHARGE PARAMETERS:              Single Port Discharge
  Nearest bank                               = left
  Distance to bank                 DISTB     = 2000 m
  Port diameter                    D0        = 0.08 m
  Port cross-sectional area        A0        = 0.0050 m^2
  Discharge velocity               U0        = 1.01 m/s
  Discharge flowrate               Q0        = 0.0051 m^3/s
  Discharge port height            H0        = 2.52 m
  Vertical discharge angle         THETA     = 0 deg
  Horizontal discharge angle       SIGMA     = 0 deg
  Discharge density                RHO0      = 1000 kg/m^3
  Density difference               DRHO      = 22 kg/m^3
  Buoyant acceleration             GP0       = 0.2111 m/s^2
  Discharge concentration          C0        = 30 deg.C
  Surface heat exchange coeff.     KS        = 0 m/s
  Coefficient of decay             KD        = 0 /s
---------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 7.19 m          Lb  = 1076.62 m
  LM  = 0.59 m          Lm' = 99999 m         Lb' = 99999 m
---------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
  Port densimetric Froude number   FR0       = 7.81
  Velocity ratio                   R         = 101.46
---------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                            = no
  Water quality standard specified           = yes
  Water quality standard           CSTD      = 8.99 deg.C
  Regulatory mixing zone                     = yes
  Regulatory mixing zone specification       = distance
  Regulatory mixing zone value               = 270 m (m^2 if area)
  Region of interest                         = 500 m
*********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-----------------------*
  | FLOW CLASS    = IPH2A5I |
  *-----------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 2.6 m
*********************************************************************************
```

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:
  Origin is located at the bottom below the port center:
    2000 m from the left bank/shore.
  Number of display steps NSTEP = 50 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge	c	= 0.1269 deg.C
Dilution at edge of NFR	s	= 236.4
NFR Location:	x	= 139.29 m
(centerline coordinates)	y	= 0 m
	z	= 2.6 m
NFR plume dimensions: half-width (bh)		= 208.79 m
thickness (bv)		= 0.29 m

Cumulative travel time: 11210.2207 sec.

Buoyancy assessment:
  The effluent density is less than the surrounding ambient water density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Benthic attachment:
  For the present combination of discharge and ambient conditions, the discharge plume becomes attached to the channel bottom within the NFR immediately following the efflux. High benthic concentrations may occur.

UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.

Intrusion length	=	200.10 m
Intrusion stagnation point	=	-165.20 m
Intrusion thickness	=	0.11 m
Intrusion half width at impingement	=	208.79 m
Intrusion half thickness at impingement	=	0.29 m

  In this case, the UPSTREAM INTRUSION IS VERY LARGE, exceeding ten (10) times the local water depth.
  This may be caused by the small ambient velocity, perhaps in combination with the strong buoyancy of the effluent, or alternatively, a strong ambient stratification.
  If the ambient conditions are quite unsteady (e.g. tidal), then the CORMIX steady-state predictions of the upstream intrusion are probably unrealistic. The plume predictions in the immediate near-field, prior to the intrusion layer formation, are acceptable, however.

PLUME BANK CONTACT SUMMARY:
  Plume in unbounded section does not contact bank in this simulation.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration	c	= 0.080111 deg.C
Corresponding dilution	s	= 374.5
Plume location:	x	= 270 m
(centerline coordinates)	y	= 0 m
	z	= 2.6 m
Plume dimensions: half-width (bh)		= 249.78 m
thickness (bv)		= 0.38 m

Cumulative travel time: 24280.8379 sec.
At this position, the plume is NOT IN CONTACT with any bank.
Furthermore, the specified water quality standard has indeed been met

within the RMZ. In particular:
The ambient water quality standard was encountered at the following plume position:

Water quality standard		= 8.99 deg.C
Corresponding dilution		s = 3.3
Plume location:		x = 1.65 m
(centerline coordinates)		y = 0 m
		z = 2.6 m
Plume dimension:	half-width (bh)	= 0.22 m

********** FINAL DESIGN ADVICE AND COMMENTS **********

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

CORMIX SESSION REPORT:

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CORMIX MIXING ZONE EXPERT SYSTEM
CORMIX Version 5.0GT
HYDRO1:Version-5.0.1.0 December,2007

SITE NAME/LABEL:
DESIGN CASE:
FILE NAME: C:\Documents and Settings\aac.sas.GLOBAL\Desktop\235928\cormix\Area6f\H2.6\Dry U90 H2.6.prd
Using subsystem CORMIX1: Single Port Discharges
Start of session: 09/29/2016--17:11:27

****

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section		= unbounded
Average depth	HA	= 2.6 m
Depth at discharge	HD	= 2.6 m
Ambient velocity	UA	= 0.02 m/s
Darcy-Weisbach friction factor	F	= 0.0228
Calculated from Manning's n		= 0.02
Wind velocity	UW	= 2 m/s
Stratification Type	STRCND	= U
Surface density	RHOAS	= 1022 kg/m^3
Bottom density	RHOAB	= 1022 kg/m^3

DISCHARGE PARAMETERS: Single Port Discharge

Nearest bank		= left
Distance to bank	DISTB	= 2000 m
Port diameter	D0	= 0.08 m
Port cross-sectional area	A0	= 0.0050 m^2
Discharge velocity	U0	= 1.01 m/s
Discharge flowrate	Q0	= 0.0051 m^3/s
Discharge port height	H0	= 2.52 m
Vertical discharge angle	THETA	= 0 deg
Horizontal discharge angle	SIGMA	= 0 deg
Discharge density	RHO0	= 1000 kg/m^3
Density difference	DRHO	= 22 kg/m^3
Buoyant acceleration	GP0	= 0.2111 m/s^2
Discharge concentration	C0	= 30 deg.C
Surface heat exchange coeff.	KS	= 0 m/s
Coefficient of decay	KD	= 0 /s

DISCHARGE/ENVIRONMENT LENGTH SCALES:

LQ = 0.07 m	Lm = 3.60 m	Lb = 134.58 m
LM = 0.59 m	Lm' = 99999 m	Lb' = 99999 m

NON-DIMENSIONAL PARAMETERS:

Port densimetric Froude number	FR0	= 7.81
Velocity ratio	R	= 50.73

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge		= no
Water quality standard specified		= yes
Water quality standard	CSTD	= 8.99 deg.C
Regulatory mixing zone		= yes
Regulatory mixing zone specification		= distance
Regulatory mixing zone value		= 270 m (m^2 if area)
Region of interest		= 500 m

****

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = IPH2A5I |

This flow configuration applies to a layer corresponding to the full water depth at the discharge site.
Applicable layer depth = water depth = 2.6 m

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:
  Origin is located at the bottom below the port center:
    2000 m from the left bank/shore.
  Number of display steps NSTEP = 50 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.
  Pollutant concentration at NFR edge c = 0.2429 deg.C
  Dilution at edge of NFR   s = 123.5
  NFR Location: x = 63.32 m
    (centerline coordinates)   y = 0 m
                                       z = 2.6 m
  NFR plume dimensions: half-width (bh) = 46.82 m
                          thickness (bv) = 0.34 m
Cumulative travel time: 1858.3932 sec.

Buoyancy assessment:
  The effluent density is less than the surrounding ambient water density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Benthic attachment:
  For the present combination of discharge and ambient conditions, the discharge plume becomes attached to the channel bottom within the NFR immediately following the efflux. High benthic concentrations may occur.

UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.
  Intrusion length   = 34.39 m
  Intrusion stagnation point   = 5.52 m
  Intrusion thickness   = 0.23 m
  Intrusion half width at impingement   = 46.82 m
  Intrusion half thickness at impingement = 0.34 m

  In this case, the UPSTREAM INTRUSION IS VERY LARGE, exceeding ten (10) times the local water depth.
  This may be caused by the small ambient velocity, perhaps in combination with the strong buoyancy of the effluent, or alternatively, a strong ambient stratification.
  If the ambient conditions are quite unsteady (e.g. tidal), then the CORMIX steady-state predictions of the upstream intrusion are probably unrealistic. The plume predictions in the immediate near-field, prior to the intrusion layer formation, are acceptable, however.

PLUME BANK CONTACT SUMMARY:
  Plume in unbounded section does not contact bank in this simulation.
********** TOXIC DILUTION ZONE SUMMARY **********
No TDZ was specified for this simulation.
********** REGULATORY MIXING ZONE SUMMARY **********
The plume conditions at the boundary of the specified RMZ are as follows:
  Pollutant concentration   c = 0.143731 deg.C
  Corresponding dilution   s = 208.7
  Plume location: x = 270 m
    (centerline coordinates)   y = 0 m
                                       z = 2.6 m
  Plume dimensions: half-width (bh) = 105.02 m
                          thickness (bv) = 0.25 m
Cumulative travel time: 12192.4678 sec.
At this position, the plume is NOT IN CONTACT with any bank.
Furthermore, the specified water quality standard has indeed been met

within the RMZ. In particular:
The ambient water quality standard was encountered at the following plume position:

Water quality standard	= 8.99	deg.C
Corresponding dilution	s = 3.3	
Plume location:	x = 1.64	m
(centerline coordinates)	y = 0	m
	z = 2.6	m
Plume dimension: half-width (bh)	= 0.21	m

********** FINAL DESIGN ADVICE AND COMMENTS **********

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                        CORMIX MIXING ZONE EXPERT SYSTEM
                            CORMIX Version 5.0GT
                         HYDRO1:Version-5.0.1.0  December,2007
SITE NAME/LABEL:
  DESIGN CASE:
  FILE NAME:                        C:\Documents and
Settings\aac.sas.GLOBAL\Desktop\235928\cormix\Area6f\H2.6\Wet U50 H2.6.prd
  Using subsystem CORMIX1:      Single Port Discharges
  Start of session:              09/29/2016--17:12:51
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                             = unbounded
  Average depth                  HA         = 2.6 m
  Depth at discharge             HD         = 2.6 m
  Ambient velocity               UA         = 0.01 m/s
  Darcy-Weisbach friction factor F          = 0.0228
    Calculated from Manning's n             = 0.02
  Wind velocity                  UW         = 2 m/s
  Stratification Type            STRCND     = A
  Surface density                RHOAS      = 1017 kg/m^3
  Bottom density                 RHOAB      = 1017.7 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:            Single Port Discharge
  Nearest bank                              = left
  Distance to bank               DISTB      = 2000 m
  Port diameter                  D0         = 0.08 m
  Port cross-sectional area      A0         = 0.0050 m^2
  Discharge velocity             U0         = 1.01 m/s
  Discharge flowrate             Q0         = 0.0051 m^3/s
  Discharge port height          H0         = 2.52 m
  Vertical discharge angle       THETA      = 0 deg
  Horizontal discharge angle     SIGMA      = 0 deg
  Discharge density              RHO0       = 1000 kg/m^3
  Density difference             DRHO       = 17.3500 kg/m^3
  Buoyant acceleration           GP0        = 0.1672 m/s^2
  Discharge concentration        C0         = 30 deg.C
  Surface heat exchange coeff.   KS         = 0 m/s
  Coefficient of decay           KD         = 0 /s
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 7.19 m          Lb  = 852.94 m
  LM  = 0.66 m          Lm' = 99999 m         Lb' = 99999 m
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
  Port densimetric Froude number FR0       = 8.77
  Velocity ratio                 R         = 101.46
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                           = no
  Water quality standard specified          = yes
  Water quality standard         CSTD       = 8.99 deg.C
  Regulatory mixing zone                    = yes
  Regulatory mixing zone specification      = distance
  Regulatory mixing zone value              = 270 m (m^2 if area)
  Region of interest                        = 500 m
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = IPH2A5I |
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.  The ambient density stratification at the
  discharge site is relatively weak and unimportant so the discharge flow
  penetrates to the surface and/or breaks down the existing stratification
```

through vigorous mixing.
Applicable layer depth = water depth = 2.6 m

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:
Origin is located at the bottom below the port center:
2000 m from the left bank/shore.
Number of display steps NSTEP = 50 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge	c	= 0.1339 deg.C
Dilution at edge of NFR	s	= 224.1
NFR Location:	x	= 129.55 m
(centerline coordinates)	y	= 0 m
	z	= 2.6 m
NFR plume dimensions: half-width	(bh)	= 183.05 m
thickness	(bv)	= 0.31 m

Cumulative travel time: 10033.9805 sec.

Buoyancy assessment:
The effluent density is less than the surrounding ambient water density at the discharge level.
Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Stratification assessment:
The specified ambient density stratification is weak relative to the discharge conditions and is dynamically unimportant. The discharge will behave as if the ambient were unstratified.

Benthic attachment:
For the present combination of discharge and ambient conditions, the discharge plume becomes attached to the channel bottom within the NFR immediately following the efflux. High benthic concentrations may occur.

UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.

Intrusion length	=	166.86 m
Intrusion stagnation point	=	-128.83 m
Intrusion thickness	=	0.13 m
Intrusion half width at impingement	=	183.05 m
Intrusion half thickness at impingement	=	0.31 m

In this case, the UPSTREAM INTRUSION IS VERY LARGE, exceeding ten (10) times the local water depth.
This may be caused by the small ambient velocity, perhaps in combination with the strong buoyancy of the effluent, or alternatively, a strong ambient stratification.
If the ambient conditions are quite unsteady (e.g. tidal), then the CORMIX steady-state predictions of the upstream intrusion are probably unrealistic. The plume predictions in the immediate near-field, prior to the intrusion layer formation, are acceptable, however.

PLUME BANK CONTACT SUMMARY:
Plume in unbounded section does not contact bank in this simulation.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration	c	= 0.07966 deg.C
Corresponding dilution	s	= 376.6

```
  Plume location:                    x = 270 m
    (centerline coordinates)         y = 0 m
                                     z = 2.6 m
  Plume dimensions:      half-width (bh) = 228.26 m
                          thickness (bv) = 0.42 m
Cumulative travel time:       24078.6426 sec.
At this position, the plume is NOT IN CONTACT with any bank.
Furthermore, the specified water quality standard has indeed been met
  within the RMZ. In particular:
The ambient water quality standard was encountered at the following
  plume position:
  Water quality standard                = 8.99  deg.C
  Corresponding dilution              s = 3.3
  Plume location:                     x = 1.65 m
    (centerline coordinates)          y = 0 m
                                      z = 2.6 m
  Plume dimension:       half-width (bh) = 0.22 m
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                        CORMIX MIXING ZONE EXPERT SYSTEM
                            CORMIX Version 5.0GT
                         HYDRO1:Version-5.0.1.0  December,2007
SITE NAME/LABEL:
  DESIGN CASE:
  FILE NAME:                        C:\Documents and
Settings\aac.sas.GLOBAL\Desktop\235928\cormix\Area6f\H2.6\Wet U90 H2.6.prd
  Using subsystem CORMIX1:      Single Port Discharges
  Start of session:              09/29/2016--17:13:23
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                              = unbounded
  Average depth                    HA        = 2.6 m
  Depth at discharge               HD        = 2.6 m
  Ambient velocity                 UA        = 0.02 m/s
  Darcy-Weisbach friction factor   F         = 0.0228
    Calculated from Manning's n              = 0.02
  Wind velocity                    UW        = 2 m/s
  Stratification Type              STRCND    = A
  Surface density                  RHOAS     = 1017 kg/m^3
  Bottom density                   RHOAB     = 1017.7 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:              Single Port Discharge
  Nearest bank                               = left
  Distance to bank                 DISTB     = 2000 m
  Port diameter                    D0        = 0.08 m
  Port cross-sectional area        A0        = 0.0050 m^2
  Discharge velocity               U0        = 1.01 m/s
  Discharge flowrate               Q0        = 0.0051 m^3/s
  Discharge port height            H0        = 2.52 m
  Vertical discharge angle         THETA     = 0 deg
  Horizontal discharge angle       SIGMA     = 0 deg
  Discharge density                RHO0      = 1000 kg/m^3
  Density difference               DRHO      = 17.3500 kg/m^3
  Buoyant acceleration             GP0       = 0.1672 m/s^2
  Discharge concentration          C0        = 30 deg.C
  Surface heat exchange coeff.     KS        = 0 m/s
  Coefficient of decay             KD        = 0 /s
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 3.60 m          Lb  = 106.62 m
  LM  = 0.66 m          Lm' = 99999 m         Lb' = 99999 m
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
  Port densimetric Froude number   FR0       = 8.77
  Velocity ratio                   R         = 50.73
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                            = no
  Water quality standard specified           = yes
  Water quality standard           CSTD      = 8.99 deg.C
  Regulatory mixing zone                     = yes
  Regulatory mixing zone specification       = distance
  Regulatory mixing zone value               = 270 m (m^2 if area)
  Region of interest                         = 500 m
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-----------------------*
  | FLOW CLASS   = IPH2A5I |
  *-----------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.  The ambient density stratification at the
  discharge site is relatively weak and unimportant so the discharge flow
  penetrates to the surface and/or breaks down the existing stratification
```

through vigorous mixing.
Applicable layer depth = water depth = 2.6 m

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:
Origin is located at the bottom below the port center:
2000 m from the left bank/shore.
Number of display steps NSTEP = 50 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge	c =	0.2073 deg.C
Dilution at edge of NFR	s =	144.7
NFR Location:	x =	70.74 m
(centerline coordinates)	y =	0 m
	z =	2.6 m
NFR plume dimensions: half-width (bh) =		48.72 m
thickness (bv) =		0.38 m
Cumulative travel time:		2075.4932 sec.

Buoyancy assessment:
The effluent density is less than the surrounding ambient water density at the discharge level.
Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Stratification assessment:
The specified ambient density stratification is weak relative to the discharge conditions and is dynamically unimportant. The discharge will behave as if the ambient were unstratified.

Benthic attachment:
For the present combination of discharge and ambient conditions, the discharge plume becomes attached to the channel bottom within the NFR immediately following the efflux. High benthic concentrations may occur.

UPSTREAM INTRUSION SUMMARY:
Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.

Intrusion length	=	40.51 m
Intrusion stagnation point	=	5.86 m
Intrusion thickness	=	0.35 m
Intrusion half width at impingement	=	48.72 m
Intrusion half thickness at impingement	=	0.38 m

In this case, the UPSTREAM INTRUSION IS VERY LARGE, exceeding ten (10) times the local water depth.
This may be caused by the small ambient velocity, perhaps in combination with the strong buoyancy of the effluent, or alternatively, a strong ambient stratification.
If the ambient conditions are quite unsteady (e.g. tidal), then the CORMIX steady-state predictions of the upstream intrusion are probably unrealistic. The plume predictions in the immediate near-field, prior to the intrusion layer formation, are acceptable, however.

PLUME BANK CONTACT SUMMARY:
Plume in unbounded section does not contact bank in this simulation.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration	c =	0.124012 deg.C
Corresponding dilution	s =	241.9

Plume location: x = 270 m
(centerline coordinates) y = 0 m
z = 2.6 m
Plume dimensions: half-width (bh) = 102.29 m
thickness (bv) = 0.30 m
Cumulative travel time: 12038.7305 sec.
At this position, the plume is NOT IN CONTACT with any bank.
Furthermore, the specified water quality standard has indeed been met within the RMZ. In particular:
The ambient water quality standard was encountered at the following plume position:
Water quality standard = 8.99 deg.C
Corresponding dilution s = 3.3
Plume location: x = 1.64 m
(centerline coordinates) y = 0 m
z = 2.6 m
Plume dimension: half-width (bh) = 0.21 m

********** FINAL DESIGN ADVICE AND COMMENTS **********

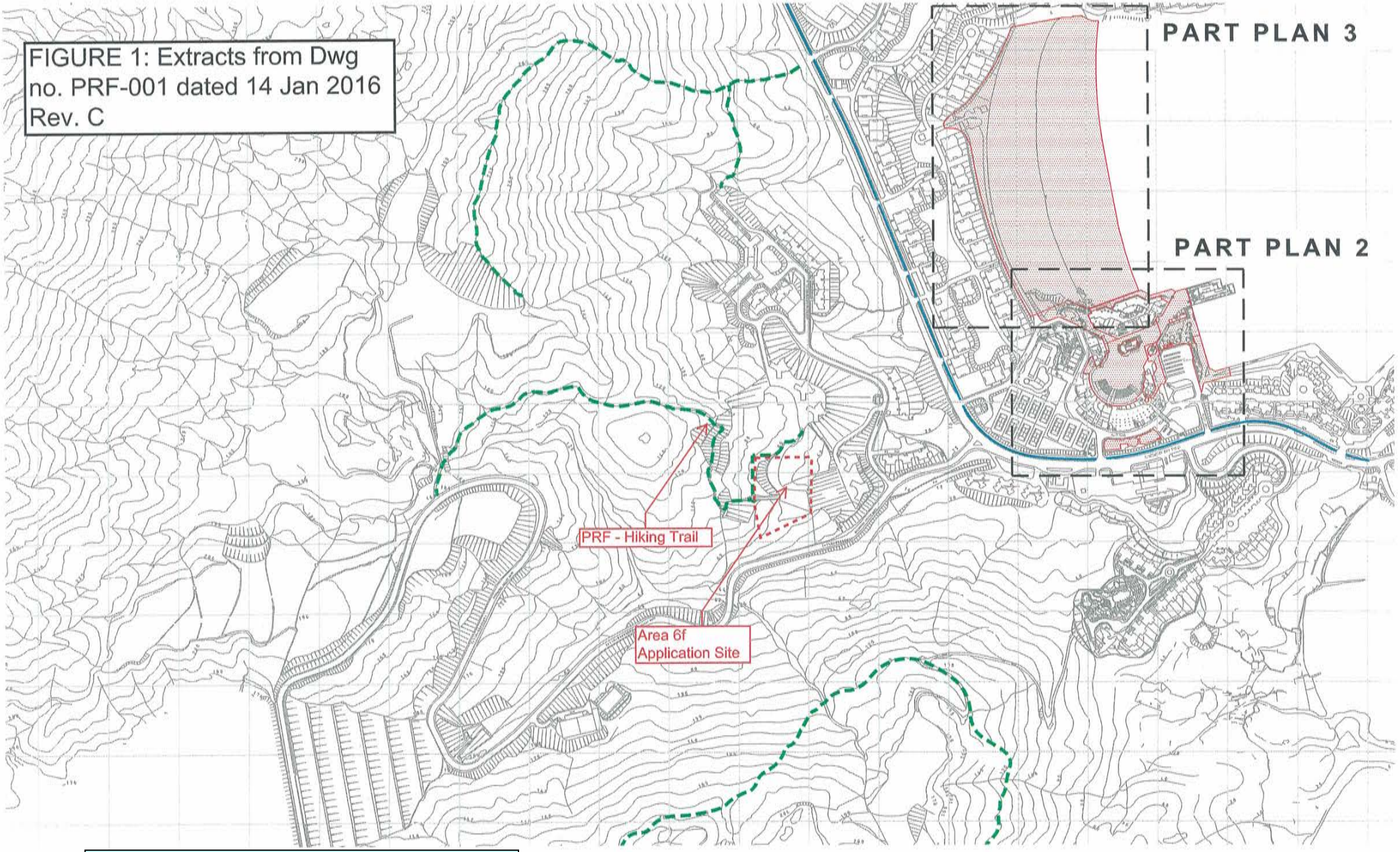
REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

Annex F

Public Recreation Facilities Demarcation Plan (extract)

and

Deeds of Restrictive Covenant (extract)



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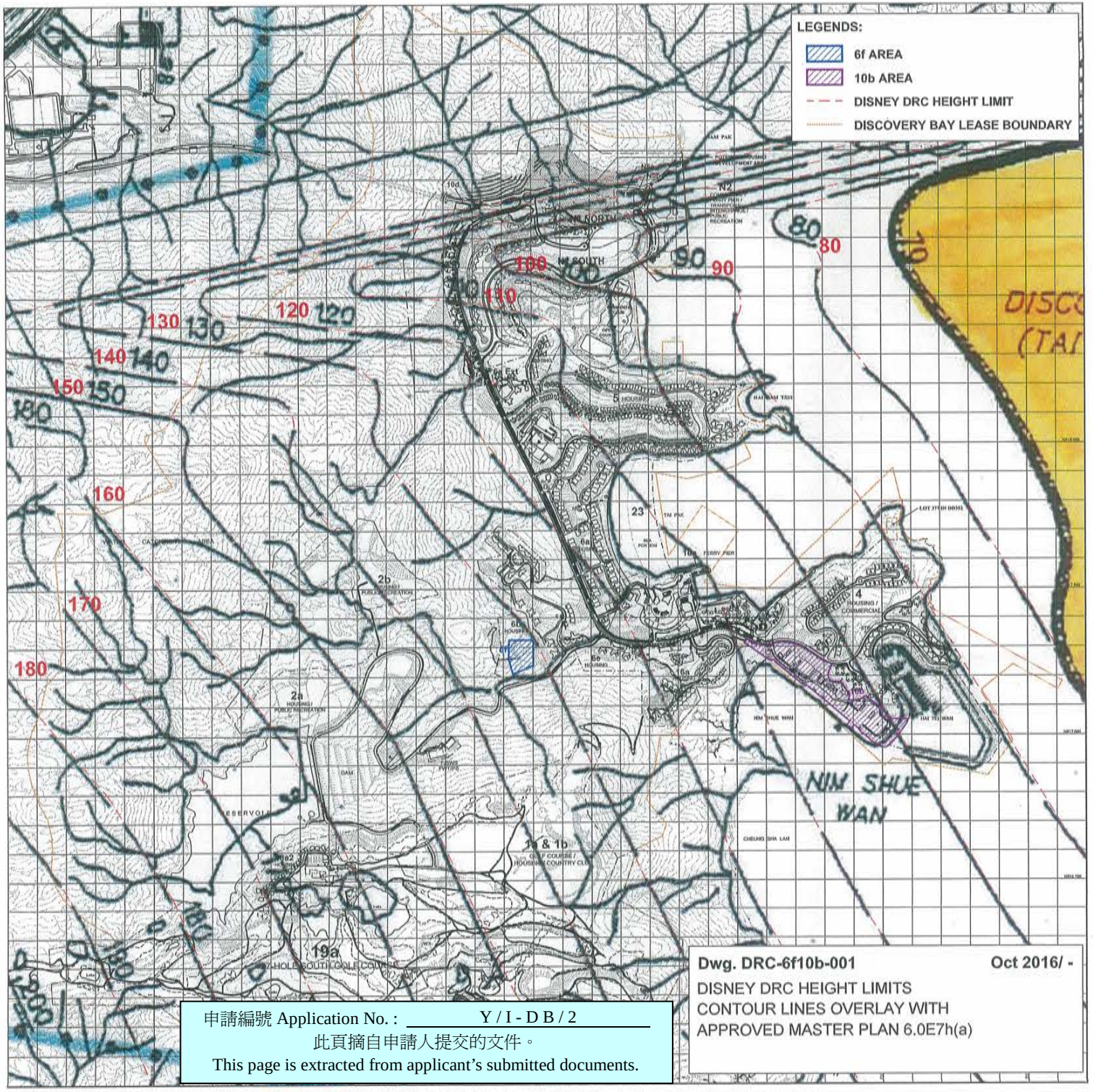

Annex G

Revised Study on Drainage, Sewerage and Water Supply

Hong Kong Resort Company Limited

Optimization of Land Use in Discovery Bay

Study on Drainage, Sewerage and Water Supply Systems for Area 6f

235928-REP-002-03

Rev 03 | October 2016

Job number 235928

Ove Arup & Partners Ltd
Level 5 Festival Walk
80 Tat Chee Avenue
Kowloon Tong
Kowloon
Hong Kong
www.arup.com

ARUP

Document Verification

ARUP

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Revision	**Date**	**Filename**	REP-002-00	
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			Prepared by	Checked by	Approved by
		Name	Various	Kenneth Kwok	Franki Chiu
		Signature			
01	Dec 2015	**Filename**	REP-002-01	
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		Name	Various	Kenneth Kwok	Franki Chiu
		Signature			
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		Name	Various	Kenneth Kwok	Franki Chiu
		Signature			
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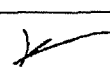
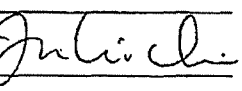
		Description	Study on Drainage, Sewerage and Water Supply Systems for Area 6f	
			Prepared by	Checked by	Approved by
		Name	Various	Yuvi Luo	Franki Chiu
		Signature			

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Capacity Checking Calculations on existing Discovery Bay Reservoir, Fresh Water Service Reservoir and Proposed Water Supply System

Executive Summary

The Hong Kong Resort Company Limited (HKRCL) has been considering the feasibility of implementing additional development areas within the existing boundary of Discovery Bay to provide additional housing supply. A planning statement, titled "Optimisation of Land Use in Discovery Bay" was submitted to Planning Department (PlanD) in July 2013. A round of comments from various Government departments was received in December 2013 (ref PlanD's letter ( ) L1/L/DBNC/352-17 dated 17 December 2013). Another round of submission was made in August 2014 and the corresponding set of comments was received from various Government departments in December 2014 (ref. PlanD's letter ( ) L1/L/DBNS/352-17(CR) dated 23 December 2014). In order to address those comments, the development proposal has been refined accordingly and a further round of submission was made in March 2015 and corresponding set of comments was received from Environmental Protection Department (EPD) in May 2015 (ref. PlanD's letter L1/L/DBNS/352-17(CR) dated 19 May 2015). In order to address those comments, the report has been revised accordingly.

The latest current scheme only refers to Area 6f. The potential development area is included in the latest approved Discovery Bay Outline Zoning Plan as "Other Specified Uses" and "Government, Institution and Community", despite the fact that some of their development parameters are proposed to be amended..

This report would address the issues relating to drainage, sewerage and water supply for the latest development proposal of Area 6f, while taking into account the cumulative impact of Area 10b. Those relating to noise, air quality, water quality, land contamination and ecology are separately presented in another report..

Drainage

Discovery Bay has a network of engineering drainage system that originates from the foot of the hills to convey the surface runoff east to the sea. The potential development is located at the catchment with total area of 202.5 ha.

In the drainage catchment, a number of drainage box culverts [from sizes of 2m (H) x 3m (W) to 3.8m (H) x 4.5m (W)] exist and mainly run along existing carriageway. The existing box culverts collect surface runoff from nearly half of Discovery Bay. They collect the runoff from natural streams of hillside as well as the urban paved area in the centre of Discovery Bay.

The potential developments will generate increase in surface runoff due to 0.22 ha of land area changed from unpaved to paved (equivalent to 0.1% of 202.5 ha total catchment area). As the existing box culverts are capable to cater for the increase in surface runoff from potential development at Area 6f, no mitigation measure is recommended to the existing box culverts.

Sewerage

Sewage generated from existing Discovery Bay developments is collected by four existing sewage pumping stations at Discovery Bay and then transferred to DSD Siu Ho Wan Sewage Treatment Works (SHWSTW) for further treatment and

disposal via the internal rising mains between the sewage pumping stations and existing 450mm diameter twin rising mains laid along Discovery Bay Tunnel to SHWSTW. SHWSTW is a chemically enhanced primary treatment (CEPT) with design treatment capacity of 180,000 m^3/d and a design peak flow of 3,750 l/s.

EPD commented in May 2015 that the current capacity of SHWSTW has been allocated for other existing and planned future developments so SHWSTW has no spare capacity to cater for the additional sewage from the potential developments at Discovery Bay despite that additional flow due to potential developments for both 6f and 10b is only 0.8% of the current SHWSTW design treatment capacity. EPD also advised that there is currently no plan to increase the design capacity of the SHWSTW in the short and medium terms.

As the EPD cannot commit to provide extra treatment capacity in SHWSTW for the proposed development in Area 6f in the short and medium terms, an alternative sewerage option of discharging the sewage from the Area 6f to an on-site small Discovery Bay Sewage Treatment Works (DBSTW) is proposed.

Nevertheless, the possibility of discharging additional sewage flows generated from the Discovery Bay potential developments to SHWSTW in the long term should not be totally ruled out. For example, the Government is actively seeking cavern development as a new source of land supply. If in the future, it is deemed suitable that the existing SHWSTW can be relocated into a cavern site to vacate valuable land for development, the relocated SHWSTW can be such designed to accommodate the increased sewage flows from the Discovery Bay.

HKRCL opines that, should EPD plans for infrastructure extension of the SHWSTW in the long term, EPD should consider all private and public developments in the vicinity on equal and fair basis.

Water Supply

Discovery Bay falls within supply zone of Siu Ho Wan Water Treatment Works (SHWWTW) via the Siu Ho Wan Fresh Water Pumping Station (FWPS). SHWWTW and Siu Ho Wan FWPS have a nominal capacity of 150,000 m^3/d. Allowance has been made in SHWWTW for expansion to an ultimate capacity of 300,000 m^3/d. An existing 1000mm / 1200 mm pumping main delivers fresh water from Siu Ho Wan FWPS to Tung Chung Fresh Water Service Reservoir. Fresh water is further pumped by Discovery Bay Fresh Water Booster Pumping Station via a 450mm branch-off pipe from the existing 1200 mm fresh water main. A 450 mm diameter outlet pumping main of Discovery Bay FWPS, laid along Discovery Bay Tunnel, delivers fresh water to Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 for fresh water supply to Discovery Bay.

The existing capacity of the SHWWTW is insufficient to supply the existing developments, other concurrent and future developments within the supply zone of SHWWTW. Therefore, SHWWTW and Siu Ho Wan FWPS are expected to be upgraded to a reported capacity of 300,000 m^3/d irrespective of the Discovery Bay potential developments. Spare capacity of the upgraded SHWWTW and upgraded Siu Ho Wan FWPS with 300,000 m^3/d capacity will then be adequate to supply additional fresh water to Discovery Bay potential development at Area 6f, which

has estimated mean daily fresh water demand of 512 m^3/d (equivalent to 0.17% of the ultimate upgraded capacity of SHWWTW).

If the expanded SHWWTW still cannot provide fresh water supply to the potential development areas of Discovery Bay, an alternative fresh water supply scheme to abstract raw water from Discovery Bay Reservoir, treat by a new water treatment plant and distribute by new water mains is recommended. An analysis has been carried out and confirmed that the existing reservoir has sufficient storage volume to supply the additional fresh water demand even during a drought year.

Additional flushing supply to the potential development Area 6f will be provided from the existing Discovery Bay Reservoir. It has been checked that the existing reservoir has enough storage even during a drought year to meet this additional flushing water demand.

To facilitate the Discovery Bay potential developments, new water mains including fresh and flushing water mains are required for water supply to potential development Area 6f.

1 Introduction

1.1 Background

1.1.1 The Hong Kong Resort Company Limited (HKRCL) has been considering the feasibility of implementing additional development areas within the existing boundary of Discovery Bay to provide additional housing supply. A planning statement, titled "Optimization of Land Use in Discovery Bay" was submitted to Planning Department (PlanD) in July 2013. A round of comments from various Government departments was received in December 2013 (ref PlanD's letter (L1/L/DBNC/352-17 dated 17 December 2013).

1.1.2 Another round of submission was made in August 2014 and the corresponding set of comments was received from various Government departments in December 2014 (ref. PlanD's letter ( ) L1/L/DBNS/352-17(CR) dated 23 December 2014). A further round of submission was made in March 2015 and only comments from Environmental Protection Department (EPD) were received in May 2015 (ref. PlanD's letter L1/L/DBNS/352-17(CR) dated 19 May 2015).

1.1.3 Ove Arup & Partners HK Ltd (Arup) has been appointed by HKRCL to conduct assessments to address those comments relating to environmental aspects including noise, air quality, water quality, land contamination, ecology, sewerage, drainage and water supply.

1.1.4 This report addresses those comments relating to drainage, sewerage and water supply for Area 6f, taking into account the cumulative impact of the concurrent development at Area 10b. Those relating to noise, air quality, water quality, land contamination and ecology are separately presented in another report.

1.2 Overview of Potential Development Proposal

1.2.1 After receiving the comments from various government departments in December 2013, December 2014 and May 2015, HKRCL has been optimising the development proposal to address those comments. Under the current planning proposal, a total of 476 nos. of flats with an estimated total population of 1,190 would be developed in Area 6f, which has a site area of 8,300 m^2.

1.2.2 **Figure 1** illustrates the locations of the potential development area 6f and more relevant description on the details of the potential development area are given in **Section 2**.

1.2.3 It is noted that there is another potential development in Area 10b of Discovery Bay for residential development (site area of 63,000 m^2 and estimated total population of 2,813). For the purpose of the study on drainage, sewerage and water supply, the cumulative impacts from both potential developments at Area 6f and Area 10b have been considered.

1.2.4 The latest approved Master Plan for Discovery Bay is MP6.0E7h(a). HKRCL is now applying to DLO for the approval of Revised Master Plan MP7.0E which includes all potential developments under the current OZP. HKRCL anticipates that MP7.0E be approved end 2017 or early 2018.

1.3 Key Objectives and Scope of this Study

1.3.1 The key objectives and scope of this study are given below:

- Obtain and examine existing drainage, sewerage and water supply records;
- Carry out site inspections;
- Estimate the surface runoff based on the proposed development scheme and determine capacity of existing drainage system immediately downstream of the potential developments;
- Assess the effect of the potential development on the existing drainage system and assess any mitigation measures are required;
- Estimate Sewage flow generation from proposed development, describe in board terms the new sewerage infrastructure needed to serve the potential development;
- Conduct a detailed water demand assessment for the proposed development scheme and examine rainwater collection in existing catchment of the Discovery Bay Reservoir in the drought year as the worst scenario for flushing water supply;
- Recommend conceptual water supply to meet the demand of the additional development; and
- Describe in board terms the new water supply infrastructure and/or upgrading requirements of the existing reservoir and water treatment facilities are required.

2 Project Description

2.1 Background

2.1.1.1 The Discovery Bay development is a self-contained sub-urban residential development comprising mainly low-density private housing, situated in the eastern part of Lantau Island covering a total land area of about 650 hectares. There are currently around 8,300 nos. of residential flat with total population around 19,300.

2.1.1.2 Discovery Bay falls within the ambit of the Discovery Bay Outline Zoning Plan (Discovery Bay OZP) which was first approved on 21 March 2003. The current approved OZP limits the population to 25,000 (i.e. 10,000 nos. of residential flat), which is reflected in the latest Master Plan.

2.2 Development Area Description

2.2.1.1 Area 6f is located south of Parkvale Village in Parkvale Drive. Site observation reveals that the site has partly been previously formed and cleared, and is mainly occupied by grassland.

2.2.1.2 The current permissible land use for Area 6f in the Discovery Bay OZP is "Other Specified Uses" for staff quarters. Within Area 6f, it is proposed to have residential buildings, together with the necessary infrastructure and landscaping elements.

2.3 Tentative Implementation Programme

2.3.1 According to the latest design, the tentative time for the occupation of the potential development areas would be beyond 2020 and this actual date would be reviewed throughout the design process.

3 Site Inspection

3.1 Several site visits were carried out in April – June 2014 to inspect existing public and Discovery Bay's private drainage, sewerage and water supply infrastructure. The following tables present the site photos for some major infrastructure components, which will be discussed in this study. Figure 1 illustrates respective location of these infrastructure.

Table 3.1a Existing Government and Private Sewerage Infrastructure

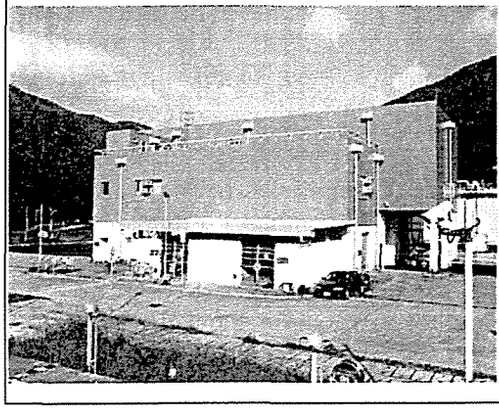
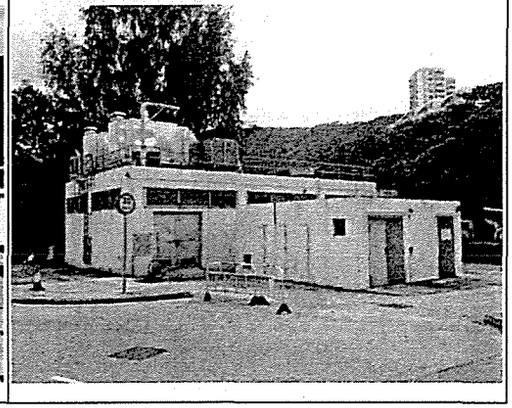
DSD Siu Ho Wan Sewage Treatment Works	Sewage Pumping Station No. 2 at Discovery Bay
	

Table 3.1b Existing Government Water Supply Infrastructure

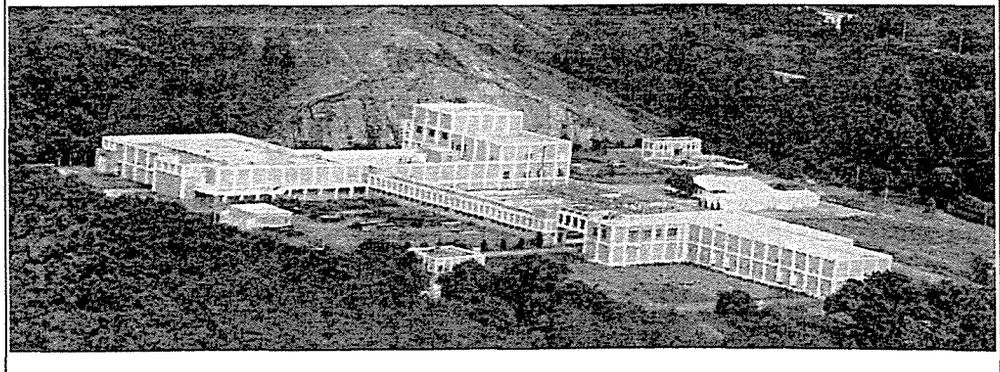
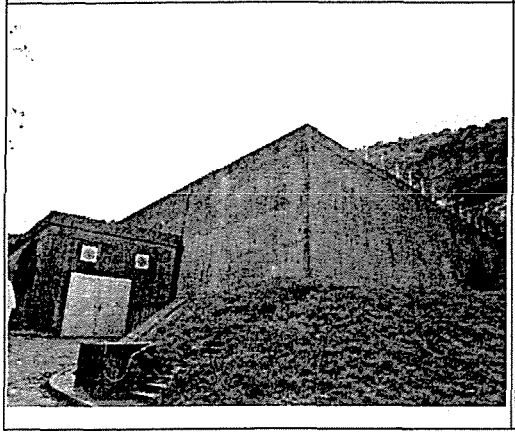
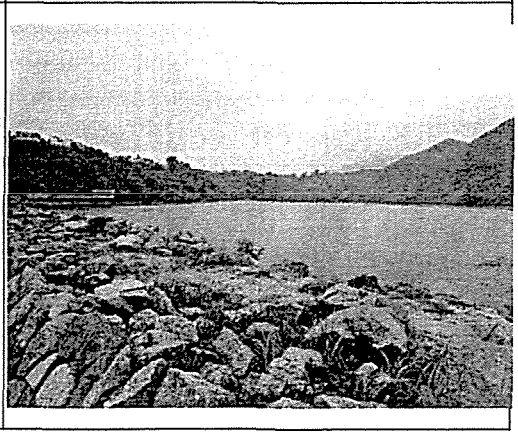
WSD Siu Ho Wan Water Treatment Works


Table 3.1c Existing Private Water Supply Infrastructure

Fresh Water Service Reservoir No. 1 at Discovery Bay	Discovery Bay Reservoir
	

4 Drainage Study

4.1 Methodology and Guidelines

4.1.1.1 The drainage study reviews the existing drainage catchment and systems at the Discovery Bay. It assesses the potential drainage impacts due to the potential development Area 6f and identifies the necessary drainage mitigation measures and proposed drainage system for Area 6f. This section presents the design method, parameters and criteria used for this drainage study.

4.1.2 Design Method

4.1.2.1 Stormwater drain capacity will be calculated based on the Continuity Equation:

$Q = AV$

Where Q = full flow capacity in m^3/s

A = cross-sectional area in m^2

V = velocity at full bore flow in m/s

4.1.2.2 Velocity at full-bore flow is based on the Colebrook-White equation:

$$V = -(32gRS)^{0.5} \log \{(k_s/14800R) + (1.255v/R(32gRS)^{0.5})\}$$

Where g = acceleration due to gravity in m/s^2

R = hydraulic radius in m

S = gradient

k_s = roughness in mm

v = kinematic viscosity of water in m^2/s

4.1.2.3 Peak stormwater runoff rate will be calculated using Rational Method:

$Q = 0.278\ C\ i\ A$

Where Q = peak stormwater runoff in m^3/s

C = runoff coefficient

i = design mean intensity of rainfall (mm/hr)

A = area of catchment in km^2

The design mean intensity of rainfall is based on Gumbel Solution in accordance with DSD Stormwater Design Manual, 4th Edition, 2013 (DSD SDM):

$$i = a / (t_c + b)^{\wedge}c$$

Where t_c = time of concentration in minutes

a, b, c = storm constants

4.1.3 Codes of Practice and Design Manuals

4.1.3.1 The assessment has been carried out in accordance with DSD SDM.

4.2 Design Parameters

4.2.1 Drainage System Capacity

4.2.1.1 Capacity of the proposed stormwater drainage system will be designed to cater for return period design peak flow as follows:

- 1 in 50 years return period design peak flow for urban drainage branch systems
- 1 in 200 years return period design peak flow for urban drainage trunk systems (equivalent to 1,800 mm diameter pipe or larger)

4.2.1.2 To account for the effect of materials deposited in the drainage systems between desilting cycles, the following reduction of flow area is assumed in accordance with DSD SDM:

- 5% reduction of flow area if the pipe gradient is greater than 1 in 25
- 10% reduction of flow area in other cases

4.2.1.3 Return period storm constants for calculation of rainfall intensities are obtained from DSD SDM and listed as follows:

- 1 in 50 years return period: a = 687; b = 4.2; and c = 0.42
- 1 in 200 years return period: a = 766; b = 4.1; and c = 0.40

4.2.2 Runoff Coefficient

Surface Characteristics	Runoff Coefficient, C
Paved Area	1.0
Unpaved Area	0.3

4.2.3 Time of Concentration

Time of concentration (t_c) is the shortest time in which all parts of the upstream catchment will contribute to the flow at the point of calculation. This is given by the equation:

$$t_c = t_e + t_f$$

Where t_e = time of entry

t_f = time of flow

The time of entry, which is equivalent to time of concentration for a natural catchment, is calculated using the Brandsby William's Equation as follows:

$$t_o = \frac{0.14465L}{H^{0.2} A^{0.1}}$$

Where t_o = time of concentration of a natural catchment (min.)

A = catchment area (m^2)

H = average slope (m per 100m) of the natural flow

L = distance (m) of the natural flow

4.3 Existing Drainage System

4.3.1 Discovery Bay has a network of engineering drainage system that originates from the foot of the hills to convey the surface runoff east to the sea. The existing drainage layout plan is illustrated in **Figure 2**. A description of this existing drainage system is provided below.

4.3.2 The potential development at Area 6f is located in a natural hillside catchment with a total area of 202.5 ha, shown as the green catchment in the following Figure.

Discovery Bay Drainage Catchment Plan

4.3.3 There are a number of drainage box culverts of varying sizes from 2m (H) x 3m (W) to 3.8m (H) x 4.5m (W) that mainly run along the existing Discovery Bay Road. These existing box culverts collect surface runoff from nearly half of Discovery Bay, including runoff from the natural hillside slopes as well as the urban paved area in the centre of Discovery Bay.

4.3.4 The uphill catchment of Discovery Bay, i.e. steep natural vegetated terrain at high elevation, is collected by a catchwater system to intercept and divert the hillside surface runoff southwest to the existing Discovery Bay Reservoir.

4.4 Potential Drainage Impacts

4.4.1 The total site area of Area 6f is 0.83 ha. The potential Area 6f development will increase surface runoff due to 0.22 ha of land area changed from unpaved to paved surface (equivalent to 0.1% of 202.5 ha total catchment area). The expected impact on the existing drainage system and the requirement for any measures to accommodate the increase of surface runoff are discussed below.

4.4.2 **Table 4.1** summarizes the change in catchment area from existing to proposed conditions.

Table 4.1: Summary of Catchment Area Changes

Downstream Drainage System	Existing / Potential Development Area	Total Catchment Area (ha)	Paved Area (ha)		
			Existing	Proposed	Increase
2.0m x 3.0m BC	Existing Area	44.2	16.1	16.1	-
3.4m x 4.5m BC	Area 6f	140.6	6.2	6.44	0.22
3.8m x 4.5m BC	Existing Area	17.7	17.7	17.7	-
	Total =	202.5			0.22

4.5 Evaluation of Drainage Impacts, Mitigation Measures and Proposed Drainage

4.5.1.1 The peak flow discharge to the existing box culverts due to the increase in surface runoff from potential development Area 6f as well as the capacities of existing box culverts have been estimated and attached in **APPENDIX B1**. It shows that all the existing box culverts are capable to cater for the increase in surface runoff. Return periods of 50 and 200 years are adopted for branch and trunk system respectively for assessment (see **Section 4.2.1.1**).

4.5.1.2 As the existing box culverts are capable to cater for the increase in surface runoff, no mitigation measure is recommended to the existing box culverts. Proposed drainage system should be provided to convey surface runoff from the potential development Area 6f to these existing box culverts via the existing stream.

4.5.1.3 Area 10b is located at a different catchment, and no cumulative drainage impact is anticipated.

5 Sewerage Study

5.1 Methodology and Guidelines

5.1.1.1 The sewerage study estimates the sewage flows to be generated from potential development Area 6f. It reviews the existing sewerage system within the Discovery Bay and its discharge to the public sewerage and sewage treatment facilities at Siu Ho Wan. It recommends the sewerage collection, treatment and disposal scheme for the potential development Area 6f. This section presents the design method, parameters and criteria used for this sewerage study.

5.1.2 Design Method

5.1.2.1 Sewer capacity will be calculated based on the Continuity Equation:

$$Q = AV$$

Where Q = full flow capacity in m^3/s

A = cross-sectional area in m^2

V = velocity at full bore flow in m/s

5.1.2.2 Velocity at full-bore flow is based on the Colebrook-White equation:

$$V = -(32gRS)^{0.5} \log \{(ks/14800R) + (1.255v/R(32gRS)^{0.5})\}$$

Where g = acceleration due to gravity in m/s^2

R = hydraulic radius in m

S = gradient

ks = roughness in mm

v = kinematic viscosity of water in m^2/s

5.1.3 Codes of Practice and Design Manuals

5.1.3.1 The assessment has been carried out in accordance with the guidelines set out in EPD Report No. EPD/TP1/05 Guidelines for Estimating Sewage Flows (GESF) for Sewage Infrastructure Planning Version 1.0 and in accordance with DSD Sewerage Manual (2013) [(Part 1: Key Planning Issues and Gravity Collection System (3rd Edition) and Part 2: Pumping Station and Rising Main (2nd Edition)]

5.2 Design Parameters

5.2.1 Unit Flow Factors

5.2.1.1 Unit flow factor is the average sewage flow (average dry weather flow or ADWF) contributed by one unit of sewage source (person, employee or unit area) per day. According to Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (GESF) published by EPD, the recommended unit flow factors are summarized in following **Table 5.1**:

Table 5.1: Unit Flow Factors

Type	Unit Flow Factor (m^3/person/day)
Domestic	
Public Rental Housing	0.19
Private R1	0.19
Private R2	0.27
Private R3	0.37
Private R4	0.37
Traditional Village	0.15
Permanent Housing	0.23 (1)
Commercial	
Commercial Employee	0.08
Commercial activities:	
S1 (J7)	-
S2 (J1)	0.45
S3 (J2)	0.25
S4 (J9)	0.15
S5 (J5)	-
S6 (J4)	-
S7 (J4)	-
S8 (J3)	0.10
S9 (J10)	1.50
S10 (J10)	1.50
S11 (J3)	0.10
S12 (J6)	-
S13 (J6)	-
S14 (J6)	-
S15 (J12)	-
S16 (J11)	0.20
S17 (J11)	0.20
S18 (J11)	0.20
S19 (J11)	0.20
Industrial	
Industrial Employee	0.08
Industrial Activities	0.20
Institutional	
School Student	0.04

Note: (1) Permanent housing for North Lantau catchment wide planning

5.2.2 Peaking Factors

5.2.2.1 Peaking factors cater for seasonal/diurnal fluctuation and normal amount of infiltration and inflow. The peaking factors shall be in accordance with GESF and are shown in **Table 5.2**.

Table 5.2: Peaking Factors for Various Population Ranges

Population Range	Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage	Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage
Sewers		
< 1,000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3
> 50,000	Max ($7.3/N^{0.15}$, 2.4)	Max ($6/N^{0.175}$, 1.6)
Sewage Treatment Works, Preliminary Treatment Works and Pumping Stations		
< 10,000	4	3
10,000 – 25,000	3.5	2.5
25,000 – 50,000	3	2
> 50,000	Max ($3.9/N^{0.065}$, 2.4)	Max ($2.6/N^{0.065}$, 1.6)

Note:

N = Contributing population in thousands.

Contributing population = Calculated total average flow (m^3/d) / 0.27 (m^3/d)

5.3 Sewage Flow Estimation

5.3.1 The potential development at Area 6f will generate 440 m^3/d as shown in **Table 5.3** below.

Table 5.3: Sewage Flow Estimation Summary

Areas	Proposed Uses	Population	Unit Flow Factor (UFF) (m^3/person/d)(1)	ADWF (m^3/d)
Area 6f	Residential	1,190	0.37	440

Note: (1) R3 residential type is adopted for potential development

5.3.2 For the purpose of assessing the potential impact on the existing sewerage and sewage treatment facilities, sewage flow generated from another potential development at Area 10b will also be considered. With a residential population of 2,813, the estimated sewage flow generation from potential development at Area 10b is 1,041 m^3/d.

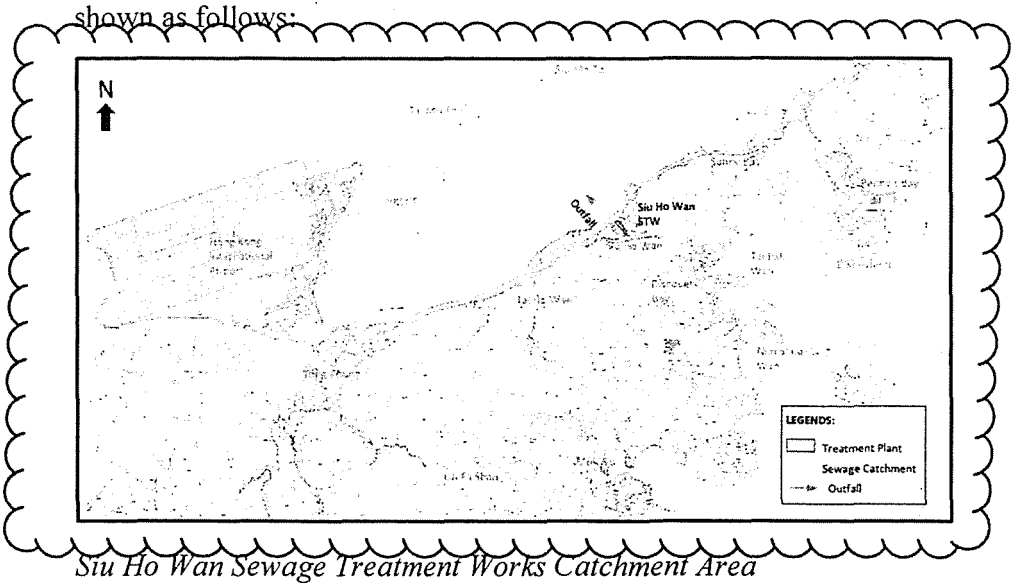
5.4 Existing Sewerage System

5.4.1 Sewage generated from existing Discovery Bay development is collected by four existing sewage pumping stations (i.e. Sewage Pumping Station No. 1, No. 2, No 3 and No. 4) at Discovery Bay and then transferred up to DSD Siu Ho Wan Sewage Treatment Works (SHWSTW) for further treatment and disposal via internal rising mains between the sewage pumping stations and existing 450mm diameter twin rising mains laid along Discovery Bay Tunnel. Existing sewerage system is illustrated in **Figure 3**.

5.4.2 Siu Ho Wan Sewage Treatment Works

5.4.2.1 Siu Ho Wan Sewage Treatment Works (SHWSTW) was a preliminary sewage treatment works when it was commissioned in 1996. It was subsequently upgraded under the Project PWP Item 4224DS "Outlying Islands Sewerage Stage 1 Phase 1C - Upgrading of Siu Ho Wan Sewage Treatment Plant" to chemically enhanced primary treatment (CEPT). The scope of the project included increasing the treatment capacity of SHWSTW to 180,000 m^3/d and a peak flow of 3,750 l/s so as to cater for the increase in sewage flow. Space was previously reserved for further extension to around 5,000 l/s.

5.4.2.2 Currently SHWSTW receives sewage from Hong Kong International Airport, Tung Chung, Disneyland, Penny's Bay, Sunny Bay, Discovery Bay and Siu Ho Wan. Catchment area of SHWSTW is shown as follows:



Siu Ho Wan Sewage Treatment Works Catchment Area

SIU HO WAN

5.5 Sewerage Impacts

5.5.1.1 EPD advised in May 2015 that the design capacity of the SHWSTW has been allocated for the treatment of the sewage arising from the development of the Expansion of Hong Kong International Airport into a Three Runway System, the new town development under Tung Chung New Town Expansion and the Penny's Bay Phase 2 development, etc. Therefore, SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development and the Sewerage Authority has no plan to increase the design capacity of the SHWSTW in the short and medium terms.

5.5.1.2 The proposed developments would need to form its own sewerage provisions to support the development. Therefore, there would be no sewerage impacts on the existing sewerage system.

5.6 Proposed Sewerage System

5.6.1.1 Based on the understanding that the Government cannot commit to provide extra treatment capacity in SHWSTW for the proposed development in Area 6f in the short and medium terms, an alternative sewage disposal option of providing a new small DBSTW at Area 6f is proposed to only treat the sewage generated from potential development at Area 6f. The treatment capacity of this proposed DBSTW at Area 6f is required to be 440 m^3/d (ADWF). A new 150mm gravity sewer is required to convey the sewage flow from Area 6f development to the DBSTW (see **APPENDIX B2** for calculation detail).

5.6.1.2 Since there will be no increase in sewage flow discharge to any section of the existing sewerage network, no upgrading of the existing system is required.

5.6.1.3 The quality of the treated sewage effluent from the new DBSTW at Area 6f will require to meet the Water Pollution Control Ordinance (WPCO) standards.

5.6.1.4 As this new DBSTW will only treat sewage from 2 single residential towers for 476 units at Area 6f so this decentralized scheme is considered not an efficient sewerage planning strategy.

5.6.1.5 Although EPD has indicated that the SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development, the possibility of discharging additional sewage flows from the potential development Area 6f to SHWSTW in the

long term should not be totally ruled out. For example, the Government is currently actively seeking cavern development as a new source of land supply. If in the future, it is deemed suitable that the existing SHWSTW can be relocated into a cavern site to vacate valuable land for development, the relocated SHWSTW can be such designed to accommodate the increased sewage flows from the Discovery Bay.

5.7 Contingency Measures

5.7.1.1 Contingency planning for disruption of normal STW operation will need to be considered in the planning and design of the STW. Scenarios like power failure, treatment facility malfunction, fire or flooding, should be considered.

5.7.1.2 The following initial contingency measures can be considered to control the emergency overflows from the STW thereby polluting the stream and the receiving water bodies at Discovery Bay:

- Dual feed power supply for the STW.
- Suitable backup of treatment process in the STW.

5.7.1.3 Should these measures fail, other further contingency measures should be considered to deal with the emergency sewage overflows:

- Due to the Area 6f site is located at a high elevation, it is proposed to provide an emergency overflow pipe from the proposed STW at Area 6f to existing sewage pumping station no. 1 (SPS1) located at the junction of Discovery Bay Road and Discovery Valley Road. During emergency situation, sewage from the STW can overflow to SPS1 which will transfer the sewage flow to SHWSTW;
- As the sewage flows is relatively small (440 m^3/day ADWF), sewage tanker vehicles (each vehicle can remove 12m^3 of sewage) could also be considered to remove some sewage from the Area 6f STW to existing SHWSTW during emergency case.

6 Water Supply Study

6.1 Methodology and Guidelines

6.1.1.1 The water supply study reviews the existing water supply systems for Discovery Bay. It estimates the fresh and flushing water demands from potential development Area 6f and recommends water supply options to supply the new development area. This section presents the design method, parameters and criteria used for this water supply study.

6.1.2 Design Method

6.1.2.1 Water main capacity will be calculated based on the Continuity Equation:

$$Q = AV$$

Where Q = full flow capacity in m^3/s

A = cross-sectional area in m^2

V = velocity at full bore flow in m/s

6.1.3 Codes of Practice and Design Manuals

6.1.3.1 In accordance with WSD's Departmental Instruction (DI) No. 1309 "Design Criteria", the following design parameters and peak demand factors are adopted for the design of proposed fresh and salt water supply systems.

6.2 Design Parameters

6.2.1 Unit Demand

6.2.1.1 The unit water demands for the residential water demand estimate listed in WSD's DI 1309 are shown in **Table 6.1** below. Since no detailed breakdown of zone types is available at this stage of Study, water unit demand for R3 has been adopted to suits the potential developments.

Table 6.1: Fresh and Flushing Water Unit Demand for Demand Estimate

Zone Type	Fresh Water		Flushing Water	Unit
	Residential	Service Trade		
Residential				
Public Rental	140	40	70	Litre/head/day

Zone Type	Fresh Water		Flushing Water	Unit
	Residential	Service Trade		
Housing				
R1	230	40	70	Litre/head/day
R2	300	40	70	Litre/head/day
R3	390	40	70	Litre/head/day
R4	390	40	70	Litre/head/day
Village	230	40	70	Litre/head/day
Commercial				
General	40	--	20	Litre/m^2 GFA/day
Hotel	1200	--	140	Litre/room/day
Hospital	455	--	295	Litre/bed/day
School Student	25	--	25	Litre/head/day

6.2.2 Water Treatment Works Capacity:

- Fresh water system – 1.2 times mean daily demand

6.2.3 Service Reservoir Capacity:

- Fresh water system (Secondary) – 85% of mean daily demand for isolated supply zones.

6.2.4 Peak Flow Rates in Pumping Main:

- Fresh water system – 1.5 times mean daily demand
- Salt water system – 1.5 times mean daily demand

6.2.5 Peak Flow Rates in Distribution Main:

- Fresh water system – 3 times mean daily demand
- Salt water system – 2 times mean daily demand

6.2.6 Residual Head Requirement:

- Fresh water system – 20m
- Salt water system – 15m

6.2.7 Maximum Flow Velocity for Pumping Main:

- 3 m/s under peak flow conditions

6.2.8 Maximum Flow Velocity for Distribution Main:

- > DN700 $\leq$ 3 m/s
- DN700 to DN525 $\leq$ 2.5 m/s
- DN450 to DN375 $\leq$ 2 m/s
- DN300 to DN200 $\leq$ 1.5 m/s

6.3 Water Demand Estimation

6.3.1 The potential development at Area 6f will generate 512 m^3/d (464+48) fresh water demand and 83 m^3/d flushing water demand based on 1,190 residential populations, as shown in **Table 6.2** below.

Table 6.2: Water Demand Estimation Summary

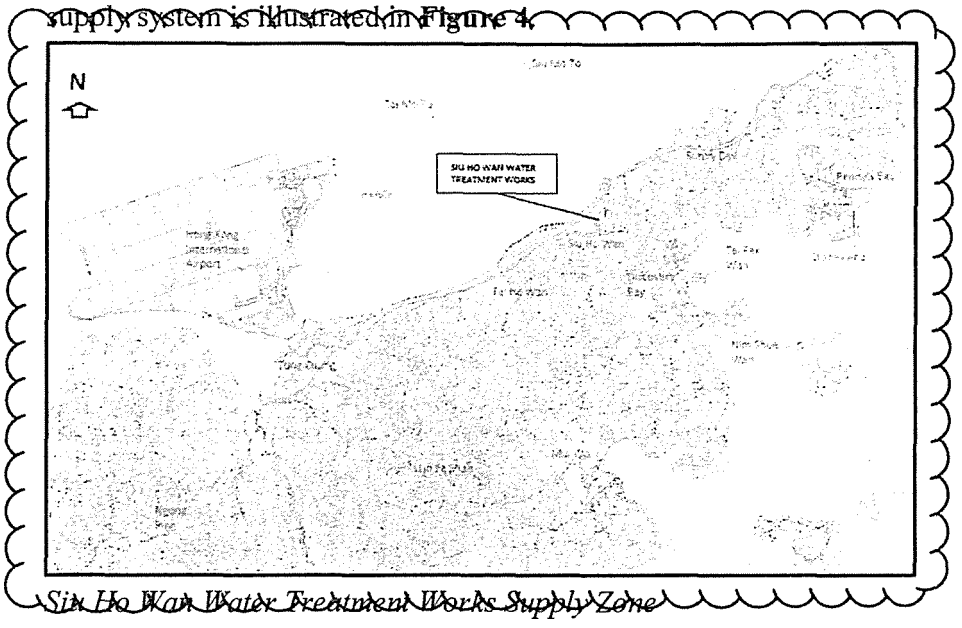
Areas	Proposed Uses	Population	Fresh Water Demand (m^3/d) [1]		Flushing Water Demand (m^3/d) [1]
			Fresh Water	Service Trades	
Area 6f	Residential	1,190	464.1	47.6	83.3
Area 10b	Residential	2,813	1,097.1	112.5	196.9
	Total Resident =	4,003	1,721.3		280.2

Note: [1] R3 residential type is adopted for potential development, i.e. fresh water unit demand = 0.390 m^3/head/day; service trades unit demand = 0.040 m^3/head/day; and flushing water unit demand = 0.070 m^3/head/day.

6.3.2 For the purpose of assessing the potential impact on the existing water supply infrastructure, water demand from another potential development at Area 10b will also be considered. With a residential population of 2,813, the estimated fresh and flushing water demands from Area 10b is 1,210 m^3/d and 197 m^3/day respectively.

6.4 Existing Fresh Water Supply System

6.4.1 Discovery Bay falls within supply zone of Siu Ho Wan Water Treatment Works (SHWWTW) and the Siu Ho Wan FWPS. Supply zone of SHWWTW is shown below and the existing fresh water supply system is illustrated in Figure 4.



Siu Ho Wan Water Treatment Works Supply Zone

6.4.2 Siu Ho Wan Water Treatment Works

6.4.2.1 SHWWTW was commissioned in November 1996 and has a nominal capacity of 150,000 m^3/d. Allowance has been made for expansion to an ultimate capacity of 300,000 m^3/d. Currently, the average water supply is approximately 46,000 m^3/d, based on our estimation of the population within the supply zone. This includes flushing water supply to Tung Chung, Siu Ho Wan, Tai Ho Wan and Ngong Ping.

6.4.3 Siu Ho Wan Fresh Water Pumping Station

6.4.3.1 Treated water from SHWWTW with capacity of 150,000 m^3/d is delivered by Siu Ho Wan FWPS to Tung Chung Fresh Water Service Reservoir via existing 1000mm / 1200mm fresh water pumping main.

6.4.4 Discovery Bay Fresh Water Booster Pumping Station

6.4.4.1 Discovery Bay Fresh Water Booster Pumping Station delivers fresh water to Discovery Bay via a 450mm branch-off pipe of the existing 1200 mm fresh water pumping main from Siu Ho Wan FWPS to Tung Chung Fresh Water Service Reservoir. A 450 mm outlet pumping main of Discovery Bay Fresh Water Booster Pumping station, laid along Discovery Bay Tunnel, delivers fresh water to the Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 for distribution to the Discovery Bay.

6.4.5 Discovery Bay Fresh Water Service Reservoir

6.4.5.1 There are two fresh water service reservoirs in Discovery Bay, namely Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2. They are interconnected and located at the same level of around +95 mPD with top water level of +101 mPD. Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 have capacities of 7,250 m^3 and 2,992 m^3 respectively. Total capacity of these two service reservoirs is 10,242 m^3.

6.5 Existing Flushing Water Supply System

6.5.1.1 Discovery Bay has its own flushing water supply system by intercepting existing hillside runoff by catchwater to the Discovery Bay Reservoir for flushing purpose. Existing flushing water supply system is illustrated in **Figure 4**.

6.5.1.2 The existing Discovery Bay Reservoir also provides both fresh and flushing water supply to the adjacent Nim Shue Wan Village.

6.5.1.3 Discovery Bay Reservoir collects and stores rainwater to supply flushing water to existing Discovery Bay developments and fresh and flushing water to Nim Shue Wan Village. It has a rainwater catchment area of around 138 ha, including 18 ha of the reservoir itself (at top water level). Summary details of the Discovery Bay Reservoir are provided in **Table 6.3**.

Table 6.3: Description of Discovery Bay Reservoir

Name of Reservoir	Supply Zone	Capacity (m^3)	Invert Level (mPD)	Top Water Level (mPD)
Discovery Bay Reservoir	Discovery Bay and Nim Shue Wan Village	3,400,000	+125	+175

6.6 Fresh Water Supply Impacts and Provisions

6.6.1 Fresh Water Supply Option 1 – Supply from Siu Ho Wan Water Treatment Works

6.6.1.1 Siu Ho Wan Water Treatment Works and Siu Ho Wan Fresh Water Pumping Station

6.6.1.2 Fresh water to the potential development areas (both Areas 6f and 10b) is proposed to be supplied by the SHWWTW.

6.6.1.3 The existing capacity of the SHWWTW is insufficient to supply the existing developments, other concurrent and future developments within the supply zone of SHWWTW. However, the future expansion works of SHWWTW and Siu Ho Wan FWPS to a capacity of 300,000

m^3/d should be adequate to supply both its catchment and additional fresh water (1,721 m^3/d) to Discovery Bay potential developments at both Area 6f and 10b (i.e. 0.57% of 300,000 m^3/d ultimate upgraded capacity of SHWWTW).

6.6.1.4 Existing capacity of Siu Ho Wan FWPS is same as SHWWTW (150,000 m^3/d). Upgrading of Siu Ho Wan FWPS to 300,000 m^3/d would be necessary.

6.6.1.5 Discovery Bay Fresh Water Booster Pumping Station

6.6.1.6 Existing Discovery Bay Fresh Water Booster Pumping Station has four pump bays and house three pump sets (2 duty and 1 standby) with a reliable output of about 15,120 m^3/d (87.5 L/s each with 100.5m head) to deliver fresh water to Discovery Bay. It will be capable of delivering the total fresh water demand of Discovery Bay including the Discovery Bay potential developments at both Area 6f and 10b (12,574 m^3/d) as shown in **Table 6.6**.

Table 6.6: Total Fresh Water Demand of Discovery Bay

Supply Zone	Population	Population Type	Unit Flow Factor (m^3/person/d)	Fresh Water Demand (m^3/d)
Existing Discovery Bay Development	25,000	Residential	0.390 + 0.04	10,750
	4,100	School	0.025	102.5
Discovery Bay potential development Areas 6f	1,190	Residential	0.390 + 0.04	512
Discovery Bay potential development Areas 10b	2,813	Residential	0.390 + 0.04	1,210
			Total MDD =	12,574

6.6.1.7 The existing 450 mm pumping main from Discovery Bay Fresh Water Booster Pumping Station to Discovery Bay has been checked to be capable of meeting total fresh water demand of Discovery Bay and potential development. No upgrading of this trunk main would be envisaged. Detailed calculations are provided in **APPENDIX B3**.

6.6.1.8 Fresh Water Service Reservoirs at Discovery Bay

6.6.1.9 According to WSD's DI 1309, fresh water service reservoir requires total storage capacity of 0.85MDD (for isolated water supply zones), i.e. 11,136 m^3/d x 0.85 = 9,660 m^3 (to supply additional potential development at Area 6f only) and 12,574 x 0.85 = 10,688 m^3 (to supply additional potential development at both Area 6f and 10b). Detailed calculations are provided in **APPENDIX B3** and summary of total fresh water demand of Discovery Bay is provided in above **Table 6.6**.

6.6.1.10 Total capacity of existing Discovery Bay Fresh Water Service

Reservoirs No. 1 and No. 2 is 10,242 m^3 (7,250m^3 + 2,992m^3) > 9,660 m^3. Therefore, the storage volume is adequate for the existing Discovery Bay development and potential development at Area 6f. The storage volume of the existing reservoirs is marginally below 0.85MDD of the ultimate fresh water demand from the existing Discovery Bay and the potential developments for both 6f and 10b (total 10,688 m^3). Therefore, additional fresh water storage of 446m^3 will be required considering the cumulative effects including both Area 6f and Area 10b. Detailed calculations are provided in **APPENDIX B3**.

6.6.2 Fresh Water Supply Option 2 – Supply from Discovery Bay Reservoir

6.6.2.1 If in the event that the SHWWTW and Siu Ho Wan FWPS cannot be expanded to match with the programme of the potential development at Discovery Bay, alternative fresh water supply proposal that does not rely on the expansion of SHWWTW will be required.

6.6.2.2 It is proposed that a new private fresh water supply system within Discovery Bay to supply the additional fresh water demands from the potential developments Areas 6f and 10b. Fresh water is proposed to be supplied from the existing Discovery Bay Reservoir.

6.6.2.3 Discovery Bay Reservoir has an invert level of 125mPD, a top water level of 175mPD and total of 3,400,000 m^3 storage. The existing Discovery Bay Reservoir supplies flushing water to Discovery Bay and both fresh and flushing water to the nearby Nim Shue Wan Village. Under this fresh water supply option 2, the existing Discovery Bay Reservoir will be extended to also supply fresh (and flushing) water supply for the potential development areas, as shown in **Table 6.7** below.

Table 6.7: Total Water Demand from Discovery Bay Reservoir

Supply Zone	Population	Population Type	Unit Flow Factor (m^3/person/d)	Flushing Water Demand (m^3/d)
Flushing Demand from Existing Discovery Bay Development	25,000	Residential	0.07	1,750
	4,100	School	0.025	102.5
Fresh and Flushing Water Demand from Existing Nim Shue Wan Village	150	Residential + Service Trades	0.23+0.04+0.07	51
Fresh and Flushing Demand from Discovery Bay potential development Areas 6f and 10b	4,003	Residential	0.39+0.04+0.07	2,001.5
			Total =	3,905

6.6.2.4 An analysis has been carried out to check the adequacy of water supply for the Discovery Bay Reservoir during a drought year. From the data collected from Hong Kong Observatory between year 2000 to 2014, the 12 month period from October 2010 to September 2011 has been selected as the drought year for assessment. Based on the lowest reservoir water level recorded between March 2008 and March 2014 (including the drought year), it has been conservatively estimated by taking into consideration all inflows and outflows to and from the reservoir that the remaining storage volume of Discovery Bay Reservoir after the drought year is around 0.36 million m^3. This means after taken into account of the various water demands from the existing and proposed developments of Discovery Bay and Nim Shue Wan Village and the reservoir evaporation loss throughout the drought year, the remaining reservoir volume after the drought year still has more than equivalent of 3 months of total water demand of 0.35 million m^3. (i.e. 3,905 m^3/d x 90 days). It demonstrates the Discovery Bay Reservoir has adequate storage to provide additional fresh (and flushing) water supply to both the potential developments at Area 6f and 10b. The relevant calculations for checking the capacity of Discovery Bay Reservoir in drought year are provided in **APPENDIX B3**.

6.6.2.5 A new water treatment works will be needed to treat the abstracted water from the Discovery Bay Reservoir before distribution to the end users.

6.7 Flushing Water Supply Impacts and Provisions

6.7.1 Discovery Bay Reservoir

6.7.1.1 Discovery Bay Reservoir provides flushing water to existing Discovery Bay and both fresh and flushing water to Nim Shue Wan Village. Following the current flushing water supply arrangement, flushing water for the potential development Areas 6f and 10b is proposed to be supplied by the Discovery Bay Reservoir. Detailed calculations are provided in **APPENDIX B3** and a summary of total water supply from Discovery Bay Reservoir is provided in **Table 6.8**.

Table 6.8: Total Water Demand from Discovery Bay Reservoir

Supply Zone	Population	Population Type	Unit Flow Factor (m^3/person/d)	Flushing Water Demand (m^3/d)
Flushing Demand from Existing Discovery Bay Development	25,000	Residential	0.07	1,750
	4,100	School	0.025	102.5
Fresh and Flushing Water Demand from Existing Nim Shue Wan Village	150	Residential + Service Trades	0.23+0.04+0.07	51.0

Supply Zone	Population	Population Type	Unit Flow Factor (m^3/person/d)	Flushing Water Demand (m^3/d)
Flushing Demand from Discovery Bay potential development Areas 6f and 10b	4,003	Residential	0.07	280.2
			Total =	2,183.7

6.7.1.2 A similar analysis has been carried out to check the adequacy of water supply for the Discovery Bay Reservoir during a drought year. The assessment considered all inflows and outflows into and out of the reservoir during the drought year (12 months between October 2010 and September 2011). It estimated that after the drought year, the Discovery Bay Reservoir will still have around 0.99 million m^3 storage volume, which is still more than total water demand for a whole year (2,184 m^3/d x 365 = 0.80 million m^3). It shows that it is feasible to provide flushing water supply for the new potential developments from the Discovery Bay Reservoir. Capacity checking calculations for Discovery Bay Reservoir in the drought year are provided in **APPENDIX B3**.

6.7.1.3 Since the Discovery Bay Reservoir is feasible to provide flushing water supply for developments at both Area 6f and Area 10b, the Discovery Bay Reservoir is then adequate to provide flushing water supply for individual development at Area 6f.

6.7.2 Existing Flushing Water Main

6.7.2.1 The existing 300 mm diameter flushing water main from Discovery Bay Reservoir has been checked to be capable to supply flushing water to Discovery Bay as well as both fresh and flushing water to Nim Shue Wan Village. No upgrading of flushing water main would be envisaged. Checking calculations are attached in **APPENDIX B3**.

6.8 Proposed Fresh and Flushing Water Supply Systems

6.8.1 New 150 mm fresh water mains and new 50mm flushing water mains are proposed for water supply to potential development Areas 6f. **Figure 4** shows the proposed water supply layout plan (based on fresh water supply option 1) and water main sizing calculations are attached in **APPENDIX B3**.

7 Conclusions

7.1.1 **Sections 4 to 6** have provided a baseline review and preliminary impact assessments on drainage, sewerage and water supply systems. Mitigation measures to existing facilities and recommendation on new facilities to cater for the potential developments have also been proposed.

7.2 Drainage System

7.2.1 The major existing drainage systems, such as box culverts, are checked to be capable of catering for the increase of surface runoff generated from the potential development Area 6f.

7.3 Sewerage System

7.3.1 Based on the understanding that the Government cannot commit to provide extra treatment capacity in SHWSTW for the proposed development in Area 6f in short and medium terms, an alternative solution has been proposed by providing a small sewage treatment plant of 440 m^3/d treatment capacity on Area 6f to treat the sewage flow generated from the development.

7.4 Water Supply System

7.4.1 Fresh Water Supply System

7.4.1.1 The existing capacity of the SHWWTW is insufficient to supply the existing developments, other concurrent and future developments within the supply zone of SHWWTW irrespective of the Discovery Bay potential developments. However, the future expansion of SHWWTW and Siu Ho Wan FWPS to the capacity of 300,000 m^3/d is expected to take into account the 0.57% fresh water demand of Discovery Bay potential developments at both Area 6f and 10b. Upgrading SHWWTW and Siu Ho Wan FWPS to the capacity of 300,000 m^3/d would be adequate.

7.4.1.2 Existing Discovery Bay Fresh Water Booster Pumping station has four pump bays and house three pump sets (2 duty and 1 standby) with a reliable output of about 15,120 m^3/d (87.5 L/s each with 100.5m head) to deliver fresh water to Discovery Bay including the potential developments. It will be capable to deliver total fresh water demand of Discovery Bay.

7.4.1.3 The two existing service reservoirs within Discovery Bay have been checked to have adequate storage volume for potential development at Area 6f.

7.4.1.4 In the event that the existing or planned SHWWTW cannot provide fresh water supply to the potential development areas, an alternative fresh water supply scheme has been developed. This will abstract water from the Discovery Bay Reservoir. New water treatment facilities and water mains will be provided for water treatment and distribution of the treated fresh water.

7.4.2 Flushing Water Supply System

7.4.2.1 Discovery Bay Reservoir, has been checked to be capable of flushing water supply to both the existing and potential developments including the existing water supply to Nim Shue Wan Village. No upgrading of Discovery Bay Reservoir would be envisaged.

7.4.3 Proposed Fresh and Flushing Water Supply Systems

7.4.3.1 New fresh and flushing water mains are proposed for water supply to potential development Areas 6f. The fresh water mains are proposed to have size of 150mm and the flushing water mains are proposed to have size of 50 mm.

Figures

N

Siu Ho Wan Sewage Treatment Works

Siu Ho Wan Water Treatment Works and Siu Ho Wan Fresh Water Pumping Station

Discovery Bay Fresh Water Booster Pumping Station

DISCOVERY BAY TUNNEL

Sewage Pumping Station No. 3

SIENA AVENUE

Sewage Pumping Station No.4

Study Area

DISCOVERY BAY ROAD

DISCOVERY BAY

DISCOVERY BAY TAI PAK WAN

Sewage Pumping Station No. 2

Area 6f

DISCOVERY VALLEY ROAD

Sewage Pumping Station No. 1

Fresh Water Service Reservoirs No.1 & No.2 and Pumping Station

Discovery Bay Reservoir

0 70 140 210 280 350

METRES

PENG CHAU

Job Title

DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 1

Date	Scale	Drawing Title
	1:15000	PROPOSED DEVELOPMENT AREAS IN DISCOVERY BAY
Drawn	Job No.	
	236078	

ARUP

N

DISCOVERY BAY TUNNEL

SIENA AVENUE

DISCOVERY BAY ROAD

DISCOVERY BAY

Existing Outfall

Ex. 2m(H) x 3m(W) BC

Ex. Catchwater to Discovery Bay Reservoir

Area 6f

Existing Natural Stream

Ex. 3.4m(H) x 4.5m(W) BC

Ex. 3.9m(H) x 4.5m(W) BC

Existing Natural Stream

Existing Natural Stream

Discovery BayReservoir

Study Area

Catchment Area of Existing Box Culvert

Inflow Location

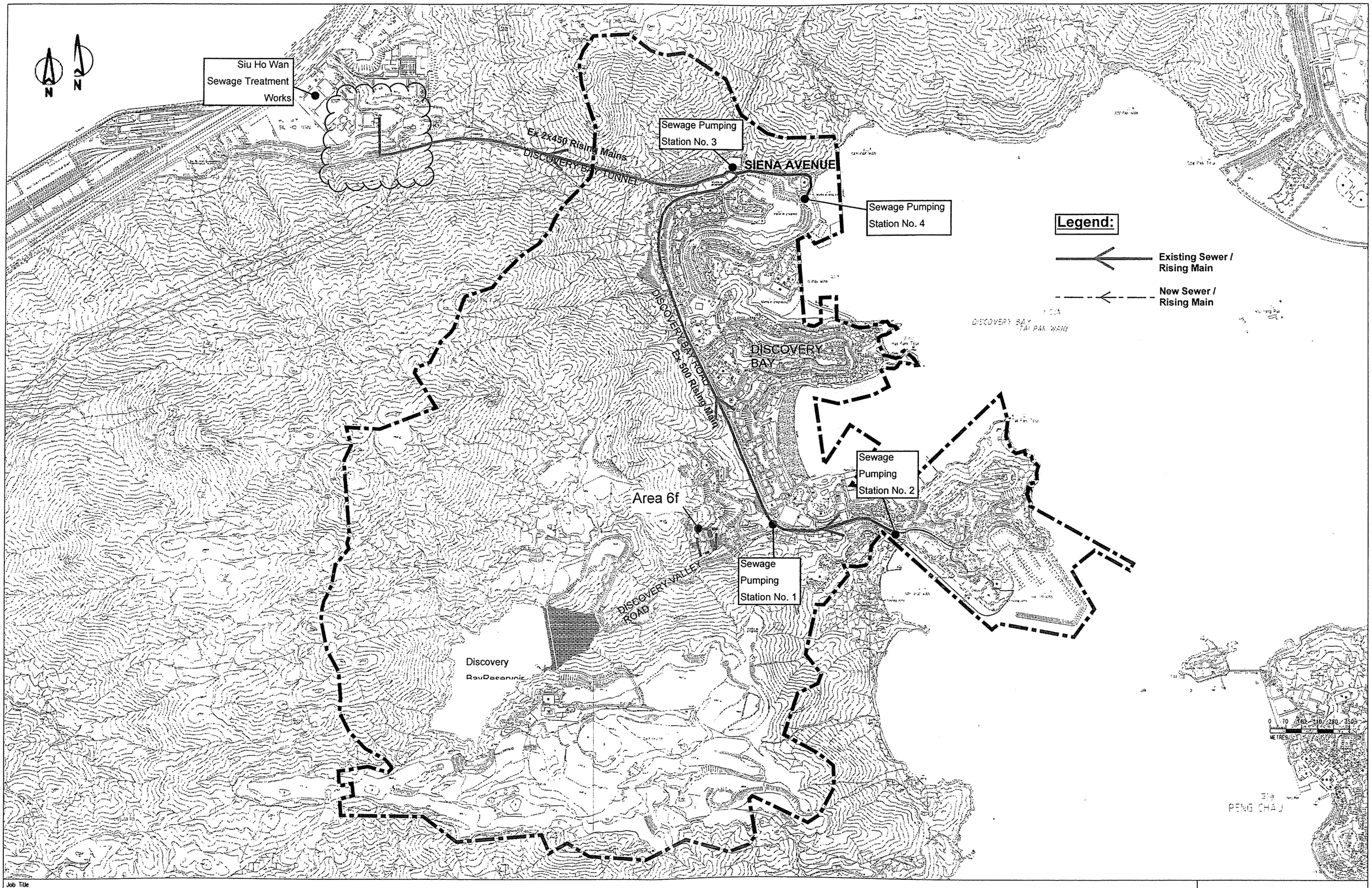
Existing Natural Stream

Existing Box Culvert (BC)

0 10 140 210 280 350
METRES

PENG CHAU

Job Title: DISCOVERY BAY - OPTIMIZATION OF LAND USE		FIGURE 2
Date	Scale: 1:15000	Drawing Title: EXISTING AND PROPOSED DRAINAGE LAYOUT PLAN
Drawn	Job No.: 226078	ARUP



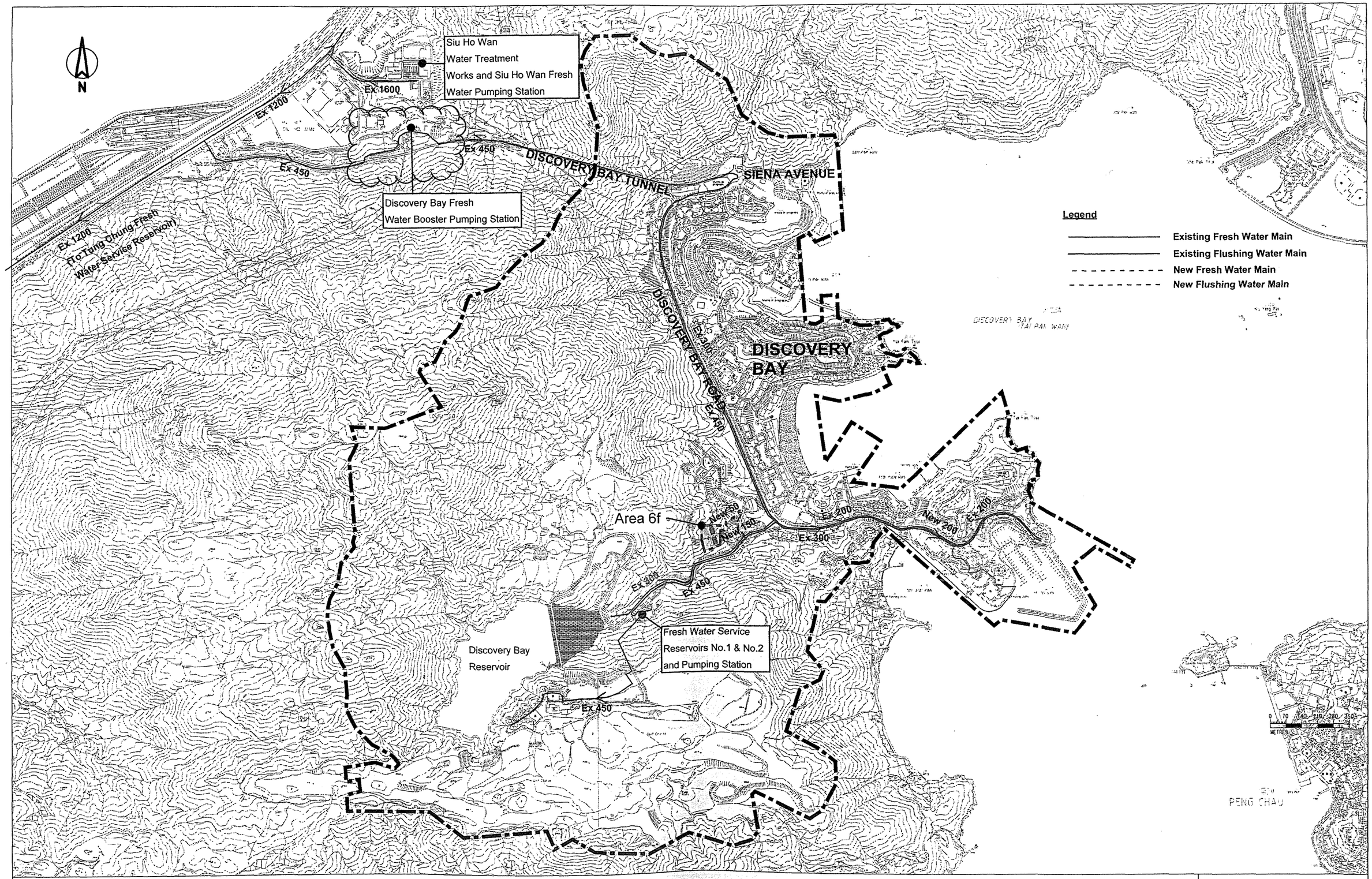
Job Title

DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 3

Date	Scale	Drawing Title
DEC 2015	1:15000	EXISTING AND PROPOSED SEWERAGE LAYOUT PLAN
Drawn	Job No.	
	236078	

ARUP



Job Title: DISCOVERY BAY - OPTIMIZATION OF LAND USE		FIGURE 4
Date	Scale: 1:15000	Drawing Title: EXISTING AND PROPOSED WATER SUPPLY LAYOUT PLAN
Drawn	Job No.: 236078	ARUP

APPENDIX B1

Capacity Checking Calculations on Existing Box Culvert

ARUP

Job Title: Discovery Bay Optimization of Land Use

Prepared By: NY
Checked By: KK
Rev.: A

Rational method to estimate runoff and determination proposed drainage pipe / box culvert (BC) sizes

Use
1 in 200 year design event for sizing trunk system
1 in 50 year design event for sizing branch system

Design Assumption:

(50 year) a= 687 b= 4.2 c= 0.42
(200 year) a= 766 b= 4.1 c= 0.40

u = 1.0E-6
ks = 3
C (Paved) = 1.00
C (unpaved)= 0.30

to = time of concentration of a natural catchment (min.)

$$= \frac{0.144651L}{H^{0.2} A^{0.1}}$$

where A = catchment area (m^2) = 32.8×10^4 m^2
H = average slope (m per 100m) of the natural flow = 72m
L = distance (m) of the natural flow =473m

Potential Development Area	Pipe / BC Size	Length (m)	No. of Pipe / Cell	BC Width (m)	BC / Pipe Height (m)	Gradient (%)	Gradient (1 in X)	Area (m2)	Perimeter (m)	H =A/P (m)	32gRS	Velocity (m/s)	TI (min)	Tc (min)	Intensity (mm/hr)	Total Catchment Area (paved & unpaved) (m2)	Catchment Area (paved) (m2)	Cumulative Catchment Area (paved) (m2)	Catchment Area (unpaved) (m2)	Cumulative Catchment Area (unpaved) (m2)	Cumulative Runoff From Catchment (m3/s)	Pipe/ BC Capacity (m3/s)	% Full Flow
Existing catchment	3 x 2 BC	473	1	3.0	2.0	0.5%	200	6.00	10.00	0.60	0.97	3.37	2.34	10.54	262	442,000	161,000	161,000	281,000	281,000	17.9	20.2	88%
Existing catchment + Site 6I	4.5 x 3.4 BC	230	1	4.5	3.4	0.7%	143	15.30	15.80	0.97	1.46	5.36	0.71	11.26	257	1,406,000	64,400	225,400	1,341,600	1,622,600	50.9	82.1	62%
Existing catchment	4.5 x 3.8 BC	260	1	4.5	3.8	0.7%	143	17.10	16.60	1.03	1.50	5.57	0.78	12.03	252	177,000	177,000	402,400	0	1,622,600	62.3	95.3	65%

APPENDIX B2

Calculations on Proposed Sewerage System

ARUP

Job Title: Discovery Bay Optimization of Land Use

Prepared By: NY
Checked By: KK
Rev.: A

Sewer Sizing Calculation for Discovery Bay New Developments (6f) ks= 1.5

Development	No. of Residential Unit	Population	Population Type	Unit Flow Factor (m^3/person/day)	ADWF (m^3/d)	Cum. ADWF (m^3/d)	Peaking Factor for Sewer	Peak Flow (L/s)	Proposed Sewer Size (mm)	Proposed Sewer Gradient (1:x)	Capacity of Proposed Sewer (L/s)	Occupied % of Proposed Sewer
6f	476	1190	Residential	0.37	440.3	440.3	8	40.8	150	10	49.2	83%
				Total ADWF (m^3/d)	440.3							

APPENDIX B3

Capacity Checking Calculations on existing Discovery Bay Reservoir, Fresh Water Service Reservoir and Proposed Water Supply System

ARUP

Job Title: Discovery Bay Optimization of Land Use

Prepared By: NY
Checked By: KK
Rev.: A

Calculation on Water Main, Service Reservoir and Reservoir

Table 1

Portable Water Consumption of Discovery Bay New Development (6f)

Development	Population	Population Type	Unit Flow Factor (m^3/person/day)	Water Demand (m^3/d)
6f	1190	Residential + Service Trade	0.43	511.7
		Total Demand (m^3/d)	511.7	(5.9 L/s)

Sizing for Fresh Water Distribution Main Supplying Discovery Bay New Development (6f)

Total Water Demand (L/s)	Factor of Distribution Main	Total Peak Flow (L/s)	Proposed Distribution Main (mm)	Cross Section Area (mm^2)	Proposed Main Velocity (m/s)
5.9	3	17.8	150	17663	1.0

Note: To take into account the fire flow, minimum size of 200mm diameter fresh water main is proposed.

Table 2

Flushing Water Consumption of Discovery Bay New Development (6f)

Development	Population	Population Type	Unit Flow Factor (m^3/person/day)	Water Demand (m^3/d)
6f	1190	Residential	0.07	83.3
		Total Demand (m^3/d)	83.3	(1.0 L/s)

Sizing for Flushing Water Distribution Main Supplying Discovery Bay New Development (6f)

Total Water Demand (L/s)	Factor of Distribution Main	Total Peak Flow (L/s)	Proposed Distribution Main (mm)	Cross Section Area (mm^2)	Proposed Main Velocity (m/s)
1.0	2	1.9	50	1963	1.0

Calculation on Water Main, Service Reservoir and Reservoir

Table 3

Total Fresh Water Consumption for Discovery Bay New Developments

Development	Population	Population Type	Unit Flow Factor (m^3/person/day)	Water Demand (m^3/d)
6f	1190	Residential + Service Trade	0.43	511.7
10b	2813	Residential + Service Trade	0.43	1209.6
		Total Demand (m^3/d)	1721.3	(19.9 L/s)

Table 4

Total Flushing Water Consumption for Discovery Bay New Developments

Development	*Population*	Population Type	Unit Flow Factor (m^3/person/day)	Water Demand (m^3/d)
6f	1190	Residential	0.07	83.3
10b	2813	Residential	0.07	196.9
		Total Demand (m^3/d)	280.2	(3.2 L/s)

Table 5

Capacity Checking of Existing Service Reservoirs No. 1 and No. 2

Existing Fresh Water Demand	10853	(m^3/d)	
New Fresh Water Demand	1721	(m^3/d)	
Total Fresh Water Demand	12574	(m^3/d)	(145.5 L/s)
Service Reservoir Capacity Required for Fresh Water System (85% of MDD)	10688	(m^3)	
Capacity of Existing Service Reservoirs No. 1 (7,250m^3) & No. 2 (2,992m^3)	10242	(m^3)	

The existing Service Reservoirs No. 1 and No.2 are marginally below capacity (96%). Additional 446m3 volume required to meet 0.85MDD storage suggested by WSD.

Capacity Checking of Existing 450mm Dia. Fresh Water Pump Main to Service Reservoir

Total Water Demand (L/s)	Factor of Pump Main	Total Peak Flow (L/s)	Existing Pump Main (mm)	Cross Section Area (mm^2)	Proposed Main Velocity (m/s)
145.5	1.5	218.3	450	158963	1.4

Table 6

Capacity Checking of Existing Reservoir Supply Flushing Water (Including both Portable and Flushing Water of Nim Shue Wan Village)

Development	Population	Population Type	Unit Flow Factor (m^3/person/day)	Water Demand (m^3/d)
Existing Discovery Bay Developments + the OZP (DB)	25000	Residential	0.07	1750.0
	4100	School	0.025	102.5
Existing Nim Shue Wan	150	Residential + Service Trade	0.23+0.04+0.07	51.0
New Discovery Bay Development	4003	Residential	0.07	280.2
		Total Demand (m^3/d)	2183.7	(25.3 L/s)

Capacity Checking of Existing 300mm Dia. Water Main of Reservoir

Total Water Demand (L/s)	Factor of Distribution Main	Total Peak Flow (L/s)	Existing Distribution Main (mm)	Cross Section Area (mm^2)	Proposed Main Velocity (m/s)
25.3	2	50.5	300	70650	0.7

ARUP

Job Title Discovery Bay Optimization of Land Use

Prepared By: NY
Checked By: KK
Rev.: A

Summary of Historic Monthly Rainfall Data Collected from Hong Kong Observatory

Rainfall Data (in mm) for Discovery Bay (from Hong Kong Observatory, HKO)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2014	0.0	40.0	165.5	139.5	547.0								
2013	1.5	1.0	95.0	223.0	434.5	502.5	329.5	309.0	297.0	0.5	46.0	114.0	
2012	50.5	44.0	26.5	338.0	200.0	182.5	443.5	122.0	128.0	63.0	72.5	52.0	
2011	7.5	27.0	29.0	47.0	193.5	379.5	182.0	219.5	120.5	115.0	97.5	1.0	
2010	27.0	110.0	22.0	128.0	233.0	422.0	306.0	217.5	543.5	19.5	43.5	29.0	(Driest Year *)
2009	0.0	2.5	119.0	143.5	257.5	342.5	321.0	238.0	248.0	10.5	31.5	48.5	
2008	40.0	21.5	70.0	188.5	175.5	1204.5	546.0	266.5	165.5	110.5	1.0	8.5	
2007	29.5	8.0	25.0	141.5	302.0	509.5	54.5	340.5	116.5	36.5	13.0	16.0	
2006	16.5	44.0	58.5	171.5	394.5	382.0	377.0	266.5	230.0	32.5	93.5	15.5	
2005	10.0	26.0	41.0	14.5	348.5	587.5	286.0	755.5	146.0	5.5	6.5	5.0	
2004	33.5	45.5	77.5	105.0	257.0	184.5	347.5	411.5	79.5	3.5	0.5	0.0	
2003	15.0	5.0	75.0	112.5	42.5	474.5	97.0	310.5	346.0	10.0	54.0	1.5	
2002	22.5	4.0	111.0	10.5	252.0	162.5	292.5	431.0	446.0	82.5	29.5	70.5	
2001	49.0	11.0	60.5	102.0	166.5	785.5	575.5	305.0	413.5	5.5	3.5	42.5	
2000	48.5	31.0	45.5	515.0	153.0	279.5	265.0	374.0	88.5	130.5	89.0	51.0	

* The driest year with minimum rainfall during a 12-month period is considered, i.e. Oct 2010 to Sep 2011

Summary of Discover Bay Reservoir Volume and Water Levels

Top water level of the Reservoir =	175	mPD	
Invert level of the Reservoir =	125	mPD	i.e. 50m water depth
Total Capacity of the Reservoir =	3,400,000	m^3	
Average surface area of the Reservoir =	68,000	m^2	
Lowest water level of the Reservoir =	168.6	mPD	i.e. 43.6m water depth
(from record data during March 2008 to March 2014)	(Assumed to be min. water level during the driest year in 2010/2011)		
By pro-rata, storage volume of the Reservoir at lowest water level of +168.6 mPD =	2,964,800	m^3	
To be very conservative, assume only 50% of the Reservoir volume is available for water supply =	**1,482,400**	m^3	

Checking of Adequacy of Existing Discovery Bay Reservoir to Meet Existing and New Water Demand during Driest Year

Water Demand Case 1: Only Flushing Water of New DB Development (Areas 6f and 10b) to be Supplied by Discovery Bay Reservoir

Development	Population	Population	Fresh Water /	Unit Flow Factor	Water Demand
Existing Discovery Bay	25000	Residential	Flushing Water	0.07	1750.0
Developments	4100	School	Flushing Water	0.025	102.5
Existing Nim Shue Wan	150	Residential + Service	Fresh & Flush	0.23+0.04+0.07	51.0
New Discovery Bay	4003	Residential	Flushing Water	0.07	280.2
			Total Water Demand Required =		2183.7 m^3/d

(a) Inflow to Discovery Bay Reservoir

a1. Runoff collected by catchwater from catchment

Total rainfall depth	=	1,297.5	mm
Catchment Area	=	120	ha
(assume runoff coefficient 0.3)			
Annual rainfall volume	=	467,100	m^3

a2. Direct Rainfall on Reservoir Area

Total rainfall depth	=	1,297.5	mm
Average surface area of Reservoir	=	68,000	m^2
Annual rainfall volume	=	88,230	m^3

(b) Outflow from Discovery Bay Reservoir

b1. Evaporation from Reservoir Surface

Annual evaporation rate in 2010 / 2011	=	1380.7	mm	
Reservoir top surface	=	18	ha	(very conservative assumption)
Annual evaporation volume	=	248,526	m^3	

b2. Water demand from Existing and Proposed New Development (Water Demand Case 1)

Daily total water demand	=	2,184	m^3
Annual water demand	=	797,054	m^3

Remaining Volume of Discovery Bay Reservoir

Reservoir Volume	+	Inflow volume	-	Outflow volume		
1,482,400 m^3		555,330 m^3		1,045,580 m^3	=	**992,150 m^3**

(Therefore Reservoir has adequate volume to meet water demand)

Water Demand Case 2: Fresh and Flushing Water of New DB Development (Areas 6f and 10b) to be Supplied by Discovery Bay Reservoir

Development	Population	Population	Fresh Water /	Unit Flow Factor	Water Demand
Existing Discovery Bay	25000	Residential	Flushing Water	0.07	1750.0
Developments	4100	School	Flushing Water	0.025	102.5
Existing Nim Shue Wan	150	Residential + Service Trade	Fresh & Flushing Water	0.23+0.04+0.07	51.0
New Discovery Bay	4003	Residential + Service	Fresh &	0.39+0.04+0.07	2001.5
			Total Water Demand Required =		3905.0 m^3/d

(a) Inflow to Discovery Bay Reservoir

a1. Runoff collected by catchwater from catchment

Total rainfall depth	=	1,297.5	mm
Catchment Area	=	120	ha
(assume runoff coefficient 0.3)			
Annual rainfall volume	=	467,100	m^3

a2. Direct Rainfall on Reservoir Area

Total rainfall depth	=	1,297.5	mm
Average surface area of Reservoir	=	68,000	m^2
Annual rainfall volume	=	88,230	m^3

(b) Outflow from Discovery Bay Reservoir

b1. Evaporation from Reservoir Surface

Annual evaporation rate in 2010 / 2011	=	1380.7	mm	
Reservoir top surface	=	18	ha	(very conservative assumption)
Annual evaporation volume	=	248,526	m^3	

b2. Water demand from Existing and Proposed New Development (Water Demand Case 2)

Daily total water demand	=	3,905	m^3
Annual water demand	=	1,425,325	m^3

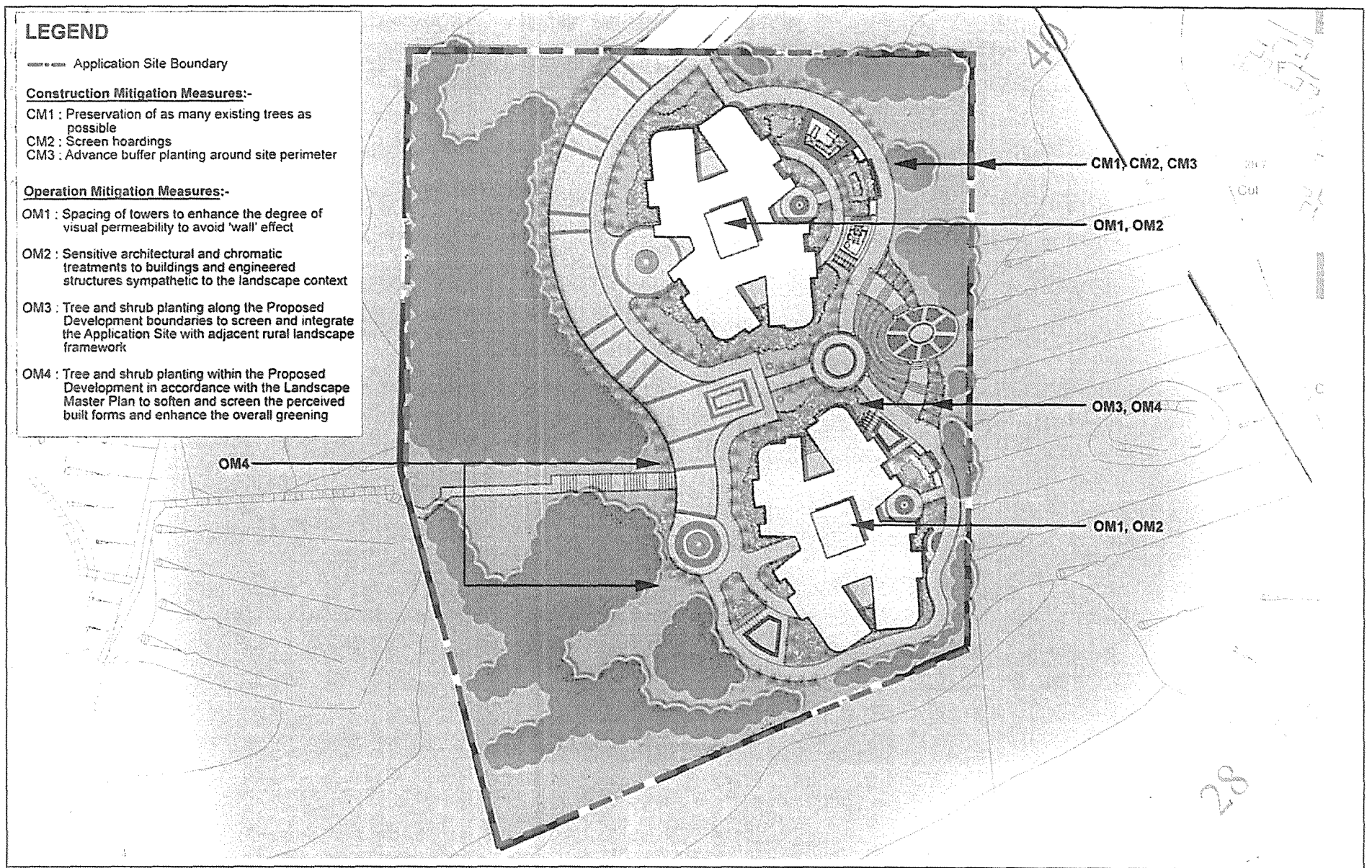
Remaining Volume of Discovery Bay Reservoir

Reservoir Volume	+	Inflow volume	-	Outflow volume		
1,482,400 m^3		555,330 m^3		1,673,851 m^3	=	**363,879 m^3**

(Therefore Reservoir has adequate volume to meet water demand)

Annex H

Updated Photomontages



TITLE **VISUAL MITIGATION MEASURES** REV. B SEPT 2016 FIGURE B.8

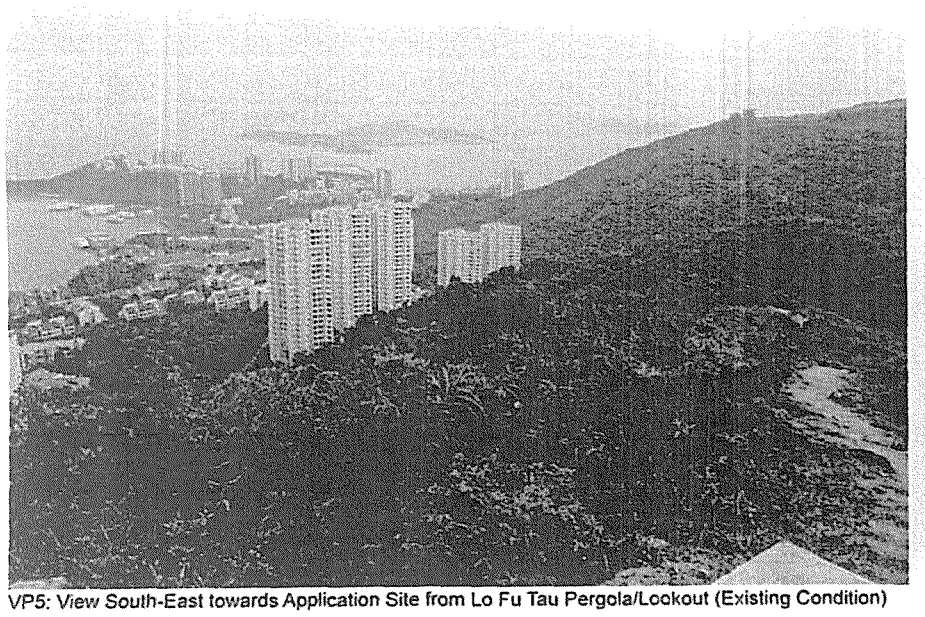
PROJECT DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREAS 6F

VP1: View South-West towards Application Site from Discovery Bay Plaza (Existing Condition)

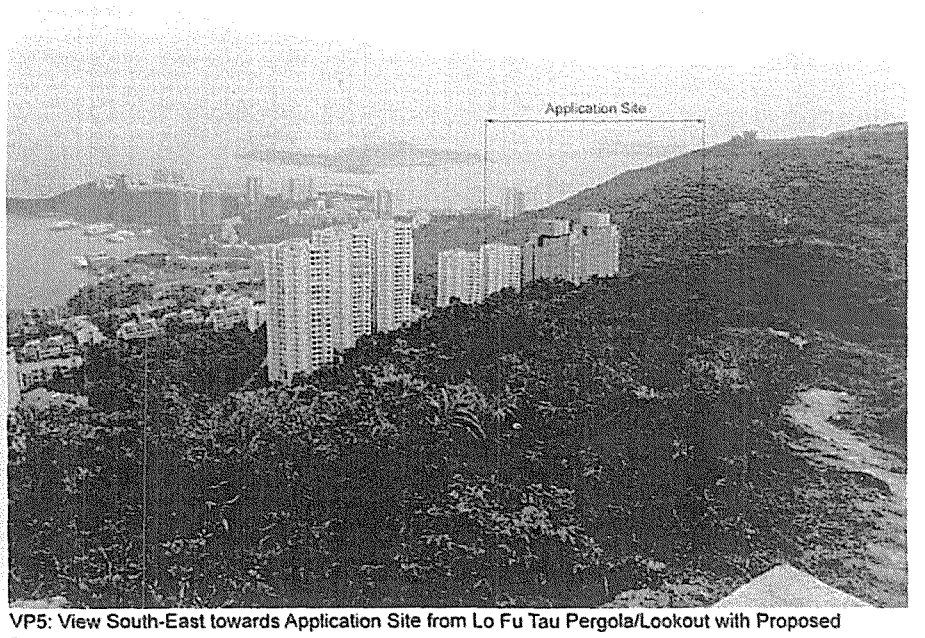
VP1: View South-West towards Application Site from Discovery Bay Plaza with Proposed Development

TITLE **PHOTOMONTAGE - VP1 (VSR REC1) FROM DISCOVERY BAY PLAZA** OCTOBER 2016 FIGURE B.9

PROJECT DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F

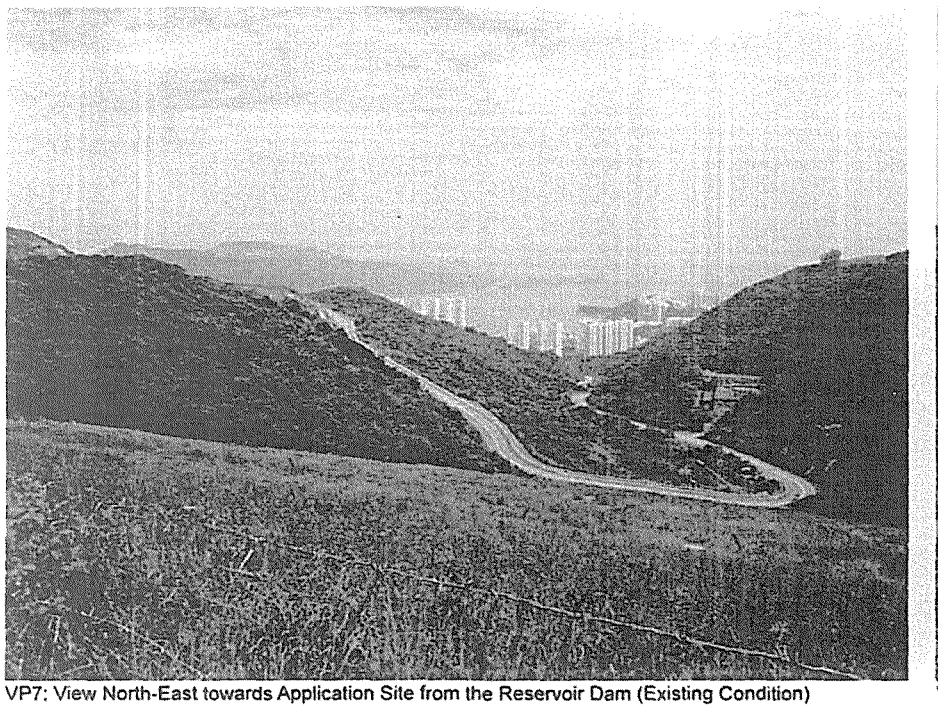


VP5: View South-East towards Application Site from Lo Fu Tau Pergola/Lookout (Existing Condition)

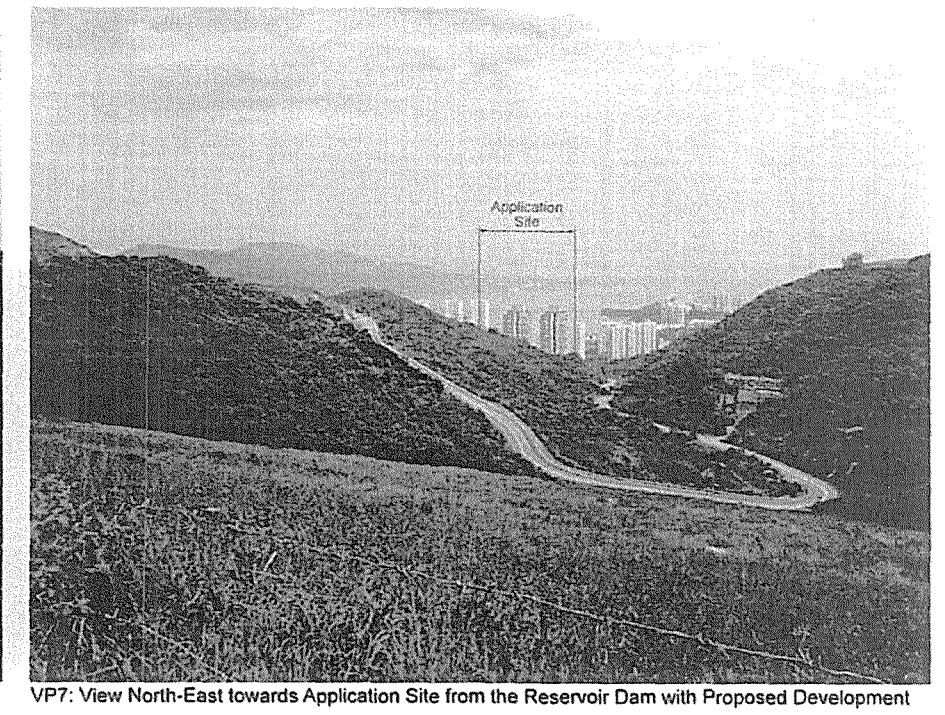


VP5: View South-East towards Application Site from Lo Fu Tau Pergola/Lookout with Proposed Development

Urbis	TITLE: PHOTOMONTAGE - VP5 (VSR REC4) FROM LO FU TAU PERGOLA/LOOKOUT	OCTOBER 2016	FIGURE: B.10
	PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F		

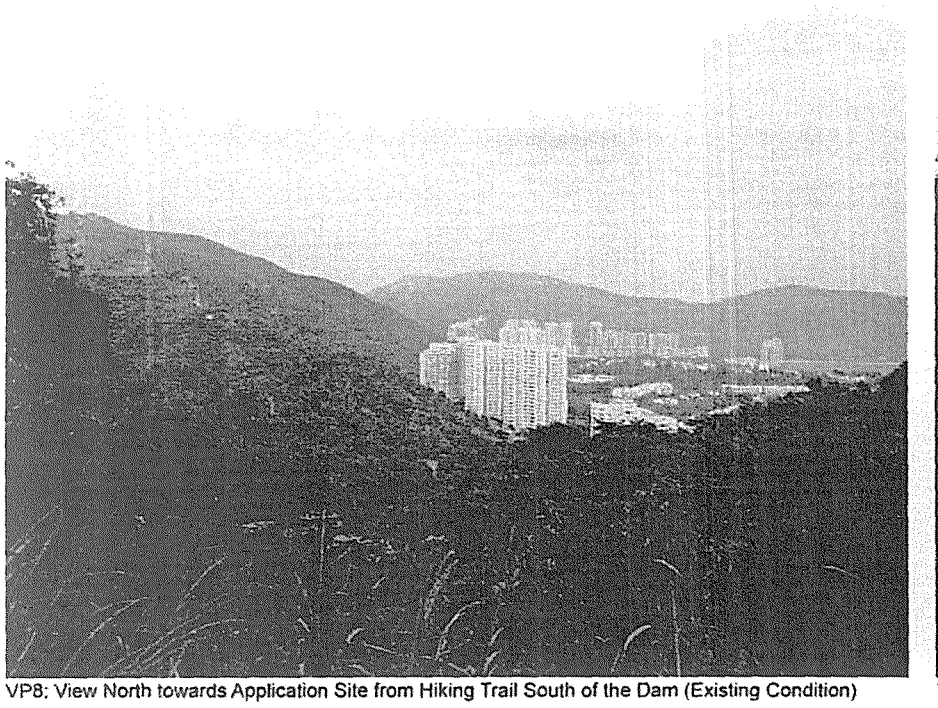


VP7: View North-East towards Application Site from the Reservoir Dam (Existing Condition)



VP7: View North-East towards Application Site from the Reservoir Dam with Proposed Development

Urbis	TITLE: PHOTOMONTAGE - VP7 (VSR REC6) FROM RESERVOIR DAM	OCTOBER 2016	FIGURE: B.11
	PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F		



VP8: View North towards Application Site from Hiking Trail South of the Dam (Existing Condition)

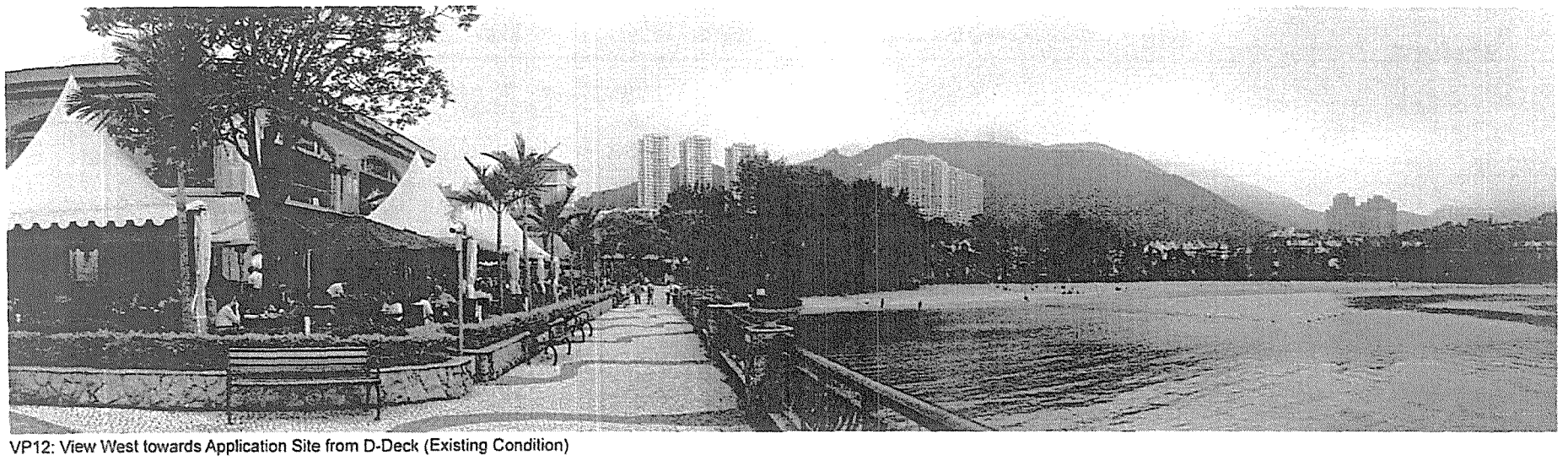
VP8: View North towards Application Site from Hiking Trail South of the Dam with Proposed Development

	TITLE: PHOTOMONTAGE - VP8 (VSR REC7) FROM HIKING TRAIL SOUTH OF DISCOVERY VALLEY	OCTOBER 2016	FIGURE: B.12
	PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F		

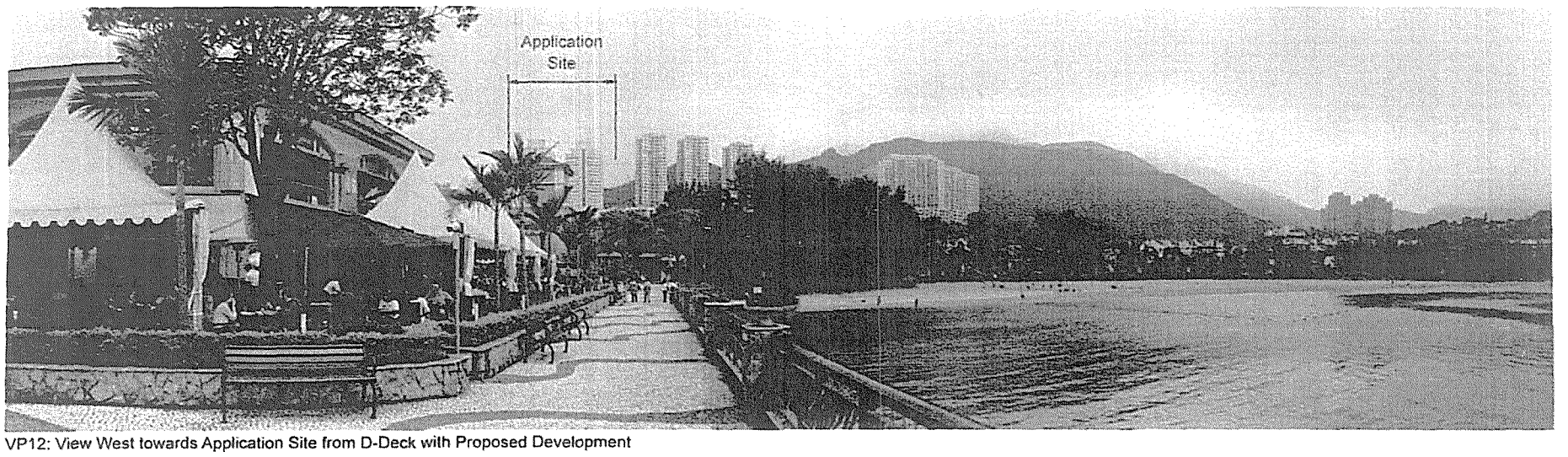
VP11: View South-West towards Application Site from the Disneyland Promenade (Existing Condition)

VP11: View South-West towards Application Site from the Disneyland Promenade with Proposed Development

	TITLE: PHOTOMONTAGE - VP11 (VSR REC9) FROM DISNEYLAND PROMENADE	OCTOBER 2016	FIGURE: B.13
	PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F		

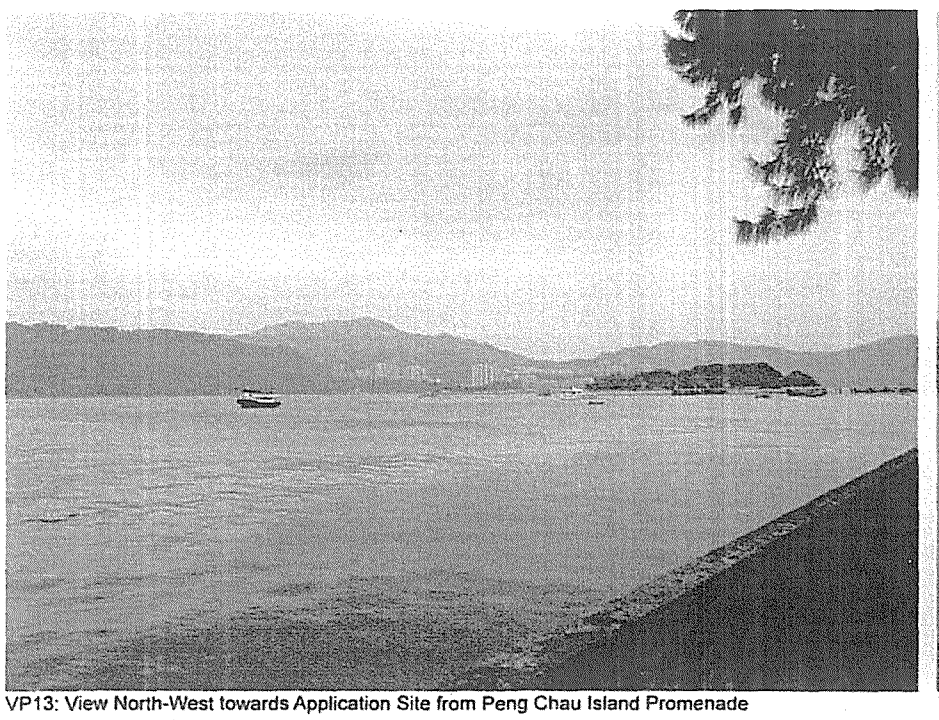


VP12: View West towards Application Site from D-Deck (Existing Condition)

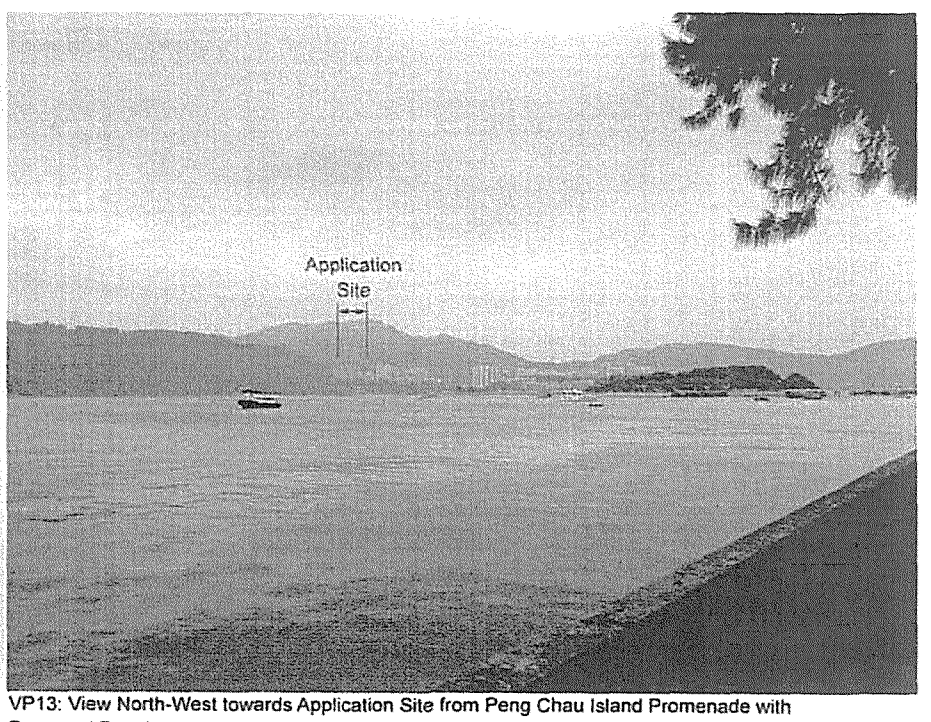


VP12: View West towards Application Site from D-Deck with Proposed Development

TITLE: PHOTOMONTAGE - VP12 (VSR REC10) FROM D-DECK		OCTOBER 2016	ANNEX: B.14
PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F			

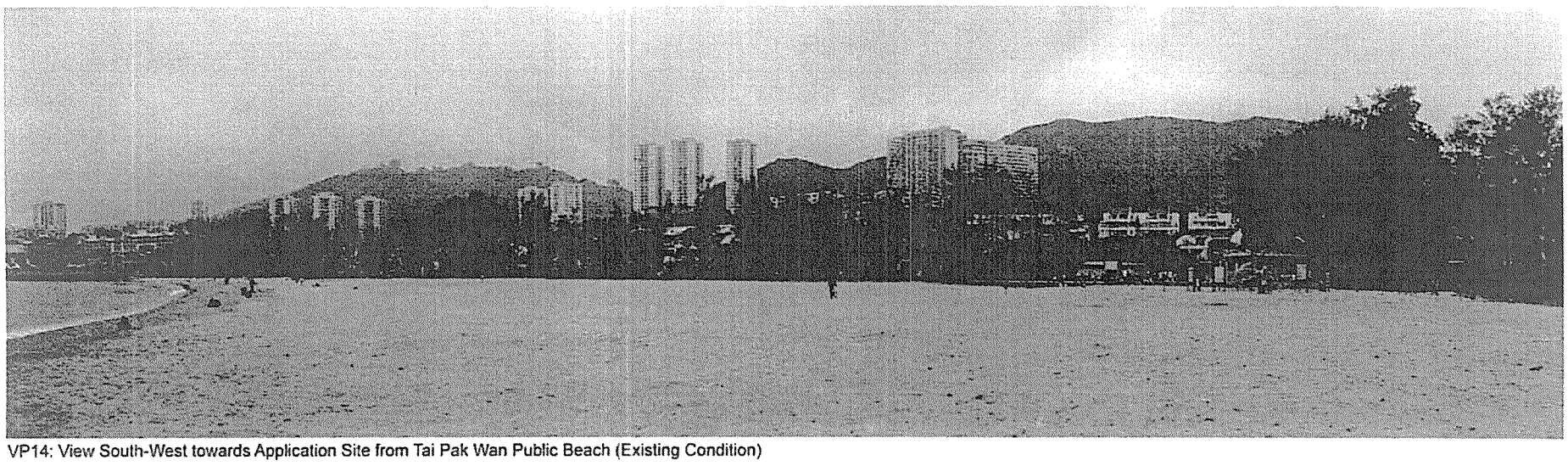


VP13: View North-West towards Application Site from Peng Chau Island Promenade (Existing Condition)

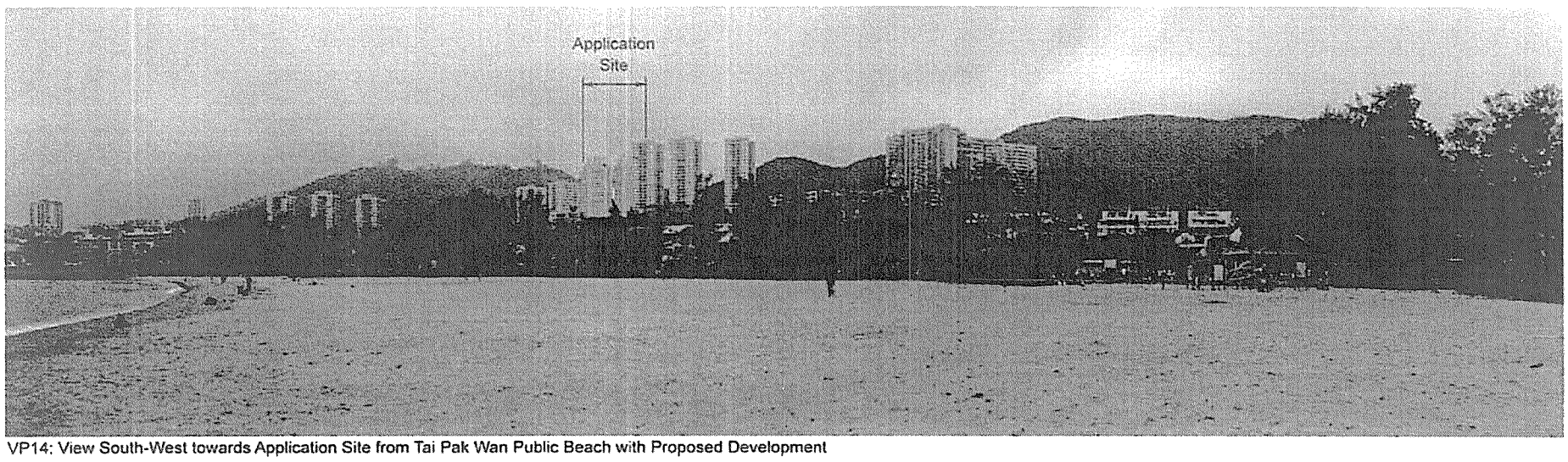


VP13: View North-West towards Application Site from Peng Chau Island Promenade with Proposed Development

TITLE: PHOTOMONTAGE - VP13 (VSR REC11) FROM PENG CHAU ISLAND PROMENADE		OCTOBER 2016	ANNEX: B.15
PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F			



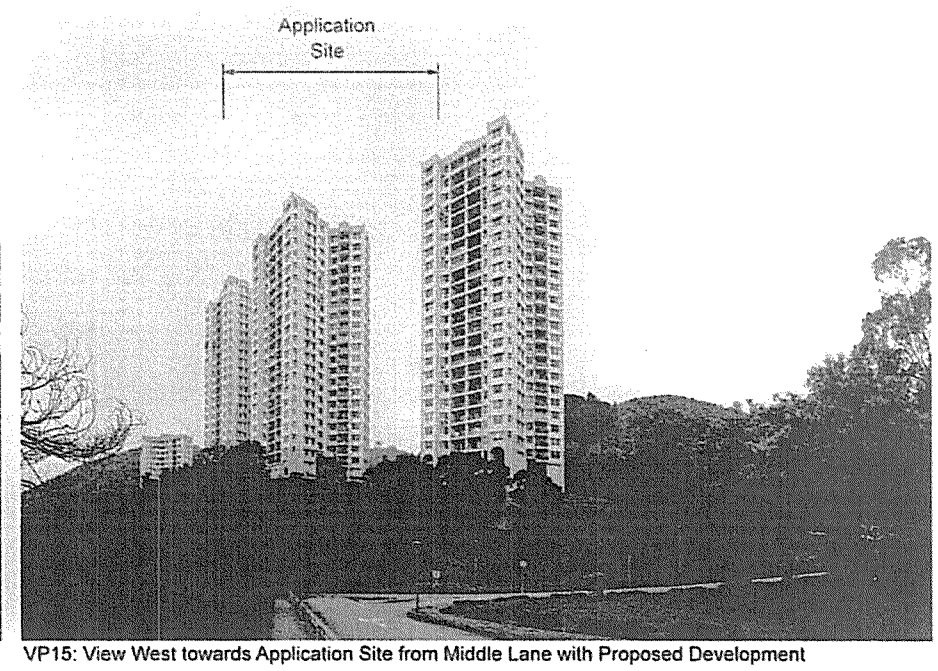
VP14: View South-West towards Application Site from Tai Pak Wan Public Beach (Existing Condition)



VP14: View South-West towards Application Site from Tai Pak Wan Public Beach with Proposed Development

Urbis	TITLE: PHOTOMONTAGE - VP14 (VSR REC12) FROM TAI PAK WAN PUBLIC BEACH	OCTOBER 2016	ANNEX: B.16
	PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F		

VP15: View West towards Application Site from Middle Lane (Existing Condition)



VP15: View West towards Application Site from Middle Lane with Proposed Development

Urbis	TITLE: PHOTOMONTAGE - VP15 (VSR T3) FROM MIDDLE LANE	OCTOBER 2016	ANNEX: B.17
	PROJECT: DISCOVERY BAY OPTIMIZATION OF LAND USE - REFINEMENT OF AREA 6F		