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工務小組委員秘書
盧慧欣女士

盧女士:

工務小組委員會
2018年6月25日會議的跟進事項

在2018年6月25日的工務小組委員會會議上，有委員要求政府就議程項目「工務計劃項目第399DS號 – 搬遷沙田污水處理廠往岩洞」提交補充資料。政府的回應現載於**附件**。

發展局局長

(陳福耀 代行)

2018年7月11日

附件

工務計劃項目第399DS號(部分) -
「搬遷沙田污水處理廠往岩洞 – 工地開拓及連接隧道工程」

補充資料

擬議工程計劃5個階段的預計工程費用及完工日期；

整項搬遷沙田污水處理廠往岩洞工程包括五個階段，暫定設計的預測總造價粗略估算約為273億元(按2017年9月價格計算)，或400至500億元左右(按付款當日價格計算)*。第一階段工程(即PWSC(2018-19)26號文件建議提升級別的部分)估計所需費用為20億7 750萬(按付款當日價格計算)，預計在2019年第一季展開，在2022年第四季完工。其餘四個階段工程分別是「主體岩洞建造工程」(約佔總造價三分之一)、「污水處理設施裝置工程」(約佔總造價二分之一)、「上游污水收集系統及泵房改動和建造工程」以及「現有沙田污水處理廠解除運作和拆卸工程」。我們仍在檢討該四個階段工程分別的推行時間表，預計整項工程需時約13年。

註* : *暫定設計的預測造價粗略估算，會因應隨後設計改動及/或深化、推展日期的更改、建造價格水平變動等因素而有可能需要作出調整，因此並不代表日後用作申請撥款的估計所需費用。*

(2a) 有關污水處理廠現址的未來用地規劃假設的研究報告；

在可行性研究階段，渠務署曾委託工程顧問為建議騰空的現有沙田污水處理廠用地進行規劃檢討，目的是為該用地作一些土地規劃假設，以進行多方面的概括技術評估。相關的規劃檢討報告(下稱「檢討報告」)於2014年完成並載於**附件光碟**(共三冊和一份補充文件)。

(2b) 就污水處理廠現址未來用地規劃的假設，包括可興建約10 000個房屋單位的相關資料；

根據規劃檢討報告，工程顧問就沙田污水處理廠現址用地所作的土地規劃假設包括不同比例的公私營房屋發展情況(假設可建單

位數量由 8 150 至 10 370 不等)，而相應的概括技術評估顯示每個規劃假設情況對各方面的影響輕微(詳見檢討報告的補充文件第 9.1 段)。然而，我們必須重申，這些土地規劃假設只用作進行多方面的概括技術評估，以確立擬議搬遷計劃的可行性。騰出沙田污水處理廠現址的未來土地用途將會在另一項規劃及工程研究中處理。該研究會聚焦於騰出土地的未來規劃及發展用途，當中會探討和建議合適的發展和土地用途計劃方案，並會諮詢公眾及持份者的意見。

(2c) 在規劃上述用地的未來用途時，曾否考慮到因其西面毗連沙田馬場的馬房，而需考慮避免在貼近該處的位置興建房屋單位，以確保人畜分隔；

上述的規劃檢討已考慮騰出土地如作發展房屋用途,其與毗鄰沙田馬場的馬房之間所需預留的分隔空間(詳見檢討報告第一冊第 10.2.8 段)。

(3a) 擬議工程計劃第一階段所產生的建築廢物會否經由大老山公路等沙田區主要幹道運往公眾填料接收設施及堆填區，而運載建築廢物的車輛每日進出工地的平均及最高架次分別為何；

建築廢物會經由一條在工程期間興建、橫跨亞公角街的臨時天橋及馬鞍山路運往公眾填料接收設施及堆填區。如有需要，運載建築廢物的車輛會途經大老山公路。我們預期第一階段工程運送建築廢物的車輛每日進出工地的平均及最高架次分別為 100 及 480。

(3b) 擬議工程計劃其餘 4 個階段預計所產生的建築廢物量及處置方法；

擬議工程計劃其餘四個階段預計所產生的建築廢物量總數約為 1 100 萬噸，大部份為第一級及第二級花崗岩石。這些石塊會被運送至藍地石礦場或其他合適地方，以加工循環再用作建築原料，供其他工程項目施工之用。

惰性建築廢物總量約為 1 080 萬噸，我們會盡量於本工程內用作填料。剩餘的惰性建築廢物主要會被運送至其他工程項目重用，部分未及重用的會被送往填料庫儲存待日後再用。非惰性建築廢物總量

約為 20 萬噸，會被盡量循環再用後才運至堆填區棄置。在詳細設計階段和施工階段，我們會繼續探討各種機會，務求能夠減少產生廢物，以及盡量把物料重新再用。我們亦會要求承建商提交計劃書，列明廢物管理措施，供政府批核。計劃書須載列適當的緩解措施，以避免和減少產生惰性建築廢物，並把這些廢物再用和循環使用。我們會確保工地的日常運作符合經核准的計劃，並會要求承建商在工地把惰性與非惰性建築廢物分開，然後運送到適當的設施處置。我們會以運載記錄制度，監管惰性和非惰性建築廢物分別運送到公眾填料接收設施和堆填區處置的情況。

AECOM

Water &
Urban Development

Report on Planning Review for Existing STSTW Site (Volume 1 of 3 – Text)
(Final)

JANUARY 2014

RESTRICTED

Agreement No. CE 43 /2011 (DS)

Relocation of Sha Tin Sewage Treatment Works to Caverns – Feasibility Study

THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION
DRAINAGE SERVICES DEPARTMENT

Agreement No. CE 43/2011 (DS)

Relocation of Sha Tin Sewage Treatment Works to Caverns – Feasibility Study

Report on Planning Review for Existing STSTW Site (Final)

January 2014

Prepared by: Keith Tsang (Project Manager) 21 January 2014

Approved for Issue: Alex Kwan (Project Director) 21 January 2014

AECOM ASIA CO. LTD.

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1 INTRODUCTION

1.1 Background of the Study

1.1.1 To support the social and economic development in Hong Kong, there is a pressing need to optimize the supply of land for various uses by sustainable and innovative approaches. The relocation of the Sha Tin Sewage Treatment Works (STSTW) into rock cavern presents an opportunity for development at the existing site which is proposed to be vacated after the relocation.

1.1.2 Cavern construction is an established technology that has seen continual improvement in its application. This may also help to reduce adverse impacts of the "Not-in-My-Backyard" (NIMBY) facilities like sewage treatment works on the local environment and alleviate the NIMBY sentiment.

1.1.3 A recent cavern study named the *Enhanced Use of Underground Space in Hong Kong*, has broadly demonstrated from technical and financial viability standpoints that cavern scheme could be implemented to house the Sha Tin Sewage Treatment Works (STSTW), thereby releasing land at the existing STSTW site (Hereafter referred to as the Study Area) for other beneficial land uses. A further detailed feasibility study was recommended in the study to identify and address the issues associated with relocation of the STSTW to caverns.

1.1.4 As part of this study, a Planning Review on the Future Land Use of the Study Area is to be conducted to review the existing planning and development context, and to assess the development feasibility, including residential developments, at the Study Area for the proposed relocation of the STSTW to cavern.

1.2 Study Area Boundary

1.2.1 The Study Area for the proposed redevelopment site consists of primarily the premise of the existing STSTW. The site is located at the opening of the Shing Mun River Channel, bounded by the Shing Mun River to its East, the Sha Tin Hoi water body to its North, Tolo Highway to its West and the Sha Tin Racecourse horse stables to its South. Land area of the Study Area is approximately 28.4 hectares. There is an option to potentially extend the boundary to include the existing Water Supplies Department's pumping station if the facility relocates elsewhere.

1.3 Scope and Objectives of this Report

1.3.1 As per Clause 6.13 of the Study Brief, the overall objective of the planning review for the Study Area is to formulate and assess feasible development scenarios for the purpose of establishing a business case to confirm the financial viability of the Project. The purpose of this report will be to formulate a potential development scheme for the Study Area for housing and other uses. While a full planning and engineering study on the Study Area shall be conducted at a later stage.

1.3.2 At the time of preparing this Report, the Government is conducting a series of public engagement activities relating to the proposed reclamation at Ma Liu Shui which is adjacent to the existing STSTW. However, as the extent of reclamation, the proposed development on the reclamation site and the implementation programme are not certain at this moment, this Report have not take into account the cumulative effect due to the potential reclamation. The proposed Ma Liu Shui waterfront is anticipated to have implication and impact on the planning and design of future developments at the STSTW site and should be further investigated in the future.

1.3.3 Key aspects of the Study Area that will be considered as part of the scheme design process include the following aspects:

- Physical setting and topography;
- Land use pattern, including the existing and planned land uses;
- Existing and planned Government, Institution or Community (G/IC) facilities;
- Land status / administrative conditions;
- Geotechnical conditions;
- Transport and traffic conditions, including road and rail networks;
- Accessibility/Connectivity;
- Other infrastructural conditions, including drainage, sewerage, waterworks and utilities;
- Environmental conditions, including air quality, noise, water quality, waste issues, areas affected by contaminated mud, ecological conditions, fisheries, cultural heritage, landscape and visual conditions, etc.; and
- Urban design and landscape context (such as building height profile, ridgeline, district/area characteristics, etc.) and landscape resources.

1.3.4 Baseline analysis of the above has been conducted and findings were recorded in the past deliverable of *Working Paper on Planning Review for Existing STSTW Site*. Findings from the baseline review have been used as basis to formulate guiding planning principles and the proposed development scheme which will be presented in this report.

1.3.5 Technical assessments for the proposed scheme have also been conducted to demonstrate, in broad terms, the technical feasibility and suitability of the proposed development scheme. The findings of the technical assessments on various aspects including traffic, environmental, geotechnical and waterworks are also presented in the later chapters of the report.

1.4 Structure of this Report

1.4.1 In respect to the scope and objective of the Planning Review for the Study Area, this report comprises, in addition to this Introduction, the following sections:

Section 2 **The Study Area and Planning Context**, which recaps the findings of the baseline review that includes review of the strategic and district planning context, prevailing statutory planning parameters, surrounding development patterns, socio-economic context and existing provisions of open space and G/IC facilities

Section 3 **Development Vision, Planning and Urban Design Principles,** which highlights the planning principles and development vision for the proposed development schemes

Section 4 **Development Scenario**, which presents the proposed development scheme, including design features and land use development parameters

Section 5 **Enhanced Development Scenario**, which presents the proposed development scheme, including design features and land use development parameters

Section 6 **Traffic & Transport Assessment** , which examines in broad terms the adequacy of the capacities of existing and planned transport systems for the proposed development scheme

Section 7 **Drainage Impact Assessment**, which reports the findings of the Drainage Impact Assessment for the proposed STSTW development

Section 8 **Sewerage Impact Assessment**, which reports the findings of the Sewerage Impact Assessment for the proposed STSTW development

Section 9 **Waterworks Impact Assessment**, which reports the findings of the Waterworks Impact Assessment for the proposed STSTW development

Section 10 **Environmental Impact Assessment**, which reviews key environmental issues and recommend possible environmental mitigation measures

Section 11 **Landscape and Visual Impact Assessment**, which reviews the landscape and visual impact due to the development

Section 12 **Air Ventilation Assessment**, which reports the findings of the Air Ventilation Assessment for the proposed STSTW development

Section 13 **Geotechnical Assessment**, which examines in broad terms the geotechnical impact arising from the proposed development

Section 14 **Sustainability Assessment**, which reports the findings for the Sustainability Assessment using CASET to evaluate the proposed development

Section 15 **Systematic Risk Management**, which broadly identify risks and uncertainties associated with the development

Section 16 **Implementation Strategy and Programme**, which describes the implementation strategy and phasing programme for the proposed development

Section 17 **Financial Implications**, discusses the cost and financial implication of the proposed development

Section 18 **Conclusion**

2 THE STUDY AREA AND PLANNING CONTEXT

2.1 Introduction

2.1.1 This section summarizes the planning context at the strategic and local levels which will form as part of the basis for the proposed development scheme. To recap the findings from the previous baseline review stage, this section will also outline the existing physical context, site topography, land status, socio-economic conditions, and the existing, committed and planned land use and provision of open space and G/IC facilities within the Study Area.

2.2 Strategic Planning Context

Hong Kong Policy Address

2.2.1 In his Policy Address 2011-2012, the Chief Executive emphasized the policy to increase Hong Kong's future land reserve for residential development. Aiming to ensure a healthy and stable development of the property market, the policy addresses pledged to make available land for an average of 20,000 residential flats each year in the next decade. This policy will serve to build up a sufficiently large land reserve within a certain period to stabilize the supply of residential land and raise people's affordability to buy flat, especially for first time homebuyers.

2.2.2 As one of the major initiatives under this policy, the Chief Executive has announced carrying out of studies and public engagement exercises on increasing land supply by reclamation outside the Victoria Harbor and rock cavern development to meet the land demand for Hong Kong's long-term social and economic needs.

2.2.3 Furthermore, a number of sites have been identified as potential sites for cavern development to be further explored. As part of his Policy Agenda's new initiatives, the Chief Executive announced the commencement of a feasibility study on the relocation of the Sha Tin Sewage Treatment Works to rock cavern so as to release the original site for housing and other uses. The potential future housing development at the existing site of the STSTW will contribute to increase Hong Kong's land supply for development and meet the government's target for housing development. The Policy Address will support the development of caverns as an innovative method to better utilize land resources for other more valuable and suitable uses to benefit the society.

2.2.4 In his latest Policy Address 2013, the Chief Executive re-iterated the effort to explore new land supply resources through the development of rock caverns to free up surface land for development. Specifically, the relocation of the Sha Tin Sewage Treatment Works has been highlighted which will create additional land supply for housing development. Amidst growing public need for housing, the resulting residential development at the site of the existing STSTW after its relocation, will aid to meet the future housing demand.

Hong Kong 2030

2.2.5 The Hong Kong 2030 Planning Strategy (Hong Kong 2030 Study), commissioned by the Development Bureau and the Planning Department, has principally set out the planning strategies and overall land supply strategy to support the future development of Hong Kong to the year 2030 and beyond.

2.2.6 As part of the housing and land use planning strategy, The Hong Kong 2030 Study has emphasized the need to ensure adequate provision of housing land. The study recommended that a good range of sources of land supply should be maintained for future housing development. It suggests that to increase the current land supply, we need to further examine the potential of unused sites, sites with obsolete uses (e.g. government and industrial uses) and sites that are under-developed. The proposed cavern

development to relocate the STSTW will suit the direction as set out in the Hong Kong 2030 by releasing a valuable site for housing development to meet the future needs.

Enhanced Use of Underground Space in Hong Kong – Feasibility Study

2.2.7 In 2009, in line with the government's initiative to explore underground space as part of Hong Kong's pursuit of sustainable development, the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department (CEDD) commissioned a study on the Enhanced Use of Underground Space in Hong Kong. The main objective of the study was to examine opportunities for underground space development and recommend approaches and way forward for planned development of underground space so as to release land for other uses.

2.2.8 As part of the study, the Sha Tin Sewage Treatment Works was selected to carry out a Preliminary Feasibility Study (PFS) to examine the feasibility of replacing the facility in rock caverns. The PFS demonstrated technical feasibility of the cavern scheme for the Sewage Treatment Works and identified key issues that would need to be addressed. For the site of the existing STSTW, the PFS assessed the site's planning context, opportunities and constraints. Subsequently, development concept schemes were formulated to explore the development opportunities of the sites.

2.2.9 The major key issues and constraints in regard to the redevelopment of the STSTW presented under the Enhanced Use of Underground Space Study are summarized as follows:

- Traffic noise generated from the adjacent Tolo Highway and Tate's Cairn Highway will potentially impact the future residential developments at the STSTW site;
- Existing Helipad adjacent to the Marine Police Station will potentially become a source of noise pollution to the future residential development;
- Tate's Cairn Highway will traverse through the site and potentially presents noise and visual impact to the future developments; and
- Land occupied by the Sha Tin Sewage Treatment Works may be contaminated after many years of plant operation. Clean up of the site will be required prior to construction of the proposed residential development.

2.2.10 In addition to identifying site issues and constraints, the study also highlighted key opportunities for future redevelopment of the site, these include:

- The Study Area is located within close proximity of the East Rail and Ma On Shan Line, providing convenient rail transport for future users;
- Future development will enjoy unobstructed views of the Sha Tin Race Course, Shing Mun River and Sha Tin Hoi;
- The Study Area is close to Tolo Highway and Tate's Cairn Highway which are the strategic road links connecting Shatin with other districts.
- The Study Area is located next to the Shing Mun Riverfront with opportunity to extend the promenade pedestrian and cycle track to Pak Shek Kok and Science Park promenade; and
- The Ma On Shan Country Park nearby offers as major landscape and visual resource that could potentially enhance the overall quality of the future developments.

2.2.11 The key issues, constraints, opportunities as well as the conceptual development schemes as identified in the *Enhanced Use of Underground Space Study* will be used as reference in this study taking into account latest development requirements. Reference will also be made to the latest Government policies, community needs and aspirations, infrastructure development as well as market situations etc. in formulating the appropriate development schemes for the future uses of the STSTW site under this assignment.

Increasing Land Supply by Reclamation and Rock Cavern Development cum Public Engagement – Feasibility Study (Land Supply Study)

2.2.12 In line with the latest government policy to expand land resources and to build up land reserves by exploring options of reclamation outside of the Victoria Harbour and rock cavern development, CEDD has commissioned the Land Supply Study in July 2011 to assess the feasibility of the two land supply options, namely reclamation at suitable location outside Victoria Harbour and Rock Cavern Development. A number of sites with potentials for rock cavern development will be selected for further review and examination to assess its feasibility.

2.2.13 According to the Study, Cavern development is regarded as a new source of land supply. The study recognizes the social benefits that cavern developments would have to communities. By relocating suitable government facilities to caverns, the original land as well as the adjacent areas can be released for housing and other uses. The released land will become valuable resource, particularly near or in the urban area.

2.2.14 The proposed cavern relocation site for the Sha Tin Sewage Treatment Works has been identified by the Land Supply Study as a Strategic Cavern Development Area with high level of suitability for cavern development. The Study Area will be released for development after its relocation. This will be in line with the overall objective of the Land Supply Study and the government policy of increasing developable land through new, innovative method such as rock caverns.

2.3 District Planning Context

Sha Tin Shing Mun River Planning Review: the Need for Water Quality Improvement (Sha Tin District Council)

2.3.1 In 2008-09, a study was commissioned by the Sha Tin District Council to conduct a thorough review on the planning issues and the need for water quality improvement of Sha Tin Shing Mun River. The purpose of the study was to assess the future enhancement potential of the Shing Mun River as an important asset of Sha Tin. The study explored proposals by integrating the land use planning and enhancing the water quality of the Shing Mun River to achieve sustainable development in economic, social and environmental aspects and optimize its potential to be a vibrant community with local characteristics.

2.3.2 According to the report, Shing Mun River was recognized as a landmark of the Sha Tin District. The land use planning and future development along the riverbanks are proposed to provide quality leisure and recreational facilities and attractive tourist spots which will have significant impact to the overall Sha Tin district.

2.3.3 Based on comments gathered from a series of public engagement exercises, the report concluded that the public envisions the Shing Mun River to be a place with leisure, recreational and tourist hotspots. Various schemes were proposed in the report to revitalize the area along the riverbanks. Suggested proposals categorized into three major zones are as follow:

- *Upstream* – To conserve natural environment and develop leisure activities such as eco-cultural tourism;
- *Midstream* – To provide series of recreational activity nodes and enhance sense of belonging within the community; and
- *Downstream* – To foster aquatic and athletic development and promote tourism and economic opportunities, such as the provision of aquatic activity centre and hosting international rowing competitions.

2.3.4 The study identified that the waterfront area across the Shing Mun River was underutilized and presented an opportunity for the development of an outdoor public performance venue and outdoor Food and Beverage (F&B) facilities. Other enhancement proposal at the riverfront area near the site includes the establishment of dog parks and toilets for pet lovers in the promenade area.

2.3.5 The Study also reports that the local community of Sha Tin expressed their wishes to improve the use of space in areas near the mouth of the Shing Mun River. As the STSTW is being relocated, it will help release the waterfront area at its current site to provide land for various leisure and recreational activities along the continuous riversides. It will also ameliorate the adverse impacts of NIMBY facilities to the neighboring residents could be minimized as well. The aspirations of the public and key concerns will be taken into consideration in the formulation of the development options at the Study Area.

2.4 Site Context

Physical Context and Site Topography

2.4.1 The STSTW redevelopment site covers primarily the premise of the existing Sha Tin Sewage Treatment Works. The Study Area is approximately 28.4 hectares in size on reclaimed land that forms part of the west bank of the Shing Mun River. Subsequent to the proposed relocation of the STW, approximately 28 hectare of land will be free for redevelopment (a portion of land will need to be reserved for pumping station and associated rising main to convey sewage to relocated STSTW). The Study Area is located at the opening of the Shing Mun River Channel, bounded by the Shing Mun River to its East, the Sha Tin Hoi water body to its North, Tolo Highway to its West and the Sha Tin Racecourse horse stables to its South.

2.4.2 The Study Area is situated on relatively flat land that was formed as part of the reclamation of the Sha Tin Hoi during the 1970's for the Sha Tin New Town Development. The mountainous area of Kau To Shan is situated to the west and northwest of the Study Area across the Tolo Highway. The natural hillside will potentially serve as a natural backdrop for the future development to be proposed at the Study Area.

Statutory Context and Surrounding Uses

OZP Designation of the Study Area

2.4.3 The Study Area falls within an "Other Specified Use" zone annotated "Sewage Treatment Plant" on the Sha Tin Outline Zoning Plan No. S/ST/27 **(Fig. No. /2.01)**. Pursuant to the Notes, "Sewage Treatment Plant" and uses directly related and ancillary to it are permitted "as of right" use within the zone. "Government Use", "Public Utility Installation" and "Utility Installation for Private Projects" on the other hand may be permitted within the zone subject to approval by the Town Planning Board.

Surrounding Uses and Characteristics

2.4.4 The major land uses found in the surrounding area include residential development of medium to high density, Village Type Development, Commercial, Industrial, Community Facilities and Open Space. Details of the surrounding land uses are described as follows:

Residential

2.4.5 To the east of the Study Area, several large scale private and government subsidized housing development are located abutting the waterfront area of Sha Tin Hoi that makes up for part of the Ma On Shan New Town. These residential development falls within the "Residential (Group A)" ("R(A)") and "Residential (Group B)" ("R(B)") zones which are primarily intended for High and Medium density residential developments. The

developments nearest to the Study Area across Shing Mun River are the Kam Tai Court HOS development, Mountain Shore, Sausalito and La Costa, which are developed in the early 2000s. Development height restrictions are stipulated within the R(A) and R(B) zones concerned, which range from 90.0 mPD to 120.0 mPD.

2.4.6 To the west of the Study Area and across the Tolo Highway, the hillside of Kau To Shan is zoned as "Residential (Group B)" ("R(B)") and "Village Type Development"("V"). Most of the existing residential blocks at Kau To Shan are of low rise structures. Building heights in this area are generally in the range of 2 – 5 storeys, comprising mostly of villa-type development.

2.4.7 Other large scale residential developments that are in relative proximity of the Study Area, both private and public, includes City One, Royal Ascot, Jubilee Garden, Wo Che Estate and Lek Yuen Estate.

2.4.8 In Pak Shek Kok, a major residential development, The Providence Bay, is currently in progress. The new development will consist of low rise towers providing approximately 1,400 residential units. The development is scheduled to be completed in 3 phases, from end of 2012 to middle of 2013.

Village Type Development

2.4.9 A "Village Type Development" ("V") zone is located to the west of the Study Area at the hillside of Kau To Shan. Several small villages are located within the "V" zone including Kau To Village and Ma Niu Village, as well as some more recently built villa developments. Developments within the "V" zone are of low profile and low density, with building heights restricted to a maximum of 3 storeys (8.23m).

2.4.10 In addition to Kau To Shan, two Village zones are located to the east of the Study Area across the Shing Mun River, which contains the Ah Kung Kok Fishermen's Village and Tai Shui Hang.

Commercial/Retail Facilities

2.4.11 The largest commercial retail development in the Sha Tin area is the New Town Plaza which is located abutting the Sha Tin MTR Station, approximately 2 kilometers southwest of the Study Area. Comprising of more than 1,300,000 sqm of commercial/retail GFA, the New Town Plaza is a major district commercial hub, serving the needs of Sha Tin District residents as well as visitors from other areas of Hong Kong. Public transport connection between New Town Plaza and the Study Area is presently limited with only two no. of buses connecting the two areas.

Industrial

2.4.12 The Fo Tan Industrial Area, zoned "Industrial" ("I"), is located approximately 1km to the southwest of the Study Area. The primary planning intention of the Industrial zone is for light manufacturing, warehousing, logistics and goods transportation facilities. Since the early 2000's, part of the industrial buildings have undergone transformation and adaptive re-use from industrial functions to other uses including offices, data centre and institutional uses.

2.4.13 The industrial area in Siu Lek Yuen, about 1 kilometers south of the Study Area is zoned "Industrial(1)". To facilitate the gradual phasing out of the Industrial area and to respond to the recent trend for hotel developments, 'Hotel' use is included under Column 2 of the notes for "Industrial(1)" to allow flexibility for hotel development in the Siu Lek Yuen Industrial Area through planning application.

Other Specified Uses (Science Park)

2.4.14 The Hong Kong Science Park is located to the north of the STSTW site and zoned as Other Specified Uses annotated "Science Park" on the Pak Shek Kok OZP. Built along the waterfront near Tolo Harbour, the 22 hectare campus provides 20 laboratory-fitted buildings, offering 220,000 square meter of office space and conference facilities that caters to the IT and Scientific Research industries. Many major companies in the fields of Biotechnology, Green Technology, Electronic Engineering, Information Technology and Communication have established offices and research facilities in Science Park. Phase 1 and Phase 2 of the Science Park development were completed in 2001 and 2002 respectively, while Phase 3 is currently under construction and schedule to be complete by 2015.

Other Specified Uses (Race Course)

2.4.15 The Sha Tin Racecourse, zoned "Other Specified Uses" annotated "Race Course" is located directly to the south of the STSTW site. Located in the centre of the race course is the Penfold Park, a public park managed by the Hong Kong Jockey Club. During the horse racing season, the racecourse is a major activity node that attract large crowds on to the area on race days. The MTR Race Course Station located at the race course provides rail service to the area on designated race days.

2.5 Existing and Planned Government, Institution or Community (G/IC) Facilities

2.5.1 In order to assess the requirements for open space and G/IC facilities to be provided at the future redevelopment site of the STSTW, a broader context taking into account the existing and planned provisions of the Sha Tin District should be evaluated.

2.5.2 Major G/IC facilities provided within the Sha Tin OZP area include:

- Sha Tin Town Hall and Sha Tin Central Library;
- Sha Tin Government Office;
- The Chinese University of Hong Kong;
- Hong Kong Institute of Vocational Education;
- Hong Kong Sports Institute;
- Prince of Wales Hospital;
- Sha Tin Hospital;
- Hong Kong Heritage Museum;
- Sha Tin Jockey Club Public Swimming Pool; and
- Yuen Wo Road Sports Centre
- Sha Tin Rowing Centre
- Jockey Club Shek Mun Rowing Centre

2.5.3 Based on the existing and planned provision of major G/IC facilities and the planned population of the planning area of Sha Tin stipulated in the OZP, the sufficiency of open space and major G/IC facilities provision within the planning area has been calculated with reference to the requirements set out in the Hong Kong Planning Standards and Guidelines ("HKPSG").

2.5.4 There are two rowing centres currently located along Shing Mun River. The Sha Tin Rowing Centre is located on the north bank of the river near the Sha Tin Sports Ground, while the Jockey Club Shek Mun Rowing Centre is located on the south bank of the river near the Pictorial Garden residential development. Opportunity may exist to provide new water sports facilities at the STSTW site.

2.5.5 A site located on the opposite side of the Shing Mun River is currently occupied by the Hong Kong Custom and Excise Department for its operational use. If the site becomes available for development of other uses in the future, there is potential opportunity to create synergy with the proposed developments at the STSTW site.

2.5.6 Based on the data on existing G/IC facilities provided by the Sha Tin District Planning Office (DPO), it is found that there are sufficient provision of schools, medical and social welfare facilities. There is a slight deficit in the provision of recreation facilities such as Sport Centre and Sports Ground. In terms of open space, there is in fact a large surplus of District and Local Open Spaces to cater for current and planned population because of the comprehensive network of riverfront promenade and park spaces within the district.

2.5.7 Given the above findings on the sufficiency of Sha Tin's G/IC facilities to meet the existing and future planned population needs, the future development option at the STSTW site should focus on providing the appropriate local open space for population arising from the new residential development. In addition, the opportunity to propose facilities serving a broader regional need should also be explored. New facilities taking advantage of the site's waterfront location, such as water sports centre, waterfront plaza and park may be considered which will serve to become a major activity node for the community.

2.5.8 To gain better insight on the possible government facilities to provide at the STSTW site, a letter was circulated to various government departments to solicit their suggestions on possible facilities. The responses from government departments on suggestions of G/IC facilities are provided in **Appendix 2.01**. It should be noted that the suggestions received are for reference only and no commitments are made to providing the suggested uses by the various government departments. A summary table of the departments suggestions of facilities is as follows:

Table 2.1 Government Department Suggestions on Potential Facilities at STSTW

Suggestion of Uses / Facilities	Department
Cycle Track Amphitheatre and floating stage Kindergarten and nursery	ASD
Farmers Market	AFCD
Cycle track along the Shing Mun River Channel	TD
Hotel	Tourism Commission
Primary/Secondary School in accordance with HKPSG	Education Bureau
Social Welfare facilities	Social Welfare Department
Film Centre	LCSD

2.6 Planned and On-going Development in the Vicinity of the Study Area

2.6.1 Several residential and Comprehensive Development Area (CDA) developments are planned or currently under construction in the vicinity of the study area.

2.6.2 A public housing development at Shui Chuen O is currently under construction. The new public housing development will provide approximately 11,000 new housing units, the housing development is proposed to be completed in phases from 2014 to 2016. The on-going public housing development will contribute to the government's policy of providing 15,000 Public Rental Housing units each year to meet the target of maintaining an average waiting time of three years for General Waiting List applicants.

2.6.3 Two sites, one for public housing development and another for HOS development, are planned at Planning Area 16 which is located west of the Fo Tan Industrial Area. The two sites are currently in the planning stage and will undergo further detailed study.

2.6.4 An on-going private housing development, the Riverpark, is located adjacent to the Che Kung Temple MTR Station. The private development project consists of four tower blocks of 48 storeys with prominent views to the Shing Mun River. The development will provide 981 units in total and is scheduled for completion by April 2013.

2.6.5 Another major private development, the Double Cove, is also currently under construction. Located in Lok Wo Sha near the Wu Kai Sha MTR Station, the new housing development will feature four residential towers of 33 – 35 storeys with views overlooking the Tolo Harbour. The new development will provide 928 units in total and will be completed in the first quarter of 2013.

2.6.6 In Pak Shek Kok, a new residential development, the Providence Bay, is currently under construction. The new development will consist of low rise towers providing approximately 1,400 units at the waterfront site near the Tolo Harbour. The Providence Bay is scheduled to be completed in 3 phases, from end of 2012 to middle of 2013.

2.6.7 In Kau To Shan, there are several residential sites in Sha Tin Area 56A on Lai Ping Road which are on the Land Sale Programme for Sale by Application. The future development at the Kau To Shan land sale sites will be primarily low rise villa type developments.

2.6.8 Besides the major CDA / Residential developments as mentioned, a long list of planning application approvals are also found within the Sha Tin Outline Zoning Plan. The most common type of uses applied is namely Shop and Services within Industrial zone. The high number of planning applications within the Industrial zone shows and confirms the on-going trend of transformation of the industrial areas such as Fo Tan and Siu Lek Yuen, for other uses. **Fig. No. /2.02** show the details and locations of the approved planning applications within the Sha Tin OZP Area in the past 5 years.

2.7 Socio-Economic Context

2.7.1 This section covers the existing demographic profile and employment characteristics of the Sha Tin District. The demographic and employment data of the district will be referenced in formulating the STSTW site's development parameters such as land use types, distribution of public and private housing development and types of community facilities to be provided. The existing population and employment characteristics of the Study Area are derived from the 2011 Census data whereas the projections of population and employments are based on the figures compiled by the Working Group on Population Distribution Projections ("WGPD") in 2009, the projection from the Territory Population and Employment Data Matrices ("TPEDM") and the Census and Statistics Department's "Hong Kong Population Projections 2012 – 2041" Report.

Demographic Profile

Existing Population

2.7.2 According to the 2011 Census, the Sha Tin District had a total population of around 630,273 people in 2011. This amounts to approximately 8.9% of the territory's population of about 7.07 million, making the Sha Tin District the most populated district in Hong Kong. **Table 2.2** shows the main characteristics of the demographic profile of the Study Area, the major findings from the major categories of census demographic data are summarized as follows:

- *Household Characteristics:* The average household size of Sha Tin District (3.00) is slightly higher than that of the territorial average (2.9).
- *Age Structure:* The age structure of the Sha Tin District is similar to that of the territorial total. For percentage of population being the working age (from 18 to 65), Sha Tin has a slightly higher percentage of working population, at 74.8%, than the rest of the territory, at 72.2%.

- *Gender*: 295,051 (46.8%) and 335,222 (53.2%) of the population in the Sha Tin District are male and female respectively. The gender distribution is similar to that in the whole territory.
- *Type of living quarters*: Statistics on the breakdown of population living patterns shows that the Sha Tin District area has a lower proportion of residents living in private housing than the whole territory.

Table 2.2 Characteristics of Resident Population 2011

Characteristics	Sha Tin District	Territory
1. Household		
Average Household Size	3.0	2.9
2. Gender		
Male	295,051 (46.8%)	3,303,015 (46.7%)
Female	335,222 (53.2%)	3,768,561 (53.3%)
Total	**630,273 (100%)**	**7,071,576 (100%)**
3. Marital Status		
Never Married	248,691 (39.5%)	2,797,110 (39.6%)
Now Married	328,864 (52.2%)	3,608,078 (51%)
Widowed/Divorced/Separated	52,718 (8.3%)	666,388 (9.4%)
Total	**630,273 (100%)**	**7,071,576 (100%)**
4. Age		
Below 15	69,117 (11%)	823,437 (11.6%)
15-34	183,405 (29%)	1,959,156 (27.7%)
35-64	305,466 (48.5%)	3,346,590 (47.3%)
Over 64	72,285 (11.5%)	941,205 (13.3%)
Total	**630,273 (100%)**	**7,071,576 (100%)**
5. Type of Living Quarters (No. of Households)		
PRH and HOS	118,199 (57.1%)	1,101,163 (46.2%)
Private Housing and Others	88,705 (42.9%)	1,279,962 (53.8%)
Total	**206,904 (100%)**	**2,381,125 (100%)**

Source: 2011 Census

Projected Population

2.7.3 According to the figures compiled by the Working Group on Population Distribution Projections (WGPD) in 2009 which is tabulated in the TPEDM PVS-405, the population in the Sha Tin District, which includes major communities such as Sha Tin New Town, Fo Tan, City One and Ma On Shan, is envisaged to increase from around 631,121 in 2011 (base year) to 684,836 in 2016, and increase to 689,974 in 2021.

2.7.4 The population and housing trend suggest that Sha Tin has an above-average household size and large percentage of married population.

Economic Characteristics

Existing Labour Force

2.7.5 The 2011 Census has estimated that the working population in Sha Tin District is approximately 328,214, or 52% of the total district population.

2.7.6 The "Import/export, wholesale and retail trades" sector has involved the largest percentages of the resident labour force in the District (23.2%). It is followed by "Public administration, education, human health and social work activities" (17.8%) and "Real estate, professional and business services" (12.2%) sectors.

Existing Job Places

2.7.7 According to the latest TPEDM data (PVS-405), the estimated number of job places in Sha Tin District in 2011 was approximately 203,572. The largest employment sector is "Social and personal services, waste management, video and audio production and broadcasting, and other business services" (37.7% of the total job places), followed by "Import and Export trade" (13.5%) and "Financing, Insurance, Real Estate & Business Services" (10.1%)

2.7.8 When comparing with the territorial figure, the Study Area has much higher number of job places in the sector of "Social and Personal Services", while lower number of job places are found from the sectors of "Financing, Insurance, Real Estate & Business Services" and "Transport Storage & Communication".

Employment Projection

2.7.9 Employment projection to be presented in this section is based on TPEDM forecasts. Employment from "Manufacturing" and "Import and Export" in the Sha Tin District are expected to drop rapidly from 2011 to 2031, whereas those from "Social and Personal Services" are expected to increase significantly from 2011 to 2031. Overall, the total number of job places in the Sha Tin District is expected to increase from 203,572 places in 2011, to 208,800 in the year 2031.

2.8 Land Status / Administrative Conditions

2.8.1 The existing Sha Tin Sewage Treatment Works site is a Government Land Allocation. The disposal of the site will therefore be subject to the Committee on Planning and Land Development's decision. A Land Status Plan showing the land status of the Study Area and the adjacent areas is provided as **Fig. No. /2.03.**

2.9 Urban Design Context

Surrounding Development Height Profiles

2.9.1 Development pattern of the Sha Tin area is primarily concentrated on the two banks of the Shing Mun River. Higher development intensity and building heights are found at the immediate areas of the riverfront to capture the open views. In some portions along the waterfront, high building height profile of residential blocks can be identified. Development heights gradually declines as developments are located further away from the Shing Mun River and towards the natural hillside (refer to **Fig. No. /2.04**).

2.9.2 Residential blocks of 20 to 29 storeys make up for the largest portion of development in Sha Tin. Tower blocks of more than 30 storeys are more prominently found closer to the waterfront and in the Tai Shui Hang / Ma On Shan area. Village type housing between 1 to 3 storeys is situated in clusters along the hillside to the west and east of the STSTW site. The mix of development intensity and height profile has help create distinctive communities that ranges from high density neighhourhood at the riverfront to village type housing and single detached villa development towards the hillside.

*Major Activity Nodes (**Fig. No. /2.05**)*

2.9.3 The largest activity node in Sha Tin is the mixed use development of New Town Plaza. Connected to the Sha Tin MTR Station, the New Town Plaza is a major gateway for visitors going to nearby public and community facilities such as the Sha Tin Town Hall, Sha Tin Central Park and the Shing Mun River Promenade. Another major retail activity node is in Ma On Shan, the commercial retail development abutting the Ma On Shan MTR station, namely Ma On Shan Plaza and Sunshine City Plaza, creates a major activity node for residents in the Ma On Shan New Town. The retail hub is also linked to nearby

community facilities such as Ma On Shan Park and the Ma On Shan waterfront promenade.

Pedestrian and Cycling Circulation

2.9.4 Pedestrian connectivity at the site surrounding area is mainly achieved via the riverfront promenade (Refer to **Fig. No. /2.06**). Areas along the Shing Mun River are linked by the riverfront pedestrian and cycle track network, creating a strong connection axis for the Sha Tin area. A series of bridges spanning across the river currently provide connections between the two banks of the river. There is the potential to provide an additional footbridge to span from the northeastern corner of the STSTW site across Shing Mun River, creating easy and direct access to Ma On Shan area and the Tai Shui Hang MTR Station (feasibility of footbridge requires further study).

2.9.5 Pedestrian connections between the STSTW site to the University Station transport node is physically difficult and unpleasant due to the physical barrier of the Tolo Highway and challenging topography. Proposal to improve connectivity between the STSTW site and University Station should be further explored.

Visual Corridors

2.9.6 The most prominent visual corridor in Sha Tin is the Shing Mun River. Visible from most developments along both sides of the river banks, the Shing Mun River creates a linear development void that offer wide open natural views and air ventilation up and down the river corridor. The greening and open spaces associated with the riverfront promenade further adds to the visual quality of the river, making it an attractive and pleasant vista to be viewed by residents from nearby development. The river corridor also offers an unobstructed view down the river channel towards Sha Tin Hoi and the Tolo Harbour.

2.9.7 The surrounding natural mountain range and ridgelines in the backdrop are key visual characters. Building design and building profile should strive to respect views from key view points to the surrounding natural ridgelines. Adequate building separations and stepping height building profile should be explored.

*Public Parks and Open Space (Refer to **Fig. No. /2.06**)*

2.9.8 The Sha Tin District has arguably one of the most comprehensive public parks and open space network in Hong Kong. The riverfront promenade along the Shing Mun River serves to provide pedestrian linkage between residential communities and offer active recreational facilities such as jogging trail and cycle tracks for public enjoyment.

2.9.9 Major parks including the Sha Tin Central Park and the Penfold Park are located near residential development and serves to provide leisure open spaces for the nearby residents, creating a balanced and green community. Smaller community parks are provided within the residential developments which are used by local residents for leisure, recreation purposes and also facilitate circulations between developments.

2.10 Landscape Context

Landscape Resources

2.10.1 The existing STSTW is developed on a low-lying reclaimed land adjoining the Shing Mun River Channel. Locally, the Study Area is characterized by an extensive area of sewage treatment features including tanks and associated infrastructure. A low level of vegetation is located on the site, however, greening efforts are evident throughout the STSTW. For instance, green roofs are developed on top of the saltwater pump house and vertical greening measures have also been implemented on the four sludge tanks.

2.10.2 From a wider perspective, the STSTW is located within an area featuring a diverse mixture of development and facilities broken by adjacent highways. Southward to the STSTW, the landscape resource is largely featured at the Sha Tin Racecourse and the Penfold Park within the racetrack. Penfold Park, a major recreational park in Sha Tin, contains a number of different species of trees floral planting and shrubs.

2.10.3 Other landscape resources found near the Study Area are mainly located within high-density residential developments including Royal Ascot, Jubilee Garden and the Palazzo. Westward to the Tolo Highway and East Rail, on the other hand, is an area of low rolling hills known as Kau To Shan. Prestigious low-rise developments are scattered through the area. Vegetation within this housing area mainly comprises street trees, scattered trees and tree groups, whilst the slopes of adjacent hillsides are covered in woodland trees and shrubs.

2.11 Key Development Issues and Site Constraints

2.11.1 The following section will summarize the key constraints and issues identified within the STSTW site from various aspects (refer to **Fig. No. /2.07**).

2.11.2 Study Area size and location presents great opportunity for a mixed and balanced use development to meet long-term community need. Emphasis should also be placed on public engagement to respect and respond to the views and needs of the public, while achieving financial viability for the STSTW project.

2.11.3 Tolo Highway, a major expressway, is a source of traffic noise and air pollution. To reduce the level of noise impacts to future users, possible measures include noise barriers at Tolo Highway, setbacks for sensitive uses and single aspect building design. A combination of measures may be considered, suitability of mitigation measures will be further assessed in the scheme design stage. Tate's Cairn Highway traversing the northern part of the Site is a source of traffic noise and air pollution. Noise barriers and other less noise sensitive uses (ie. Commercial, G/IC uses) should be considered adjacent to the highway to reduce and buffer noise impact;

2.11.4 Major traffic constrained locations include signalized junction at Kiu Ha Road/Tolo Highway and the and the three roundabouts located to the north of the Site, road widening and junction improvements should be considered.

2.11.5 The Study Area is currently accessed through the junction of Kiu Ha Road and Shui Chong Street which is a dual 1-lane carriageway with limited ingress/egress capacity to meet future development needs.

2.11.6 Current pedestrian access to the 2 closest MTR stations is indirect and over 500m distance. Public transport terminus should be considered to accommodate future development need. Proposal to enhance physical connection to University Station and Tai Shui Hang Station should be further explored.

2.11.7 Adjacent stables along the south boundary of the Study Area and the adjoining Shing Mun River poses possible odour impact. A buffer distance of 100m (indicative) should be considered for odour sensitive uses such as residential developments.

2.11.8 A partially underground sewage and effluent pumping station is proposed at the northwest corner of the site. Some related facilities are planned to be located aboveground, the future development at this location should take into consideration of these facilities in its layout and building design.

2.11.9 Air Corridor in northeast-southwest direction should be reserved to allow predominated winds from north and northeast direction to penetrate hinderlands. Appropriate building disposition and massing should be incorporated with reasonable building gaps to allow good air penetration.

2.11.10 Building heights of future development shall respect adjacent ridgeline of the adjacent Kau To Shan and Nui Po Shan. Future development profile shall take into consideration visual impact imposes on nearby existing communities. A stepped height profile with lower buildings facing Sha Tin Hoi shall be considered for future developments. Wall development at the waterfront should be avoided.

3 DEVELOPMENT VISION, PLANNING AND URBAN DESIGN PRINCIPLES

3.1 Development Vision

3.1.1 The present Study will witness a change in land use planning paradigm in Hong Kong. With the pressing need to increase land supply to cater future growth in Hong Kong, rock cavern development is considered as a sustainable and innovative approach for new source of land supply which would help to release surface land for more beneficial uses, including housing development.

3.1.2 As demonstrated and recommended under CEDD's "Enhanced Use of Underground Space in Hong Kong – Feasibility Study" (the Recent Cavern Study), cavern scheme could be implemented to house the Sha Tin Sewage Treatment Works (STSTW), thereby releasing the existing prime waterfront site for other more beneficial uses.

3.1.3 The present Study is a direct consequence of the recent Cavern Study, taking forward its recommendation to carry out a further detailed feasibility to identify and address the issues associated with relocation of the STSTW to caverns, as well as to carry out a planning review on the future land use of the Study Area for establishing a business case for the project. According to the Study Brief, this planning review on the future land use should begin to formulate a "Development Scenario" for housing and other uses.

3.1.4 In addition, planning priorities have been changing in recent years, public aspirations for more interactive, people-oriented planning, quality living environment and sustainable design would contribute to a more fruitful planning and development process.

3.1.5 Against this background as well as the findings of the baseline review, the overall development vision for the STSTW site is proposed as follows:

"A balanced waterfront development for housing and other beneficial uses while responsive to community needs and aspirations"

3.1.6 While it is understood under the study brief that it is also required to establish a business case for the future land use. The cost information for the relocation is, however, not yet available at the time preparing this Report. As such, the proposed scheme under the planning review should be taken as a notional baseline scheme established to fulfill basic planning and design principles, as well as various technical requirements.

3.2 Planning & Urban Design Principles

3.2.1 Based on the above vision as well as the opportunities and constraints identified in this Working Paper, the following preliminary planning principles are proposed for the Study Area:

Planning

- To take into account needs of the community and the overall development of Hong Kong;
- To bring the people to the waterfront and the waterfront to the people
- To create a coherent community supported by a variety of commercial, social and recreational facilities
- To enhance the connectivity of the Study Area with the adjacent districts
- To accommodate appropriate transport infrastructure required to serve future population and visitors
- To promote sustainable site planning

Urban Design Principles

- Based on the above vision, the opportunities and constraints identified in this Working Paper, as well as making reference to the Urban Design Guidelines for Hong Kong, the following preliminary urban design principles are proposed for the Study Area. Illustrative diagrams of the design principles are enclosed in **Fig. No. /3.01**.
- To enhance pedestrian connectivity to nearby transport hub and railway station to improve accessibility to the future development site
- To provide efficient and direct internal pedestrian and vehicular circulation suitable for the site setting, with emphasis placed on creating easy linkages to the riverfront open space area
- To apply a building height profile and adequate building separations to respect existing ridgeline, to preserve existing key visual corridors, and to define the neighbourhood character
- To create development-free corridors with respect to natural air paths and view corridors to allow better ventilation and visual permeability of the Study Area
- To provide a pleasant waterfront promenade to connect with the existing Shing Mun River promenade and existing open spaces, creating a continuous riverfront promenade along the Shing Mun River
- To provide green pocket parks and public open space to create a pleasant, attractive and green living environment

4 DEVELOPMENT SCENARIO

4.1 Introduction

4.1.1 Taking into account the Study Area baseline information and understanding of the planning and development objectives, a "Development Scenario" for the future land use of the existing STSTW site is formulated and presented in the following section. The proposed development scheme presents the planning and development layout and proposed parameters for the future development at the study area.

4.2 Development Concept

4.2.1 The proposed "Development Scenario" will be driven by the development of a well balanced, residential focus community. As an overall concept, the "Development Scenario" will create a community that capitalizes on the site's prime location for optimal residential development. Taking into account the key development issues / constraints as highlighted in Section 2.9, a set of development concept has been set which will guide the formulation of the scheme layout plan. The development concepts applied to the schematic layout are summarized in the following:

Medium to High Density Residential Development

4.2.2 To meet the territorial need for housing, residential development of medium to high density will be considered at the study site as well as a stepped height profile will be considered with building height of the residential tower blocks gradually stepping down as it gets closer to the riverfront, preserving views to the hinterland. The proposed residential community should be supported by new local road and other utility infrastructures. Adequate building separations will be provided to allow for sufficient visual porosity and air ventilation Local park open spaces and community facilities should also be provided near the developments to create a balanced and pleasant living environment for future residents.

4.2.3 To create a balanced and socially beneficial community, different housing types may be considered. The specific distribution of the housing mix will require further review and investigation which should be conducted in a future planning and engineering (P&E) study for the site.

Commercial (Retail)

4.2.4 A commercial retail development consisting of a multi-level shopping centre should be considered at the northern end of the Study Area. The proposed commercial centre will serve to add to the existing retail facilities in the Sha Tin area which, at present, is highly concentrated at the New Town Plaza area. The proposed commercial development will serve as a secondary retail node serving nearby communities such as Ma On Shan, Fo Tan, Tai Shui Hang, the Chinese University of Hong Kong (CUHK) and Science Park, providing an alternative location to fulfill the resident's retail needs. A Public Transport Interchange (PTI) may be provided at the underside of the retail centre to provide access to the facilities from other communities.

G/IC Facilities to Meet the Future Population Needs

4.2.5 To meet the future community needs, G/IC facilities such as schools and medical facilities will be provided to serve the future community. The proposed school facilities should meet the required provision under the Hong Kong Planning Standards and Guidelines (HKPSG) to support the future new population at the subject site. Medical facilities such as clinics can possibly be located located within the proposed commercial and or G/IC blocks. These facilities should be located at conveniently accessible locations at the Study Area to facilitate easy access for the future residents.

Green Open Space and Recreational Facilities

4.2.6 To create a green and active living environment, ample open spaces will be provided in the form of a Central Park, open plaza, children playground and fitness station. A waterfront promenade will be proposed abutting the Shing Mun River and Sha Tin Hoi, the proposed waterfront, with opportunities to incorporate a cycle track, will enhance the connection of the riverfront promenade, creating a continuous waterfront linkage from Shing Mun River to Sha Tin Hoi. To create a vibrant waterfront environment, outdoor retail kiosks and outdoor F&B facilities can be considered. There is also the potential for Water Sports facilities to be located at the waterfront area to further enhance the active Shing Mun River promenade.

Enhanced Pedestrian Connection to Nearby Transport Hubs

4.2.7 To improve accessibility to existing nearby transport hubs, the existing pedestrian connections to University Station is proposed to be improved with paving and landscape enhancement measures. Connectivity to the Tai Shui Hang MTR can also be enhanced by a potential new footbridge at the opening of the river channel. The feasibility of constructing a footbridge at this location shall be further assessed in later stages of the study.

4.2.8 The above development concepts has been considered and reflected in the proposed development scheme. The following section will describe, in further detail, land use components and development parameters of the proposed scheme.

4.3 Proposed Development Parameters and Land Use

4.3.1 Based on the baseline review, planning and urban design principles as established in the preceding sections, a schematic layout plan for the "Development Scenario" has been formulated (refer to **Fig. Nos. /4.01 – 4.05**). The parameters for the proposed land use are summarized as follows:

Residential

4.3.2 The proposed residential development will consist of a mix of medium to high rise tower blocks, positioned to achieve a stepped height profile descending towards the waterfront. In total, 33 tower blocks, ranging in heights from 17 to 30 storeys, are proposed. With the assumptions of 8 flats per each residential floor, a total of 6,816 flats would be achieved, which will accommodate an estimated population of 19,800 persons. The gross floor area generated from the residential development will total approximately 570,240 sqm, with a gross domestic plot ratio of about 4.0. The proposed block layout and disposition has been designed to allow for air ventilation and view penetration, the layout design also complies with the PNAP 152 Sustainable Building Design Guidelines. Clubhouse facilities will be provided at each tower block which will occupy one whole floor of each block.

Commercial (Retail)

4.3.3 Two blocks of multi-level shopping centre are proposed to accommodate the retail needs of the future STSTW residents and users from surrounding areas. It will be located near the Sha Tin Hoi waterfront which will compliment the proposed promenade and public open space. A public Transport Interchange (PTI) is proposed at the underside of one of the commercial block which will serve as the public transport for the future STSTW residents and visitors. The proposed shopping centre will be 5 to 7 storeys in height. A total of about 70,000 sqm of commercial GFA will be achieved.

4.3.4 The commercial block is also designed to function as a noise barrier/enclosure to the Tate's Cairn Highway elevated road. The two commercial blocks are proposed to deck

over sections of the elevated road, thus shielding road traffic noise from the proposed residential towers at the site.

School Facilities

4.3.5 To meet the educational needs of the future STSTW residents and in accordance with the provision requirements of the Hong Kong Planning Standards and Guidelines (HKPSG), one primary school and one secondary schools are proposed within the study area. The schools are located in a central and accessible location, it is also positioned away from noise and odours sources to minimize these impact to the students and staff using the school facilities. Other facilities such as kindergartens and nurseries can possibly be incorporated within the proposed commercial and/or G/IC blocks north of the Tate's Cairn vehicular bridge.

Open Space

4.3.6 In order to create a green and environmentally friendly community, a generous portion of the study area has been proposed for open space and green areas. A number of pocket parks and open spaces are proposed within the residential development clusters. A large communal open space is proposed near the two commercial blocks, which can accommodate various community activities. An open space in between the two proposed commercial retail centre near the waterfront is proposed to become a waterfront open plaza that can host outdoor activities such as Farmer's Market and outdoor concerts.

Waterfront Promenade with Cycle Track and Watersports Facilities

4.3.7 An extension of the existing Shing Mun River promenade is proposed along the waters edge of the study area. The proposed promenade will further extend to the Sha Tin Hoi waterfront with potential future opportunities to connect with the Pak Shek Kok Waterfront Park. The proposed waterfront promenade with a suggested width of 20m will include a number of recreational and leisure facilities. The facilities provided at the promenade includes a cycle track with bicycle parking facilities, jogging trail, sitting areas and landscape planting. Water sports facilities can also potentially be provided at the waterfront to further enhance the dynamic waterfront area. There is also the potential to utilize the existing pier north of the site for leisure and recreational use such as sightseeing boat tours to further add appeals to the site. With its prominent location, the proposed promenade will become a destination attracting visitors from the community and other areas of Hong Kong.

G/IC Facilities (Indoor)

4.3.8 G/IC facilities such as indoor sports centre, community centre or other utility facilities (e.g. pumping station), have the potential to be placed at the western edge of the study area or near the retail shopping centre abutting the waterfront. Indoor facilities are considered suitable at the western edge of the study area as buffer to relieve the odour impact from the nearby horse stable. Facilities at the visually prominent waterfront can become an iconic development with interesting architectural design. The G/IC facilities to be provided and their locations should be subject to further study by the concerned government departments in due course.

4.3.9 In response to the suggestion for G/IC facilities by LCSD, a Film Centre is proposed near the retail shopping centre and abutting the waterfront. The Film Centre, located at a visually prominent waterfront can become an iconic development with interesting architectural design.

4.3.10 The specifics of the development parameters are presented in the following table:

Table 4.1 Development Parameters Table for "Development Scenario"

Development Parameters – "Development Scenario"	
Gross Site Area	28.4 ha
Development Site Area	14.2 ha
Non-Domestic GFA	About 70,000 m^2
Domestic GFA	About 570,240 m^2
No. of Flats	About 6,816 flats
Estimated Total Population	About 19,800 persons
Non-Domestic Plot Ratio*	About 0.5
Domestic Plot Ratio*	About 4.0
Overall Plot Ratio*	About 4.50

*Note: The plot ratio calculated based on the 50% utilization rate of the site area, i.e. 14.2ha. Should the site divided into different size of site in later stage, different plot ratio will be worked out for each individual site.

4.4 Sustainable Design Features

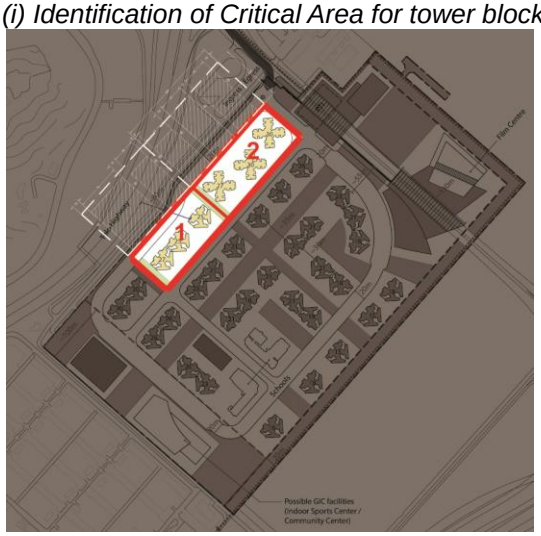
4.4.1 Checking of the proposed layout plan against the Sustainable Building Design Guidelines PNAP APP-152, it is realized that Permeability (Lp) of buildings, width of adjoining street canyon (U) & site coverage of greenery for this proposed schematic layout plan generally fulfills the design requirement.

Building Separation and Permeability

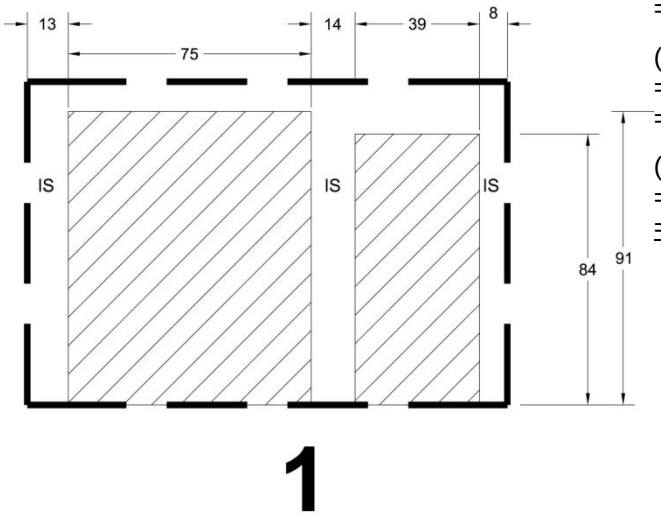
4.4.2 After a preliminary checking of the proposed layout plan, the provided permeability of buildings (Lp) is about 25% - 35% which is higher than the required Lp value (20%; 33.3%). The result shows that there are sufficient areas of intervening spaces and permeable elements within an assessment zone. It can facilitate sufficient air penetration across groups of buildings from one side to the other sides.

4.4.3 Detailed checking of two critical areas is given below:

(i) Identification of Critical Area for tower blocks:



(ii) Calculations of Provided Permeability in Area 1:

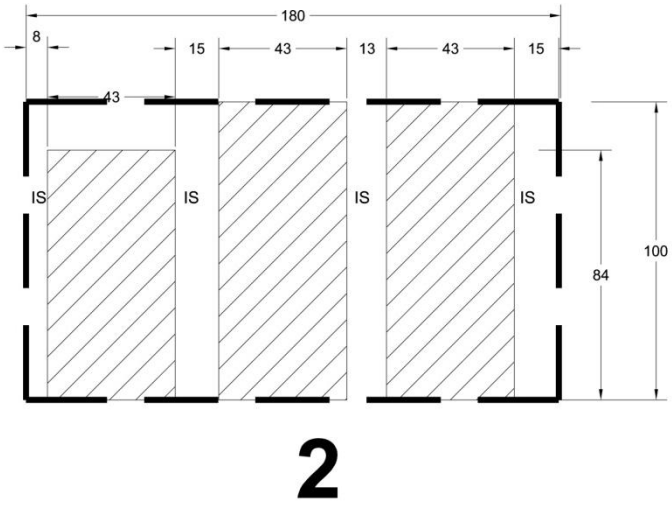


(I) Sum of area of IS
= [(13+14+8) x 91]+[39 x (91-84)]
= 3458

(II) Area of assessment zone
= (13+75+14+39+8) x 91
= 13559

(III) Permeability (Lp)
= 3458 / 13559 x 100%
= 25.5%

(iii) Calculations of Provided Permeability in Area 2:



(I) Sum of area of IS
= [(8+15+13+15) x 100]
+ [43 x (100-84)]
= 4788

(II) Area of assessment zone
= 180 x 100
= 18000

(III) Permeability (Lp)
= 4788 / 18000 x 100%
= 26.6%

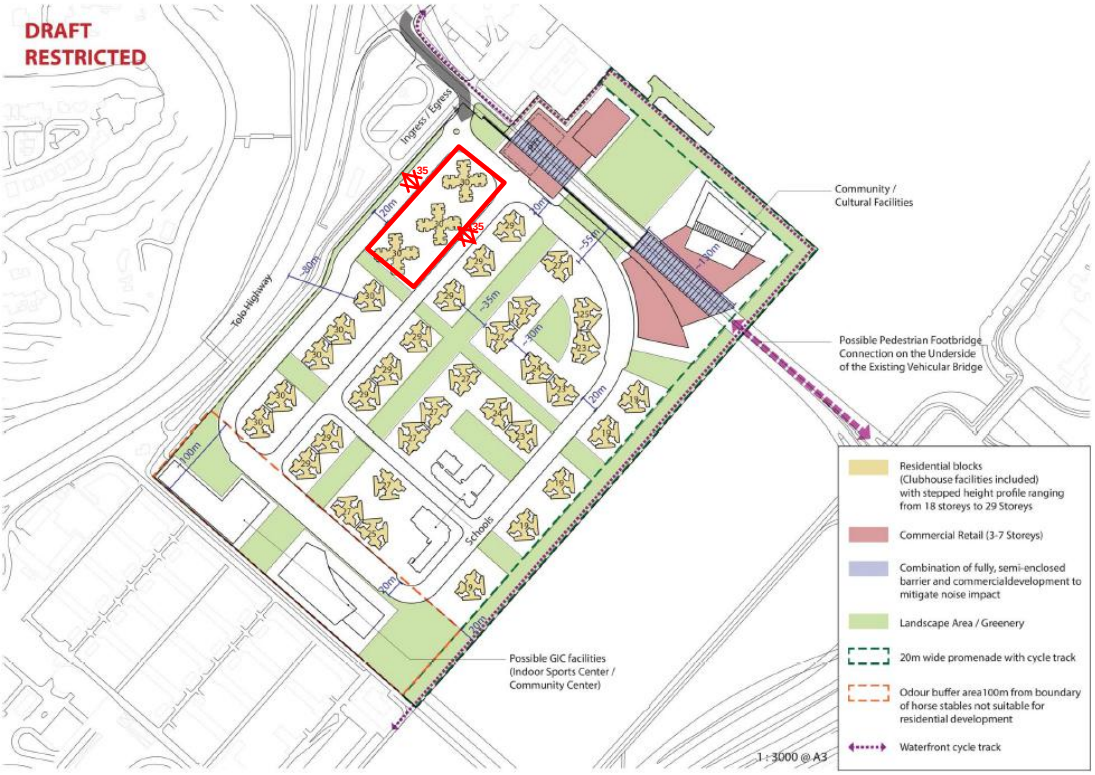
(iv) Design Requirement in PNAP APP-152:

HEIGHT (H) OF THE TALLEST BUILDING	PERMEABILITY (P) OF BUILDINGS	
	SITE AREA < 20,000 M^2 AND WITH BUILDING(S) OF LP ≥ 60M LONG	SITE AREA ≥ 20,000 M^2 (REGARDLESS OF THE LENGTH OF BUILDINGS)
H ≤ 60M	20%; 20%	20%; 25%
H > 60M	20%; 20%	20%; 33.3%

Building Set Back

4.4.4 The proposed widths of adjoining street canyon (U) for this layout plan are generally higher than 15m which is the minimum design requirement. Considering the critical area for group of buildings near ingress/ egress, the total project length of façade of this group of buildings is 180m, while the provided width of adjoining street canyon (U) is 35m which can fulfill the design requirement with the formula :

"Max (Lp) = 5 x (U)".
The diagram is as specified in table below:



Site Coverage of Greenery

4.4.5 The provided greenery areas at the pedestrian zone, communal podium roof, flat roof of all tower buildings for this layout plan is about 35% which is higher than the design requirement (30%) as specified in table below:

Table 4.2 Site Coverage of Greenery

Site Area (A)	Minimum Site Coverage of Greenery (i.e. percentage of greenery area over site area)		
	Pedestrian zone	Other locations	Total greenery areas
1,000 m^2 ≤A< 20,000 m^2	10%	No limit	20%
A ≥ 20,000 m^2	15%	No limit	30%

4.4.6 After examining the key requirements prescribed within PNAP-152, the results show that the proposed schematic layout plan can provide better air ventilation, greenery to mitigate the heat island effect to enhance better environmental quality of the urban space.

5 ENHANCED DEVELOPMENT SCENARIO

5.1 Introduction

5.1.1 In the "Enhanced Development Scenario", an area of land at the waterfront currently occupied by the WSD's Salt Water Pumping Station will be incorporated into the Study Area. The additional land area can potentially be utilized for further development to generate additional financial return for the STSTW development. The new vacated land can also be incorporated with the proposed promenade open space along the Shing Mun River and the Sha Tin Hoi waterfront to further enhance the quality of the waterfront open space for the public.

5.1.2 Another potential use for the additional use is the development of a waterfront hotel. The Tourism Commission has suggested the development of Hotel at the study site (refer to **Appendix 2.01**), in view of the current shortage of hotel room supply in Hong Kong. The development of hotel would also generate additional revenues that will help to establish a stronger financial case for the relocation project.

5.1.3 Taking into account the Study Area baseline information and understanding of the planning and development objectives, an "Enhanced Development Scenario" is formulated and presented in the following section. The proposed scheme will present the planning and development layout and proposed parameters of the "Enhanced Development Scenario" incorporated the additional site area. The following section will describe in detail the development concept and land use parameters of the proposed development scheme.

5.2 Development Concept

5.2.1 The overall development concept for the "Enhanced Development Scenario" will be similar to the original "Development Scenario", in that a well balanced, residential focus community is proposed. The additional site vacated by the removal of the pumping station is proposed for a waterfront hotel which will complement the adjacent retail development and add attractiveness to the waterfront area. Like the original "Development Scenario", the "Enhanced Development Scenario" will strive to create a pleasant community at a prime location at the mouth of the Shing Mun River. Detailed development concepts for the proposed STSTW development scheme can be referred to in **Section 4.2**

Medium to High Density Residential Development

5.2.2 To meet the territorial need for housing, residential development of medium to high density will be considered at the study site with stepped height profile to preserve view to the hinterland. Refer to **Sections 4.2.2** to **4.2.3** for more details of the residential development concepts.

Commercial (Retail)

5.2.3 A commercial retail development consisting of a multi-level shopping centre should be considered at the northern end of the Study Area. The commercial development can be linked with the hotel development proposed under the "Enhanced Development scenario".

G/IC Facilities to Meet the Future Population Needs

5.2.4 To meet the future community needs, G/IC facilities such as schools and medical facilities will be provided to serve the future community. Refer to **Sections 4.3.7** to **4.3.8** for details of the proposed G/IC facilities.

Green Open Space and Recreational Facilities

5.2.5 To create a green and active living environment, ample open spaces will be provided in the form of a Central Park, open plaza, children playground and fitness station. A

waterfront promenade with cycle track will be proposed abutting the Shing Mun River and Sha Tin Hoi. Refer to **Sections 4.2.6** for more details of the proposed open space and recreational facilities.

Enhanced Pedestrian Connection to Nearby Transport Hubs

5.2.6 Refer to **Sections 4.2.7** and **4.2.8** for the proposed pedestrian enhancements to nearby transport hubs including University and Tai Shui Hang Stations.

Waterfront Hotel at the Existing WSD Site

To capitalize on the waterfront location of the additional WSD site in the "Enhanced Development Scenario" and to increase Hong Kong's hotel room supply. Hotel development can be proposed and be integrated with the nearby attractions of the waterfront promenade, shopping mall and outdoor F&B facilities. The hotel development will be attractive in design that could potentially serve as a landmark development for the STSTW site. The hotel development will be of medium rise structure to conform with the overall stepped height development profile of the study site and avoid forming visual intrusion in the site.

5.2.7 The above development concepts has been considered and reflected in the proposed development scheme. The following section will describe, in further detail, land use components and development parameters of the proposed scheme.

5.3 Proposed Development Parameters and Land Use

5.3.1 A schematic layout plan for the "Enhanced Development Scenario" has been formulated (refer to **Fig. Nos. /5.01 – 5.05**) which has incorporated the additional WSD site into the development area. The parameters for the proposed land use are summarized as follows:

Hotel Facilities

5.3.2 To capture the development potential of the additional waterfront site, a hotel development is proposed in the form of a boutique hotel. The proposed hotel will be connected with the nearby waterfront promenade, shopping center, outdoor F&B and a Public Transport Interchange (PTI). The proposed building height of the hotel will be about 13 storeys, with an approximate total GFA of 22,000 sqm, which will provide about 270 to 350 hotel rooms. Because of its prime location, hotel guests will enjoy pleasant views of the Sha Tin Hoi waterfront and the Kau To Shan mountain range. The medium height profile also means the development will not be overly intrusive to existing views. With an interesting and innovative architectural design, the proposed hotel will become a physical landmark for the overall STSTW development

Residential

5.3.3 The proposed residential development will be the same, in terms of building layout and development parameters, as the "Development Scenario". A mix of medium to high rise tower blocks between 17 to 30 storeys are proposed. A total of approximately 570,240 sq.m. of residential GFA will be achieved to accommodate an estimated population of 19,800 persons. For more details on the development parameters, please refer to **Sections 4.2.2** and **4.2.3**.

Commercial (Retail)

5.3.4 The shopping facilities will remain unchanged from the "Development Scenario", which will be located near the north eastern side of the study site. For more details on the development parameters, please refer to **Sections 4.3.3** to **4.3.5**.

School Facilities

5.3.5 The proposed school facilities of one primary school and one secondary school will be the same as the "Development Scenario". For more details on the development parameters, please refer to **Section 4.3.5**.

Open Space

5.3.6 The proposed open space facilities will be unchanged from those proposed under the "Development Scenario". For more specific details, please refer to **Section 4.3.6**.

Waterfront Promenade with Cycle Track and Watersports Facilities

5.3.7 Same as in the "Development Scenario", an extension of the existing Shing Mun River promenade is proposed along the waters edge of the study area. For more details, please refer to paragraph 4.3.7.

G/IC Facilities (Indoor)

5.3.8 The proposed G/IC facilities will be unchanged from the "Development Scenario". For more details, please refer to **Sections 4.3.8** and **4.3.9**.

5.3.9 The specifics of the development parameters are presented in the following table:

Table 5.1 Development Parameters Table for "Enhanced Development Scenario"

Development Parameters – "Enhanced Development Scenario"	
Gross Site Area	28.8 ha
Development Site Area	14.6 ha
Retail GFA	About 70,000 m^2
Hotel GFA	About 22,000 m^2
Domestic GFA	About 570,240 m^2
No. of Flats	About 6,816 flats
Estimated Total Population	About 19,800 persons
Non-Domestic Plot Ratio	About 0.6
Domestic Plot Ratio	About 3.9
Overall Plot Ratio	About 4.5

*Note: The plot ratio calculated based on the 50% utilization rate of the site area plus the site area of salt water pumping station, i.e. 14.6ha. Should the site divided into different size of site in later stage, different plot ratio will be worked out for each individual site.

6 TRANSPORT AND TRAFFIC ASSESSMENT

6.1 Introduction

6.1.1 Planning review on the future land use of the Study Area would facilitate feasible development scenarios. Comprehensive planning and development of a supporting road network would be a crucial key element of the future land use of the Site. Although the Study Area is located in proximity of major highways, due to the low trip generations from the current sewage treatment works, the current road network serving the Study Area does not provide direct access from major roadways, such as Tolo Highway and Tate's Cairn Highway, in all directions. Based on the various potential development options and future land uses, accessibility of the Study Area would be required to improve accordingly in order to cater for the additional traffic demand.

6.2 Road-based Public Transport System

6.2.1 As no existing residential or commercial developments are located at the Study Area, it is not directly served by any public bus or green mini bus (GMB). Ferry to Tung Ping Chau is operating between Ma Liu Shui Ferry Pier along Science Park Road, and therefore one GMB route, no. 27, is available to transfer passengers between Sha Tin Pai Tau Street and the Ferry Pier. The Chinese University of Hong Kong Water Sports Centre is located along Science Park Road and is served by 4 bus routes, details summarized as follows:

Table 6.1 Public Bus Lines Serving Area in Vicinity of the Study Area

Public Bus Line	Terminating Points		Remarks
43P	Hong Kong Science Park	Tsuen Wan West Station Public Transport Interchange	
272K	University Station	Hong Kong Science Park	Circular Route
272S	Diamond Hill Station	Hong Kong Science Park	No services on Sundays and public holidays
274P	Wu Kai Sha Station	Tai Po Industrial Estate	No services on Sundays and public holidays

6.2.2 No Public Bus Interchange and major bus terminus are located in vicinity of the Study Area while only bus laybys are available for boarding and alighting of passengers. Other bus/mini-bus routes are available on the other side of Tolo Highway serving residents of Kau To Shan, which is very hard to access from the Study Area.

6.2.3 Public bus lines serving the University Station exceeds acceptable walking distance from the Study Area and are not intended to serve the area of the Study Area. **Fig. No. /6.01** shows the locations of the existing bus/minibus stops and railway stations within the vicinity of the Study Area. Condition of the University Station Public Transport Interchange (PTI) would be elaborated in more detail in the following sections.

Key Issues

6.2.4 The preliminary requirement and framework of the road-based Public Transport (PT) system in the Study Area would be determined by the planning parameters recommended in this Study. PTI and additional bus routes would be proposed taking into account the demand of the potential developments at the Study Area.

6.2.5 An area within the commercial retail area has been reserved for development of a future Public Transport Interchange (PTI), located as presented in **Fig. No. /6.02**. Based on Transport Planning and Design Manual (TPDM), the maximum walking distance to a bus stop is 400m for urban area and 600m for rural area. As shown in **Fig. No. / 6.02**, if only one PTI is provided, walking distance towards the PTI from the schools and some of the

residential towers in the south would exceed 500m. Therefore an additional pair of bus lay-by along the internal roads would be proposed to facilitate a comprehensive public transport network for the proposed development.

6.3 Rail-based Public Transport System

6.3.1 Based on the existing rail-based public transport system plan, no MTR station is provided within 500m of the Study Area. The Racecourse Station and the University Station are the two closest MTR stations in vicinity of the Study Area which both are located along the East Rail line with a minimum of 650m distance from the Study Area. Tai Shui Hang Station of the Ma On Shan line are locating even further from the Study Area comparing to the Racecourse Station and the University Station. As the Racecourse Station only operates on horse-racing days, which are usually only on Wednesdays and Saturdays, it may not be the best to serve as the major rail-based PT connection. Feeder services from the Study Area would be connected to the University Station or Tai Shui Hang Station, subjecting to further study.

Key Issues

6.3.2 As the Study Area is not subjected to direct linkage with any rail-based public transport system, feeder bus/shuttle services would potentially play a major role, especially with such a high proportion of residential developments as proposed in the current scheme. A preliminary review on the existing University Station Public Transport Interchange (PTI) has been conducted as it is the most conveniently located MTR connection station.

6.3.3 Located adjacent to the University Station, the University Station PTI is bounded by a goods vehicle car park in the east and a car park in the north. It is the major transportation hub connecting road-based transportation to railway system and frequent loading / unloading activities including bus, GMB, taxi and residential shuttles have been observed. Based on recent on-site observation, the existing GMB bays and taxi bays are highly utilized during peak periods with limited capacity for additional traffic generated from the potential development.

6.3.4 Four lines of residential shuttles (with 15-20mins headway) and a line of MTR shuttle (with 5-10mins headway) are operating along the pick-up/drop-off bay. Additional KMB services (only available at 8:45am and 9:00am) will be introduced starting from September 2012, taking up the available space of the existing pick-up/drop-off bay. Base on the existing level of activities along the loading/unloading bays, the utilization is considered to be high during peak periods as double parking for loading/unloading has been occasionally observed along the bays.

6.3.5 The public bus bays are currently serving four bus lines. Based on the on-site observation, the utilization ratio of the public bays is considered to be adequate with potential room for additional bus services. Improvement measures would be required in order for the PTI to cater for additional feeder services. **Table 6.2** summarized the facilities of the PTI.

Table 6.2 Summary of Loading/unloading Facilities of University Station PTI

	No.	Length	Purpose
Taxi Bays	1	35m	Urban Taxi Pick Up
	1	20m	New Territories Taxi Pick Up
	1	25m	Taxi Drop Off
GMB Bays	1	65m	Serving 807K and 807B (frequency 7-10min)
	1	55m	Serving 807A and 807P (frequency 7-8min)
Bus Bays	1	45m	Serving 289K (frequency 10-20min)
	1	35m	Serving 272K (frequency 6-20min)
	1	40m	Bypass bay for 87K and 87S (frequency 6-12min)
Pick-up / Drop-Off Bay	1	70m	Pick-up / drop-off of shuttle services and other vehicles

6.3.6 In addition to the University Station PTI, another consideration for a connecting bus terminus would be in the Ma On Shan town center. On one hand connection with nearby developments would be necessary for the residents daily need, on the other hand, connection to Ma On Shan Line would be preferred as East Rail Line in general has higher passenger demand.

6.3.7 Circular route for GMB or franchised bus should also be considered with only one terminus at the existing STSTW development site. Potential destinations would be Sha Tin town centre and Ma On Shan town centre which commute traffic would be in high demand.

6.3.8 Potential feeder public transportation route is presented in **Fig. No. /6.03**.

6.4 Pedestrian and Cyclist Network

Pedestrian Network

6.4.1 The Study Area is located along Shing Mun River with Tolo Highway on its west and the Hong Kong Jockey Club Sha Tin Racecourse at its south end. As the existing STSTW only generate/attract very limited pedestrian trips, and no pedestrian link is being provided towards the Racecourse, footpath is only provided along the cycle track towards the Water Sports Centre and the Ma Liu Shui Ferry Pier. **Fig. No. /6.04** shows existing pedestrian and cycle track network near the Study Area.

6.4.2 Although it is considered that major rail-based PT station are beyond acceptable walking distance from the Study Area, a user-friendly pedestrian link should still be provided in order to improve connectivity and accessibility of the Study Area. The proposed pedestrian link, either using existing pedestrian facilities or new linkage, should be convenient and barrier-free in order to facilitate all pedestrians including those with disabilities.

6.4.3 A pedestrian footbridge has been proposed, locating under the existing Tate's Cairn Highway (T6 Bridge) to facilitate pedestrian connection on both sides of the river. As community and cultural facilities have been proposed at the existing STSTW site, the proposed pedestrian link would enhance coverage of these facilities serving also nearby communities including Kam Tai Court and Chevalier Garden.

6.4.4 In addition to the connectivity between the Study Area and the nearby MTR stations, connectivity between the Study Area and the nearby developments should also be taken into account. In addition to the proposed pedestrian footbridge, the existing footpaths also provide pedestrian linkage towards the University Station, although walking distance deems to be substantial with over 1,000m.

6.4.5 The internal pedestrian network within the Study Area is designed by integrating pedestrian areas, various facilities on site, and pedestrian main spine routes to the transport modes to establish a pedestrian friendly environment. The proposed pedestrian network would greatly depend on the arrangement and types of the potential developments which would be in coherent with the whole planning environment.

Cyclist Network

6.4.6 The Tolo Harbour Cycle network is one of the most popular cycle tracks in Hong Kong with the highest usage, up to 300 bicycles per hour, within the Tai Po and Sha Tin areas. Currently, sections of the cycle track are running along the Shing Mun River passing by the Hong Kong Jockey Club Sha Tin Racecourse and the Study Area towards Tolo Highway and Tai Po. This current cycle track provides the cyclists with a very well connected cycling route. It would be the preferred planning option to maintain the connectivity and accessibility for cyclists with the future development at the Study Area.

6.4.7 The proposed pedestrian linkage would also potentially be equipped with cycle track and eventually connected back with the existing cyclist network. **Fig. No. /6.05** presents the existing cyclist network and future potential cyclist network in vicinity of the existing STSTW site. Planning and engineering feasibility of this pedestrian linkage would be conducted in future studies.

6.5 Highway Infrastructure and Internal Traffic Arrangements

6.5.1 A few potential constraints for the development of the Study Area have been identified, including the Marine Police Station and the Ma Liu Shui Weigh Station located in close proximity of the Study Area as well as the columns and abutments of the Tate's Cairn Highway, limiting the potential scope to extensively expand the local and access roads to the Study Area. Traffic from Tolo Highway is only accessible from Shui Chong Street and Kiu Ha Road by the three roundabouts with a direct slip road from Shui Chong Street onto Tolo Highway southbound. **Fig. No. /6.06** shows the locations of the critical junctions and site access to the STSTW.

6.5.2 Observed traffic flows for the identified key junctions are presented in **Fig. No. /6.07**. Junction capacity analysis has been performed based on the observed traffic flow in Year 2012 for the identified critical junctions and the major road links, results summarized in **Table 6.3** and **Table 6.4**. As shown, the roundabout at Chak Cheung Street and Tate's Cairn Highway is at capacity under the existing traffic flow. Although Tolo Highway is at capacity under the existing traffic, it is expected that the Tai Po Road widening improvement would increase capacity of Tolo Highway in design year 2034. The calculation of the capacity of junctions for Year 2012 are attached as **Appendix 6.01** of this report.

Table 6.3 Junction Performance Assessment for Year 2012

No.	Junctions	AM Peak	PM Peak
J1	Chak Cheung Street / Slip Roads of Tolo Highway	0.87	0.70
J2	Chak Cheung Street / Science Park Road	0.74	0.60
J3	Chak Cheung Street / Sui Cheung Street	0.60	0.63
J4	Sui Cheung Street / Kiu Ha Road	>100%	93%

Table 6.4 Major Road Link Capacity for Year 2012

Major Road Link	Link Capacity	AM Peak Hour		PM Peak Hour	
		Flow (pcu)	VC Ratio	Flow (pcu)	VC Ratio
Tolo Highway (NB)	3,600	3,430	0.95	3,895	1.08
Tolo Highway (SB)	3,600	4,040	1.12	3,760	1.04
Tate's Cairn Highway (bridge) (NB)	3,600	3,495	0.97	3,690	1.03
Tate's Cairn Highway (bridge) (SB)	3,600	4,315	1.20	2,930	0.81

6.5.3 Based on our proposed development schemes, additional vehicular trips are expected to be generated or attracted. It is expected that private housing would generate the highest vehicular trips, and as a conservative first-round preliminary analysis, it has been assumed that all residential are private housing only.

Table 6.5 Development Parameters Assumptions for Traffic Modelling

Parameters	Proposed Submission
Housing Type	Private Housing
Population	< 20,000
Non-Domestic GFA	70,000m^2

Table 6.6 Estimated Trip Generation and Attraction

Housing Type	AM Peak Hour		PM Peak Hour	
	Generation	Attraction	Generation	Attraction
Private Residential	945	495	415	575
Commercial Retail	175	185	235	270
Total	1,120	680	645	845

6.5.4 A "Development Scenario" has been developed, incorporating committed land uses in the vicinity. It has been assumed that development would be completed by Year 2031 the earliest and the preliminary traffic impact review would be based on Year 2034, which is 3 years after completion of the proposed development. The road network would also include the existing road network and all committed future road improvement schemes within the Subject Site and its close vicinity, which includes widening of the Sha Tin section of Tai Po Road. Future traffic flow has been modeled taking into account trips generated/attracted by the subject site development, presented in **Fig. No. /6.08**.

6.5.5 Junction performance assessment has been performed on the "Development Scenario", assuming no further mitigation measure would be applied, results summarized in **Table 6.7**. As some of the identified critical junctions were already at capacity during year 2012, with the addition of new trips generation by the proposed development, these existing junctions is expected to perform beyond capacity during design year 2034. The calculations of junction capacity are attached as **Appendix 6.02**.

Table 6.7 Junction Performance Assessment for Year 2034 with Proposed Development

No.	Junctions	AM Peak	PM Peak
J1	Chak Cheung Street / Slip Roads of Tolo Highway	1.52	1.45
J2	Chak Cheung Street / Science Park Road	1.00	0.95
J3	Chak Cheung Street / Sui Cheung Street	0.79	1.22
J4	Sui Cheung Street / Kiu Ha Road	-42%	-29%

Table 6.8 Major Road Link Capacity for Year 2034 with Proposed Development

Major Road Link	Link Capacity	AM Peak Hour		PM Peak Hour	
		Flow (pcu)	VC Ratio	Flow (pcu)	VC Ratio
Tolo Highway (NB)	5,400	4,960	0.92	5,705	1.06
Tolo Highway (SB)	5,400	5,865	1.09	5,410	1.00
Tate's Cairn Highway (bridge) (NB)	3,600	4,770	1.33	4,405	1.22
Tate's Cairn Highway (bridge) (SB)	3,600	4,820	1.34	3,655	1.02

6.5.6 Due to the low trip generation/attraction of the existing STSTW, the road network in vicinity is not originally designed to cater for a high trip-generation development. As only one access for the subject site is available at Kiu Ha Road, the subject site traffic would heavily rely on the Tolo Highway and the 3 roundabouts (J1, J2, and J3), especially for the attracted trips towards the site.

6.5.7 As shown, J1 and J2 are over capacity taking into account the proposed development traffic. A more reasonable residential housing mix would need to be assumed in order to provide a reasonable trip generation / attraction. Improvement measures would be required in order for the road network to cater for all traffic demand.

6.5.8 As shown, assuming acceptable VC ratio to be 1.2 for existing road link, Tolo Highway would be performing within acceptable level of service while Tate's Cairn Highway, the bridge section across the existing STSTW site would be performing beyond capacity.

6.5.9 In view of the limited roadway capacity of the existing road network at the Study Area, potential improvement measures may include:

- Upgrading the existing Shui Chong Street to increase its capacity;
- Improving the roundabouts located in vicinity to enhance the accessibility of the developments on the Study Area to and from Tolo highway and Tate's Cairn Highway;
- Potential introduction of additional vehicular access other than Shui Chong Street would effectively divert traffic from the current access roads;
- Review of the future development's need of public transport facilities such as on-street bus bay for bus and GMB services, Public Transport Interchange (PTI), loading/unloading facilities for coaches and taxi for recreational facilities, if any; and
- Review and improve the connectivity of the existing pedestrian footpath and cycle track to and from the development on the Study Area.

6.5.10 The arrangement of emergency vehicular access shall comply with the Code of Practice for Fire Safety in Building 2011 which is administered by Buildings Department.

6.6 Pedestrian and Road Connection to Hinterland

Pedestrian Connection

6.6.1 The internal road arrangement and their connections to the hinterland area shall be reviewed as appropriate to take into account the potential development framework formulated in this Study. Currently, as the existing STSTW would only generate a very minimal level of pedestrian traffic, no major direct pedestrian connections points connecting the Study Area to the externals are available.

6.6.2 A footbridge along Shui Chong Street is available in order to provide a safe pedestrian crossing over the Tolo Highway. However, the captioned footbridge does not provide direct access to the hinterland areas. As the MTR stations and other nearby developments are located beyond acceptable walking distances from the Study Area, only a minimal pedestrian traffic is expected from the Study Area to the external areas.

Road Connection

6.6.3 Tolo Highway serves as the major access connecting Study Area towards Sha Tin and Tate's Cairn Highway serves as the main route towards Kowloon. Currently, no direct road connections with the hinterland areas have been observed due to the isolated location of the Study Area.

6.6.4 Accessing to Tolo Highway from the Study Area is controlled by a signalised junction at Kiu Ha Road and Sui Chong Street. This junction is operating within capacity base on the current traffic generations; however, as the proposed development may significantly increases the future traffic volume, appropriate improvement works should be applied along with the potential development in order to ensure the level of service of the road network. Improvement schemes would be further discussed in the following section.

6.6.5 Accessing onto Tolo Highway from the Study Area would also be affected by the three roundabouts, J1, J2, and J3. As presented in **Table 6.4**, the existing road network would not be able to cater for the proposed traffic demand if all residential is assumed to be private housing. Potential residential housing type mix would need to be assumed in order to provide a reasonable trip generation/attraction of the subject site development.

6.6.6 From traffic point of view, we assume a mix of 30% of low vehicular trip generator (e.g. residential highly depend on public transportation), in order to reduce traffic impact of the subject site development to the existing road network. It has also been assumed that the commercial retail is mainly developed for the local residential which would require less vehicular trips.

6.6.7 Trip generation and attraction would decrease by approximately 25% with the proposed residential type mix. The road network in vicinity of the subject site would maintain level of service taking into account proposed improvement measures, which will be further explained in later section.

6.6.8 Taking into account the decrease in trip generation and attraction with the proposed residential type mix, the associated junction performance result and road link capacity assessment, without any improvement measures, is summarized in Table 6.9 and 6.10 respectively.

Table 6.9 Junction Performance Assessment for Year 2034 (proposed residential type mix)

No.	Junctions	AM Peak	PM Peak
J1	Chak Cheung Street / Slip Roads of Tolo Highway	1.31	1.16
J2	Chak Cheung Street / Science Park Road	0.91	0.88
J3	Chak Cheung Street / Sui Cheung Street	0.73	0.94
J4	Sui Cheung Street / Kiu Ha Road	-25%	-8%

Table 6.10 Major Road Link Capacity for Year 2034 (proposed residential type mix)

Major Road Link	Link Capacity	AM Peak Hour		PM Peak Hour	
		Flow (pcu)	VC Ratio	Flow (pcu)	VC Ratio
Tolo Highway (NB)	5,400	4,895	0.91	5,565	1.03
Tolo Highway (SB)	5,400	5,655	1.05	5,320	0.99
Tate's Cairn Highway (bridge) (NB)	3,600	4,740	1.32	4,355	1.21
Tate's Cairn Highway (bridge) (SB)	3,600	4,765	1.32	3,620	1.01

6.6.9 As shown, J1 and J4 are performing better in comparing to the original residential mix, though still at capacity. Therefore, further mitigation measures would be required, which will be further developed in later section 6.8.

6.6.10 An "Enhanced Development Scenario" has also been developed as described in previous sections. A 13-storey hotel would be included in the plan. Refer to section 5, the hotel could provide about 270 to 350 hotel rooms. The estimated flow is provided as following **Table 6.11**:

Table 6.11 Estimated Trip Generations and Attractions of the Hotel

No. of Rooms	AM Peak		PM Peak	
	Generation	Attraction	Generation	Attraction
270	36	39	35	42
350	47	51	45	54

6.6.11 As 5% trip generation/attraction has already been built into the "Development Scenario", it is anticipated our assessment scenario would be sufficient to cover the "Enhanced Development Scenario" as well.

6.7 Special Traffic Generator

6.7.1 The Hong Kong Jockey Club Sha Tin Racecourse is identified as a special traffic generator in vicinity of the Study Area. Visitors of the Sha Tin Racecourse will be served by road-based transport including taxi, private car and public bus as well as rail-based PT, the East Rail line. Majority of the racing event would occur on Saturdays and Sundays with some occasionally on Wednesdays evening.

6.7.2 Although a significant increase of traffic in vicinity of the Sha Tin Racecourse is expected due to the horse racing event, most of these event do not occur concurrently with the regular AM and PM traffic peak period which minimize the cumulative traffic impacts. Moreover, the Sha Tin Racecourse has a designated access to/from Tolo Highway which would minimize usage of any connecting roads at the Study Area, reducing its traffic impact of the future developments.

6.8 Traffic Improvement and Mitigation Measures

6.8.1 Traffic survey has been conducted for developing the local traffic model in order to replicate traffic condition in vicinity of existing site and to determine the demand and requirement of the transport infrastructure. The transport demand model has incorporated the latest planning data and assumptions including the demographic and land use data, socio-economic characteristics, highway infrastructure, and railway network assumptions.

6.8.2 A concept layout plan of the proposed traffic improvement measures are presented in **Fig. No. /6.09** and **Fig. No. /6.10**.

6.8.3 Based on our assumed residential housing type mix, for the purpose of TIA (ie a mix of 30% low vehicular trip generation – residential highly depends on public transportation) improvements would still need to be provided on the critical junctions in order to ensure level of services of the road network in vicinity. It has been observed J1 and J2 are both performing at capacity. Increasing the inscribed circle diameter of these roundabouts to 85m would greatly improve the capacity of the roundabouts. It has also been observed that majority of the traffic at the roundabout would be from NB Tolo Highway (65% during AM Peak), an additional lane would be provided along the Tolo Highway slip road.

6.8.4 J3 would be eliminated and be replaced by free-flow road links which intention is to reduce delay and enhance carrying capacity of the road network.

6.8.5 The existing signalised junction at Kiu Ha Road would become the major access of the development site which requires a much higher carrying capacity. As shown in the conceptual plan, additional right turn lane would be provided to facilitate development traffic to be discharged onto Tolo Highway. Another potential improvement measure would be to provide a secondary access from Ma On Shan Road which would relieve some traffic pressure at the Kiu Ha Road access.

6.8.6 Junction performance of the proposed roundabout is presented in **Table 6.12**. Under new develop transport facilities, the general goal is to meet a DFC less than 0.85 or a RC more than 15%, which has been achieved by the proposed plan.

Table 6.12 Junction Performance Assessment with Improvement Measures

No.	Junctions	AM Peak	PM Peak
	Chak Cheung Street Roundabout	0.80	0.80
J4	Sui Cheung Street / Kiu Ha Road	15%	25%

6.8.7 Tate's Cairn Highway (Bridge Section) is over capacity in both existing Year 2012 and future design Year 2034. Although only 15% - 20% of the development generated traffic would depend on Tate's Cairn Highway, provision of an additional road link between Tolo Highway and Tate's Cairn Highway toward Tate's Cairn Tunnel is recommended in order to relieve traffic pressure for all users.

6.9 Summary of Findings

6.9.1 The existing STSTW site is located in vicinity of major trunk roads which would be easily connected to other major parts of Hong Kong.

6.9.2 The existing STSTW site only generates and attracts very few vehicular trips currently due to the nature of sewage water treatment facility. However, the proposed development on this site contains high proportion of residential as well as other land use which would generate/attract a much higher amount of traffic.

6.9.3 Due to the limited accessibility of the existing STSTW site, in order to accommodate dramatic increase in traffic in the future, road improvement works would be essential. Potential improvements include junction improvements and provision of additional access for the site as discussed above are needed.

7 Drainage Impact Assessment

7.1 Existing surface characteristic and ground level

7.1.1 The existing STSTW is located at downstream of Shing Mun River and it occupies approximately 28.4ha of land. To the West of the Study Area is Tolo Highway and Shui Chong Street, which is generally at a level of 6.0mPD. To the south is Jockey Club Sha Tin Racecourse, which is at a level of 7.0mPD.

7.1.2 The majority of the Study Area is paved area with minimum ground level of approx. 5mPD. It is located in the low-lying area comparing with the surrounding ground level.

7.1.3 With reference to the latest drainage records collected and the as-built drawing of the existing STSTW, the storm water drainage system includes:

- 2cells 2600(w) x 2600(h) box culvert located at Shui Chong Street.
- 370mm - 750mm storm water drains located at Kiu Ha Road.
- 450mm storm water drains located near the administration building of the Study Area
- 4nos. of outfall along Shing Mun River Seawall

7.1.4 The existing drainage system near the STSTW is shown in **Fig. No. /7.01**. Drainage reserve, which is non-building area, is provided for the section of box culvert located within the Study Area boundary. As per the requirement of Stormwater Drainage Manual, the future development should provide a free and unrestricted access for Drainage Services Department to construct, repair and maintain the facilities inside the drainage reserve.

7.1.5 With reference to previous Drainage Master Plan (DMP), the existing STSTW is one of the catchment areas of the Shing Mun River. There are five existing outfalls located at the eastern seawall of the existing STSTW site and collect surface runoff catchment within the existing site as indicated in **Fig. No. /7.01**. The outfalls finally discharge the runoff into Shing Mun River.

7.1.6 Shing Mun River has a catchment area of approx. 3700 ha, as **Appendix 7.01** refers. The river has a 1 in 200yr flood protection level under previous DMP study.

7.2 Overview of Methodology

7.2.1 This broad drainage impact assessment (DIA) is prepared in accordance with the requirements of ETWB TC(W) 2/2006 – Drainage Impact Assessment Process for Public Sector Projects.

7.2.2 Excel spreadsheets are adopted as the calculation tool to assess the detention effect of the detention systems.

7.3 Hydrological Calculation

7.3.1 Peak instantaneous runoff has been calculated using the Rational Method in accordance with Section 7.5.2 of Stormwater Drainage Manual (SDM), and assuming uniform intensity rainfall.

$$Q = 0.278\,C\,i\,A$$

where Q – the runoff (m^3/s)
i – the rainfall intensity (mm/hr)
A – the catchment area (km^2)
C – the runoff coefficient

7.3.2 Rational Method with fixed runoff coefficients is adopted to simulate the rainfall runoff of the site. The adopted runoff coefficients are made reference with tabulated below:-

Table 7.1 Adopted Runoff Coefficients

	Paved	Unpaved
Runoff Coefficient	1.0	0.3

7.3.3 4-hr synthetic rainfall profile in accordance with Table 5 of Stormwater Drainage Manual is adopted as design rainfall profile for detention calculation.

7.4 Time of Concentration

7.4.1 The time of concentration (tc) used for determining the duration of the design storm for urbanised catchment areas has been determined by the time of entry (te) (assumed to be 2 mins) and the time of flow (tf), in which the time of flow (tf) has been decided from the length of the drainage channel assuming a design velocity between 1.0m/s depending on channel diameter and drainage gradient.10min tc is assumed under this broad DIA.

$$t_c = t_e + t_f$$

7.5 Overview of Potential Drainage Impacts

7.5.1 As described in **Section 4.4**, the proposed development site will occupy 28.4heature of area with approx. 30% green ratio. By this assumption, the paved area and un-paved area would be approx. 199,000m^2 and 85,000m^2 respectively.

7.5.2 The potential drainage impacts incurred by the proposed development will be the increase in runoff and peak discharge due to change in land use. Site visit has been conducted in November 2012 to identify coverage of green area of the existing site and **Fig. No. /11.02** present the extent of green area. The approx. of paved and unpaved area are 184,000m^2 and 100,000m^2 respectively.

7.5.3 The potential impacts are assessed in paragraphs below. Mitigation measures are proposed.

7.6 Drainage Arrangement

7.6.1 The surface runoff generated from the proposed development is to be collected by stormwater drain within the development and discharged to Shing Mun River and box culvert at the northern boundary of the development respectively.

7.6.2 There are three existing DN900 stormwater pipes, one DN600 stormwater pipe and one DN300 located along Shing Mun River currently serving the existing site. Northern part of the surface runoff is collected and discharged to the box culvert at the northern boundary of the development.

7.6.3 The changes in land use and peak discharge are summarized in **Table 7.2** below.

Table 7.2 Changes in Land Use and Peak Discharge of the existing STSTW site

Scenario	Area (ha)		1 in 50yr Peak Discharge (m^3/s)
	Unpaved	Paved	
Before Development	10.0	18.4	13
After Development	8.5	19.9	14
Change	-1.5	+1.5	+ 1 (7.69%)

7.6.4 The Shing Mun River has a 1in200yr flood protection level under previous DMP study, as **Appendix 7.01** refer. In these regards, the impact to Shing Mun River incurred by the increased peak discharge ($1m^3/s$) is insignificant and negligible.

7.6.5 The ground level of the proposed development would be formed at the same level of the existing site (approx. 5.5mPD) in order to avoid altering the overland flow path and increasing the flood risk of the surrounding area.

7.6.6 It is recommended to adopt the current drainage arrangement for the proposed development. i.e. the surface runoff generated from the northern part of the site discharge to box culvert while the southern part discharge to the existing outfall along Shing Mun River. Referring to the **Fig. No. /7.01**. Survey should be conducted in the later stage to identify the internal drainage arrangement of the existing site and asses the spare capacity of box culvert and existing outfall.

7.6.7 Based on the available information, a new DN900 outfall is proposed at the location near the mouth of Shing Mun River to collect and discharge the additional surface runoff generated from the development to eliminate the potential drainage impact to the existing drainage system. There will be no drainage impact to Shing Mun River which is the downstream channel of Tai Shui Hang River.

7.7 Temporary Drainage Arrangements during Construction

7.7.1 There are no major difficulties in temporary drainage arrangement during construction. In light of the above, the temporary drainage arrangement will not be addressed in this report, but by the contractor in construction phase.

7.7.2 The temporary drainage arrangements during the construction of the proposed development will be the responsibility of the contractor. The following conditions will be incorporated into the relevant construction contracts to ensure the drainage characteristics in the area will not be worsened during the construction stages:

(i) Any temporary diversions of streams or rivers during construction shall have to be sized to provide the equivalent hydraulic capacity as the existing drainage systems;

(ii) If any existing drains are adversely affected, the project proponent should submit a construction stage DIA according to the requirements stipulated in DSD Technical Circular No.14/2000;

(iii) Runoff from the construction site shall pass through settling ponds or tanks before discharging into existing drainage systems. This will minimize silting of the existing drainage system during construction of the development.

7.8 "Enhanced Development Scenario"

7.8.1 The "Enhanced Development Scenario"is the same as the "Development Scenario", except a hotel of 13-storey is proposed at the site of the existing salt water pumping station. As the land use and ground level at the site of existing water pumping station is kept unchanged, it is anticipated the hotel would not alter the drainage condition of the area. Hence, no impact would be induced on the existing drainage system.

7.9 Summary of Findings

7.9.1 The objective of this broad DIA is to assess the drainage feasibility of the proposed development.

7.9.2 The potential drainage impacts incurred by relocation of STSTW include:

(i) Increase in runoff and peak discharge due to increase in paved area.

7.9.3 It is recommended to upgrade the existing drainage outfall of the existing STSTW site for conveying and discharging the surface runoff of the development.

7.9.4 The temporary drainage arrangements during construction will be the responsibility of the contractor. A construction stage DIA should be prepared and submitted to DSD for approval if required.

7.9.5 It is concluded that the proposed development can be completed without aggravating flooding condition within, upstream or downstream of the site.

8 Sewerage Impact Assessment

8.1 General

8.1.1 A total of 33 nos. of residential towers, 2 nos. of school, 2 nos. of commercial building and 2 nos. G/IC buidling making up a total number of 6816 residential units is (round up to 6900 unit in the following section) proposed to be constructed within the site. The preliminary layout plan refers to **Fig. No. /8.01**. The earliest completion date of the proposed development is 2031.

8.1.2 The purpose of this Broad Sewerage Impact Assessment is to assess the impact of the sewage flow due to the proposed development and recommend the appropriate mitigation measure wherever necessary.

8.2 Existing Sewerage and Disposal Facilities

8.2.1 The existing STSTW, commissioned since 1982, is the largest secondary sewage treatment works in Hong Kong. Since the substantial completion of the Stage III Extension works in Year 2010, the treatment capacity of STSTW has been increased from 150,000m^3/day in average to 340,000m^3/day in average (1,020,000 m3/day at maximum) for a projected residential population of 834,000. Sewage from Sha Tin and Ma On Shan districts is currently conveyed to the inlet of the existing STSTW via the following six upstream sewage pumping stations (SPSs):

(a) Ma On Shan Sewage Pumping Station;
(b) A Kung Kok Sewage Pumping Station;
(c) Shui Chong Street Sewage Pumping Station;
(d) Chinese University Sewage Pumping Station;
(e) Pak Shek Kok No. 3 Sewage Pumping Station; and
(f) Sha Tin Main Sewage Pumping Station.

8.2.2 The treated effluent from the existing STSTW is combined with that from Tai Po Sewage Treatment Works (TPSTW) at Sha Tin Effluent Pumping Station (STEPS), which has an existing capacity of about 5.2m3/s, and is pumped to the portal of the Tolo Harbour Effluent Export Scheme (THEES) tunnel at A Kung Kok for conveying the effluent to Kai Tak River and then discharging to Victoria Harbour. There is an emergency bypass outfall to Tolo Harbour from STEPS for the event that there is an overflow at STEPS due to suspension of STEPS or THEES for maintenance or other reasons.

8.3 Future Sewerage Strategy

8.3.1 Options for the proposed works on the upstream sewerage to enable relocation of STSTW to caverns have been discussed under the “Preliminary Sewerage Impact Assessment Report”. An option with the following proposed works would be adopted under this Study:

- Upgrade existing Ma On Shan SPS and divert existing rising mains directly to the relocated STSTW at south bank of Shing Mun River
- Reconstruct A Kung Kok SPS and construct new rising mains directly to the relocated STSTW at south bank of Shing Mun River
- Reconstruct Sha Tin Main SPS and construct new rising mains directly to the relocated STSTW at south bank of Shing Mun River

8.3.2 Divert sewage from Pak Shek Kok No. 3 SPS , Chinese University SPS and Shui Chong Street SPS to a new SPS, to be constructed at the DSD staff quarter of existing STSTW site, and construct rising mains connected to the relocated STSTW

8.3.3 A new pumping station is proposed to be constructed at the DSD staff quarter of existing STSTW site, which will be a composite structures consisted of two pumping stations,

including (a) a new SPS to convey sewage from existing Pak Shek Kok No. 3 SPS, Chinese University SPS and Shui Chong Street SPS and sewage flow to be generated from the developments on vacated existing STSTW site and (b) a new effluent pumping station (EPS) to convey effluent pumped from TPSTW. Under this Study, the existing STEPS was proposed to be demolished after the relocation of STSTW and thus a new EPS is required for the continuous conveyance of the effluent from TPSTW to the THEES tunnel portal.

8.4 Proposed Sewerage System

8.4.1 The major parameters of sewage flow estimates for proposed development are provided in **Table 8.1** as follows:

Table 8.1 Sewage Flow Generated from School and Residential Unit

Items	Quantity
Residential	
Residential Type	R1
Site Area (m^2)	28,400
Total No. of residential units	6,900#
Population per residential unit	2.9
Total Residential Population	20,000#
Unit Flow Factor (R1) (m^3/d/person)*	0.190
Average Dry Weather Flow from Residential , ADWF (m^3/d)	**3,800**
School	
No. of School	2
Total Number of Student	2,000#
Unit Flow Factor (School) (m^3/d/person)*	0.04
Average Dry Weather Flow from School, ADWF (m^3/d)	**80**

* Based on Table T-1 of EPD's GESF.
# The value has been roundup

8.4.2 The proposed use of commercial and G/IC facilities are not available in the current stage, it is assumed that the sewage flow generated by commercial and G/IC facilities are the sum of fresh water and salt water consumption estimated under **Section 9**.

8.4.3 It is considered that the flow estimation by this approach in conservative side as part of the used water would not run into foul sewer system such as general cleansing of the building block. It is sufficient for achieving the purpose of broad sewage impact assessment. The estimated sewage flow is provided under **Table 8.2**:

Table 8.2 Sewage Flow Generated from Commercial and G/IC Facilities

Items	Quantity
Total Fresh Water Demand of Commercial and G/IC(m^3/d)	2,100
Total Salt Water Demand of Commercial and G/IC(m^3/d)	735
Estimated Sewage Flow Generated from Commercial and G/IC(m^3/d)	**2,835**

8.4.4 The total sewage flow contributed by ADWF generated by the development is 6,715m^3/day by summing up the above-mentioned sewage flow generated.

8.5 Impact on sewerage and sewage treatment facilities

8.5.1 The flow projection for the proposed developments at existing STSTW site previously discussed under "Working Paper on Design Flow and Load For Relocated STSTW" was based on the planning information from PFS, which was estimated to be 6,730m^3/day (ultimate scenario). It was only 0.2% deviated from the estimation in **Section 8.4** by using the latest preliminary development layout which is negligible.

8.5.2 In addition, it should be mentioned that with an additional 10% contingency allowance to cater for the update of sewerage projects and inherent uncertainties in flow projection for relocated STSTW, the projected ADWF of 340,000m^3/day, which has taken into account of the projected flow from the developments at existing STSTW site, for the design of relocated STSTW in this Study, is considered still valid. No impact would be envisaged to the relocated STSTW due to the proposed developments.

8.5.3 As mentioned in **Section 8.3.2**, a sewage and effluent pumping station is proposed to be constructed at the DSD staff quarter of existing STSTW site. The SEPS, to cater for the projected flow from Pak Shek Kok SPS, Chinese University SPS, Shui Chong Street SPS and developments of existing STSTW site, will be designed for ADWF and peak flow of 22,400m^3/day and 0.8m^3/s respectively. It is preliminarily considered that a site area of about 4,000m^2 (including loading/unloading area and green area), would be required and reserved for the construction of this composite pumping station as shown in **Fig. No. /8.01**. It is considered that the new sewers serving the developments of the existing STSTW site will be directly connected to this new SPS, of which the sewage will be directly conveyed to the relocated STSTW. Therefore, no impact would be envisaged to the existing and planned sewerage network due to the proposed developments.

8.5.4 It is recommended to construct the sewage and effluent pumping station at underground as far as possible. For the electrical and mechanical (E&M) equipments which could not be placed underground, such as transformer, it is recommended to accommodate them in the proposed G/IC facilities on top of the composite pumping station.

8.6 "Enhanced Development Scenario"

8.6.1 The "Enhanced Development Scenario" is the same as the "Development Scenario", except a hotel of 13-storey is proposed at the site of the existing salt water pumping station. The sewage flow is assumed to be sum of fresh and salt water demand estimated under **Section 9**. i.e. 440 + 154 = 594 m^3/day. The total sewage flow under "Enhanced Development Scenario" would be 7,309 m^3/day. As discussed under section 8.5.2, 10% allowance which is equivalent to approx. 30,000 m3/d is provided to cater for the update of

sewerage projects and inherent uncertainties in flow project uncertainties in flow projection, it is anticipated that no impact would be envisaged to the relocated STSTW due to the proposed development under “Enhanced Development Scenario”.

8.7 Summary of Findings

8.7.1 The objective of the broad SIA is to review the projected flow and identify the potential impact on the relocated STSTW.

8.7.2 Based on the current preliminary layout, the estimated sewage flow generated from the proposed development is close to the flow projection estimated under Working Paper on Design Flow and Load for Relocated STSTW. As such, it is concluded that the proposed development would not induce any impact on the design of the relocated STSTW.

9 Waterworks Impact Assessment

9.1 Assessment Methodology

9.1.1 The proposed demand rates and peaking factors are based on the values defined in the WSD's Departmental Instruction No. 1309 (DI No. 1309), where relevant rates are not available, assumptions based on past records for similar user types have been adopted.

9.1.2 The watermains record plans information included in this Report is an extract of the available information provided by WSD, topographic survey and the locations of the watermains as shown on drawings are indicative only. The data was provided as soft copies of record drawings, and has been shown as received.

9.2 Estimated Number of Users

9.2.1 The estimated number of personnel of the future development in existing STSTW is tabulated in **Table 9.1** below.

Table 9.1 Summary of Estimated Population in the Future Development

Future Development	Number of Person
Residential	Approx. 20000
Secondary School	Approx. 1000
Primary School	Approx. 1000

9.3 Unit Rate for Commercial and G/IC Area

9.3.1 Estimation of water demands of the development are based on DI. No. 1309. Water consumption in the commercial sector is not addressed in DI No. 1309. However, WSD has analyzed actual metered water consumption figures in typical office buildings in Tsim Sha Tsui East and Causeway Bay and has subsequently adopted a fresh water demand of 2,000m^3/ha/day and a flushing water demand of 700m^3/ha/day for water planning for the West Kowloon Reclamation (WSD Planning Report No. 20/95 refers). It is considered that the above limit demands as appropriate to this Study. These figures have to be converted to gross floor area (GFA) before they can be applied to this Study. Assuming that the average plot ratio for this type of development is 10, the converted values for fresh water demand and flushing water demand are 20 L/m^2 GFA/day and 7 L/m^2 GFA/day respectively.

9.3.2 The unit demands for G/IC are not addressed in DI No. 1309. These are low density developments for which a plot ratio of 1 has been assumed. Applying this to the unit demand for commercial category having an assumed plot ratio of 10, the unit fresh water demand and flushing water demand are taken to be 200m^3/ha net area/day and 70m^3/hectare net area/day respectively. The adopted unit rates of commercial and G/IC sectors are summarized in **Table 9.2**.

Table 9.2 Summary of Unit Rates

User	Unit Rate (m^3/ha/d)	Reference
Fresh Water		
Commercial sector	200*	WSD Planning Report No.20/95
G/IC sector	200	WSD Planning Report No.20/95

User	Unit Rate (m^3/ha/d)	Reference
Salt Water		
Commercial sector	70*	WSD Planning Report No.20/95
G/IC sector	70	WSD Planning Report No.20/95

*Note: The area used in unit rate is Gross Floor Area (GFA).

9.4 Peaking Factors

9.4.1 In line with the guidelines in WSD's DI.No. 1309, the following peak demand factors will be adopted:

- Peak flow rate in fresh water distribution mains = 3 × mean daily demand
- Peak flow rate in flushing water distribution mains = 2 × mean daily demand
- Peak flow rate in fresh water trunk mains = 1.5 × mean daily demand
- Peak flow rate in flushing water trunk mains = 1.2 × mean daily demand

9.5 Fire-Fighting

9.5.1 Based on "COP on Minimum Fire Service Installations and equipment", the following fresh water supply should be allowed for fire-fighting purpose.

9.5.2 Fire-fighting water of 6,000m^3/day with discharge pressure of 17m head. The fire hydrant should be of an accepted standard pattern and the minimum output and pressure should be made available from two 65mm-dia. outlets of a system delivering at the same time (i.e., total output of not less than 4,000L/min which lasts for 60 minutes). **Table 9.3** summarizes the fire-fighting requirement.

Table 9.3 Fire-fighting Requirement

Items	Requirements
Minimum fresh water supply	6,000m^3/day
Discharge pressure	17m
Minimum output (from 2 nos. of 65mm-dia. outlets)	4,000L/min (5,760m^3/day) which lasts for an hours (i.e., 4,000×60 = 240,000L/ hour/day or 240m^3/ hour/day)

9.6 Residual Heads

9.6.1 The fresh water and flushing water supply systems for the development will be designed to provide minimum residual heads at the extremity of the system as follows:

- Fresh water: 30m
- Flushing water: 15m

9.7 Estimation of Water Demand for Users at the Future Development

9.7.1 To estimate water demand for each facility, the following equations are used for estimation:

$$Water\ Demand\ for\ Domestic\ Use = Number\ of\ Occupants \times Unit\ Demand$$

$$Water\ Demand\ for\ Commerical\ Use = Gross\ Floor\ Area \times Unit\ Demand$$

$$Water\ Demand\ for\ G/IC\ Use = Site\ Area \times Unit\ Demand$$

9.7.2 To estimate the water demand for irrigation of the development, the following equation is used:

$$Water\ Demand\ for\ Irrigation = Site\ Area \times Unit\ Demand$$

9.7.3 According to ArchSD's TIP No. 10/05 the recommended daily water consumption for irrigation design is 7L/m^2/day.

9.7.4 The total water demands are summarized in the **Table 9.4.** below:

Table 9.4 Summary of Estimated Water Demands

Development	Quantity	Unit Demand Rate (m^3/d/unit)		Demand (m^3/day)	
		Fresh Water	Flushing Water	Fresh Water	Flushing Water
Normal Demand					
Residential	20,000 ppl	0.23	0.07	4,600	1,400
Service Trade for Residential	20,000 ppl	0.045	-	900	-
Primary and Secondary Schools	2,000 ppl	0.025	0.025	50	50
G/IC	1.5 ha	200	70	300	105
Commercial	7 ha (GFA)	200	70	1,400	490
Club House	2 ha (GFA)	200	70	400	140
Irrigation	87,000 m^2	0.007	-	609	-
Sub-Total	-	-	-	8,259	2,185
Emergency Demand					
Fire Fighting	-	-	-	6,000	-
Total	-	-	-	**14,259**	**2,185**

9.7.5 The numbers of users/site area in residential, schools, G/IC, commercial and irrigation are estimated based on available information.

9.8 Fresh Water Supply System

9.8.1 A combined system of fresh water supply and fire-fighting water supply is recommended so as to achieve an economic design. Based on total fresh water demand of 14,259 m^3/day, a new DN450 Fresh water main is proposed. The connection point of the fresh water main is indicated in **Fig. No. /9.01**.

9.9 Proposed Fire-Fighting System

9.9.1 The provision of fire hydrants and fire mains should be in accordance with the relevant stipulations in HyD's "Technical Circular No. 4/2010: Fire Mains and Hydrants on new Trunk Roads and Elevated Highway Structures". The average spacing of fire hydrants to at-grade trunk road should be at a distance of 100m with alternate fresh water and flushing water hydrants where both systems exist, and these should further be agreed in consultation with Fire Services Department (FSD).

9.9.2 A combined system for the portable and fire-fighting water system is proposed as the combined system could reduce the construction cost and facilitate the relevant operation and management works in comparison with the separate water supply systems.

9.9.3 Main system is proposed for fire-fighting services in all the development facilities. Final recommendation is subject to FSD decision.

9.9.4 As mentioned in the above sections, in accordance with the fire-fighting requirements, the water supply with discharge pressure of 1.7bar (17m head) and flow of 4,000L/min which lasts for an hour will be provided.

9.10 Flushing Water Supply System

9.10.1 The total water demand for salt water is 2,185m^3/day. DN150 salt water main is proposed for the development. The proposed connection point is indicated in **Fig. No. /9.01**.

9.11 "Enhanced Development Scenario"

9.11.1 Under "Enhanced Development Scenario" a hotel of 13-storey is proposed at the site of the existing salt water pumping station. As mentioned in the **Section 5**, the GFA of the hotel is approx. 22,000 sqm. Its required water demand is estimated as **Table 9.5**.

Table 9.5 Summary of Estimated Water Demands

Development	Quantity	Unit Demand Rate (m^3/d/unit)		Demand (m^3/day)	
		Fresh Water	Flushing Water	Fresh Water	Flushing Water
Normal Demand					
Commercial	2.2 ha (GFA)	200	70	440	154
Total Water Demand	-	-	-	14,259 + 440 = 14,699	2,185 + 154 =2,339

9.11.2 The size of the proposed fresh water main and salt water main under "Enhanced Development Scenario" are DN450 and DN150, which are same as the proposed size under "Development Scenario".

10 ENVIRONMENTAL IMPACT ASSESSMENT

10.1 Introduction

10.1.1 This section aims to provide a broad environmental impact assessment in respect to the development of the vacant site after the relocation of the existing STSTW, and to present the findings for addressing these potential environmental impacts. Possible measures to mitigate the identified environmental impacts would also be suggested in this section based on the best available information at this early study stage. The suggested mitigation measures will be further refined with reference to the findings of the environmental impact assessment to be carried out at a later planning and engineering study stage and any updated design/project information.

Relevant environmental aspects to be covered under this Report include:

- Air quality
- Noise
- Water Quality
- Waste Management
- Land Contamination
- Ecology and Fisheries
- Cultural Heritage
- Landscape and Visual Impact

10.2 Air Quality

10.2.1 The Study Area is located in the Sha Tin District. The historical air quality monitoring data from the nearest EPD monitoring station, Sha Tin Air Quality Monitoring Station, is taken as the air quality baseline for the assessment. The latest five years (Year 2007-2011) annual average concentrations of the pollutants (NO_2, SO_2, RSP and TSP) recorded at Sha Tin EPD air quality monitoring station are summarized in **Table 10.1.**

Table 10.1 The Latest Five Years (Year 2007-2011) Annual Average Concentrations of Pollutants at Sha Tin Air Quality Monitoring Station

Air Quality Monitoring Stations	Annual Average Concentrations in the Latest Five Years (Year 2007-2011) (Unit: µg/m^3)			
	NO_2	SO_2	RSP	TSP
Sha Tin	43	15	48	66

Identification of Air Sensitive Receivers

10.2.2 The representative existing Air Sensitive Receivers (ASRs) in the vicinity of the development site at existing STSTW within 500m study area are identified for construction and operational phase assessments. The identified ASRs are the nearest ASRs to the works boundary. The details of the ASRs are summarized in **Table 10.2** and its locations are indicated in **Fig. No. /10.01**.

Table 10.2 Details of Representative Air Sensitive Receivers during Construction Phase and Operation Phase

ASR ID	Descriptions	Land Use
A1	Kam Tai Court	Residential
A2	S.K.H. Ma On Shan Holy Spirit Primary School	Educational

A3	Seaview Villa	Residential
A4	Kam On Garden	Residential
A5	Shatin Lookout	Residential
A6	Evergreen Villa	Residential
A7	Racecourse Gardens	Residential
A8	Marine North Division Headquarters	Government Office
A9	Hyatt Regency Hong Kong Sha Tin	Hotel
A10	Ah Kung Kok Fishermen's Village	Residential
A11	Ah Kung Kok Government Quarters	Government Office
A12	Sha Tin Hospital	Hospital
A13	Hong Kong Mountaineering Union	Societal
A14	Ma On Shan Park / Promenade	Park

10.2.3 For operational phase impact assessment, the proposed commercial, educational institution, G/IC, hotel and residential developments at the existing STSTW site are identified as ASRs for assessment, its locations are indicated in **Fig. No. /10.01**.

Identification and Evaluation of Potential Air Quality Impacts

Construction Phase

10.2.4 Dust emissions would be generated from the construction activities including demolition works, excavation works, site formation, material handling and stockpiling. In consideration of the long separation distances between the development site at the existing STSTW and the ASRs in the vicinity, adverse construction dust impact would not expected with the implementation of dust suppression measures specified in the *Air Pollution Control (Construction Dust) Regulation* and good site practices. In addition, the construction programme of this development site would not overlap with that of relocation of the STSTW. Based on the information available to us, there are no other concurrent projects to be constructed in the vicinity of the proposed development site at this stage. Therefore, cumulative construction dust impacts would not be expected. Environmental monitoring and audit programme is recommended to be implemented during construction phase to verify the effectiveness of the dust control measures.

10.2.5 Once the STSTW is terminated in operation, the inlet works, sedimentation tanks and sludge treatment facilities in the STSTW which are the potential odour sources would be cleaned by DSD. The odour nuisance from the retired STSTW is considered to be insignificant during construction phase. Hence, no odour impact is expected during construction phase.

Operation Phase

10.2.6 Vehicle emissions from the existing and proposed road networks within 500m from the site boundary and odour nuisance from the stable of Shatin Horse Racing Course are key air quality issues during the operational phase.

10.2.7 Setback of the development is generally considered as an appropriate measure for minimizing the potential air quality impact from traffic emission from major trunk roads. . A buffer distance of 40 meters is provided for the development to Tolo Highway and the Tate's Cairn Highway. A buffer distance of at least 5 meters is also provided for the proposed residential development to the local roads within the site. It is anticipated that no adverse traffic emission impact is expected.

10.2.8 In accordance with the findings of the approved Environmental Impact Assessment Report (EIA Report) of Main Arena of the 2008 Olympic Equestrian Event, the odour patrol results indicated that the odour nuisance from Sha Tin Racecourse was become insignificant at around 100m from the boundary of the horse stable areas. Making reference to this EIA finding, a setback distance of 100m from the horse stable has been considered in the

design of the development layout, insignificant odour impact is therefore expected at the proposed development.

Conclusion

Construction Phase

10.2.9 With the implementation of mitigation measures specified in the Air Pollution Control (Construction Dust) Regulation and good site practices checked by regular site environmental monitoring and audits, no insurmountable dust impact on the ASRs in the vicinity of the construction site would be anticipated. At the detailed design stage, when detailed information is available, quantitative assessment will be conducted when necessary to confirm the findings during the construction phase.

Operation Phase

10.2.10 No insurmountable impact from traffic emission and odour from Sha Tin Racecourse would be expected on the proposed development site with appropriate setback distances from the main truck roads and horse stable areas. At the detailed design stage, when more information is available, quantitative assessment will be conducted when necessary to confirm the findings during the operation phase.

10.3 Noise

Introduction

10.3.1 This section presents the noise impact assessment for the construction and operation phases of the proposed development. The site would likely be affected by road traffic noise, railway noise, fixed plant noise from nearby sewage pumping station, marine traffic noise and helicopter noise from Marine Police Headquarters. During the construction phase of the proposed development, the use of powered mechanical equipment (PME) for construction activities may affect the nearby existing noise sensitive receivers (NSRs). The potential noise impacts associated with the construction and operation phase of the proposed development have been assessed and appropriate mitigation measures are recommended to alleviate potential noise impacts.

Environmental Legislation and Guidelines

10.3.2 The Noise Control Ordinance, Cap. 400 (NCO) and Environmental Impact Assessment Ordinance, Cap. 499 (EIAO) provide the statutory framework for noise control. Assessment procedures and standards are set out in the following Technical Memoranda (TMs):

- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM);
- Technical Memorandum on Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM);
- Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM);
- Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM); and
- Technical Memorandum on Noise from Percussive Piling (PP-TM).

Construction Phase

10.3.3 The NCO provides the statutory framework for noise control of construction work, other than percussive piling, using powered mechanical equipment (PME) between the hours of 1900 and 0700 hours or at any time on Sundays and general holiday (that is, restricted hours). Noise control on construction activities taking place at other times is subject to the Criteria for Evaluating Noise Impact stated in Table 1B of Annex 5 in the EIAO-TM. The noise limit is $L_{eq\ (30\ minutes)}$ 75 dB(A) at the façades of dwellings and 70 dB(A) at the façade of schools (65 dB(A) during examinations).

10.3.4 Between 1900 and 0700 hours and all day on Sundays and public holidays, activities involving the use of PME for the purpose of carrying out construction work is prohibited unless a construction noise permit (CNP) has been obtained. A CNP may be granted provided that the Acceptable Noise Level (ANL) for the NSRs can be complied with. ANLs are assigned depending upon the area sensitive rating (ASR). The corresponding basic noise levels (BNLs) for evening and night time periods are given in **Table 10.3**.

Table 10.3 Construction Noise Criteria for Activity other than Percussive Piling

Time Period	Basic Noise Level (BNLs)		
	ASR A	ASR B	ASR C
Evening (1900 to 2300 hours) (1)	60	65	70
Night (2300 to 0700 hours)	45	50	55

Note: (1) Includes Sundays and Public Holiday during daytime and evening.

10.3.5 Under the DA-TM, the use of five types of Specified Powered Mechanical Equipment (SPME) and three types of Prescribed Construction Work (PCW) within a designated area during restricted hours would require a valid CNP. The SPME includes hand-held breaker, bulldozer, concrete lorry mixer, dump truck and hand-held vibratory poker. The PCW are:

- Erecting or dismantling of formwork or scaffolding.
- Loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material.
- Hammering.

10.3.6 In general, it should not be presumed that a CNP would be granted for carrying out PCW within a designated area during restricted hours. The CNP may be granted for the execution of construction works during restricted hours involving the use of PME and/ or SPME if the relevant Acceptable Noise Levels and criteria stipulated in the GW-TM and DA-TM can be met.

10.3.7 Percussive piling is prohibited between 1900 and 0700 hours on any weekday not being a general holiday and at any time on Sunday or general holiday. A CNP is required for the carrying out of percussive piling between 0700 and 1900 hours on any day not being a general holiday. PP-TM sets out the requirements for working and determination of the permitted hours of operations. ANLs for percussive piling for different types of NSRs are shown in **Table 10.4**.

Table 10.4 Acceptable Noise Levels for Percussive Piling

NSR Window Type or Means of Ventilation	ANL, dB(A)
(i) NSR (or part of NSR) with no windows or other opening	100
(ii) NSR with central air conditioning system	90
(iii) NSR with windows or other openings but without central air conditioning system	85

Note: 10 dB(A) should be subtracted from the ANLs shown above for NSRs which are hospitals, medical clinics, educational institutes, courts of law or other NSRs which are considered by the Authority to be particularly sensitive to noise.

10.3.8 In accordance with PP-TM, the permitted hours of operation for carrying out of percussive piling work, subject to the issuance of a CNP, are listed in **Table 10.5**.

Table 10.5 Permitted Hours of Operation for Percussive Piling

Amount by which Corrected Noise Level (CNL) exceeds Acceptable Noise Level (ANL), CNL-ANL	Permitted hours of operation on any day not being a general holiday
-10 dB(A) < CNL-ANL	0800 to 0900 AND 1230 to 1330 AND 1700 to 1800
0 dB(A) < CNL-ANL ≤ -10 dB(A)	0800 to 0930 AND 1200 to 1400 AND 1630 to 1800
CNL-ANL ≤ 0 dB(A)	0700 to 1900

Operation Phase

Road Traffic Noise

10.3.9 For road traffic noise, Annex 5, Table 1A "A Summary of Noise Criteria" of the EIAO-TM defines the criteria $L_{10\ (1\ hour)}$ for the road traffic noise at various noise sensitive receivers (NSRs):

- 70dB(A) at the façades of residential dwellings, hotels, offices;
- 65dB(A) at the façades of schools, places of public worship, courts of law, places where unaided voice communication is required; and
- 55dB(A) at the façades of hospital or clinics.

Railway Noise

10.3.10 Railway noise is controlled under the NCO and the associated IND-TM, and the relevant noise criteria are listed in Table 1A, Annex 5 of EIAO-TM. In accordance with the Hong Kong Planning Standards and Guidelines (HKPSG), the railway noise level assessed at 1m from the external façade shall not exceed 65 dB(A) $L_{eq\ (24\ hour)}$. The HKPSG also recommends 85m separation between the East Rail Line and the façades of the development in order to meet the noise criteria.

Fixed Plant Noise

10.3.11 Fixed noise sources from the proposed sewage pumping station, Marine Police Headquarters (including running vessel engines, siren, etc) and Hong Kong Jockey Club stables and the central store would be controlled by section 13 of the NCO and IND-TM.

10.3.12 More stringent criteria for fixed plant noise impact recommended in the EIAO-TM for planning purposes are as follows (**Table 10.6**):

- 5dB(A) below the appropriate ANL set out in the IND-TM (the ANL-5dB(A) criterion); or
- The prevailing background noise level where the prevailing background noise level is lower than 5dB(A) below the appropriate ANL (i.e. ANL - 5dB(A)).

Table 10.6 Acceptable Noise Levels (ANLs) (in dB(A))

	Fixed Plant Noise for Different Area Sensitivity Rating, (Leq, 30min, dB(A))					
	ANL, dB(A)			ANL-5, dB(A)		
Time Period	ASR A	ASR B	ASR C	ASR A	ASR B	ASR C
Day (0700 to 1900 hours)	60	65	70	55	60	65

Time Period	Fixed Plant Noise for Different Area Sensitivity Rating, (Leq, 30min, dB(A))					
	ANL, dB(A)			ANL-5, dB(A)		
	ASR A	ASR B	ASR C	ASR A	ASR B	ASR C
Evening (1900 to 2300 hours)	60	65	70	55	60	65
Night (2300 to 0700 hours)	50	55	60	45	50	55

Helicopter Noise

10.3.13 Potential noise impact on the proposed development site would arise from the helicopter services of the Marine Police Headquarters. According to Table 1A of Annex 5 "A Summary of Noise Criteria" in the EIAO-TM, the criteria for helicopter noise is L_{max} 90 dB(A) for offices and L_{max} 85 dB(A) for domestic premises, hotels, hostels, education institutes, places of worship, hospital and clinics during 0700-1900 hours. The standards apply to uses that rely on openable windows for ventilation and the standards should be viewed as the maximum permissible noise levels assessed at 1 m from the external façade.

Description of Environment

10.3.14 The proposed development is located on the west riverside at the estuary of Shing Mun River to Sha Tin Hoi. The existing land uses in the surrounding areas are Residential, G/IC (Government/Institutional/Community), Open Space, Other Specified Uses and Green Belt. Tolo Highway, Tate's Cairn Highway and other distributor networks are dominant noise sources in the area.

Noise Sensitive Receivers

10.3.15 The study area for noise impact assessment will be defined by a distance of 300m from the site boundary of the development site at the existing STSTW.

10.3.16 The key existing Noise Sensitive Receivers (NSRs) for the construction phase are listed below. The identified representative NSRs are listed in and its locations are shown in **Fig. No. /10.02.**

Table 10.7 Noise Sensitive Receivers During Construction Phase

NSR ID	Description	Type of Use	Existing or Planned	Distance from the Construction Site Boundary (m)
NSR1	Kam Tai Court	Residential	Existing	290
NSR2	S.K.H. Ma On Shan Holy Spirit Primary School	Education	Existing	290
NSR3	Seaview Villa	Residential	Existing	140
NSR4	Kam On Garden	Residential	Existing	210
NSR5	Shatin Lookout	Residential	Existing	260
NSR6	Evergreen Villa	Residential	Existing	290
NSR7	Racecourse Gardens	Residential	Existing	280

10.3.17 The NSRs for operation phase impact assessment are the residential facades and educational institution at the proposed development site. The locations of these representative NSRs are shown in **Fig. No. /10.03.** For the "Enhanced Development Scenario", there is a hotel development near the coast of Shatin Hoi. However, it would be provided with central air conditioning and would not rely on the openable window for ventilation. Therefore, below assessment would not include the proposed hotel development.

Approach and Methodology

Construction Phase

10.3.18 Since the detailed information on construction activities of the proposed development are not yet available, the construction noise impact is addressed qualitatively in this stage.

Operation Phase

Road Traffic Noise

10.3.19 Calculations were conducted using the UK Department of Transport's "Calculation of Road Traffic Noise" 1988 (CRTN), which is accepted by Environmental Protection Department (EPD) for use in Hong Kong. Predicted noise levels are given in terms of $L_{10\ (1\ hour)}$ dB(A).

10.3.20 In accordance with the EPD requirements, road traffic noise should be predicted based on the maximum traffic forecast within 15 years upon the occupation of the proposed development. As the tentative completion year for the proposed development is 2031, the noise assessment has been conducted based on the peak hour traffic flow predictions for year 2046 as provided by the traffic consultant. The existing roads within 300m from the proposed development site were included in the assessment. Total flows and vehicle compositions used are given in **Appendix 10.01**.

10.3.21 Since the detailed information (such as no. of bus bay and location of car park) on local roads inside the proposed development area are not yet available in the current stage, so they are not included in the road traffic noise impact calculation.

Railway Noise

10.3.22 In accordance with the HKPSG, at least separation distance of 85m between the Rail Line and the development site is required. As the setback distance from East Rail Line is more than 100m, qualitative railway noise impact assessment is conducted for the operation phase of the development and no adverse railway noise impact on the proposed development would be expected.

Fixed Plant Noise

10.3.23 Subject to the findings and recommendation of the Preliminary Sewage Impact Assessment Report to be conducted under this Feasibilities Study, there is a new sewage pumping station will be constructed within the Study Area. Potential noise impacts arising from the operation of ventilation fans is expected. As the detail design of the sewage pumping station is not available yet, qualitative assessment for fixed plant noise is conducted in this stage.

10.3.24 The operation of Marine Police Headquarters such as running vessel engines, siren, etc may pose fixed plant noise impact to the nearby NSRs. However, the proposed residential developments are located at least 150m away from the Headquarters. Marine Police Headquarters building and proposed commercial developments/hotel would also provide noise screening effect on these fixed plant sources, adverse fixed plant noise impact from the operation of Marine Police Headquarters is not anticipated and the assessment is therefore in qualitative approach.

10.3.25 The operation of Hong Kong Jockey Club stables and central store may pose fixed plant noise impact to the nearby NSRs as well. Since the distance between the Jockey Club stables and central store and the proposed residential development is more than 120m and the proposed G/IC developments located between the residential developments and the stables and central store would provide noise screening effect, adverse fixed plant noise impact is not anticipated and the assessment is therefore in qualitative approach.

Helicopter Noise

10.3.26 As advised by Marine North Division of Hong Kong Police, the helicopter used in Marine Police Headquarters is for emergency use only and the usage is about 3 to 4 times per year. Therefore, the helicopter noise impact is unusual and would be in a short time (during departure and take off period) if there is operation. Therefore, the assessment is in qualitative approach.

Impact Assessment and Mitigation Measures

Construction Phase

10.3.27 In view of the nature of the development, the major construction noise may generate from construction activities including demolition of the existing STSTW, excavation, foundation, building and concreting works. Decontamination works on the existing STSTW site may be needed subject to findings of the land contamination assessment. Potential noise impacts generated from the use of PME such as excavators, generators, air compressors, cranes, dump trucks, and pneumatic breakers, etc. for these construction activities would be expected.

10.3.28 Due to the large separation distances (140m to 290m) between the boundary of the proposed site and the NSRs in the vicinity, it is expected that the potential construction noise impact to the NSRs would be limited.

10.3.29 In order to alleviate the potential construction noise impacts to the identified NSRs, the following mitigation measures are recommended in addition to the guidelines laid down in the EIAO Guidance Note No. 9/2010 "*Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance*" (GN 9/2010):

- Implementation of good site practices to limit noise emissions at source
- Use of quieter PMEs
- Use of quieter alternative construction method
- Use of noise barriers/enclosure on noisy PMEs

10.3.30 With the implementation of the noise mitigation measures, it is anticipated that there would be no unacceptable construction noise impacts on nearby NSRs.

Operation Phase

Road Traffic Noise

10.3.31 Road traffic noise levels at the representative noise sensitive facades were predicted based on the traffic forecast in 2046. The predicted noise levels at the residential towers and education institution at the proposed development site are presented in **Appendix 10.01**.

10.3.32 Referring to the results in **Appendix 10.01**, without noise mitigation measures, the predicted noise levels at education institutions would be 40 – 61 dB(A) complying with the traffic noise criterion. The representative residential NSRs would be exposed to road traffic noise levels ranging from 46 to 82 dB(A), depending on the orientation of the facades. All of the residential facades located next to Tolo Highway and/or Tate's Cairn Highway would not comply with the 70 dB(A) noise criterion due to the high traffic noise from these two highways. Mitigation measures are required to alleviate the potential adverse traffic noise impact.

10.3.33 As T6 Bridge of Tate's Cairn Highway strikes through the site, to mitigate the associated road traffic noise, full/semi enclosures extended from commercial buildings are proposed to cover part of T6 Bridge as shown in **Fig. No. /4.02**.

10.3.34 With the provision of full/semi enclosures, the predicted road traffic noise levels at all facades of residential towers near the Tate's Cairn Highway, including Tower T1, 9, 10, 17, 18, 29 and 30 are lowered by a significant amount. All the sensitive façades at Towers T10 and T30 would comply with the noise criteria of 70 dB(A). Exceedances of up to 3 dB(A) would still be found at the sensitive façades of Towers 17, 18 and 29.

10.3.35 Noise exceedances up to 12 dB(A) would be predicted at the sensitive facades of Towers T1, 2, 3, 4, 5, 6, 7, 8, 9, 15 and 16 due to Tolo Highway and other sections of Tate's Cairn Highway. Following mitigation measures are proposed to diminish potential adverse traffic noise impact.

Direct mitigation measures on the traffic noise source:

- Low noise surfacing on Tolo Highway and Tate's Cairn Highway
- Retrofitting of noise barriers/enclosure at the Tolo Highway
- Longer length of noise semi enclosures on T6 Bridge (but it may have impact on the air ventilation)

Mitigation measures on the sensitive facade:

- Further setback of the sensitive facades from Tolo Highway and Tate's Cairn Highway
- Changing the building layout to reduce the angle of view of the facades to the Highways
- Single aspect design for the first layer of the residential towers next to Tolo Highway and Tate's Cairn Highway, including Tower T1, 2, 3, 4, 5, 6, 7, 8, 9
- Absorptive architectural vertical fins and end walls for affected sensitive facades
- Balcony design for affected sensitive facades
- Acoustic or recessed windows for affected sensitive façades

Railway Noise

10.3.36 In accordance with the HKPSG, at least separation distance of 85m between the Rail Line and the development site is required. As the setback distance from East Rail Line is more than 100m, no adverse railway noise impact on the proposed development would be expected.

Fixed Plant Noise

10.3.37 Potential noise impacts arising from the operation of ventilation fans of proposed sewage pumping station is expected. However, with the installation of silencers at the ventilation fan, no adverse noise impact would be expected on the proposed development. In addition, the detailed design is recommended to incorporate the following good practice in order to minimize the nuisance on the neighbouring NSRs.

- The exhaust of the ventilation system should be located facing away from any NSRs; and
- Louver or other acoustic treatment equipment could also be applied to the exhaust of the ventilation system.

10.3.38 The proposed residential developments are located at least 150m setback from the Marine Police Headquarters. In addition, there would have noise screening effect from the proposed commercial developments/hotel which would be located between the residential developments and the Headquarters. Therefore, adverse fixed plant noise impact from the operation of Marine Police Headquarters on the proposed residential development is not expected.

10.3.39 The proposed residential developments are located at least 150m setback from the Hong Kong Jockey Club stables and central store. The noise arise from the operation of the stables and central store would be negligible due to the large setback distance and the potential screening effect from the purposed G/IC development. Therefore, adverse fixed

plant noise impact from the operation of Jockey Club stables and central store on the proposed residential development is not expected.

Helicopter Noise

10.3.40 The number of usage of the helipad inside the Marine Police Headquarter is 3 to 4 times per year as advised by Marine North Division of Hong Kong Police. It is considered that the helipad usage is limited to emergency use. The potential impact would be in a short time and limited, no mitigation measures would be required.

Conclusion

Construction Phase

10.3.41 This assessment has assessed the construction noise impacts of the Project. Due to the large separation distances between the existing NSRs and the construction site, it is expected that the construction noise impact to the existing NSRs would be minimal. To further mitigate the potential noise impact, good site practice, and use of quiet PME, movable barriers/temporary barriers, etc. have been proposed to minimize the impact. No insurmountable construction noise impact would be anticipated with the mitigation measures in place. Yet, a quantitative assessment would be conducted if necessary in the later stage of the purposed development when relevant information is available to ensure any potential impacts to the NSRs are minimized to an acceptable level.

Operation Phase

10.3.42 Potential traffic noise impact from Tolo Highway and Tate's Cairn Highway would be expected on the residential facades of proposed development. A series of noise mitigation measures on the traffic noise sources and sensitive receivers are proposed to diminish the impacts. Fixed plant noise impact from proposed sewage pumping station on the proposed development is not anticipated with the silencers/louver or other acoustic treatment equipment applied on the ventilation fan/exhaust of ventilation system. No insurmountable fixed plant noise impact from operation of Marine Police Headquarters and Hong Kong Jockey Club stables and central store would be expected at the proposed residential development as there is a large setback distance and the noise would also be screened by the proposed commercial developments/hotel and G/IC development. With a certain setback distance from East Rail Line, adverse railway noise impact on the proposed development is also not expected. The helicopters with limited operations at Marine Police Headquarter would not pose adverse noise impacts on the proposed development.

10.3.43 Quantitative assessment on fixed plant noise would be conducted in the later stage of the purposed development when relevant information is available to ensure the potential noise impacts to the NSRs are acceptable.

10.4 Water Quality

Description of the Environment and Baseline Condition

Marine Water

10.4.1 The Study Area is located at the waterfront of Sha Tin Hoi of the Tolo Harbour & Channel Water Control Zone (WCZ). The EPD water quality monitoring station TM2 in Harbour Subzone of the Tolo Harbour & Channel WCZ is the nearest EPD marine water quality monitoring stations to the Study Area. A summary of the monitoring data (in 2011) for TM2 is presented below in **Table 10.8**.

Table 10.8 EPD Marine Water Quality Monitoring Data in 2011

Parameter		Harbour Subzone TM2	WPCO WQO (in marine waters)
Temperature (°C)		23.6 (15.5-30.2)	Change due to waste discharge not to exceed 1°C
Salinity		31.2 (27.2-32.6)	Not to cause more than 3ppt change
Dissolved Oxygen (mg/L)	6.5 (2.1-9.2)	6.7 (4.5 - 8.5)	Harbour and Buffer Subzones: not <4mg/L other than within 2m of the bottom; Channel Subzone: not <4mg/L
	6.2 (3.8-7.7)	6.7 (2.8 - 8.5)	Harbour Subzone: not <2mg/L within 2m of the bottom; Buffer Subzone: not <3mg/L within 2m of the bottom; Channel Subzone: not <4mg/L
Dissolved Oxygen (% Saturation)	90.0 (32-136)	94 (68 - 126)	Not available
	87.0 (52-113)	94 (43 - 119)	Not available
pH		7.9 (7.6-8.4)	Harbour Subzone: not to exceed by ±0.5 pH units; Buffer Subzone: not to exceed by ±0.3 pH units; Channel Subzone: not to exceed by ±0.1 pH units
Secchi Disc Depth (m)		2.6 (1.9-3.5)	Not available
Turbidity (NTU)		1.7 (0.7-5.0)	Not available
Suspended Solids (SS) (mg/L)		2.1 (0.9-6.4)	Not available
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)		1.7 (0.8-2.9)	Not available
Ammonia Nitrogen (NH_3-N) (mg/L)		0.076 (0.035-0.165)	Not available
Unionised Ammonia (mg/L)		0.003 (<0.001-0.008)	Not available
Nitrite Nitrogen (NO_2-N) (mg/L)		0.003 (<0.002-0.008)	Not available
Nitrate Nitrogen (NO_3-N) (mg/L)		0.149 (<0.002-1.560)	Not available
Total Inorganic Nitrogen (TIN) (mg/L)		0.23 (0.04-1.66)	Not available
Total Kjeldahl Nitrogen (mg/L)		0.26 (0.19-0.41)	Not available
Total Nitrogen (TN) (mg/L)		0.41 (0.20-1.86)	Not available
Orthophosphate Phosphorus (PO_4) (mg/L)		0.005 (<0.002-0.029)	Not available
Total Phosphorus (TP) (mg/L)		0.03 (<0.02-0.06)	Not available
Silica (as SiO_2) (mg/L)		0.90 (0.17-1.85)	Not available
Chlorophyll-a (µg/L)		6.6 (3.0-13.7)	Harbour Subzone: not >20µg/L; Buffer Subzone: not >10µg/L; Channel Subzone: not >6µg/L
E.coli (count/100mL)		9 (<1-390)	Geometric mean not to exceed 610 per 100mL at the secondary contact recreation subzone and fish culture zones

Parameter	Harbour Subzone TM2	WPCO WQO (in marine waters)
Faecal Coliforms (count/100mL)	44 (2-2800)	Not available

Note:
1. *Data source: 2011 Marine Water Quality in Hong Kong*
2. *Except as specified, data presented are depth-averaged values calculated by taking the means of three depths: surface, mid-depth, bottom.*
3. *Data presented are annual arithmetic means of depth-averaged results except for E.coli and faecal coliforms that are annual geometric means.*
4. *Data in brackets indicate the ranges.*

10.4.2 According to the "2011 Marine Water Quality in Hong Kong", non-compliance in Water Quality Objectives (WQO) for depth-averaged DO was recorded in 2011, while compliance in *E.coli* and chlorophyll-a was achieved at this monitoring station.

Inland Water

10.4.3 The Study Area is located next to the estuary of the Shing Mun River, where the Tai Shui Hang Nullah runs into the Sha Tin Hoi (as shown in **Fig. No. /10.04**). A small watercourse at Kau To Hang is located northwest to the Study Area. All these three inland watercourses are located outside the Study Area boundary but within 500m from the Study Area.

10.4.4 The water quality at the section upstream of the existing STSTW is regularly monitored by the EPD. The river water quality monitoring station TR19I is the nearest river monitoring station upstream at the main channel of the Shing Mun River. A summary of the monitoring data at TR19I in 2011, which is the most recent monitoring data published on the EPD website at the moment of preparing this Report, is presented in **Table 10.9** below.

Table 10.9 EPD River Water Quality Monitoring Data in 2011

Parameter	Shing Mun River Main Channel TR19I	River WQO
Dissolved Oxygen (mg/L)	7.5 (4.8 - 9.5)	No less than 4 mg/L
pH	7.8 (7.6 - 8.3)	6 – 9
Suspended Solids (mg/L)	3 (1 - 8)	Not to cause more than 25 mg/L increase
5-day Biochemical Oxygen Demand (mg/L)	4 (<1 - 5)	No more than 5 mg/L
Chemical Oxygen Demand (mg/L)	11 (4 - 26)	No more than 30 mg/L
Oil & grease (mg/L)	<0.5 (<0.5 - 1.4)	Not available
Faecal coliforms (cfu/100mL)	2700 (660 - 8,300)	Not available
E.coli (cfu/100mL)	160 (30 - 520)	1000 counts per 100ml
Ammonia-nitrogen (mg/L)	0.13 (0.06 - 0.36)	0.5 mg/L at any time

Parameter	Shing Mun River Main Channel	River WQO
	TR19I	
Nitrate-nitrogen (mg/L)	0.13 (0.02 - 0.40)	Not available
Total Kjeldahl Nitrogen (mg/L)	0.36 (0.33 - 0.67)	Not available
Ortho-phosphate (mg/L)	0.01 (<0.01 - 0.04)	Not available
Total Phosphorus (mg/L)	0.05 (0.03 - 0.06)	Not available
Total Sulphide (mg/L)	<0.02 (<0.02 - <0.02)	Not available
Aluminium (µg/L)	<50 (<50 - 70)	Not available
Cadmium (µg/L)	<0.1 (<0.1 - 0.1)	Not available
Chromium (µg/L)	2 (<1 - 3)	Not available
Copper (µg/L)	3 (2 - 6)	Not available
Lead (µg/L)	<1 (<1 - 2)	Not available
Zinc (µg/L)	10 (<10 - 30)	Not available

Note:
1. *Data source: 2011 River Water Quality in Hong Kong*
2. *Data presented are annual arithmetic means of depth-averaged results except for E.coli and faecal coliforms that are annual geometric means.*
3. *Data in brackets indicate the ranges.*

10.4.5 The Shing Mun River was notoriously known to be polluted by industrial discharge, livestock waste as well as sewage discharge from the unsewered village development. With the effort of the implementation Water Pollution Control Ordinance (WPCO), Livestock Waste Control Scheme and the provision of sewerage connection to the unsewered village developments in the area, the water quality of the watershed has significantly improved since the last decade. Although Shing Mun River in the Tolo Harbour and Channel WCZ have not yet reached 100% WQO compliance in 2011, they showed marked improvement during the last decade. The compliance rate rose from 78% in 1997 to 90% in 2011.

Identification of Water Sensitive Receivers

10.4.6 Potential water sensitive receivers (WSRs) within 500m of the Study Area were identified. These WSRs are given in the **Table 10.10** below. Their locations are shown in **Fig. No. /10.04**.

Table 10.10 Water Sensitive Receivers

WSRs	Description
WSR1	Marine Water of Sha Tin Hoi of Tolo Harbour and Channel Water Control Zone Harbour Subzone
WSR2	Shing Mun River
WSR3	Tai Shui Hang Nullah
WSR4	Streams at Kau To Hang

WSRs	Description
WSR5	WSD Sha Tin Saltwater Intake

Identification and Evaluation of Potential Water Quality Issues

Demolition and Construction Phase

10.4.7 Potential water pollution sources during the demolition of the existing STSTW facilities and construction of the proposed development at the Study Area will include construction site runoff, sewage effluent from construction workforce, accidental spillage of chemicals, groundwater from potentially contaminated area and hydro geological groundwater impacts.

10.4.8 Appropriate mitigation measures as stipulated in the ProPECC PN 1/94 "Construction Site Drainage" would be proposed to minimize the potential impact from these sources as much as possible. The nearest saltwater intake is the WSD Sha Tin Saltwater Intake shown in **Fig. No. /10.04** (WSR5). The Water Pollution Control Ordinance requirement for maintaining minimum distances of 100 m between the discharge points of construction site run-off and the existing saltwater intakes is observed and measures would be taken to ensure compliance to the WPCO requirement. An exclusion zone of 100 m from the WSD Sha Tin Saltwater Intake is shown in **Fig. No. /10.04** where no discharge of construction site run-off is allowed.

10.4.9 Since the re-development site is situated directly at the waterfront, groundwater infiltration would be expected during excavation works below sea level. As discussed in the land contamination assessment section below, there is limited use of land contaminating chemicals in the existing STSTW. Therefore the risk of land contamination at the re-development site is low. In case land contamination impact is identified, appropriate mitigation measures will be proposed to minimize the water quality impacts arising from contaminated runoff and decontamination process, if required. Any contaminated groundwater shall be either properly treated or properly recharged into the ground in compliance with the requirements of the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS). No major water quality issue regarding groundwater from potentially contaminated area is anticipated provided that suitable mitigation measures are properly implemented. Besides, the infiltration of groundwater is not expected to result in significant change in the water table nearby, in view of the short distance from the water front (and the associated recharging of groundwater).

Operation Phase

10.4.10 In view of the increase in population at the development site, significant level of sewage effluent is expected to be generated from the proposed development at the Study Area. Based on the latest design information and **Section 8**, a total of 6,230 m^3/d of sewage effluent (average dry weather flow for the maximum development scenario) is expected to be generated from the increase population (including residents, employment and other activities). Besides, the 13-storey hotel proposed in the "Enhanced Development Scenario" is expected to result in 594 m^3/d increase in sewage generated. Yet, it is anticipated that the sewage effluent from the proposed development would be discharged to the local foul sewer and be conveyed to the relocated STSTW at Nui Po Shan. No adverse water quality impact from the sewage effluent generated from the increase population is expected.

10.4.11 The major source of water pollution during the operation of the proposed development at the Study Area would be the urban runoff from the proposed development (due to the potential increase of paved area at the proposed development). Mitigation measures as stipulated in the next section will be taken into account in the redevelopment area to minimize the potential impact on the nearby waterbodies.

10.4.12 Appropriate and adequate drainage system will be provided to collect the increased runoff from the redevelopment area. Besides, silt trap and oil interceptor will be provided at appropriate locations, such as carpark and public transport station, to remove pollutants from the non-point sources of the urban environment to minimize the potential water quality impact associated with the urban runoff.

Conclusion

10.4.13 The land-based works for the demolition of the existing STSTW and the subsequent re-development would be mostly land-based and will not required\ major marine works. With the implementation of appropriate mitigation measures, no adverse water quality impacts from the land-based works is anticipated.

10.4.14 During the operation of the proposed development, significant increase in population at the re-development site is anticipated. Since all sewage effluent would be disposed into the public sewer and be treated in the relocated STSTW at Nui Po Shan, no adverse water quality impact from the increase sewage effluent from the re-development site is expected. Other design features for controlling water pollution from urban runoff, such as silt trap and oil interceptor, would be taken into account in the design. No insurmountable water quality impact from the increase in urban runoff is expected.

10.5 Waste Management

Identification of Potential Sources of Waste Impacts and Mitigation Measures

Demolition and Construction Phase

10.5.1 The redevelopment at the Study Area would require the demolition of the existing STSTW and the construction of new buildings at the existing site. The demolition / construction activities to be carried out for the proposed development would generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate method of disposal. The identified waste types include:

- Construction and demolition (C&D) materials from the construction works;
- General refuse from the workforce; and
- Chemical waste from any maintenance of construction plant and equipment.

10.5.2 It should be noted that the business case established under this Report could be quite different from the actual design adopted. Therefore a reliable estimation on the amount of C&D material and waste generated would not be possible and thus is not provided in this stage. On the other hand, the C&D material and waste generated from the demolition of the existing STSTW has already been included in the relevant section of the Preliminary Environmental Review Report under this Study and therefore is included here again.

10.5.3 As the existing STSTW is built on reclaimed land, the foundation and piling works required for the redevelopment at STSTW site may generate excavated marine sediment. In view of the very long time before the actual construction (over ten years) of the proposed development at the vacated site of the existing STSTW, sampling and testing of marine sediment for categorization of the sediment would not be conducted at the current stage. Instead, sediment sampling and testing, if required (in case marine disposal of excavated sediment is necessary) would be conducted after the demolition of the existing STSTW to allow proper categorization and marine disposal of the excavated sediment. Besides, any fill content excavated from the foundation of the vacated site of the existing STSTW would be reused as far as practicable, taken into account any potential contamination from the operation of the existing STSTW. Any need for sediment sampling and testing shall be further determined and conducted as appropriate when the detail design of the redevelopment is confirmed in the future stages of this Project. A detailed condition survey

on the existing plants and equipment could be carried out before demolition to investigate the possibility of re-use of some of the E&M plants.

10.5.4 Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Mitigation measures to achieve waste reduction include:

- Excavated fill material shall be re-used on-site as backfill material as far as possible. The surplus excavated material should be disposed of at the designated public fill reception facility, as agreed with the Secretary of the Public Fill Committee, for other beneficial uses. C&D waste would require disposal to the designated landfill site. In order to monitor the disposal of C&D materials at the public fill reception facility and landfill and to control fly-tipping, a trip-ticket system should be included.
- Chemical wastes should be handled according to the Code of Practice on the Packaging, Labeling and Storage of Chemical Wastes. Spent chemicals should be collected by a licensed collector for disposal at the Chemical Waste Treatment Centre (CWTC) or other licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.
- General refuse should be stored in enclosed bins or compaction units separated from C&D material. Reputable waste collectors should be employed by the contractors to remove general refuse from the Study Area, separately from C&D material. An enclosed and covered area is preferred to reduce the occurrence of 'wind-blow' light material.

10.5.5 It is expected that the inert C&D material generated from site clearance, demolition and various works for the construction of buildings and infrastructure within the re-development area would be reused as far as practicable on-site as fill material. Any remaining surplus C&D materials from these practices would be disposed of to the Public Fill Reception Facilities (PFRFs) for other beneficial uses. In view of the long lead time before the actual demolition of the existing STSTW, there is limited information regarding the interfacing projects that could be the potential recipient sites for the reuse of surplus C&D material. Further investigation on this possibility shall be conducted in the next stage of the project when more detail information is available.

Operation Phase

10.5.6 The major portion of solid waste arising from the redevelopment at the Study Area will be domestic waste from residents as well as general refuse from commercial operators. This waste includes food waste, paper, wood, plastic, office waste etc.

10.5.7 Chemical wastes such as paints, lubricants and used batteries may be generated during maintenance activities in the proposed development.

10.5.8 It is expected that refuse collection point(s) (RCP) would be provided in the re-development area to accept domestic waste generated by the building itself. While the details regarding these RCPs have not been confirmed at the current stage, it is expected that the design of the RCPs would conform to the guidelines stipulated in the HKPSG. In addition, other facilities should be provided for waste storage and handling where appropriate, including high-pressure water for regular cleaning purposes, leachate drainage system connected to the foul sewer, air/exhaust cleaning facility for enclosed area and wheeled refuse bins with lids. Provided that the environmental control measures are properly implemented, no adverse environmental impact would be anticipated with respect to solid waste.

10.5.9 A hotel of 13-storey is proposed at the site of the existing salt water pumping station under the “Enhanced Development Scenario” under this Study. Minor increase in waste

generation is expected from the operation of the hotel. Yet no major waste management implication is expected.

Conclusion

10.5.10 The decommission of the existing STSTW is expected to generate C&D materials such as Artificial Hard Material (AHM) and fill, which would be sorted on site for onsite reuse (e.g. road base or drainage layer), export to other concurrent projects or export to the PFRFs for other beneficial use. Further investigation shall be conducted in the next stage of the Project to look for potential recipient projects for the inert C&D materials.

10.5.11 It is expected that the design of RCPs in the re-development area would conform to the guidelines stipulated in the HKPSG. Other associated facilities for waste storage and cleaning would also be provided as appropriate. No adverse waste management implication is anticipated from the operation of the proposed development.

10.6 Land Contamination

Review of Existing Conditions and Site History

10.6.1 The desk study employed the following information sources:

- Relevant ground investigation reports from the Civil Engineering and Development Department (CEDD) civil engineering library;
- Hong Kong Geological Survey Map (Series HGM20) – Sheet No. 7 (1:20,000);
- Selected aerial photographs and topographic map held by the Lands Department.

10.6.2 The Study Area was formed by reclamation by 1980. STSTW was commissioned in 1982 with a treatment capacity of 100,000 m^3 per day which was subsequently increased to 200,000 m^3 per day in 1986. To reduce nutrient discharge load to Tolo Harbour, nutrient removal facilities were installed in 1991; as a result treatment capacity was reduced to 150,000 m^3 per day. To account for population growth in Sha Tin and Ma On Shan, STSTW Stage III Extension commenced in 2001. With the completion of the Stage III Extension and provision of disinfection, the treatment capacity of STSTW is now 340,000 m^3 per day.

10.6.3 According to the Hong Kong Geological Survey Map (Series HGM20) – Sheet No. 7, the upper layer of soil is Fill/Sanitary Fill of natural earth and waste overlying Holocene marine mud comprising shelly clay and silt. Based on the GI reports, the immediate top layer is fill material to 14m below ground level (bgl). Marine deposits extend from 14 m bgl to 21m bgl and alluvium extends from 21m bgl to 23m bgl. Granite extends from 23m bgl onwards.

Identification of Potential Site of Land Contamination Concern

10.6.4 The site location was open sea prior to reclamation as such potential land contamination is not an issue. Based on the existing site layout and nature of sewage treatment operations, no widespread contamination is envisaged across the site, however in reviewing the main processes associated with sewage treatment, potential 'hotspots' of land contamination concern are most likely to be encountered at the locations of existing bulk fuel storage tanks, electrical transformers and workshops. The locations of potential land contamination hotspots are shown in **Fig. No. /10.05**.

10.6.5 To acquire information regarding chemical spillage, the Fire Service Department (FSD) and Environmental Protection Department (EPD) were contacted. FSD confirm there have been no recorded incidents of spillage or leakage of dangerous goods. EPD have not replied to the request for information regarding reported incidences of chemical spillage or leakage.

10.6.6 The dangerous goods license record was also acquired from FSD. Storage of the following dangerous goods on record:

- Sodium Hydroxide Solution (in various above-ground storage tanks);
- Sodium Hypochlorite Solution (in various above-ground storage tanks);
- Diesel (in a 1000L above-ground storage tank);
- Acetylene (in gas cylinders);
- Hydrogen (in gas cylinders);
- Compressed Air (in gas cylinders);
- Argon (in gas cylinders);
- Helium (in gas cylinders);
- Nitrogen (in gas cylinders);
- Oxygen (in gas cylinders);
- Carbon dioxide (in gas cylinders);
- 40% carbon dioxide balanced in methane (in gas cylinders);
- Nitrous oxide (in gas cylinders);
- Hydrochloric acid (in 2.5L cylinders);
- Sulphuric acid (in 2.5L cylinders);
- Phosphoric acid (in 2.5L cylinders); and
- Nitric acid (in 2.5L cylinders)

10.6.7 There is also bulk chemical storage of ferric chloride (iron (III) chloride). When dissolved in water ferric chloride forms highly charged ionic solution which is used as flocculant in sewage treatment. Iron (III) may reduce to Iron (II), however neither iron (II/III) nor chloride ions are considered as potentially land contaminating.

10.6.8 Acetylene, hydrogen, compressed air, argon, helium, nitrogen, oxygen, carbon dioxide and nitrous oxide are gaseous and insoluble in water and not considered to be land contaminants.

10.6.9 Hydrochloric acid, sulphuric acid, phosphoric acid and nitric acid are common acids. Sodium Hydroxide is a common base. Both are highly soluble in water. The primary effect of leakage of these chemicals to the ground would be lowering or raising of soil pH respectively. Acids or bases are not considered to be land contaminants.

10.6.10 Sodium hypochlorite is a strong oxidizer. Once expose to the environment, it rapidly reduces to chloride which is not considered a land contaminant.

10.6.11 Diesel fuel is commonly known as land contaminant. Following a release, the liquid will migrate under gravity to the water table and may accumulate as non-aqueous phase liquid layer on the groundwater surface and begin dissolution. Relevant chemicals of concern (COC) for diesel are Polyaromatic hydrocarbons (PAHs) and petroleum carbon ranges (PCR).

10.6.12 Other potential locations of sources of land contamination are transformer, workshop, power house and blower rooms. Likely contaminants associated with these facilities are organic compounds present in fuel oils such as diesel used for power generation, lube oils to maintain operation of pumps, valves etc and electrical insulating oils used in transformers.

10.6.13 As the STSTW is still in operation, recovery of soil samples directly under structures which may be the source of potential land contamination hotspots is not possible until such time as the structures are removed. The GI works for these locations will be required upon decommissioning of the existing STSTW. Nevertheless, soil sampling locations are proposed as near as possible to transformers, workshop, power house and blower room and around the diesel fuel storage tanks. Soil samples collected from these locations will be sent to laboratory for chemical analysis. The proposed sampling locations are presented in **Fig. No. /10.05**. All soil samples will be analyzed for the following COCs:

- Petroleum carbon range (PCR); and
- Polyaromatic hydrocarbons (PAHs)

Preliminary Site Investigation

10.6.14 Soil sampling locations are proposed near to transformers, workshops power house and blower rooms, as well as diesel storage tanks as far as possible but not affecting the operation of the existing STSTW. Soil samples collected from these locations will be sent to laboratory for chemical analysis. Actual sampling locations were determined based on site conditions and the presence of aboveground/underground structures, which might give rise to potentially contaminative issues. Sampling locations details are provided in **Table 10.11**.

Table 10.11 Details of Proposed Soil and Groundwater Sampling Locations

Sampling Location	Proposed Coordinates		Rationale
	Easting	Northing	
BH-ENV01	839764.96	829558.34	To assess potential impacts from transformers
BH-ENV02	839861.00	829482.00	To assess potential impacts from the workshop and the diesel tank
BH-ENV03	840016.55	829608.81	To assess potential impacts from the fuel oil tank
BH-ENV04	840038.91	829631.51	
BH-ENV05	840027.00	829660.00	
BH-ENV06	839987.00	829655.00	
BH-ENV07	840043.34	829752.97	To assess potential impacts from the transformers
BH-ENV08	840003.58	829734.16	
BH-ENV09	840024.66	829714.36	To assess potential impacts from the Power House
BH-ENV10	840183.00	829602.00	To assess potential impacts from the transformers
BH-ENV11	840118.85	830025.26	To assess potential impacts from the Air Blower House
BH-ENV12	840125.00	829987.00	
BH-ENV13	839957.91	829937.31	To assess potential impacts from the Transformer and Switchgear House

10.6.15 A sampling and testing plan is provided in **Appendix 10.02**.

Assessment Criteria

10.6.16 The assessment methodology adopted is in accordance with the Guidance Note for Contaminated Land Assessment and Remediation (Guidance Note), Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management (Guidance Manual) and Practice Guide issued by EPD.

10.6.17 Interpretation of results has made reference to those Risk-based Remediation Goals (RBRGs) presented in Table 2.1 and Table 2.2 of the Guidance Manual.

10.6.18 The RBRGs are developed based on a risk assessment approach to suit the local environmental conditions and community needs in Hong Kong. Decisions on contaminated soil and groundwater remediation are based on the nature and extent of the potential risks that are posed to human receptors as a result of exposure to chemicals in the soil and/or groundwater RBRGs are developed for four different land use scenarios reflecting the typical physical settings in Hong Kong under which people could be exposed to contaminated soil and groundwater. A description of each land use scenario is as follows:

- Urban residential – Sites located in an urban area where main activities involve habitation by individuals. The typical physical setting is a high rise residential building situated in a housing estate that has amenity facilities such as landscaped yards and children's playgrounds. The receptors are residents who stay indoors most of the time except for a short period each day, during which they are outdoors and have the chance of being in direct contact with soil at landscaping or play areas within the estate.

- Rural residential – Sites located in a rural area where the main activities involve habitation by individuals. These sites typically have village-type houses or low rise residential blocks surrounded by open space. The receptors are rural residents who stay at home and spend some time each day outdoors on activities such as gardening or light sports. The degree of contact with the soil under the rural setting is more than that under the urban setting both in terms of the intensity and frequency of contact.

- Industrial – Any site where activities involve manufacturing, chemical or petrochemical processing, storage of raw materials, transport operations, energy production or transmission, etc. Receptors include those at sites where part of the operation is carried out directly on land and the workers are more likely to be exposed to soil than those working in multi-storey factory buildings.

- Public parks – Receptors include individuals and families who frequent parks and play areas where there is contact with soil present in lawns, walkways, gardens and play areas. Parks are considered to be predominantly hard covered with limited areas of predominantly landscaped soil. Furthermore, public parks are not considered to have buildings present on them.

10.6.19 In addition to the RBRGs, screening criteria (soil saturation limits, Csat developed for Non-aqueous Phase Liquid [NAPL] in soil and water solubility limits for NAPL in groundwater) for the more mobile organic chemicals must be considered to determine whether a site requires further action.

10.6.20 As future redevelopment of the the Site may be for residential housing, in accordance with the Guidance Manual, future land use is characterized as "Urban Residential"; and 'Urban Residential' RBRGs are adopted as the assessment criteria for this land contamination assessment.

10.6.21 Relevant soil and groundwater RBRGs level for this land contamination study including the Soil Saturation Limit and the Solubility Limit are presented in **Table 10.12.**

Table 10.12 Relevant RBRGs for Soil and Groundwater – Urban Residential

Chemical	Soil (mg/kg)		Groundwater (µg/L)	
	RBRGs for Urban Residential	Soil Saturation Limits (Csat)	RBRGs for Urban Residential	Solubility Limits
Volatile Organic Compounds (VOCs)				
Acetone	9,590	***	10,000,000	***
Benzene	0.704	336	3,860	1,750,000
Bromodichloromethane	0.317	1030	2,220	6,740,000
2-Butanone	10,000	***	10,000,000	***
Chloroform	0.132	1100	956	7,920,000
Ethylbenzene	709	138	1020,000	169,000
Methyl tert-Butyl Ether	6.88	2380	153,000	***
Methylene Chloride	1.3	921	19,000	***
Styrene	3,220	497	3,020,000	310,000
Tetrachloroethene	0.101	97.1	250	200,000
Toluene	1,440	235	5,110,000	526,000
Trichloroethene	0.523	488	1,210	1,100,000
Xylenes (Total)	95	150	112,000	175,000

Chemical	Soil (mg/kg)		Groundwater (µg/L)	
	RBRGs for Urban Residential	Soil Saturation Limits (Csat)	RBRGs for Urban Residential	Solubility Limits
Semi Volatile Organic Compounds (SVOCs)				
Acenaphthene	3,510	60.2	10,000,000	4,240
Acenaphthylene	2,340	19.8	1,410,000	3,930
Anthracene	10,000	2.56	10,000,000	43.4
Benzo(a)anthracene	12	NA	NA	NA
Benzo(a)pyrene	1.2	NA	NA	NA
Benzo(b)fluoranthene	9.88	NA	539	1.5
Benzo(g,h,i)perylene	1,800	NA	NA	NA
Benzo(k)fluoranthene	120	NA	NA	NA
bis-(2-Ethylhexyl)phthalate	30	NA	NA	NA
Chrysene	871	NA	581,00	1.6
Dibenzo(a,h)anthracene	1.2	NA	NA	NA
Fluoranthene	2400	NA	10,000,000	206
Fluorene	2380	54.7	10,000,000	1,980
Hexachlorobenzene	0.243	NA	58.9	6,200
Indeno(1,2,3-cd)pyrene	12	NA	NA	NA
Naphthalene	182	125	61,700	31,000
Phenanthrene	10,000	28	10,000,000	1,000
Phenol	10,000	7260	NA	NA
Pyrene	1,800	NA	10,000,000	135
Metals				
Antimony	29.5	NA	NA	NA
Arsenic	22.1	NA	NA	NA
Barium	1,0000	NA	NA	NA
Cadmium	73.8	NA	NA	NA
Chromium III	10,000	NA	NA	NA
Chromium VI	221	NA	NA	NA
Cobalt	1,480	NA	NA	NA
Copper	2,950	NA	NA	NA
Lead	258	NA	NA	NA
Manganese	10,000	NA	NA	NA
Mercury	11	NA	486	NA
Molybdenum	369	NA	NA	NA
Nickel	1,480	NA	NA	NA
Tin	10,000	NA	NA	NA
Zinc	10,000	NA	NA	NA
Petroleum Carbon Ranges (PCR)				
C6 - C8	1,410	1000	82,200	5,230
C9 - C16	2,240	3000	714,000	2,800
C17 - C35	10,000	5000	12,800	2,800
Polychlorinated Biphenyls (PCBs)				
PCBs	0.226	NA	433	31

Note: NA - Not Available
*** indicates that the C_{sat} value/ solubility limit exceeds the 'ceiling limit' therefore the RBRG applies.

Preliminary Investigation Results

Soil Boring and Sampling

10.6.22 The soil and groundwater sampling works were carried out from 28 June to 29 July 2013. Inspection pits or trial pit were excavated to retrieve the soil samples under supervision of AECOM.

10.6.23 The SI works were generally conducted in accordance with the original sampling location plan. Actual locations of boreholes were ammended slightly according to actual site conditions. Three boreholes, BH-ENV03, BH-ENV04 and BH-ENV08 were relocated and presented as BH-ENV03A, BH-ENV04A and BH-ENV08A respectively. Strata logging for

boreholes was undertaken by a qualified geologist. The logs include a stratigraphic description, soil sampling depths, sample notation and groundwater levels (where encountered). The presence of rocks/boulders/cobbles/concrete and any foreign materials such as metal, wood or plastic was also recorded. Soil boring logs are provided in **Appendix 10.03**.

10.6.24 Soil samples were proposed to be collected at 0.5m, 1.0m and 3.0m below ground level. However, in some cases where groundwater, concrete or drainage aggregate was encountered, sampling at the proposed levels was precluded. BH-ENV01 and BH-ENV06 did not reach proposed target sampling depths of 1.0m and 3.0m below ground level since concrete layers were encountered at 0.85m and 0.75m respectively. BH-ENV13 did not achieve the proposed sampling depth due to encountering of layer of drainage aggregate. For BH-ENV03 and BH-ENV08, drilling was terminated due to the presence of concrete at 0.3m and 0.35m below ground level, and were relocated and as BH-ENV03A and BH-ENV08A. Drainage aggregate was encountered in borehole BH-ENV04 at 1.6m below ground level therefore the borehole was relocated to BH-ENV04A. Sampling depths and locations are presented in **Table 10.13**.

Table 10.13 Summary of soil samples collection

Sampling Location	As Built Co-ordinates		Termination Depth (m bgs)	Proposed Sampling Depth (m bgs)			Remarks
				0.5	1.0	3.0	
	Easting	Northing		Actual Sampling Depth (m bgs)			
BH-ENV01	839763.11	829554.48	0.85	0.5	0.83	/	The sample location was terminated at a depth of 1.11m bgs due to encountering concrete.
BH-ENV02	839860.62	829473.24	1.75	0.50	1.00	1.10	Groundwater was encountered at 1.15m bgs. Borehole terminated at 1.75m bgs
BH-ENV03A	840009.62	829614.33	1.00	0.50	0.80	/	Groundwater was encountered at 0.85m bgs Borehole terminated at 1.00m bgs
BH-ENV04A	840038.91	829625.63	1.90	0.50	1.00	1.8	Groundwater was encountered at 1.8m bgs. Borehole terminated at 1.85m bgs
BH-ENV05	840026.61	829661.33	2.75	0.50	1.00	2.50	Groundwater was encountered at 2.73m bgs. Borehole terminated at 2.75m bgs
BH-ENV06	839985.50	829654.19	0.74	0.50	0.73	/	The sample location was terminated at a depth of 0.74m bgs due to encountering concrete.
BH-ENV07	840048.60	829755.53	1.80	0.50	1.00	1.50	A steel pipe was encountered at 1.20m and groundwater was encountered at 1.60m therefore the borehole terminated at 1.80m
BH-ENV08A	839995.69	829740.88	1.05	0.50	0.85	/	Groundwater was encountered at 0.90m bgs therefore the borehole terminated at 1.05m bgs
BH-ENV09	840025.49	829724.22	1.60	0.50	0.95	/	Groundwater was encountered at 1.00m bgs therefore the borehole terminated at 1.60m bgs

BH-ENV10	840187.38	829602.99	3.00	0.50	1.00	3.00	Slow groundwater recharge noted, therefore a water sample was also collected from 2.20m bgs
BH-ENV11	840117.20	830025.06	3.00	0.50	1.00	3.00	The sample location was terminated at a depth of 3.00m bgs
BH-ENV12	840108.15	829999.93	2.32	0.50	1.00	2.20	Groundwater was encountered at 2.30m bgs therefore the borehole terminated at 2.32m bgs
BH-ENV13	839961.69	829936.22	1.20	0.50	1.00	/	Inspection Pit transformed into trial pit as a coarse gravel layer and drainage aggregate layer were encountered at 0.95m. Borehole terminated at 1.15m bgs

Groundwater Sampling

10.6.25 Groundwater was encountered in 9 boreholes during the soil boring process. Groundwater samples were collected from these boreholes and the sampling depths are shown in **Table 10.14**. The groundwater samples collection marked the termination of boring of the corresponding boreholes.

Table 10.14 Summary of groundwater samples collection

Sampling Location	Coordinates		Ground water level (mbgl)[1]
	Easting	Northing	
BH-ENV01	839763.11	839763.11	Nil
BH-ENV02	839860.62	829473.24	1.15
BH-ENV03A	840009.62	829614.33	0.85
BH-ENV04A	840038.91	829625.63	1.85
BH-ENV05	840026.61	829661.33	2.75
BH-ENV06	839985.50	829654.19	Nil
BH-ENV07	840048.60	829755.53	1.60
BH-ENV08A	839995.69	829740.88	0.90
BH-ENV09	840025.49	829724.22	1.00
BH-ENV10	840187.38	829602.99	2.20
BH-ENV11	840117.20	830025.06	Nil
BH-ENV12	840108.15	829999.93	2.30
BH-ENV13	839961.69	829936.22	Nil

Note:
1: mbgl = meter below ground level

10.6.26 After collection, soil samples were transferred to laboratory certified clean glass sample containers which promptly sealed with a septum-lined cap. All samples were clearly labeled. Immediately following collection, samples were subsequently stored in cool box with ice brick and delivered to analytical laboratory on the same day. All soil samples were analyzed in accordance with the analysis schedules approved by CEDD.

Soil and Groundwater Laboratory Analytical Results

10.6.27 A total of 35 soil samples (including 2 duplicate samples) and 9 groundwater samples were collected during the SI for laboratory analysis. According to the laboratory testing

results, no exceedance of the adopted urban residential RBRGs are identified for all the soil and groundwater samples.

10.6.28 Summary tables of the laboratory testing result with RBRG Guidance Manual for assessing the soil and groundwater samples are presented in **Appendix 10.04** and detailed laboratory analytical reports refer to **Appendix 10.05**.

Results of QA/QC Analysis

10.6.29 QA/QC is the practice of assessing whether collection and analysis techniques provide precise and accurate information. This process is to ensure the levels of contamination measured in the environmental samples reflect the actual environmental levels and are not due to accidental contamination of the sample or sample container.

10.6.30 All the equipment blanks and field blanks, analytical results were recorded below their respective detection limits, therefore QA/QC procedures for sample collection and preparation are therefore considered acceptable. The laboratory testing results for soil and duplicate samples are presented in **Table 10.15**.

Table 10.15 Summary of Quality Assurance / Control

Parameters	Soil (mg/kg)		Water (µg/L)	
	Duplicate Soil (A)	Duplicate Soil (B)	Equipment Blank	Trip Blank
PAHs				
Acenaphthene	<0.500	<0.500	<2.0	-
Acenaphthylene	<0.500	<0.500	<2.0	-
Anthracene	<0.500	<0.500	<2.0	-
Benzo(a)anthracene	<0.500	<0.500	<2.0	
Benzo(a)pyrene	<0.500	<0.500	<2.0	
Benzo(b) & Benzo(k)fluoranthene	<0.500	<0.500	<1.0	-
Benzo(g,h,i)perylene	<0.500	<0.500	<2.0	-
Chrysene	<0.500	<0.500	<1.0	-
Dibenzo(a,h)anthracene	<0.500	<0.500	<2.0	-
Fluoranthene	<0.500	<0.500	<2.0	-
Fluorene	<0.500	<0.500	<2.0	
Indeno(1,2,3-cd)pyrene	<0.500	<0.500	<2.0	-
Naphthalene	<0.500	<0.500	<2.0	-
Phenanthrene	<0.500	<0.500	<2.0	-
Pyrene	<0.500	<0.500	<2.0	-
BTEX				
Benzene	-	-	-	<5.0
Ethylbenzene	-	-	-	<5.0
Toluene	-	-	-	<5.0
meta- & para-Xylene	-	-	-	<10
ortho-Xylene	-	-	-	<5.0
Xylenes (Total)	-	-	-	<20
Petroleum Carbon Ranges				
C6 - C8	<5	<5	<20	<20
C9 - C16	<200	<200	<500	-
C17 - C35	<500	<500	<500	-

10.6.31 For the soil duplicate samples Duplicate A & Duplicate B (Duplicate samples of soil sample BH-ENV07 1.5m), there are no significant differences between the results of the duplicates and the original samples. Furthermore, the equipment blank and trip blank show no detected parameters and the laboratory QA/QC measures (laboratory duplicate, Method

Blank, Laboratory Control Spike and Matrix Spike) also show no exceedance of acceptance criteria. Thus there is not any contamination during sampling or laboratory procedure is excluded.

10.6.32 Given that all QA/QC analysis results are normal and there is no exceedance of RBRGs for all samples and duplicates. QA/QC procedures for sample collection and preparation are considered acceptable.

Conclusion

10.6.33 Since all potentially land contaminating facilities at the site are clearly identifiable and above ground, significant widespread land contamination is not anticipated. However, as the samples collected are not directly under the contamination hotspot, and the relocation of STSTW will only compete in 2027, further samples should be collected by that time to confirm the findings. In the event that new land contamination hotspots are identified in the future, based on today's preliminary findings any land contamination issues are unlikely to be insurmountable and could be effectively remediated to mitigate impacts to acceptable levels.

10.6.34 A total of 13 sampling locations close to those contamination hotspots but not affect the operation of the existing STSTW were drilled and a total of 35 soil samples (including 2 duplicate samples) and 9 groundwater samples were collected and analysed for SVOC and PCR respectively.

10.6.35 The analytical results are presented as a baseline for future reference against, however assessment against the locally adopted risk based screening levels (Urban residential land use RBRGs for soil and groundwater) indicated that no sample analyzed exceed the adopted RBRGs and no unacceptable risk are identified, potential land contamination is not expected. Soil remediation is therefore not required.

10.7 Ecology and Fisheries

Approach and Methodology

10.7.1 The ecological and fisheries baseline conditions of the Study Area and the subsequent impact assessment has been established using a desktop study approach. Potential ecological receptors that may be affected by the proposed project works have been identified based on the review of existing and available literature including technical reports, Government reports and aerial photography. Based on the survey findings of the reviewed literature, the likely direct, indirect, on-site, and off-site ecological impacts arising from the proposed development have been evaluated. Mitigation measures to avoid, minimize and compensate (if any) for any potential adverse impacts have been proposed.

10.7.2 For the purpose of this assessment, the development proposals are assumed to be land-based only therefore the establishment of the ecological baseline and subsequent consideration of potential impacts will focus on the area within the Study Area and its immediate surrounds.

Description of the Environment and Baseline Conditions

10.7.3 The existing STSTW is located on the coast at the mouth of the Shing Mun River where it enters Tolo Harbour. The site occurs within urban developed area, surrounded by residential buildings in the west and Sha Tin Racecourse in the south (refer to **Fig. No. /10.06**). While the adjacent coastal environs include the Shing Mun River to the east and Tolo Harbour to the north.

10.7.4 The coastal environment falls within Tolo Harbour and Channel WCZ. Tolo Harbour is a semi-enclosed water body, which has historically had poor water quality as evidenced by the very high incidence of red tides in the 1980s. However, the water quality of the WCZ has continued to improve since the implementation of the Tolo Harbour Action Plan in the mid-80s (EPD, 2011a). This has included water quality improvements to the Shing Mun River over the last decade, with a 90% compliance during the last monitoring period in 2011 (EPD, 2011b).

10.7.5 There is no Site of Special Scientific Interest (SSSI) within 500 m of the Study Area. The Tolo Harbour and Channel WCZ includes Tin Kok SSSI, Hoi Ha Wan SSSI, Sam Mun Tsai Egretry SSSI, Shuen Wan Egretry SSSI, and Kei Ling Ha Mangal SSSI (refer to **Table 10.11** and **Fig. No. /10.06**). These SSSIs occur at considerable distance from the site, with the closest occurring over 5 km to the east.

Table 10.11 Sites of Special Scientific Interest (SSSI) Located within Tolo Harbour and Channel Water Control Zone

Name of SSSI	Description	Distance to the STSTW (km)
Ting Kok SSSI	A typical example of mangrove habitat	6.7
Hoi Ha Wan SSSI	This site, being a sheltered bay that open to oceanic waters and not affected critically by pollution, provides a good environment for corals to flourish.	14.2
Sam Mun Tsai Egretry SSSI	This egretry provides an important habitat for resting and breeding of different kinds of herons.	5.1
Shuen Wan Egretry SSSI	This egretry provides an important habitat for resting and breeding of different kinds of herons.	6.1
Kei Ling Ha Mangal SSSI	This site includes a mangal community which in of the largest stands of mangroves in Hong Kong. All mangroves and their associated plants recorded in Hong Kong can be found at this site. The mud flat	5.8

Name of SSSI	Description	Distance to the STSTW (km)
	outside the mangal supports numerous invertebrates which in turn provide food for larger animals such as birds and fish.	

10.7.6 There is no marine fish culture zone within 500m from the Study Area. Yim Tin Tsai and Yim Tin Tsai (East), and Yung Shue Au and Lo Fu Wat Fish Culture Zones (FCZ) also occur within Tolo Harbour and Channel WCZ. The closest, Yim Tin Tsai and Yim Tin Tsai (East), are approximately 5 km distance from the Study Area (refer to **Fig. No. /10.06**).

10.7.7 According to the 2006 Port Survey by the Agriculture, Fisheries and Conservation Department (AFCD), Tolo Harbour supports low fisheries production, with production value ranging from $500 – $5,000/ha. Fisheries production value in terms of weight (kg/ha) the inner Tolo Harbour (waters in closest proximity to the assessment area) is low (100 – 200 kg/ha), moving towards the Tolo Channel, weight production value increases slightly to 200 – 400 kg/ha. This area supports mostly Rabbitfish and Croaker production when compared to other fisheries resources. The fishing operations in Tolo Harbour are low to moderate (50 – 400 vessels), dominated by vessels less than 15 m. Sampans were the dominant fishing vessels within the Study Area.

10.7.8 Tolo Harbour is not considered as a fish spawning ground or nursery area for commercial fish species. Although there were reproductive individuals of Ponyfish collected in Tolo Harbour, this species does not appear to have a specific spawning ground as reproductive individuals were collected across a wide area from Tolo Harbour and northeastern waters, to the Junk Bay and as far as west South Lantau (ERM, 1998).

10.7.9 Four coral species have been identified within Tolo Harbour and Channel WCZ in previous studies, namely *Oulastrea crispata*, *Cyphastrea serailia*, *Psammocora superficialis,* and *Antipathes* sp. The overall coral coverage at all recorded sites was low, with coverage between 1-5%. There is no known coral community within 500 m from the Study Area. The closest coral community to the Study Area (approximately 3.6 km to the north-east) occurs just off the western coast of Whitehead Peninsula, where one black coral colony *Antipathes* sp. was identified (TDD, 2002).

10.7.10 The benthic community within Tolo Harbour and Channel WCZ is represented by low species richness, abundance and biomass. Grab samples in inner Tolo Harbour, just south of the Tai Po Industrial Estate, were dominated by polychaetes (HKCGCL, 2003), while organisms from the Phyla Annelida and Mollusca were dominant in Shuen Wan Hoi (CEDD, 2007). Additionally, grab samples were also obtained in a territory-wide study on marine benthic communities in Hong Kong during which, low species richness (4 – 23 species per 0.5 m^2) and abundance (26 – 106 individuals per m^2) were recorded at sampling stations within the Tolo Harbour and Channel WCZ (AFCD, 2002).

10.7.11 Intertidal communities of various characteristics such as sandy shore, mangroves, mudflats and artificial seawall, occur within Tolo Harbour and support only common intertidal species. Yet the entire shoreline within 500 m from the Study Area is either man-made sloped or vertical seawall. Artificial seawalls at the Tai Po Waterfront Park (south of the Tai Po Industrial Estate) supported common intertidal species such as periwinkles, gastropods and barnacles (HKCGCL, 2003). The mudflats at Shuen Wan were dominated by snails and oysters (DSD, 2007). Extending further east, near Tai Mei Tuk, sandy shore and artificial seawall were identified (CEDD, 2007). Relatively undisturbed mangroves were found at Ting Kok SSSI (See **Fig. No. /10.06**).

10.7.12 Apart from a Seagrass community recorded at Starfish Bay and Hoi Ha (AFCD, 2011b) 3.9 km and 12.8km to the east of the Study Area respectively. No other marine-related sites or

species of conservation interest such as marine mammals or Horseshoe Crabs were recorded within the Tolo Harbour and Channel WCZ (Hung, 2012; AFCD, 2006a).

10.7.13 Penfold Park egretry occurs 750m south-west of the Study Area. The egretry occurs within the Penfold Park inside the Sha Tin Racecourse and is monitored as part of the annual territory-wide egretry survey by Hong Kong Bird Watching Society (Anon, 2013). The site is both a winter night roosting and summer breeding site. It supports Great Egret *(Ardea modesta)*, Little Egret *(Egretta garzetta)*, Black-crowned Night Heron *(Nycticorax nycticorax),* and Chinese Pond Heron *(Ardeola bacchus)*. During the 2012-2013 breeding season, 29 nests of Great Egret, 10 nests of Little Egret,15 nests of Black-crowned Night Heron and three nests of Chinese Pond Heron were recorded in Banyan trees *(Ficus microcarpa)* within the site (Anon, 2013).

10.7.14 The Shing Mun River is a modified watercourse flowing from the Tai Wai area, through the Sha Tin town centre to the Tolo Harbour. Along its course it flows through high-rise residential, commercial and industrial buildings and numerous villages. Historically, it was heavily polluted; however, due to river improvement works in 2002, the water quality has improved in recent years (EPD, 2011b). Similar to other watercourses in highly disturbed environments with historic water quality issues, the Shing Mun River is likely to provide habitats of low value and support only common faunal species. However, the close proximity of the Penfold Park egretry to the river provides an opportunity for the river to be utilized by ardeids as a commuting and/or foraging habitat.

10.7.15 The Study Area is dominated by sewage treatment facilities and areas of hard-standing. A programme of "greening" has been implemented within the site including tree and shrub planting, green roofs and vertical planting. Whilst these features provide some simple habitats and connectivity within the site, they are heavily disturbed from the operational activities of the facility and therefore only likely to support locally common generalists such as common bird species.

Impact Assessment

Construction Phase

10.7.16 As the development proposals will be predominantly land-based and the sensitive aquatic and marine receptors identified occur at distance from the Study Area, potential impacts resulting from the construction phase on these features are likely to be minor and insignificant.

10.7.17 The five SSSIs located in Tolo Harbour and Channel WCZ all occur greater than 5 km from the STSTW site. Three of the SSSIs, recorded within the Tolo Harbour and Channel WCZ are egretries. Impacts to egretries are usually associated with disturbance or loss of feeding grounds (Carey *et al*., 2001). Given the distance between the egretries and the Study Area, disturbance impacts (e.g. visual, noise, air quality during the construction or operational phases) and/or loss of feeding grounds are unlikely. Ting Kok and Kei Ling Ha Mangal SSSIs are both designated for their mangal communities. Given the distance between these SSSIs and the Project Site boundary, direct loss of habitats will not occur and issues associated with sedimentation/water quality are unlikely.

10.7.18 The closest coral communities occur 3.6 km from the Study Area, while the closest FCZs are approximately 5km from the Study Area. In addition, the closest seagrass community occurs 3.9 km from the Study Area. Given the distance from the Project Site and the land-based, temporary nature of the proposed works, it is unlikely that changes to water quality would impact the coral or seagrass communities or FCZs. Significant impacts on capture fisheries are also not anticipated due to the low production value, the low to moderate levels of fishing operations within the area and the temporary nature of the construction works.

10.7.19 Consideration should be given to any potential impacts on ardeids associated with the Penfold Park egretry, which may use the river for foraging/commuting. A detailed assessment of this option would be required at the next stage of the Study; however, mitigation measures for consideration are provided in **Section 10.7.25** to minimize impacts where required.

10.7.20 Construction of the proposed development will not result in direct impacts on the Penfold Park Egretry, which is located 750 m to the south. The Study Area is not known to support any ardeid feeding grounds; however, the environment along the river and coastal edges may provide foraging habitat. Use of these areas should be checked through survey and appropriate mitigation considered if the area is found to be important for ardeids. Indirect impacts such as noise, visual and dust disturbance during construction are unlikely to be significant given the distance between the sites. In addition, the local environment of the park and the racecourse infrastructure would contribute toward providing a buffer between the egretry and the Study Area. However, the implementation of standard mitigation practices would further minimize the potential for impacts. This is discussed in **Section 10.7.24**.

10.7.21 Decommission of the STSTW and construction of the proposed development is likely to result in the loss of terrestrial habitats of low ecological value, namely landscape planting of developed area habitats within the existing STSTW site. As these habitats are only likely to support locally common fauna species, significant impacts are unlikely to result.

Operation Phase

10.7.22 If the development proposals include any utilization of the Shing Mun River for recreational or other purposes, consideration should be given to how the river environment contributes to the habitat resources of the egretry (e.g. for foraging or commuting) to avoid any significant impacts on these uses and hence potentially the egretry. Specific survey may be required to establish this and evaluate the potential impacts of the development proposals.

10.7.23 In addition, artificial lighting (glare) has been shown to affect some wildlife and can result in a reduction in the density of a faunal population in an area through disorientation from, and attraction to artificial light, and effects on the light-sensitive cycles of a species. This can affect migration, foraging/predation and breeding success of species. New large-scale developments can contribute to the overall glare impact of an area.

Mitigation Measures

Construction Phase

10.7.24 The implementation of standard mitigation practices during the land-based works would further minimize the potential for impacts on the nearby egretry. This could include: the use of quiet excavation methods, quiet construction plants and temporary noise barriers, such as hoarding, to minimizing noise and hoarding would also avoid visual impacts. In addition, dust impacts could be minimized through regular watering, complete coverage of dusty material storage piles, and the use of minimum practical height for dropping excavated material

10.7.25 Although the Shing Mun River is likely to provide only low value habitat, standard, good site practices in relation to drainage and water quality issues should be implemented during the construction phase and considered during the development design and operational phases. The potential impact could be minimized by implementing appropriate water quality mitigation measures to control site runoff and wastewater generated from construction activities. If the option to upgrade the existing utility bridge is taken forward, these mitigation measures would also apply to minimize impacts to the aquatic and marine environment. In addition potential impacts on ardeids utilizing the river channel could be

minimized by: the timing of the works to avoid sensitive periods and avoiding the creation of barriers or structures which may result in bird collision/strike.

10.7.26 The retention of mature trees and provision of adequate protection of the tree canopy and root zone during the construction phase, where possible, is recommended. Opportunities to include native species or species of wildlife benefit into the proposed development landscape master plan should be considered as this would provide biodiversity enhancement, particularly where the planting could provide habitat connections and stepping stones throughout the development. This can be achieved through landscape planting, green roofs, vertical greening and community allotments.

Operation Phase

10.7.27 Proposals for utilizing the river for recreation or other activities should avoid any disturbance impacts to ardeids using the river channel for foraging, etc., particularly during the sensitive breeding season. Use of the river by ardeids should be checked through survey and appropriate mitigation considered if the area is found to be important for ardeids.

10.7.28 In order to minimize the development's contribution to glare impact during the operation phase, consideration could be given to the location and type of lighting included within the development masterplan. A balance between lighting for safety and avoiding excessive lighting of residences and adjacent habitats can be achieved through consideration of the following: the type of lamp (light source) used; use of directional lighting to avoid light spill; height of the lighting column can affect the amount/extent of glare; and lighting levels..

Conclusion

10.7.29 The ecological and fisheries baseline conditions of the Study Area and the subsequent impact assessment has been established using a desktop study approach. The existing STSTW is located on the coast at the mouth of the Shing Mun River where it enters Tolo Harbour. As the development proposals will be predominantly land-based and the sensitive aquatic and marine receptors identified occur at distance from the Study Area (>500 m), potential impacts resulting from the construction phase on these features are likely to be minor and insignificant.

10.7.30 Construction of the proposed development will not result in direct impacts on the Penfold Park Egretry, which occurs 750 m south-west of the Study Area. The Study Area and its vicinity are not known to support any ardeid feeding grounds; however, the environment along the river and coastal edges may provide foraging habitat. Use of these areas should be checked through survey and appropriate mitigation considered if the area is found to be important for ardeids. Indirect impacts such as noise, visual and dust disturbance during construction are unlikely to be significant given the distance between the sites. However, the implementation of standard mitigation practices would further minimize the potential for impacts. How the ardeids use the river should also inform proposals for recreation and other uses along the river.

10.7.31 In order to minimize impacts to the aquatic and marine environment resulting from any upgrade of the existing utility bridge, the following mitigation measures would be considered in next stage of the Study: avoidance of construction during wet season, the use of cofferdam, the implementation of silt curtains, etc. Survey to identify how ardeids are utilizing the river channel would be used to consider mitigation requirements during the construction of the bridge, as appropriate.

10.7.32 Decommission of the STSTW and construction of the proposed development is likely to result in the loss of terrestrial habitats of low ecological value, namely landscape planting within the existing site. As these habitats are only likely to support locally common fauna species, significant impacts are unlikely to result. The retention of mature trees where possible, and the inclusion of native species or species of wildlife benefit into the proposed

development landscape master plan should be considered as this would provide biodiversity enhancement. In addition, to minimize the development's contribution to glare impact during the operation phase, consideration could be given to the location and type of lighting included within the development masterplan.

10.8 Cultural Heritage

Identification of Potential Cultural Heritage Sensitive Items

10.8.1 Potential impacts on the existing cultural heritage resources will be identified based on the following considerations:

- Direct impact to the structure of the cultural heritage resource, if any (e.g. demolition, disassembling, reinforcing or repairing works);
- Direct alteration to the visual cultural landscape and historical setting of the cultural heritage resource, if any; and
- Indirect impacts to the physical structure of the cultural heritage resource, if any (e.g. vibration or change of ground water level due to development works).

Approach and Methodology

10.8.2 The feasibility study will be consisted of desktop study field evaluation and impact assessment and recommendation, which aims to identify cultural heritage resources at the existing STSTW and its proximity (**Fig. No. /10.07**), so that corresponding mitigation measures can be recommended and implemented to minimize potential impacts.

10.8.3 Desktop study has been carried out to identify any cultural heritage within the study area. The research focused on previous EIA reports, journal articles and papers, historical photos and drawings, historical map, aerial photos, and the most up-to-date List of Historic Buildings in Building Assessment and Site of Archaeological Interest List established by the Antiquities and Monument Office.

10.8.4 Based on results of desktop study and field evaluation, potential impacts arises from the change of land use at the existing STSTW have been assessed. The assessment follows relevant legislations and guidelines.

Baseline Condition

10.8.5 Within the existing STSTW, no site of archaeological interest, declared monument, government historic site or graded historic building is identified. However, one new item of historic buildings[1], with assessment not yet conferred, barely touches the 500m study area, namely:

- The early campus of Chung Chi College, The Chinese University of Hong Kong, Sha Tin, N.T.

10.8.6 The existing STSTW was commissioned in 1982 on the reclaimed lands created during the development of Sha Tin New Town in early 1980s. Therefore, possibility to discover new archaeological resources within the existing STSTW is nil.

10.8.7 The nearby Sha Tin Racecourse was also built on reclaimed lands in 1978, which also contains no cultural heritage resource.

[1] AMO 2013 *List of New Items and New Categories with Assessment Result (as at 17 April 2013)*. Antiquities Advisory Board website: http://www.aab.gov.hk/form/AAB-SM-chi.pdf accessed 7 Aprile 2013)

Field Evaluation

10.8.8 The early campus of the Chung Chi College touches the study area at the 500m away from this Project.

Impact Assessment

10.8.9 Since no cultural heritage resource was detected within the 500m Study Area, no impact is anticipated.

Mitigation Measure

10.8.10 While the early campus of Chung Chi College barely situates within the study area, due to the vast distance in between it and the Project area, no mitigation measure for cultural heritage is recommended.

Conclusion

10.8.11 Desktop study and field evaluation suggested that cultural heritage resource would be impacted within the existing STSTW nor within the 500m Study Area. In the light of this, development at the existing STSTW imposes no impact on the cultural heritage. Thus no mitigation measure is recommended.

11 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

11.1 Introduction

11.1.1 This section presents the landscape and visual impact assessment of the Proposed "Development Scenario" and the "Enhanced Development Scenario".

11.2 Environmental Legislation, Standards and Guidelines

11.2.1 The following legislation, standards and guidelines are applicable to landscape and visual impact assessment associated with the construction and operation of the Project:

- Environmental Impact Assessment Ordinance (Cap.499.S.16) (EIAO) and the EIAO-TM, particularly Annexes 10 and 18;
- EIAO Guidance Note 8/2010;
- Town Planning Ordinance (Cap 131);
- Hong Kong Planning Standards and Guidelines;
- ETWB TC No. 25/92 - Allocation of Space for Urban Street Trees;
- ETWB TC No. 25/93 – Control of Visual Impact of Slopes;
- ETWB TC No. 17/2000 – Improvement to the Appearance of slopes in connection with ET WBTC 25/93;
- ETWB TC No. 7/2002 – Tree Planting in Public Works;
- ETWB No. 36/ 2004 - Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS);
- ETWB TC(W) No. 2/2004 - Maintenance of Vegetation and Hard Landscape Features;
- ETWB TC(W) No. 29/2004 - Registration of Old and Valuable Trees, and Guidelines for their Preservation;
- ETWB TC(W) No. 3/2006 - Tree Preservation;
- DEVB TC(W) No. 2/2012 - Allocation of Space for Quality Greening on Roads;
- DEVB TC(W) No. 2/2013 - Greening on Footbridges and Flyovers; and
- Study on Landscape Value Mapping of Hong Kong.

11.3 Approaches for Landscape and Visual Impact Assessment

11.3.1 Landscape and visual impact assessment are assessed in accordance with the criteria and guidelines as stated in Annexes 10 and 18 of the EIAO-TM and the EIAO Guidance Note No.8/2010 on "Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance".

11.3.2 The assessment areas for landscape impact shall include all areas within a 500m distance from the site boundary of the Study Area. The assessment areas for the visual impact assessment shall be defined by the visual envelope of the Study Area.

11.3.3 The existing landscape resources and character within the assessment area are described, appraised, analyzed and evaluated. A system is derived for judging landscape and visual impact significance. The sensitivity of the landscape framework and its ability to accommodate change are particularly focused on. The degree of compatibility of the Project with the existing and planned landscape setting is identified. The landscape impact assessment evaluates the potential landscape impact so as to illustrate the significance of such impacts arising from the proposed Project

11.3.4 The merit of preservation in total, in parts or total destruction of existing landscape and the establishment of a new landscape character shall be evaluated. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of the existing landscape and visual quality. Mitigation measures to minimize the adverse effects identified above shall be recommended. The mitigation measures shall also include the preservation of vegetation, transplanting of trees of good amenity value, provision of screen planting, compensatory

planting, provisioning of amenity areas and open spaces, integration of proposed landscape frameworks to existing landscape context etc.

11.3.5 Annotated illustration such as coloured plans and section/elevation, oblique aerial photographs, photographs taken at vantage points and computer-generated photomontage shall be adopted where appropriate to illustrate the significance of the landscape and visual impacts of the proposed development at Study Area.

11.4 Landscape Impact Assessment Methodology

11.4.1 The landscape impacts would be assessed according to the following procedures.

- Identification of the baseline landscape resources and landscape character areas found within the Study Area
- Assessment of the degree of sensitivity of the landscape resources and landscape character areas
- Identification of potential sources of landscape impacts
- Identification of the magnitude of landscape impacts
- Recommendation of potential landscape mitigation measures
- Prediction of the significance of landscape impacts before and after the implementation of the mitigation measures
- Prediction of acceptability of impacts

11.5 Visual Impact Assessment Methodology

11.5.1 The assessment of visual impacts has involved the following procedures.

- Identification of the Visual Envelope and associated VSRs within the Visual Envelope
- Assessment of the degree of sensitivity of the VSRs
- Identification of relative numbers of individuals of the VSRs
- Identification of potential sources of visual impacts
- Assessment of the potential magnitude of visual change
- Recommendation of potential visual mitigation measures
- Prediction of the significance of visual impacts before and after the implementation of the mitigation measures
- Prediction of Acceptability of Impacts

11.6 Baseline Findings

Landscape Resources

11.6.1 Based on the desktop study and site visits, the following key landscape resources are identified within the 500m landscape impact study boundary are mapped in **Fig. No. / 11.01**.

11.6.2 Based on desktop study and site visits, the following landscape resources are identified within the landscape impact study boundary: -

- LR-01a Trees and Shrubs Planting, Vertical Greening and Green Roof within the Existing STSTW Site
- LR-01b Trees and Shrubs Planting within Marine Police Outer Waters District Headquarters and Marine Police North Police Station
- LR-02 Waterbodies in Shing Mun River and Sha Tin Hoi
- LR-03 Penfold Garden
- LR-04a Ma On Shan Promenade
- LR-04b Shing Mun River Promenade

- LR-04c Promenade along Tolo Highways
- LR-05 Landscape Areas within Kam Tai Court
- LR-06a Roadside Planting Areas along Tolo Highway
- LR-06b Roadside Planting Areas along Ma On Shan Road
- LR-07a Woodland on slopes of Kau To Shan
- LR-07b Woodland on slopes of Ma On Shan

11.6.3 Among the resources identified, only LR-01a would be potentially affected by the Proposed "Development Scenario" and the "Enhanced Development Scenario". LR-01a covers extensive at grade trees and shrubs planting, vertical greening and green roof within the Existing STSTW Site. Details of the landscape elements found within this resource are shown in **Fig. Nos. /11.02** to **11.05**. Trees and shrubs are found in the landscape areas between access road and buildings/structures. Tree founds are all common landscape species. There is no OVT or endangered and protected species identified within this resource. Key species found include *Bauhinia variegata*, *Syzygium jambos*, *Tabebuia pentaphylla*, *Michelia alba*, *Plumeria acutifolia*, *Liquidambar formosana*, *Terminalia catappa*, *Magnolia denudate* and *Bixa orellana*. Most of these trees are recently planted in 2011. There are 11 nos. of large trees (10 nos. *Ficus elastica* and 1 no. *Ficus microcarpa*) with outstanding tree form and amenity value. They are recommended to be preserved in situ where possible. Green roofs are found on a number of utility buildings with common landscape species. Vertical greening are found on the facade of existing sludge storage tank. As a whole, this landscape resource is common and of local importance. The quality of these resources is high. Most of the vegetation are recently established and considered as young. The ability to accommodate change is high and the sensitivity of these resources is considered as medium.

11.6.4 The Proposed Development would be confined to within the boundary of STSTW Site. Apart from LR-01a, it is anticipated that other landscape resources within the 500m of the proposed development would not be affected by the Proposed "Development Scenario" and "Enhanced Development Scenario".

Landscape Characters Areas

11.6.5 Landscape character areas have been identified within the 500m Landscape Impact Study Boundary making reference to the Study on Landscape Value Mapping of Hong Kong.

11.6.6 Based on desktop study and site visits, landscape characters identified within the study boundary are mapped in **Fig. No. /11.06**. They are

- LCA-01 Sha Tin Sewage Treatment Works Industrial LCA
- LCA-02 Sha Tin Hoi and Shing Mun River Inshore Water LCA
- LCA-03 Ma On Shan Waterfront Residential LCA
- LCA-04 Ma On Shan Transportation Corridor LCA
- LCA-05 Ah Kung Kok Hillside LCA
- LCA-06 Shatin Racecourse LCA
- LCA-07 Tolo Highway Transportation Corridor LCA
- LCA-08 Kau To Shan Residential Urban Fringe LCA

11.6.7 Among the LCAs identified, only LCA-01 would be potentially affected by the Proposed Development. The STSTW Site falls within the boundary of Sha Tin Sewage Treatment Works Industrial LCA (LCA-01). This LCA comprise of low-lying reclaimed land adjoining the Shing Mun River Channel. It is primarily characterized by an extensive area of sewage treatment features including tanks, associated plants and buildings. Trees, shrubs, vertical greening and roof greening have been extensively planted to the STSTW Site. Most of the greening works were implemented in 2011. The maturity of the vegetation found on site is considered as young. This LCA has high ability to accommodate change. The overall sensitivity of this LCA is therefore considered as low.

11.6.8 Apart from LCA-01, it is anticipated that other LCAs within the 500m of the proposed development would not be affected by the Proposed "Development Scenario" and "Enhanced Development Scenario".

Visual Envelope

11.6.9 The prominent lowland location of the Study Area gives rise to a large visual envelope which extends beyond the immediate vicinity in several directions. The visual envelope of the Project is embraced by the ridgeline of Ma On Shan to the East, the ridgeline of Kau To Shan to the West, ridgeline of Lion Rock to the South and Tolo Harbour at the North.

Visual Sensitive Receivers (VSRs)

11.6.10 There are four types of Key VSR Types identified in the Visual Envelope of the Study Area. They include Residential VSRs who are living in the adjacent high rise residential developments to the East and the South of the Site and the low rise private housing on Kau To Shan, Institutional VSRs at work or at study including temporarily occupants in hotel or hospital etc., Recreational VSRs at play in hiking trails, open spaces, promenades and water bodies and Travelling VSRs travelling on a public thoroughfare. Visual Envelope and key Sensitive Receivers are shown in **Fig. No. /11.07**.

11.6.11 The sensitivity of the Key VSRs Groups is assessed in **Table 11.1**.

Table 11.1 Sensitivity of Key VSRs Groups

VSR ID.	Visually Sensitive Receiver (VSR) Groups	Sensitivity
	Residential VSRs	
R-01	Residents in Ma On Shan including Kam Tai Court, Mountain Shore, Sausalito, La Costa, Ocean View, Oceanaire, Baycrest, Vista Paradiso Kam Fung Court etc.	High
R-02	Chevalier Garden	High
R-03	Residents in Pictorial Garden, Garden Vista, Ravana Garden etc	High
R-04	Residents in City One and Belair Garden	High
R-05	Residents in Sha Kok Estate, Yue Shing Court and Jat Ming Chuen	High
R-06	Residents in The River Park (under Construction)	High
R-07	Residents in Wo Che Estate	High
R-08	Residents in Fo Tan including Jubilee Garden and The Palazzo	High
R-09	Residents in Royal Ascot,	High
R-10	Low Rise Private Residential Developments at Kau To Shan including Windsor Park, Kam On Gardens, Greenland Villas, Yucca Villa, Pine Villa, Jade Villa, Windsor Heights, Evergreen Gardens, Double Haven House, Forest Hill, Grenery Villas and Shatin Knoll, etc.	High
R-11	Potential Residential Development at Lai Ping Road	High
R-12	Villages to the South of Tate's Cairn Highways	High
	Institutional VSRs	
I-01	Occupants in Tak Sun Secondary School	Medium
I-02	Occupants in Tsung Tsin Secondary School	Medium
I-03	Occupants in Sha Tin Hospital, Bradbury Hospice and Cheshire	Medium

VSR ID.	Visually Sensitive Receiver (VSR) Groups	Sensitivity
	Home	
I-04	Occupants in Hyatt Regency Hong Kong	Medium
I-05	Occupants in Chinese University of Hong Kong	Medium
I-06	Occupants in Hong Kong Science Park	Medium
	Recreational VSRs	
O-01	Recreational Users in Ma On Shan Promenade	High
O-02	Recreational Users including cyclists along cycle track in the promenades at the both sides of the Shing Mun River Channel and	High
O-03	Water based recreational users in the watebodies from Tolo Harbour to Shing Mun River Channel	High
O-04	Recreational Users in Sha Tin Racecourse and Penfold Park	High
O-05	Recreational Users Pak Shek Kok Promenade	High
O-06	Hikers/Visitors on Hiking Trails	High
	Travelling VSRs	
T-01	Travelers along Tolo Highways	Low
T-02	Travelers along Tate's Cairn Highways	Low
T-03	Passengers on MTR East Rail Line	Low
T-04	Travelers along Ma On Shan Road	Low

11.7 Landscape Impact Assessment

Potential Sources of Landscape Impact

11.7.1 The potential sources of landscape impact due to the Proposed "Development Scenario" or the "Enhanced Development Scenario" would include: -

- Removal of existing landscape amenity areas, including existing vegetation, trees and shrub planting, green roof and vertical greening within the STSTW; and
- Change of landscape character permanently.

Magnitude and Significance of Landscape Impacts

11.7.2 Based on the Proposed "Development Scenario" or the "Enhanced Development Scenario", it is predicted that most of the existing amenity areas including existing vegetation, trees and shrub planting, green roof and vertical greening in LR-01a would be affected and removed. The magnitude of change is considered large. The sensitivity of LR-01a is considered as medium. The significance of unmitigated impact on this LR is considered as moderate.

11.7.3 Apart from LR-01a, there would not be any significant impact on other landscape resources identified within the study boundary due to the Proposed "Development Scenario" or the "Enhanced Development Scenario".

11.7.4 Under the Proposed "Development Scenario" or the "Enhanced Development Scenario", it is anticipated that the existing STSTW site will be undergone significant transformation from a low-rise industrial landscape with low sensitivity to a new waterfront high rise

residential orientated development landscape. The magnitude of change is considered as large. The sensitivity of LCA-01 is considered as low. The resultant significance of unmitigated impact on LCA-01 is considered as moderate.

11.7.5 Apart from LCA-01, there would not be any significant impact on other landscape character areas identified within the study boundary due to the Proposed "Development Scenario" or the "Enhanced Development Scenario".

11.8 Visual Impact Assessment

Potential Sources of Visual Impact

11.8.1 The potential sources of visual impact due to the Proposed "Development Scenario" or the "Enhanced Development Scenario" would include: -

- Removal of existing landscape amenity areas, including existing vegetation, trees and shrub planting, green roof and vertical greening within the STSTW;
- Change of visual context of the site permanently; and
- Potential blockage of distance view of certain VSRs Groups.

Recommendation on Photomontage Viewpoints

11.8.2 Representative viewpoints are recommended to illustrate the potential visual impact on key VSRs Groups. The criteria for selection of representative viewpoints for photomontages include: -

- Viewpoints which cover the development viewed from major public viewpoints represent key VSR groups who would be potentially affected by the development
- Viewpoints shall be able to represent the worst case scenarios from different directions and angles
- Viewpoints shall demonstrate the compatibility of the development to the adjacent landscape and visual context.

11.8.3 Based on the location of the proposed development, proposed viewpoints for preparation of photomontages from key representative VSRs are mapped in **Fig. No. /11.07**. They are described as follow:

- Viewpoint V1 from Ma On Shan Promenade near Kam Tai Court which represents the medium distant views (approx. 500m from the proposed development) of the key VSRs from the northeast including I-01, O-01 at close distance and R-01 (Kam Tai Court).
- Viewpoint V2 from Ma On Shan Promenade toward Kau To Shan which represents the views (at approx. 200m from the proposed development) of the VSRs along the Ma On Shan Promenade and the key VSRs from the southeast including R-02, R-12, O-01, O-03, I-02, I-03, T-02 and T-04.
- Viewpoint V3 from On King Street Park which represents the distant views (at approx. 1000m from the proposed development) of the key VSRs at the southeast of Shing Mun River including R-03, R-04, R-05 and R-06.
- Viewpoint V4 from Penfold Park which represents the views (at approx. 600m from the proposed development) of the VSRs in the Penfold Park and the key VSRs at the northwest of Shing Mun River including R-07, R-08 and R-09.
- Viewpoint V5 from Lai Ping Road of Kau To Shan at around 60mPD which represents the views (at approx. 350m from the proposed development) of the key elevated VSRs from the northwest including R-10, R-11, I-04, I-05, T-01 and T-03.

- Viewpoint V6 from Pak Shek Kok Promenade which represents the views (at approx. 1300m from the proposed development) of the key VSRs from Pak Shek Kok (O-05) and the Hong Kong Science Park (I-06).
- Viewpoint V7 from Ma On Shan Promenade near Kam Fung Court which represents the distant views (at approx. 1800m from the proposed development) of the VSRs Groups in Ma On Shan.
- Viewpoint V8 from Amah Rock (Hung Mui Kuk Nature Trail) at approximate 240mPD which represents the distant elevated strategic views (at approx. 5800m from the proposed development) from the VSRs from Amah Rock and the hikers in Shatin (O-06).

11.8.4 Photomontages showing the comparison with the existing view and the view with the Proposed "Development Scenario" and the "Enhanced Development Scenario" are illustrated in **Fig. Nos. 60269233/RPR/11.09** to **11.16**.

Magnitude and Significance of Visual Impacts

11.8.5 Under the Proposed "Development Scenario" or the "Enhanced Development Scenario", it is anticipated that the existing STSTW site will be undergone significant transformation from a visual character with open and low rise development to a high rise residential and associated development. It is considered as an urbanization extension from the Shatin Town Centre and Ma On Shan. The compatibility of the Project with the surrounding landscape is considered as medium. The scale of development is large. The duration of impact is long and the change is irreversible. There are potential blockage of views on VSRs who are close to the Development. The overall magnitude of change due to the Proposed "Development Scenario" or the "Enhanced Development Scenario" is considered as large on VSRs who are close to the Development and medium on VSRs who view the Development from a distance.

11.8.6 There would be large magnitude of change on VSRs who view the development at a short distant as illustrated in Photomontages V2 and V5. The concerned VSRs in V2 include R-02, R-12, O-01, O-03, I-02, I-03, T-02. Their distant view to Kau To Shan will be blocked by the Proposed Development. The concerned VSRs in V5 include R-10, R-11, I-04, I-05, T-01 and T-03. Their distant view from these VSRs to Buffalo Hill will be blocked by the Proposed Development. The sensitivity of these VSRs varies from high to low. It is predicted that the significance of change on these VSRs would be in a range from significant to moderate.

11.8.7 There would be medium magnitude of change on VSRs who view the development at a medium distant as illustrated in Photomontages V1, V3, V4, V6 and V7 due to the significant change in visual context from a low rise industrial development to a high rise residential development. The concerned VSRs include R-01, I-01 and O-01 in V1, R-03, R-03, R-04, R-05 and R-06 in V3, R-07, R-08 and R-09 in V4, O-05, I-06 in V6 and VSRs R-01 in Ma On Shan. The sensitivity of these VSRs varies from high to low. It is predicted that the significance of change on these VSRs would be in a range from significant to moderate.

11.8.8 There would be medium magnitude of change on VSRs who view the development at a long distant as illustrated in Photomontage V8 due to the localized change in development context in the field of view. The concerned VSRs are the hikers in strategic viewpoints in Shatin. The sensitivity of these VSRs is high. It is predicted that the significance of change on these VSRs would be moderate.

11.8.9 The "Enhanced Development Scenario" is the same as the Proposed "Development Scenario" except a waterfront boutique Hotel is proposed at the site of the existing salt water pumping station. As illustrated in the photomontages, it is predicted that there would not be any significant change in the findings of visual impact assessment in both scenarios.

11.9 Improvement and Mitigation Measures

11.9.1 It is anticipated that there would be significant transformation of landscape and visual character and condition from a low rise industrial site to a mix of high rise residential development. In order to alleviate some of the adverse effect of the transformation, a series of landscape and visual mitigation measures are recommended to be incorporated in the layout of the Proposed "Development Scenario" or the "Enhanced Development Scenario" at the planning and design stage. These mitigation measures are illustrated **Fig. /11.08** and discussed below.

Creation of New Landscape Framework

11.9.2 A series of new landscape system that create an interconnected series of landscape elements to accommodate a number of leisure, recreation and civic activities shall be proposed in the development layout. These landscape elements include plaza, public open spaces, private landscape gardens, streetscape, green connectors and landscape corridors. This new landscape system shall be well integrated within the existing landscape framework of the area. The new landscape elements would provide space for the compensation for the loss of existing greenery, including trees, shrubs vertical green and green roof system within the Existing STSTW Site.

Creation of Visual Connection and Breezeways

11.9.3 Potential visual impact and obstruction resulting from an introduction of a mix of high and low rise development on a formerly flat waterfront area become unavoidable. In order to reduce the effect of these may cause, it is recommended that regional view corridor, local view corridors, vantage points and breezeways shall be maintained and reinforced.

Control of Development Heights and Massing

11.9.4 Development Heights and Massing within the Proposed Development shall be designed to create and define the spatial character of the Site. Building height restriction is intended to ensure a controlled skyline profile across the Site when viewed from prominent locations within and around the Site. Wherever possible, buildings and built groups are arranged to maximize outward views towards the Tolo Harbour and Shing Mun River. Building deployment and massing control shall maximize the overall permeability of the area, which shall also act to increase ventilation, allow sunlight penetration and preserve views.

Visual Compatibility of the Proposed Development

11.9.5 The Proposed Development shall be visually compatible with the adjacent landscape setting. The overall settings of the Proposed Development, including building layouts and forms, materials, finishing (e.g. colour theme, pattern, texture), vertical greening, roof greening, shall be carefully designed and effectuated to match the adjoining environment.

Preservation of Existing Water Bodies

11.9.6 The existing coastal line shall be preserved to minimize any potential adverse impact on the existing water bodies of Tolo Harbour and Shing Mun River.

Aesthetic Design of Roads and Streetscapes within the Proposed Development

11.9.7 Internal roads and streetscapes shall be carefully planned and designed. Pleasant pedestrian environment with sympathetic landscape treatments for road networks within the site shall be provided. Roadside tree planting shall be provided for all local road where possible and practicable.

Preservation of Existing Trees

11.9.8 Based on the proposed development, most of the existing trees found within the STSTW Site would be unavoidably affected. There are 11 nos. of large trees (10 nos. *Ficus elastica* and 1 no. *Ficus microcarpa*) with outstanding tree form and amenity value identified. They are recommended to be retained and preserved in situ where possible. Detailed tree survey, preservation and removal application shall be carried in accordance with in accordance with ET WBTC (W) No. 3/2006 in the Investigation Stage.

Transplanting of High Amenity Value Trees

11.9.9 Trees unavoidably affected by the works shall be transplanted where practical. Trees of high amenity value and survival rate after tree transplanting to be affected by the Proposed Development shall be transplanted where possible. Detailed transplanting proposal will be submitted to seek agreement from relevant authorities in accordance with ET WBTC (W) No. 3/2006 in the Investigation Stage.

Provision of Compensatory Planting

11.9.10 It is anticipated most of the existing trees found within the Existing STSTW Site would be affected by the Proposed Development. New public open spaces, private landscape gardens and streetscapes shall be created as an integral part of the Proposed Development. This will provide opportunity for the compensation to the loss of existing greenery within the Existing STSTW Site.

Maximization of Greenery Provision

11.9.11 Under the Proposed Development, the greening opportunities, in terms of trees and shrub planting, vertical greening and green roof shall be maximized to soften to future Development so as to minimize the potential landscape and visual impact.

11.10 Overview

Landscape Impacts

11.10.1 Under the Proposed “Development Scenario” or the “Enhanced Development Scenario” with the implementation of Improvement and Mitigation Measures, it is anticipated that extensive landscape tree and shrub planting will be proposed for the development including an adoption of approximate 30% green ratio for the development. It is predicted that the residual impact on the landscape resources would be reduced to slight. However, detailed tree preservation, transplanting, felling and compensation planting proposal shall be prepared in accordance with ETWB TC(W) No. 3/2006 in the Investigation and Detailed Design Stage of the Project.

11.10.2 It is anticipated that the existing STSTW site will be undergone significant transformation from a low-rise industrial landscape with low sensitivity to a new waterfront high rise residential orientated development landscape. With the implementation of the Improvement and Mitigation Measures, it is predicted that the residual impact on landscape character areas would be reduced to slight.

Residual Visual Impacts

11.10.3 It is predicted that there would be substantial to moderate impact on adjacent VSRs due to the Proposed “Development Scenario” or the “Enhanced Development Scenario”. With the implementation of the Improvement and Mitigation Measures, it is predicted that the residual impact on adjacent VSRs would be reduced to moderate to slight.

11.11 Summary of Findings

11.11.1 Under the Proposed "Development Scenario" or the "Enhanced Development Scenario" with the implementation of proposed mitigation measures, it is considered that the residual landscape and visual impact would be acceptable.

12 AIR VENTILATION ASSESSMENT

12.1 Background

12.1.1 Air Ventilation Assessment (AVA) has been conducted to examine the development proposal at STSTW with respect to the wind environment in the surrounding areas.

12.1.2 City University of Hong Kong (CityU) was appointed to conduct wind tunnel test for the AVA study.

12.2 Purpose of this assessment

12.2.1 Experimental site wind availability testing was carried out to obtain precise wind availability and characteristics information in terms of wind directions, magnitudes and frequencies, wind speed and turbulence intensity profiles of the subject site. An expert evaluation was conducted to assess the initial option in relation to the wind characteristics of the site, specifically, to: identify good design features and obvious problem areas, to propose some mitigation measures, and to define focuses and methodology of the initial studies.

12.2.2 Initial AVA Study was then conducted to assess the possible air ventilation impacts of the Maximum Option (refer to Figure 14 (a) & (b) on Page 54 & 55 of CityU's AVA report attached in **Appendix 12.04**) instead of "Development Scenario" or "Enhanced Development Scenario" presented under this Report and to address the problem areas identified, if any. Such approach allow testing of the 'worst ventilation scenario' and avoiding the need to conduct another round of wind tunnel test in case higher site coverage by building blocks was found to be necessary for technical or financial reasons. More specifically, the following tasks may be achieved: (1) initially assess the characteristics of the wind availability of the site. (2) provide a general pattern and a rough quantitative estimate of wind performance at the pedestrian level reported using wind Velocity Ratio (VR). (3) further refine the understanding of the expert evaluation, and so on. Practical and effective improvements and mitigation measures would be recommended in refining the proposals.

12.3 Site Wind Availability Study through Wind Tunnel Test

12.3.1 The Experimental Site Wind Availability Study has been undertaken in accordance with the current best international practice requirements stipulated in the Australasian Wind Engineering Society Quality Assurance Manual, AWES-QAM-1-2001 (2001), the American Society of Civil Engineers Manual, Chinese wind load codes (GB 50009-2012), Japanese wind load codes (AIJ-2004), Report on Engineering Practice No. 67 for Wind Tunnel Studies of Buildings and Structures (1999) and the Technical Guide for Air Ventilation Assessment for Developments in Hong Kong (2006).

12.3.2 A 1:4000 scale topographical study was undertaken to determine the effects of local topography and the surrounding urban environment on the mean wind speed and turbulence intensity profiles of the study area. The physical model covers the surrounding area up to a distance of not less than 10 km from the existing site boundary. B5000 Digital Topographic Map is used for the model construction.

12.3.3 The measurement points for the site wind availability study were located at the center of the subject development site.

12.3.4 The topographical study was referenced with the wind data measured by Hong Kong Observatory at Waglan Island during the period between 1989 and 2012. Wind measurement data at the Sha Tin Racecourse station were also considered for comparison purpose.

12.3.5 Waglan Island (WGL), located approximately 5km southeast of Hong Kong Island, has been used by the Hong Kong Observatory (HKO) for the collection of long-term wind data

since December 1952. Data collected at WGL is considered to be representative of winds approaching Hong Kong and are of the highest quality available for wind engineering purposes. Meanwhile, there is another weather station located near to the STSTW: the Sha Tin racecourse station (SHA). Wind records at this station can by adopted for comparison purpose to check the validity of the wind tunnel test results. Wind roses for both annual and summer winds are determined based on the measurements at both WGL and SHA stations. Results are shown in **Appendix 12.01**.

12.3.6 The annual wind rose at WGL indicates the prevailing winds approaching Hong Kong occur mainly from the north-east directions and, to a lesser extent, the south-west directions. For summer winds, the prevailing wind is mainly from the southwest. Wind roses at SHA show that the annual prevailing winds occur mainly from the north, east, and southwest directions. The dominated summer wind at this station is also mainly from the southwest.

12.3.7 The key parameters for modeling the wind behaviour within the atmospheric boundary layer over a particular terrain are the variation in the mean wind speed and the variation of the turbulence intensity with height. Turbulence intensity is a measure of the gustiness of wind due to eddies and vortices generated by frictional effects at surface level, the roughness of the terrain over which air is flowing and convective effects due to opposing movements of air masses of different temperature. In typical atmospheric boundary layer flow, turbulence intensity generally decreases with height. Closer to the ground, at pedestrian level for example, the magnitude of the turbulence intensity can be very large due to the effects of wind flowing around buildings and other structures.

12.3.8 The boundary layer wind tunnel test facility at CityU has a 4.0 m wide × 2.0 m high working section and a maximum mean free stream wind speed of approximately 20 m/s. The wind flow regime can be modified through the use of devices such as spires, fences, and roughness elements to model different scale atmospheric boundary layer flows.

12.3.9 Appropriate combinations of roughness elements and fences were used to simulate the characteristics of winds approaching Hong Kong as represented by the mean wind speed and turbulence intensity profiles corresponding to wind flowing over open water. The mean wind speed profile of the wind flow approaching the study area made reference to the power law expression, defined in Equation (1), specified in the Chinese wind codes (GB 50009-2012) as well as the corresponding profile stipulated in Hong Kong Code of Practice on Wind Effects (2004). The selected mean velocity profile is based on a 0.12 power law exponent.

$$U(z) = U_{ref}(z / z_{ref})^{\alpha}. \quad (1)$$

where:

$U(z)$ stands for the mean wind speed at a height z (m/s);
U_{ref} is the mean speed at a suitable reference height z_{ref} (m/s);
α is the power law exponent, which is a constant depended on the terrain roughness, $\alpha = 0.12$.

For the turbulence profile, item stipulated in the Japanese wind codes (AIJ-2004) was adopted:

$$I(z) = 0.1(z / z_G)^{-\alpha-0.05}. \quad (2)$$

where:

z_G stands for the gradient height;
α is the same as the power exponent in Equation 1.

12.3.10 The locations of the measurement points were measured at both the center of the proposed development and the SHA station position. Winds approaching the modeled region were calibrated to simulate winds flowing over open water and the topographical model is used to determine the effects of the surrounding complex terrains on the profiles of wind speed and turbulence intensity. The 1:4000 scale topographical test model covers the surrounding area up to a distance of approximately 12 km from the study. The surrounding area is shown in **Appendix 12.02**.

12.3.11 Wind tunnel measurements are taken at 22.5° intervals for the full 360° azimuth (i.e. 16 wind directions), with the wind direction defined as positive clockwise from the north. For each wind direction, mean wind speeds and turbulence intensities are determined at 9 different height levels, equivalent to 15, 50, 100, 150, 200, 250, 300, 400 and 500m in prototype scale, for the center position. For the SHA test position, since the test records at this position serve only for the validation purpose through comparing with field measurements from the anemometer which is installed at 10 m above local ground level, fewer height levels of 6 are considered, equivalent to 15, 20, 30, 52, 100, and 200m (suffering from the wind-tunnel-wall effects, credible records at the 10 m height level in full-scale in the tunnel test cannot be obtained).

12.3.12 The mean wind speed at 1.25 m height in wind tunnel test (corresponding to 500 m height in full-scale) are adopted as denominator for normalization of each mean wind speed for all 16 directions. Turbulence intensities was also obtained from the local means and standard deviations of wind speeds by the equations defined below.

$$\text{Normalized wind velocity} = \frac{U_z(\theta)}{U_{500,\text{approach}}(\theta)};$$

$$\text{Turbulence intensity} = \frac{\sigma_{U,z}(\theta)}{U_z(\theta)}.$$

12.3.13 Profiles of mean wind speed and turbulence intensity are presented in graphical and tabulated forms in the documents.

12.3.14 Wind rose and the frequency table of the study area at an urban canopy level, i.e. 20, 50, 100, and 200 m, are presented.

12.4 Initial Study

12.4.1 The initial AVA study was undertaken in accordance with the Technical Guide No. 1/06 for Air Ventilation Assessment for Developments in Hong Kong and the current best international practice requirements stipulated in the Australasian Wind Engineering Society Quality Assurance Manual, AWES-QAM-1-2001 (2001) and the American Society of Civil Engineers Manual, Report on Engineering Practice No. 67 for Wind Tunnel Studies of Buildings and Structures (1999) for the preferred option.

12.4.2 Planning Department has completed “Feasibility Study for Establishment of Air Ventilation Assessment System” in late 2005, which sets out a framework for undertaking the air ventilation assessment. The assessment framework was subsequently promulgated as a Technical Guide attached to the joint Technical Circular No. 1/06 on Air Ventilation Assessment issued by the former Housing, Planning and Lands Bureau and Environment, Transport and Works Bureau in mid-2006. The Technical Guide defines the project site, assessment area and surrounding model area under study, the wind velocity ratio which serves as an indicator of the air ventilation performance as well as the spatial averaged wind velocity ratio that should be reported as the assessment results.

12.4.3 The velocity ratio provides a basis for comparing the merits and demerits of the design schemes, and to identify any ventilation problems for design improvement purposes. There is yet no benchmark for evaluating the acceptability of a particular design.

12.4.4 A physical model covering the project site, the assessment area and the surrounding model area is prepared in a 1:800 scale for preferred design option. The physical model includes details of the land topography and the local building morphology including the surrounding area up to 800 m from the study area. The terrain is fabricated from information acquired from the HKSAR's Survey and Mapping Office, Lands Department. The model covers all existing and planned developments and the proposed design option on the subject site.

12.4.5 In these tests, mean wind velocities in and around the developments are measured at 120-180 test points which belongs to three types: perimeter, overall, and special. Data at these test points are measured with Kanomax Multichannel Anemometer System at a height of 2 m is full scale and are expressed as a speed ratio form for 16 wind directions.

12.4.6 To validate the efficiency of the test records at a relatively low level of 2.5 mm in the wind tunnel (2 m in full scale), vertical profiles of mean wind speed at two selected test position using the Cobra Probe measurement system are also conducted.

12.5 Assessment Methodology

12.5.1 Mean wind speed, turbulence characteristics and yaw angle profiles for 16 wind directions at those previously mentioned 9 heights at the site measurement position are calibrated as the inlet boundary for the Initial Study, according to the SWAS results.

12.5.2 The resulting wind profiles from the SWAS study carried out on the 1:4000 model are simulated at the 1:800 scale model for the initial AVA study. The 1:4000 wind speed profiles was be grouped into several typical profiles, which are considered representative for the study.

12.5.3 The 1:800 model area extend for a radius of 1600m from the center of the PDA (which is approximately a 400 m×700 m rectangular region) to make sure that the assessment area include: (1) the region more than 2H, H being the height of the tallest building on site (on the order of 150 m), (2) more topographical features of hills and/or mountains (**Appendix 12.03**).

12.5.4 The perimeter test points are positioned on the project site boundary at around 10 m to 50 m center to center except in the region where there is no major air ventilation issue, to assess the immediate effect of the project to the assessment area. The junctions of all roads leading to the project site, main entrances to the project, and corners of the project site are specially considered and tested. According to Technical Circular No. 1/06, 30-50 perimeter test points well-spaced out and located will suffice.

12.5.5 Overall test points are placed outside the project site and within the assessment area. These points are evenly distributed and positioned in the open spaces, on the streets and places of the project and assessment areas where pedestrians frequently access (such as the bus-stop), to provide data for the local air ventilation assessment together with the perimeter test points. 50-80 test points for this type may be adequate for typical development sites.

12.5.6 Special test points can be positioned in areas that special localized problems are likely to appear, e.g., wind gust problem for exposed sites. These special test points only provide additional information to assessors, and should be not included in the site and local air ventilation assessment.

12.5.7 All test point locations should be determined subject to development layout plan to be formulated and are submitted for agreement before the commencement of the wind tunnel testing.

12.5.8 In these tests, mean wind velocities in and around the developments are measured at various stations with Kanomax Multichannel Anemometer System and expressed as a

ratio with the mean wind velocity at a scaled reference height of 500m at 22.5° increments for the full 360° azimuth, i.e. for 16 wind directions for all the test points defined, and their probability of occurrences are accounted for when calculating the wind Velocity Ratios (VR). The annual and summer VRs and wind speed are determined by multiplying the VR and wind speed of each test position with the corresponding annual and summer probability of occurrences. Perimeter test points are provided to collect data for calculating site spatial average velocity ratio (SVR) for site air ventilation assessment and the overall test points and perimeter test points are grouped and used to calculate the local spatial average velocity ratio (LVR) for local air ventilation assessment. A spatial average velocity ratio (SAVR), defined as the spatial average of the velocity ratios of all relevant perimeter and overall test points test points, shall also be determined for each nominated focus or functional area. The 50% of the year median wind speed of the selected wind roses, including the best approximate 50% of the year near pedestrian level median wind speed are documented in the report. Moreover, both annual and summer velocity ratios and wind speeds of all the test points and tested wind directions are provided and analyzed in table and graphical formats.

12.6 Summary of Findings

12.6.1 The AVA was conducted based on the Maximum Option for which the 'worst ventilation scenario' was assessed. The results show that the Site Spatial Average Velocity Ratio (SVR) under annual wind and summer wind are 0.29 and 0.24 respectively while the Local Spatial Average Velocity Ratio (LVR) under annual wind and summer wind are 0.28 and 0.23 respectively.

12.6.2 The AVA results show that there is no adverse impact on air ventilation based on the Maximum Option. The "Development Scenario" with less development intensity may even improve the air ventilation. The detailed AVA report prepared by City U is included in **Appendix 12.04**.

13 GEOTECHNICAL ASSESSMENT

13.1 Introduction

13.1.1 This section details the geotechnical aspects of the STSTW site. In accordance with the brief, we have conducted a broad geotechnical assessment of the site based on existing records. The assessment has the general aims of establishing the baseline conditions, reviewing the key issues which will have implications on the development of the existing STSTW site for housing and other uses and demonstrating the technical feasibility of the proposed development.

13.2 Existing Ground Conditions

Published Geology (Solid & Superficial)

13.2.1 The site is covered by the 1:20,000 Geological Map Sheet 7. Edition 2 of this map was published in 2008. An extract from the map is presented in **Fig. No. /13.01** and in addition, the solid geology of the site as extracted from the digital edition of the map is presented as **Fig. No. /13.02**.

Existing Ground Investigation

13.2.2 A number of existing ground investigations have been obtained from the Geotechnical Information unit (GIU) of the Geotechnical Engineering Office (GEO). A list of the reports applicable to the site and the boreholes included in the reports are listed in **Appendix 13.01**. A total of 303 boreholes have been identified within or immediately adjacent to the site and a further number of trial pits and GCO probes are also available at GIU. The locations of the boreholes are shown on **Fig. No. /13.03** and **Fig. No. /13.04**.

Published Papers

13.2.3 Short and Mills (Ref. 19.1.15) published a paper in 1983 detailing the construction of Stage 1 of STSTW and a summary of the ground conditions. Further information is presented below.

13.2.4 Whiteside (Ref. 19.1.16) published a paper in 1984 detailing the superficial deposits encountered at a site adjacent to the STSTW.

13.2.5 Yim and Kwong (Ref. 19.1.17) have presented a paper detailing with difficulties in pile construction in similar ground conditions in a reclaimed area in Sha Tin.

13.3 Site History

Aerial Photograph Interpretation (API)

13.3.1 Aerial photographs of the site have been obtained from GEO and a detailed Aerial Photograph Interpretation (API) has been carried out and is presented in **Appendix 13.03** together with selected annotated photographs. A plan illustrating the salient findings of the API is also presented in **Fig. No. /13.09**.

13.3.2 In summary, prior to the commencement of reclamation in 1974, the site was located underwater at the mouth of the Shing Mun River. Tai Po Road and the Kowloon to Canton Railway (KCR) are seen on the earliest photos and were constructed along the original coastline. Tai Po Road opened in 1902 and the KCR opened in 1910.

13.3.3 Reclamation of the adjacent race course can be seen to have begun between the February and November 1974 aerial photographs with fill material largely originating from a ridge south of Kau To Hang. It appears that material was excavated from the ridge and

transported to the reclamation where it was placed from land based plant. The earliest reclamation is at the land edge of the area currently occupied by the Jockey Club stables. By the November 1975 photograph, the majority of the reclamation for the race course and adjacent stables had been completed.

13.3.4 The reclamation for the STSTW can first be seen on the August 1976 aerial photographs, with fill material apparently originating from a volcanic spur on the northern side of Kau To Hang. Again the reclamation material appears to have been transported to site by road and placed by land plant. By this time building work for the race course and associated stables was advancing. The July 1977 photo shows reclamation progressing from south west to north east across the STSTW site and by the January 1978 photograph the majority of the STSTW site had been reclaimed except for a small area to the north east of the site. This has been completed by 1979.

13.3.5 The construction for the sewage treatment works probably began around 1978 and by the 1979 photographs the outlines of the tanks in Stage 1 can be identified. The sewage works were constructed in various stages up until around 1993. The pipe bridge across the Shing Mun River can be seen under construction in 1986 and the Tate's Cairn Highway that crosses the site and the associated bridge across the Shing Mun River were completed between 1989 and 1991. Between 1991 and the present day there has been no significant change to the overall site development although some buildings continued to be constructed.

Published Papers

13.3.6 The paper by Short and Mills (Ref. 19.1.15) details the construction difficulties at the site during construction of the Stage 1 sewage treatment works. The salient points from this paper include the following:

- The ground conditions prior to reclamation consisted of 6m of 'alluvial mud and silt overlying decomposed granite and bedrock'. The original design of the foundations for the structures had the lowest levels above the top of the marine mud and all structures and major pipelines would have piled foundations.
- Early reclamation at the racecourse was carried out by end tipping and displaced a mud-wave ahead of the reclamation. The reclamation at the STSTW site continued by end tipping and the mud wave continued to move across the STSTW site as the reclamation proceeded between 1977 and 1979. This resulted in the top of the mud being significantly higher than before reclamation in some areas and within the proposed foundation excavations. Large scale slips also occurred during reclamation.
- Remedial measures were implemented including raising the level of the major structures by 1.5m to minimize the effect of the high mud on the shallower excavations. Installing pre fabricated band drains and surcharging with fill material was also carried out over other local areas with high mud levels.
- Piling was subsequently carried out for minor pipelines across the site in addition to the structures and major pipelines.
- Some piles were found to be displaced and out of verticality which was attributed to displacement when driving adjacent piles. However, later studies of similar issues by Yim and Kwong (Ref. 19.1.17) suggest that piles could be displaced laterally due to instability of the marine clay when excavating to form the pile caps. The most significantly deviated piles at STSTW were abandoned and replaced.
- A total of 5,082 in-situ concrete piles and 2,682 steel 'aitch' piles were constructed for Stage 1.
- Differential settlement caused damage to structures shortly after construction. This was attributed to structures being founded in areas of a steep interface between the fill and the marine clay.

13.4 Geotechnical Assessment

General

13.4.1 The geotechnical assessment below is based on a review of the available information. A summary of the materials encountered in the boreholes located at the site is presented in **Appendix 13.01**. Cross sections across the site are presented in **Fig. No. /13.07** and **Fig. No. /13.08**. The locations of the sections are shown in **Fig. No. /13.05**.

13.4.2 The broad geotechnical assessment blow applies to both the development and enhanced scenarios.

Fill

13.4.3 The existing STSTW site is located on an area of reclaimed land with fill underlain by marine Deposits of the Hang Hau Formation and Alluvium of the Chek Lap Kok Formation.

13.4.4 As noted above, reclamation fill was placed at the site between 1976 and 1979. Evidence from the aerial photographs and published papers indicated that the fill originated from land based excavations on the hill slope above the site and was end tipped from land. Filling progressed from the racecourse at the south west end of the site to the north east end of the site.

13.4.5 The borehole information suggests that the fill material appears not to have been controlled compared to modern standards. In recent boreholes for which AGS data is available, 29% of the fill material required coring through gravel, cobbles and boulders and in some boreholes (e.g. 28030_BH24) practically all of the fill is composed of gravel to boulder sized material and required coring. The percentage of boulders and cobble layers in the fill appears to be higher towards the north east edge of the site and especially the northern corner.

13.4.6 The remaining fill material appears to be logged as clay, silt or sand in roughly equal proportions.

13.4.7 The thickness of the fill varies significantly across the site dependent on the depth of the top of the Marine Deposits onto which it was placed. As can be seen in **Appendix 13.01**, the maximum thickness of fill at the site is 22.71m in borehole 34386_DH1 which is located in the northern corner of the site. The average thickness of fill in the available boreholes is 13.3m.

Marine Deposits

13.4.8 During the reclamation, the Marine Deposits were left in situ and fill material was placed on the Marine Deposits in phases generally from south west to north east across the site.

13.4.9 The Marine Deposits below the fill predominantly comprise slightly sandy, highly or very highly plastic clay although a basal sand or silty sand layer is identified in some boreholes. After 30 years of reclamation, the clay is now expected to have consolidated significantly since reclamation and SPT tests in recent boreholes for which AGS data is available indicate 80% of N values in the marine clay were between 9 and 19 with an average N value of around 12.5. The marine sand which occurs at the base of the deposits generally has higher N values. A small number of shear vane tests in the clay taken in the last few years are available and indicate a mean peak shear strength of 35 kPa. This is significantly higher than unconsolidated Marine Deposits which generally have N values of 0 and shear strength less than 20 kPa.

13.4.10 A contour plan showing the thickness of the Marine Deposits below the fill across the site is presented as **Fig. No. /13.05**. It should be noted that the available boreholes have been drilled from shortly after the reclamation in 1981and 1982 until recently and the thickness of marine clay is likely to have reduced due to natural settlement since the earlier boreholes were drilled. The available boreholes indicate a significant variation in the thickness of the Marine Deposits across the site from no deposits in some boreholes to a maximum thickness of 14.5m in borehole 03189_BH12 (drilled in 1981). The highest level of the top of the marine clay in boreholes drilled between 1981 and 1982 is +0.9m PD whereas the highest level recorded in boreholes drilled in the 123 No. of available boreholes after 1997 is -1.87mPD. It is possible that early boreholes were trying to investigate potentially high mud levels, however, and the data may not be directly comparable.

13.4.11 However, it is likely that the thickest levels of marine clay shown on **Fig. No. /13.05** may not actually be as thick today although significant variation in the marine clay thickness almost certainly exists at the present time as is evident in thickness variation recorded in 46663_BH12 and 46663_BH26 (drilled in 2007) where the marine deposit thickness varies by 6.5m over a plan distance of 10m.

13.4.12 This variation in Marine Deposits thickness is consistent with the observations in Short and Mills (Ref. 19.1.15) that a mud wave formed during the reclamation with significant lateral displacements of the marine clay. The level of the upper surface of the marine deposits was also observed to vary considerably due to the dumping techniques used during reclamation at the Sha Tin racecourse by Whiteside (Ref. 19.1.16). The uncontrolled reclamation method caused the mud to become unstable and 'flow' from one area to another. This can result in high long term total and differential settlements of the site.

13.4.13 There are isolated occurrences of beach deposits and estuarine deposits below the Marine Deposits but the thickness and lateral extent is not considered to have a significant impact on redevelopment of the site.

Alluvium

13.4.14 Alluvium of the Chek Lap Kok is present under the majority of the site and alluvium is absent only over the west of the site close to the original shoreline. The maximum proven thickness of the alluvium is 17.4m in borehole 03189_BH17 which is located adjacent to the Shing Mun River. The average thickness of the alluvium across the site in the available boreholes is 7.6m.

13.4.15 The boreholes record significant layers of boulder and cobbles in the alluvium below the site. Where coring data is available in AGS format, the zones of coring through gravel, cobble and boulder layers are shown on the cross sections A-A and B-B. On average, approximately 50%-70% of the alluvium required coring through these gravel, cobble and boulder deposits. The remaining material is predominantly gravelly sand with a minor (around 7%) occurrence of material logged as silt or clay in the recent boreholes. This channel of coarse to very coarse grained alluvium extends off-shore from the STSTW site in a northerly direction as discussed in the Desk Study Report (Ref. 19.1.18). There appears to be no discernable pattern as to the distribution of boreholes with a high percentage of cobbles and boulder in the alluvium across the site.

13.4.16 In isolated boreholes, a cemented 'conglomerate' assigned to the Chek Lap Kok Formation has been identified at the base of the alluvium lying directly on rock head.

Bedrock

13.4.17 The digital version of the 1:20,000 geological map Sheet 7 shows the site to be underlain by Sha Tin Granite with minor intrusions of fine grained granite. The solid geology map is presented as **Fig. No. /13.02**.

13.4.18 In general, the boreholes confirm that the site is underlain by granite and **Appendix 13.01** lists the solid geology in the various boreholes at the site as recorded on the logs. Isolated boreholes record rock types other than granite. Where Rhyolite has been encountered this appears to have been interpreted as fine grained granite on the geological map. Some Tuff and Granodiorite is also recorded although in all cases there are nearby holes with granite. It is considered that these occurrences are unlikely to be significant for the development of the site. Some older boreholes record the presence of 'Volcanics' which is possibly rhyolite or fine grained granite.

Weathered Rock (Saprolite)

13.4.19 There appears to be only a thin layer of weathered rock at the site with alluvium lying directly on rock head in a number of boreholes. This is consistent with observations in Whiteside (Ref. 19.1.16) which notes minimal weathered rock below the site studied in his paper at Sha Tin racecourse. Where a thicker layer of saprolite is indicated within the STSTW site, the saprolite predominantly comprises corestones of grade III/IV or less decomposed rock within highly or completely decomposed material (e.g. 05908_HAZ30, 46663_BH26 and 46663_BH27). The only significant thickness of completely or highly decomposed rock appears to be in the vicinity of the pipe bridge crossing the Shing Mun River as evident in boreholes 05728_HAZ26, 05728_HAZ27 and 12898_BH89.

Rock Head

13.4.20 **Fig. No. /13.06** shows the interpreted engineering rock head contours for the site from the existing boreholes. For this plan, engineering rock head has been interpreted as the upper level of rock of Grade III or less decomposition with a Total Core Recovery (TCR) of at least 85%. For foundation design, rock would generally be proven to at least 5m depth but in a number of cases, especially for the older boreholes and boreholes where instruments have been installed, less than 5m (and in some cases less than 3m) penetration below rock head has occurred. Where 'rock head' in these boreholes is lower than the interpreted rock head from boreholes with greater than 5m of proven rock, the rock head level has been lowered. The boreholes with less than 3m and less than 5m penetration below rock head level are highlighted in **Fig. No. /13.06**. For the purposes of this plan, the Unconfined Compressive Strength (UCS) of the rock has not been used in the rock head criteria due to the lack of available tests at the site.

13.4.21 It can be seen that rock head levels generally fall from west to east across the site although isolated boreholes with deeper rock head do occur. The highest rock head lies at -11m PD on the landward west side of the site and the deepest at -40m PD in borehole 05908_HAZ_30 in the south of the site.

13.4.22 A geophysical survey has been carried out for this project in the Shing Mun River Channel and Tolo Harbour. A geological feature identified from the seismic data as a rock outcrop was identified approximately 215m off shore of the existing STSTW. The location is identified in the field by a navigation beacon and 3 isolated danger beacons and the feature can be seen in aerial photographs prior to the start of construction of the STSTW. This feature had not been identified previously and the geological map indicates superficial deposits to around -20m PD at this location. This feature has not been confirmed by boreholes drilling and the nearest historical boreholes located at the STSTW pier also indicate rock head to be deeper than -18m PD. This feature further suggests that rock head levels on the site may be more variable than indicated by the available borehole information.

13.4.23 It should be noted that there are significant areas of the site where there are few existing boreholes reaching rock head level.

Faults

13.4.24 Two main faults are shown in the vicinity of the site on the published geological map. The major Tolo Channel Fault is shown to pass along the south-eastern edge of the site where the site bounds the Shing Mun River and trends approximately south-west to north-east. This fault can be traced for many kilometers across Hong Kong and into China and is known to have variable ground conditions associated with it. To the north east of the site, some marble has been encountered in the vicinity of the fault close to the Ma On Shan Reclamation. This is discussed in more detail in our Preliminary Geotechnical Assessment Report (PGA).

13.4.25 A second fault is shown on the geological map to trend approximately north south across the site. Other faults are also shown to impact marginally on the site.

13.4.26 Even close to the mapped location of the Tolo Channel Fault, rock head does not appear to be significantly deeper than elsewhere across the site. Boreholes carried out in the Shing Mun River Channel for the two bridges that cross the channel also record reasonably shallow rockhead levels between -19.75m PD (09737_B09) and -37.65m PD (12898_BH89).

13.4.27 In a couple of boreholes taken a significant distance into rock, evidence of faulting is apparent. For instance in 46663_BH14, a shear zone and breccias are recorded between 45.71-49.74m BGL. In 28451_BH13, the rock is logged as Mylonite with some relict granite and in 19389_BH1 fault breccias are logged above rock head.

Groundwater

13.4.28 Standpipes were installed across the site in 2006 and the results are contained in GIU report 42038 and a number of standpipes have also been installed in holes from other recent investigations. The water level readings from recent investigations are presented in **Appendix 13.02** and the water table level from this data has been plotted on the cross sections.

13.4.29 As expected, the water table across the site is reasonably shallow and reflects the proximity of the site to the Shing Mun River and the sea.

13.5 Key issues

Potential On-going Settlement

13.5.1 The paper by Short and Mills (Ref. 19.1.15) indicate settlement at the site was an issue shortly after construction. Based on the available information, a significant thickness of marine clay was retained in place below the fill with apparently only localised attempts to pre-consolidate the material using prefabricated vertical drains and pre-loading. Significant settlement at the site would therefore have been expected and based on the variability of the thickness of marine clay across the site, differential settlement would also be expected as confirmed in Short and Mills (Ref. 19.1.15). However, the reclamation is now 30 years old so any residual settlement is likely to be comparable with settlement expected from new reclamations formed using modern day techniques and unlikely to pose a major constraint to development.

13.5.2 Our review of information at GIU has uncovered a report detailing the installation of a significant number of instruments including inclinometers, extensometers and piezometers in 2006 (GIU report No. 44617) but the report does not contain long term monitoring data. DSD have advised that no settlement monitoring records are available for the site. Consideration should be given to monitoring the site for on-going settlement at an early stage prior to redevelopment to assist with the design of the future facilities.

13.5.3 It is likely that due to the potential properties of the marine clay and potential for differential settlement under increased loading, the majority of structures at the site are likely to require piling. The use of shallow footings for structures would require careful consideration at this site.

Excavation limitations

13.5.4 Any shallow excavations at the site will need careful design to avoid any instability of the marine clay especially where it is at shallow depth below the reclamation fill. Issues associated with such excavations are described in the paper by Yim and Kwong (Ref. 19.1.17)

Existing piles in the ground

13.5.5 The paper by Short and Mills confirms that all structures and pipelines in Stage 1 of the sewage treatment work were founded on piles. Further stages of STSTW development are also considered likely to have employed heavy piling. The high density of existing piles at the site may form a constraint on any future piling at the site. It is unlikely that the existing piles which generally support small scale structures at the site and are now upwards of 30 years old could be re-used to support multi-storey residential buildings although this could be examined at a later stage in accordance with the guidance given in GEO Publication 1/2006 (Ref. 19.1.19).

13.5.6 Otherwise, piling will have to be carried out around the existing piles or the existing piles will need to be removed which can be a difficult and time consuming operation.

Boulders and cobbles in the fill and alluvium

13.5.7 The boreholes at the site indicate extensive boulders and cobbles in the alluvium and in some areas extensive boulders and cobbles in the fill. These may present problems with the construction of certain types of piles such as driven piles.

Piling through the marine clay

13.5.8 Any piling through the marine clay may induce squeezing of the marine clay and possible necking of the piles and pile construction methods will need to mitigate against this effect. In addition, it may be necessary to design for negative skin friction in some areas if continued residual settlement of the marine clay is anticipated.

Piling close to major faults

13.5.9 The geological map indicates that the site lies adjacent to the major Tolo Channel Fault. Deep and variable rock conditions could be expected in the vicinity of the fault. However, the available borehole information does not indicate that rock head in the vicinity of the fault is significantly deeper than elsewhere across the site and is not deep enough to significantly affect the feasibility of the proposed development.

Natural Terrain Hazard Screening Study

13.5.10 The site has been assessed in terms of GEO Report No. 138 with regards to the potential hazards from Natural Terrain instability. In terms of section 1.5.1 of GEO report No. 138, a small portion of the western part of the site is located at less than 100m from terrain sloping at more than 15° and a screening exercise is necessary.

13.5.11 However, the screening exercise indicates that the Alert Criteria as defined in Section 1.5.3 of GEO Report 138 is not met. The edge of the site is greater than 50m from any slope with an angle greater than 15° and the angular elevation to the nearest natural terrain is less than 20°.

13.5.12 Therefore no further Natural Terrain Hillside Study is required for the STSTW site.

Contamination at the site

13.5.13 Given the past use of the site, there may be some contamination of the soils below the site and may affect any buried structures. In addition, the groundwater is likely to be saline and this will need to be considered in the design of any foundations and buried structures located below the water table.

13.6 Summary of Findings

13.6.1 There are a large number of existing boreholes at the site and these have generally been used to determine the ground conditions with support from a detailed API.

13.6.2 The key geotechnical issues that may affect the development include:

- Variable thickness of marine clay across the site and lack of previous pre-loading of the marine clay means the site is sensitive to further settlement
- Extensive boulders and cobbles in the fill and alluvium may constrain future piling works at the site
- Extensive existing piles to support the existing structures is likely to constrain future piling works at the site
- Possible deep rock head and poor rock conditions in the vicinity of the major faults which lie close to the site may result in increased piling requirements although the available borehole information indicates this may not be a major issue
- Possible contamination of the site and saline groundwater conditions.

However, it is considered at this stage that none of these issues will make redevelopment of the site unfeasible.

Proposed additional work

13.6.3 Due to the significant number of existing boreholes at the site, no further ground investigation for geotechnical purposes are proposed during this Study. Some minor ground investigation works are, however, planned to study any potential contamination at the site. Further ground investigation is likely to be required at future stages to provide information for the detailed design of the foundations of various structures.

14 SUSTAINABILITY ASSESSMENT

14.1 Scope

14.1.1 The scope of this Section includes the following:-

- Present the information used as input to the Computer-aided Sustainability Evaluation Tool (CASET);
- Identify the key sustainability implications of the social, economic and environmental aspects of the proposed planning development, using the CASET as the evaluation framework;
- Evaluate and analyses the key sustainability implications identified;
- Conclude the sustainability of the proposed planning development based on the results of the analysis

14.1.2 The scenarios assessed and presented in this Section would be based on the "Enhanced Development Scenario" and the proposed "Development Scenario" advised in this Report.

14.1.3 This sustainability assessment is to be read in conjunction with other report as listed below:

- Preliminary Sewerage Impact Assessment Report
- Preliminary Geotechnical Assessment Report
- Preliminary Environmental Review Report
- Preliminary Drainage Impact Assessment Report
- Preliminary Traffic Impact Assessment Report
- Preliminary Marine Traffic Impact Assessment Report
- Preliminary Waterworks and Utilities Impact Assessment Report
- Preliminary Ground Investigation Report
- Project Financial Report

14.2 Key Sustainability Implication

Computer-aided Sustainability Evaluation Tool (CASET)

Introduction

14.2.1 This sustainability assessment is modeled on the Computer-aided Sustainability Evaluation Tool (CASET), developed under the Study on Sustainability Development for the 21st Century in Hong Kong (SUSDEV21 Study). CASET incorporates a list of indicators under a set of guiding principles for sustainable development. It aims to assist in evaluating a proposal from a sustainable development perspective.

14.2.2 The basis of the CASET system is the list of indicators of sustainable development described in the previous section. In simple terms CASET works by linking a series of questions, which the user must answer in relation to the given project or policy being tested, to one or more indicators. The logic of the tool was developed through a process called "knowledge elicitation" in which the key "drivers" affecting each indicator were identified through consultation with relevant experts.

14.2.3 By drawing out the issues and drivers affecting each indicator, a long list of influencing factors was established and these issues were framed in the form of questions, with each question linking to one or more indicators. The questions were then grouped into sectoral categories (e.g. economy, biodiversity, land and infrastructure and so on). These questions are used in CASET to characterize each scenario and were phrased such that a simple "yes" or "no" response could be provided by the user. Where the questions produce

a "yes" response, the indicators to which the question is linked are effectively "triggered" that is they are considered to be relevant to the scenario concerned and the CASET would be designed to ensure that the user addresses the effect of the proposal on that indicator.

14.2.4 **Appendix 14.01** presents the inputs to the pre-defined questions in the CASET for variation characterization assessment. The answers to these questions set the basis for the CASET in determining which indicators to be assessed for the variation.

14.2.5 The proposed planning development is compared against a counterfactual scenario of no planning development (refers as “Without Scenario”) using CASET.

Guiding Principles

14.2.6 There are eight guiding principles developed in the SUSDEV 21 Study to define and summarize the issues that represent sustainability in Hong Kong:-

- **Economy** - Hong Kong should achieve a competitive and prosperous market-based economy which provides the resources to meet the needs and aspirations of the population, both now and in the future.
- **Health and Hygiene** - Hong Kong should provide a living and working environment and pursue policies which promote and protect the physical and mental health and safety of the people of Hong Kong.
- **Natural Resources** - Hong Kong should promote the sustainable use of natural resources to minimize its ecological footprint through improving consumption efficiency, minimizing the use of non-renewable resources and re-using, recycling waste and recovering energy from wastes.
- **Society and Social Infrastructure** - Hong Kong should foster a stable, equitable, ethical and progressive society and enable present and future individuals to contribute to and fulfill their potential by providing universal access to adequate and appropriate educational opportunity and social infrastructure.
- **Biodiversity** - To maintain the biodiversity of Hong Kong and to minimize any threat which consumption in Hong Kong may have on biodiversity elsewhere.
- **Leisure and Cultural Vibrancy** - Protect and enhance the vibrancy of Hong Kong’s recreational opportunities, leisure activities, cultural diversity, archaeological, historical and architectural assets.
- **Environmental Quality** - Hong Kong should be pro-active in avoiding environmental problems for present and future generations, seek to find opportunities to enhance environmental quality, and minimize the unwanted side effects, locally, nationally and internationally, of development and inefficiencies such as air, noise and water pollution or land contamination.
- **Mobility** - Hong Kong should provide safe, accessible, efficient and clean transport systems and pedestrian facilities along with an efficient transport network for the movement of goods and facilitation of services for the community.

Selected Indicators

14.2.7 In the CASET model, there are 27 indicators developed from the eight guiding principles for assessing the sustainability of a project.

14.2.8 After carrying the characterization assessment, a list of indicators, shown in **Appendix 14.02**, are identified for carrying out the qualitative assessment for the proposed “Development Scenario”.

14.2.9 Since the development under "Enhanced Development Scenario" is similar to that under proposed "Development Scenario", the identified indicators and the qualitative assessment for both scenarios would be the same.

Table 14.1 Relevant Indicators for Sustainability Assessment

Principles	Indicator	Proposed "Development Scenario"
Economy	1. Cost-Benefit • Economic return as determined through cost benefit analysis	√
	2. Fixed Capital • Gross domestic fixed capital formation as a ratio of GDP	√
	3. Income Differential • Difference between percentage change in the upper quartiles of household income and that of lower quartiles	√
	4. Unemployment Rate • Unemployment rate	√
Natural Resources	5. Construction Waste • Quantity of construction waste requiring final disposal per capita	√
	6. Energy Consumption • Consumption of energy per unit of output ($GDP)	√
	7. Landfill capacity • The total remaining landfill capacity (by volume)	√
	8. Local Freshwater • Percentage of demand met by locally-derived freshwater resources	√
	9. Significant landscape features (Area) • Area of significant landscape features	√
	10. Significant landscape features (Point) • Point-based significant landscape features	√
Biodiversity	11. Marine eco-value • Area of Hong Kong of high marine ecological value	√
	12. Terrestrial eco-value • Area of Hong Kong of high terrestrial ecological value	√
Leisure and Cultural Vibrancy	13. Open space shortfall • Percentage of population living within districts with a shortfall of required provision of open space	√
Environmental Quality	14. Carbon Dioxide Emitted Per Year • Quantity of carbon dioxide emitted per year	√

Principles	Indicator	Proposed "Development Scenario"
	15. Criteria Air Pollutant • Composite index for Criteria Air Pollutants based on percentage of Air Quality Objectives	√
	16. Excessive noise • Percentage of population exposed to excessive noise	√
	17. Marine water quality • Composite index for marine water quality pollutant based on percentage of Water Quality Objectives	√
	18. River water quality • Composite index for river water quality pollutant based on percentage of Water Quality Objectives	√
	19. Toxic Air Pollutant • Composite index for toxic air pollutants based on percentage of acceptable risk	√
Mobility	20. Freight Costs • The cost of road-based freight transport, the cost of charges and operation costs as a ratio to GDP	√
	21. Travel Distance • Distance in kilometres travelled by passengers	√
	22. Travel Speed • Network speed which calculated as total passenger kilometres divided by total passenger hours	√

Note: √ indicator being assessed in the scenario

14.3 Sustainability Assessment (For Proposed Planning Development)

Introduction

14.3.1 22 relevant indicators under the six guiding principles, including "Economy", "Natural Resources", "Biodiversity", "Leisure and Cultural Vibrancy ", "Environmental Quality" and "Mobility" were assessed via the CASET for indicator assessment of the proposed "Development Scenario". The sustainability evaluation report for the indicator assessment via CASET is shown in **Appendix 14.03**.

Economy

14.3.2 The affected indicators under this planning development are "Cost Benefit", "Fixed Capital", "Income Differential" and "Unemployment Rate".

Cost Benefit

14.3.3 For the "Without Scenario", the economic return is assumed to be the same as the baseline year.

14.3.4 The indicator of implementing the planning development is expected to increase and the change is expected to be qualitatively moderate. New development in the proposed site will attract people and firms fostering economic activities and employment opportunities. Residents will benefit from the enhanced social features and facilities. These add values

to the local liveability and thus the indicator is expected to have a qualitative moderate increase. A quantitative assessment would be conducted in next stage when more detailed information is available.

14.3.5 The details of the cost benefit analysis could refer to Project Financial Report.

Fixed Capital

14.3.6 For the "Without Scenario", there is no change on the current fixed capital investments.

14.3.7 The proposed planning development located adjacent to Shing Mun River in which enjoying unobstructed views of the Sha Tin Race Course, Shing Mun River and Sha Tin Hoi, with the convenient rail transport by East Rail and Ma On Shan Line, it will attract capital from both domestic and foreign investors and thus this indicator is expected to have a moderate increase. A quantitative assessment would be conducted in next stage when more detailed information is available.

Income Differential

14.3.8 For the "Without Scenario", the indicator will remain the same.

14.3.9 The indicator is expected to remain the same because the proposed planning development would not have any implication on the income differential.

Unemployment Rate

14.3.10 For the "Without Scenario", the unemployment rate will remain the same.

14.3.11 With the implementation of the proposed planning development, job opportunities will be provided during construction stage. In addition, the proposed commercial building in the proposed planning development provides the opportunity for creation of new employment. As a result, this indicator will have a small decrease. A quantitative assessment would be conducted in next stage when more detailed information is available.

Natural Resources

14.3.12 The affected indicators under this planning development are "Construction Waste", "Energy Consumption", "Landfill Capacity", "Local Freshwater", "Significant Landscape Features (Area)" and "Significant Landscape Features (Point)".

Construction Waste

14.3.13 For the "Without Scenario", the amount of Construction and Demolition (C&D) material for final disposal is assumed to be the same as the baseline year.

14.3.14 The indicator is expected to increase and the change is expected to be small with the implementation of the proposed development. C&D materials would be generated from site formation and construction of the civil structures and access road. Basically, if possible, the excavated material will be used for the filling works. Filling works would include site formation, backfilling and access road construction. Volume of materials disposed of at landfills will be estimated in the next stage. A quantitative assessment would be conducted in next stage when more detailed information is available.

Energy Consumption

14.3.15 For the "Without Scenario", the amount of energy consumption is assumed to be the same as the baseline year.

14.3.16 With the implementation of the proposed planning development, its population intake will increase the energy consumption such as electricity supply and gas supply. Nevertheless, as the planning is developed based on the principle of sustainability development, energy saving technique and environmentally friendly transportation mode will be adopted. Thus, the electricity and fuel consumption in the area will be only little and the indicator will be increased and the degree is therefore small. A quantitative assessment would be conducted in next stage when more detailed information is available.

Landfill Capacity

14.3.17 For the "Without Scenario", the indicator is expected to be decrease slightly as most of the waste generated is disposed of at landfill.

14.3.18 With the implementation of the proposed planning development, the landfill capacity is expected to decrease.

14.3.19 During construction, non-inert materials shall be reused whenever possible and be disposed of at landfills as a last resort. Basically, if possible, the excavated material will be used for the filling works, the volume of materials disposed of at landfill will be estimated in the next stage. A quantitative assessment would be conducted in next stage when more detailed information is available.

Local Freshwater

14.3.20 For the "Without Scenario", the indicator is expected to remain the same.

14.3.21 Freshwater would be consumed mainly by the resident and commercial activities within the proposed development. According to the Waterworks Impact Assessment in Section 9 of this Report, an additional watermain would be extended from the existing water supply networks for the proposed development to meet the increased water demand. In view of the changes in the percentage of demand met by locally-drived freshwater resources is insignificant, thus the indicator would remain the same. A quantitative assessment would be conducted in next stage when more detailed information is available.

Significant Landscape Features (Area)

14.3.22 For the "Without Scenario", no significant landscape features (area) will be affected.

14.3.23 The indicator is expected to remain the same because the proposed planning development would not have any implication on the significant landscape features.

14.3.24 The details of visual impact assessment at this stage could refer to Preliminary Environmental Review Report.

Significant Landscape Features (Point)

14.3.25 For the "Without Scenario", no significant landscape features (point) will be affected.

14.3.26 The indicator is expected to remain the same because the proposed planning development would not have any implication on the significant landscape features.

Biodiversity

14.3.27 The affected indicators under this planning development are "Marine eco-value" and "Terrestrial eco-value".

Marine eco-value

14.3.28 For the "Without Scenario", the indicator is expected to remain the same.

14.3.29 The indicator is expected to remain the same because the proposed planning development would not have any implication on the area with high marine ecological value.

Terrestrial eco-value

14.3.30 For the "Without Scenario", the indicator is expected to remain the same.

14.3.31 The indicator is expected to remain the same because the proposed planning development would not have any implication on the area with high terrestrial ecological value.

Leisure and Cultural Vibrancy

14.3.32 "Open space shortfall" is the only indicator under this guiding principle.

Open Space Shortfall

14.3.33 For the "Without Scenario", the variation of the open space shortfall is negligible and marked as "remain unchanged" to the baseline year.

14.3.34 It is expected that population will increase as a result of movements into the proposed development from other areas. Since the open space provision for the development would also follow the requirement of Hong Kong Planning Standards and Guidelines. It is anticipated that the indicator would not be worsen nor improved as there is no deficit of open space in Sha Tin District base on the requirement stipulated in Hong Kong Plannning Standards and Guidelines. As a result, the indicator is expected to remain the same. A quantitative assessment would be conducted in next stage when more detailed information is available.

Environmental Quality

14.3.35 The affected indicators under this planning development are "Carbon Dioxide Emitted Per Year", "Criteria Air Pollutant", "Excessive Noise", "Marine Water Quality", "River Water Quality" and "Toxic Air Pollutant".

Carbon Dioxide Emitted Per Year

14.3.36 For the "Without Scenario", the indicator is expected to remain the same.

14.3.37 Carbon dioxide is expected to increase slightly with the development because of the growth of population and traffic in the region. With the increased traffic flow within the development, the carbon dioxide emitted from the vehicles will also be increased. Thus the indicator is expected to have a small increase. A quantitative assessment would be conducted in next stage when more detailed information is available.

Criteria Air Pollutant

14.3.38 For the "Without Scenario", the indicator is expected to decrease due to Government's continuing efforts in improving our air quality. This has been confirmed from the PATH prediction of Hong Kong's air quality in future years.

14.3.39 Criteria air pollutants are expected to have a small increase with the implementation of the proposed development. The major pollutant sources will be vehicular emission from the road traffic within the development, even with the requirement for the development to set back from the traffic road to maintain a certain distance between the emission sources and

the receiver. It is expected that pollution due to the vehicular emission inside/ adjacent to the proposed development would be worsen and thus the indicator is expected to have small increase. A quantitative assessment would be conducted in next stage when more detailed information is available.

Excessive Noise

14.3.40 For the "Without Scenario", the indicator is expected to remain the same.

14.3.41 Major noise sources in the proposed planning development are predominantly from road traffic due to the existing roads (e.g. Tolo Highway and Tate's Cairn Highway and newly proposed local roads) and fixed noise sources.

14.3.42 It is estimated that a significant number of residential areas will be affected by the existing road network development. Some noise sensitive receivers would experience high traffic noise impacts exceeding the noise criteria and direct noise mitigation measures as discussed in **Section 10.3** would be required to protect these receivers. However, since the newly proposed local roads within the development will not carry heavy traffic, the noise impact is within acceptable levels.

14.3.43 Fixed noise sources including helicopter would create localized noise problem to proposed development. As discussed in **Section 10.3**, since the usage is limited to emergency use, the potential impact would be in a short time and limited, therefore no mitigation measures should be required.

14.3.44 The indicator is expected to be increased slightly with the increased traffic due to the introduction of population within the development, but the effect to the district is insignificant. Information about sensitive receivers and the impacts to them may be referred to **Section 10.3**.

14.3.45 The details of noise impact assessment at this stage could refer to Preliminary Environmental Review Report.

Marine Water Quality

14.3.46 For the "Without Scenario", the indicator is expected to remain the same.

14.3.47 This indicator will remain the same as all sewage will be treated at the relocated STSTW before discharge and the proposed development will not produce any additional pollution loading into Sha Tin Hoi/ Tolo Harbour.

River Water Quality

14.3.48 For the "Without Scenario", the indicator is expected to remain the same.

14.3.49 The indicator is expected to remain the same because the proposed planning development would not have any discharge to river. All sewage would be treated at the relocated STSTW before discharge.

Toxic Air Pollutant

14.3.50 For the "Without Scenario", the indicator is expected to remain the same.

14.3.51 The indicator is expected to remain the same because the implementation of proposed development would not have any contribution to the toxic air pollutants generation in the region. A quantitative assessment would be conducted in next stage when more detailed information is available.

Mobility

14.3.52 The affected indicators under this planning development are "Freight Cost", "Travel Distance" and "Travel Speed".

Freight Cost

14.3.53 For the "Without Scenario", the indicator is expected to remain the same.

14.3.54 The indicator is expected to remain the same with the implementation of the proposed development. It is because the enhanced roadworks between the proposed development and other parts of the territory could only mitigate the traffic impact induced from the increased population and activities in the proposed development, it has insignificant enhancement on the overall freight cost.

Travel Distance

14.3.55 For the "Without Scenario", the indicator is expected to remain the same.

14.3.56 The indicator is expected to remain the same with the implementation of the proposed development. It is because the enhanced roadworks between the proposed development and other parts of the territory could only mitigate the traffic impact induced from the increased population and activities in the proposed development, it has no impact on the travel distance.

Travel Speed

14.3.57 For the "Without Scenario", the indicator is expected to remain the same.

14.3.58 With the enhanced roadworks between the proposed development and other parts of the territory, the average travel speed would be increased as the total passenger hours is reduced in light of the improved road networks and efficiency.

14.4 Social Checklist

Affected Indicators

14.4.1 **Section 14.3** describes the respond on the CASET for indicator assessment on the six guiding principles including "Economy", "Natural Resources", "Biodiversity", "Leisure and Cultural Vibrancy", "Environmental Quality" and Mobility.

14.4.2 In going through the social checklist questions, please refer to **Appendix 14.04**. There is five relevant checklist questions are identified with the implementation of the proposed planning development. These questions are:

- The level of provision, quality and/ or variety of sports, recreational or cultural facilities?
- People's participation in sports, recreational or cultural activities?
- The waiting time for public rental housing?
- The rental level in the private housing market?
- The number of people residing in inadequate housing?

In which all of the above mentioned checklist questions are expected to have positive impact from the implementation of the proposed planning development. For detailed elaboration, please refer to **Appendix 14.04**.

14.5 First SD Strategy Checklist Question

Affected Indicators

14.5.1 In going through the social checklist questions, there is no affected indicator in the three pilot areas under the Government's First Sustainable Development Strategy. The details are shown in **Appendix 14.04**.

14.6 Analysis and Evaluation

General

14.6.1 The result of the sustainability assessment for the proposed planning development is shown .

Table 14.2 Sustainability Assessment Diagram

Indicator	Without Scenario	Proposed "Development Scenario"
Carbon Dioxide Emitted Per Year	❍	⊘⊘
Construction Waste	❍	⊘⊘
Cost-Benefit	❍	☑☑☑
Criteria Air Pollutant	☑☑	⊘⊘
Energy Consumption	❍	⊘⊘
Excessive Noise	❍	⊘⊘
Fixed Capital	❍	☑☑☑
Freight Costs	❍	❍
Income Differential	❍	❍
Landfill Capacity	⊘⊘	⊘⊘
Local Freshwater	❍	❍
Marine Eco-Value	❍	❍
Marine Water Quality	❍	❍
Open Space Shortfall	❍	❍
River Water Quality	❍	❍
Significant Landscape Features (Area)	❍	❍
Significant Landscape Features (Point)	❍	❍
Terrestrial Eco-Value	❍	❍
Toxic Air Pollutant	❍	❍
Travel Distance	❍	❍
Travel Speed	❍	☑☑
Unemployment Rate	❍	☑☑
Legend		

❍	Annotates no change to the current baseline situation					
	Very Small	Small	Moderate	Moderate to Large	Large	Very Large
Improvement	☑	☑☑	☑☑☑	☑☑☑☑	☑☑☑☑☑	☑☑☑☑☑☑
Deterioration	⊘	⊘⊘	⊘⊘⊘	⊘⊘⊘⊘	⊘⊘⊘⊘⊘	⊘⊘⊘⊘⊘⊘

14.6.2 For the "Without Scenario", all indicators would remain unchanged, except "Landfill Capacity" which would be moderately deteriorated.

14.6.3 For the proposed planning development, 22 indicators were assessed. It is expected that the development would have improvement in "Cost-Benefit", "Fixed Capital" and "Unemployment Rate" because it will attract capital from domestic and foreign investors and stimulating economic activities from people and firm as well as the job opportunities. In addition, it would also improve "Travel Speed" in light of the enhancement in roadworks between the development and other parts of territory. However, the Project is anticipated to cause slight deterioration in "Carbon Dioxide Emitted Per Year", "Construction Waste", "Criteria Air Pollutant", "Energy Consumption" and "Excessive Noise". The remaining indicators, such as "Freight Cost", "Income Differential", "Local Freshwater", "Marine Eco-Value", "Marine Water Quality", "Open Space Shortfall", "River Water Quality", "Significant Landscape Features (Area)", "Significant Landscape Features (Point)", "Terrestrial Eco-Value" , "Toxic Air Pollutants" and "Travel Distance" would remain unchanged.

14.7 Summary and Recommendation

General

14.7.1 Sustainability assessments for the proposed development and the "Enhanced Development Scenario", using the Computer-aided Sustainability Evaluation Tool (CASET) were carried out. The key sustainability implications of the social, economic and environmental aspects were identified. 3 summarizes the identified sustainability indicators.

Table 14.3 Summary of the Sustainability Indicators

Principles	Indicator	Proposed "Development Scenario"
Economy	1. Cost-Benefit	√
	2. Fixed Capital	√
	3. Income Differential	√
	4. Unemployment Rate	√
Natural Resources	5. Construction Waste	√
	6. Energy Consumption	√
	7. Landfill capacity	√
	8. Local Freshwater	√
	9. Significant landscape features (Area)	√
	10. Significant landscape features (Point)	√
Biodiversity	11. Marine eco-value	√
	12. Terrestrial eco-value	√
Leisure and Cultural Vibrancy	13. Open space shortfall	√
Environmental Quality	14. Carbon Dioxide Emitted Per Year	√
	15. Criteria Air Pollutants	√
	16. Excessive noise	√
	17. Marine water quality	√

	18. River water quality	√
	19. Toxic Air Pollutants	√
Mobility	20. Freight Costs	√
	21. Travel Distance	√
	22. Travel Speed	√

Note: √ indicator being assessed in the scenario

14.7.2 For the proposed planning development, 22 indicators were assessed. It is expected that the development would have improvement in "Cost-Benefit", "Fixed Capital" and "Unemployment Rate" because it will attract capital from domestic and foreign investor and stimulating economic activities from people and firm as well as the job opportunities. In addition, it would also improve "Travel Speed" in light of the enhancement in roadworks between the development and other parts of territory. However, the Project is anticipated to cause slight deterioration in "Carbon Dioxide Emitted Per Year", "Construction Waste", "Criteria Air Pollutant", "Energy Consumption" and "Excessive Noise". The remaining indicators, such as "Freight Cost", "Income Differential", "Local Freshwater", "Marine Eco-Value", "Marine Water Quality", "Open Space Shortfall", "River Water Quality", "Significant Landscape Features (Area)", "Significant Landscape Features (Point)", "Terrestrial Eco-Value" , "Toxic Air Pollutants" and "Travel Distance" would remain unchanged.

14.7.3 For the "Enhanced Development Scenario", the assessment result is the same as the assessment for "Development Scenario" as there is no significant difference between the planning under these two scenarios.

14.7.4 This sustainability assessment is prepared based on the broad term technical assessment result available up to now. Thus it shall be further reviewed upon available of more technical assessment result.

15 SYSTEMATIC RISK MANAGEMENT

15.1 Scope

15.1.1 This Section defines how risks to the achievement of the development planning for the Study Area will be identified and managed. It details the approach, methodology, steps and procedures to manage the risks involved in the development planning. In view that the purpose of this report is to formulate a potential development scheme for the Study Area, only a broad systematic risk assessment will be given. This broad systematic risk assessment will form the basis for the full systematic risk management in the planning and engineering study for the Study Area.

15.1.2 Specifically, this Section provides the following:

- An outline of the risk management activities that will take place from planning phases on the development;
- Details on the roles, responsibilities, processes and procedures, standards, tools and documentation to be utilised during the course of the development planning in relation to the management of risk;
- Details on the context in which risks are to be managed, how they will be identified, analysed, evaluated, treated, monitored, reviewed, reported, and associated communication and consultation activities related to the risk management process;

15.2 Key Elements and Stakeholders

15.2.1 Key elements for the development planning have been preliminarily identified and has generally covered the following:

- *Engineering Assessment*
- *Financial*
- *Community & Society*
- *Traffic*
- *Geotechnical*
- *Environmental*

15.2.2 Project Stakeholders (to be reviewed and updated as necessary) include:

- *Drainage Services Department*
- *Planning Department*
- *Civil Engineering and Development Department*
- *Leisure and Cultural Services Department*
- *Lands Department*
- *Fire Services Department*
- *Consultants*
- *Environmental Protection Department*
- *Highways Department*
- *Agriculture, Fisheries and Conservation Department*
- *Water Supplies Department*
- *Sha Tin District Office*
- *Hong Kong Police Force*
- *Transport Department*

15.3 Risk Management Methodology

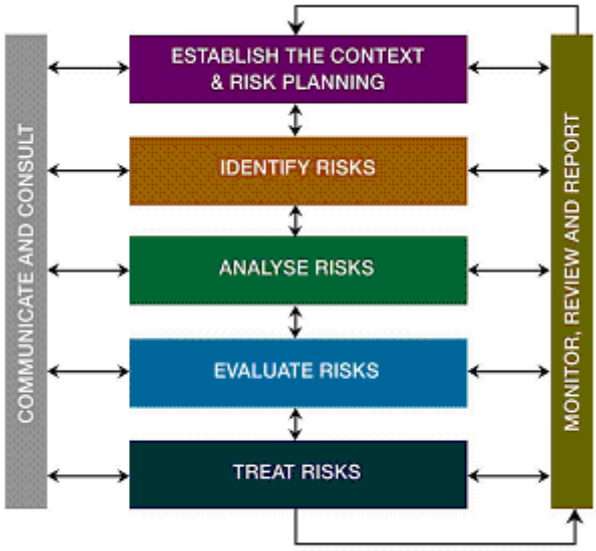
Policy

15.3.1 The risk management methodology adopted in this planning review follows generally with the policy requirements and guidelines as set out under the following Environment, Transport and Works Bureau (ETWB) documents:

- ETWB TCW No. 6/2005: Implementation of Systematic Risk Management in Public Works Projects,
- ETWB Risk Management User Manual

Methodology

15.3.2 The methodology used for the management of risk on this Section will be consistent with the risk management process described in the ETWB Risk Management User Manual. This is summarised in the flowchart below:



THE RISK MANAGEMENT PROCESS

Establish Context and Risk Planning

15.3.3 At the start of the risk management process, the basic parameters within which risks must be managed will need to be established and the scope set for the rest of the risk management process. The principles of establishing the context and risk planning are outlined in the following:

- The planning review will be satisfactorily completed on time and within budget whilst meeting all the prescribed qualities and requirements as prescribed in the Project Brief;
- The project team on risk management includes a Risk Manager, various throughout the Planning Phase of this planning review; and
- It is intended to adopt the use of circulation of this draft report in order to facilitate the identification of further risk elements, agreement on the risk controlling measures and risk owners forming part of the Risk Register and ultimately the Risk Treatment Action Plan where appropriate.

15.3.4 The overall intent is to clearly define the basic parameters within which the risks can be managed. All returned documentation including individual written responses to the draft report from the respective stakeholders will be reviewed and incorporated, subsequently the Risk Register and Risk Treatment Action Plan forming part of the Risk Management Plan will be updated where necessary.

15.3.5 Responsibility for implementing the risk management process and the resources requirements on the Project will be identified for administering the process. The Risk Manager will be responsible for the implementation of the risk management process throughout the various phases of the Project. Further, to ensure that the process of the risk management to be successful, the relevant departments or individuals who hold risk

will therefore have a responsibility to manage it. They should also familiarise themselves with the risk management process that is described in this Report.

15.3.6 All the information that has been generated so far during the risk planning stage serves the purpose of defining how risk management will be undertaken during the execution of the Project. The Risk Management Plan shall be updated in response to changes in Project circumstances and available Project information at later stages. It initially will include the current versions of the Project Risk Register and sample of Risk Treatment Action Plan as shown in **Appendices 15.01 and 15.02** respectively of this Plan and these shall be updated upon comments and responses have been obtained from various stakeholders via the circulation of the Plan.

Risk Identification

15.3.7 Risk identification is the process of determining the individual risks that are present and relevant to the planning review. The basic intent is to generate a comprehensive list of the possible events and consider scenario and causes. Preliminary risk identification will be undertaken at an initial circulation of this Report to various representatives from the client team, consultant project team and key stakeholders. The proposed composition of the participants are outlined in **Section 15.2** of this Report. The feedback response and comment would be returned to the consultants for further review and action. This will enable the collection of views from the stakeholders on the objectives and concerns on the project in their own words. The responses received from the draft will be collated and selectively summarised in the Risk Management Plan in the Final Report for reference during the planning and engineering study. During the future planning and engineering study, the similar approach is recommended to be followed.

Risk Categories

15.3.8 The following categories of risks have been proposed and incorporated into the Risk Register of the Draft Risk Management Plan whereby all risk elements identified have been classified into the Design, Construction and Operation phases of the Project.

- Engineering Assessment
- Financial
- Community & Society
- Traffic
- Geotechnical
- Environmental

Risk Analysis

15.3.9 Risk will be analysed against the identified risks (as shown in the Risk Register in **Appendix 15.01**) using qualitative techniques. This form of analysis will involve the assessment of probability of each risk occurring and the respective consequences in determining the relative level of risk. The calculated risk level is then compared with risk acceptance criteria.

15.3.10 The tables below present the proposed consequence criteria and the risk probability criteria. These will be reviewed and incorporated into the revised plan upon the collection of the returned questionnaires after circulation.

Proposed Consequence Criteria

Consequence Descriptor	Description of Consequences
Catastrophic	Death, regional uncontained environmental impact, project halted or huge delay (increases duration by >100%), huge financial loss **(>HK$200 million)**, operation not possible or facility closed / impact on well being of personnel.
Major	Extensive injuries, localised uncontained environmental impact, major project delay (increases duration by >25%), major financial loss **(HK$80 million - HK$200 million),** major disruption to operations and additional resources may be required.
Moderate	Medical treatment required, contained environmental impact, significant project delay (increases duration by >10%), moderate financial loss **(HK$40 million - HK$80 million)**, moderate impact on operations and may require a change in operation.
Minor	First aid treatment, immediately contained environmental impact, short project delay (increases duration by >2.5%), minor financial loss **(HK$8 million - HK$40 million)**, minor impact on operations and some change to operations / some inconvenience to personnel.
Insignificant	No injuries, insignificant environmental impact, little or no delay, insignificant financial loss **(< HK$8 million)**, negligible impact on operation

Proposed Probability (Likelihood) Criteria

Probability Descriptor	Description of Frequency
Frequent / Almost Certain	Occurs many times during period of the project (perhaps daily, or continuously)
Likely	Likely to occur once or more during period of the project (perhaps several times a year)
Possible	Could occur during period of the project (perhaps once per year)
Unlikely	Unlikely to occur, but it is possible during period of the project (perhaps once in 10 years)
Rare	May occur only in exceptional circumstances – can be assumed not to occur during period of the project (perhaps once in 100 years, or less)

15.3.11 The following proposed risk analysis matrix will be adopted in this Report.

Proposed Risk Analysis Matrix

		Consequence				
		Catastrophic	Major	Moderate	Minor	Insignificant
Probability (Likelihood)	Frequent	Extreme	Very High	High	High	Medium
	Likely	Very High	High	High	Medium	Medium
	Possible	High	High	Medium	Medium	Low
	Unlikely	High	Medium	Medium	Low	Low
	Rare	Medium	Medium	Low	Low	Low

Risk Evaluation

15.3.12 The purpose of risk evaluation phase is to gain an understanding of risk level associated with each identified risk in order to facilitate making decisions of future actions and define priorities. The following risk evaluation criteria will be adopted in the Risk Management Plan:

Proposed Risk Evaluation Criteria

Level of Risk	Recommended Level of Management Attention
Extreme	IMMEDIATE senior management attention needed, action plans must be developed, with clear assignment of individual responsibilities and timeframes.
Very High	Senior management attention needed, action plans must be developed, with clear assignment of individual responsibilities and timeframes.
High	
Medium	Risk requires specific ongoing monitoring and review, to ensure level of risk does not increase. Otherwise manage by routine procedures.
Low	Risk can be accepted or ignored. Manage by routine procedures, however unlikely to need specific application of resources.

Risk Treatment

15.3.13 Risk treatment involves the identification of cost-effective strategies and the associated Risk Treatment Action Plans when necessary so as to develop the course of action and prioritise these risks so identified. For this planning review, the following hierarchy and priority of treatment level will be adopted for those risks that require treatment:

1. Avoiding the risk
2. Reducing the likelihood of occurrence
3. Reducing the consequences
4. Transferring or sharing the risk
5. Accepting or retaining the risk

15.3.14 Selection of preferred risk treatment will typically be a cost-benefit decision, with preference given to the treatment that provides the best all round benefits to the project.

Options for risk treatment will be assessed on the basis of the extent of any additional benefits or opportunities created. For a particular risk, a number of treatments may be considered and applied either individually or in combination.

15.3.15 The circulation of this report will be adopted for the identification and consideration of the risk treatment options. In addition, one of the designated purposes of the report is to enable the attainment of the risk treatment options for incorporation into the Risk Treatment Action Plan via the returned comments and responses from various stakeholders and any other feedbacks for the identified risks. This will enable the identification and agreement of risk owners who are in a position to best control the risk having been identified. The Risk Register and the Risk Treatment Action Plan will then be updated accordingly. During the later planning and engineering study, regular project meetings are recommended for identification and consideration of the risk treatment options.

Communication and Consultation

15.3.16 Communication of risk information and consultation with project participants and stakeholders are important considerations at each step of the risk management process. Internal stakeholders involved in the risk management process will be communicated via information distribution by project communication protocols (such as meetings, minutes, progress reports etc.). During the later planning and engineering study, the following approaches are proposed to be followed.

15.3.17 All relevant stakeholders directly or indirectly involved in risk management process are encouraged to contribute by proposing risks through their supervisors or the project co-ordinator to the Risk Manager.

15.3.18 The Risk Management Plan, Risk Register and Risk Treatment Action Plan will be circulated to the Project Steering Committee, leaders within the project team and the consultant's project team.

15.3.19 Project progress meetings shall be held monthly and risk management shall feature as a regular agenda item during these meetings. Initial and any thereafter revised Risk Register and Risk Treatment Action Plan with reference to the returned comments and responses from the stakeholders during the Risk Management Process will be presented and discussed in the meetings for ensuring that the risk management process is being implemented, reviewed and controlled. Progress of risk issues and any higher-level decisions that require action will also be discussed in the meetings. This includes decisions on issues such as the adequacy of current risk activity, performance of stakeholders and problems being encountered. The Risk Manager or his delegate will chair this section of the Project progress meeting.

Record of Risk Management Process

15.3.20 For this planning review, three forms of risk management documentation shall be utilized as follows.

- Risk Management Plan – This document will be reviewed and updated if necessary near the following key milestones:
  1. At the start of planning review
  2. During finalisation of the planning review
- Risk Register- This will be the primary source of all risk information and will be updated regularly during the course of the project. The template for the Risk Register being used will be the same as highlighted in the ETWB Risk Management User Manual and as shown in **Appendix 15.01**; and

- Risk Treatment Action Plans - The template for the Risk Treatment Action Plan that will be used is the same as that contained in the ETWB Risk Management User Manual and a sample of the Risk Treatment Action Plan is presented in **Appendix 15.02**.

15.4 Responsibilities

Strategic Management

15.4.1 The strategic management of risk is the responsibility of the project office and includes:

- Ensuring that a risk management process is implemented on the Project to comply with DEVB policy.
- Ensuring that there are sufficient resources to undertake risk management activities.
- Ensuring that strategic risks are identified, assessed, treated and communicated to other levels of management where appropriate.
- Making decisions on project risk issues that are passed up from tactical levels of management.

15.4.2 Responsible Person: CE/SP of DSD or his delegate at this stage of study. Subject to the DSD's decision, the Responsible Person may be changed to other such as PlanD during the planning and engineering study stage.

Organisation: DSD

Tactical Management

15.4.3 Tactical risk management is the responsibility of the Project Manager and includes:

- Responsible for the Risk Management Plan preparation
- Ensuring that it is properly implemented in accordance with the ETWB Risk Management User Manual and effective throughout the entire duration of the Project
- Assigning operational level responsibilities
- Co-ordinating all risk related project activities
- Making risk based decisions that are passed up from operational levels
- Ensuring that project and operational risks are identified, assessed, treated and communicated to other levels of management
- Referring strategic level decisions to strategic management

15.4.4 Responsible Person: Project Manager of the Consultants. The Responsible Person will be changed to the Contractor's representative (To be approved) after starting Construction Stage.

15.4.5 Organisation: The Consultants.

Operation Management

15.4.6 The Risk Manager of the Project is responsible for the operational management in order to ensure that risk management activity is properly facilitated and administered, and the responsibilities include:

- Ensuring that risk is addressed in a manner that is consistent with the principles of the ETWB Risk Management User Manual
- Assigning risk management activity where appropriate
- Managing all risk identification, assessment and treatment activities
- Application for strategic or tactical decisions on conflicting risk issues
- Verification of the implementation of decisions and their effectiveness
- Communicating information of risk management issues
- Monitoring and reviewing of risk management process and implementing corrective action when required
- Reporting of the progress of risk management activity
- Recording and updating risk information on the Risk Register

15.4.7 Responsible Person: A dedicated professional staff equipped with relevant experience in this field. The Responsible Person will be changed to the Contractor's representative (To be approved) after starting Construction Stage.

15.4.8 Organisation: The Consultants.

16 IMPLEMENTATION STRATEGY AND PROGRAMME

16.1 General

16.1.1 The objective of this section is to formulate a feasible implementation strategy and programme for the development and enhanced scenarios for the existing STSTW site.

16.2 Proposed Institutional Framework for Development

16.2.1 Based on the recommended approach, the Government agencies responsible for the four development components are described broadly as follows:

- Component 1 – Decommissioning and demolition of the existing STSTW carried out by Drainage Services Department;
- Component 2 – Provision of engineering infrastructure including decontamination, if any. Where particular strategic infrastructure (highways, sewerage, drainage or waterworks) were needed to match the development, the works would be undertaken by the responsible department/organizations or they may be entrusted to Civil Engineering and Development Department (CEDD) to facilitate better programming and to minimize interface issues;
- Component 3 – Land formation involves provision of formed sites for public and private developments by CEDD; and
- Component 4 – Land development involves developing the land with buildings and facilities in the public and private domains by the site developers.

16.2.2 ***Overall Coordination –*** The Government agency responsible for the overall land formation and infrastructure development would be the CEDD, like the common practice of new town development, including coordination of the development programme; obtaining funds for the site formation and engineering infrastructure works for which the department was responsible; coordinating the inputs and requirements of other Government agencies and relevant utility undertakings; assisting land disposal and other land administration actions undertaken by Lands Department; and commissioning of engineering works.

16.2.3 ***Statutory Plan Making –*** The RODP would provide the basis for the Planning Department to amend the existing OZPs. Any objections to the revised OZPs would be heard by the Town Planning Board for a decision before submission to CE-in-Council for approval.

16.2.4 ***Development of Landuse Components –*** While the public facilities would be developed by the Government, the private development, including private housing, and business uses would be implemented by the private sector. Development rights would be sold by auction or tender.

16.2.5 ***Environmental Mitigation Works*** – Environmental mitigation works would be identified during the Environmental Impact Assessment stage. Mitigation works would be undertaken by CEDD in conjunction with (or in accordance of where appropriate) the engineering works for the development.

16.2.6 The above proposed institutional framework for development follows the common practices for new town development. A more detailed framework is subject to the findings in the planning and engineering study to be conducted in a later stage.

16.3 Programme Assumptions for Development

Statutory Requirements and Procedures

Environmental Impact Assessment Ordinance (EIAO)

16.3.1 The EIAO provides a statutory framework for the assessment of environmental impacts of designated projects and the implementation of prevention and mitigation measures to protect the environment. The proposed development is a Designated Project under Item 1 of Schedule 3 of the EIAO.

16.3.2 According to the EIAO, EPD will issue the Study Brief within 45 days after the submission of Project Profile, taking into account any comments from public and other stakeholders.

16.3.3 The EIA study shall comply with all the requirements given in the Study Brief. The EIA report will need to be submitted to Environmental Management Steering Group (EMSG) and incorporate any comments from the members. After that, the report will be submitted to ACE and be subjected to open inspection by the public. Forums and meetings may be required to explain the EIA findings and recommendations to District Councils, Heung Yee Kuk, green groups and other stakeholders. A total of 150 days will be required for EIA Report review, public consultation, EIA Report approval and issuance of Environmental Permit (EP) before construction commences.

Town Planning (Amendment) Ordinance (TPO)

16.3.4 The Study Area falls within land zoned "Other Specified Use" annotated "Sewage Treatment Works" ("OU (Sewage Treatment Plant)") under the Sha Tin Outline Zoning Plan No. S/ST/27. Under the current zoning, the site is primarily to provide land for sewage treatment plant uses. Taking into account the proposed uses under the planning review exercise of this Study (for example residential, commercial, G/IC uses etc), and subsequent to a planning and engineering feasibility study on the existing STSTW site, it is expected that amendment to the OZP will be required to fully reflect the planning intention of the site. As mentioned, prior to OZP amendment, a separate Planning and Engineering (P&E) Study should be conducted to further investigate the planning and technical feasibility, and formulate the Preliminary Outline Development Plan (PODP) and Recommended Outline Development Plan (RODP) for the subject site. Upon the completion of the P&E Study and the RODP with the proposed land uses confirmed, the government shall then initiate the process to amend the OZP. The statutory procedure for OZP amendment are further described in the following paragraphs.

16.3.5 In order to realize any future development and land uses at the existing STSTW site, a process for OZP amendment will be required. According to the Town Planning Ordinance (TPO), any amendment to the OZP to support the proposed development at the existing Sha Tin Sewage Treatment Works site will be exhibited by the Town Planning Board (TPB) for public inspection under Section 5 (s.5) or (s.7) of the Town Planning Ordinance for a period of 2 months. After which the public representation will be published for a further 3 weeks and any resulting additional amendment to the OZP will also be published for public inspection for a period of 3 weeks. Upon completing the public reviewing and representation process, the TPB will proceed to amend the draft OZP by the proposed amendments, the amended draft OZP will then be submitted to the CE in C for approval under s.8 of the TPO. In general, the time requirement for the statutory procedure for amendment to an OZP will be within 9 months after the expiry of the OZP exhibition period (2 months), which the CE may allow a further period of up to 6 months. Assuming a smooth programme, the whole process will take about 11 months.

Roads (Works, Use and Compensation) Ordinance, Cap 370

16.3.6 This Ordinance provides for publication of road works proposals, objections to the proposals, authority to carry out the works and for the use of the road scheme, powers in relation to resumption of private land, creation of easements and other rights, closure of roads, compensation, etc. Under the provisions of this Ordinance, the proposed road works are published in the Gazette containing a description of the general nature and the extent of the road works. The Gazette Notice (Chinese and English) will have to be affixed

in prominent locations within the works area. Any person may, by notice in writing delivered to the Authority not later than 60 days after the first publication of the notice, object to the works or the use or both. The Secretary for Transport and Housing may authorize the scheme if no objections to the scheme have been received or if any objections received have been withdrawn.

16.3.7 If objections received cannot be resolved, the scheme has to be submitted to the Chief Executive in Council for a decision. The Chief Executive in Council, after considering the scheme and any objections, may authorize the scheme with or without any changes, or decline to authorize the scheme. The power to order resumption of land of the authorized scheme has been delegated to the Director of Lands.

Water Pollution Control (Sewerage) Regulation, Cap 358AL

16.3.8 For the purpose of the carrying out of works or the construction, maintenance, repair or demolition or works under this Regulation, or of any matter related or incidental to such purpose, provisions similar to those in the Roads (Works, Use and Compensation) Ordinance, Cap 370 shall apply. The land resumption procedures are hence similar to those specified in the Roads (Works, Use and Compensation) Ordinance, Cap 370.

Public Consultation

16.3.9 Public consultation is an important aspect in the planning and implementation of a new development and associated public works. Being accountable and open to the public are core principles of the Government and providing opportunities for public consultation are formalised in the Government's consultative and statutory processes.

16.3.10 Public consultation with Rural Committees (RC) and District Councils (DC), as appropriate, will be conducted prior to all gazettal procedures under Town Planning Ordinance (TPO), Roads (Works, Uses & Compensation) Ordinance, Railways Ordinance and Water Pollution Control Ordinance. Four months would be allowed for consultation with the RC and DC in a sequential manner in the programme.

16.3.11 The gazettal of the OZPs will also be made available for public comment in accordance with Section 5 of TPO and the public can make representation under Section 6 of the TPO within 2 months.

Summary of Programme Assumptions and Draft Programme

16.3.12 Timing assumptions for different procedures are broadly summarized in the **Table 16.4**.

Table 16.4 Basic Timing Assumptions for Development Programme

Activity	Duration (month)
Town Planning Ordinance/Procedure	11
Decommissioning of the existing STSTW	17
Demolition of the existing STSTW and decontamination (if necessary)	19
Construction of Engineering Infrastructures	30
Land Sale	3
Construction for Residential Development (assume all phases implemented concurrently in order to achieve the earliest occupation of the site)	36

16.3.13 Residential development could be split into several phases. One possible split is show on **Fig. No. /16.01**. However, in order to achieve the earliest occupation, it is assumed that all 4 sites to be implemented concurrently.

16.3.14 The above timing has assumed all statutory procedures / gazette and the public consultation could be completed smoothly. Therefore, based on the above timing assumptions, implementation programme for each development packages is formed as presented in **Appendix 16.01**. The earliest possible population intake will be 2031. However, a more detailed programme is subject to the finding of the upcoming planning and engineering study of the site.

17 FINANCIAL IMPLICATIONS

17.1 Introduction

17.1.1 The objective of this planning review on future land use of existing STSTW site is to establish a business case to justify the financial viability of the Project. The "Development Scenario" and plot ratio of the future development is subjected to the relocation cost of the STSTW and the findings of some preliminary technical assessments. It will be provided in the later stage of the project when the preliminary design of the STSTW is formulated.

17.1.2 To justify the financial viability of the Project and formulate the preliminary layout of the future development, the following assumptions with justifications are discussed in this section.

17.2 Assumptions on the Land Sale Premium Assessment

17.2.1 The Study Area will be carved out into different parcels of land for either pure residential, commercial or G/IC uses. The proposed site coverage of land for residential and commercial use would be about 50% taking into account the existing site constraints and area required for other infrastructure and greening. The tentative land use would be based on this value to formulate the preliminary layout.

17.2.2 In arriving at the development bulk of residential sites, reference is made to the existing land leases of two newly completed residential developments at Science Park namely Providence Bay Phase I (Tai Po Town Lot No. 186) and Phase II (Tai Po Town Lot No. 188) which were sold by Government Land Auction on 17th September 2007 and 13th March 2007 respectively. The two developments have just been completed and put on the market for sale recently.

17.2.3 As compared with subject site, both have similar physical environment and enjoying an unobstructed sea view over the Tolo Harbour. The traffic distances to the nearby MTRC East Line University Station are also similar. With reference to these two development lots, the average flat sizes of about 80 square metres (in Gross Floor Area) is assumed in the development.

17.2.4 The proposed development periods (i.e. Building Covenant) are based on the current land sale policy and the date of Occupation Permit (OP) and the date of the lands Sale. For the two reference lot, the average development period is about 60 months (i.e. from March, September 2007 to 2013).

17.2.5 The ratio and saleable price of the proposed car parking spaces, loading/unloading bays, etc. are based on the land grant documents of the two reference lots and the current Hong Kong Planning Standard and Guidelines.

17.2.6 The interest rate of 5% per year adopted in the residual calculations throughout the development period is based on the prevailing prime rate of 5%.

17.2.7 The developers' profit of about 20% is based on the current practices of other residential development projects in the Territories.

17.2.8 The efficient ratio of about 80% for those residential developments is based on those of the two reference lots (77%).

17.2.9 When calculating the land value for residential developments, the land value for developing subsidized housing will not be differentiated from the land value for developing private housings. It is considered that the Government has sacrificed the opportunity cost for using the land as private housings when it is developed as public housings. Therefore, the land value for private housings will be applied to the whole residential developments.

17.2.10 The unit rates adopted in assessing the Gross Development Values (GDVs) of the proposed developments are based saleable area unit rates of those recent transaction records of the two reference lots and with the nearby districts.

17.2.11 For the estimated total development cost, the construction unit costs are based on the Quarterly Construction Cost Review (3rd quarter of 2012) published by Rider Levett and Bucknall, one of the leading quantity surveying firms in Hong Kong.

17.2.12 The above discussed assumptions are summarized in **Table 17.1** below.

Table 17.1 – **Summary of Assumption Adopted in Land Sale Assessment**

	Item	**Assumed Value**
1.	Proposed Site Coverage for Residential and Commercial Use	About 50%
2.	Efficient Ratio	About 80%
3.	Average Flat Size	About 80 sq.m
4.	Car Park Space Price Loading/Unloading Bays Price	With reference to the existing land leases of two newly completed residential development at Science Park - Lot No. 186 - Lot No. 188
5.	Car Park Size Car Park Ratio	About 40 sq.m About one per 3.3 flats
6.	Loading/Unloading Bays Ratio	About one per 800 flats
7.	Residential Unit Rate (Saleable) Shop Unit Rate (Gross)	With reference to the existing land leases of two newly completed residential development at Science Park - Lot No. 186 - Lot No. 188
8.	Construction Cost (Gross) Residential Construction Cost (Gross) Arcade Shops	About $1,784/sq.ft About $2,415/sq.ft
9.	Developer's Profit	About 20%
10.	Interest Rate	5%

17.2.13 The details of the financial implication will be discussed under separate deliverable.

18 SUMMARY AND WAY FORWARD

18.1 Summary of Findings

18.1.1 The purpose of this planning review is to formulate a notional development scheme for establishing a business case for the relocation of the existing STSTW. This Report has presented the schematic proposal for the potential redevelopment at the existing STSTW site. Taking into account the planning, design and various aspects of technical considerations, the proposed development scheme will comprise mainly of residential use with supporting commercial, community and open space facilities to create a balanced community. Two development scenarios has been formulated, namely the "Development Scenario" and the "Enhanced Development Scenario".

18.1.2 As a conclusion, to recap on the major findings and recommendations generated from the planning review exercise for the existing STSTW, a brief summary on the major tasks and components under the planning review are provided in this chapter. Key components including key issues, opportunities and constraints of the site, major planning and design concepts, and the two notional development schemes will be summarized in the following:

Development Opportunities and Constraints of the Site

18.1.3 Based on findings from the baseline review of the existing site context conducted at the previous stage, a list of key issues, opportunities and constraints pertaining to the future land use and development of the existing STSTW site have been identified. These information have formed the basis and major considerations for formulating development vision and principles, as well as the planning and design of the future development scheme. The major development opportunities as identified within the STSTW site are as follows:

- The size and location of the site present considerable opportunities for a mixed and comprehensive use development to meet the long-term community needs.
- The site enjoys prominent waterfront location at the mouth of Shing Mun River. Visual impacts on the neighbouring existing communities should be taken into consideration in the course of site planning and design. A stepped height profile with lower buildings facing Sha Tin Hoi should be considered and wall development near the waterfront should be avoided.
- Taking advantage of the waterfront location, a more generous provision of open space (including the provision of 20m-wide waterfront promenade with cycle track and other possible water sports facilities) should be considered.
- Taking into account the preservation of major wind corridor in northeast-southwest direction penetrating the site, appropriate building disposition and massing should be carefully considered.
- Development opportunities of the adjacent Water Supplies Department (WSD)'s salt water pumping station site should be taken into account when planning the future development of the Study Area.

18.1.4 In addition, development constraints in various technical aspects are also identified and are considered in the formulation of the proposed development schemes. The identified development constraints are provided as follows:

- Tolo Highway, a major expressway west to the site, and Tate's Cairn Highway, an elevated expressway traversing the north portion of the site, are the major source of traffic noise and air pollution. To minimize the noise impact, noise barriers, setbacks for sensitive uses, single aspect building design and other less noise sensitive uses (ie. commercial, G/IC uses) should be considered adjacent to the highways.
- The current accessibility of the site is limited by a couple of major traffic constrained locations including signalized junction at Kiu Ha Road/Tolo Highway and the three roundabouts to the north of the site. Road widening and junction improvements should be considered.

- The current pedestrian access to the two closest MTR stations (University Station and Tai Shui Hang Station) is indirect and beyond 500m walking distance. Public transport interchange (PTI) should be considered while the enhancement of physical connections between the site and the MTR stations should be further explored.
- Adjacent to the south boundary of the site and Shing Mun River, stables are a possible source of odour impact. Buffer or single aspect buildings should be considered for odour sensitive uses.
- A Partially underground sewage pumping station with some related facilities located above ground is proposed at the northwest corner of the site. Its layout and building design should be taken into consideration in the future development.

Planning and Urban Design Concepts

18.1.5 Having considered the development opportunities and constraints and the public aspiration for more people oriented quality living environment with sustainable urban design. A series of planning principles are formulated, these principles have served to provide the guiding directions for the proposed "Development Scenario".

- To take into account the needs of the community and the overall development of Hong Kong
- To bring the people to the waterfront and the waterfront to the people
- To create a coherent community supported by a variety of commercial, social and recreational facilities
- To enhance the connectivity of the Study Area with the adjacent districts
- To accommodate appropriate transport infrastructure required to serve future population and visitors
- To promote sustainable site planning

18.1.6 With reference to the development opportunities and constraints, community aspirations for quality living environments, and the Urban Design Guidelines for Hong Kong, the urban design principles are proposed as follows:

- To enhance pedestrian connectivity to nearby transport hub and railway station to improve accessibility to the future development site
- To provide efficient and direct internal pedestrian and vehicular circulation suitable for the site setting, with emphasis placed on creating easy linkages to the riverfront open space area
- To apply a building height profile and adequate building separations to respect existing ridgeline, to preserve existing key visual corridors, and to define the neighbourhood character
- To create development-free corridors with respect to natural air paths and view corridors to allow better ventilation and visual permeability of the Study Area
- To provide a pleasant waterfront promenade to connect with the existing Shing Mun River promenade and existing open spaces, creating a continuous riverfront promenade along the Shing Mun River
- To provide green pocket parks and public open space to create a pleasant, attractive and green living environment

Major Parameters and Features of the "Development Scenario" and "Enhanced Development Scenario"

18.1.7 Having carefully reviewed and considered the key development opportunities and constraints, planning and urban design principles as well as public aspirations, two notional development schemes for the future development at the existing STSTW site have been formulated, namely the "Development Scenario" and the "Enhanced Development Scenario" as presented on **Fig. No. /4.01 and 5.01** respectively. The "Development Scenario" proposes a residential community with supporting facilities within

the site area of the existing STSTW. While under the "Enhanced Development Scenario", an additional area of land at the waterfront currently occupied by the WSD's Salt Water Pumping Station will be incorporated into the Study Area for further development to generate extra financial return for the STSTW development. A summary of the development and land use parameters and features of the two proposed scenarios under this study are provided as follows:

"Development Scenario"

a) *Key Development Features*

18.1.8 Under the proposed "Development Scenario", it aims to create a well balanced, residential focus community that capitalizes on the site's prime location. Residential development of medium to high density is proposed. To preserve views to the hinterland, a stepped height profile is proposed, in which the residential blocks are gradually lower when they are closer to the riverfront.

18.1.9 To allow sufficient visual porosity and air ventilation along the identified breezeway, diverse building disposition and intensity with adequate building separations are recommended. The residential will be well connected by new local road and other utility infrastructures, and supported by conveniently accessible open spaces and community facilities nearby, creating a balanced and quality living environment.

18.1.10 In terms of supporting uses for the proposed new community, at the northern tip of the Study Area, a commercial retail development consisting of a multi-level shopping centre is proposed at the northern end of the STSTW site. The proposed facility will serve the retail needs of the future new residents at the STSTW site, while also providing a new commercial activity node for the communities nearby. To serve the transport needs of the future community, a Public Transport Interchange (PTI) may be provided at the underside of the retail centre to connect the facilities with other areas. In addition, enhancement to existing pedestrian connections to the nearby MTR stations of University and Tai Shui Hang Station are proposed to improve physical linkages to rail transport facilities.

18.1.11 In accordance with the provision requirements of the Hong Kong Planning Standards and Guidelines (HKPSG), one primary school and one secondary school are proposed, which are proposed to be located at the centre the Study Area. Other educational facilities such as kindergartens and nurseries are possible to be incorporated within the proposed commercial and/or G/IC blocks.

18.1.12 Other G/IC facilities such as indoor sports centre, community centre or other facilities like film centre are possibly located at the west tip of the Study Area or near the retail shopping centre abutting the waterfront. Indoor facilities with open space are suitable to serve as a buffer to minimize the odour impact from the nearby stables.

18.1.13 Ample open space will be provided in the form of a Central Park, open plaza, pocket parks, children playground and fitness station. A continuous waterfront linkage from Shing Mun River to Sha Tin Hoi will be created with the possible provision of cycle track, water sports facilities, outdoor retail kiosks and F&B facilities. Green pedestrian linkage towards the waterfront is also proposed to be maximized. These open space and recreation facilities will serve to transform the site in becoming a popular destination.

b) Land Use and Development Parameters

18.1.14 Medium to high density residential towers ranging from 17 to 30 storeys are proposed. It will provide about 6,816 flats to accommodate an estimated population of about 19,800 persons. The proposed domestic GFA is about 570,240 m^2 with an overall domestic plot ratio of about 4 (based on the total area of the site being 28ha with 50% utilization).

18.1.15 Two blocks of multi-level shopping center of 5 to 7 storeys in height are proposed to meet the retail needs of the residential community and nearby area. They also serve as a noise barrier/enclosure to the elevated Tate's Cairn Highway. The non-domestic GFA is about 70,000 m^2 and an overall non-domestic plot ratio is 0.5 (based on the total area of the site being 28ha with 50% utilization).

"Enhanced Development Scenario"

18.1.16 In the "Enhanced Development Scenario", an area of land at the waterfront currently occupied by the WSD's Salt Water Pumping Station will be incorporated into the Study Area and be utilized for further development.

18.1.17 Given the prime waterfront location of the additional site fronting Sha Tin Hoi but expose to high traffic noise due to the presence of Tate's Cairn Highway & Tolo Highway adjacent to it, a waterfront hotel is proposed. The proposed hotel will serve to generate additional revenue to offset part of the capital cost for providing facilities for re-use of reclaimed water for non-portable use, while providing new hotel room supplies to support Hong Kong's Tourism industry. The key development features and parameters for the "Enhanced Development Scenario" are summarized as follows:

a) *Key Development Features*

18.1.18 Under the "Enhanced Development Scenario", the same planning vision and principle will apply to create a balanced residential community, maximizing the sites prime location and development potentials to achieve a business case for the relocation of the STSTW. As such medium and high density residential development are proposed with supporting commercial, G/IC and open space facilities similar to those proposed in the "Development Scenario".

18.1.19 The addition of the WSD Salt Water Pumping Station site will be utilised for the development of a waterfront hotel and waterfront open space serving as an extension to the promenade from the Shing Mun River. The proposed hotel development will be incorporated with the attractions along the waterfront promenade, retail and outdoor F&B facilities to form a major activity node.

b) *Land Use and Development Parameters*

18.1.20 The proposed waterfront hotel is envisaged to provide between 270 to 350 rooms. The proposed building height of the hotel will be about 13 storeys, with an approximate total GFA of 22,000 sqm. Together with the rest of the development within the site, the "Enhanced Development Scenario" proposes 570,240 sqm of domestic GFA and 92,000 sqm of non-domestic GFA (including the proposed hotel), resulting in an overall development plot ratio of approximately 4.5.

Findings of Preliminary Technical Assessments and Mitigation Measures

18.1.21 The proposed notional schemes have undergone preliminary technical assessments in various aspects to ascertain its broad technical feasibility. The various technical aspects assessed include transport and traffic, waterworks infrastructure, environmental impact, geotechnical, air ventilation and sustainability. Key findings of the technical assessments and suggested mitigation measures are briefly summarized as follows:

a) Transport and Traffic

18.1.22 Currently connected through the junction of Kiu Ha Road and Shui Chong Street is a dual 1-lane carriageway with limited ingress/egress capacity. The proposed development site has inadequate road network and capacity to support proposed development and incoming population. The proposed development scheme will generate/attract additional

vehicular trips. For the purpose of TIA, a residential housing type mix (ie a mix of 30% low vehicular trip generator – residential highly depends on public transportation) has been assumed. However several improvement works would still needed to be provided on the critical junctions in order to ensure the level of services of the road network in vicinity. These improvement measures includes improvement works to existing roundabout/ junctions/ roads, improve the connectivity of the existing pedestrian footpath and cycle track and review of the future development need of public transport facilities.

b) Environmental

18.1.23 No adverse dust impact on the Air Sensitive Receivers (ASRs) in the vicinity of the construction site is anticipated with the implementation of mitigation measures specified in the Air Pollution Control (Construction Dust) Regulation and good site practices during construction phase.

18.1.24 To mitigate the odour impact arising from the adjacent horse stable, a buffer area at the southern portion of the STSTW site is proposed. There will also be no adverse traffic emission impact and odour impact from Sha Tin Racecourse expected on the proposed development site with the appropriate setback from the main truck roads and buffer area at the southern portion of the site.

18.1.25 In terms of noise impact from the adjacent Tate's Carin Highway and Tolo Highway, various mitigation measures, such as noise barriers, buffer areas, or single aspect as the last resort are proposed to reduce impact to the sensitive receivers in the proposed development. No other major noise nuisance is expected.

18.1.26 No major impacts on water quality, waste management, land contamination, ecology and fisheries, cultural heritage are anticipated.

c) Landscape and Visual Impact Assessment

18.1.27 Significant visual impacts on Kau To Shan and Buffalo Hill are expected, as it experiences a great change from a low rise industrial site to a mix of high rise residential development. Extensive landscape trees and shrubs planting will be proposed for the development including an adoption of approximate 30% green ratio for the development. With the implementation of the improvement and mitigation measures, for example, the creation of new landscape framework and visual connection and breezeways, the control of development heights and density, it is expected that the visual impacts could be minimized.

d) Air Ventilation

18.1.28 A wind tunnel test was conducted to test the adequacy of air ventilation within the study site. The result of the wind tunnel test for the proposed future development at the existing STSTW site is found to be satisfactory.

e) Geotechnical

18.1.29 From the geotechnical aspect, it is considered that there are no major issues, at this stage, that will make redevelopment of the site unfeasible.

f) Utilities

18.1.30 No major impacts on drainage, sewerage and waterworks are anticipated. With the necessary upgrading and enhancement works to the existing systems, the utilities would be capable of meeting the future needs of development of a new community.

g) Sustainability

18.1.31 In terms of the proposed development, 22 sustainability indicators were assessed. The development is expected to bring improvements in “Cost-Benefit”, “Fixed Capital” and “Unemployment Rate” as future development will stimulate economic activities and job opportunities. It would also improve “Travel Speed” in light of the enhancement in roadworks between the development and other parts of territory. However, the proposed development is anticipated to cause slight environmental deterioration in “Carbon Dioxide Emitted Per Year”, “Construction Waste”, “Criteria Air Pollutant”, “Energy Consumption” and “Excessive Noise”.

18.2 Way Forward

18.2.1 As the main objective of the planning review is to formulate a notional development scheme for assessment the financial viability of STSTW relocation, it should not be considered as any commitment on after-use of the site, which should be subject to detailed planning and engineering study for the existing STSTW site to be taken place in due course.

18.2.2 Issues such as the financial implication of the proposed development and the combined effect of any possible reclamation in the vicinity will have ramification to the overall planning and design of the future STSTW development. These issues will require further investigation in the future planning and engineering review under a separate study.

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Project Management Initials: Checked:

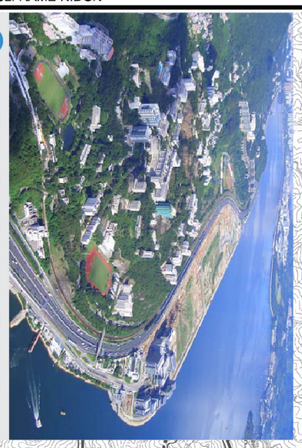
ISO A3 297mm X 420mm

1 Sha Tin Sewage Treatment Works

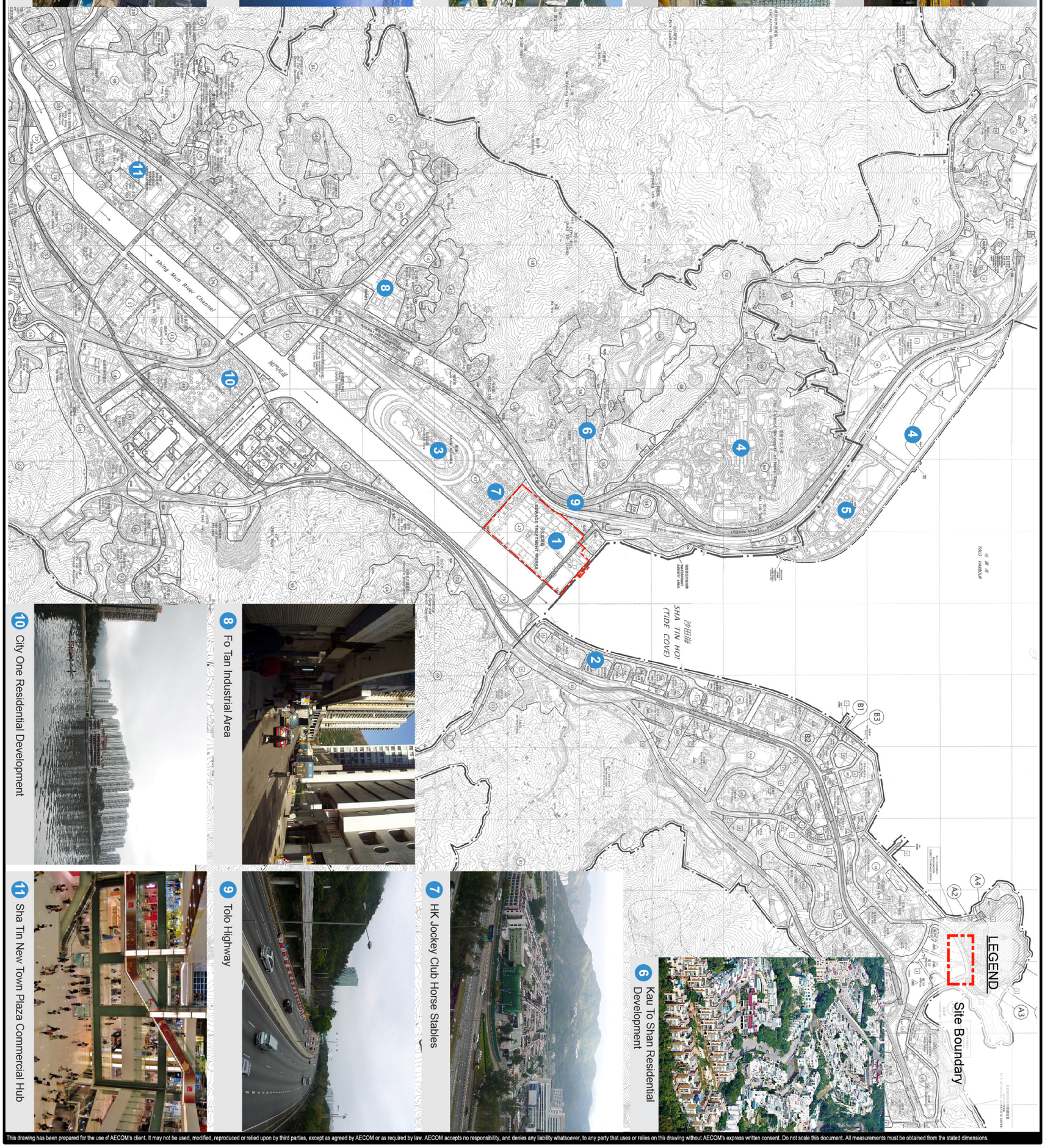
2 Residential Development abutting Ma On Shan Waterfront Promenade

3 Sha Tin Racecourse & Penfold Park

4 The Chinese University of Hong Kong and Pak Shek Kok Development



5 Hong Kong Science Park



10 City One Residential Development

8 Fo Tan Industrial Area

11 Sha Tin New Town Plaza Commercial Hub

9 Tolo Highway

7 HK Jockey Club Horse Stables

6 Kau To Shan Residential Development

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: APR. 2013

STATUTORY PLANNING AND DEVELOPMENT CONTEXT OF SURROUNDING AREAS

AECOM

60269233/RPR/2.01

Plot File by: kwokme 6/25/2012
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Project Management Initials: Checked:

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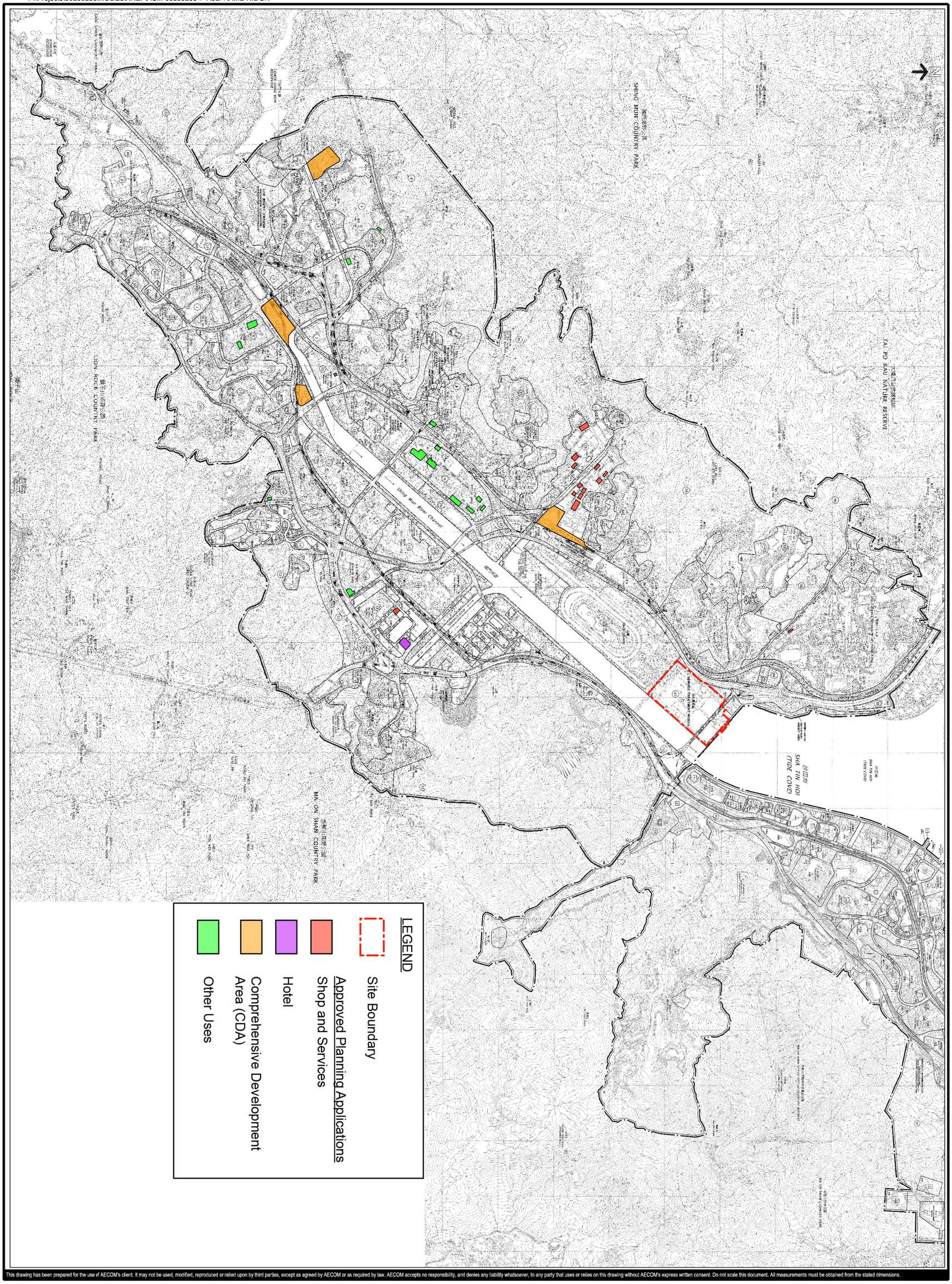

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 **Date: APR 2013**

APPROVED PLANNING APPLICATION WITHIN SHA TIN DISTRICT IN PAST 5 YEARS

AECOM

60269233/RPR/2.02

Plot File by: kwokme 6/25/2012
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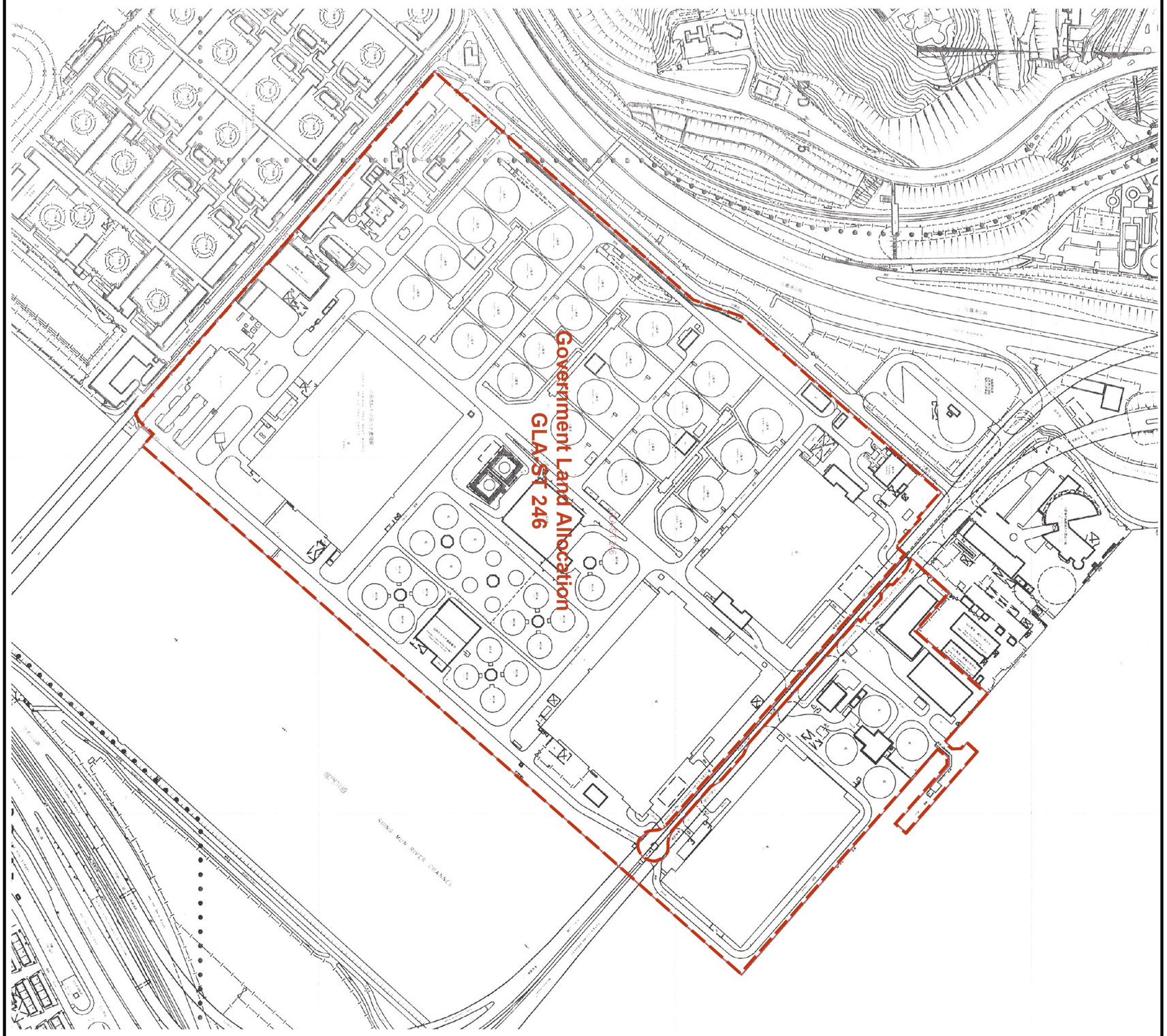

Source: Lands Department / Land Administration Office (Sheet Number: 7-NE-C, 7-SE-A)

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 **Date:** APR 2013

LAND STATUS OF EXISTING SHA TIN SEWAGE TREATMENT WORKS

AECOM

60269233/RPR/2.03

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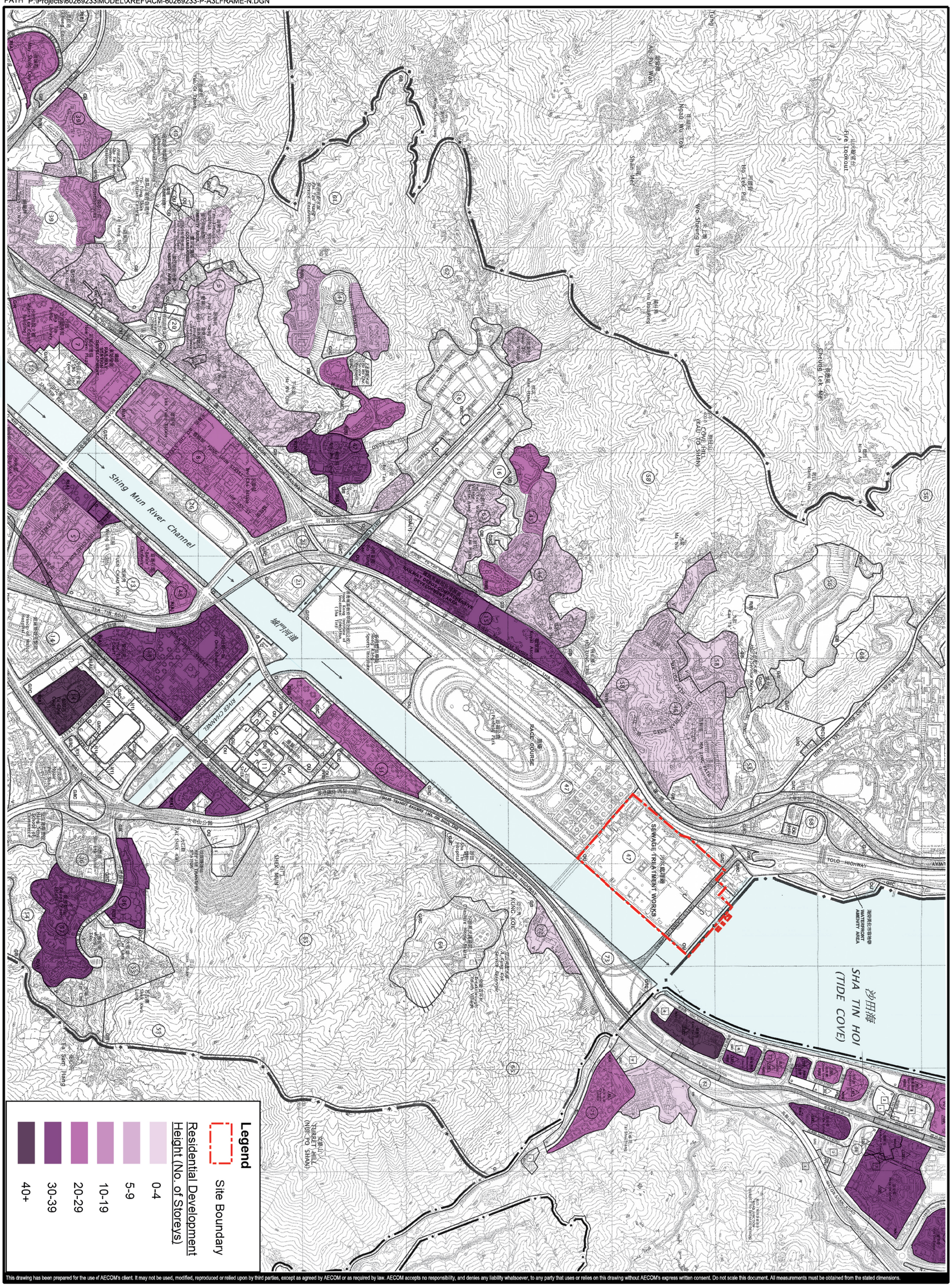

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: APR 2013

BUILDING HEIGHT PROFILE OF SURROUNDING MAJOR RESIDENTIAL DEVELOPMENTS

AECOM

60269233/RPR/2.04

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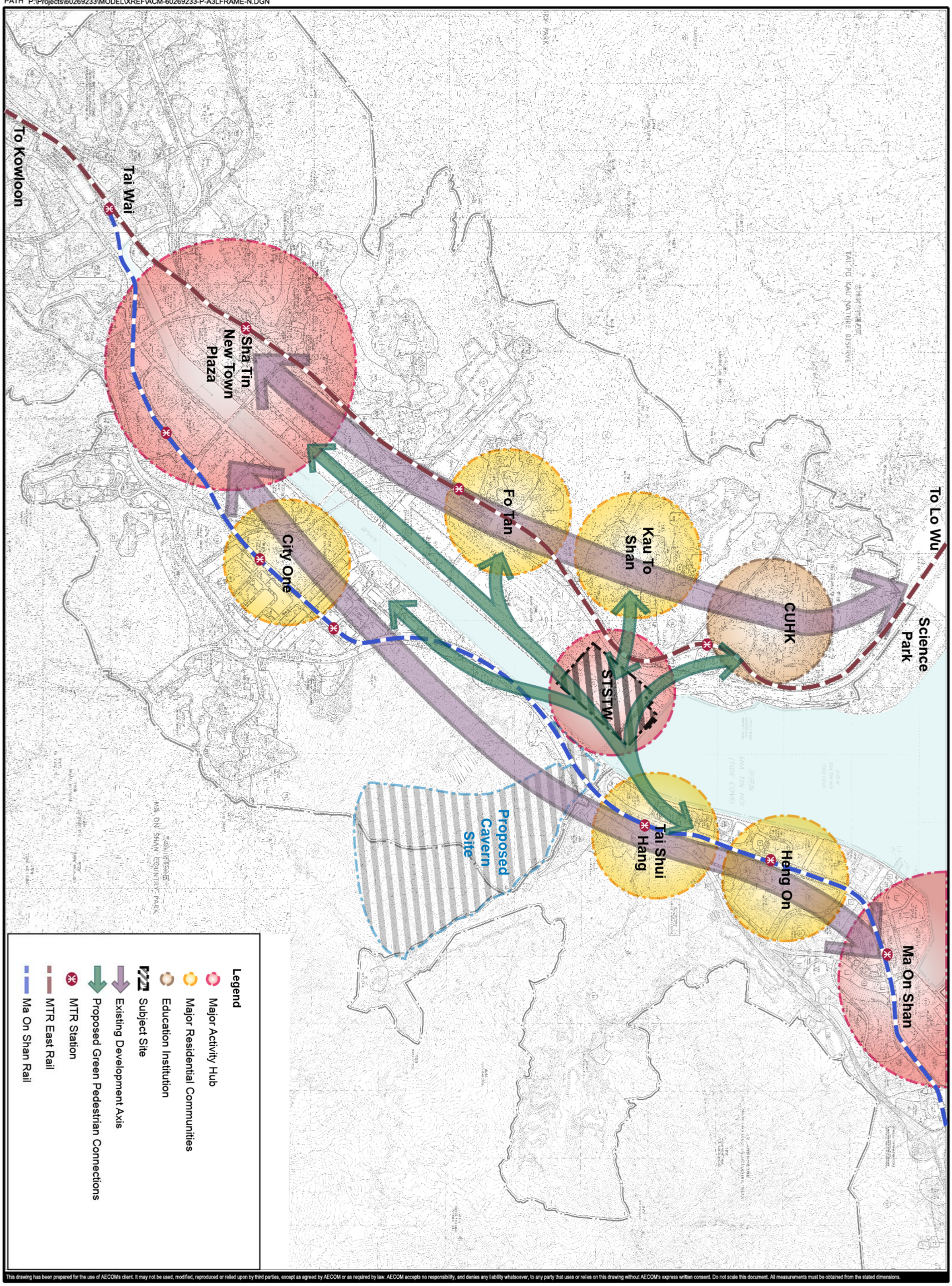

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR 2013

DEVELOPMENT FRAMEWORK

AECOM

60269233/RPR/2.05

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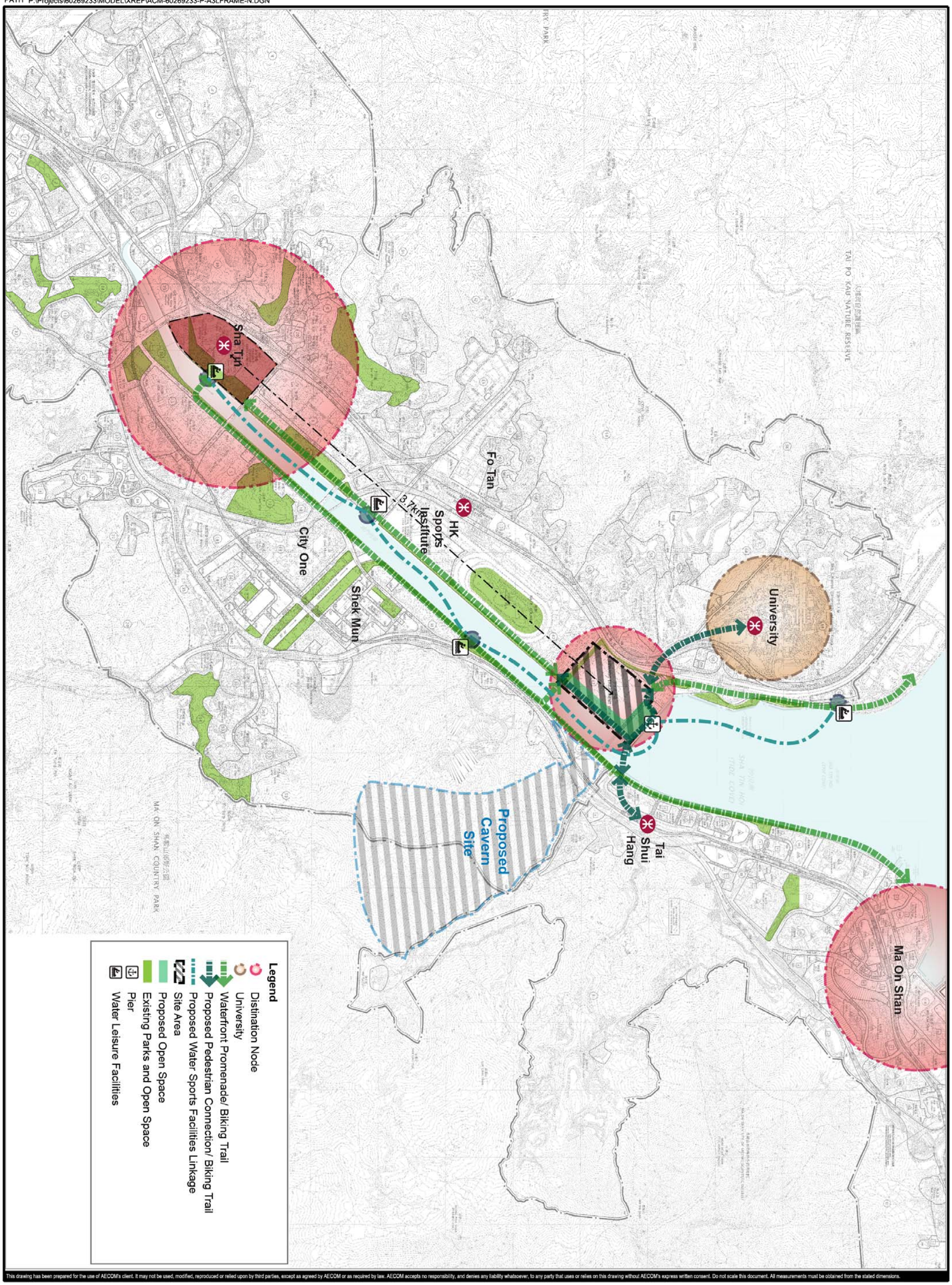

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR 2013

EXISTING PLANNING FRAMEWORK THE SHING MUN RIVER CORRIDOR

AECOM

60269233/RPR/2.06

ISO A3 297mm X 420mm

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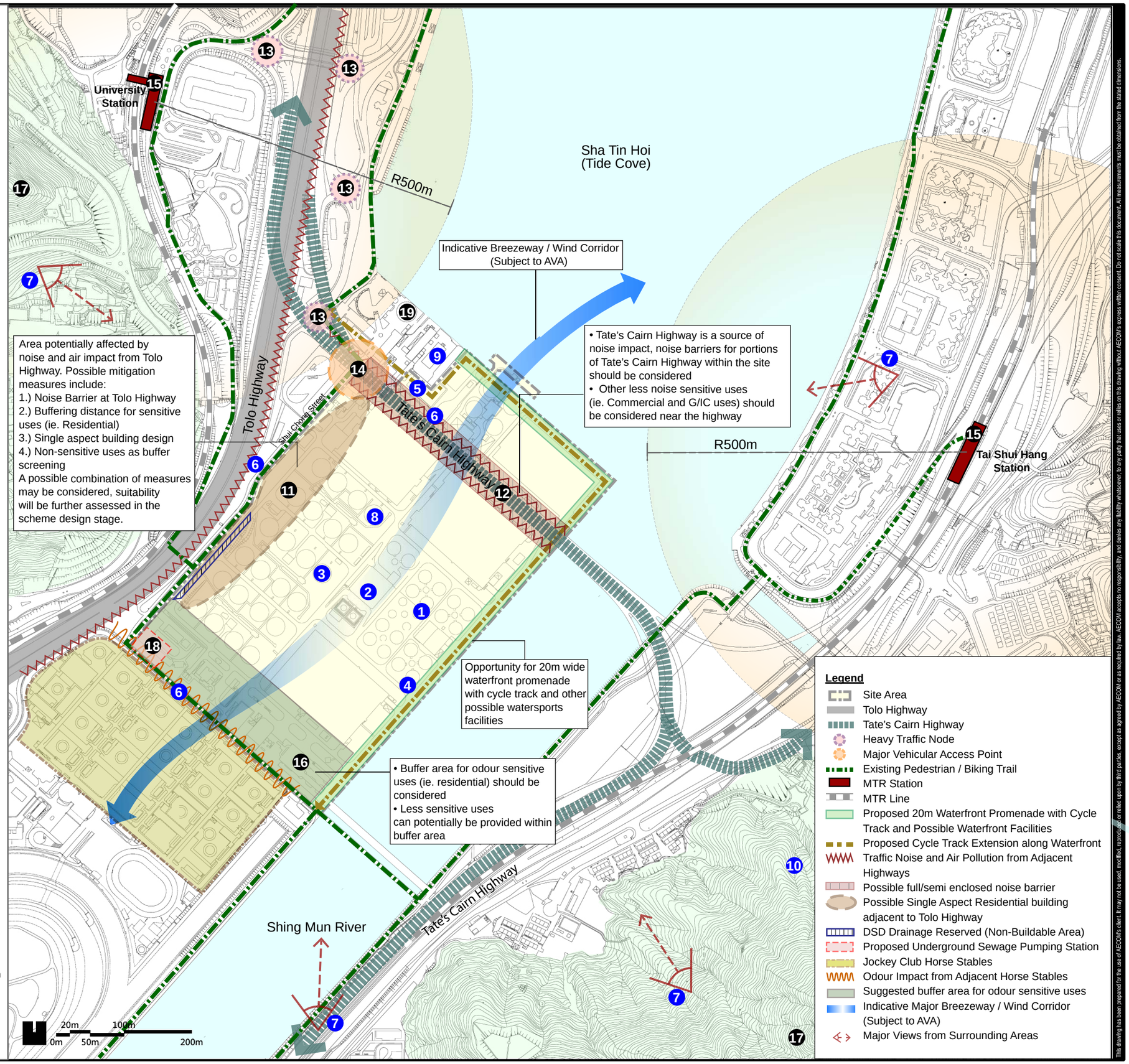
Project Management Initials:

KEY ISSUES

1. The site area is approximately 28ha, its size and location presents great opportunity for a mixed and balanced use development to meet long-term community need. Emphasis should also be placed on public engagement to respect and respond to the views and needs of the public, while achieving financial viability for the STSTW project.
2. Local wind is predominated from north and northeast direction; an air corridor in north-south direction should be reserved to allow air penetration to hinterlands.
3. Appropriate building disposition and massing should be incorporated with reasonable building gaps to allow good air penetration.
4. The green ratio should not be less than 30% of the site area (including vertical greening) tallying with relevant guidelines for Sustainable Design. Open space provision should also be in compliance with the HKPSG.
5. Since MTR Stations are located beyond comfortable walking distance, public transport terminus and other form of connections/enhancement in transport should be considered to accommodate future development need.
6. Setback and mitigation measures (such as noise barrier) from air and noise pollution (e.g. adjacent stables and Highways) should be provided.
7. The site is located at a visually prominent location at the mouth of the Shing Mun River. Future development profile shall take into consideration visual impact imposes on nearby existing communities.
8. A stepped height profile with lower buildings facing Sha Tin Hoi shall be considered for future developments.
9. Design of future development shall take into account the development opportunity of the adjacent WSD's salt water pumping station site
10. Development phasing should be carefully considered to tie in with the overall phasing of the relocation programme of the STW facilities.

CONSTRAINTS

11. Tolo Highway, a major expressway, is a source of traffic noise and air pollution. To reduce the level of noise impacts to future users, possible measures include noise barriers, setbacks for sensitive uses and single aspect building design.
12. Tate's Cairn Highway traversing the northern part of the Site is a source of traffic noise and air pollution. Noise barriers and other less noise sensitive uses (ie. Commercial, G/IC uses) should be considered adjacent to the highway to reduce and buffer noise impact.
13. Major traffic constrained locations include signalized junction at Kiu Ha Road/Tolo Highway and the three roundabouts located to the north of the Site, road widening and junction improvements should be considered.
14. The Site is currently accessed through the junction of Kiu Ha Road and Shui Chong Street which is a dual 1-lane carriageway with limited ingress/egress capacity, junction improvements shoud be considered to meet future development needs.
15. Current pedestrian access to the 2 closest MTR stations is indirect and over 500m distance. Public Transport Interchange and other form of connections/enhancement in transport should be provided to serve future resident's needs. Potential enhancements of pedestrian connections to railway stations should be further studied.
16. The horse stables to the south of the Site is a source of odour impact. A buffer distance of 100m (indicative) for odour sensitive uses, such as Residential, should be considered to reduce odour impact.
17. The site is located at a visually prominent location at the mouth of the Shing Mun River. Building heights of future development shall respect adjacent ridgeline of the adjacent Kau To Shan and Nui Po Shan.
18. An underground sewage pumping station is proposed at the northwest corner of the site, the future development at this location should take into consideration of these facilities in its layout and building design.
19. Existing Helipad adjacent to the Marine Police Station will potentially become a source of noise pollution to the future residential.



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60269233/RPR/2.07

DEVELOPMENT ISSUES AND SITE CONSTRAINTS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: JAN 2014

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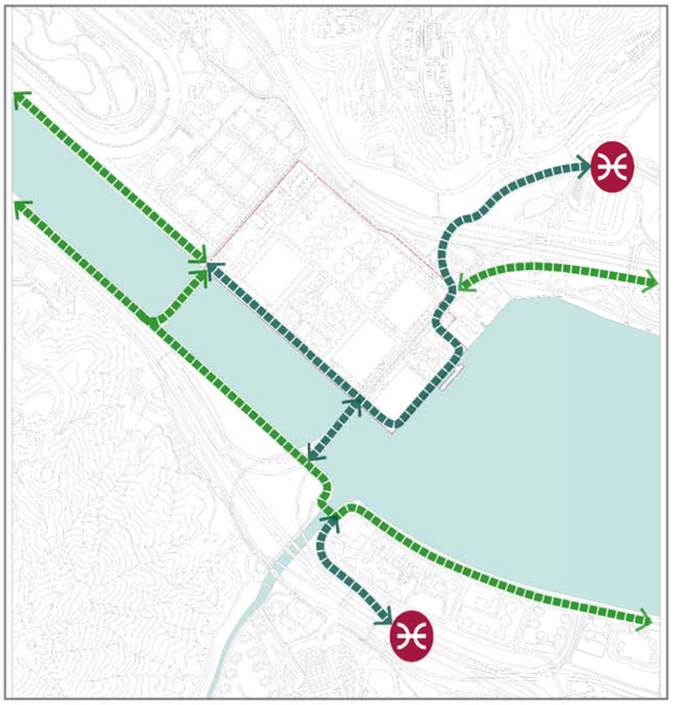
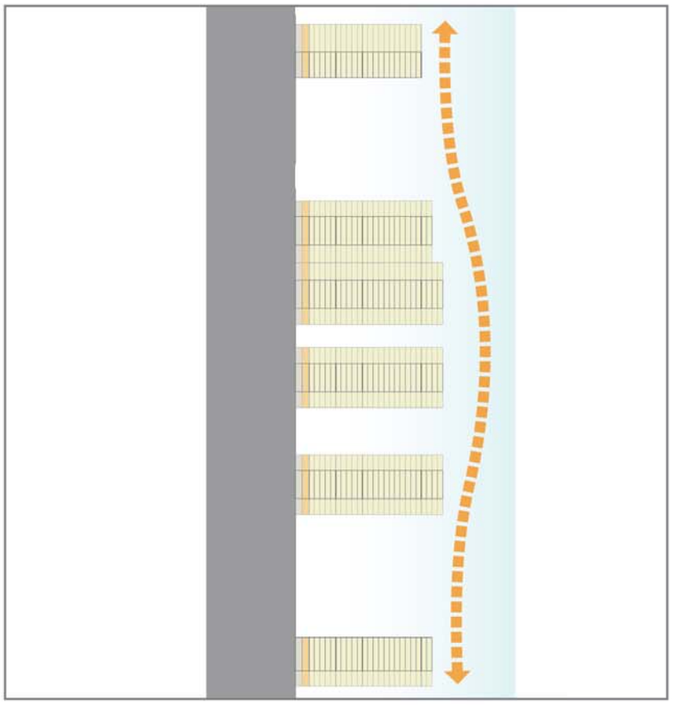
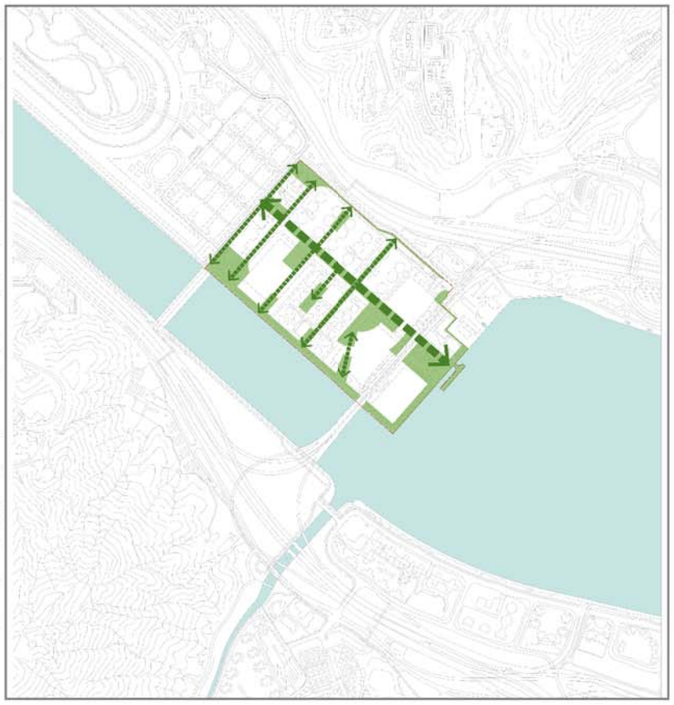
Pedestrian Accessibility



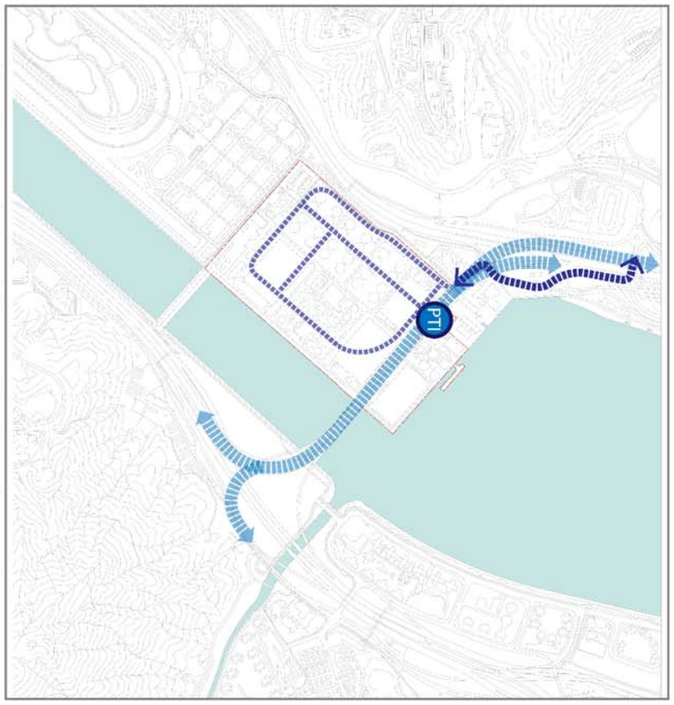
Diverse Development Height and Intensity



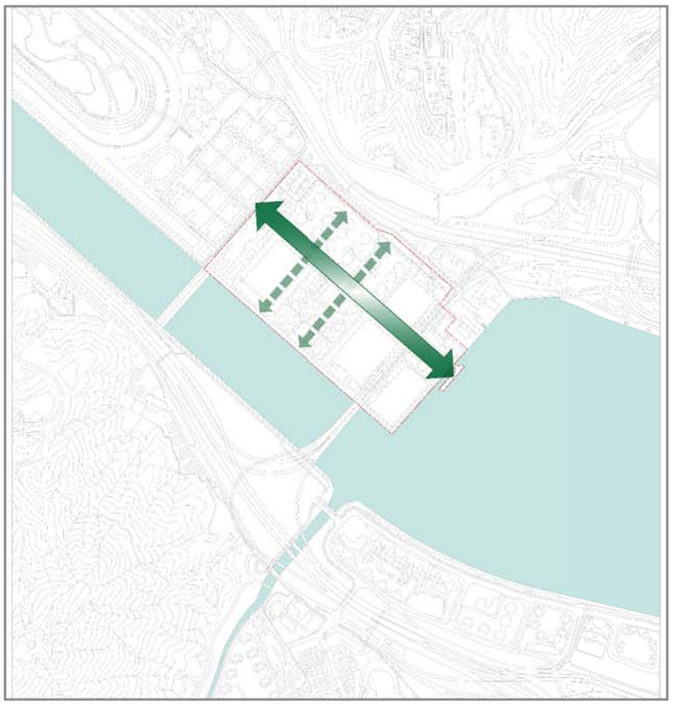
Maximize Green Pedestrian Linkage to the Waterfront



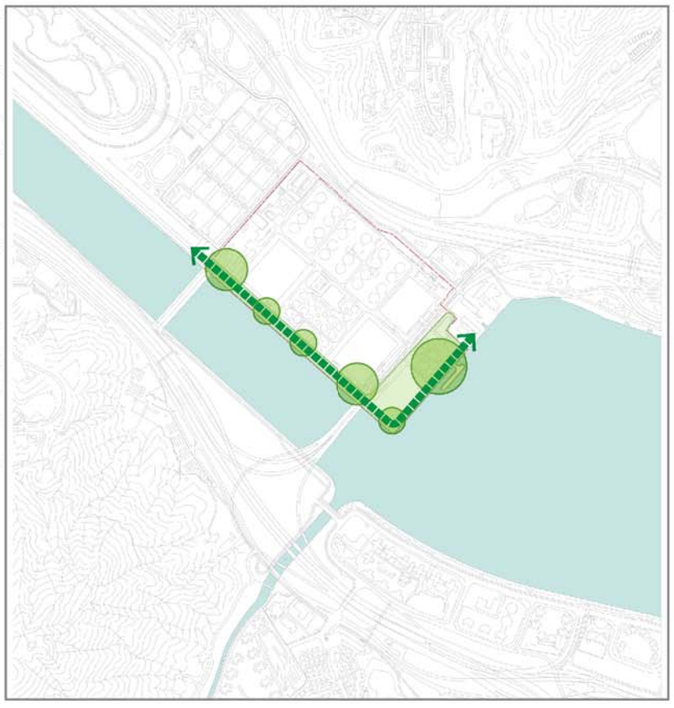
Creating Connected and Accessible Development



Creation of Visual / Ventilation Corridors



Creating Active and Dynamic Waterfront



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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 **Date: MAY 2013**

URBAN DESIGN PRINCIPLES

AECOM

60269233/RPR/3.01

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 **Date: JAN 2014**

PROPOSED DEVELOPMENT SCENARIO
MASTER LAYOUT PLAN

AECOM

60269233/RPR/4.01

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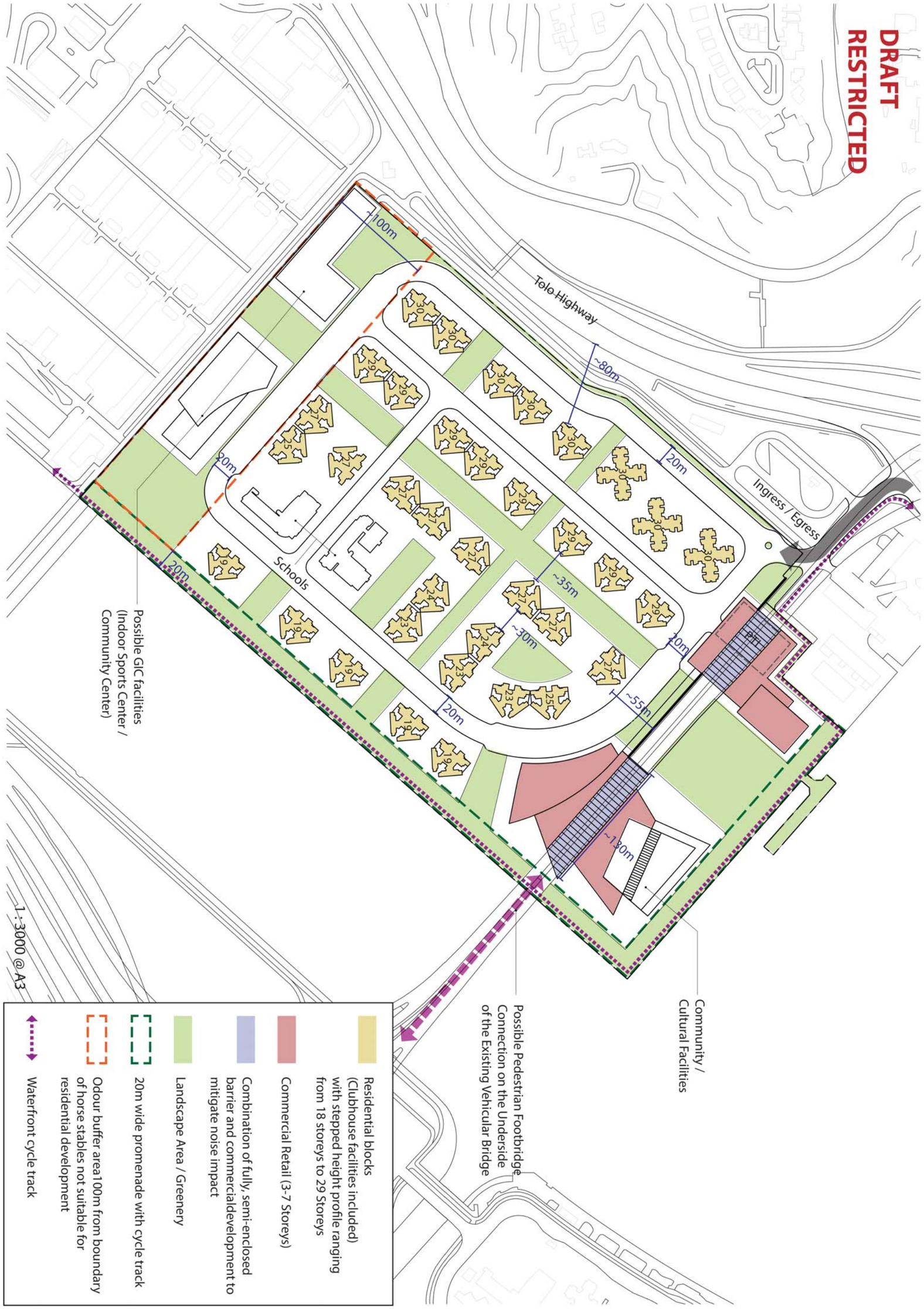

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 **Date: JAN 2014**

PROPOSED DEVELOPMENT SCENARIO
LAND USE DIAGRAM

AECOM

60269233/RPR/4.02

Plot File by: kwokme 6/25/2012
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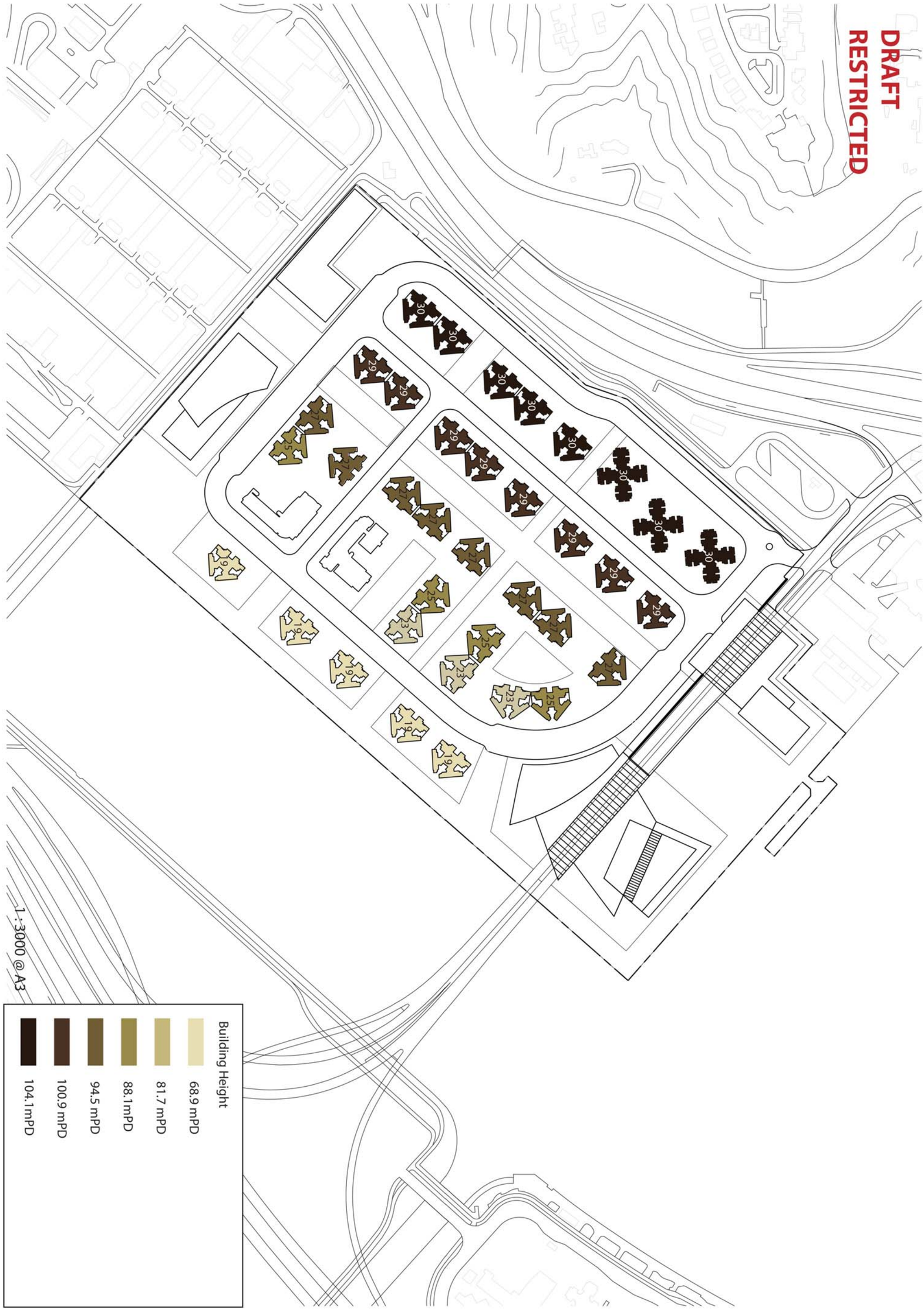

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

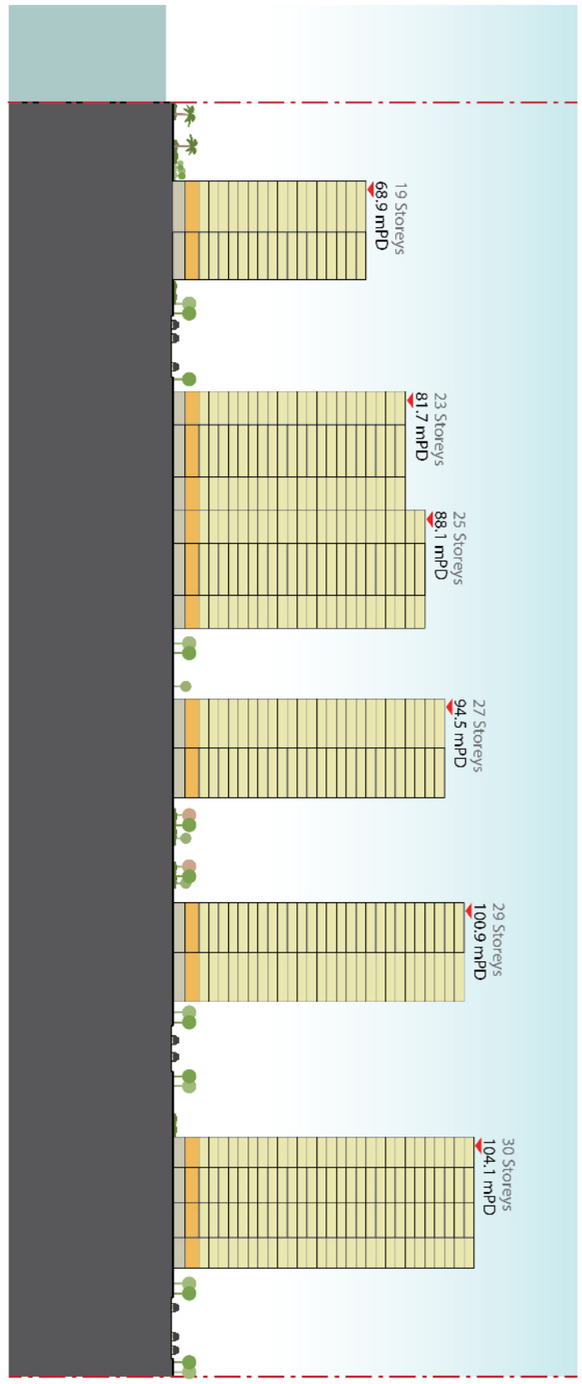
Project No.: 60269233 **Date: JAN 2014**

PROPOSED DEVELOPMENT SCENARIO
BUILDING HEIGHT PROFILE

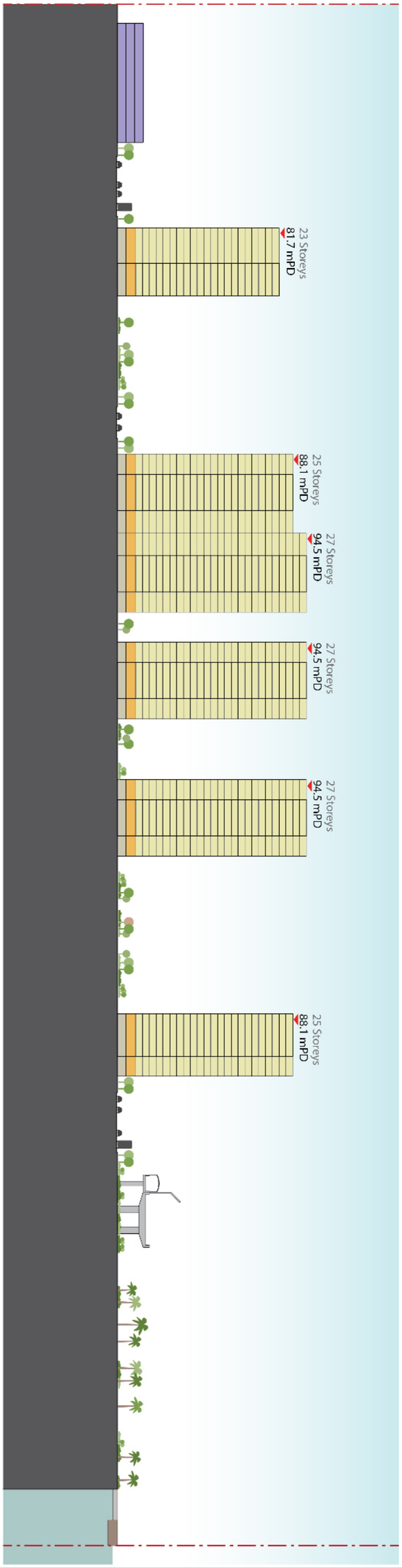
AECOM

60269233/RPR/4.03

Section A - A'



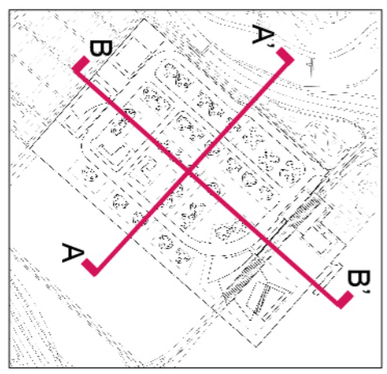
Section B - B'



Legend

- Residential Floors
- Club House Facilities
- Building Lobby
- GIC Facilities

Key Plan



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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: APR 2013

PROPOSED DEVELOPMENT SCENARIO SECTION DIAGRAM

AECOM

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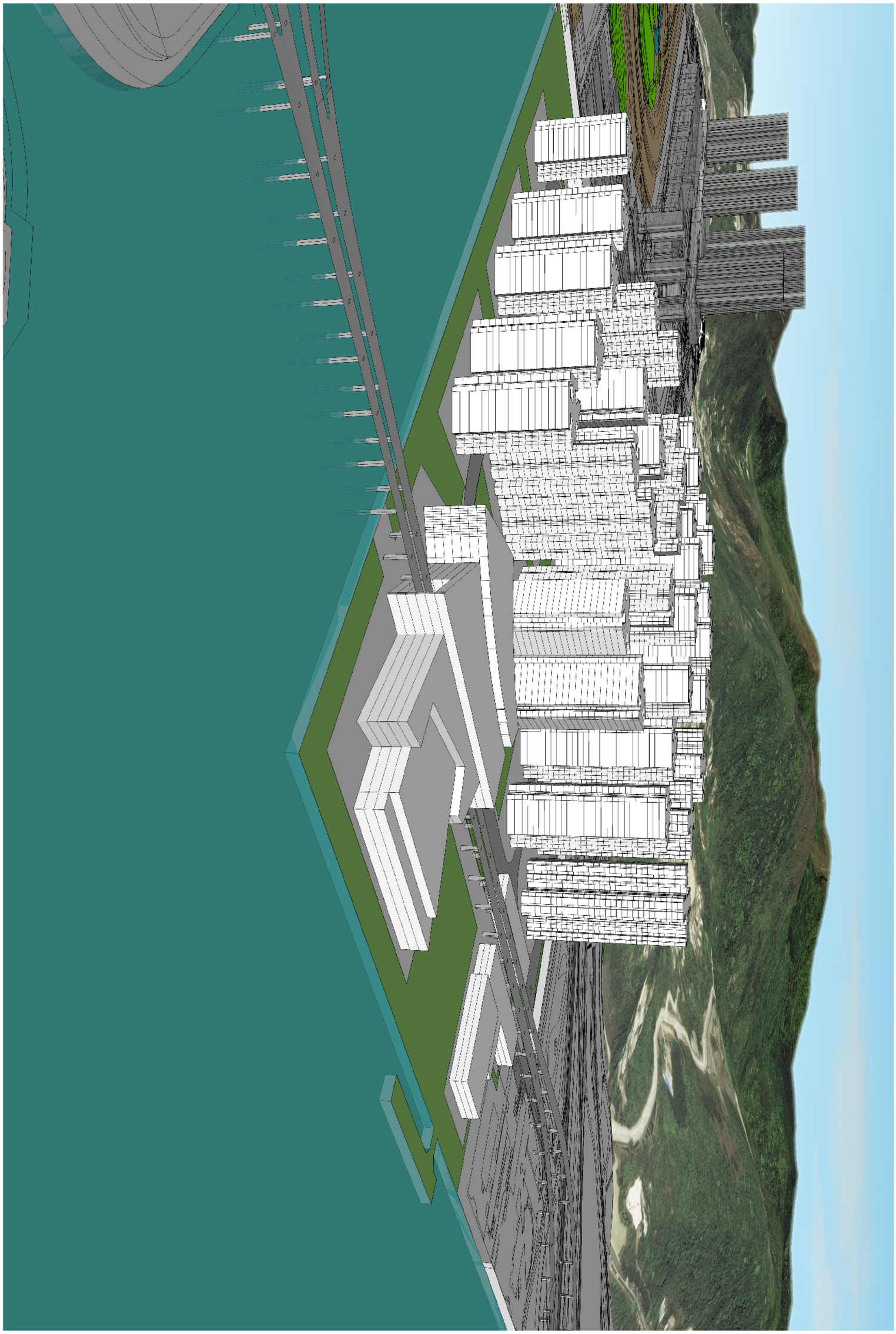

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 **Date:** APR 2013

PROPOSED DEVELOPMENT SCENARIO
MASSING DIAGRAM

AECOM

60269233/RPR/4.05

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 **Date: JAN 2014**

PROPOSED ENHANCED SCENARIO
MASTER LAYOUT PLAN

AECOM

60269233/RPR/5.01

Plot File by: kwokme 6/25/2012
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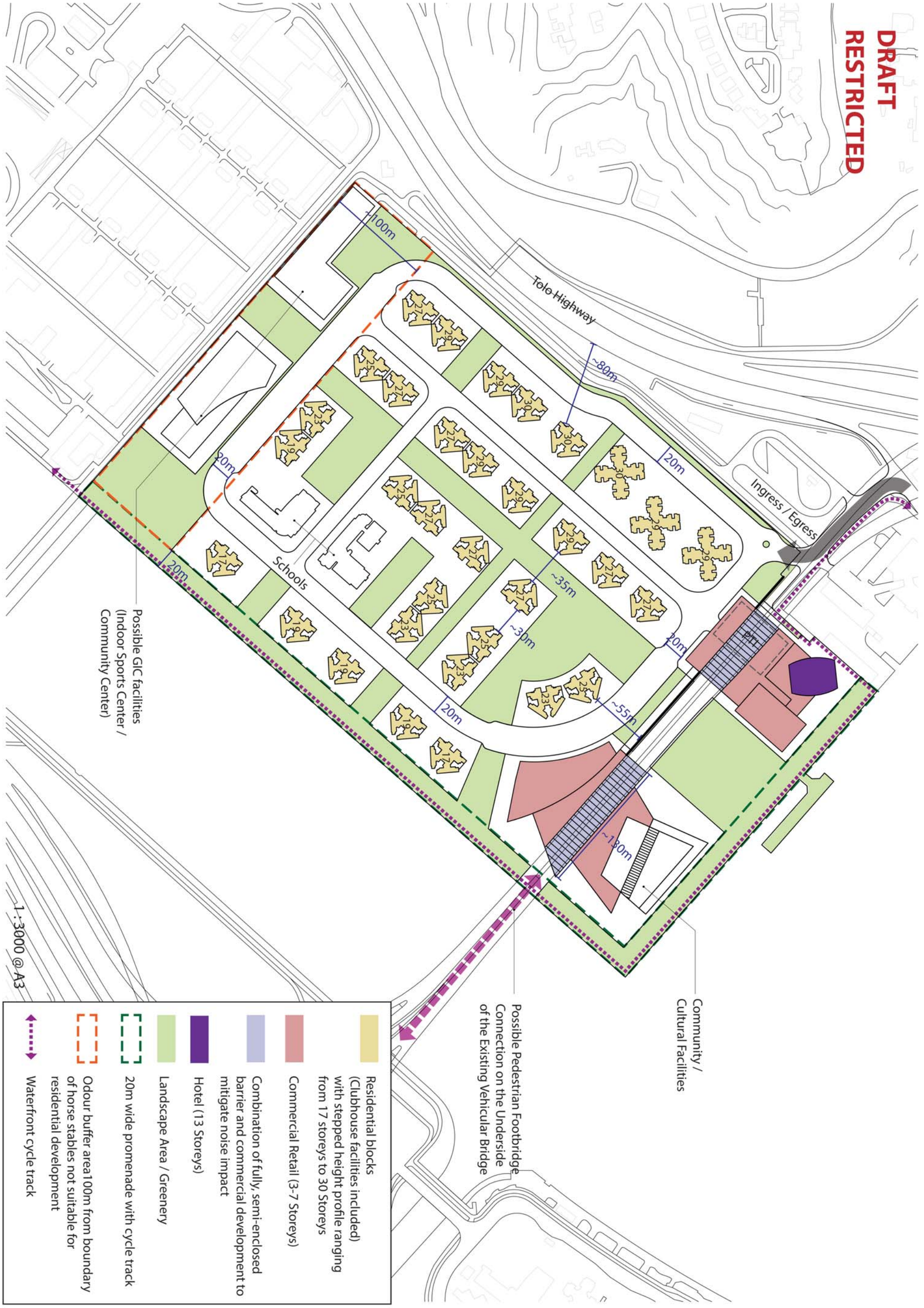

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 **Date: JAN 2014**

PROPOSED ENHANCED SCENARIO
LAND USE DIAGRAM

AECOM

60269233/RPR/5.02

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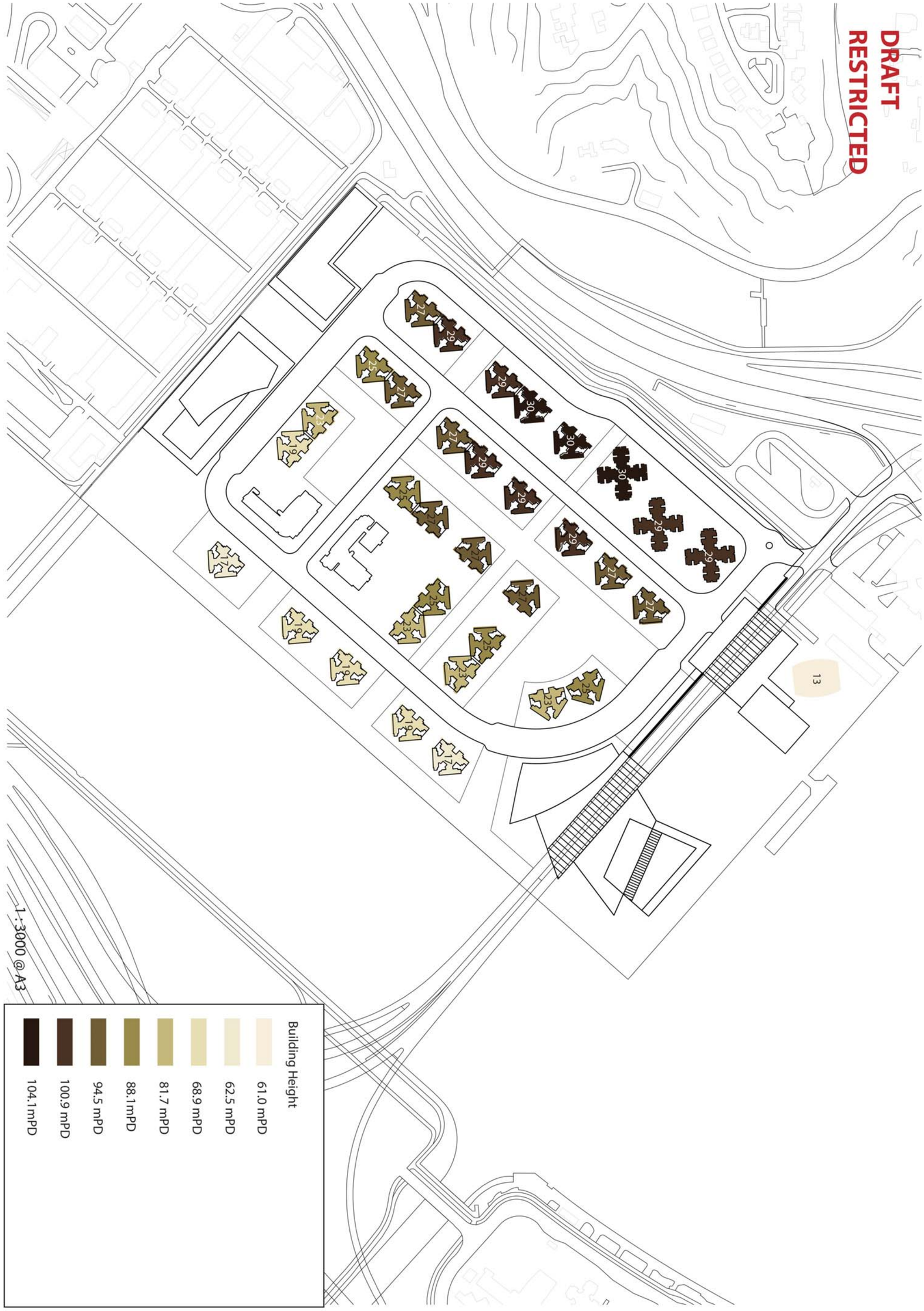

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

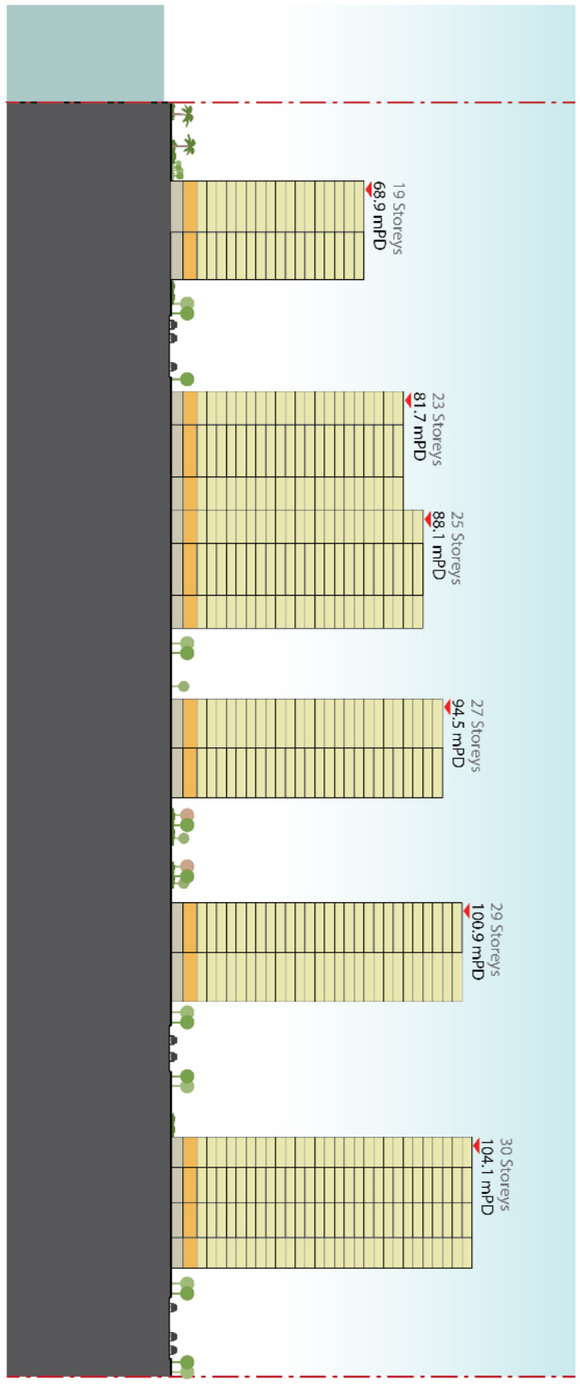
Project No.: 60269233 **Date: JAN 2014**

PROPOSED ENHANCED SCENARIO
BUILDING HEIGHT PROFILE

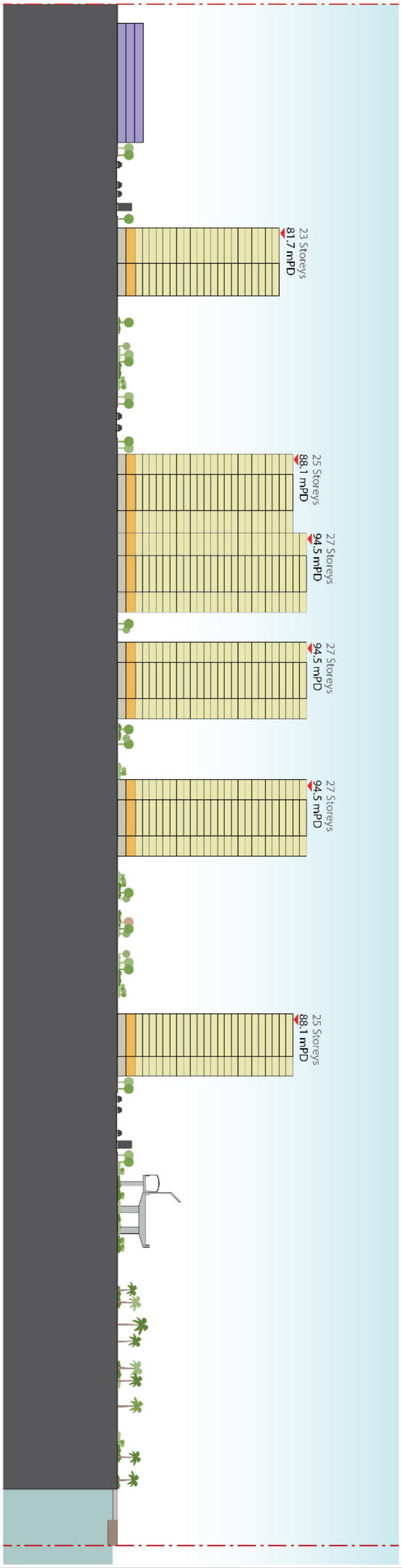
AECOM

60269233/RPR/5.03

Section A - A'



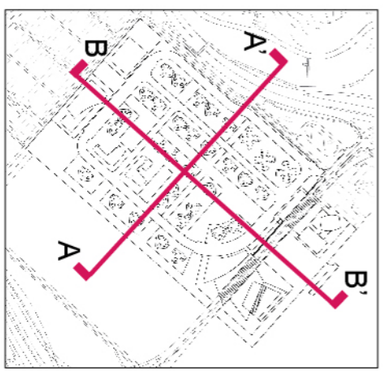
Section B - B'



Legend

- Residential Floors
- Club House Facilities
- Building Lobby
- GIC Facilities

Key Plan



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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR 2013

PROPOSED ENHANCED SCENARIO SECTION DIAGRAM

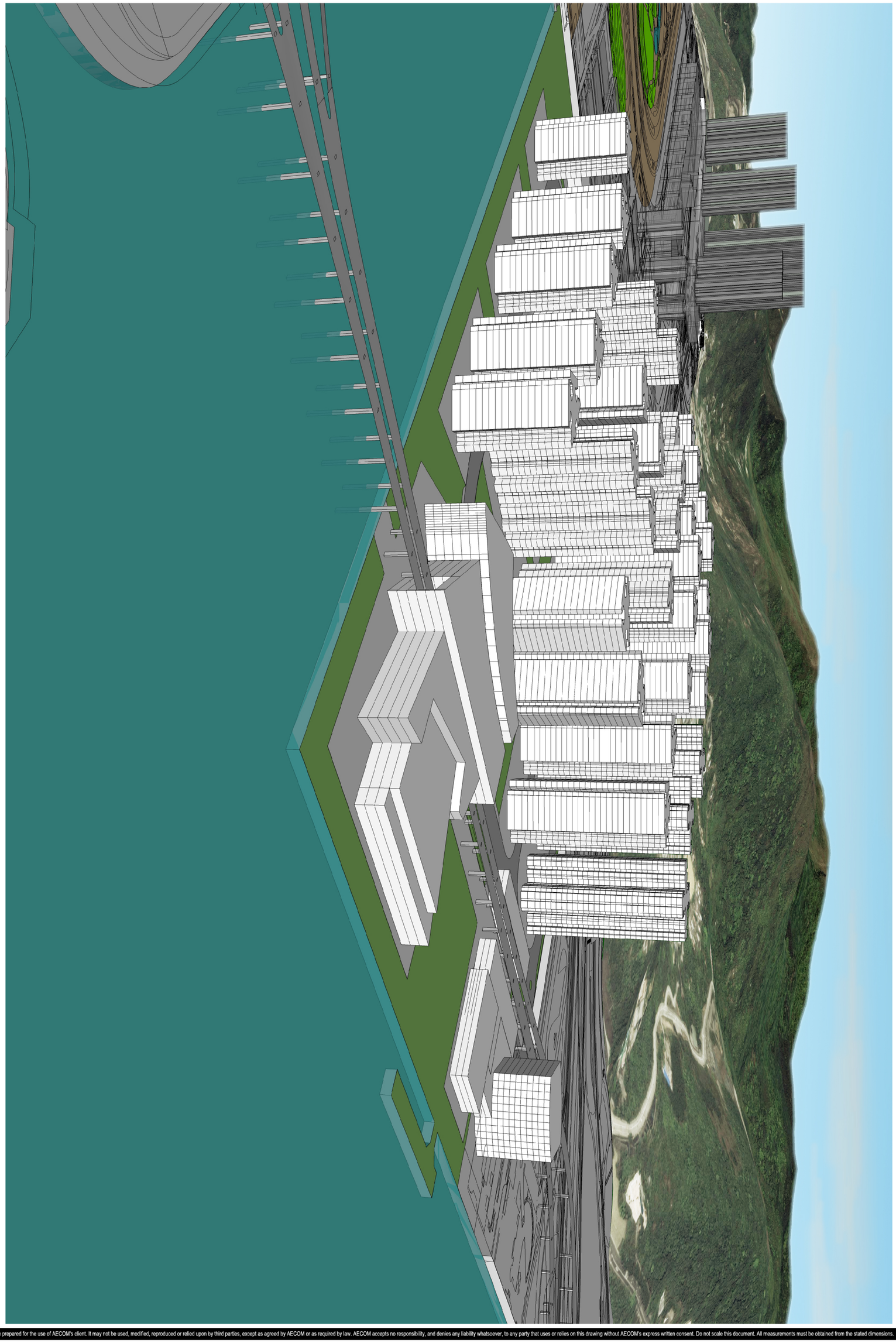
AECOM

Plot File by: kwokme 6/25/2012
PATH P:\Projects\60269233\MODEL\XREF\ACM-60269233-P-A3LFRAME-N.DGN

Project Management Initials:

Checked:

ISO A3 297mm X 420mm



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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 **Date: APR 2013**

PROPOSED ENHANCED SCENARIO MASSING DIAGRAM

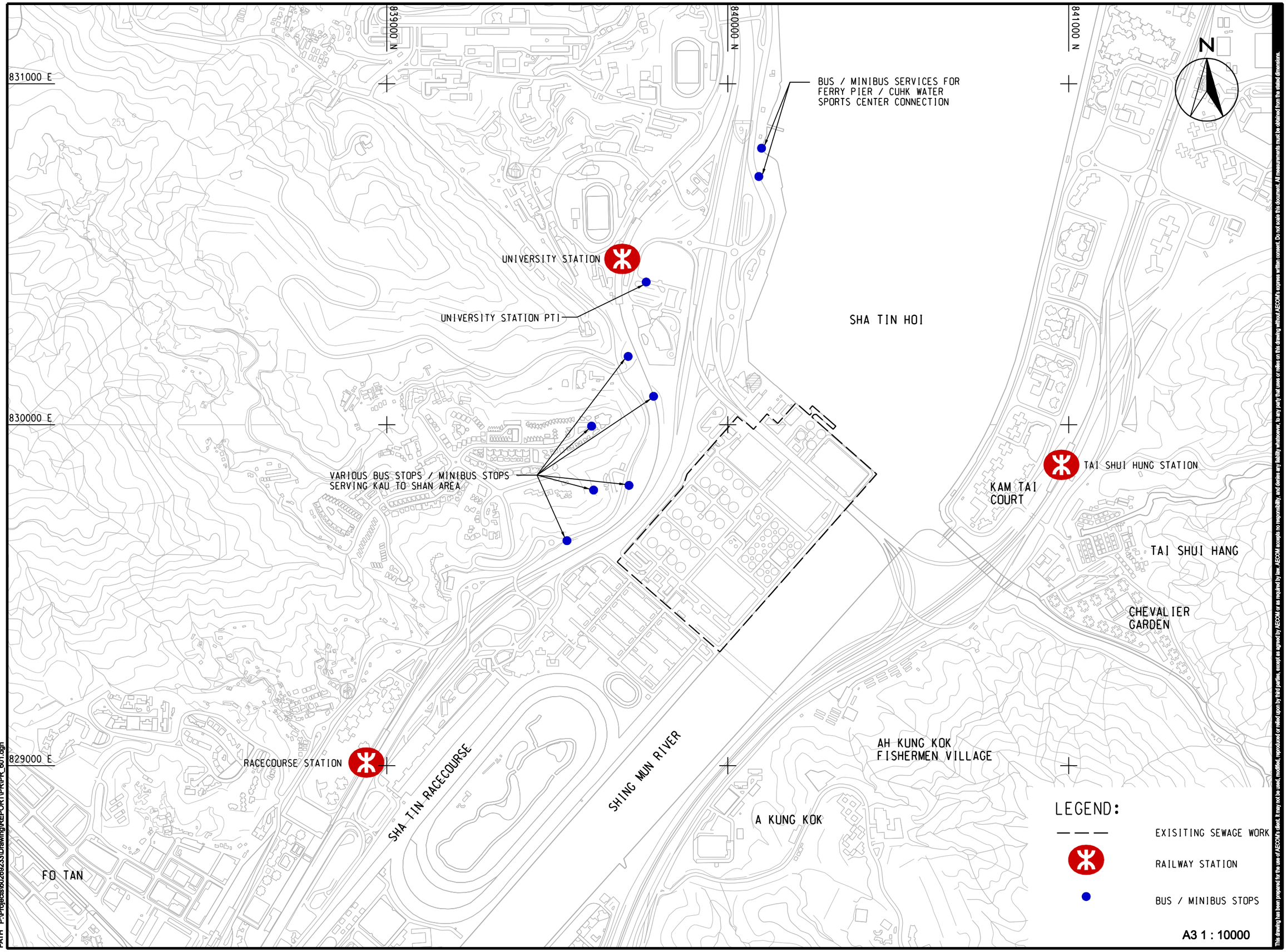
AECOM

60269233/RPR/5.05

ISO A3 297mm X 420mm

Checked:

Project Management Initials:



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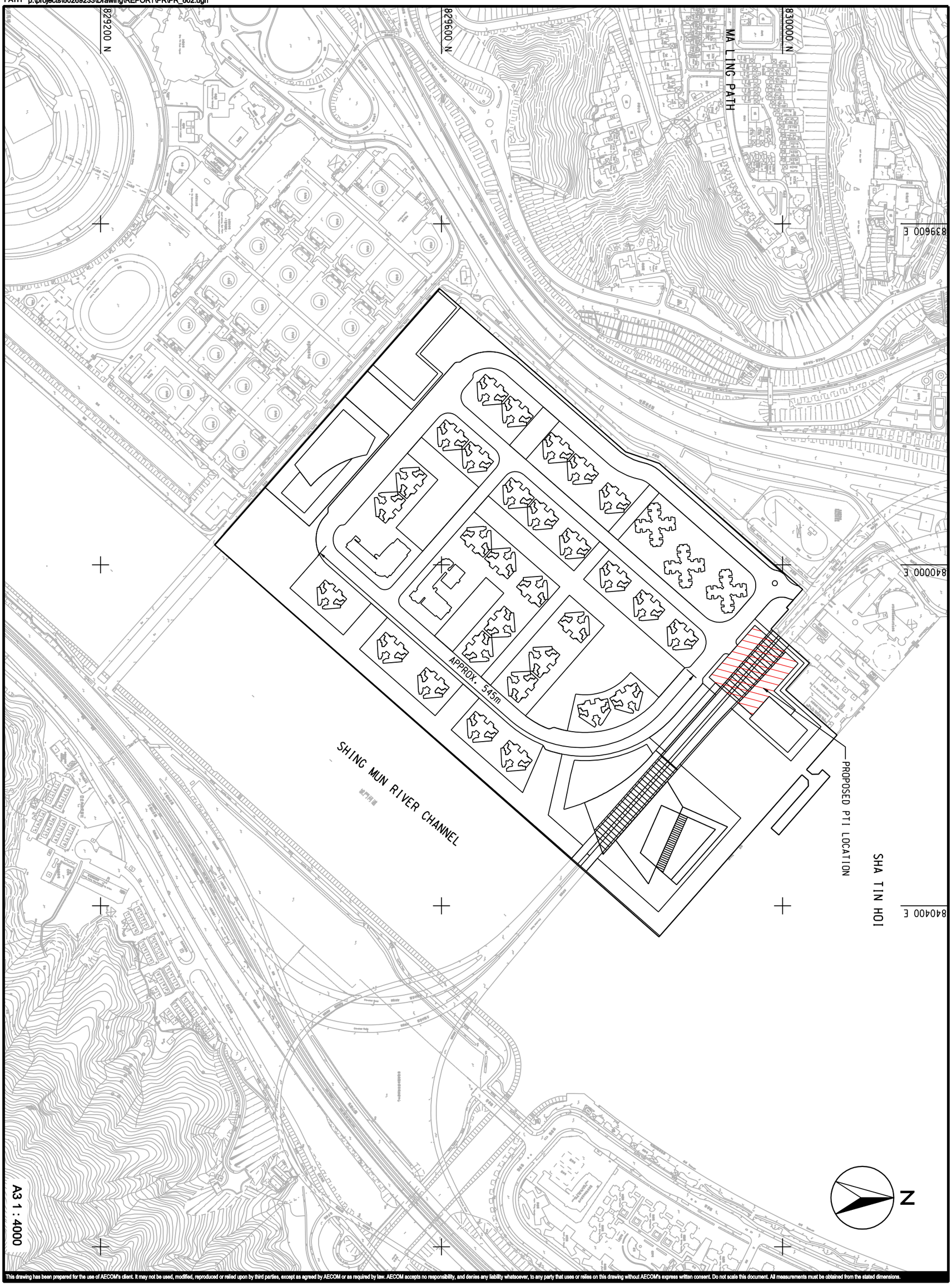
AECOM

60269233/RPR/6.01

MAJOR PT FACILITIES IN THE VICINITY OF EXISTING STSTW

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Plot File by: DUW 2013/5/13
PATH P:\Projects\60269233\Drawing\REPORT\PRIPR_601.dgn



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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

PROPOSED LOCATION OF PUBLIC TRANSPORT INTERCHANGE (PTI)

AECOM

60269233/RPR/6.02A

ISO A3 297mm X 420mm

Checked:

Project Management Initials:

827900 N

829900 N

831900 N

817200 E

839200 E

SHA TIN STATION

SHING MUN RIVER CHANNEL

TAI PO ROAD (SHA TIN)

TOLO HIGHWAY

UNIVERSITY STATION

MA ON SHAN ROAD

TATE'S CAIRN HIGHWAY

SAI SHA ROAD

MA ON SHAN STATION

TAI SHUI HANG STATION

LEGEND:

POTENTIAL FEEDER ROUTE

RAILWAY STATION

A3 1 : 20000

Plot File by: DUW 2014/1/22
PATH P:\Projects\60269233\Drawing\REPORT\PRIPR_603.dgn

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AECOM

60269233/RPR/6.03

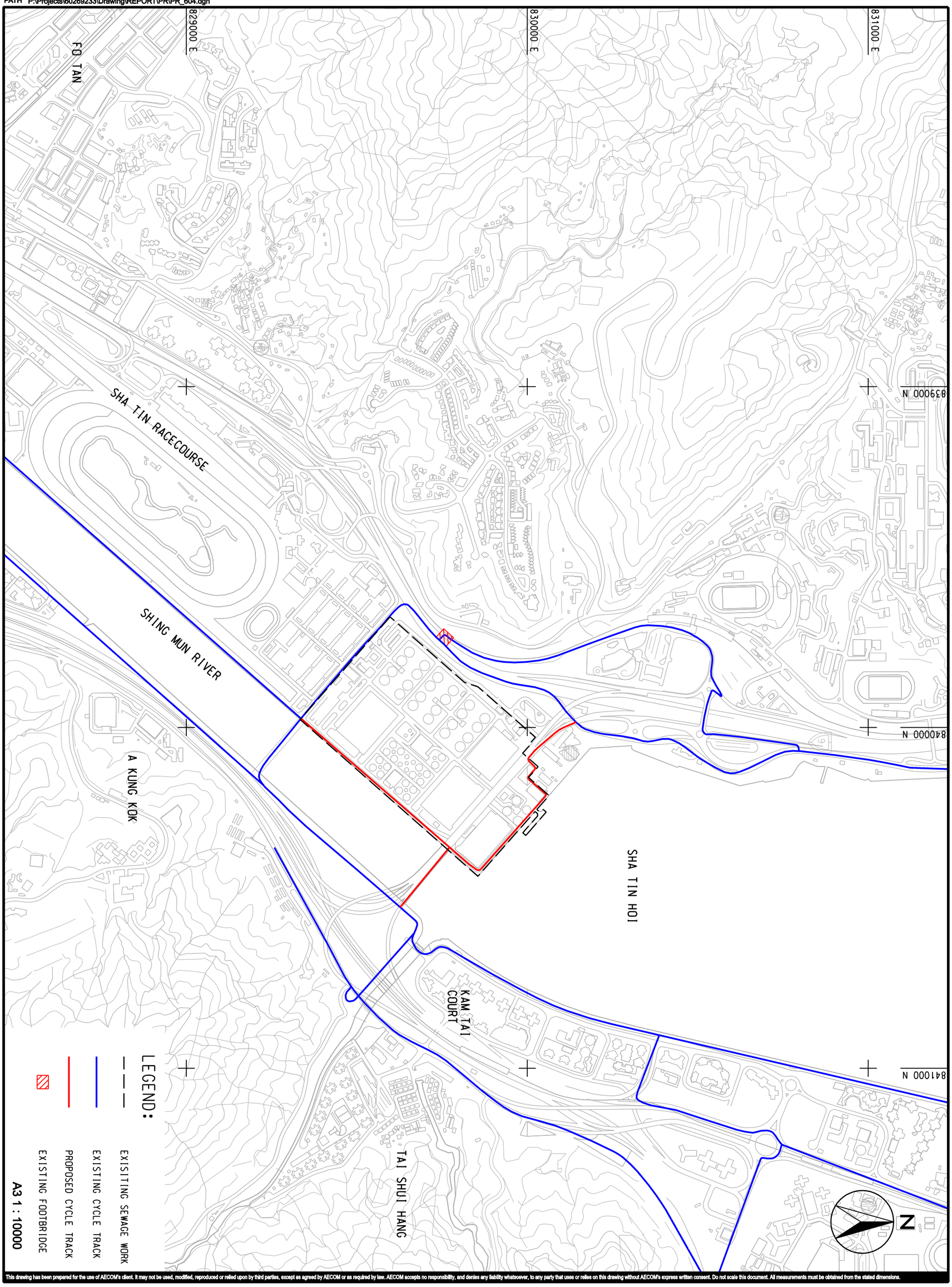
POTENTIAL FEEDER PUBLIC TRANSPORT ROUTES

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: JAN. 2014

Plot File by: DUW 2013/5/16
PATH P:\Projects\60269233\Drawing\REPORT\PR\PR_604.dgn

Project Management Initials: Checked:

ISO A3 297mm X 420mm



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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: MAY 2013

EXISTING PEDESTRIAN FACILITIES & CYCLE TRACK

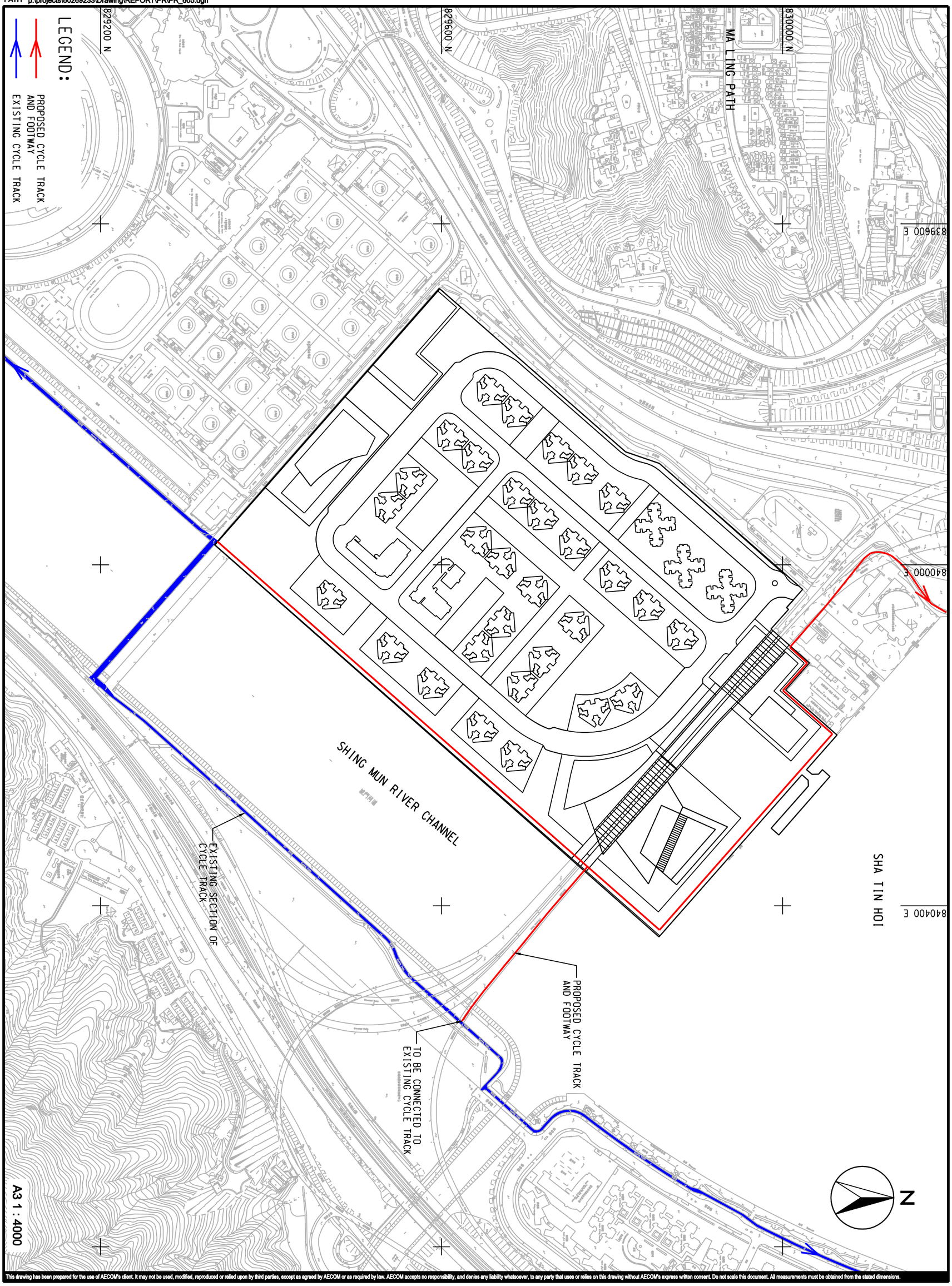
AECOM

60269233/RPR/6.04

Plot File by: ZHOUY3 2014/1/21
PATH p:\projects\60269233\Drawing\REPORT\PR\PR_605.dgn

Project Management Initials: Checked:

ISO A3 297mm X 420mm



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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: MAY 2013

EXISTING AND PROPOSED FUTURE CYCLIST NETWORK

AECOM

60269233/RPR/6.05A

ISO A3 297mm X 420mm

Checked:

Project Management Initials:

N

830500 N

830000 N

829500 N

840500 E

840000 E

839500 E

KAM TAI COURT

AH KUNG KOK FISHERMEN VILLAGE

SHA TIN HOI

SHING MUN RIVER

KIU HA ROAD

SHUI CHONG STREET

SCIENCE PARK ROAD

SCIENCE PARK ROAD ROUNDABOUT

SUI CHEUNG STREET SOUTH ROUNDABOUT

SIGNALIZED JUNCTION AT KIU HA ROAD / SUI CHEUNG STREET

CHAK CHEUNG STREET ROUNDABOUT

CHAK CHEUNG STREET

TOLO HIGHWAY

LEGEND:

EXISITING SEWAGE WORK

CRITICAL JUNCTIONS NEAR STSTW

EXISTING ACCESS OF STSTW

VEHICULAR MOVEMENT

A3 1 : 5000

Plot File by: DUW 2013/5/13
PATH P:\Projects\60269233\Drawing\REPORT\PRIPR_606.dgn

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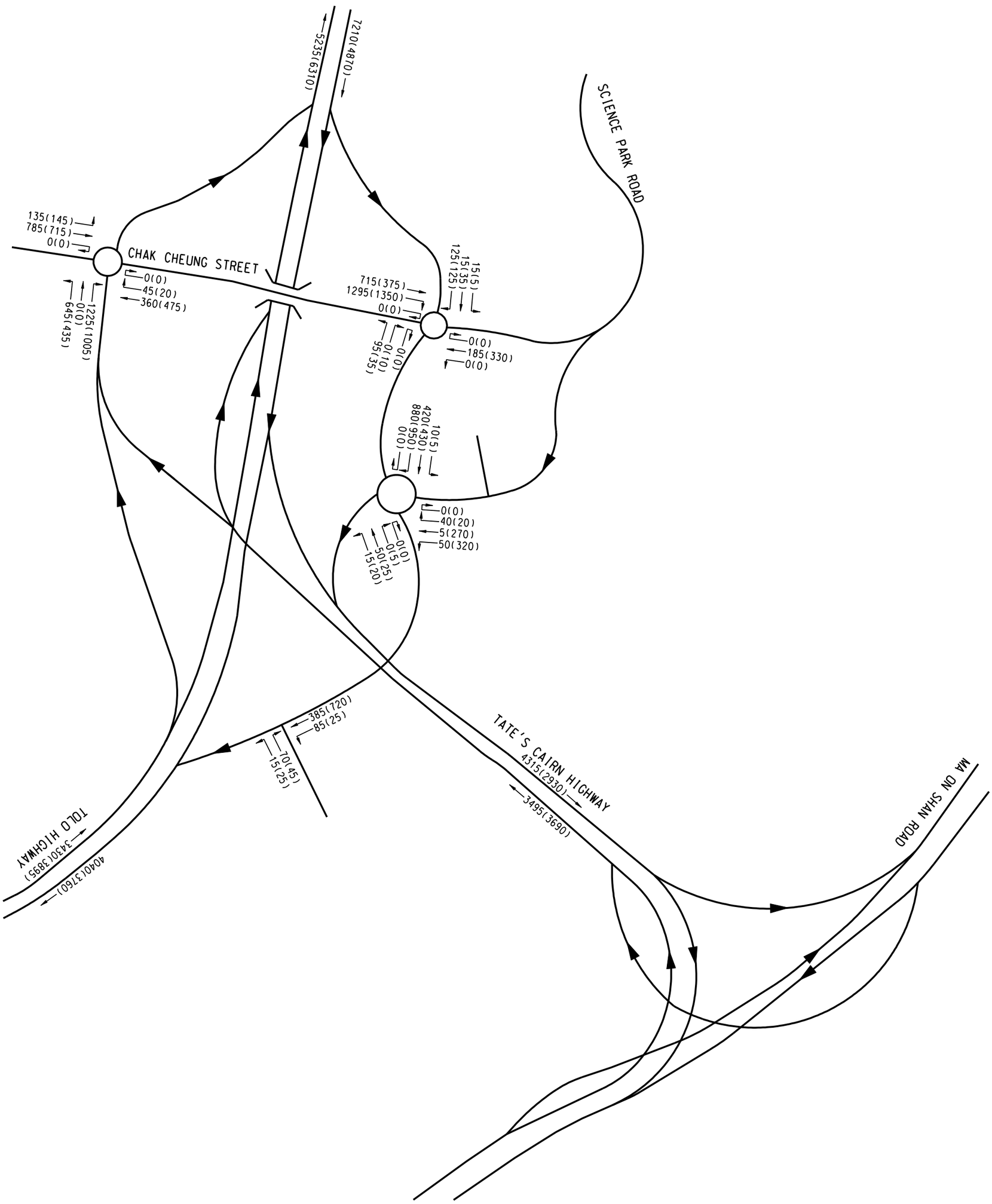
AECOM

60269233/RPR/6.06

CRITICAL JUNCTIONS AND SITE ACCESS OF STSTW

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013



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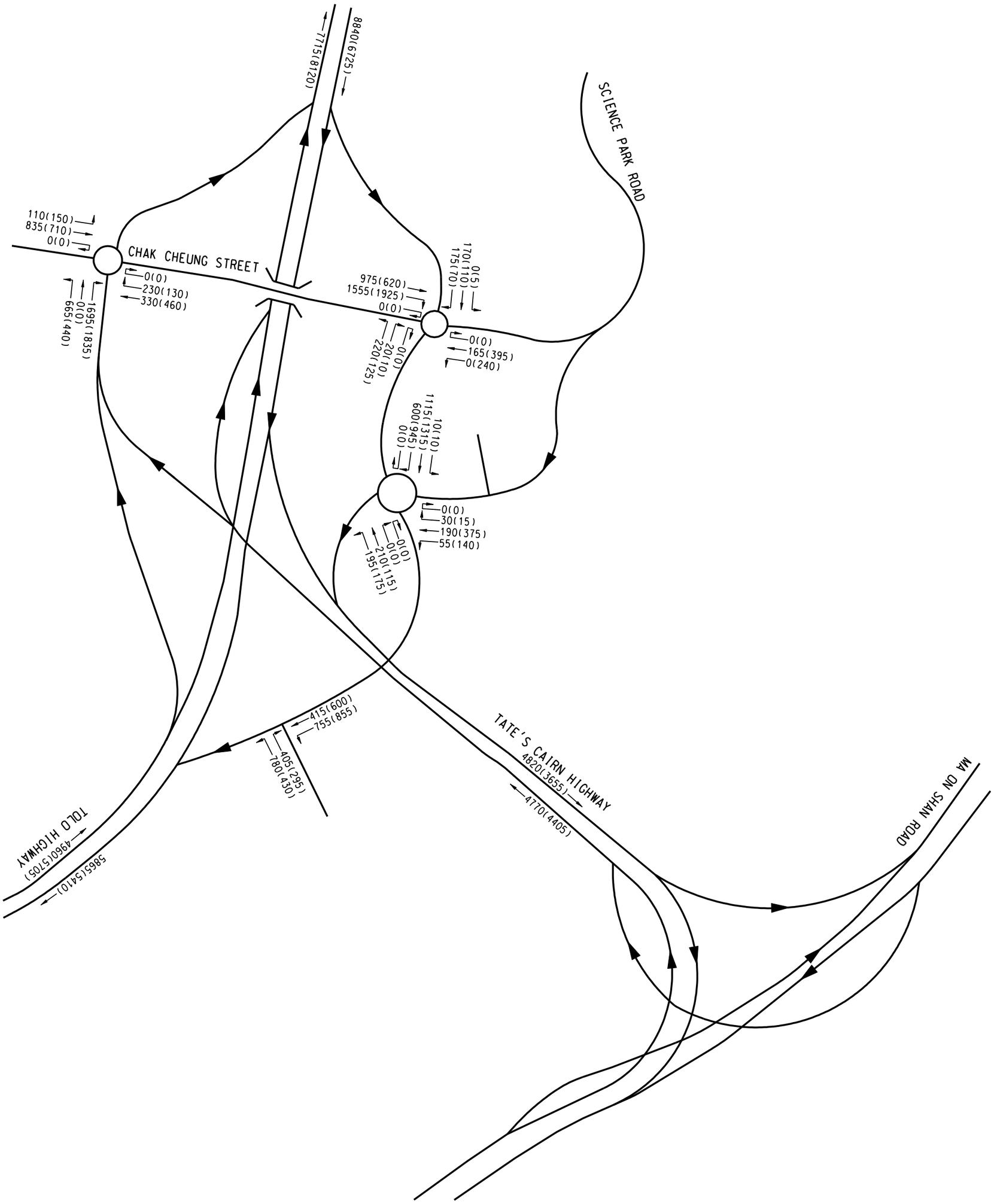
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

2012 OBSERVED FLOW

AECOM

60269233/RPR/6.07



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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

2034 FORCAST TRAFFIC FLOW - DESIGN SCENARIO

AECOM

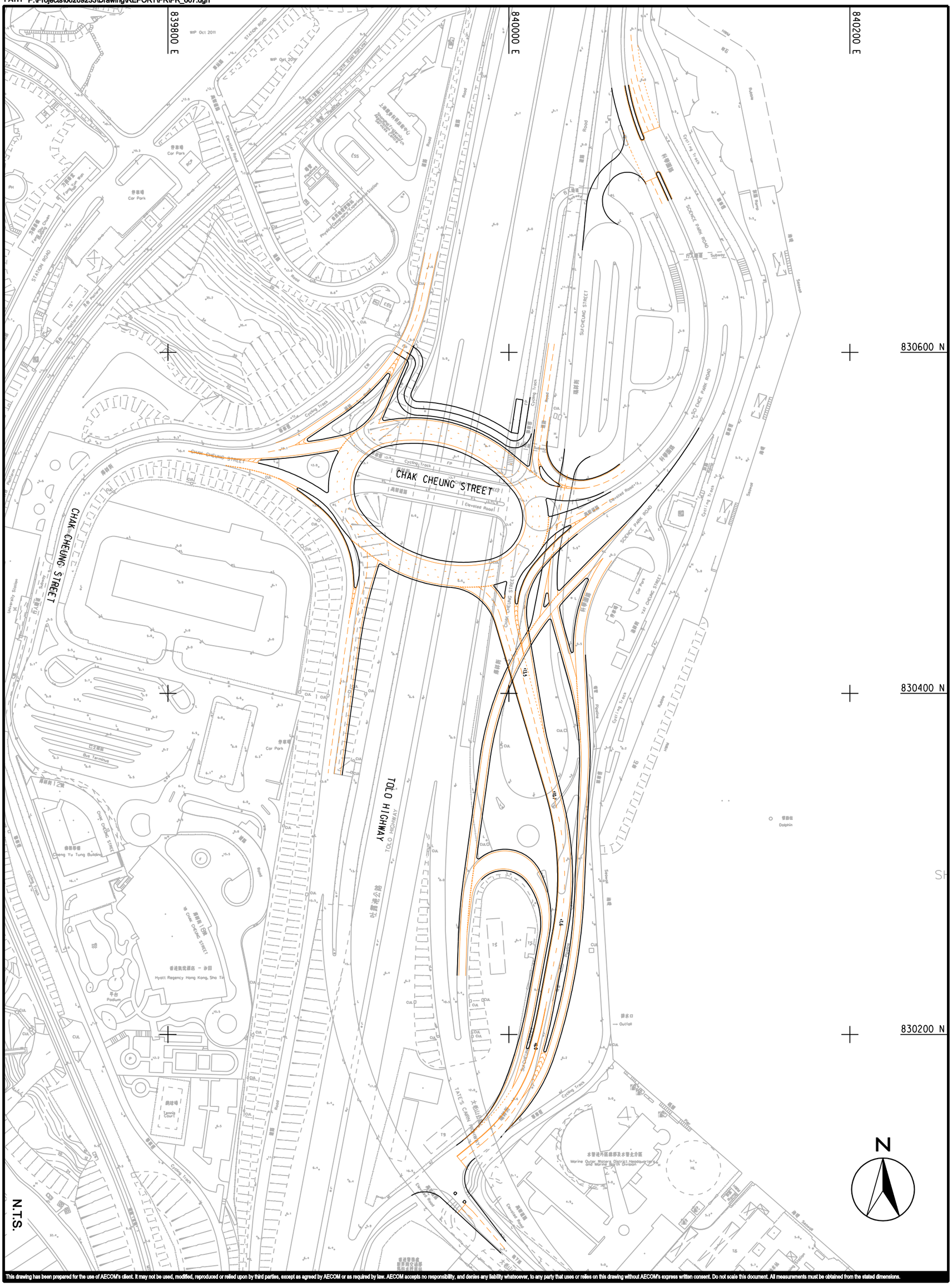
60269233/RPR/6.08

Plot File by: DUW 2013/5/13
PATH P:\Projects\60269233\Drawing\REPORT\PR\PR_607.dgn

Project Management Initials:

Checked:

ISO A3 297mm X 420mm



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AGREEMENT NO. CE43/2011 (DS)

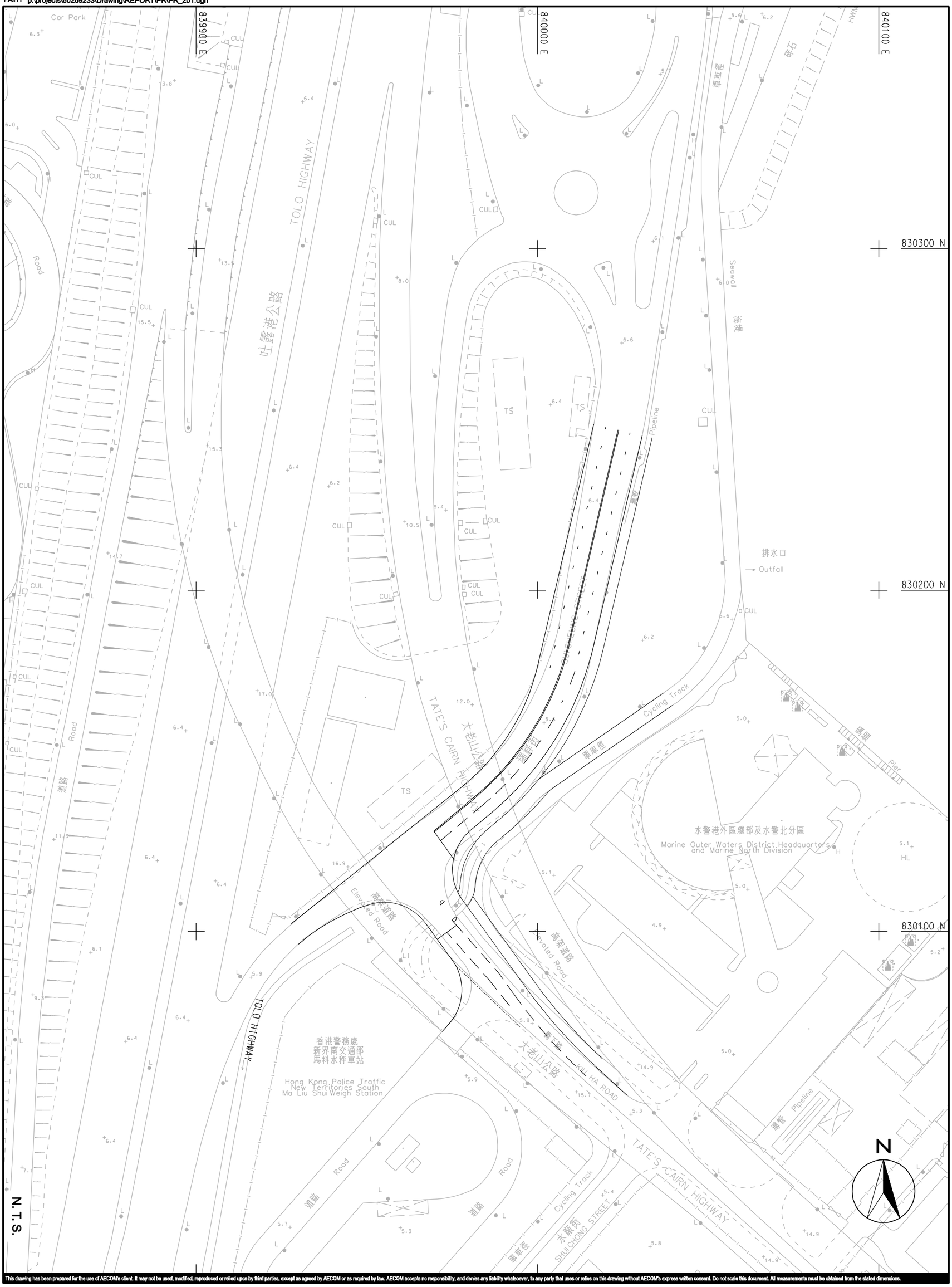
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: MAY 2013

CONCEPTUAL LAYOUT PLAN FOR ROUNDABOUT IMPROVEMENT MEASURE

AECOM

60269233/RPR/6.09



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AGREEMENT NO. CE43/2011 (DS)

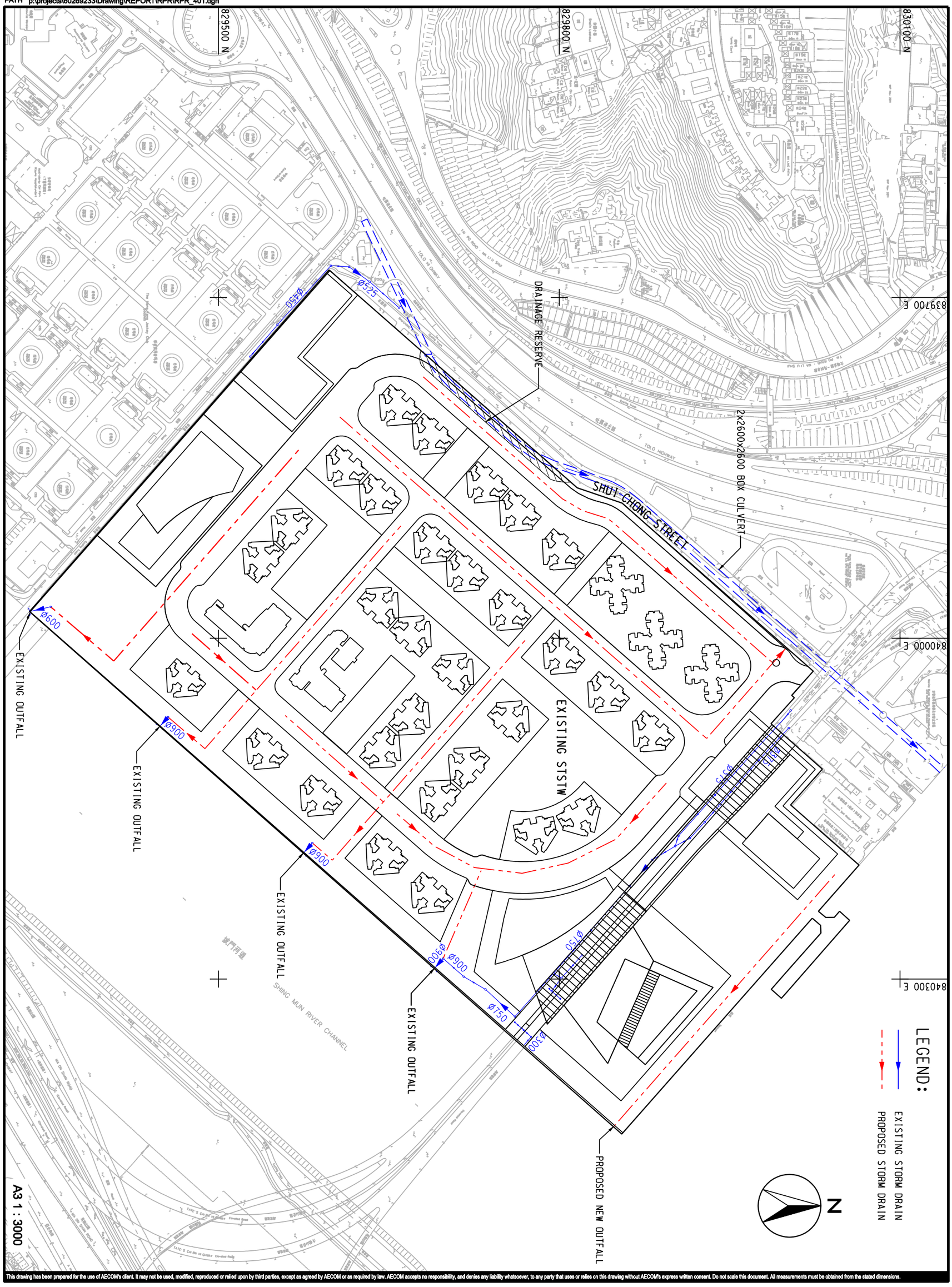
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: MAY 2013

CONCEPTUAL LAYOUT PLAN FOR IMPROVEMENT MEASURE OF JUNCTION J/O KIU HA ROAD / SUI CHEUNG STREET

AECOM

60269233/RPR/6.10



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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

EXISTING AND PROPOSED DRAINAGE SYSTEM

AECOM

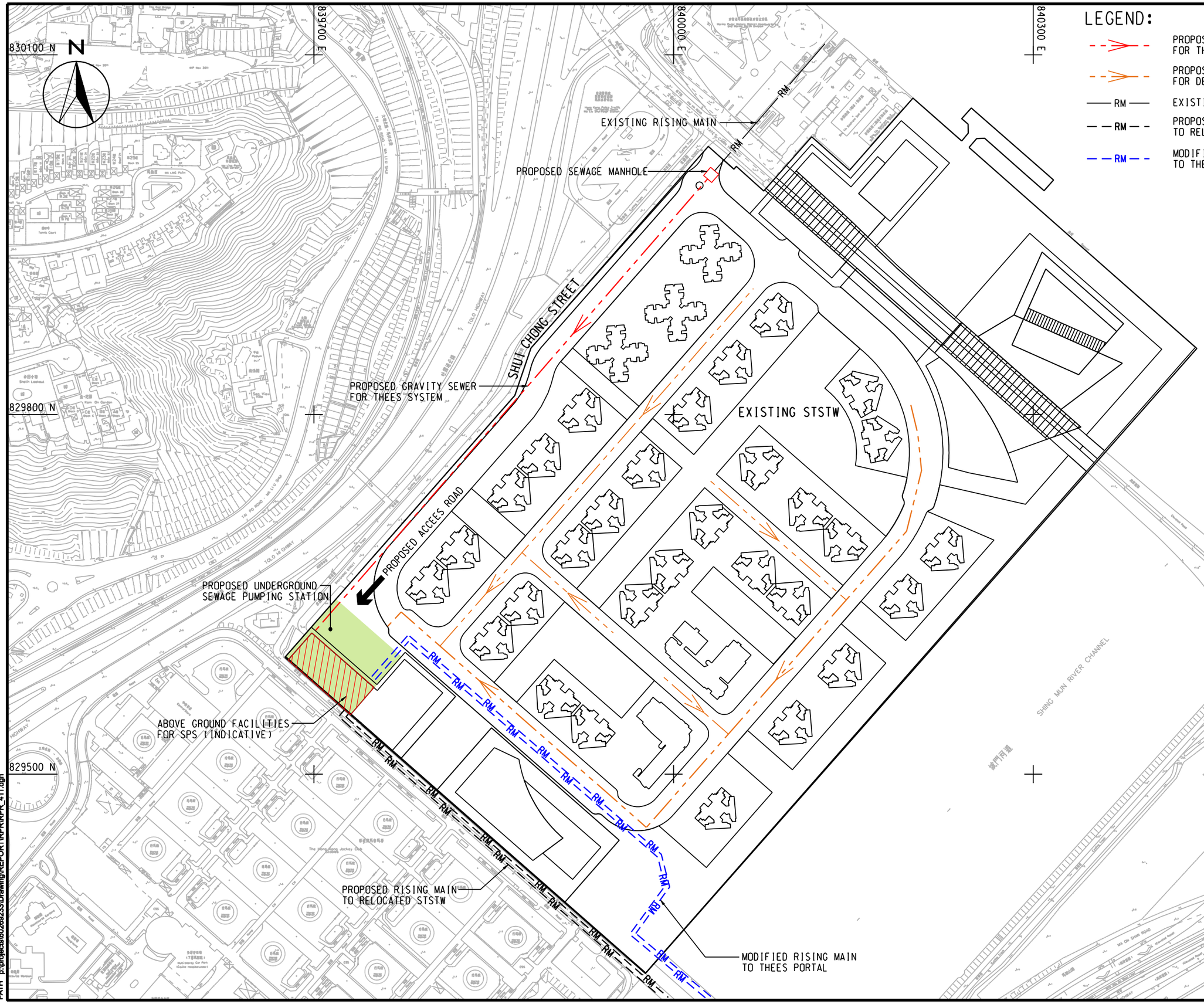
60269233/RPR/7.01A

ISO A3 297mm X 420mm

Checked:

Project Management Initials:

Plot File by: YANGQ 2014/1/22
PATH p:\projects\60269233\Drawing\REPORT\RPR\RPR_411.dgn



AECOM

60269233/RPR/8.01A

PROPOSED LOCATION FOR UNDERGROUND SEWAGE PUMPING STATION

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

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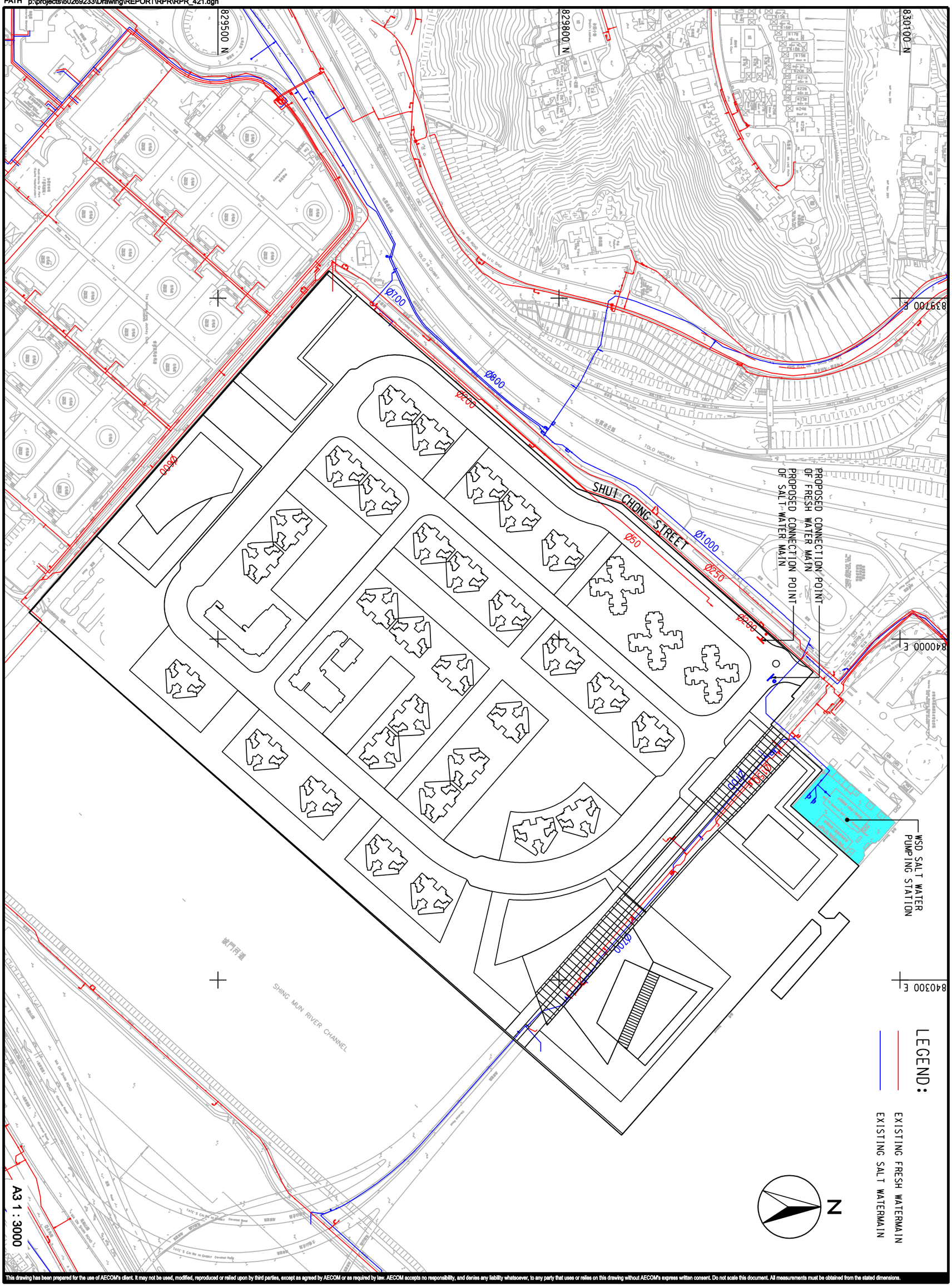
Plot File by: WUMT 2014/1/21
PATH p:\projects\60269233\Drawing\REPORT\RPR\RPR_421.dgn

Project Management Initials:

Checked:

ISO A3 297mm X 420mm



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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: APR. 2013

EXISTING WATERMAINS AND PROPOSED CONNECTION POINTS OF WATERMAINS

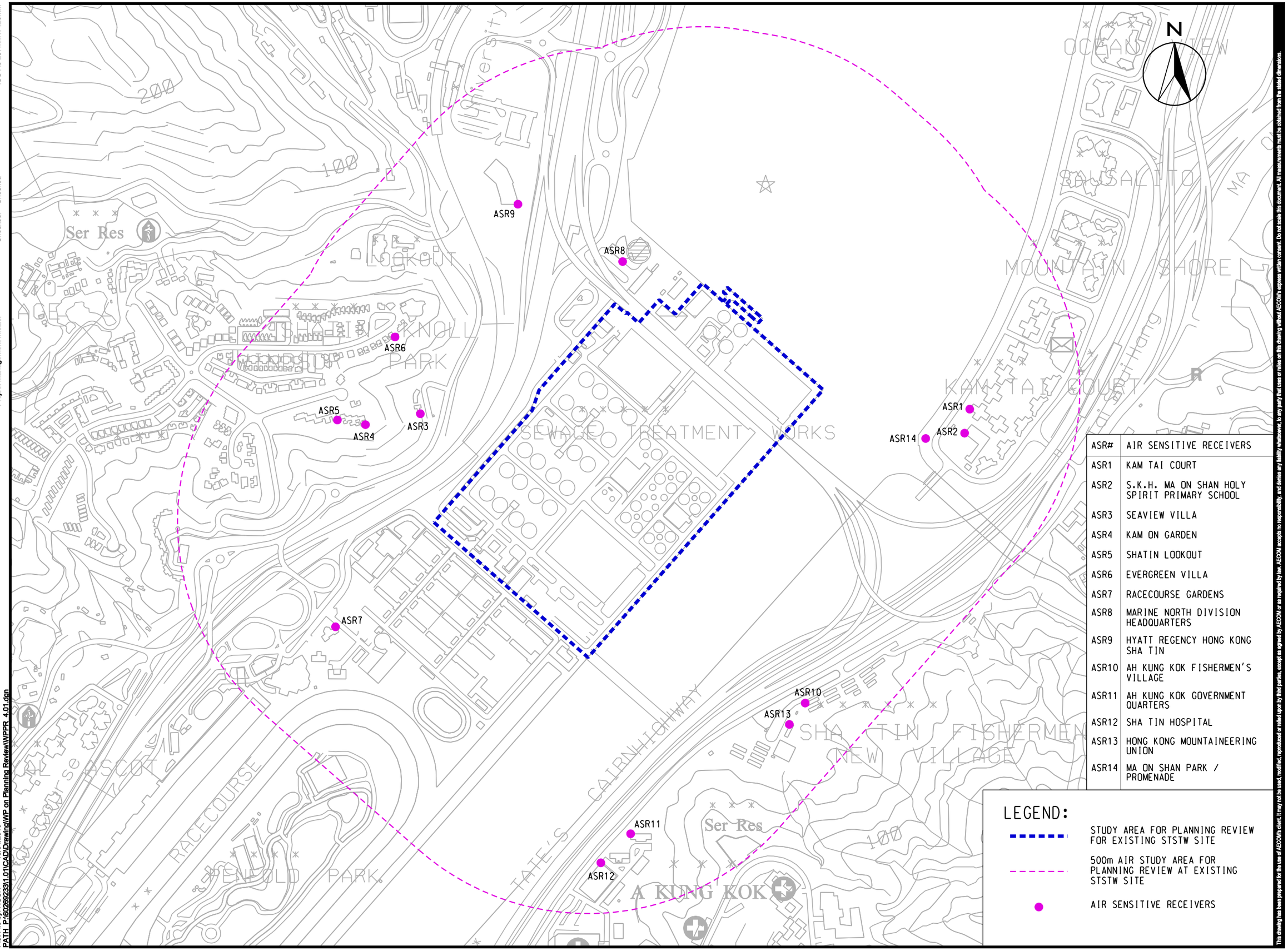
AECOM

60269233/RPR/9.01A

ISO A3 297mm x 420mm

Checked: Checked

Project Management Initials:



ASR#	AIR SENSITIVE RECEIVERS
ASR1	KAM TAI COURT
ASR2	S.K.H. MA ON SHAN HOLY SPIRIT PRIMARY SCHOOL
ASR3	SEAVIEW VILLA
ASR4	KAM ON GARDEN
ASR5	SHATIN LOOKOUT
ASR6	EVERGREEN VILLA
ASR7	RACECOURSE GARDENS
ASR8	MARINE NORTH DIVISION HEADQUARTERS
ASR9	HYATT REGENCY HONG KONG SHA TIN
ASR10	AH KUNG KOK FISHERMEN'S VILLAGE
ASR11	AH KUNG KOK GOVERNMENT QUARTERS
ASR12	SHA TIN HOSPITAL
ASR13	HONG KONG MOUNTAINEERING UNION
ASR14	MA ON SHAN PARK / PROMENADE

LEGEND:

- STUDY AREA FOR PLANNING REVIEW FOR EXISTING STSTW SITE
- 500m AIR STUDY AREA FOR PLANNING REVIEW AT EXISTING STSTW SITE
- AIR SENSITIVE RECEIVERS

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AECOM

60269233/RPR/10.01

REPRESENTATIVE AIR SENSITIVE RECEIVERS FOR THE PROPOSED DEVELOPMENT AT EXISTING STSTW

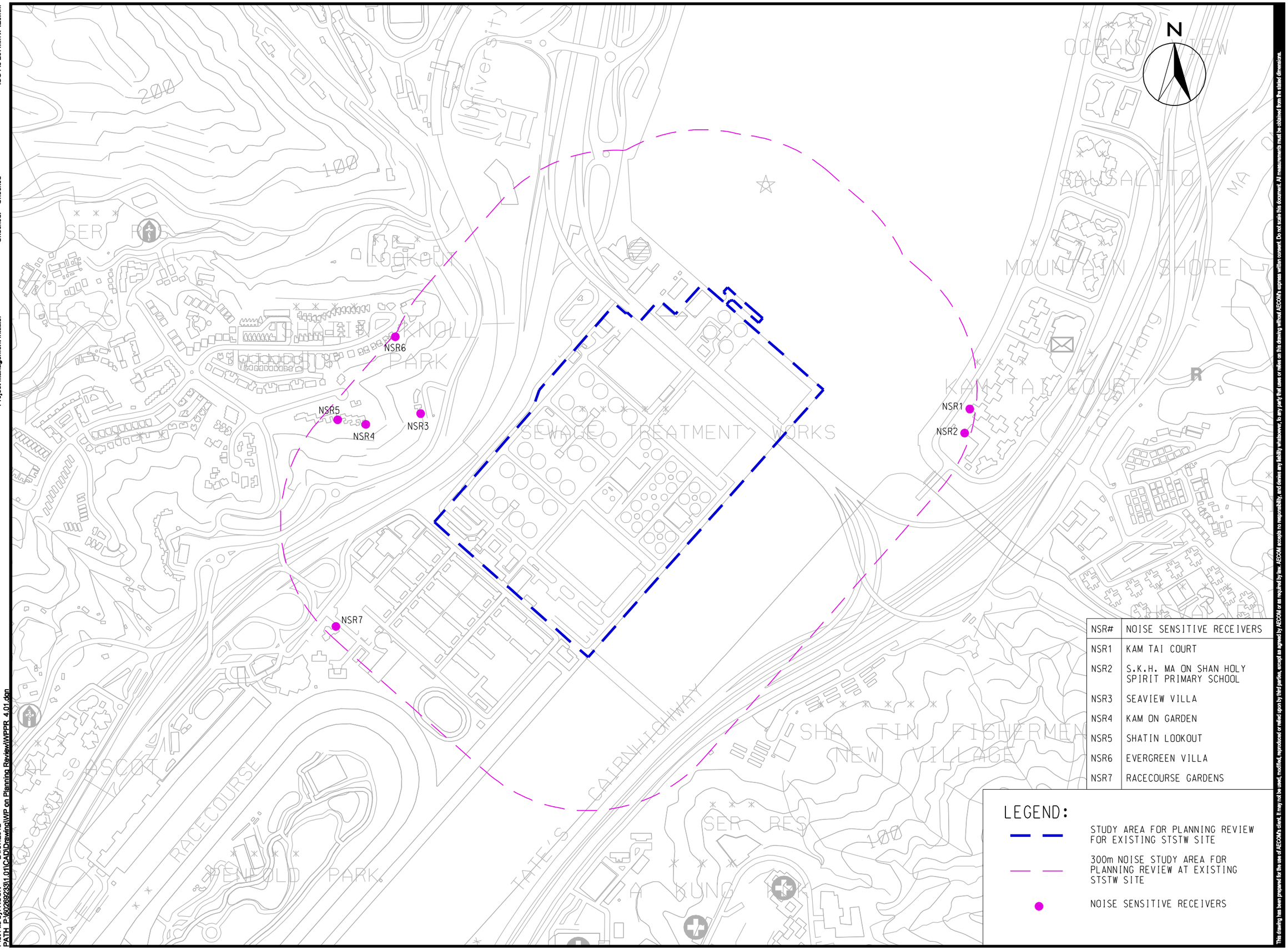
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

Plot File by: NCCN 16/04/2013
PATH: P:\60269233\1.01\CAD\Drawing\WP on Planning Review\WPPR_4.01.dgn

ISO A3 297mm x 420mm

Checked: Checked

Project Management Initials:



NSR#	NOISE SENSITIVE RECEIVERS
NSR1	KAM TAI COURT
NSR2	S.K.H. MA ON SHAN HOLY SPIRIT PRIMARY SCHOOL
NSR3	SEAVIEW VILLA
NSR4	KAM ON GARDEN
NSR5	SHATIN LOOKOUT
NSR6	EVERGREEN VILLA
NSR7	RACECOURSE GARDENS

LEGEND:

- STUDY AREA FOR PLANNING REVIEW FOR EXISTING STSTW SITE
- 300m NOISE STUDY AREA FOR PLANNING REVIEW AT EXISTING STSTW SITE
- NOISE SENSITIVE RECEIVERS

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AECOM

60269233/RPR/10.02

REPRESENTATIVE NOISE SENSITIVE RECEIVERS
DURING CONSTRUCTION PHASE FOR THE
PROPOSED DEVELOPMENT AT EXISTING STSTW

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT
WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: SEP. 2012

Plot File by: NCCN 24/07/2012
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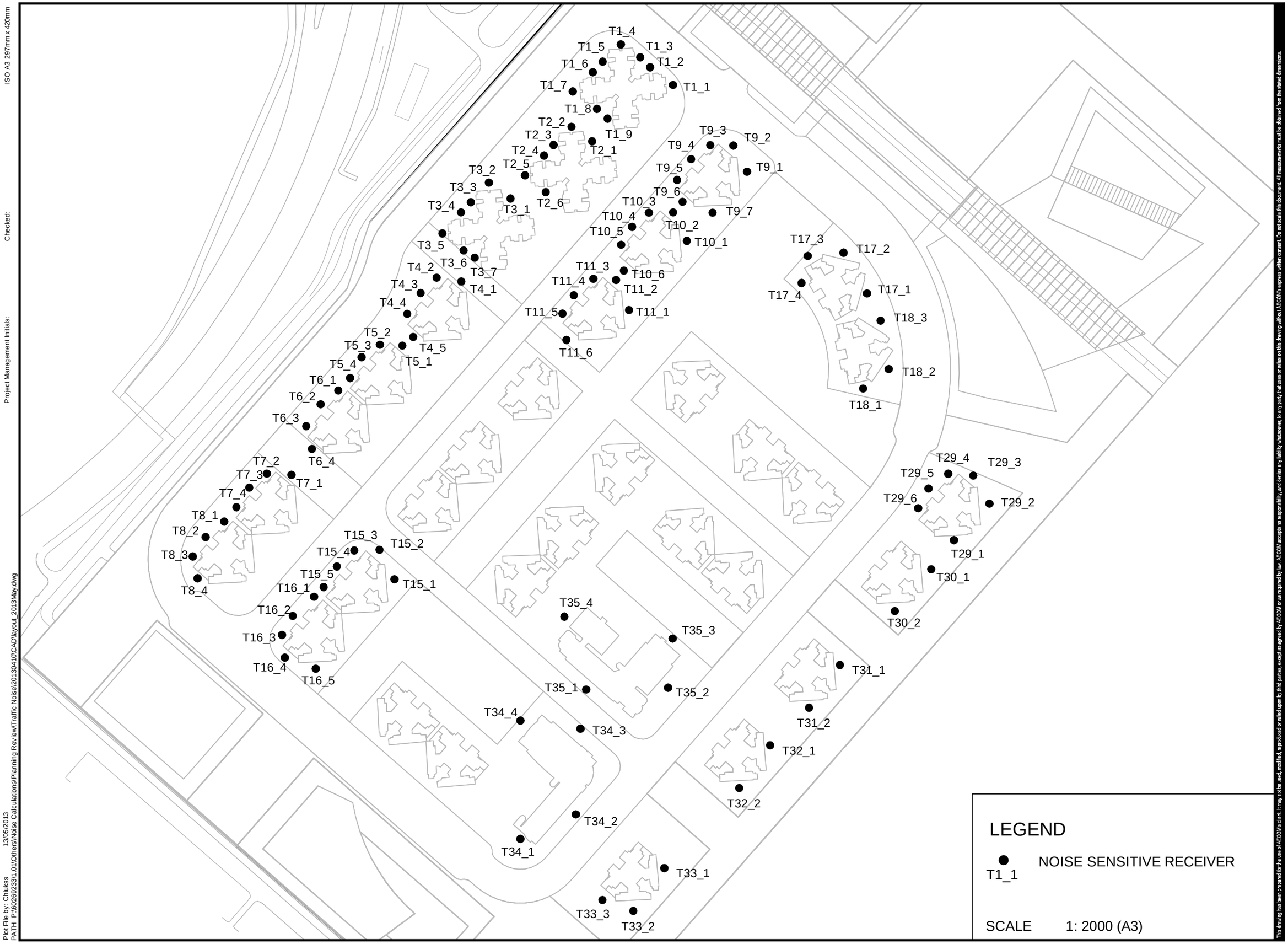
ISO A3 297mm x 420mm

Checked:

Project Management Initials:



LEGEND

T1_1 NOISE SENSITIVE RECEIVER

SCALE 1: 2000 (A3)

Plot File by: Chiukss 13/05/2013
PATH P:\60269233\1.01\Others\Noise Calculations\Planning Review\Traffic Noise\20130410CADlayout_2013May.dwg

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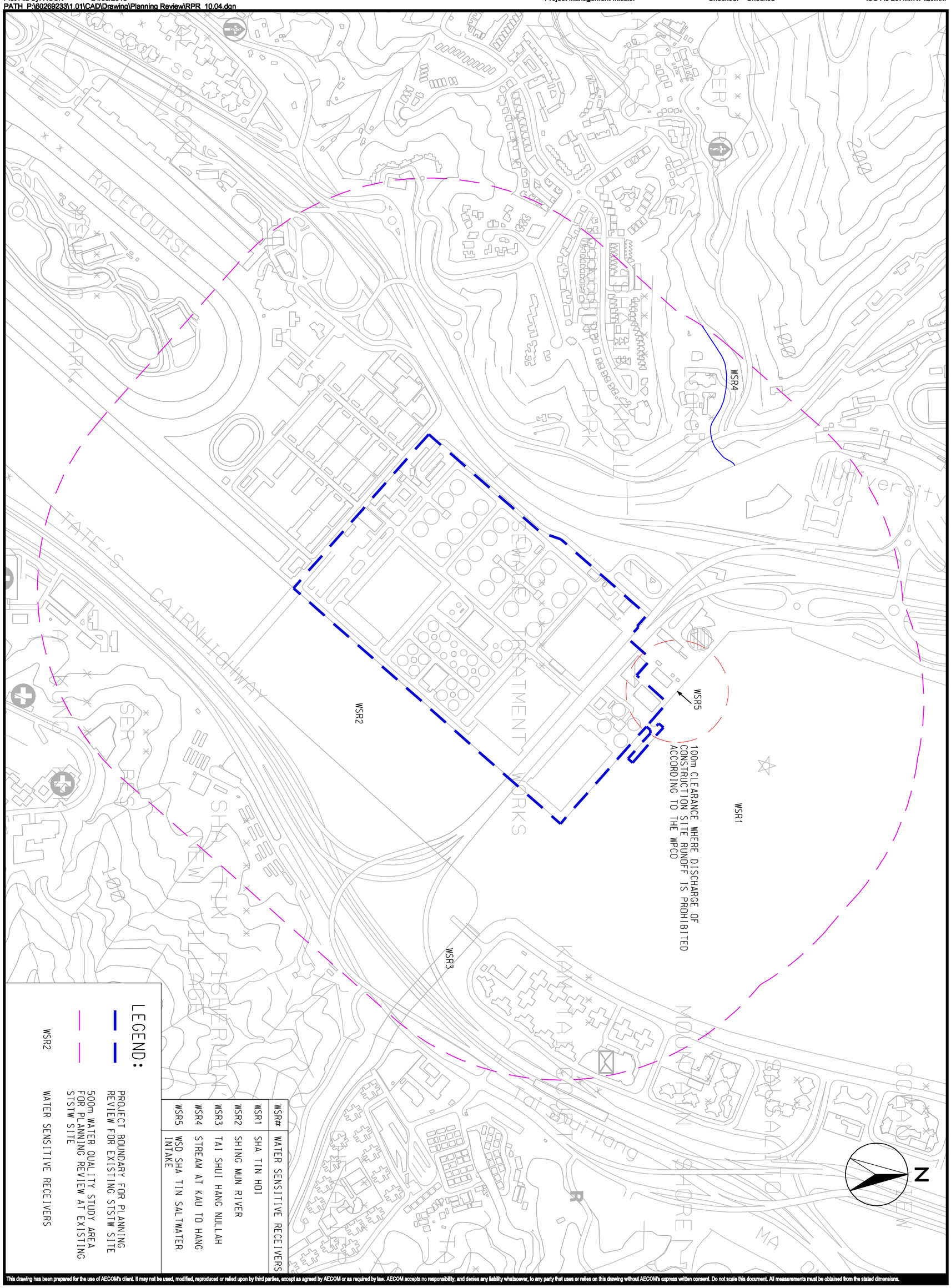
AECOM

60269233/RPR/10.03

LOCATIONS OF NOISE SENSITIVE FACADES DURING OPERATION PHASE

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERN - FEASIBILITY STUDY

Project No.: 60269233 Date:



LEGEND:

- PROJECT BOUNDARY FOR PLANNING REVIEW FOR EXISTING STSTW SITE
- 500m WATER QUALITY STUDY AREA FOR PLANNING REVIEW AT EXISTING STSTW SITE
- WSR2 WATER SENSITIVE RECEIVERS

WSR#	WATER SENSITIVE RECEIVERS
WSR1	SHA TIN HOI
WSR2	SHING MUN RIVER
WSR3	TAI SHUI HANG NULLAH
WSR4	STREAM AT KAU TO HANG
WSR5	WSD SHA TIN SALTWATER INTAKE

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

WATER SENSITIVE RECEIVERS FOR THE PROPOSED DEVELOPMENT AT THE EXISTING STSTW

AECOM

60269233/RPR/10.04

ISO A3 297mm X 420mm

Checked: —

Project Management Initials:

LEGEND:

BOUNDARY OF POTENTIAL LAND CONTAMINATION HOTSPOT

BH-ENV01 INSPECTION PIT

TRANSFORMER

BH-ENV01

BH-ENV13

TRANSFORMER

BH-ENV11

BH-ENV12

TRANSFORMER

AIR BLOWER HOUSE

BH-ENV08

BH-ENV07

BH-ENV06

BH-ENV09

WORKSHOP

BH-ENV02

FUEL OIL TANKS

BH-ENV05

POWER HOUSE

NaOH STORAGE

BH-ENV03

BH-ENV04

NaOCl STORAGE

NaOH STORAGE

BH-ENV10

FeCl3 STORAGE

NaOH STORAGE

FeCl3 STORAGE

FeCl3 STORAGE

TRANSFORMER

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AECOM

60269233/RPR/10.05

POTENTIAL LAND CONTAMINATION HOTSPOTS AND PROPOSED SAMPLING LOCATIONS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: JUL. 2013

Plot File by: $USER$ $DATE$
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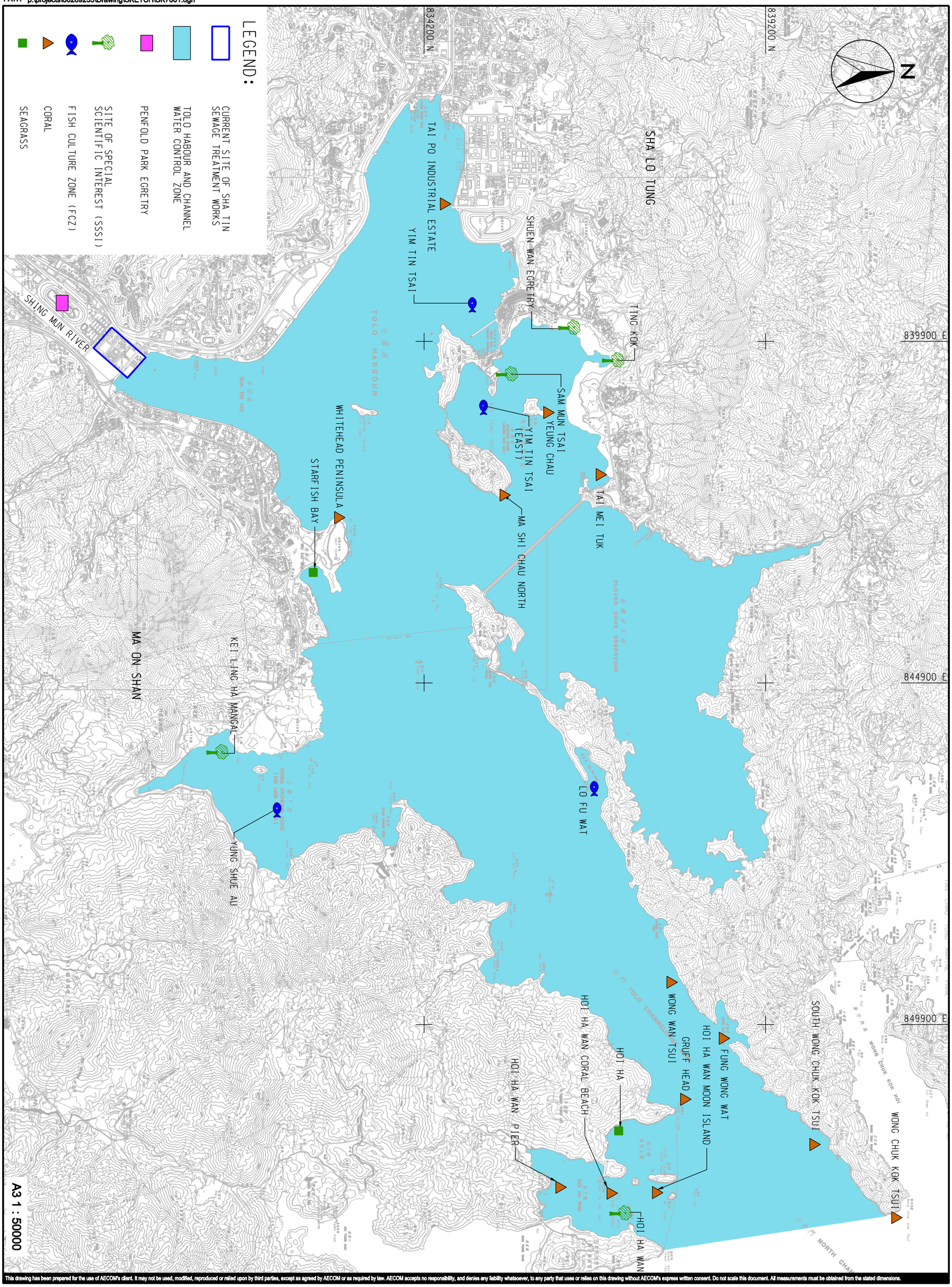

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AGREEMENT NO. CE43/2011 (DS)

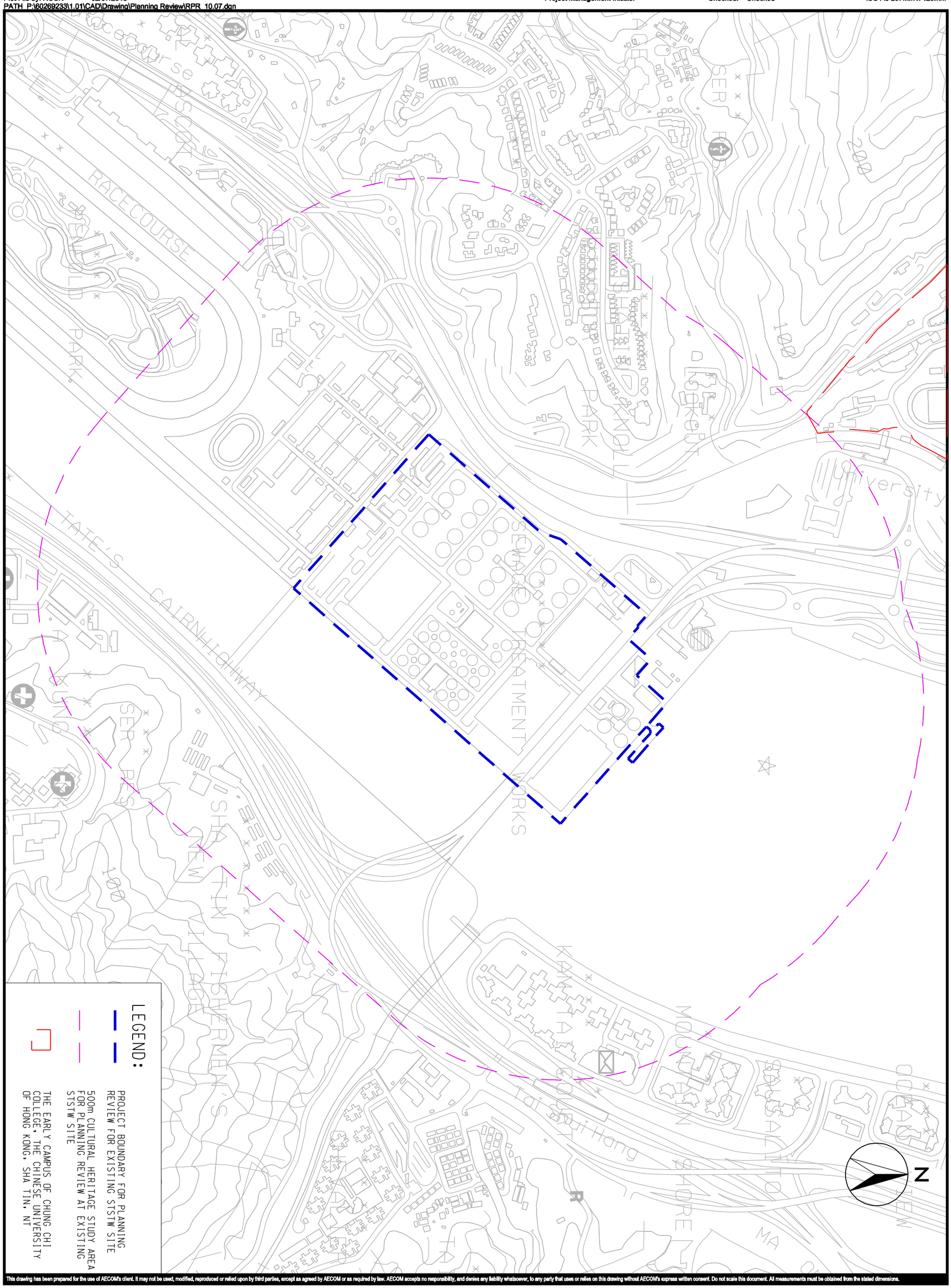
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: SEP. 2012

SITES OF CONSERVATION INTEREST

AECOM

60269233/RPR/10.06



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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: JUL. 2013

500m CULTURAL HERITAGE STUDY AREA FOR THE PROPOSED DEVELOPMENT AT EXISTING STSTW

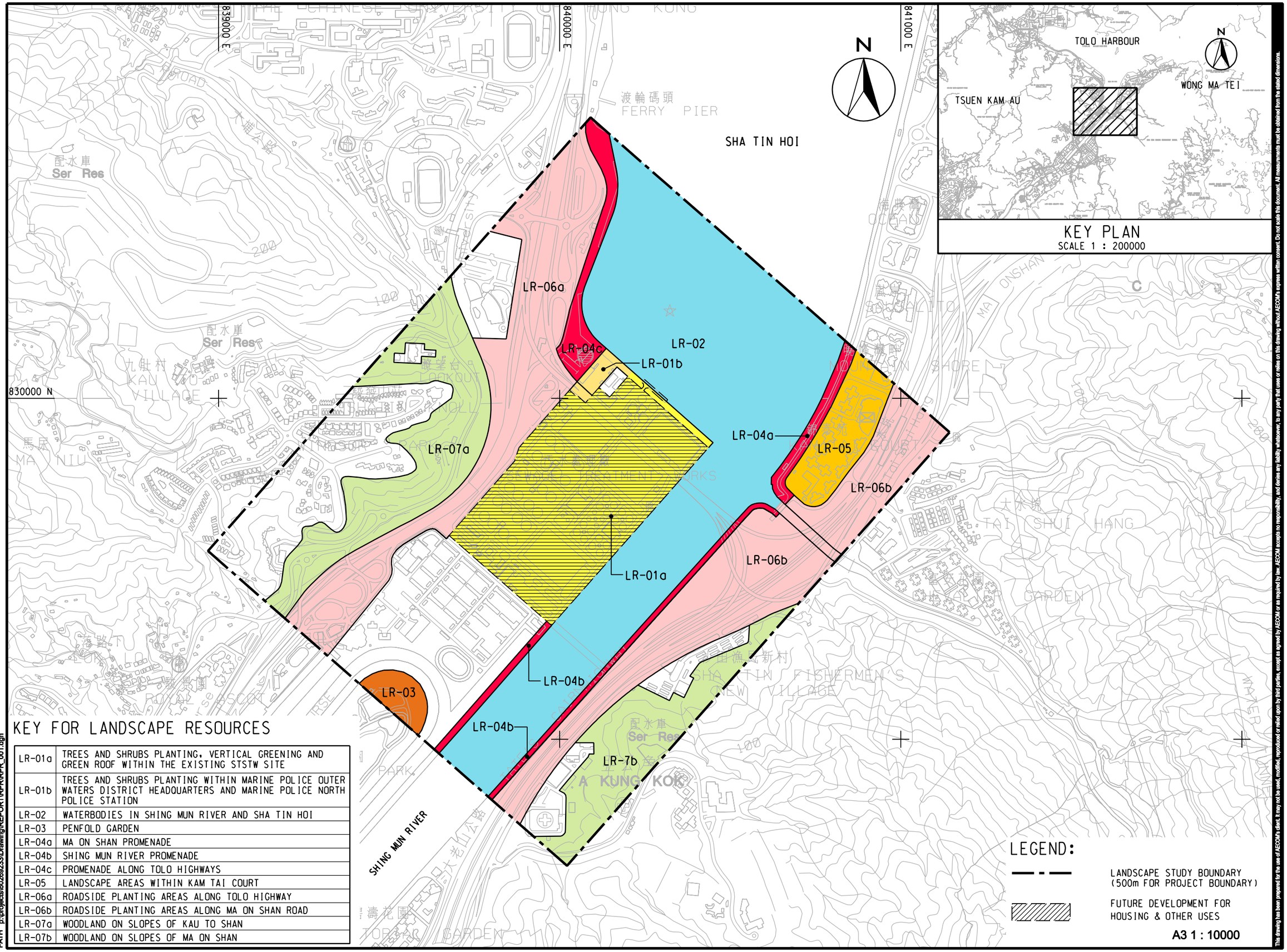
AECOM

60269233/RPR/10.07

ISO A3 297mm X 420mm

Checked:

Project Management Initials:



KEY FOR LANDSCAPE RESOURCES

LR-01a	TREES AND SHRUBS PLANTING, VERTICAL GREENING AND GREEN ROOF WITHIN THE EXISTING STSTW SITE
LR-01b	TREES AND SHRUBS PLANTING WITHIN MARINE POLICE OUTER WATERS DISTRICT HEADQUARTERS AND MARINE POLICE NORTH POLICE STATION
LR-02	WATERBODIES IN SHING MUN RIVER AND SHA TIN HOI
LR-03	PENFOLD GARDEN
LR-04a	MA ON SHAN PROMENADE
LR-04b	SHING MUN RIVER PROMENADE
LR-04c	PROMENADE ALONG TOLO HIGHWAYS
LR-05	LANDSCAPE AREAS WITHIN KAM TAI COURT
LR-06a	ROADSIDE PLANTING AREAS ALONG TOLO HIGHWAY
LR-06b	ROADSIDE PLANTING AREAS ALONG MA ON SHAN ROAD
LR-07a	WOODLAND ON SLOPES OF KAU TO SHAN
LR-07b	WOODLAND ON SLOPES OF MA ON SHAN

LEGEND:

LANDSCAPE STUDY BOUNDARY (500m FOR PROJECT BOUNDARY)

FUTURE DEVELOPMENT FOR HOUSING & OTHER USES

A3 1 : 10000

Plot File by: ZHOUYP 2013/5/15
PATH p:\projects\60269233\Drawing\REPORT\RPR\RPR_001.dgn

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AECOM

60269233/RPR/11.01

LANDSCAPE RESOURCES

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

ISO A3 297mm X 420mm

Checked:

Project Management Initials:

TOLO HIGH WAY

SHUI CHONG STREET

TRANSFORMER AND SWITCHGEAR HOUSE

EFFLUENT PUMPING STATION

UV DISINFECTION CHAMBER

RAS PUMPING STATION No.5

ACCOMMODATION BLOCKS

FINAL SEDIMENTATION TANKS

RAS PUMPING STATION No.1

RAS PUMPING STATION No.2

RAS PUMPING STATION No.3

ADMINISTRATION BUILDING

LABORATORY BUILDING

TRANSFORMER COMPOUND

RAS PUMPING STATION No.4

WSD SALT WATER PUMPING STATION

AIR BLOWER HOUSE

SLUDGE DEWATERING HOUSE

KIU HA ROAD

WATER RECLAMATION HOUSE

SLUDGE TRANSFER PUMPING STATION

SLUDGE STORAGE TANKS

FUEL OIL TANKS

POWER HOUSE

BOILER HOUSE

DIGESTION TANKS

AERATION TANKS

SLUDGE HOLDING TANKS

GAS HOLDERS

SLUDGE THICKENING HOUSE EXTENSION

SLUDGE THICKENING HOUSE

INLET WORKS

GRIT CLASSIFIERS

PRIMARY SEDIMENTATION TANKS

AERATED GRIT CHANNEL No.5

FLUME CHANNEL NOS. 7 & 8

SODIUM HYDROXIDE STORAGE AND DOSING SYSTEM

WASTE GAS BURNER

FERRIC CHLORIDE STORAGE AND DOSING SYSTEM

TRANSFORMER ROOM

BOUNDARY OF EXISTING SHA TIN SEWAGE TREATMENT WORKS

TATES CAIRN HIGHWAY

A1 A2 A3 A4 A5 A6 G1 G2 G3 G4 G5 G6 T1 T2 T3 T4 T5 T6

EXISTING SHA TIN SEWAGE TREATMENT WORKS

SHA TIN

MA LIU SHUI

SHING MUN RIVER

KEY PLAN

SCALE 1 : 50000

LEGEND:

GREEN ROOF

LANDSCAPE AMENITY AREA

TREE OF OUTSTANDING FORM AND AMENITY VALUE

A1 PHOTO TAKING POINT

A3 1 : 2000

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AECOM

60269233/RPR/11.02

AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

LAYOUT OF EXISTING SHA TIN SEWAGE TREATMENT WORKS

Project No.: 60269233 Date: APR. 2013

Plot File by: LIUJ3 20134/30

PATH P:\Projects\60269233\Drawing\REPORT\RPR\RPR_006.dgn

PHOTO T1

PHOTO T2

PHOTO T3

PHOTO T4

PHOTO T5

PHOTO T6

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: APR. 2013

PHOTO OF TREE OF OUTSTANDING FORM AND AMENITY VALUE IN STSTW

AECOM

60269233/RPR/11.03

PHOTO A1

PHOTO A2

PHOTO A3

PHOTO A4

PHOTO A5

PHOTO A6

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: APR. 2013

PHOTO OF LANDSCAPE AMENITY AREA IN STSTW

AECOM

60269233/RPR/11.04

PHOTO G1

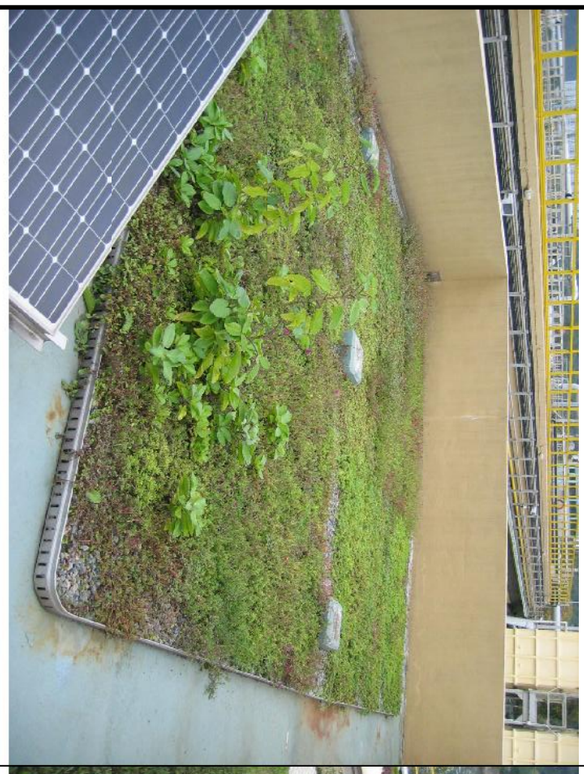

PHOTO G2

PHOTO G3

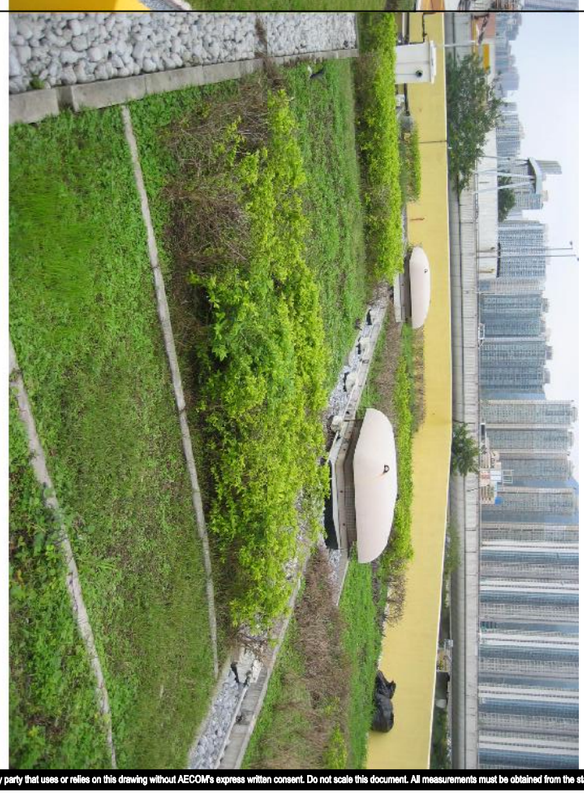

PHOTO G4

PHOTO G5

PHOTO G6

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

PHOTO OF GREEN ROOF IN STSTW

AECOM

60269233/RPR/11.05

ISO A3 297mm X 420mm

Checked:

Project Management Initials:

839000 E

840000 E

841000 E

830000 N

829000 N

N

SHA TIN HOI

SHING MUN RIVER

LCA-01

LCA-02

LCA-03

LCA-04

LCA-05

LCA-06

LCA-07

LCA-08

KEY PLAN
SCALE 1 : 200000

TOLO HARBOUR

TSUEN KAM AU

WONG MA TEI

KEY FOR LANDSCAPE CHARACTER AREAS

LCA-01	SHA TIN SEWAGE TREATMENT WORKS INDUSTRIAL LCA
LCA-02	SHA TIN HOI AND SHING MUN RIVER INSHORE WATER LCA
LCA-03	MA ON SHAN WATERFRONT RESIDENTIAL LCA
LCA-04	MA ON SHAN TRANSPORTATION CORRIDOR LCA
LCA-05	AH KUNG KOK HILLSIDE LCA
LCA-06	SHATIN RACECOURSE LCA
LCA-07	TOLO HIGHWAY TRANSPORTATION CORRIDOR LCA
LCA-08	KAU TO SHAN RESIDENTIAL URBAN FRINGE LCA

LEGEND:

LANDSCAPE STUDY BOUNDARY
(500m FOR PROJECT BOUNDARY)

FUTURE DEVELOPMENT FOR
HOUSING & OTHER USES

A3 1 : 10000

Plot File by: ZHOUYP 2013/5/14
PATH p:\projects\60269233\Drawing\REPORT\rpt\RPR_009.dgn

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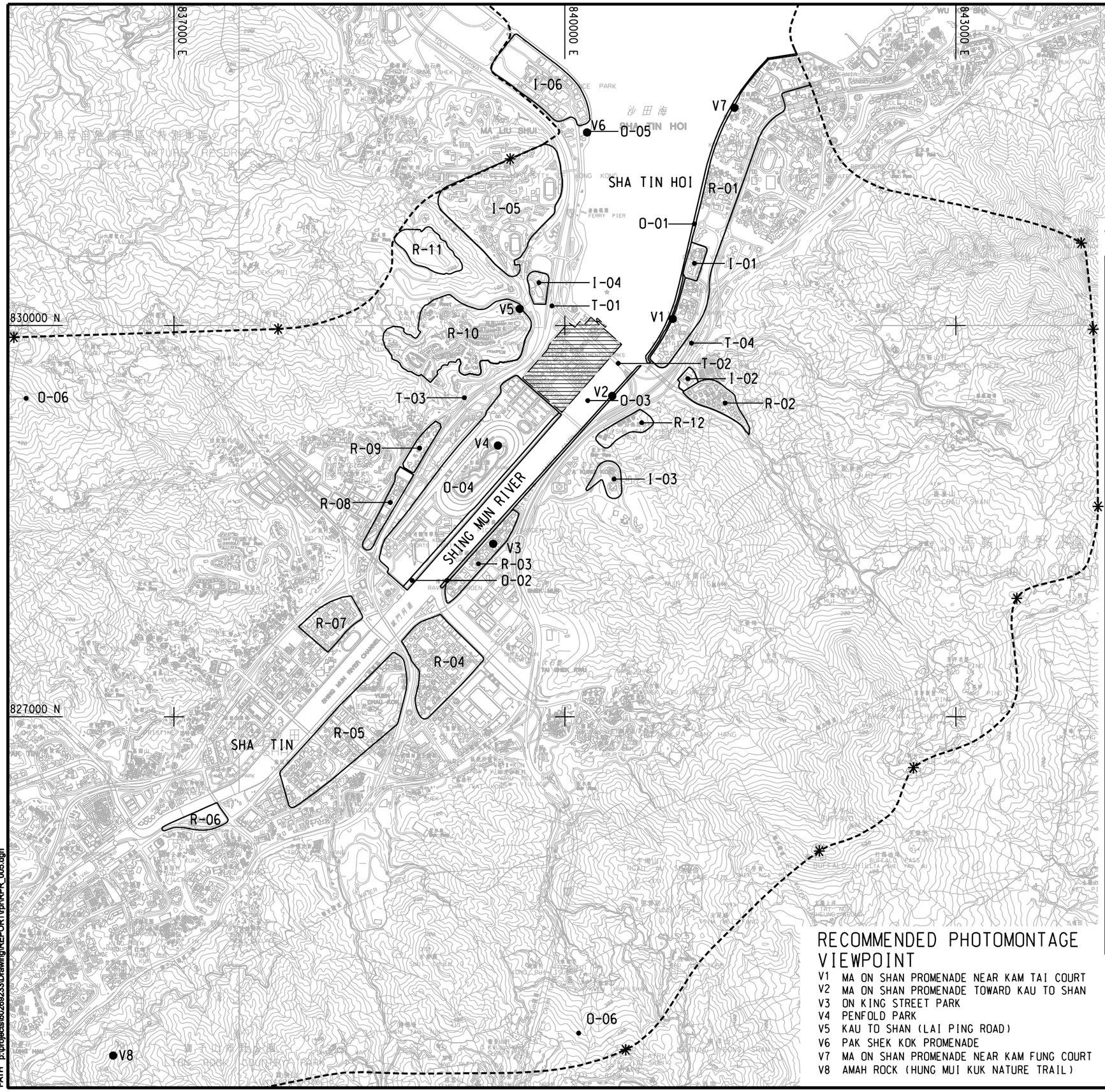
60269233/RPR/11.06

LANDSCAPE CHARACTER AREAS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY. 2013



VSR GROUPS

	RESIDENTIAL VSRS
R-01	RESIDENTS IN MA ON SHAN INCLUDING KAM TAI COURT, MOUNTAIN SHORE, SAUSALITO, LA COSTA, OCEAN VIEW, OCEANAIRE, BAYCREST, VISTA PARADISO KAM FUNG COURT ETC.
R-02	CHEVALIER GARDEN
R-03	RESIDENTS IN PICTORIAL GARDEN, GARDEN VISTA, RAVANA GARDEN ETC
R-04	RESIDENTS IN CITY ONE AND BELAIR GARDEN
R-05	RESIDENTS IN SHA KOK ESTATE, YUE SHING COURT AND JAT MING CHUEN
R-06	RESIDENTS IN THE RIVER PARK (UNDER CONSTRUCTION)
R-07	RESIDENTS IN WO CHE ESTATE
R-08	RESIDENTS IN FO TAN INCLUDING JUBILEE GARDEN AND THE PALAZZO
R-09	RESIDENTS IN ROYAL ASCOT
R-10	LOW RISE PRIVATE RESIDENTIAL DEVELOPMENTS AT KAU TO SHAN INCLUDING WINDSOR PARK, KAM ON GARDENS, GREENLAND VILLAS, YUCCA VILLA, PINE VILLA, JADE VILLA, WINDSOR HEIGHTS, EVERGREEN GARDENS, DOUBLE HAVEN HOUSE, FOREST HILL, GRENERY VILLAS AND SHATIN KNOLL, ETC.
R-11	POTENTIAL RESIDENTIAL DEVELOPMENT AT LAI PING ROAD
R-12	VILLAGES TO THE SOUTH OF TATE'S CAIRN HIGHWAYS
	INSTITUTIONAL VSRS
I-01	OCCUPANTS IN TAK SUN SECONDARY SCHOOL
I-02	OCCUPANTS IN TSUNG TSIN SECONDARY SCHOOL
I-03	OCCUPANTS IN SHA TIN HOSPITAL, BRADBURY HOSPICE AND CHESHIRE HOME
I-04	OCCUPANTS IN HYATT REGENCY HONG KONG
I-05	OCCUPANTS IN CHINESE UNIVERSITY OF HONG KONG
I-06	OCCUPANTS IN HONG KONG SCIENCE PARK
	RECREATIONAL VSRS
O-01	RECREATIONAL USERS IN MA ON SHAN PROMENADE
O-02	RECREATIONAL USERS INCLUDING CYCLISTS ALONG CYCLE TRACK IN THE PROMENADES AT THE BOTH SIDES OF THE SHING MUN RIVER CHANNEL
O-03	WATER BASED RECREATIONAL USERS IN THE WATERBODIES FROM TOLO HARBOUR TO SHING MUN RIVER CHANNEL
O-04	RECREATIONAL USERS IN SHA TIN RACECOURSE AND PENFOLD PARK
O-05	RECREATIONAL USERS PAK SHEK KOK PROMENADE
O-06	HIKERS/VISITORS ON HIKING TRAILS
	TRAVELLING VSRS
T-01	TRAVELLERS ALONG TOLO HIGHWAYS
T-02	TRAVELLERS ALONG TATE'S CAIRN HIGHWAYS
T-03	PASSENGERS ON MTR EAST RAIL LINE
T-04	TRAVELLERS ALONG MA ON SHAN ROAD

RECOMMENDED PHOTOMONTAGE VIEWPOINT

V1 MA ON SHAN PROMENADE NEAR KAM TAI COURT
V2 MA ON SHAN PROMENADE TOWARD KAU TO SHAN
V3 ON KING STREET PARK
V4 PENFOLD PARK
V5 KAU TO SHAN (LAI PING ROAD)
V6 PAK SHEK KOK PROMENADE
V7 MA ON SHAN PROMENADE NEAR KAM FUNG COURT
V8 AMAH ROCK (HUNG MUI KUK NATURE TRAIL)

LEGEND:

- - - - - - - - BROAD VISUAL ENVELOPE
✳ PEAK
● V1 RECOMMENDED PHOTOMONTAGE VIEWPOINT
FUTURE DEVELOPMENT FOR HOUSING & OTHER USES

A3 1 : 30000

AECOM

60269233/RPR/11.07

RECOMMENDED PHOTOMONTAGE LOCATIONS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

ISO A3 297mm X 420mm
Checked:
Project Management Initials:
Plot File by: ZHOUYP 2013/5/14
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Plot File by: LIUJ3 2013/4/27
PATH P:\Projects\60269233\Drawing\SKETCH\SK0066.dgn

Project Management Initials: Checked:

ISO A3 297mm X 420mm

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR.2013

LANDSCAPE AND VISUAL MITIGATIONS PLAN

AECOM

60269233/RPR/11.08

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.: 60269233 Date: MAY 2013

Photomontage V1

AECOM

60269233/RPR/11.09

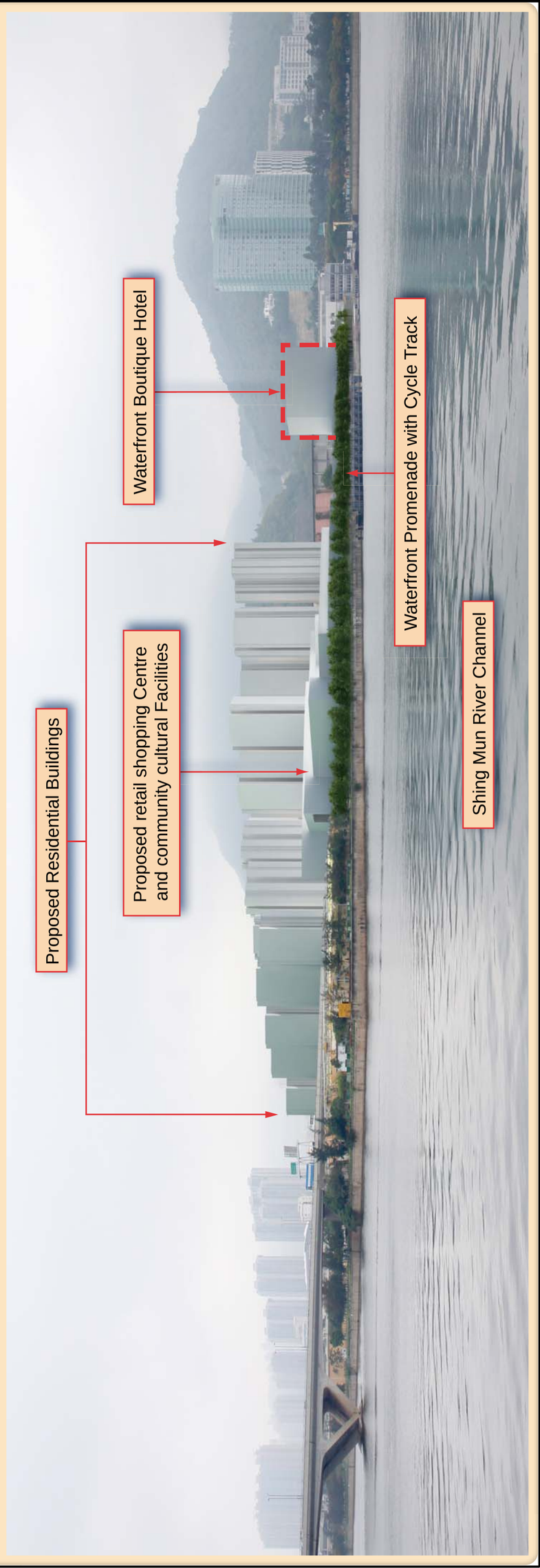
Plot File by: $USER$ $DATE$
PATH P:\60269233\1.01\CAD\Drawing\WP on Planning Review\WPRR_4.03.dgn

Project Management Initials: Checked: —

ISO A3 297mm X 420mm

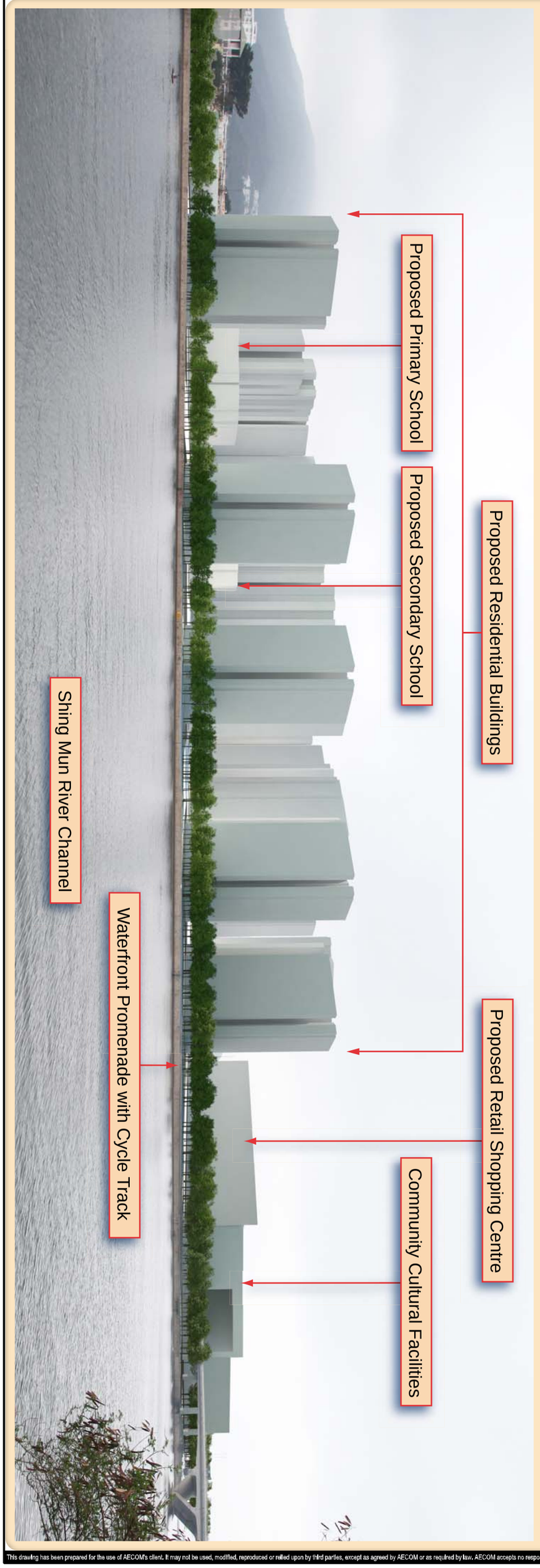
Existing View

Photomontage Showing Proposed Development



Existing View

Photomontage Showing Proposed Development



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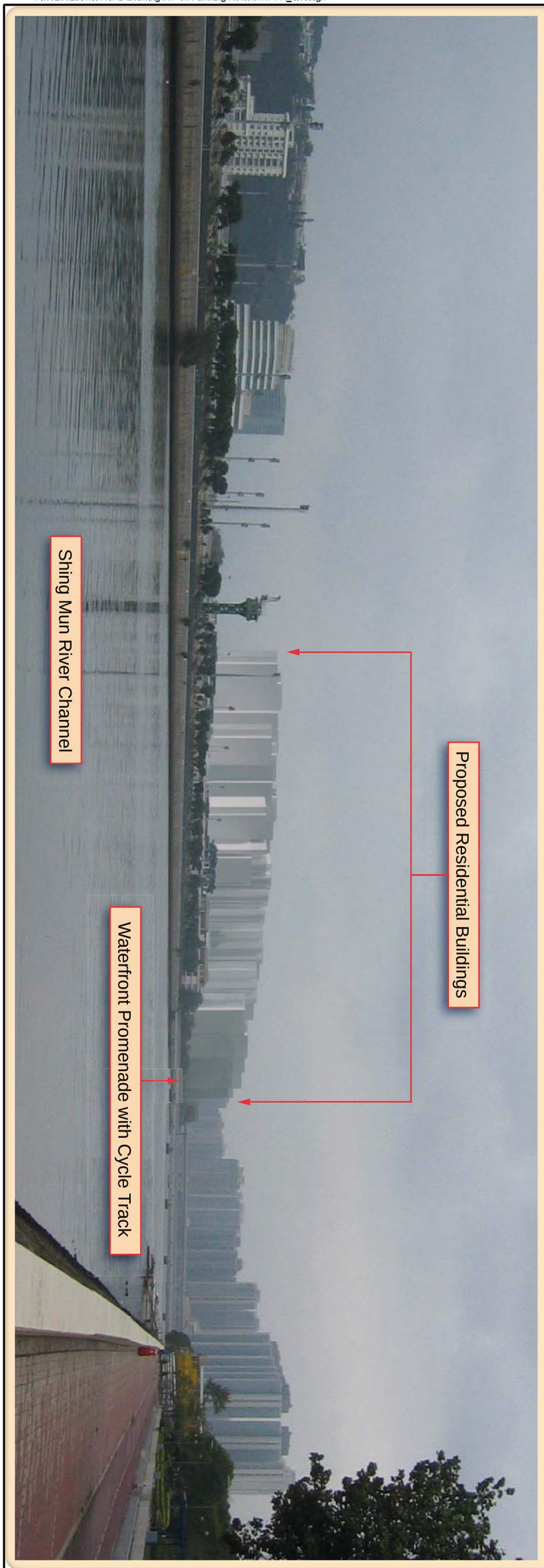
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Photomontage V2

AECOM

Existing View

Photomontage Showing Proposed Development



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Existing View

Photomontage Showing Proposed Development

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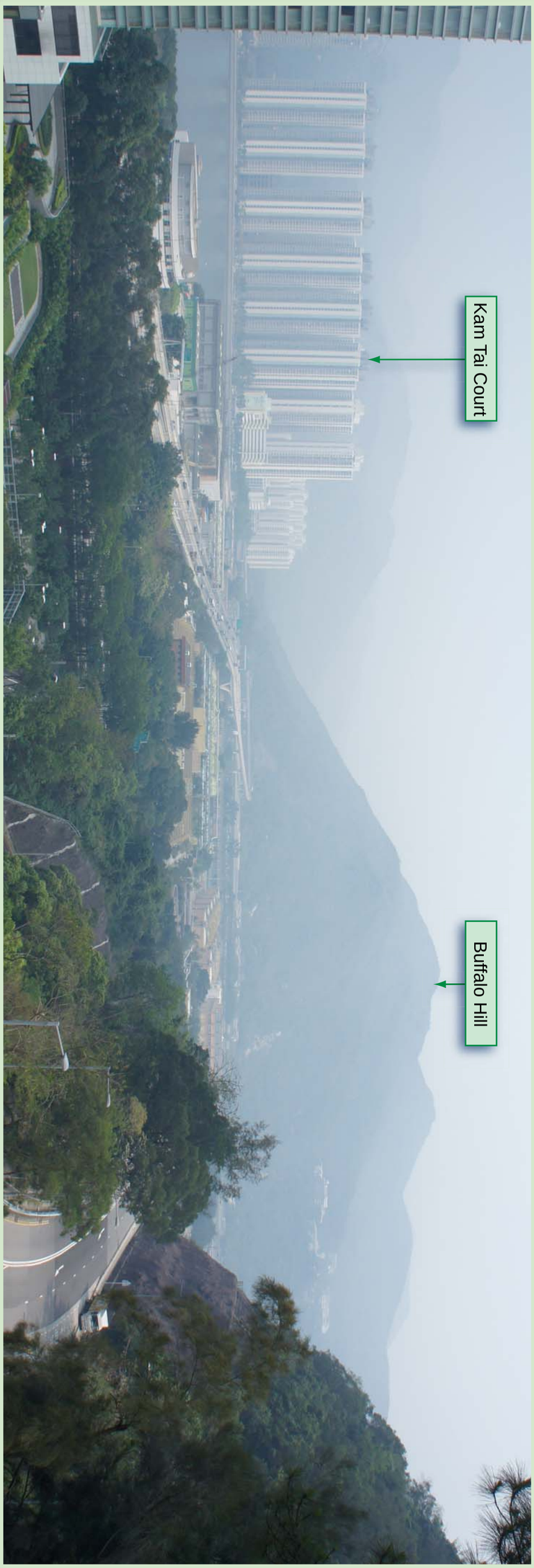
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Photomontage V4

AECOM

Existing View



Photomontage Showing Proposed Development

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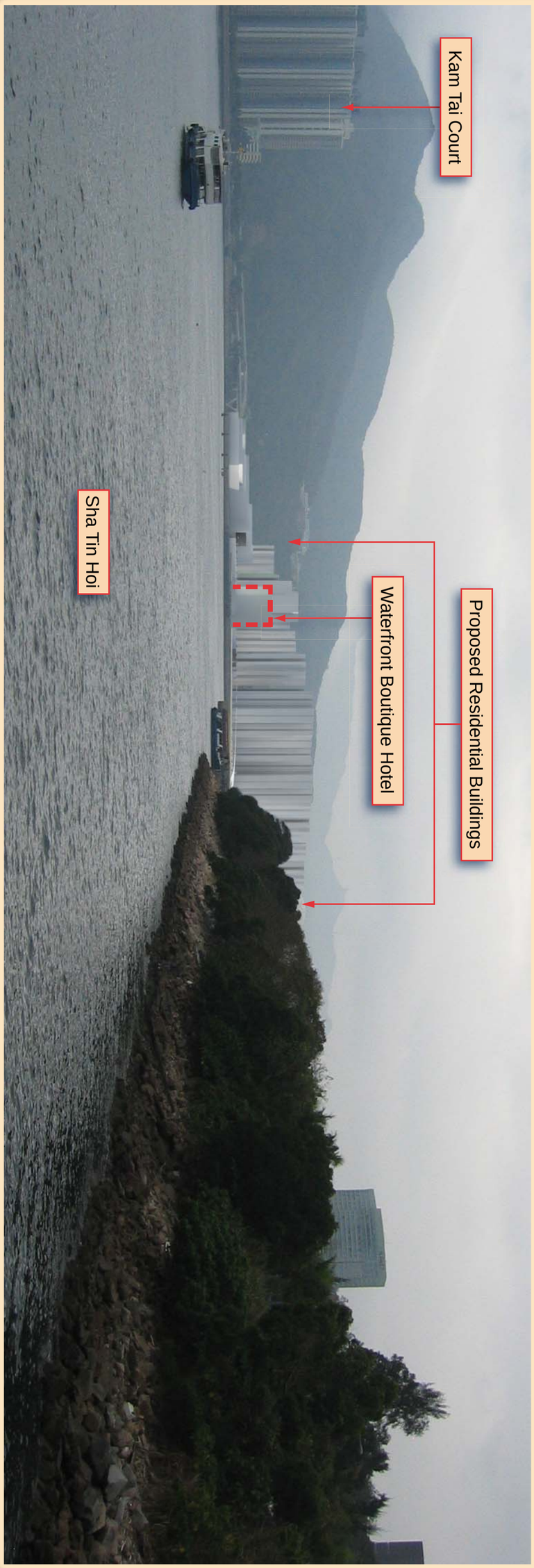
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Photomontage V5

AECOM

Existing View

Photomontage Showing Proposed Development



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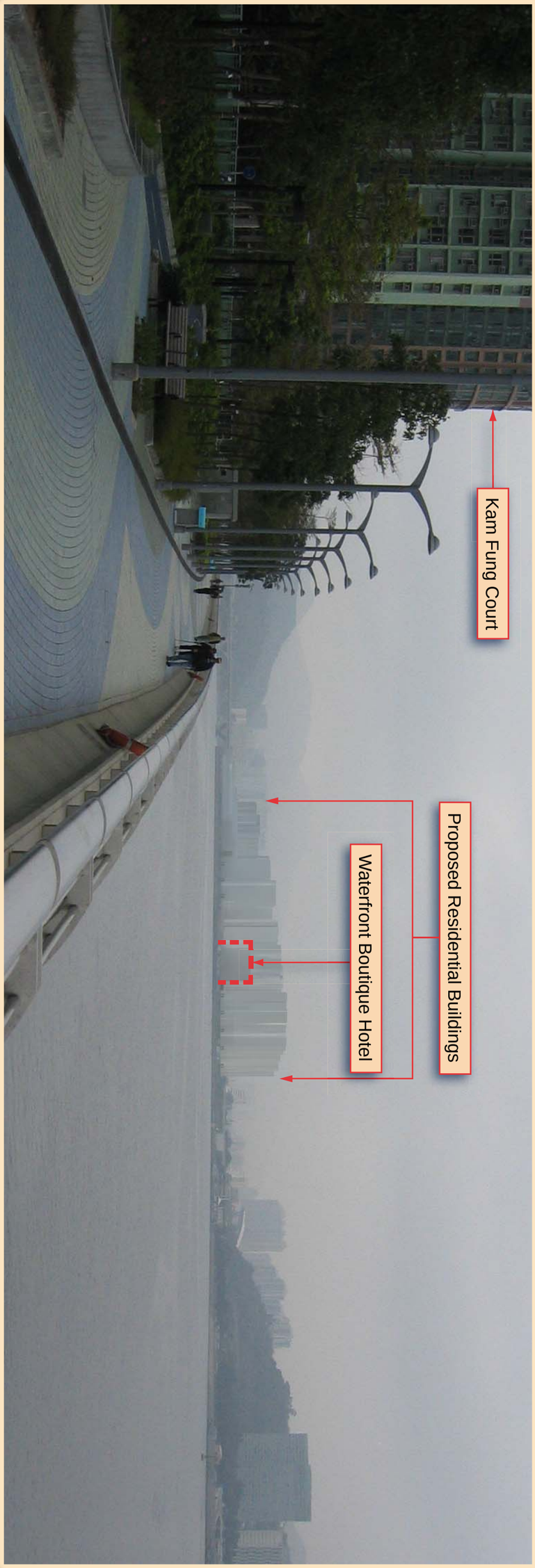
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Photomontage V6

AECOM

Existing View

Photomontage Showing Proposed Development



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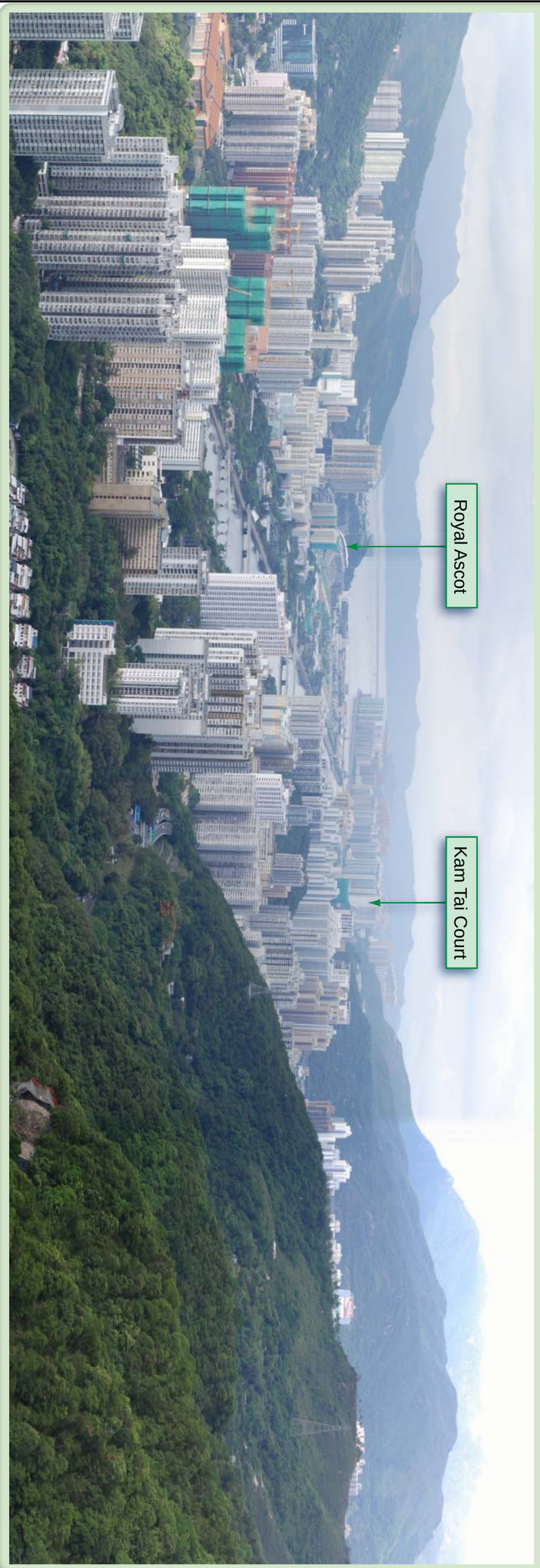
AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Photomontage V7

AECOM

Existing View



Photomontage Showing Proposed Development

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: MAY 2013

Photomontage V8

AECOM

ISO A3 297mm x 420mm

Checked:

Project Management Initials:

15/4/2013

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AECOM

60269233/RPR/13.01

GEOLOGICAL MAP SHEET 7 EDITION II (SOLID AND SUPERFICIAL GEOLOGY) FOR SHA TIN SEWAGE TREATMENT WORKS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.:60269233 Date: APR. 2013

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Legend

- Sha Tin Sewage Treatment Works
- Sha Tin Seafront Salt Water Pumping Station

Solid Geology

- Jkn_gf — Dominantly porphyritic fine-grained granite with some equigranular medium-granited granite
- Jkt_gm — Medium-grained biotite granite
- Jty_cat — Lapilli lithic-bearing coarse ash crystal tuff
- Jty_tt — Tuffite
- Kcs_gm — Dominantly equigranular medium-grained granite with some porphyritic fine-grained granite

Fault

- F1 — Fault, observed
- F2 — Fault, approximate
- F3 — Fault, concealed
- F4 — Fault, inferred
- GP — Photogeological lineament

Superficial Geology

- Qd — Colluvium
- Qfa — Alluvium
- Qhb — Beach deposits
- Qhi — Intertidal deposits
- Qhm — Marine mud
- Qhs — Marine sand
- Fill; sanitary fill

0 250 500
Scale (m)
1:5,000

ISO A3 297mm x 420mm

Checked:

Project Management Initials:

Plot File by: AF
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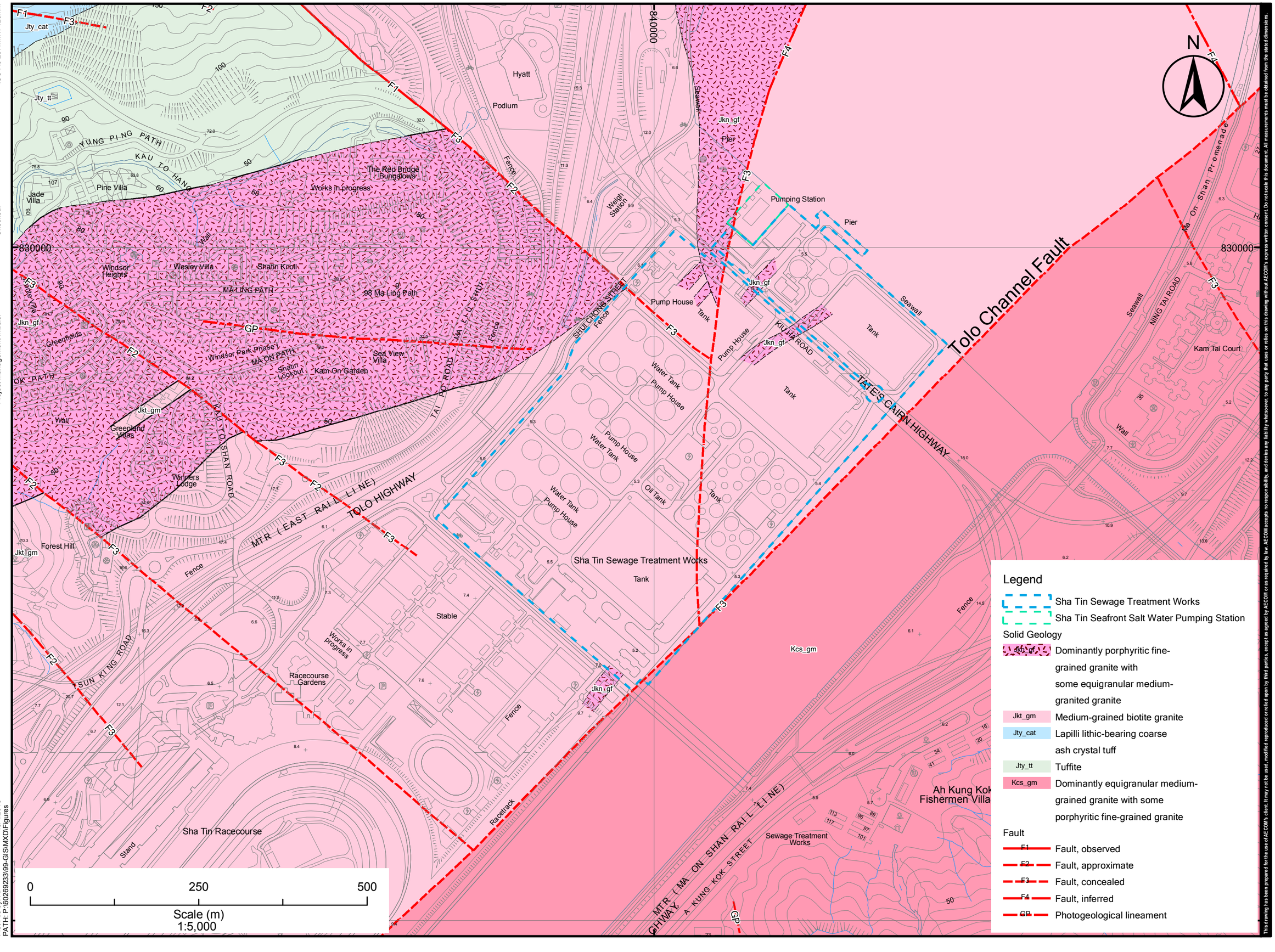
15/4/2013



Legend

Sha Tin Sewage Treatment Works

Sha Tin Seafront Salt Water Pumping Station

Solid Geology

- Jkt_gf — Dominantly porphyritic fine-grained granite with some equigranular medium-granited granite
- Jkt_gm — Medium-grained biotite granite
- Jty_cat — Lapilli lithic-bearing coarse ash crystal tuff
- Jty_tt — Tuffite
- Kcs_gm — Dominantly equigranular medium-grained granite with some porphyritic fine-grained granite

Fault

- F1 — Fault, observed
- F2 — Fault, approximate
- F3 — Fault, concealed
- F4 — Fault, inferred
- GP — Photogeological lineament

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60269233/RPR/13.02

GEOLOGICAL MAP SHEET 7 EDITION II
(SOLID GEOLOGY ONLY)
FOR SHA TIN SEWAGE TREATMENT WORKS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.:60269233 Date: APR. 2013

Plot File by: AF 15/4/2013
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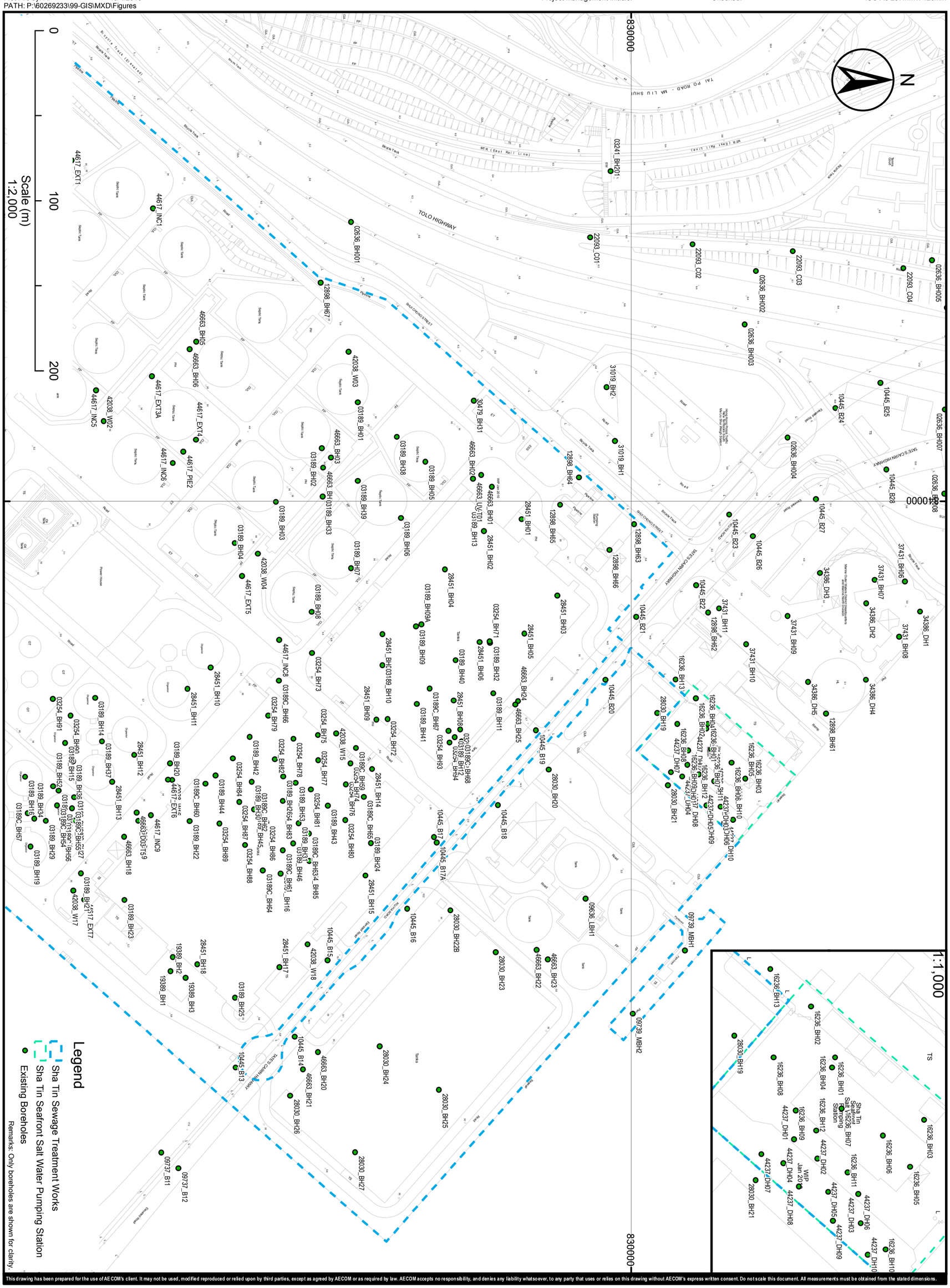

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.:60269233 Date: APR. 2013

EXISTING BOREHOLE LOCATION PLAN FOR THE NORTHERN PORTION OF THE SHA TIN SEWAGE TREATMENT WORKS

AECOM

60269233/RPR/13.03

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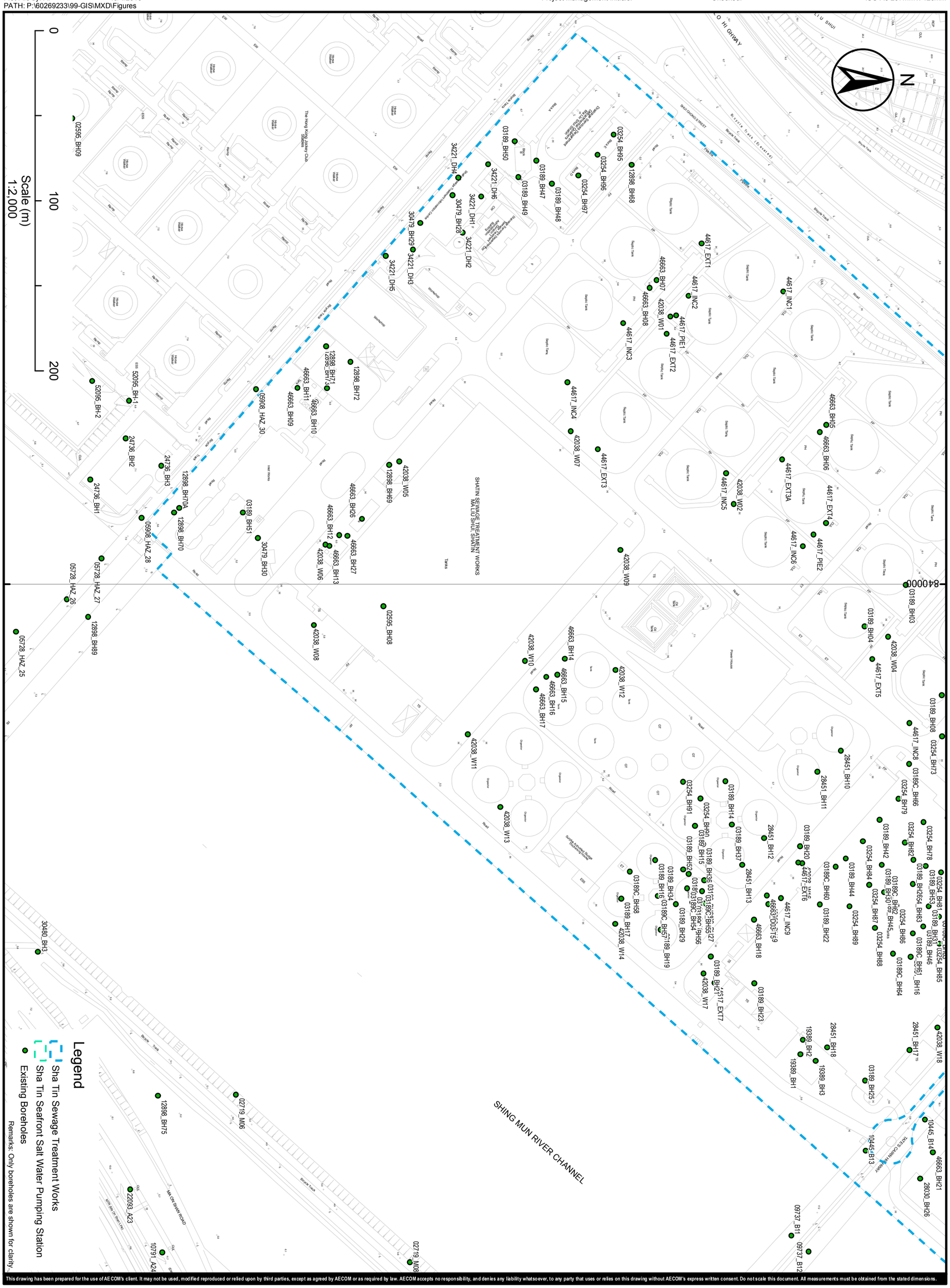

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.:60269233 Date: APR. 2013

EXISTING BOREHOLE LOCATION PLAN FOR THE SOUTHERN PORTION OF THE SHA TIN SEWAGE TREATMENT WORKS

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60269233/RPR/13.04

ISO A3 297mm x 420mm

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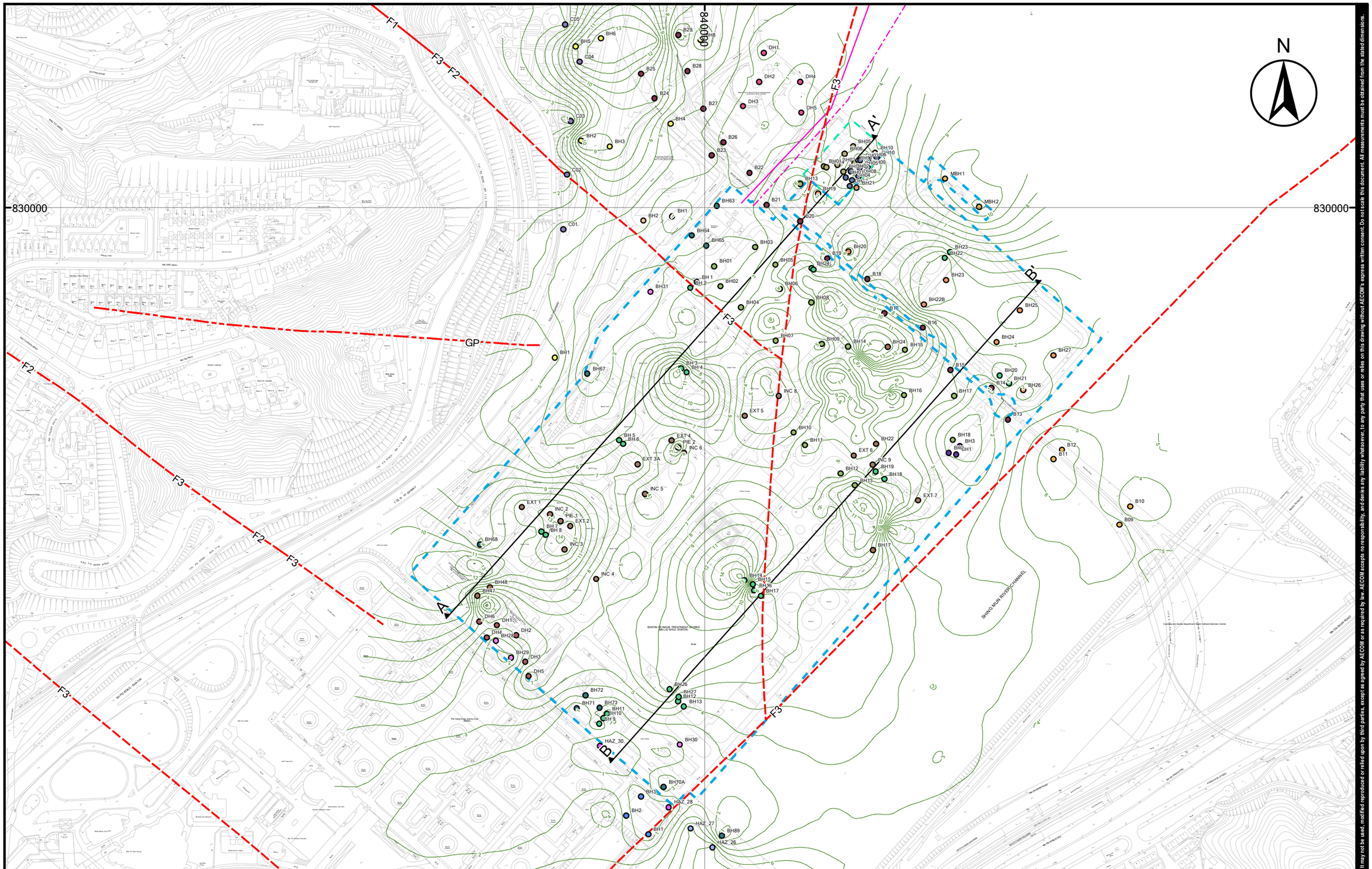

*For Section A-A' & B-B', please refer to figures 7.07 & 7.08.

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60269233/RPR/13.05

THICKNESS OF MARINE DEPOSIT CONTOUR PLAN FOR SHA TIN SEWAGE TREATMENT WORKS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.:60269233 Date: APR. 2013

Plot File by: RM 15/4/2013
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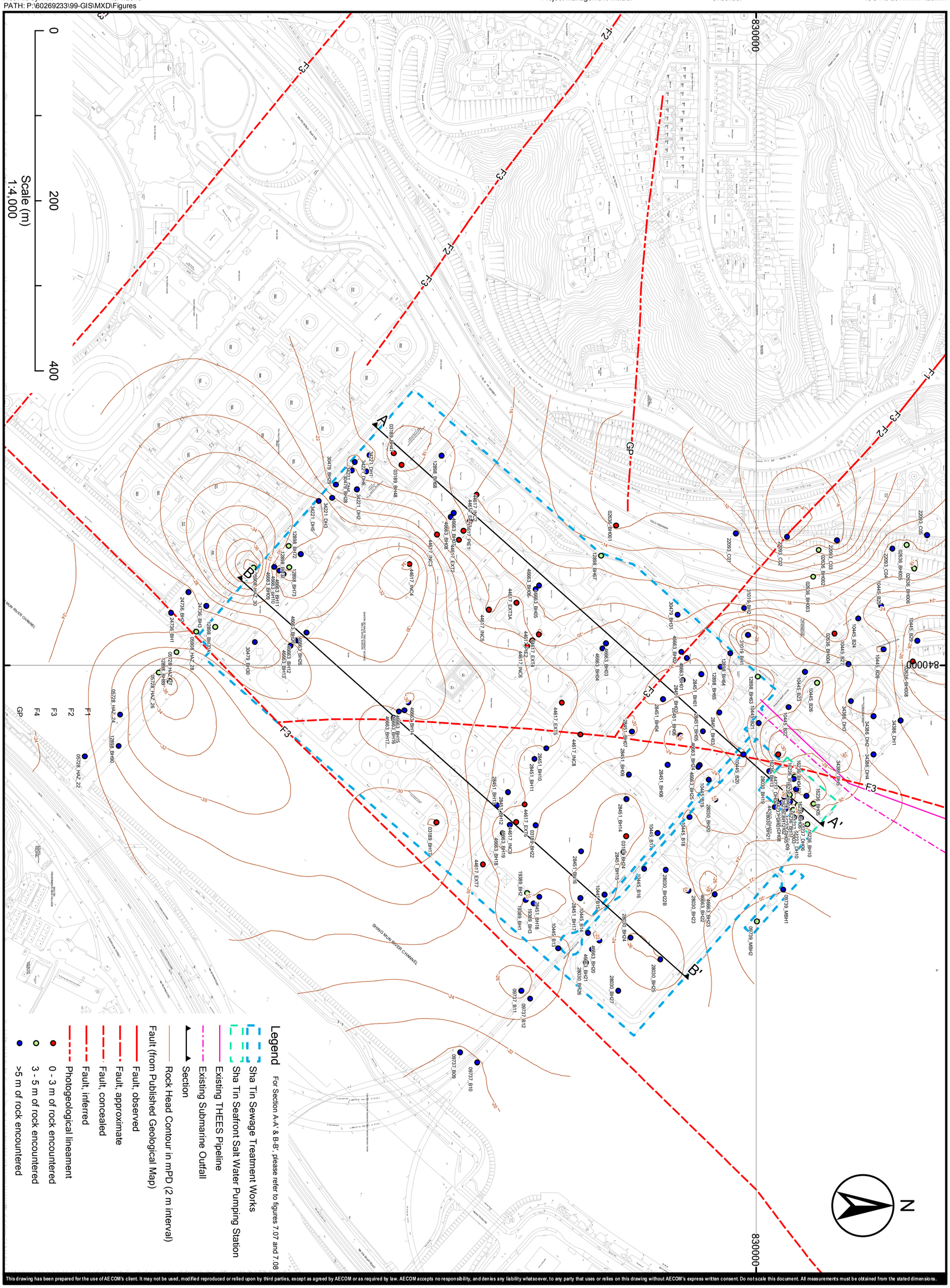

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.:60269233 Date: APR. 2013

ROCK HEAD CONTOUR PLAN FOR SHA TIN SEWAGE TREATMENT WORKS

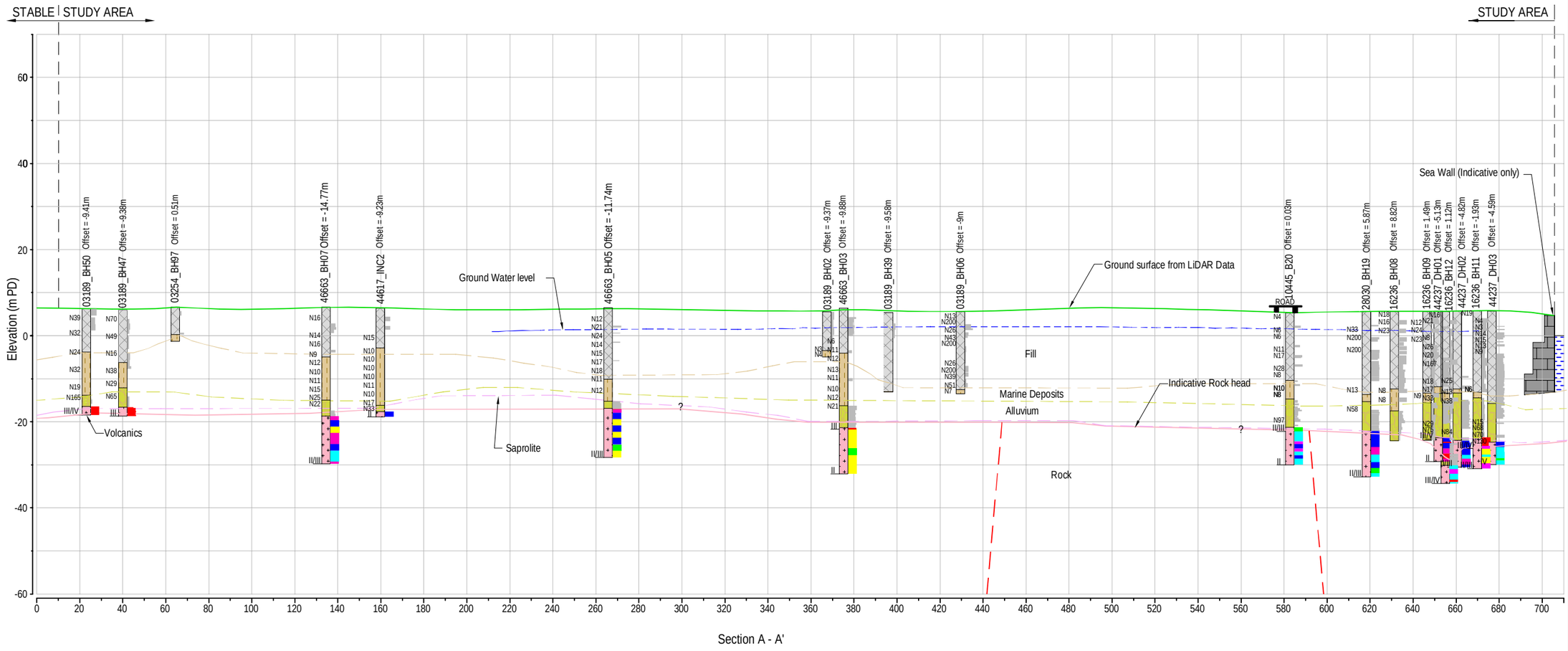
AECOM

60269233/RPR/13.06

ISO A3 297mm X 420mm

Checked: Stephen P.

Project Management Initials:



Section A - A'

LEGEND

- Ground surface from LiDAR Data
- Rockhead level
- Fill
- Marine Deposit
- Alluvium Deposit
- Granite / Rhyolite
- "Concealed" Fault from Geological Map
- Ground water level from available monitoring

NOTES

1. Seawall construction is indicative only
2. Strata boundaries taken from contour plan of the strata.
3. N200- N value greater or equal to 200

% RQD colour code
Coring in boulders
0 - 25
26 - 50
51 - 75
76 - 90
91 - 99
100
% CORE RECOVERY 0 TO 100

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Section A - A'
At SHA TIN SEWAGE TREATMENT WORKS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: Apr. 2013

Plot File by: Ritesh 17/09/2012
PATH P:\60269233\Drawings

ISO A3 297mm X 420mm

Checked: Stephen P.

Project Management Initials:

STABLE | STUDY AREA

STUDY AREA

Elevation (m PD)

Ground Water level

Fill

Marine Deposits

Alluvium

Saprolite

Rock

Indicative Rock head

Ground surface from LiDAR Data

Alluvium Deposit

Sea Wall (Indicative only)

ROAD

05908_HAZ_30 Offset = 20.54m
46663_BH26 Offset = 5.05m
46663_BH27 Offset = -8.02m
42038_W10 Offset = 6.63m
46663_BH16 Offset = 7.91m
46663_BH17 Offset = -1.58m
03189_BH15 Offset = 0.85m
03189_BH36 Offset = -4.07m
28451_BH13 Offset = 2.27m
46663_BH19 Offset = -4.71m
44617_INC9 Offset = 2.77m
42038_W18 Offset = 7.33m
10445_B15 Offset = 8.34m
28030_BH24 Offset = -9.1m
28030_BH25 Offset = -5.05m

Section B - B'

LEGEND

- Ground surface from LiDAR Data
- Rockhead level
- Fill
- Marine Deposit
- Alluvium Deposit
- Granite / Rhyolite
- "Concealed" Fault from Geological Map
- Water Level
- Ground water level from available monitoring

NOTES

1. Seawall construction is indicative only
2. Strata boundaries taken from contour plan of the strata.
3. N200- N value greater or equal to 200

% RQD colour code
- Coring in boulders
- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 90
- 91 - 99
- 100

% CORE RECOVERY 0 TO 100

Plot File by: Ritesh 17/09/2012
PATH P:\60269233\Drawings

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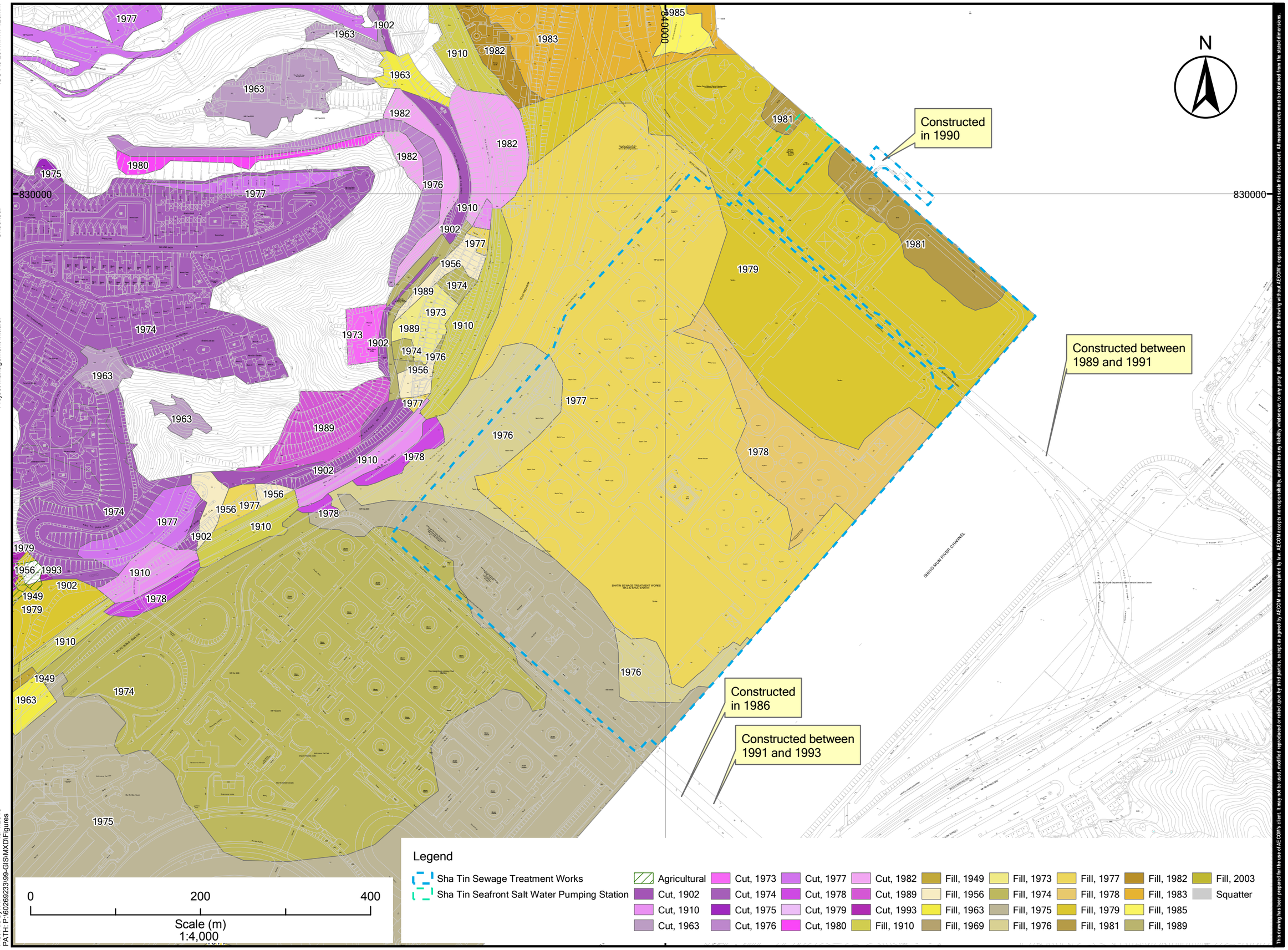
60269233/RPR/13.08

Section B - B'
At SHA TIN SEWAGE TREATMENT WORKS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233



ISO A3 297mm x 420mm

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Project Management Initials:

Plot File by: AF
PATH: P:\60269233\99-GIS\MXD\Figures
15/4/2013

AECOM

60269233/RPR/13.09

AERIAL PHOTOGRAPH INTERPRETATION
FOR SHA TIN SEWAGE TREATMENT WORKS

AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.:60269233 Date: APR. 2013

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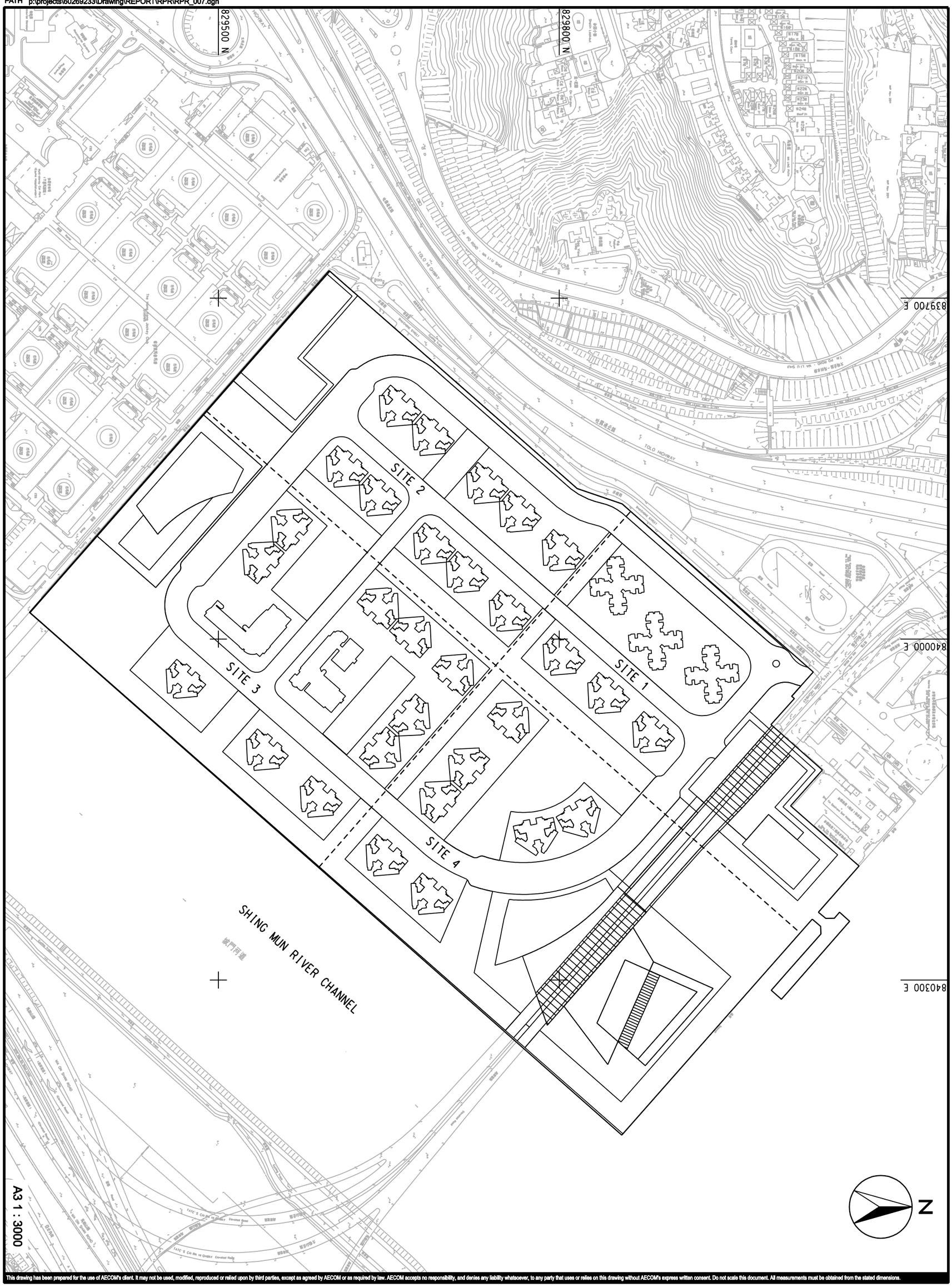

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AGREEMENT NO. CE43/2011 (DS)
RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY
Project No.: 60269233 Date: APR. 2013

SCHEDULE OF IMPLEMENTATION OF THE PROPOSED DEVELOPMENT

AECOM

60269233/RPR/16.01A

AECOM

Water &
Urban Development

Report on Planning Review for Existing STSTW Site (Volume 3 of 3 – Appendices)
(Final)

JANUARY 2014

RESTRICTED

Agreement No. CE 43 /2011 (DS)

Relocation of Sha Tin Sewage Treatment Works to Caverns – Feasibility Study

Volume 3 of 3

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Appendix 15.01	Risk Register
Appendix 15.02	Sample Risk Treatment Action Plan
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Appendix 2.01

List of Suggestion on Future Land Use for the Existing STSTW Site after Relocation Work

Agreement No. CE43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns
- Feasibility Study

List of Suggestion on Future Land Use for the Existing STSTW Site after Relocation Work

Comments Received	Date Received
1. Architectural Services Department Letter ref.: ASD18/920501/TEC/DSD/1	25 October 2012
2. Fire Services Department Letter ref.: (24) in FSD/PG 31/7596/00.	23 November 2012
3. Hong Kong Police Force / Planning and Development Branch email	27 November 2012
4. Agriculture, Fisheries and Conservation Department Letter ref.: (137) in AF GR AGD 07/1 Pt 10	28 November 2012
5. Transport Department Letter ref.: ( ) in TDNR 171/200-288	29 November 2012
6. Tourism Commission Letter ref.:TC T2 22/25/13	3 December 2012.
7. Education Bureau Email	7 December 2012
8. Social Welfare Department Letter ref.: (12) in L/M (1) in SWD 4/212/2001	10 December 2012
9. Leisure and Cultural Services Department Letter ref.: ( ) in LCS 1/HQ 715/00 (5) VI	3 January 2013
10. Home Affairs Department/ Sha Tin District Office Letter ref.: ( ) in STD 17/30/20/15	5 March 2013

Agreement No. CE43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns
- Feasibility study

List of Suggestion on Future Land Use for the Existing STSTW Site after Relocation Work

Item	Comments
1.	**Architectural Services Department Letter ref.: ASD18/920501/TEC/DSD/1 dated 25 October 2012**
	We refer to your above quoted letters, received by this office on 11 October 2012 and 22 October 2012 respectively, with regard to the above subject. Please be advised that we have no particular comment on the draft Working Paper at this stage as it is mainly concerned with land use planning but would suggest the following issues to be addressed in the next stage of the Study: (i) Cycle track, which should be connected to waterfront promenade, residential development, open space and other recreational facilities inside the site, as well as the existing cycle track between Shatin and Taipo, should be indicated in drawings nos. 60269233/WPPR/9.01 to 9.03. (ii) Traffic noise impact from Tolo Highway and Tate's Cairn Highway on the proposed residential/housing development should be addressed. (iii) Further to paragraph 2.3.2, 2.3.3 and 2.5.5, provision of aquatic and proposed amphitheatre and floating stage, should be investigated. (iv) The need for kindergarten and nursery etc. in the Study Area should be further assessed. Please address all future correspondence regarding the captioned subject to Chief Architect/ Central Management Division 2 via the above contract details.
2.	**Fire Services Department, letter ref.: (24) in FSD/PG 31/7596/00, dated 23 November 2012**
	Please be advised that I have no specific comment on the captioned submission.
3.	**Hong Kong Police Force / Planning and Development Branch, email, dated 27 November 2012**
	I refer to your letter dated 2012-11-15 on the captioned. 2. HKPF have a number of intended projects including construction of new facilities for both operational and training purpose as well as staff quarters. There are also other reprovisioning proposals suggested by other Gov't Dept/Bureaux which require new sites to be identified. 3. We are of the opinion that PlanD may be in a more appropriate position to provide you the details of our requests for site search for those projects.
4.	**Agriculture, Fisheries and Conservation Department, letter ref.: (137) in AF GR AGD 07/1 Pt 10, dated 28 November 2012**
	Thank you for your letter dated 15 November 2012. I understand that you are developing a conceptual scheme for the captioned proposed development, and assess the area required for G/IC facilities. In your invitation letter, you have mentioned "farmers market" as one of the possible planned uses of the site. From the perspective of agricultural development, we would like to see the site being used as such, benefiting the local community there. However, please note that farmers markets in Hong Kong are not operated by the Government, but by farmer organizations, NGOs or private organizations.

	If you have any further suggestions, please feel free to contact the undersigned at 2150 7040.
5.	**Transport Department, letter ref.: ( ) in TDNR 171/200-288, dated 29 November 2012**
	We refer to your above letters dated 15 November 2012 regarding the captioned subject. Please would you consider for provision of a continuous cycle track along the river bank of Shing Mun River Channel by extending the existing cycle track at the eastern boundary of the STSTW site to Pak Shek Kok. A plan showing the suggested cycle track is attached below for your consideration.
6.	**Tourism Commission, letter ref.: TC T2 22/25/13, dated 3 December 2012**
	I refer to your letter dated 15 November 2012. In view of the shortage of hotel room supply, you may wish to consider if "hotel" could be a possible land use at the subject site.
7.	**Education Bureau, email, dated 7 December 2012**
	I refer to your letter dated 15 November 2012 regarding the above subject. As the planning of the site will involve residential development, you are kindly reminded to reserve primary/secondary school sites in accordance with the recommendations in Hong Kong Planning Standards and Guidelines to meet the future educational need of the residents. Should you have any enquiries, please feel free to contract me at 3509 8432.
8.	**Social Welfare Department, letter ref.: (12) in L/M (1) in SWD 4/212/2001, dated 10 December 2012**
	I refer to your letter dated 15.11.2012 concerning the captioned. Please note that we would like to propose the following welfare facilities for incorporation in the captioned site –

Welfare facilities	Proposed Provision	Area requirement
a) Day care Centre for the Elderly (To be located on ground floor and 3 parking spaces for 24-seater van is required)	One 60-place	IFA of 537 sq.m. NOFA of 358 sq.m.
b) Residential Care Home for the Elderly (One parking space for 24-seater van is required)	One 100-place	IFA of 1 754 sq.m NOFA of 1 096 sq.m.
c) Day Activity Centre (To be paired up with item (d))	One 50-place	IFA of 415 sq.m. NOFA of 319 sq.m.
d) Hostel for Severely Mentally Handicapped Persons (To be paired up with item (c))	One 50-place	IFA of 925 sq.m. NOFA of 661 sq.m.

	e) Integrated Vocational and Rehabilitation Services Centre (To be located on G/F, otherwise a goods lift is needed. One parking space for 5.5-ton goods vehicle with loading/unloading area for goods. To be paired up with item (f))	One 50-place	IFA of 925 sq.m. NOFA of 653 sq.m.
	f) Hostel for Moderately Mentally Handicapped Persons (To be paired up with item (e))	One 100-place	IFA of 1 496 sq.m. NOFA of 1 068 sq.m.
	g) Care and Attention Home for Severely Disabled Persons (One parking space for 24-seater van is required)	One 50-place	IFA of 1 182 sq.m. NOFA of 788 sq.m.
	h) Supported Hostel for Mentally Handicapped Persons	One 20-place	IFA of 316 sq.m. NOFA of 243 sq.m.
	i) Halfway House	One 40-place	IFA of 676 sq.m. NOFA of 483 sq.m.
	Please let me know if you require any further information.		
9.	**Leisure and Cultural Services Department, letter ref.: ( ) in LCS 1/HQ 715/00 (5) VI, dated 3 January 2013**		
	I refer to your letter dated 15 November 2012. We are interested in setting up a Film Centre at the present site of Sha Tin Sewage Treatment Works (STSTW) after relocation of the facilities. The net operational floor area required is 18,560m2. Enclosed please find the details of the proposal for consideration. **Background** The Hong Kong Film Archive (HKFA), under the Heritage and Museums Division of the Leisure and Cultural Services Department (LCSD), is dedicated to the preservation of Hong Kong's rich film heritage. With the opening of the Archive building in Sai Wan Ho equipped with professional film vaults and public facilities in 2001, the HKFA became a full-fledged film archive of its own right. In the past decade, HKFA has been bringing film art to the wider community by providing public access facilities and a wide range of activities like thematic exhibitions, screening programmes, post-screening talks, seminars, guided tours, educational activities, outreach programmes, etc. HKFA also actively promotes film culture and facilities research on Hong Kong cinema.		

2. With the success of our acquisition efforts and coupled by the enthusiastic responses of film owners to deposit and donate films, the number of HFKA's collections has grown to over 12 500 film titles and over one million items of film-related materials by the end of October 2012 including posters, stills, photos, scripts, audio-visual materials, machinery, artifacts, etc. The quantity of the collection items keeps growing. In order to accommodate the huge amount of precious collections, three off-site stores located at Lei Yue Mun Park, Cornwall House of Taikoo Place and ocean Court at Aberdeen have been acquired since 2002, 2006 and 2011 respectively in addition to the existing Sheung Shing Street Store which is share-used with the Hong Kong Museum of History.

Justifications for Setting up a Film Centre at Sha Tin

3. In recent years, the general public and regular patrons commented that the location of HKFA is not very convenient and there is suggestion of opening another film venue at a more accessible and prominent location other than in Hong Kong Island. Moreover, the HKFA has been facing acute storage problem over the years. The existing collection stores in the HKFA premises as well as the above-mentioned off-site stores have reached its full capacity. It is envisage that the acquisition and preservation works of the HKFA will be hindered without additional stores for proper storage of precious collections.

4. Due to the rapid expansion of the scope of services provided by the HKFA and the limitation of its surrounding area for further development at Sai Wna Ho, it is necessary for the LCSD to plan for the construction of another venue, tentatively named as Film Centre, in either Kowloon or the New Territories in order to meet the growing demands for cultural services and to solve the storage problem in the near future while the HKFA would continue its operation.

5. The proposal for the construction of a Film Centre at Sha Tin Which is close to Kowloon area can address the expectation of the public. The proposed Film Centre will partner with the HKFA and the Film Programmes Office (FPO), which is the sister office of HKFA now location at Tsim Sha Tsui, in organizing the thematic exhibitions and various screening programmes to better serve the public in the New Territories and Kowloon.

6. After the opening of the proposed Film Centre, the HKFA should remain in operation. The public can be given the chance to attend programmes held in the Hong Kong Side apart from joining the activities held at the proposed Film Centre in Sha Tin. It can help to expand the audience base for the film art. In addition, the HKFA will be able to focus its works more on research and allocate more resources to the organization of educational and extension activities. For instance, the existing Resource Centre of HKFA can be modified to accommodate more viewing booths/ rooms to facilitate more public and researchers to conduct film-related study and allow more students to attend educational programmes. Furthermore, the stores of the HKFA are purpose-built for keeping film collection as such it is cost-effective to retain them for keeping our film heritage.

Visions and Missions of Film Centre

7. The LCSD has the vision to establish the proposed Film Centre as a renowned film organization in promoting the film culture, making it a part of everyday life for the people of Hong Kong and introducing the local cinematic art overseas. The missions of the proposed Film Centre will be:

    a) To acquire and preserve Hong Kong films and related materials;

    b) To provide film materials, facilities and enquiry services for industry professionals, researchers and interested parties; and

    c) To enhance public appreciation of films by organizing topical retrospectives, exhibitions, symposiums and seminars; as well as through collaboration with overseas counterparts and local organizations including film societies, film festivals, government departments, cultural organizations, district organizations and education/academic institutions.

Proposed Facilities and Floor Area of Film Centre

8. The proposed Film Centre would be equipped with facilities including a cinema, an exhibition hall, a resource centre, numerous climate-controlled collection stores, office accommodation, box office, souvenir cum coffee shop, car park and loading area, workshop area and so on. The storage area for films and film-related materials would be equipped with independent air conditioning system with dehumidification and acidic gaseous removal functions. Other major area is used for screening, exhibition, public access functions, catering services, parking and offices.

9. To have a better cooperation and utilization of limited resources among the HKFA, the Film Programmes Office and the proposed Film Centre, it is proposed to relocate the existing office of FPO from Tsim Sha Tsui to the proposed Film Centre. The proposed total net floor area around 18 560 sq m. for the proposed Film Centre is detailed in Appendix 1.

Benefits to the Government and Society

10. The inauguration of the Film Centre will bring the following benefits to the Government and the society:

    i. A more spacious Film Centre can facilities more valuable film items to be showcased. A more comprehensive exhibition on the history of Hong Kong film can be staged for better promotion of the local cinematic art;
    ii. The Government shows a very good example through setting up of this film-related organization which encourages the promotion of film culture and arouses the public awareness of the preservation of local film heritage;
    iii. The HKFA and the FPO will work along with the Film Centre in utilizing the resources for better planning of the film programmes and exhibitions both locally and abroad;
    iv. The Film Centre can complement the work of the HKFA by organizing more educational and outreaching activities on film art to better nurture the younger generation especially to the students in film appreciation;
    v. The Film Centre will also line up with overseas counterparts and local film-related organizations and institutions which contribute towards to development of the Hong Kong film industry;
    vi. It is the Government's commitment to the donors that the donated materials should be kept in optional and environmental-controlled stores. The Film Centre will provide more proper and efficient storage environment to replace those less equipped off-side stores of the HKFA which can build up the image and effort of the Government in preserving and safeguarding the precious collections. Accommodation of the location at better storage facilities in the Film Centre is crucial for their long-term preservation and subsequent appreciation by future generation that is beneficial to the society as a whole.
    vii. After the opening of the proposed Film Centre, the off-site stores of HKFA and the office space of the FPO can be released for other usages. In addition, HKFA will no longer be required to rent storage areas at commercial/ industrial buildings to accommodate the ever-expanding collection and would save the related rental.

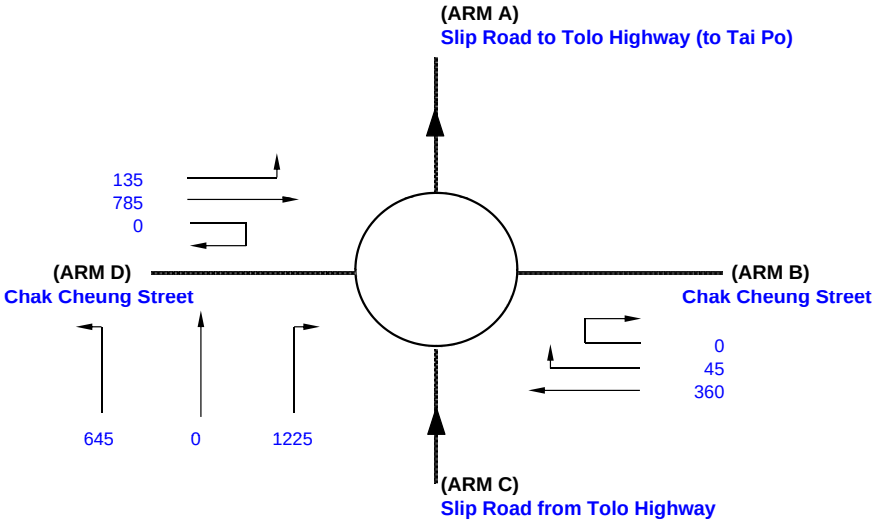
10.	**Home Affairs Department/ Sha Tin District Office** **Letter ref.: ( ) in STD 17/30/20/15, dated 5 March 2013**
	I refer to your letter of 15 November 2012 regarding the captioned subject. The Hong Kong Planning Standards and Guidelines provide a yardstick to measure the sufficiency of land for various uses and adequacy of facilities to serve a planning area. It also provides guidance on the scale, intensity and site requirements of developments as well as the supporting facilities required. I understand that you have been working closely with the Planning Department. We suggest reserving a standalone or joint development site for a community hall subject to the proposed population of the development area. In this connection, we would like to have more information about the projected population and the linkage with On Tai of the area. Separately, as you may be aware, the Sha Tin District Council (STDC) members have expressed concerns in quite a few occasions about the insufficient provision of sport centre, recreational facilities, community hall and library in Sha Tin district. You are advised to consult the relevant stakeholders including the STDC, Sha Tin Rural Committee and the residents in the vicinity at an appropriate juncture.

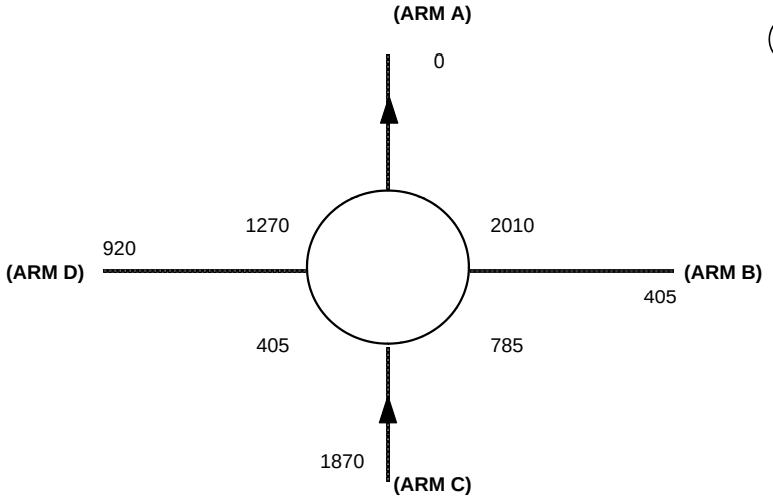
Appendix 6.01

Roundabout Capacity Calculation (2012)

ROUNDABOUT CAPACITY CALCULATION

Junction J1 - Chak Cheung Street / Slip Road of Tolo Highway	2012 AM Observed Traffic Flows	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





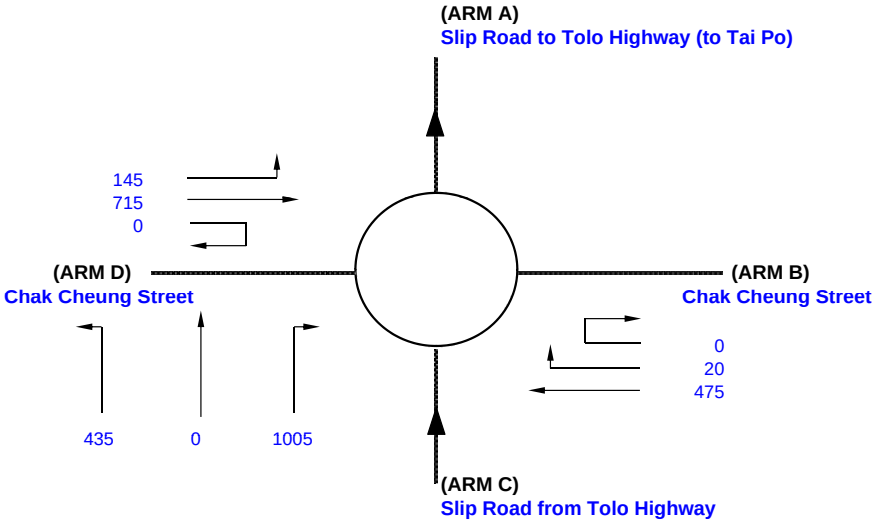
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	7.00	2.50	7.00	3.50
E = Entry width (m)	8.00	7.00	8.00	7.50
L = Effective length of flare (m)	5.00	10.00	5.00	25.00
R = Entry radius (m)	70.00	10.00	70.00	70.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	20.00	22.00	20.00	26.00
Q = Entry flow (pcu/h)	0	405	1870	920
Qc= Circulating flow across entry (pcu/h)	2010	785	405	1270
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.32	0.72	0.32	0.26
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.07	0.98	1.07	1.05
X2= V + ((E-V)/(1+2S))	7.61	4.34	7.61	6.15
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	2306	1316	2306	1862
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.75	0.55	0.75	0.66
Qe= K(F-Fc*Qc)	862	864	2143	1075
DFC = Design flow/Capacity = Q/Qe	0.00	0.47	0.87	0.86

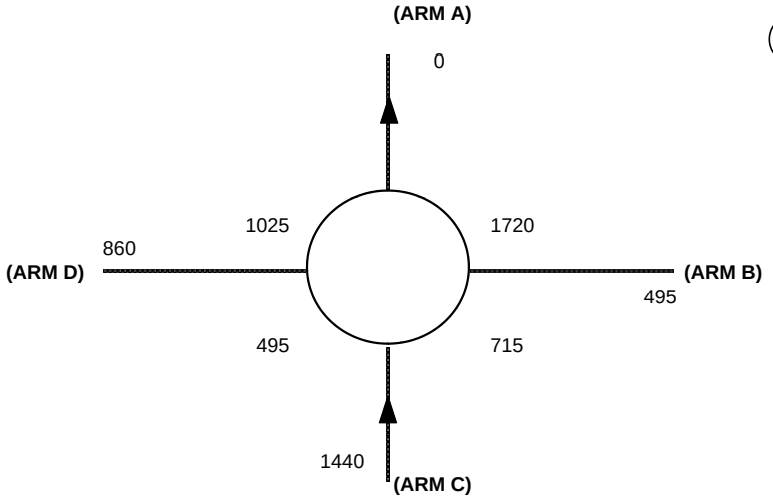
TOTAL ENTRY FLOWS = 3195 PCU

CRITICAL DFC = 0.87

ROUNDABOUT CAPACITY CALCULATION

Junction J1 - Chak Cheung Street / Slip Road of Tolo Highway	2012 PM Observed Traffic Flows	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





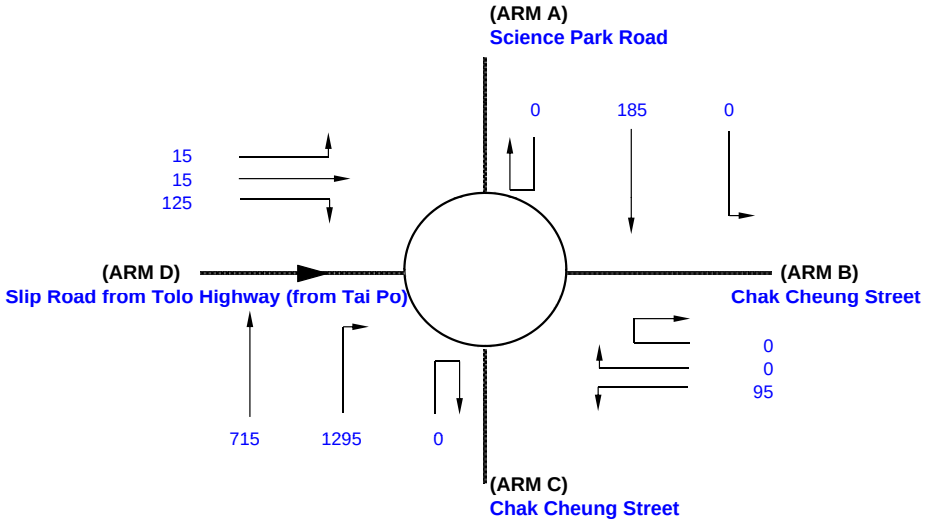
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	7.00	2.50	7.00	3.50
E = Entry width (m)	8.00	7.00	8.00	7.50
L = Effective length of flare (m)	5.00	10.00	5.00	25.00
R = Entry radius (m)	70.00	10.00	70.00	70.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	20.00	22.00	20.00	26.00
Q = Entry flow (pcu/h)	0	495	1440	860
Qc= Circulating flow across entry (pcu/h)	1720	715	495	1025
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.32	0.72	0.32	0.26
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.07	0.98	1.07	1.05
X2= V + ((E-V)/(1+2S))	7.61	4.34	7.61	6.15
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	2306	1316	2306	1862
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.75	0.55	0.75	0.66
Qe= K(F-Fc*Qc)	1094	902	2071	1244
DFC = Design flow/Capacity = Q/Qe	0.00	0.55	0.70	0.69

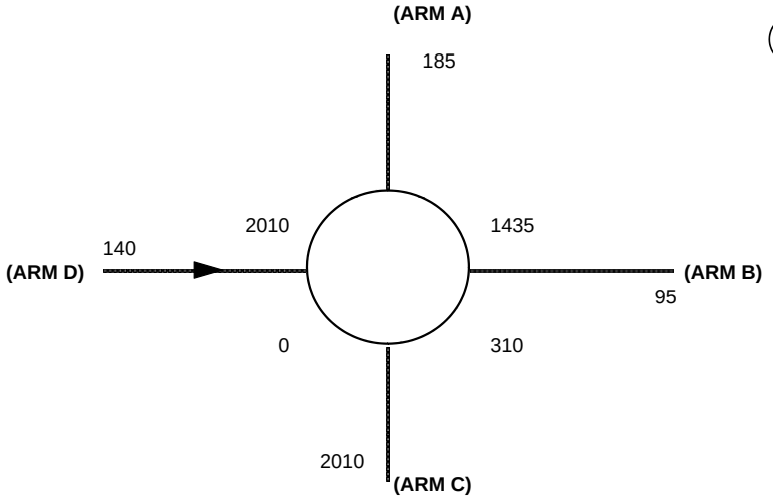
TOTAL ENTRY FLOWS = 2795 PCU

CRITICAL DFC = 0.70

ROUNDABOUT CAPACITY CALCULATION

Junction J2 - Chak Cheung Street / Science Park Road	2012 AM Observed Traffic Flows	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





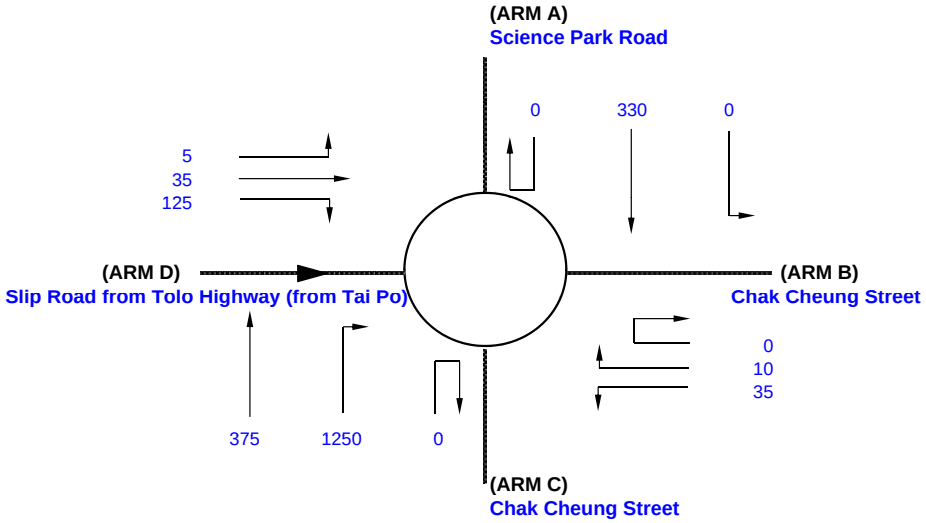
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	9.00	7.00	7.30	7.00
E = Entry width (m)	10.75	9.00	8.50	7.50
L = Effective length of flare (m)	11.50	20.00	15.00	10.00
R = Entry radius (m)	100.00	15.00	25.00	20.00
D = Inscribed circle diameter (m)	43.00	43.00	43.00	43.00
A = Entry angle (degree)	25.00	50.00	10.00	40.00
Q = Entry flow (pcu/h)	185	95	2010	140
Qc= Circulating flow across entry (pcu/h)	1435	310	0	2010
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.24	0.16	0.13	0.08
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.06	0.91	1.08	0.97
X2= V + ((E-V)/(1+2S))	10.18	8.52	8.26	7.43
M = EXP((D-60)/10)	0.18	0.18	0.18	0.18
F = 303*X2	3084	2580	2501	2252
Td= 1+(0.5/(1+M))	1.42	1.42	1.42	1.42
Fc= 0.21*Td(1+0.2*X2)	0.91	0.81	0.79	0.74
Qe= K(F-Fc*Qc)	1883	2130	2699	732
DFC = Design flow/Capacity = Q/Qe	0.10	0.04	0.74	0.19

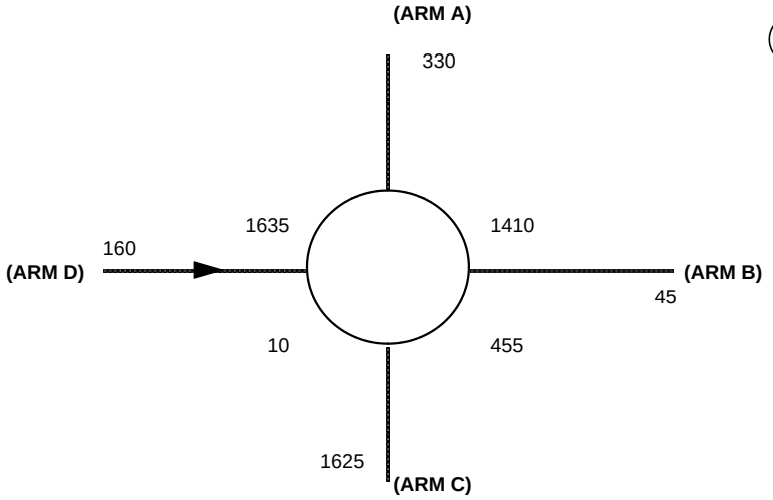
TOTAL ENTRY FLOWS = 2445 PCU

CRITICAL DFC = 0.74

ROUNDABOUT CAPACITY CALCULATION

Junction J2 - Chak Cheung Street / Science Park Road	2012 PM Observed Traffic Flows	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





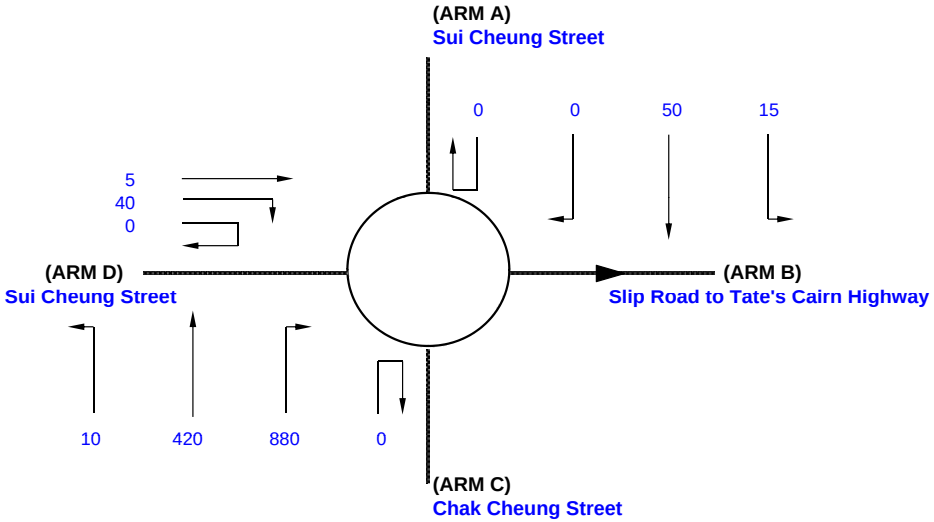
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	9.00	7.00	7.30	7.00
E = Entry width (m)	10.75	9.00	8.50	7.50
L = Effective length of flare (m)	11.50	20.00	15.00	10.00
R = Entry radius (m)	100.00	15.00	25.00	20.00
D = Inscribed circle diameter (m)	43.00	43.00	43.00	43.00
A = Entry angle (degree)	25.00	50.00	10.00	40.00
Q = Entry flow (pcu/h)	330	45	1625	160
Qc= Circulating flow across entry (pcu/h)	1410	455	10	1635
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.24	0.16	0.13	0.08
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.06	0.91	1.08	0.97
X2= V + ((E-V)/(1+2S))	10.18	8.52	8.26	7.43
M = EXP((D-60)/10)	0.18	0.18	0.18	0.18
F = 303*X2	3084	2580	2501	2252
Td= 1+(0.5/(1+M))	1.42	1.42	1.42	1.42
Fc= 0.21*Td(1+0.2*X2)	0.91	0.81	0.79	0.74
Qe= K(F-Fc*Qc)	1907	2023	2691	1001
DFC = Design flow/Capacity = Q/Qe	0.17	0.02	0.60	0.16

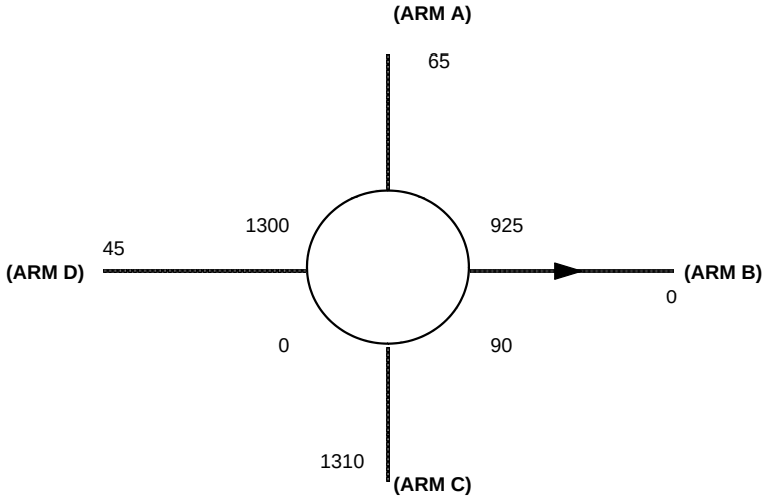
TOTAL ENTRY FLOWS = 2165 PCU

CRITICAL DFC = 0.60

ROUNDABOUT CAPACITY CALCULATION

Junction J3 - Chak Cheung Street / Sui Cheung Street	2012 AM Observed Traffic Flows	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





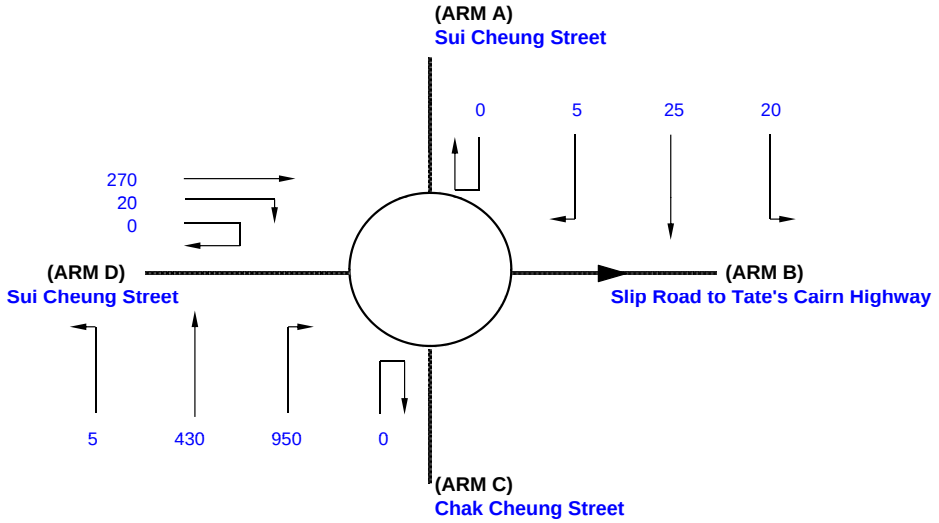
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	3.50	7.50	7.50	3.50
E = Entry width (m)	4.00	8.00	8.00	7.50
L = Effective length of flare (m)	15.00	10.00	10.00	15.00
R = Entry radius (m)	30.00	20.00	20.00	60.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	45.00	55.00	55.00	10.00
Q = Entry flow (pcu/h)	65	0	1310	45
Qc= Circulating flow across entry (pcu/h)	925	90	0	1300
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.05	0.08	0.08	0.43
K = 1-0.00347(A-30)-0.978(1/R-0.05)	0.96	0.91	0.91	1.10
X2= V + ((E-V)/(1+2S))	3.95	7.93	7.93	5.66
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	1197	2403	2403	1714
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.53	0.77	0.77	0.63
Qe= K(F-Fc*Qc)	682	2132	2195	986
DFC = Design flow/Capacity = Q/Qe	0.10	0.00	0.60	0.05

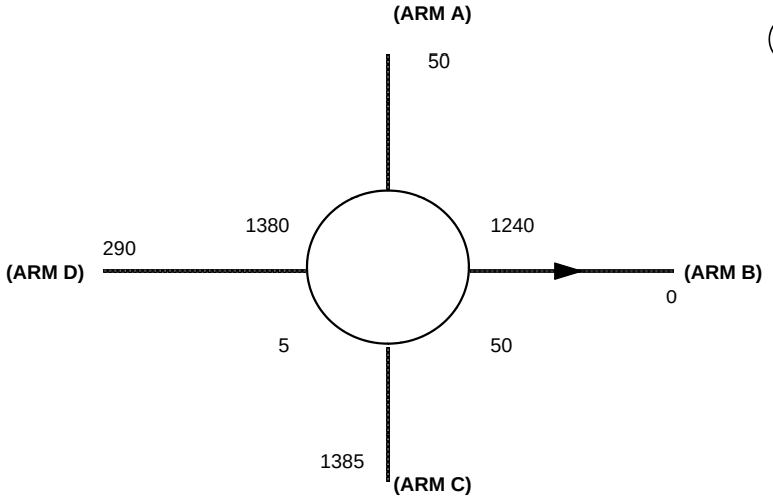
TOTAL ENTRY FLOWS = 1420 PCU

CRITICAL DFC = 0.60

ROUNDABOUT CAPACITY CALCULATION

Junction J3 - Chak Cheung Street / Sui Cheung Street	2012 PM Observed Traffic Flows	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	3.50	7.50	7.50	3.50
E = Entry width (m)	4.00	8.00	8.00	7.50
L = Effective length of flare (m)	15.00	10.00	10.00	15.00
R = Entry radius (m)	30.00	20.00	20.00	60.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	45.00	55.00	55.00	10.00
Q = Entry flow (pcu/h)	50	0	1385	290
Qc= Circulating flow across entry (pcu/h)	1240	50	5	1380
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.05	0.08	0.08	0.43
K = 1-0.00347(A-30)-0.978(1/R-0.05)	0.96	0.91	0.91	1.10
X2= V + ((E-V)/(1+2S))	3.95	7.93	7.93	5.66
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	1197	2403	2403	1714
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.53	0.77	0.77	0.63
Qe= K(F-Fc*Qc)	521	2160	2191	930
DFC = Design flow/Capacity = Q/Qe	0.10	0.00	0.63	0.31

TOTAL ENTRY FLOWS = 1725 PCU

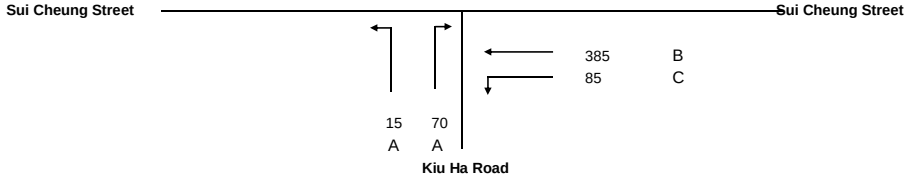
CRITICAL DFC = 0.63

JUNCTION CAPACITY CALCULATION

Junction J4 - Sui Cheung Street / Kiu Ha Road	2012 AM Observed Traffic Flows	DESIGN: 0	CHECK: 0	JOB NO: 60269233	DATE: May 13

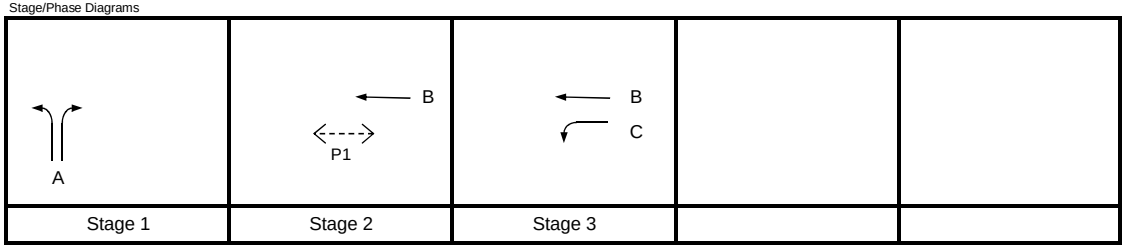
J4

Traffic Flow Diagram
(pcu/hr)



No. of stages per cycle		N =	3	
Cycle time		C =	80	sec
Sum(y)		Y =	0.240	
Lost time		L =	11	sec
Total Flow		=	5,895	pcu
Optimum Cycle C_o	= (1.5×L+5)/(1-Y)	=	28	sec
Min. Cycle Time C_m	= L/(1-Y)	=	14	sec
Y_{ult}	= 0.9-0.0075×L	=	0.818	
R.C.$_{ult}$	= (Y_{ult}-Y)/Yx100%	=	240.0	%
Practical Cycle Time C_p	= 0.9×L/(0.9-Y)	=	15	sec
Y_{max}	= 1-L/C	=	0.863	

Stage/Phase Diagrams



I/G = 7 I/G = I/G = 6

Critical Case : A,B

R.C.(C) = (0.9xY_{max}-Y)/Yx100% = >100%

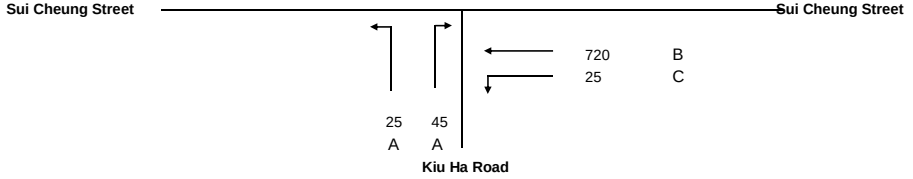
MOVEMENT	PHASE	STAGE	LANE WIDTH (m)	NO. OF LANES	RADIUS (m) LEFT	RADIUS (m) RIGHT	OPPOSING TRAFFIC	NEAR SIDE LANE	UPHILL GRADIENT (%)	GRADIENT EFFECT (pcu/hr)	ADDITIONAL CAPACITY (pcu/hr)	STRAIGHT-AHEAD SAT. FLOW (pcu/hr)	FLOW (pcu/hr) LEFT	FLOW (pcu/hr) STRAIGHT AHEAD	FLOW (pcu/hr) RIGHT	TOTAL FLOW (pcu/hr)	PROPORTION OF TURNING VEHICLES (%) LEFT	PROPORTION OF TURNING VEHICLES (%) RIGHT	REVISED SAT. FLOW (pcu/hr)	FLOW FACTOR *y*	CRITICAL *y*
⇔	A	1	4.000	1	20	30	0	1		0		2015	15		70	85	18%	82%	1911	0.044	0.044
↑	B	2,3	3.500	1				1		0		1965		385		385			1965	0.196	0.196
↰	C	3	3.000	1	15			1		0		1915	95			95	100%		1741	0.055	
Pedestrian Crossing				GM		FGM															
	P1	2	min.	5	+	7	=	12	sec												

JUNCTION CAPACITY CALCULATION

Junction J4 - Sui Cheung Street / Kiu Ha Road	2012 AM Observed Traffic Flows	DESIGN: 0	CHECK: 0	JOB NO: 60269233	DATE: May 13

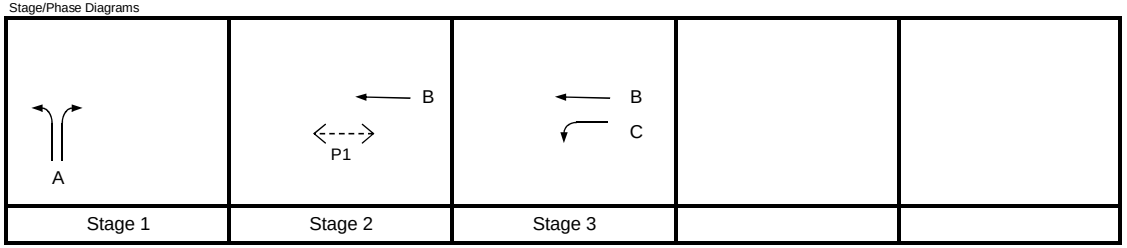
J4

Traffic Flow Diagram
(pcu/hr)



No. of stages per cycle		N =	3	
Cycle time		C =	80	sec
Sum(y)		Y =	0.403	
Lost time		L =	11	sec
Total Flow		=	5,895	pcu
Optimum Cycle C_o	= (1.5×L+5)/(1-Y)	=	36	sec
Min. Cycle Time C_m	= L/(1-Y)	=	18	sec
Y_{ult}	= 0.9-0.0075×L	=	0.818	
R.C.$_{ult}$	= (Y_{ult}-Y)/Yx100%	=	102.8	%
Practical Cycle Time C_p	= 0.9×L/(0.9-Y)	=	20	sec
Y_{max}	= 1-L/C	=	0.863	

Stage/Phase Diagrams



Critical Case : A,B

R.C.(C) = (0.9xY_{max}-Y)/Yx100% = 93%

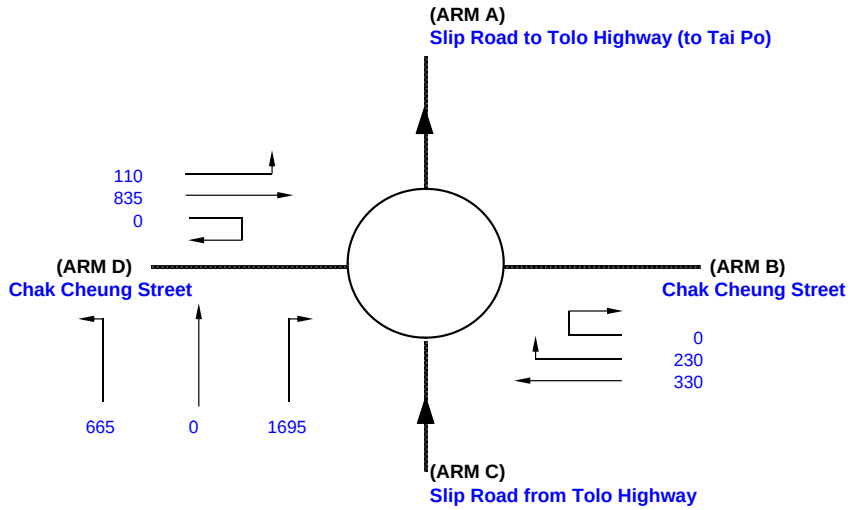
MOVEMENT	PHASE	STAGE	LANE WIDTH (m)	NO. OF LANES	RADIUS (m) LEFT	RADIUS (m) RIGHT	OPPOSING TRAFFIC	NEAR SIDE LANE	UPHILL GRADIENT (%)	GRADIENT EFFECT (pcu/hr)	ADDITIONAL CAPACITY (pcu/hr)	STRAIGHT-AHEAD SAT. FLOW (pcu/hr)	FLOW (pcu/hr) LEFT	FLOW (pcu/hr) STRAIGHT AHEAD	FLOW (pcu/hr) RIGHT	TOTAL FLOW (pcu/hr)	PROPORTION OF TURNING VEHICLES (%) LEFT	PROPORTION OF TURNING VEHICLES (%) RIGHT	REVISED SAT. FLOW (pcu/hr)	FLOW FACTOR *y*	CRITICAL *y*
⇔	A	1	4.000	1	20	30	0	1		0		2015	25		45	70	36%	64%	1903	0.037	0.037
↑	B	2,3	3.500	1				1		0		1965		720		720			1965	0.366	0.366
↰	C	3	3.000	1	15			1		0		1915	25			25	100%		1741	0.014	
Pedestrian Crossing				GM		FGM															
	P1	2	min.	5	+	7	=	12	sec												

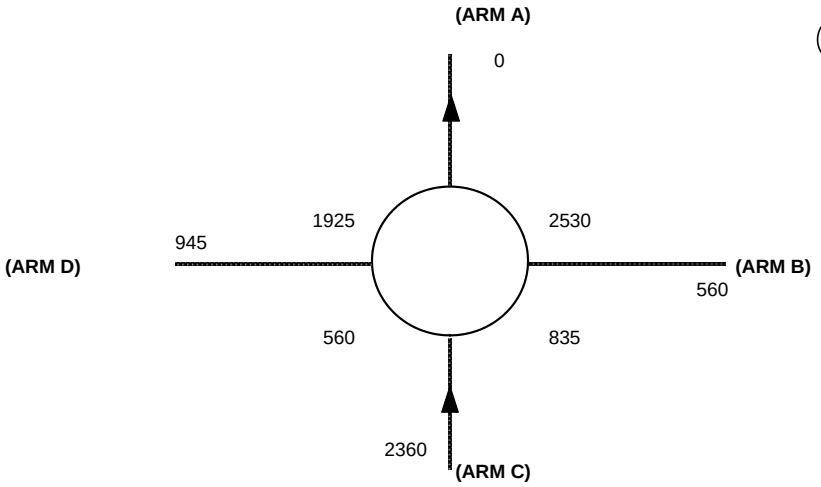
Appendix 6.02

Roundabout Capacity Calculation (2034)

ROUNDABOUT CAPACITY CALCULATION

Junction J1 - Chak Cheung Street / Slip Road of Tolo Highway	2034 AM Forcast Traffic Flow - Design Scenario	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





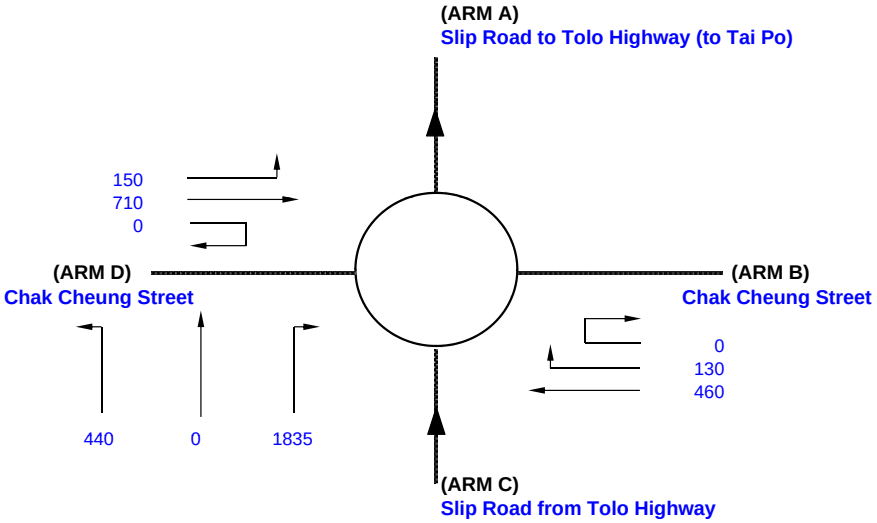
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	7.00	2.50	7.00	3.50
E = Entry width (m)	8.00	7.00	8.00	7.50
L = Effective length of flare (m)	5.00	10.00	5.00	25.00
R = Entry radius (m)	70.00	10.00	70.00	70.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	20.00	22.00	20.00	26.00
Q = Entry flow (pcu/h)	0	560	2360	945
Qc= Circulating flow across entry (pcu/h)	2530	835	560	1925
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.32	0.72	0.32	0.26
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.07	0.98	1.07	1.05
X2= V + ((E-V)/(1+2S))	7.61	4.34	7.61	6.15
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	2306	1316	2306	1862
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.75	0.55	0.75	0.66
Qe= K(F-Fc*Qc)	447	837	2019	622
DFC = Design flow/Capacity = Q/Qe	0.00	0.67	1.17	1.52

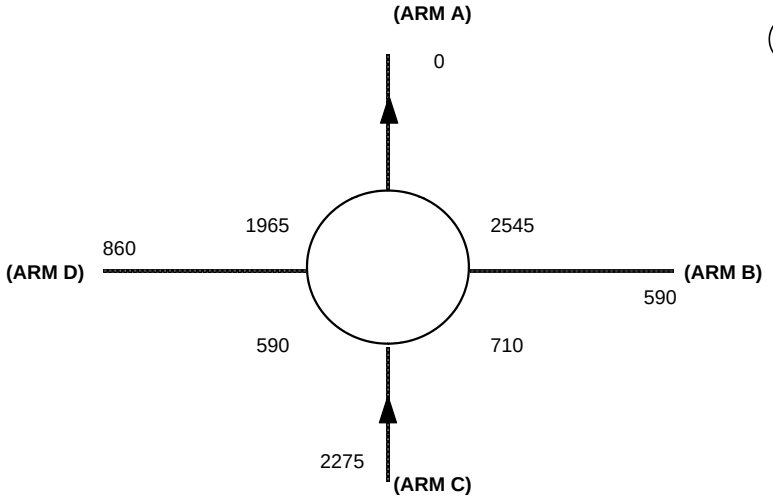
TOTAL ENTRY FLOWS = 3865 PCU

CRITICAL DFC = 1.52

ROUNDABOUT CAPACITY CALCULATION

Junction J1 - Chak Cheung Street / Slip Road of Tolo Highway	2034 PM Forcast Traffic Flow - Design Scenario	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





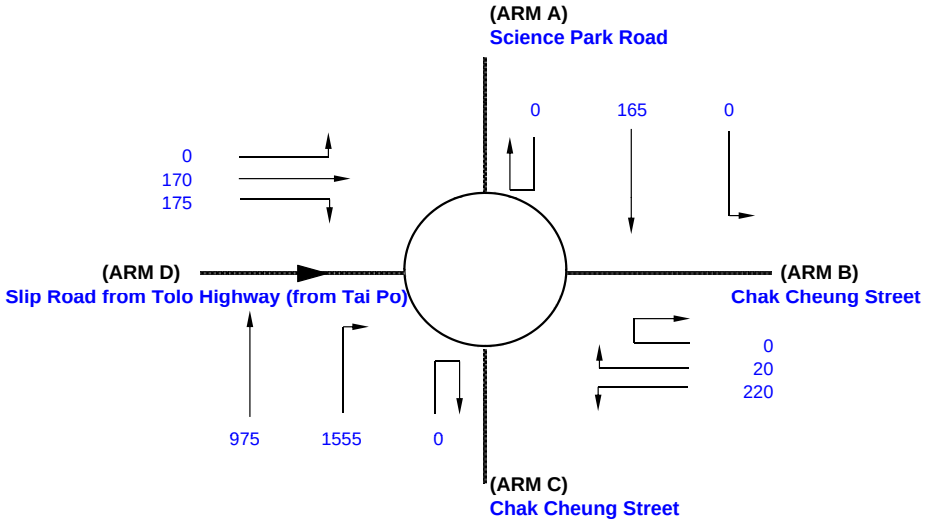
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	7.00	2.50	7.00	3.50
E = Entry width (m)	8.00	7.00	8.00	7.50
L = Effective length of flare (m)	5.00	10.00	5.00	25.00
R = Entry radius (m)	70.00	10.00	70.00	70.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	20.00	22.00	20.00	26.00
Q = Entry flow (pcu/h)	0	590	2275	860
Qc= Circulating flow across entry (pcu/h)	2545	710	590	1965
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.32	0.72	0.32	0.26
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.07	0.98	1.07	1.05
X2= V + ((E-V)/(1+2S))	7.61	4.34	7.61	6.15
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	2306	1316	2306	1862
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.75	0.55	0.75	0.66
Qe= K(F-Fc*Qc)	435	904	1995	594
DFC = Design flow/Capacity = Q/Qe	0.00	0.65	1.14	1.45

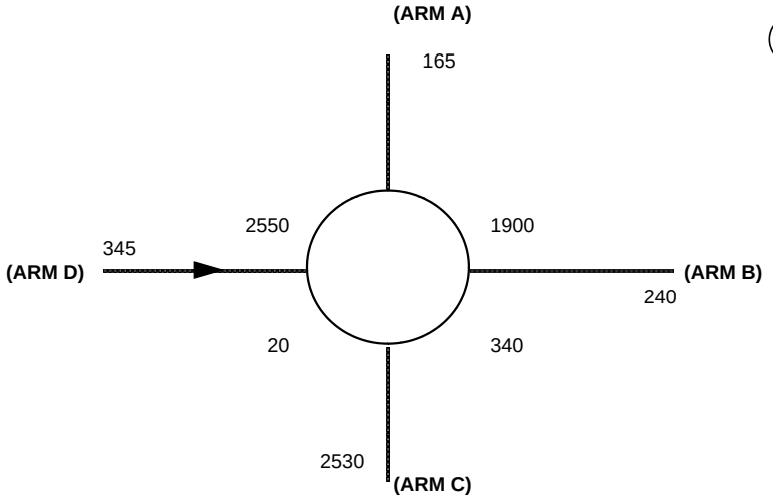
TOTAL ENTRY FLOWS = 3725 PCU

CRITICAL DFC = 1.45

ROUNDABOUT CAPACITY CALCULATION

Junction J2 - Chak Cheung Street / Science Park Road	2034 AM Forecast Traffic Flow - Design Scenario	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





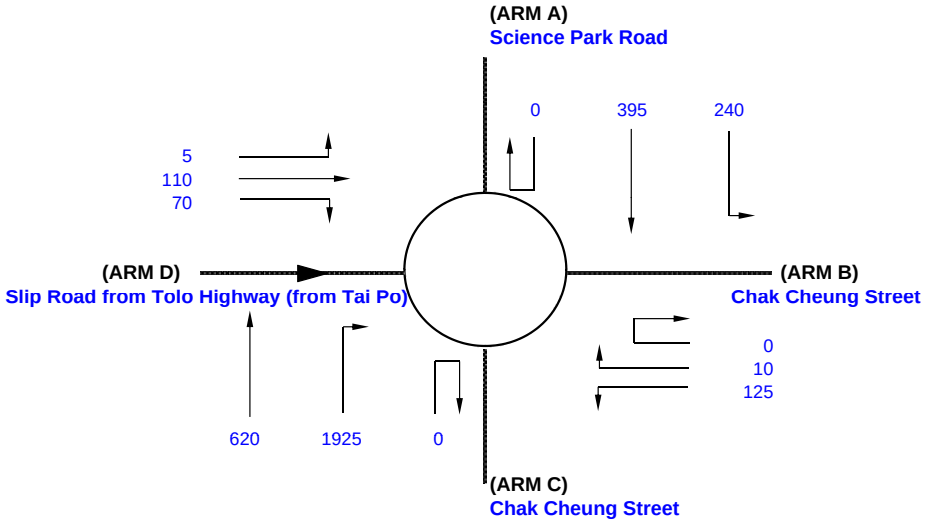
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	9.00	7.00	7.30	7.00
E = Entry width (m)	10.75	9.00	8.50	7.50
L = Effective length of flare (m)	11.50	20.00	15.00	10.00
R = Entry radius (m)	100.00	15.00	25.00	20.00
D = Inscribed circle diameter (m)	43.00	43.00	43.00	43.00
A = Entry angle (degree)	25.00	50.00	10.00	40.00
Q = Entry flow (pcu/h)	165	240	2530	345
Qc= Circulating flow across entry (pcu/h)	1900	340	20	2550
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.24	0.16	0.13	0.08
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.06	0.91	1.08	0.97
X2= V + ((E-V)/(1+2S))	10.18	8.52	8.26	7.43
M = EXP((D-60)/10)	0.18	0.18	0.18	0.18
F = 303*X2	3084	2580	2501	2252
Td= 1+(0.5/(1+M))	1.42	1.42	1.42	1.42
Fc= 0.21*Td(1+0.2*X2)	0.91	0.81	0.79	0.74
Qe= K(F-Fc*Qc)	1437	2108	2682	345
DFC = Design flow/Capacity = Q/Qe	0.11	0.11	0.94	1.00

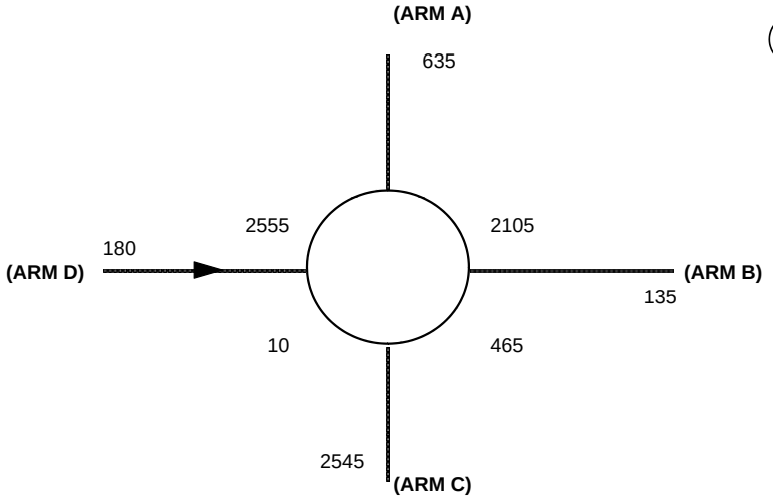
TOTAL ENTRY FLOWS = 3280 PCU

CRITICAL DFC = 1.00

ROUNDABOUT CAPACITY CALCULATION

Junction J2 - Chak Cheung Street / Science Park Road	2034 PM Forecast Traffic Flow - Design Scenario	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





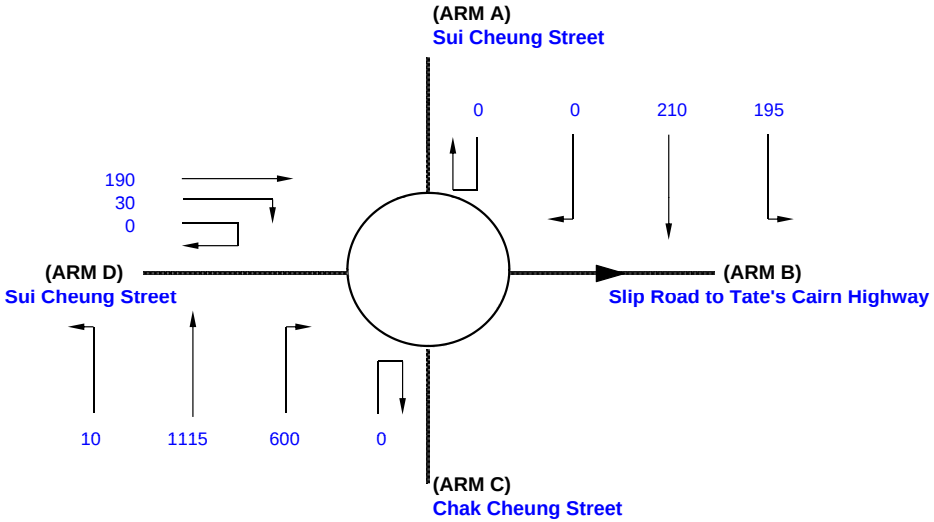
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	9.00	7.00	7.30	7.00
E = Entry width (m)	10.75	9.00	8.50	7.50
L = Effective length of flare (m)	11.50	20.00	15.00	10.00
R = Entry radius (m)	100.00	15.00	25.00	20.00
D = Inscribed circle diameter (m)	43.00	43.00	43.00	43.00
A = Entry angle (degree)	25.00	50.00	10.00	40.00
Q = Entry flow (pcu/h)	635	135	2545	180
Qc= Circulating flow across entry (pcu/h)	2105	465	10	2555
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.24	0.16	0.13	0.08
K = 1-0.00347(A-30)-0.978(1/R-0.05)	1.06	0.91	1.08	0.97
X2= V + ((E-V)/(1+2S))	10.18	8.52	8.26	7.43
M = EXP((D-60)/10)	0.18	0.18	0.18	0.18
F = 303*X2	3084	2580	2501	2252
Td= 1+(0.5/(1+M))	1.42	1.42	1.42	1.42
Fc= 0.21*Td(1+0.2*X2)	0.91	0.81	0.79	0.74
Qe= K(F-Fc*Qc)	1241	2016	2691	341
DFC = Design flow/Capacity = Q/Qe	0.51	0.07	0.95	0.53

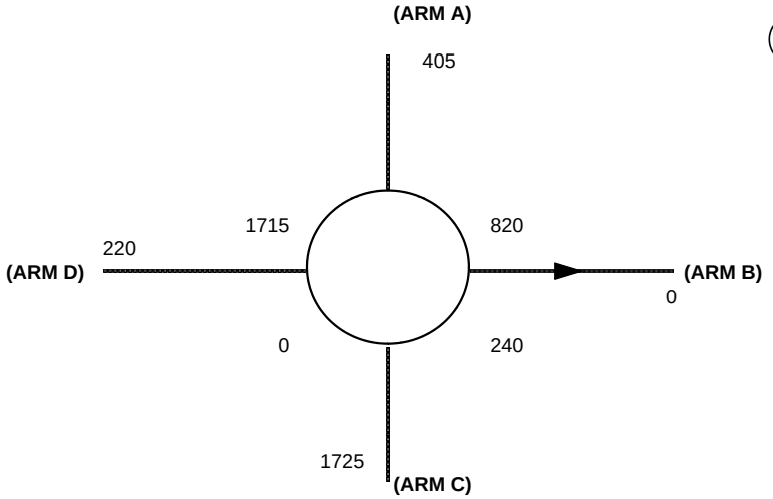
TOTAL ENTRY FLOWS = 3500 PCU

CRITICAL DFC = 0.95

ROUNDABOUT CAPACITY CALCULATION

Junction J3 - Chak Cheung Street / Sui Cheung Street	2034 AM Forecast Traffic Flow - Design Scenario	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





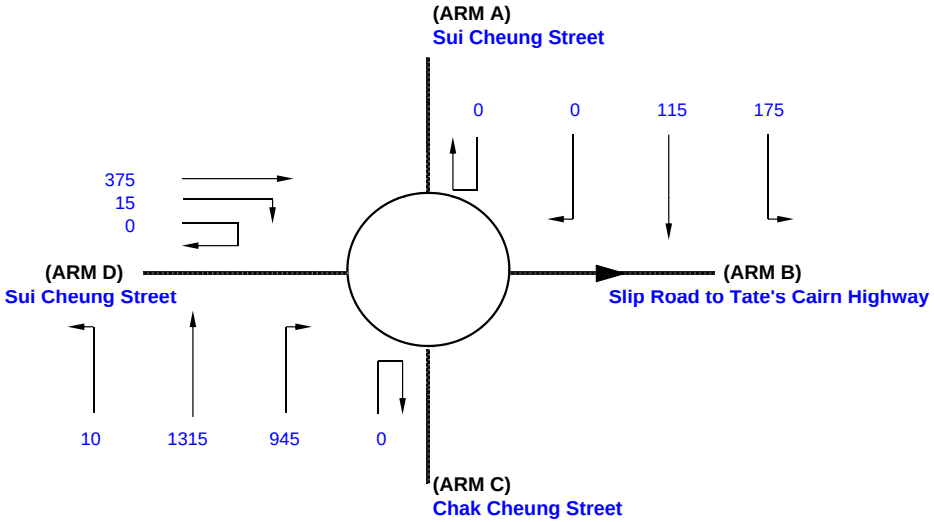
ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	3.50	7.50	7.50	3.50
E = Entry width (m)	4.00	8.00	8.00	7.50
L = Effective length of flare (m)	15.00	10.00	10.00	15.00
R = Entry radius (m)	30.00	20.00	20.00	60.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	45.00	55.00	55.00	10.00
Q = Entry flow (pcu/h)	405	0	1725	220
Qc= Circulating flow across entry (pcu/h)	820	240	0	1715
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.05	0.08	0.08	0.43
K = 1-0.00347(A-30)-0.978(1/R-0.05)	0.96	0.91	0.91	1.10
X2= V + ((E-V)/(1+2S))	3.95	7.93	7.93	5.66
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	1197	2403	2403	1714
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.53	0.77	0.77	0.63
Qe= K(F-Fc*Qc)	736	2027	2195	697
DFC = Design flow/Capacity = Q/Qe	0.55	0.00	0.79	0.32

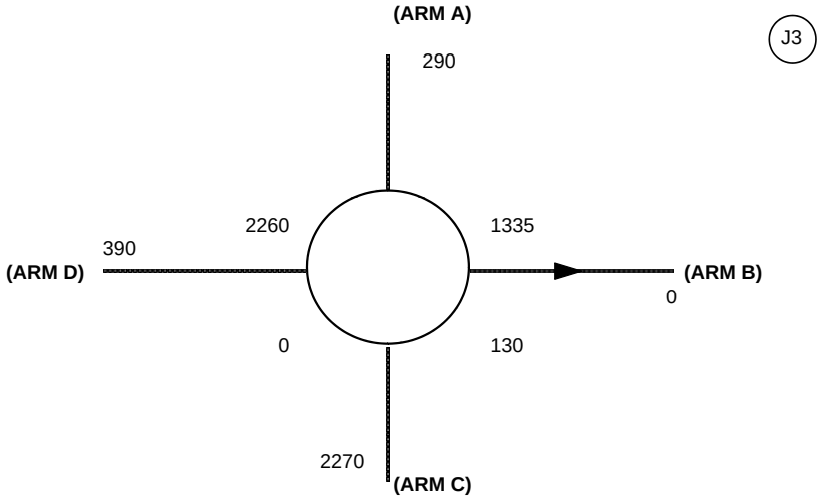
TOTAL ENTRY FLOWS = 2350 PCU

CRITICAL DFC = 0.79

ROUNDABOUT CAPACITY CALCULATION

Junction J3 - Chak Cheung Street / Sui Cheung Street	2034 PM Forecast Traffic Flow - Design Scenario	Designed By :	Checked By :	Job No. : 60269233	Date : May 13





ARM	A	B	C	D
INPUT PARAMETERS:				
V = Approach half width (m)	3.50	7.50	7.50	3.50
E = Entry width (m)	4.00	8.00	8.00	7.50
L = Effective length of flare (m)	15.00	10.00	10.00	15.00
R = Entry radius (m)	30.00	20.00	20.00	60.00
D = Inscribed circle diameter (m)	45.00	45.00	45.00	45.00
A = Entry angle (degree)	45.00	55.00	55.00	10.00
Q = Entry flow (pcu/h)	290	0	2270	390
Qc= Circulating flow across entry (pcu/h)	1335	130	0	2260
OUTPUT PARAMETERS:				
S = Sharpness of flare = 1.6(E-V)/L	0.05	0.08	0.08	0.43
K = 1-0.00347(A-30)-0.978(1/R-0.05)	0.96	0.91	0.91	1.10
X2= V + ((E-V)/(1+2S))	3.95	7.93	7.93	5.66
M = EXP((D-60)/10)	0.22	0.22	0.22	0.22
F = 303*X2	1197	2403	2403	1714
Td= 1+(0.5/(1+M))	1.41	1.41	1.41	1.41
Fc= 0.21*Td(1+0.2*X2)	0.53	0.77	0.77	0.63
Qe= K(F-Fc*Qc)	473	2104	2195	319
DFC = Design flow/Capacity = Q/Qe	0.61	0.00	1.03	1.22

TOTAL ENTRY FLOWS = 2950 PCU

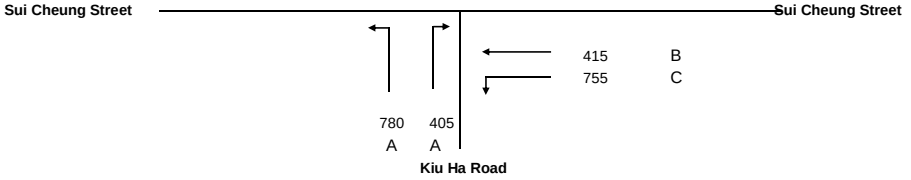
CRITICAL DFC = 1.22

JUNCTION CAPACITY CALCULATION

Junction J4 - Sui Cheung Street / Kiu Ha Road	2034 AM Forecast Traffic Flow - Design Scenario	DESIGN: 0	CHECK: 0	JOB NO: 60269233	DATE: May 13

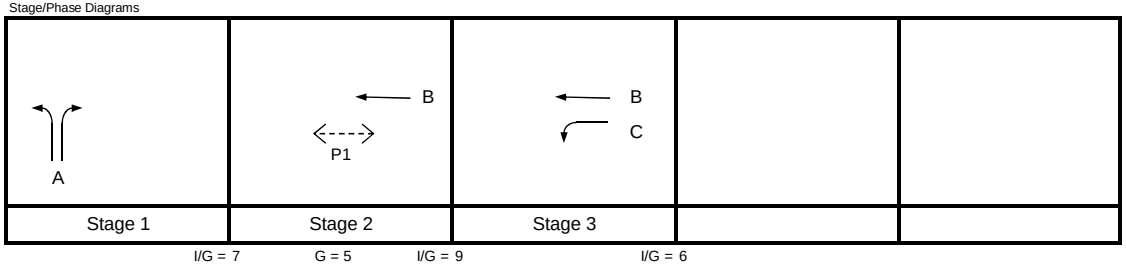
J4

Traffic Flow Diagram
(pcu/hr)



No. of stages per cycle		N =	3	
Cycle time		C =	80	sec
Sum(y)		Y =	1.061	
Lost time		L =	25	sec
Total Flow		=	5,895	pcu
Optimum Cycle C_o	= (1.5×L+5)/(1-Y)	=	-698	sec
Min. Cycle Time C_m	= L/(1-Y)	=	-411	sec
Y_{ult}	= 0.9-0.0075×L	=	0.713	
R.C.$_{ult}$	= (Y_{ult}-Y)/Yx100%	=	-32.8	%
Practical Cycle Time C_p	= 0.9×L/(0.9-Y)	=	-140	sec
Y_{max}	= 1-L/C	=	0.688	

Stage/Phase Diagrams



Critical Case : A,P1,C

R.C.(C) = (0.9xY_{max}-Y)/Yx100% = -42%

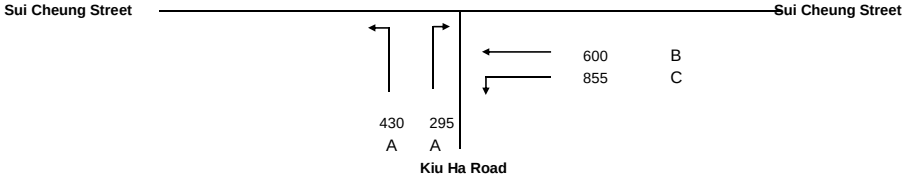
MOVEMENT	PHASE	STAGE	LANE WIDTH (m)	NO. OF LANES	RADIUS (m) LEFT	RADIUS (m) RIGHT	OPPOSING TRAFFIC	NEAR SIDE LANE	UPHILL GRADIENT (%)	GRADIENT EFFECT (pcu/hr)	ADDITIONAL CAPACITY (pcu/hr)	STRAIGHT-AHEAD SAT. FLOW (pcu/hr)	FLOW (pcu/hr) LEFT	FLOW (pcu/hr) STRAIGHT AHEAD	FLOW (pcu/hr) RIGHT	TOTAL FLOW (pcu/hr)	PROPORTION OF TURNING VEHICLES (%) LEFT	PROPORTION OF TURNING VEHICLES (%) RIGHT	REVISED SAT. FLOW (pcu/hr)	FLOW FACTOR *y*	CRITICAL *y*
⇔	A	1	4.000	1	20	30	0	1		0		2015	780		405	1185	66%	34%	1889	0.627	0.627
↑	B	2,3	3.500	1				1		0		1965		415		415			1965	0.211	
↰	C	3	3.000	1	15			1		0		1915	755			755	100%		1741	0.434	0.434
Pedestrian Crossing				GM		FGM															
	P1	2	min.	5	+	7	=	12	sec												*

JUNCTION CAPACITY CALCULATION

Junction J4 - Sui Cheung Street / Kiu Ha Road	2034 AM Forecast Traffic Flow - Design Scenario	DESIGN: 0	CHECK: 0	JOB NO: 60269233	DATE: May 13

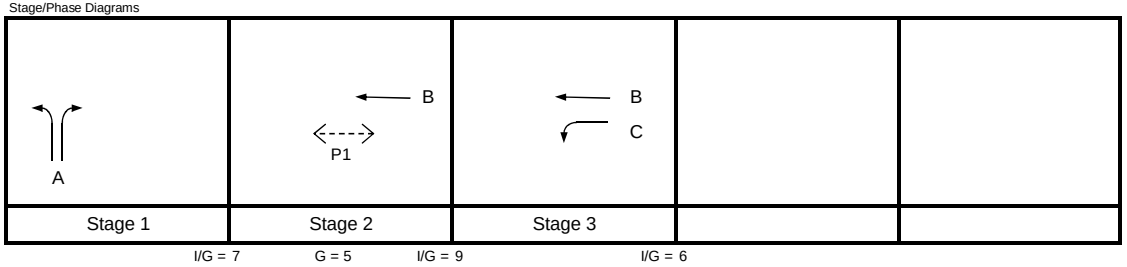
J4

Traffic Flow Diagram
(pcu/hr)



No. of stages per cycle		N =	3	
Cycle time		C =	80	sec
Sum(y)		Y =	0.874	
Lost time		L =	25	sec
Total Flow		=	5,895	pcu
Optimum Cycle C_o	$= (1.5 \times L+5)/(1-Y)$	=	338	sec
Min. Cycle Time C_m	$= L/(1-Y)$	=	199	sec
Y_{ult}	$= 0.9-0.0075 \times L$	=	0.713	
R.C.$_{ult}$	$= (Y_{ult}-Y)/Yx100\%$	=	-18.5	%
Practical Cycle Time C_p	$= 0.9 \times L/(0.9-Y)$	=	874	sec
Y_{max}	$= 1-L/C$	=	0.688	

Stage/Phase Diagrams



Critical Case : A,P1,C

R.C.(C) $= (0.9xY_{max}-Y)/Yx100\% =$ -29%

MOVEMENT	PHASE	STAGE	LANE WIDTH (m)	NO. OF LANES	RADIUS (m) LEFT	RADIUS (m) RIGHT	OPPOSING TRAFFIC	NEAR SIDE LANE	UPHILL GRADIENT (%)	GRADIENT EFFECT (pcu/hr)	ADDITIONAL CAPACITY (pcu/hr)	STRAIGHT-AHEAD SAT. FLOW (pcu/hr)	FLOW (pcu/hr) LEFT	FLOW (pcu/hr) STRAIGHT AHEAD	FLOW (pcu/hr) RIGHT	TOTAL FLOW (pcu/hr)	PROPORTION OF TURNING VEHICLES (%) LEFT	PROPORTION OF TURNING VEHICLES (%) RIGHT	REVISED SAT. FLOW (pcu/hr)	FLOW FACTOR *y*	CRITICAL *y*
⇔	A	1	4.000	1	20	30	0	1		0		2015	430		295	725	59%	41%	1892	0.383	0.383
↑	B	2,3	3.500	1				1		0		1965		600		600			1965	0.305	
↰	C	3	3.000	1	15			1		0		1915	855			855	100%		1741	0.491	0.491
Pedestrian Crossing				GM		FGM															
	P1	2	min.	5	+	7	=	12	sec												*

Appendix 7.01

Performance Drawing of Existing Drainage System

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LEGEND

Mike 11 Watercourses

- 200 yr event capacity
- 100 yr
- 50 yr
- 20 yr
- 10 yr
- 5 yr
- 2 yr
- Less than 2 yr
- Basin Boundary
- Culvert

Revision	Date	Description			Initial
B	02/02	Revision to Catchment Area			CSL
A	12/01	Minor Catchment Amendment			CSL
		Designed	Checked	Drawn	Checked
Initial		GEW	ECO	LC	ECO
Date		3/00	3/00	3/00	3/00

Approved

AGREEMENT No. CE 29/97

Contract title

STORMWATER DRAINAGE MASTER PLAN STUDY IN SHA TIN & TAI PO

Figure title

PERFORMANCE DRAWING
Sha Tin (Basins 14 & 15)
Ultimate Development - MIKE 11
Sheet 1 of 1

Drawing no.	Scale
Figure 16	1 : 20000

Client

DRAINAGE SERVICES DEPARTMENT HONG KONG 渠務署 香港

Consultant

Binnie Black & Veatch Hong Kong Limited
博威工程顧問有限公司
Engineers and Scientists

cp377_data\gis\mapinfo\job\0220\ud\tp044.wor - Layout2 (Figure16.plt)

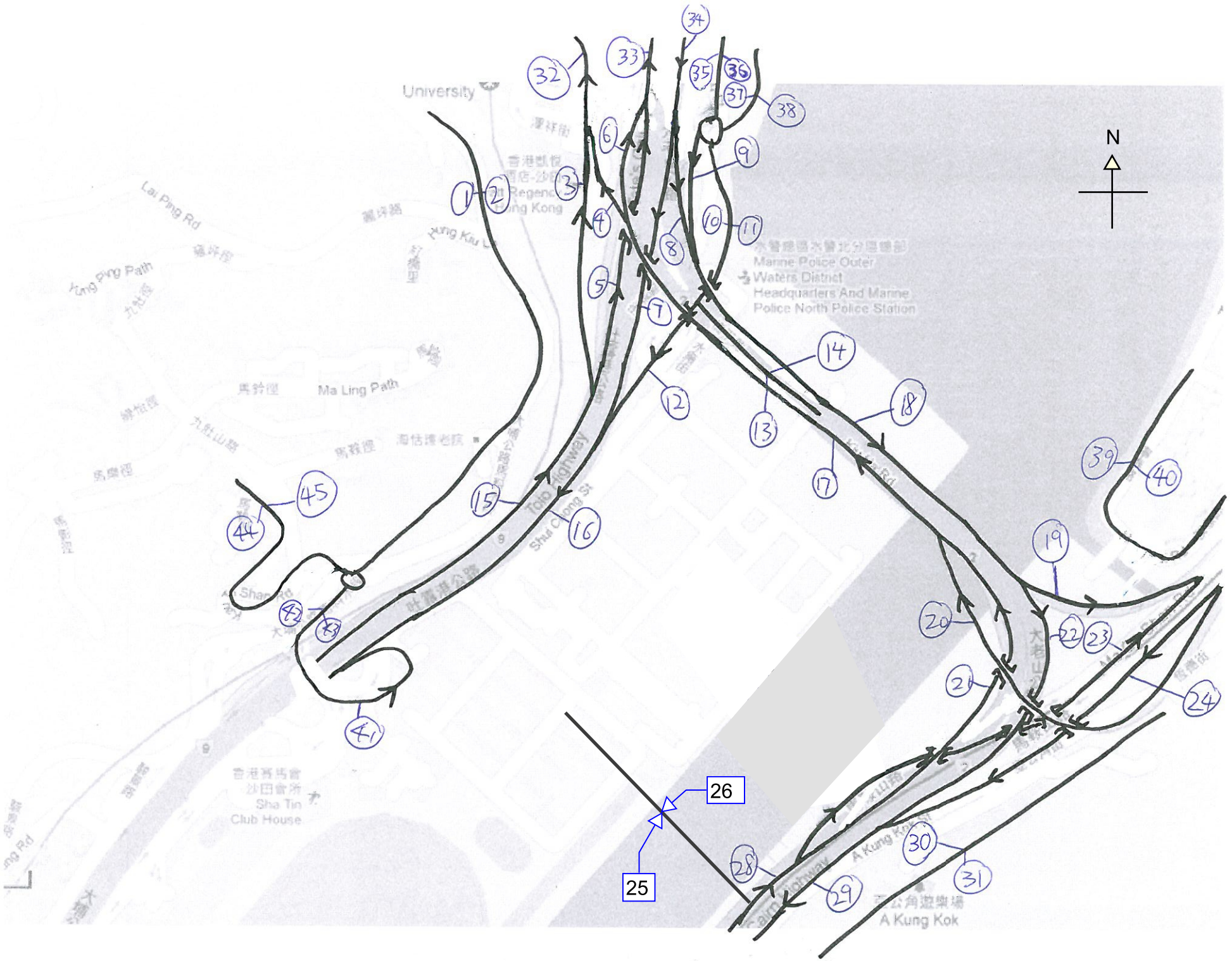
Appendix 10.01

Detailed Results of Traffic Noise

Appendix 10.01 Detailed Results of Traffic Noise Assessment

Year 2046 forecast traffic flows

	AM		PM	
Link ID	**Total Veh Flow**	**HV %**	**Total Veh Flow**	**HV %**
1	426	29%	508	23%
2	582	25%	519	23%
3	878	19%	1049	22%
4	936	19%	730	25%
5	2714	40%	3346	33%
6	2871	32%	2836	27%
7	3724	33%	3432	34%
8	3008	36%	1780	27%
9	734	18%	1288	22%
10	241	44%	201	22%
11	782	18%	959	23%
12	1072	19%	923	24%
13	983	19%	591	18%
14	417	20%	431	16%
15	3592	35%	4395	31%
16	4797	30%	4355	32%
17	3807	29%	3566	27%
18	3742	33%	3068	25%
19	1162	29%	1425	22%
20	1949	22%	1202	22%
21	1858	36%	2364	29%
22	2579	35%	1643	27%
23	1360	23%	1525	13%
24	2321	15%	1150	19%
25	244	16%	338	16%
26	62	17%	61	10%
27	1542	22%	1802	14%
28	3400	30%	4166	23%
29	4900	25%	2793	24%
30	295	69%	324	71%
31	634	52%	371	52%
32	1814	19%	1779	23%
33	5585	36%	6182	31%
34	6732	35%	5212	32%
35	206	24%	110	30%
36	1194	19%	1606	24%
37	9	22%	8	52%
38	259	14%	556	20%
39	79	75%	65	87%
40	254	43%	174	46%
41	429	28%	362	28%
42	469	29%	602	22%
43	686	24%	570	22%
44	34	29%	82	17%
45	95	20%	39	23%


N
University
Lai Ping Rd
Kung Ping Path
Ma Ling Path
Tolo Highway
Shui Chong St
Shan Rd
Marine Police Outer Waters District Headquarters And Marine Police North Police Station
香港賽馬會沙田會所
Sha Tin Club House
A Kung Kok
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Appendix 10.01 Detailed Results of Traffic Noise Assessment

Unmitigated Scenario

ID	Noise Level, dB(A)																												
	1/F	2/F	3/F	4/F	5/F	6/F	7/F	8/F	9/F	10/F	11/F	12/F	13/F	14/F	15/F	16/F	17/F	18/F	19/F	20/F	21/F	22/F	23/F	24/F	25/F	26/F	27/F	28/F	29/F	30/F	Max
T1_1	74	75	76	78	79	79	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	78	78	78	78	-	80
T1_2	76	77	77	78	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	-	80
T1_3	75	76	77	78	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	-	80
T1_4	78	79	79	80	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	-	81
T1_5	79	79	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	-	80
T1_6	78	78	78	79	79	79	79	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	79	79	-	80
T1_7	79	79	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	-	80
T1_8	74	74	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	74	74	74	74	74	74	-	75
T1_9	73	73	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	-	74
T2_1	67	68	69	69	70	70	71	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72	72	72	71	71	71	72	73	-	73
T2_2	77	78	78	78	78	78	79	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	78	-	79
T2_3	78	79	79	79	79	79	79	79	80	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	-	80
T2_4	78	78	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	-	79
T2_5	78	78	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	-	79
T2_6	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	68	68	68	68	68	68	68	69	-	69
T3_1	73	73	74	74	74	74	74	74	74	74	74	75	75	75	75	75	75	75	75	75	75	74	74	74	74	74	74	74	74	74	75
T3_2	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	79	80
T3_3	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	81
T3_4	80	80	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	81
T3_5	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	79	81
T3_6	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	75	75	75	75	75	75	75	75	75	75	75	75	74	75	76
T3_7	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	76	76	76	76	76	76	76	76	76	76	77
T4_1	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	75	75	75	75	75	75	75	75	76
T4_2	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	81
T4_3	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	79	81
T4_4	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	79	81
T4_5	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	78
T5_1	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	77	77	78
T5_2	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	82
T5_3	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	82
T5_4	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	82
T6_1	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	-	82
T6_2	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	-	82
T6_3	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	-	82
T6_4	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	78	78	-	80
T6_5	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	71	71	71	71	71	71	71	71	71	71	71	71	-	72
T7_1	74	73	73	73	73	73	73	73	73	73	73	73	72	72	72	72	72	72	72	72	72	72	72	71	71	71	71	71	71	-	74
T7_2	79	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	-	79
T7_3	82	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	-	82
T7_4	82	82	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	-	82
T7_5	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	-	82
T8_1	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	-	-	-	82
T8_2	82	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	-	-	-	82
T8_3	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	-	-	-	82
T8_4	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	77	-	-	-	78
T8_5	71	71	71	71	71	71	71	71	71	71	71	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72	72	-	-	-	72
T9_1	72	74	74	76	76	77	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	-	-	-	78
T9_2	75	76	77	78	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	-	-	-	80
T9_3	73	74	75	76	76	77	77	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	-	-	-	78
T9_4	71	72	72	73	74	75	75	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	75	75	-	-	-	76
T9_5	69	69	69	70	70	71	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	71	72	-	-	-	72
T9_6	67	67	67	67	67	67	67	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	-	-	-	67
T9_7	64	65	65	66	67	67	68	69	69	70	70	70	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	-	-	-	71

Appendix 10.01 Detailed Results of Traffic Noise Assessment

Unmitigated Scenario

ID	Noise Level, dB(A)																												
	1/F	2/F	3/F	4/F	5/F	6/F	7/F	8/F	9/F	10/F	11/F	12/F	13/F	14/F	15/F	16/F	17/F	18/F	19/F	20/F	21/F	22/F	23/F	24/F	25/F	26/F	27/F	28/F	29/F	30/F	Max
T10_1	65	66	66	67	67	68	69	69	70	70	70	**71**	**71**	**71**	**71**	**71**	**71**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	-	-	-	**72**
T10_2	68	68	69	69	70	70	70	**71**	**71**	**71**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	-	-	-	**73**
T10_3	66	66	67	67	68	68	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	-	-	70
T10_4	63	64	65	65	66	66	67	67	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	-	-	-	69
T10_5	65	65	65	66	66	66	66	67	67	67	67	67	67	67	67	67	68	68	68	68	68	68	68	68	68	68	68	-	-	-	68
T10_6	64	64	65	65	66	66	66	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	-	-	67
T11_1	61	62	63	63	63	63	64	64	65	65	66	66	66	66	67	67	67	67	67	67	67	67	67	68	68	68	68	68	68	-	68
T11_2	63	64	65	65	66	66	67	67	67	67	67	67	67	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	-	68
T11_3	68	68	69	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	70
T11_4	69	69	69	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	70
T11_5	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	68	68	68	68	68	68	68	68	68	68	69	-	69
T11_6	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	67
T15_1	42	42	42	42	42	42	42	42	42	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	44	45	46	-	-	-	46
T15_2	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	-	-	**71**
T15_3	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	-	-	-	**71**
T15_4	70	70	70	70	70	70	70	70	70	70	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	-	-	-	**71**
T15_5	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	-	-	-	**72**
T16_1	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	**72**	-	-	-	-	-	**72**
T16_2	**72**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	-	-	-	-	-	**73**
T16_3	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	-	-	-	-	-	**74**
T16_4	**72**	**72**	**72**	**72**	**73**	**73**	**73**	**73**	**73**	**73**	**73**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	-	-	-	-	-	**74**
T16_5	50	51	52	52	53	54	56	57	58	60	61	62	62	63	64	64	65	65	65	66	66	66	66	66	67	-	-	-	-	-	67
T17_1	70	**71**	**72**	**73**	**74**	**75**	**76**	**76**	**77**	**77**	**77**	**77**	**77**	**78**	**78**	**78**	**78**	**78**	**78**	**77**	**77**	**77**	**77**	**77**	**77**	-	-	-	-	-	**78**
T17_2	**73**	**74**	**75**	**76**	**77**	**78**	**78**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	**79**	-	-	-	-	-	**79**
T17_3	**71**	**72**	**73**	**74**	**75**	**75**	**76**	**76**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**76**	-	-	-	-	-	**77**
T17_4	66	67	67	68	69	69	70	70	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**72**	-	-	-	-	-	**72**
T18_1	64	65	66	66	67	67	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	**71**	-	-	-	-	-	-	-	**71**
T18_2	68	69	69	70	**71**	**72**	**72**	**73**	**73**	**74**	**74**	**74**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	-	-	-	-	-	-	-	**75**
T18_3	70	**71**	**72**	**73**	**74**	**75**	**75**	**76**	**76**	**77**	**77**	**77**	**77**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	-	-	-	-	-	-	-	**78**
T29_1	65	65	66	66	66	66	67	67	67	68	68	68	68	68	69	69	69	-	-	-	-	-	-	-	-	-	-	-	-	-	69
T29_2	69	69	70	**71**	**71**	**72**	**72**	**73**	**74**	**74**	**74**	**75**	**75**	**75**	**75**	**75**	**76**	-	-	-	-	-	-	-	-	-	-	-	-	-	**76**
T29_3	70	70	**71**	**72**	**72**	**73**	**74**	**74**	**75**	**75**	**75**	**76**	**76**	**76**	**76**	**76**	**76**	-	-	-	-	-	-	-	-	-	-	-	-	-	**76**
T29_4	66	67	68	68	69	69	70	**71**	**71**	**72**	**72**	**72**	**73**	**73**	**73**	**73**	**74**	-	-	-	-	-	-	-	-	-	-	-	-	-	**74**
T29_5	65	66	66	67	67	68	68	69	69	70	70	**71**	**71**	**71**	**72**	**72**	**72**	-	-	-	-	-	-	-	-	-	-	-	-	-	**72**
T30_1	64	65	66	66	66	67	67	67	68	68	69	69	69	70	70	70	70	**71**	**71**	-	-	-	-	-	-	-	-	-	-	-	**71**
T30_2	65	65	65	65	65	65	65	66	66	66	66	66	66	66	67	67	67	67	67	-	-	-	-	-	-	-	-	-	-	-	67
T31_1	65	65	65	65	66	66	66	66	66	66	67	67	67	67	68	68	68	68	68	-	-	-	-	-	-	-	-	-	-	-	68
T31_2	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	-	-	-	-	-	-	-	-	-	-	-	68
T32_1	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	-	-	-	-	-	-	-	-	-	-	-	66
T32_2	68	68	68	68	68	68	68	68	68	68	68	69	69	69	69	69	69	69	69	-	-	-	-	-	-	-	-	-	-	-	69
T33_1	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	-	-	-	-	-	-	-	-	-	-	-	-	-	69
T33_2	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	-	-	-	-	-	-	-	-	-	-	-	-	70
T33_3	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	-	-	-	-	-	-	-	-	-	-	-	-	-	68
T34_1*	53	53	53	53	53	54	54	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55
T34_2*	61	61	61	61	61	61	61	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
T34_3*	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
T34_4*	61	61	61	61	61	61	61	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
T35_1*	61	61	61	61	61	61	61	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
T35_2*	48	48	48	48	49	49	49	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
T35_3*	42	42	43	43	43	43	43	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
T35_4*	47	47	48	48	48	49	49	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50

Remarks:

- Highlighted in red are facades exceeded the 70 dB(A) criteria.
- Indicated by asterisked are schools, which the noise criteria is 65 dB(A)

Appendix 10.01 Detailed Results of Traffic Noise Assessment

Mitigated Scenario

ID	Noise Level, dB(A)																													
	1/F	2/F	3/F	4/F	5/F	6/F	7/F	8/F	9/F	10/F	11/F	12/F	13/F	14/F	15/F	16/F	17/F	18/F	19/F	20/F	21/F	22/F	23/F	24/F	25/F	26/F	27/F	28/F	29/F	30/F	Max
T1_1	71	72	73	74	75	76	76	76	76	76	76	76	76	76	76	76	76	76	76	75	75	75	75	75	75	75	75	75	75	-	76
T1_2	74	75	76	77	77	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	-	78
T1_3	74	75	75	76	77	77	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	77	76	76	77	-	78
T1_4	78	79	79	80	80	80	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	-	81
T1_5	79	79	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	-	80
T1_6	78	78	78	79	79	79	79	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	79	79	-	80
T1_7	79	79	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	-	80
T1_8	74	74	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	74	74	74	74	74	74	-	75
T1_9	73	73	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	-	74
T2_1	66	67	67	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	71	-	71
T2_2	77	78	78	78	78	78	78	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	78	78	78	-	79
T2_3	78	79	79	79	79	79	79	79	80	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	-	80
T2_4	78	78	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	-	79
T2_5	78	78	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	-	79
T2_6	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	68	68	68	68	68	68	68	-	69
T3_1	73	73	74	74	74	74	74	74	74	74	74	75	75	75	75	75	75	75	75	75	75	74	74	74	74	74	74	74	74	74	75
T3_2	79	79	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	79	80
T3_3	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	81
T3_4	80	80	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	81
T3_5	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	79	81
T3_6	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	75	75	75	75	75	75	75	75	75	75	75	75	75	74	75	76
T3_7	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	76	76	76	76	76	76	76	76	76	76	76	77
T4_1	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	75	75	75	75	75	75	75	75	76
T4_2	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	79	79	79	79	79	81
T4_3	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	79	81
T4_4	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	80	80	79	81
T4_5	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	78
T5_1	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	77	77	78
T5_2	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	82
T5_3	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	82
T5_4	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	80	82
T6_1	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	80	-	82
T6_2	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	80	-	82
T6_3	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	-	82
T6_4	80	80	80	80	79	79	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	78	78	-	80
T6_5	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	71	71	71	71	71	71	71	71	71	71	71	71	-	72
T7_1	74	73	73	73	73	73	73	73	73	73	73	73	72	72	72	72	72	72	72	72	72	72	72	71	71	71	71	71	71	-	74
T7_2	79	79	79	79	79	79	79	79	79	79	79	79	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	-	79
T7_3	82	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	-	82
T7_4	82	82	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	-	82
T7_5	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	80	80	-	82
T8_1	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	-	-	-	82
T8_2	82	82	82	82	82	82	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	-	-	-	82
T8_3	82	82	82	82	82	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	80	80	80	80	80	80	-	-	-	82
T8_4	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	78	77	77	77	77	77	77	77	77	77	77	-	-	-	78
T8_5	71	71	71	71	71	71	71	71	71	71	71	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72	72	-	-	-	72
T9_1	63	64	65	66	67	68	68	68	69	69	69	69	69	69	69	69	69	69	68	68	68	68	68	68	68	68	68	-	-	-	69
T9_2	72	72	73	74	74	75	75	76	76	76	76	76	76	76	76	76	76	76	75	75	75	75	75	75	75	75	75	-	-	-	76
T9_3	71	72	72	73	74	74	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	74	-	-	-	75
T9_4	69	70	70	71	72	72	73	73	73	73	74	74	74	74	74	73	73	73	73	73	73	73	73	73	73	73	73	-	-	-	74
T9_5	68	69	69	70	70	70	71	71	71	71	71	71	71	71	71	72	71	71	71	71	71	71	71	71	71	71	71	-	-	-	72
T9_6	67	67	67	67	67	67	67	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	-	-	-	67
T9_7	55	56	56	57	58	59	59	60	60	60	60	60	60	61	61	61	61	61	61	61	61	60	60	60	60	60	60	-	-	-	61

Appendix 10.01 Detailed Results of Traffic Noise Assessment

Mitigated Scenario

ID	Noise Level, dB(A)																													
	1/F	2/F	3/F	4/F	5/F	6/F	7/F	8/F	9/F	10/F	11/F	12/F	13/F	14/F	15/F	16/F	17/F	18/F	19/F	20/F	21/F	22/F	23/F	24/F	25/F	26/F	27/F	28/F	29/F	30/F	Max
T10_1	52	53	53	54	55	55	56	57	57	57	57	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	59	-	-	-	59
T10_2	66	66	67	67	67	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	-	-	-	69
T10_3	64	64	64	65	65	65	66	66	66	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	-	-	67
T10_4	58	59	59	60	60	61	62	62	62	63	63	63	63	63	64	64	64	64	64	64	64	64	64	64	64	64	64	-	-	-	64
T10_5	64	65	65	65	65	66	66	66	66	66	66	66	66	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	-	-	67
T10_6	64	64	65	65	66	66	66	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	-	-	67
T11_1	51	51	52	52	53	53	53	54	54	54	54	55	55	55	55	56	56	56	56	56	57	57	57	57	57	57	58	58	58	-	58
T11_2	63	64	64	65	66	66	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	67
T11_3	67	68	68	68	68	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	-	69
T11_4	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	68	68	-	69
T11_5	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	68	68	68	68	68	68	68	68	68	68	68	68	-	69
T11_6	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	-	67
T15_1	42	42	42	42	42	42	42	42	42	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	44	45	46	-	-	-	46
T15_2	71	71	71	71	71	71	71	71	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	-	-	71
T15_3	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	-	-	-	71
T15_4	70	70	70	70	70	70	70	70	70	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	-	-	-	71
T15_5	71	71	71	71	71	71	71	71	71	71	71	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72	72	-	-	-	72
T16_1	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	-	-	-	-	-	72
T16_2	72	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	73	-	-	-	-	-	73
T16_3	73	73	73	73	73	73	73	73	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	74	-	-	-	-	-	74
T16_4	72	72	72	72	73	73	73	73	73	73	73	74	74	74	74	74	74	74	74	74	74	74	74	74	74	-	-	-	-	-	74
T16_5	50	51	52	52	53	54	56	57	58	60	61	62	62	63	64	64	65	65	65	66	66	66	66	66	67	-	-	-	-	-	67
T17_1	64	65	66	67	68	68	69	69	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	-	-	-	-	70
T17_2	65	66	67	68	69	70	70	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	-	-	-	-	-	71
T17_3	66	67	68	69	69	70	70	71	71	71	71	72	72	72	72	72	72	72	72	71	71	71	71	71	71	-	-	-	-	-	72
T17_4	65	66	67	68	68	69	70	70	70	70	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	-	-	-	-	-	71
T18_1	64	65	66	66	67	67	68	68	69	69	69	70	70	70	70	70	70	70	70	70	70	70	71	-	-	-	-	-	-	-	71
T18_2	65	66	66	67	68	69	69	70	70	70	71	71	71	71	71	71	71	71	71	71	71	71	71	-	-	-	-	-	-	-	71
T18_3	64	65	66	67	68	69	69	70	70	70	70	70	71	71	71	71	71	71	71	71	71	71	70	-	-	-	-	-	-	-	71
T29_1	65	65	66	66	66	66	67	67	67	68	68	68	68	68	69	69	69	-	-	-	-	-	-	-	-	-	-	-	-	-	69
T29_2	67	68	69	69	69	70	71	71	72	72	72	73	73	73	73	73	73	-	-	-	-	-	-	-	-	-	-	-	-	-	73
T29_3	67	68	69	69	69	70	71	71	72	72	73	73	73	73	73	73	73	-	-	-	-	-	-	-	-	-	-	-	-	-	73
T29_4	53	54	55	55	55	56	57	57	58	58	59	59	59	59	59	60	63	-	-	-	-	-	-	-	-	-	-	-	-	-	63
T29_5	38	38	38	39	39	39	39	40	40	40	40	40	40	40	41	43	50	-	-	-	-	-	-	-	-	-	-	-	-	-	50
T30_1	64	65	65	66	66	66	67	67	68	68	68	69	69	69	70	70	70	70	70	-	-	-	-	-	-	-	-	-	-	-	70
T30_2	65	65	65	65	65	65	65	66	66	66	66	66	66	66	67	67	67	67	67	-	-	-	-	-	-	-	-	-	-	-	67
T31_1	64	64	65	65	65	65	65	66	66	66	66	67	67	67	67	67	67	68	68	-	-	-	-	-	-	-	-	-	-	-	68
T31_2	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	-	-	-	-	-	-	-	-	-	-	-	68
T32_1	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	-	-	-	-	-	-	-	-	-	-	-	66
T32_2	68	68	68	68	68	68	68	68	68	68	68	69	69	69	69	69	69	69	69	-	-	-	-	-	-	-	-	-	-	-	69
T33_1	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	69	-	-	-	-	-	-	-	-	-	-	-	-	-	69
T33_2	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	-	-	-	-	-	-	-	-	-	-	-	-	-	70
T33_3	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	-	-	-	-	-	-	-	-	-	-	-	-	-	68
T34_1	53	53	53	53	53	54	54	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55
T34_2	61	61	61	61	61	61	61	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
T34_3	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
T34_4	61	61	61	61	61	61	61	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
T35_1	61	61	61	61	61	61	61	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61
T35_2	48	48	48	48	49	49	49	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
T35_3	42	42	43	43	43	43	43	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
T35_4	47	47	48	48	48	49	49	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50

Remarks:

- Highlighted in red are facades exceeded the 70 dB(A) criteria.
- Indicated by asterisked are schools, which the noise criteria is 65 dB(A)

Appendix 10.02

Schedule of Laboratory Chemical Testing on Soil Samples

Project: Agreement No. CE 43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns – Feasibility Study
Client: CE/SP, DSD

Schedule of Laboratory Chemical Test on Soil Samples

			BTEX				**SVOC**																**PCR**		
Sample location/ Investigation Station No.	Sample type (grab, vibrocore etc.) & sample diameter (if applicable)	Sample Depth (from -m to m below existing ground level	Benzene	Ethylbenzene	Toluene	Xylenes (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
BH-ENV01	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV01	Grab (Distributed Sample)	1.0					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV01	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV02	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV02	Grab (Distributed Sample)	1.0					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV02	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV03	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV03	Grab (Distributed Sample)	1.0					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV03	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Form completed by: William Wong ~~Department~~/Consultant*: AECOM Date: 11 June 2013

Project: Agreement No. CE 43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns – Feasibility Study
Client: CE/SP, DSD

			BTEX				**SVOC**																**PCR**		
Sample location/ Investigation Station No.	Sample type (grab, vibrocore etc.) & sample diameter (if applicable)	Sample Depth (from -m to m below existing ground level	Benzene	Ethylbenzene	Toluene	Xylenes (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
BH-ENV04	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV04	Grab (Distributed Sample)	1.0					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV04	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV05	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV05	Grab (Distributed Sample)	1.0					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV05	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV06	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV06	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV06	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV07	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Form completed by: William Wong ~~Department~~/Consultant*: AECOM Date: 11 June 2013

Project: Agreement No. CE 43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns – Feasibility Study
Client: CE/SP, DSD

			BTEX				**SVOC**																**PCR**		
Sample location/ Investigation Station No.	Sample type (grab, vibrocore etc.) & sample diameter (if applicable)	Sample Depth (from -m to m below existing ground level	Benzene	Ethylbenzene	Toluene	Xylenes (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
BH-ENV07	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV07	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV08	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV08	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV08	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV09	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV09	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV09	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV10	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV10	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Form completed by: William Wong ~~Department~~/Consultant*: AECOM Date: 11 June 2013

Project: Agreement No. CE 43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns – Feasibility Study
Client: CE/SP, DSD

			BTEX				SVOC																PCR		
Sample location/ Investigation Station No.	Sample type (grab, vibrocore etc.) & sample diameter (if applicable)	Sample Depth (from -m to m below existing ground level	Benzene	Ethylbenzene	Toluene	Xylenes (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
BH-ENV10	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV11	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV11	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV11	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV12	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV12	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV12	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV13	Grab (Distributed Sample)	0.5					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BH-ENV13	Grab (Distributed Sample)	1					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Form completed by: William Wong ~~Department~~/Consultant*: AECOM Date: 11 June 2013

Project: Agreement No. CE 43/2011 (DS)
Relocation of Sha Tin Sewerage Treatment Works to Caverns – Feasibility Study
Client: CE/SP, DSD

			BTEX				**SVOC**															**PCR**		
Sample location/ Investigation Station No.	Sample type (grab, vibrocore etc.) & sample diameter (if applicable)	Sample Depth (from -m to m below existing ground level	Benzene	Ethylbenzene	Toluene	Xylenes (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
BH-ENV13	Grab (Distributed Sample)	3.0 or interface of water table					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Will be selected on site	Duplicate soil samples (i.e. total two (2)	To be selected on site					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Will be selected on site	Equipment Blank samples (i.e. total one (1))	NA					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Will be selected on site	Trip Blank samples (i.e. total one (1))	NA	x	x	x	x																	x		

Form completed by: _William Wong___ ~~Department~~/Consultant*: AECOM_____ Date: _11 June 2013__

Appendix 10.03

Soil Boring Logs

PROJECT	Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)		WORKS ORDER NO. GE/2011/25.15A
CO-ORDINATES	E 839961.59 N 829937.42	GROUND LEVEL: +5.28 mPD	LOGGED S.L. Chiu DATE 30.07.2013 / CHECKED R. Chu DATE 31.07.2013
			EXCAVATION DATES: 22.07.2013 to 24.07.2013 BACKFILL DATES: 02.08.2013 to 02.08.2013

DRILTECH

TRIAL PIT RECORD

CONTRACT NO. GE/2011/25

TRIAL PIT NO. TP-ENV13

SHEET 1 of 1

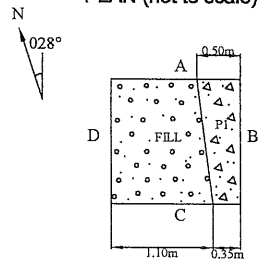
SAMPLES and TESTS | DEPTH (m) | SKETCH | DEPTH (m) | LEGEND | GRADE | DESCRIPTION

SKETCH: FACE A: 1.50 m; FACE B: 1.50 m; FACE C: 1.50 m; FACE D: 1.50 m

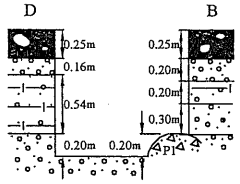
DEPTH (m)	DESCRIPTION
0.00 – 0.25	Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
0.25 – 0.41	Angular, greyish brown (10YR 5/2), sandy fine to coarse GRAVEL of rock fragments. (FILL)
0.41 – 0.95	Firm, brown (7.5YR 4/4) spotted grey and black, slightly silty sandy CLAY with some angular fine to coarse gravel and cobble of quartz and rock fragments and with occasional refuse, asphalt and concrete fragments. (FILL)
0.95 – 1.15	Angular, brown (7.5YR 4/4) mottled pink, slightly sandy fine to coarse GRAVEL of rock fragments. (FILL) At 0.95m: P1: Grey (10YR 5/1), a concrete pipe with 700mm in diameter.
1.15	End of trial pit at maximum depth of 1.15 m.

SMALL DISTURBED SAMPLE
LARGE DISTURBED SAMPLE
U76 SAMPLE (VERTICAL / HORIZONTAL)
U100 SAMPLE (VERTICAL / HORIZONTAL)
BLOCK SAMPLE
IN-SITU DENSITY TEST
WATER SAMPLE
WATER SEEPAGE
N-SCHMIDT HAMMER TEST

PLAN (not to scale)



SECTION (not to scale)



REMARKS

Maximum Depth: 1.15 m
Average Depth: 1.15 m
Shoring: NO
Stability: STABLE
Water Seepage: NO

1. Small disturbed samples were taken at 0.50m and 1.00m.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV01**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**

DATE **29.06.2013** to **02.07.2013**

CO-ORDINATES
E **839763.11**
N **829554.48**

METHOD **MANUAL EXCAVATION**

GROUND LEVEL **+6.33** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
29.06.2013			+6.33	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+6.23	0.10			Angular, greyish brown (10YR 5/2), slightly clayey silty sandy fine to coarse GRAVEL of rock fragments. (FILL)
29.06.2013	Dry at 1800	1 0.45	+5.88	0.45			Dense, yellowish red (5YR 5/8), slightly silty clayey fine to coarse SAND with some angular fine to coarse gravel of rock fragments. (FILL)
02.07.2013	Dry at 0800						At bottom: Grey (10YR 6/1) mottled brown, CONCRETE.
02.07.2013	Dry at 1800	2 0.80	+5.48	0.85			End of inspection pit at 0.85 m.
1							
2							
3							

↥ SMALL DISTURBED SAMPLE
▨ U76 SAMPLE
↕ LARGE DISTURBED SAMPLE
▩ U100 SAMPLE
▲ WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **05.07.2013**
CHECKED **R. Chu**
DATE **15.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m and 0.85m.
2. Environmental samples were taken at 0.50m and 0.83m.
3. The inspection pit was backfilled on 12 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV02**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **839860.82** N **829473.24**	METHOD **MANUAL EXCAVATION**
DATE **27.06.2013** to **29.06.2013**			GROUND LEVEL **+6.37** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
27.06.2013			+6.37	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+6.27	0.10			Grey (10YR 6/1), CONCRETE. (CONCRETE SUBBASE)
			+6.09	0.28			Dense, brown (7.5YR 5/4), slightly clayey silty fine to coarse SAND with some angular to subangular fine to coarse gravel and occasional cobble of rock fragments. (FILL)
27.06.2013	Dry at 1800	1 ↕ 0.45					
28.06.2013	Dry at 0800						
28.06.2013	Dry at 1800	2 ↕ 0.95					
29.06.2013	Dry at 0800	▲ 1.15					
		3 ↕ 1.45					
29.06.2013	1.15 at 1800	4 ↕ 1.70	+4.62	1.75			End of inspection pit at 1.75 m.

↕ SMALL DISTURBED SAMPLE
↕ LARGE DISTURBED SAMPLE
▲ WATER SAMPLE
U76 SAMPLE
U100 SAMPLE

LOGGED **S.L. Chiu**
DATE **29.06.2013**
CHECKED **R. Chu**
DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m and 1.75m.
2. Environmental samples were taken at 0.50m, 1.00m and 1.10m.
3. Groundwater sample was taken at 1.15m.
4. The inspection pit was backfilled on 11 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV03**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**

DATE **26.06.2013** to **26.06.2013**

CO-ORDINATES
E **840016.15**
N **829611.81**

METHOD **MANUAL EXCAVATION**

GROUND LEVEL **+5.23** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+5.23	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+5.00	0.23			
26.06.2013	Dry at 1800	1 0.28	+4.90	0.33			Angular to subangular, greyish brown (10YR 5/2), slightly sandy fine to coarse GRAVEL of rock fragments. (FILL)
							At bottom: Grey (10YR 6/1) mottled brown, CONCRETE.
							End of inspection pit at 0.33 m.

1

2

3

↥ SMALL DISTURBED SAMPLE

↕ LARGE DISTURBED SAMPLE

▲ WATER SAMPLE

▨ U76 SAMPLE

■ U100 SAMPLE

LOGGED **S.L. Chiu**

DATE **28.06.2013**

CHECKED **R. Chu**

DATE **06.07.2013**

REMARKS

1. Small disturbed sample was taken at 0.33m.
2. The inspection pit was backfilled on 11 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV03A**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO.	**GE/2011/25.15A**	CO-ORDINATES E **840009.62** N **829614.33**	METHOD **MANUAL EXCAVATION**
DATE	**11.07.2013** to **12.07.2013**		GROUND LEVEL **+5.19** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
11.07.2013			+5.19	0.00			Dense, brown (10YR 5/3), slightly clayey silty fine to coarse SAND with some angular fine to coarse gravel of rock fragments and with some roots. (FILL) From 0.45m to 0.60m: Grey, a PVC pipe with 160mm in diameter.
11.07.2013	Dry at 1800	1 ↕ 0.45					
12.07.2013	Dry at 0800						
		0.85					
12.07.2013	0.85 at 1800	2 ↕ 0.95	+4.19	1.00			End of inspection pit at 1.00 m.
2							
3							

↕ SMALL DISTURBED SAMPLE

↨ LARGE DISTURBED SAMPLE

▲ WATER SAMPLE

▨ U76 SAMPLE

▩ U100 SAMPLE

LOGGED **S.L. Chiu**

DATE **12.07.2013**

CHECKED **R. Chu**

DATE **13.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m and 1.00m.
2. Environmental samples were taken at 0.50m and 0.80m.
3. Groundwater sample was taken at 0.85m.
4. The inspection pit was backfilled on 2 August 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV04**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO.	**GE/2011/25.15A**	CO-ORDINATES	METHOD **MANUAL EXCAVATION**
DATE	**26.06.2013** to **28.06.2013**	E **840036.89** N **829634.61**	GROUND LEVEL **+6.20** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+6.20	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+6.00	0.20			Angular to subangular, grey (10YR 5/1), slightly silty sandy fine to coarse GRAVEL of rock fragments. (FILL)
			+5.80	0.40			
26.06.2013	Dry at 1800	1 0.45					Dense, brown (7.5YR 5/4), slightly silty fine to coarse SAND with occasional to some angular to subangular fine to coarse gravel and cobble of rock fragments and with occasional refuse fragments. (FILL)
27.06.2013	Dry at 0800						
27.06.2013	Dry at 1800	2 0.95					At bottom: Angular to subangular, greyish brown (10YR 5/2), coarse GRAVEL and occasional cobble of rock fragments. (FILL)
28.06.2013	Dry at 0800						
		3 1.45					
28.06.2013	Dry at 1800	4 1.60	+4.55	1.65			
							End of inspection pit at 1.65 m.

‡ SMALL DISTURBED SAMPLE
U76 SAMPLE
LARGE DISTURBED SAMPLE
U100 SAMPLE
WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **29.06.2013**
CHECKED **R. Chu**
DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m and 1.65m.
2. Environmental samples were taken at 0.50m and 1.00m.
3. The inspection pit was backfilled on 2 August 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV04A**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **840038.91** N **829625.63**	METHOD **MANUAL EXCAVATION**
DATE **23.07.2013** to **29.07.2013**			GROUND LEVEL **+5.98** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
23.07.2013			+5.98	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+5.82	0.16			Dense, brown (7.5YR 4/4) spotted light brown and grey, slightly silty clayey fine to coarse SAND with some to much angular fine to coarse gravel and cobble of rock fragments. (FILL)
	Dry at 1800	1 0.45	+5.58	0.40			Firm, brown (7.5YR 4/4), silty sandy CLAY with some angular fine to coarse gravel of quartz and rock fragments. (FILL)
23.07.2013 29.07.2013	Dry at 0800						
			+5.08	0.90			Dense, brown (7.5YR 4/4) spotted light brown and grey, slightly silty clayey fine to coarse SAND with some to much angular fine to coarse gravel and cobble of rock fragments. (FILL) From 1.40m to 1.60m: Partially with a boulder (<350mm) sized concrete fragment with steel bar reinforcement.
1		2 0.95					
		3 1.45					
29.07.2013	1.80 at 1800	1.80	+4.08	1.90			
2							End of inspection pit at 1.90 m.
3							

‡ SMALL DISTURBED SAMPLE

U76 SAMPLE

LARGE DISTURBED SAMPLE

U100 SAMPLE

WATER SAMPLE

LOGGED **S.L. Chiu**

DATE **30.07.2013**

CHECKED **R. Chu**

DATE **31.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m and 1.50m.
2. Environmental samples were taken at 0.50m, 1.00m and 1.80m.
3. Groundwater sample was taken at 1.80m.
4. The inspection pit was backfilled on 2 August 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV05**

SHEET **1** of **1**

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**

DATE **26.06.2013** to **29.06.2013**

CO-ORDINATES
E **840026.61**
N **829661.33**

METHOD **MANUAL EXCAVATION**

GROUND LEVEL **+6.91** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+6.91	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+6.77	0.14			Angular to subangular, brown (7.5YR 5/4), slightly clayey silty sandy fine to coarse GRAVEL of rock fragments and with some concrete fragments. (FILL)
26.06.2013	Dry at 1800	1 0.45					
27.06.2013	Dry at 0800						
			+6.11	0.80			Firm, brown (7.5YR 4/4), silty sandy CLAY with some angular to subangular fine to coarse gravel and occasional cobble of rock fragments and with some concrete fragments. (FILL)
27.06.2013	Dry at 1800	2 0.95					
28.06.2013	Dry at 0800						
			+5.51	1.40			Dense, brown (7.5YR 4/4), slightly clayey silty fine to coarse SAND with some angular to subangular fine to coarse gravel and cobble of rock fragments and with some concrete fragments. (FILL)
		3 1.45					From 1.40m to 2.40m: Partially with grey (10YR 6/1) mottled brown, CONCRETE.
2		4 1.95					
28.06.2013	Dry at 1800						
29.06.2013	Dry at 0800						
		5 2.45					
29.06.2013	2.73 at 1800	6 2.70 2.73	+4.16	2.75			End of inspection pit at 2.75 m.
3							

↧ SMALL DISTURBED SAMPLE
U76 SAMPLE
↕ LARGE DISTURBED SAMPLE
U100 SAMPLE
▲ WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **29.06.2013**
CHECKED **R. Chu**
DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 2.75m.
2. Environmental samples were taken at 0.50m, 1.00m and 2.50m.
3. Groundwater sample was taken at 2.73m.
4. The inspection pit was backfilled on 11 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV06**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **839985.50** N **829654.19**	METHOD **MANUAL EXCAVATION**
DATE **26.06.2013** to **27.06.2013**			GROUND LEVEL **+5.21** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+5.21	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+4.91	0.30			Angular to subangular, grey (10YR 5/1) spotted brown, slightly sandy fine to coarse GRAVEL of rock fragments. (FILL)
26.06.2013	Dry at 1800	1 ↥ 0.45					
27.06.2013	Dry at 0800						At bottom: Grey (10YR 6/1) mottled brown, CONCRETE.
27.06.2013	Dry at 1800	2 ↥ 0.69	+4.47	0.74			
1							End of inspection pit at 0.74 m.
2							
3							

↥ SMALL DISTURBED SAMPLE

↕ LARGE DISTURBED SAMPLE

▲ WATER SAMPLE

▨ U76 SAMPLE

▩ U100 SAMPLE

LOGGED **S.L. Chiu**

DATE **28.06.2013**

CHECKED **R. Chu**

DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m and 0.74m.
2. Environmental samples were taken at 0.50m and 0.73m.
3. The inspection pit was backfilled on 12 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV07**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **840048.60** N **829755.53**	METHOD **MANUAL EXCAVATION**
DATE **26.06.2013** to **02.07.2013**			GROUND LEVEL **+5.66** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+5.66	0.00			Firm, reddish brown (5YR 5/4), streaked dark brown, slightly sandy silty CLAY with occasional angular to subangular fine to coarse gravel of rock fragments and with occasional decayed wood fragments. (FILL)
	Dry at 1800	1 0.45					At 1.20m: Dark grey, a steel pipe with approx. 450mm in diameter.
26.06.2013 / 27.06.2013	Dry at 0800						
127.06.2013	Dry at 1800	2 0.95					
28.06.2013	Dry at 0800						
28.06.2013	Dry at 1800	3 1.45					
02.07.2013	Dry at 0800	▲ 1.60					
02.07.2013	1.60 at 1800	4 1.75	+3.86	1.80			End of inspection pit at 1.80 m.

↧ SMALL DISTURBED SAMPLE
▨ U76 SAMPLE
↕ LARGE DISTURBED SAMPLE
▩ U100 SAMPLE
▲ WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **29.06.2013**
CHECKED **R. Chu**
DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m and 1.80m.
2. Environmental samples were taken at 0.50m, 1.00m and 1.50m.
3. Groundwater sample was taken at 1.60m.
4. The inspection pit was backfilled on 9 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV08**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **839996.83** N **829738.67**	METHOD **MANUAL EXCAVATION**
DATE **26.06.2013** to **26.06.2013**			GROUND LEVEL **+5.07** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+5.07	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
							At bottom: Grey (10YR 6/1) mottled brown, CONCRETE.
26.06.2013	Dry at 1800	1 0.30	+4.72	0.35			End of inspection pit at 0.35 m.
1							
2							
3							

↥ SMALL DISTURBED SAMPLE

↕ LARGE DISTURBED SAMPLE

▲ WATER SAMPLE

▨ U76 SAMPLE

▩ U100 SAMPLE

LOGGED **S.L. Chiu**

DATE **29.06.2013**

CHECKED **R. Chu**

DATE **06.07.2013**

REMARKS

1. Small disturbed sample was taken at 0.35m.
2. The inspection pit was backfilled on 11 July 2013.

DRILTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV08A**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**

DATE **11.07.2013** to **12.07.2013**

CO-ORDINATES
E **839995.69**
N **829740.88**

METHOD **MANUAL EXCAVATION**

GROUND LEVEL **+5.09** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
11.07.2013			+5.09	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+4.99	0.10			Angular, greyish brown (10YR 5/2), slightly silty sandy fine to coarse GRAVEL of rock fragments. (FILL)
			+4.74	0.35			
11.07.2013	Dry at 1800	1 0.45					Dense, brown (7.5YR 4/4) spotted light reddish brown, slightly clayey silty fine to coarse SAND with some angular fine to coarse gravel of rock fragments. (FILL)
12.07.2013	Dry at 0800						
1		0.90					
12.07.2013	0.90 at 1800	2 0.95	+4.04	1.05			
							End of inspection pit at 1.05 m.
2							
3							

↧ SMALL DISTURBED SAMPLE
U76 SAMPLE
↕ LARGE DISTURBED SAMPLE
U100 SAMPLE
▲ WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **12.07.2013**
CHECKED **R. Chu**
DATE **13.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m and 1.00m.
2. Environmental samples were taken at 0.50m and 0.85m.
3. Groundwater sample was taken at 0.90m.
4. The inspection pit was backfilled on 2 August 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV09**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **840025.49** N **829724.22**	METHOD **MANUAL EXCAVATION**
DATE **26.06.2013** to **28.06.2013**			GROUND LEVEL **+5.07** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
26.06.2013			+5.07	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+4.99	0.08			Angular to subangular, brown (7.5YR 4/4), slightly clayey silty sandy fine to coarse GRAVEL of rock fragments. (FILL)
			+4.72	0.35			Firm, light reddish brown (5YR 6/3), clayey sandy SILT with occasional to some angular fine to coarse gravel and occasional cobble of rock fragments. (FILL)
26.06.2013	Dry at 1800	1 0.45					
27.06.2013	Dry at 0800						
127.06.2013	1.00 at 1800	2 0.95					
28.06.2013	1.00 at 0800	1.00					
		3 1.45					
28.06.2013	1.00 at 1800	4 1.55	+3.47	1.60			End of inspection pit at 1.60 m.

SMALL DISTURBED SAMPLE

LARGE DISTURBED SAMPLE

WATER SAMPLE

U76 SAMPLE

U100 SAMPLE

LOGGED **S.L. Chiu**

DATE **29.06.2013**

CHECKED **R. Chu**

DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m and 1.60m.
2. Environmental samples were taken at 0.50m and 0.90m.
3. Groundwater sample was taken at 1.00m.
4. The inspection pit was backfilled on 11 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV10**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**

DATE **27.06.2013** to **11.07.2013**

CO-ORDINATES
E **840187.38**
N **829602.99**

METHOD **MANUAL EXCAVATION**

GROUND LEVEL **+6.34** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
27.06.2013			+6.34	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+6.12	0.22			Angular to subangular, greyish brown (10YR 5/2), slightly silty sandy fine to coarse GRAVEL of rock fragments. (FILL)
			+5.92	0.42			Stiff, brown (10YR 5/3), slightly sandy silty CLAY with occasional angular to subangular fine to coarse gravel of rock fragments. (FILL)
27.06.2013	Dry at 1800	1 0.45					
28.06.2013	Dry at 0800						
28.06.2013	Dry at 1800	2 0.95					
29.06.2013	Dry at 0800						
		3 1.45	+4.74	1.60			Dense, brown (10YR 5/3), slightly clayey silty fine to coarse SAND with much angular to subangular fine to coarse gravel of rock fragments. (FILL) At 1.80m: Partially with a boulder of moderately decomposed granite fragments.
2		4 1.95					
		▲ 2.20					
29.06.2013	2.20 at 1800	5 2.45					
11.07.2013	2.20 at 0800						
311.07.2013	2.20 at 1800	6 2.95	+3.34	3.00			End of inspection pit at 3.00 m.

↧ SMALL DISTURBED SAMPLE
↕ LARGE DISTURBED SAMPLE
▲ WATER SAMPLE
▨ U76 SAMPLE
■ U100 SAMPLE

LOGGED **S.L. Chiu**
DATE **29.06.2013**
CHECKED **R. Chu**
DATE **06.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m.
2. Environmental samples were taken at 0.50m, 1.00m and 3.00m.
3. Groundwater sample was taken at 2.20m.
4. The inspection pit was backfilled on 2 August 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV11**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO.	**GE/2011/25.15A**	CO-ORDINATES E **840117.20** N **830025.06**	METHOD **MANUAL EXCAVATION**
DATE	**29.06.2013** to **03.07.2013**		GROUND LEVEL **+5.43** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
29.06.2013			+5.43	0.00			Grey (10YR 5/1), CONCRETE with steel reinforcement. (TRAFFIC ROAD)
			+5.19	0.24			Angular, grey (10YR 5/1) mottled brown, sandy fine to coarse GRAVEL of rock fragments. (FILL)
29.06.2013	Dry at 1800	1 0.45	+4.95	0.48			Dense, yellowish red (5YR 5/6) and dark brown (7.5YR 3/4), slightly clayey silty fine to coarse SAND with some to much angular fine to medium gravel of rock fragments. (FILL)
02.07.2013	Dry at 0800						
1		2 0.95					
		3 1.45					
202.07.2013	Dry at 1800	4 1.95					
03.07.2013	Dry at 0800						
		5 2.45					
303.07.2013	Dry at 1800	6 2.95	+2.43	3.00			End of inspection pit at 3.00 m.

‡ SMALL DISTURBED SAMPLE
U76 SAMPLE
LARGE DISTURBED SAMPLE
U100 SAMPLE
WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **05.07.2013**
CHECKED **R. Chu**
DATE **15.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m, 2.00m, 2.50m and 3.00m.
2. Environmental samples were taken at 0.50m, 1.00m and 3.00m.
3. The inspection pit was backfilled on 11 July 2013.

DRiLTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV12**

SHEET **1** of **1**

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO.	**GE/2011/25.15A**	CO-ORDINATES E **840108.15** N **829999.93**	METHOD **MANUAL EXCAVATION**
DATE	**29.06.2013** to **03.07.2013**		GROUND LEVEL **+5.36** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
29.06.2013			+5.36	0.00			Grey (10YR 5/1), CONCRETE with steel reinforcement. (TRAFFIC ROAD)
			+5.11	0.25			Angular, grey (10YR 5/1) mottled brown, sandy fine to coarse GRAVEL of rock fragments. (FILL)
29.06.2013	Dry at 1800	1 0.45	+4.85	0.51			
02.07.2013	Dry at 0800						Dense, yellowish red (5YR 5/8) and brown (10YR 5/3), slightly silty clayey fine to coarse SAND with some angular fine to coarse gravel of rock fragments. (FILL)
1		2 0.95					
		3 1.45	+3.86	1.50			
							Firm, yellowish red (5YR 5/8) spotted yellowish brown, silty sandy CLAY with some angular fine gravel of quartz and rock fragments. (FILL)
202.07.2013	Dry at 1800	4 1.95					
03.07.2013	Dry at 0800						
03.07.2013	2.30 at 1800	▲ 2.30	+3.04	2.32			
							End of inspection pit at 2.32 m.
3							

↧ SMALL DISTURBED SAMPLE

↕ LARGE DISTURBED SAMPLE

▲ WATER SAMPLE

▨ U76 SAMPLE

▩ U100 SAMPLE

LOGGED **S.L. Chiu**

DATE **05.07.2013**

CHECKED **R. Chu**

DATE **15.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m, 1.50m and 2.00m.
2. Environmental samples were taken at 0.50m, 1.00m and 2.20m.
3. Groundwater sample was taken at 2.30m.
4. The inspection pit was backfilled on 11 July 2013.

DRILTECH

INSPECTION PIT RECORD

CONTRACT NO. **GE/2011/25**

PIT NO. **BH-ENV13**

SHEET 1 of 1

PROJECT **Ground Investigation - New Territories East (Term Contract), Agreement No. CE 43/2011(DS), Relocation of Sha Tin Sewage Treatment Works to Cavers - Feasibility (GI inside STSTW)**

WORKS ORDER NO. **GE/2011/25.15A**		CO-ORDINATES E **839961.69** N **829936.22**	METHOD **MANUAL EXCAVATION**
DATE **29.06.2013** to **02.07.2013**			GROUND LEVEL **+5.29** mPD

Excavation Progress	Water Level (m) Shift Start / End	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
29.06.2013			+5.29	0.00			Black (10YR 2/1), ASPHALT. (TRAFFIC ROAD)
			+5.07	0.22			Angular, greyish brown (10YR 5/2), slightly silty sandy fine to coarse GRAVEL of rock fragments. (FILL)
29.06.2013	Dry at 1800	1 ↕ 0.45	+4.84	0.45			Dense, yellowish red (5YR 5/8), slightly clayey silty fine to coarse SAND with some angular fine gravel of rock fragments. (FILL)
02.07.2013	Dry at 0800						At bottom: With some medium to coarse gravel of rock fragments.
1		2 ↕ 0.95					
02.07.2013	Dry at 1800	3 ↕ 1.15	+4.09	1.20			End of inspection pit at 1.20 m.
2							
3							

↕ SMALL DISTURBED SAMPLE
▨ U76 SAMPLE
↨ LARGE DISTURBED SAMPLE
■ U100 SAMPLE
▲ WATER SAMPLE

LOGGED **S.L. Chiu**
DATE **05.07.2013**
CHECKED **R. Chu**
DATE **15.07.2013**

REMARKS

1. Small disturbed samples were taken at 0.50m, 1.00m and 1.20m.
2. Environmental samples were taken at 0.50m and 1.00m.
3. The inspection pit was backfilled on 2 August 2013.

Appendix 10.04

Summary of The Laboratory Testing Results of Soil and Groundwater

Summary Tables of The Laboratory Testing Result - Soil

Parameters			SVOC																Petroleum Carbon Ranges		
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
Unit			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5	200	500
RBRGs of Urban Residentail			**3510**	**2340**	**10000***	**12**	**1.2**	**9.88**	**1800**	**120**	**871**	**1.2**	**2400**	**2380**	**12**	**182**	**10000***	**1800**	**1410**	**2240**	**10000***
Saturation Limit			**60.2**	**19.8**	**2.56**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**54.7**	**--**	**125**	**28**	**--**	**1000**	**3000**	**5000**
Sample Location	Sampling Depth (m bgs)	Date of Sampling																			
BH-ENV01	0.50	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BHENV01	0.83	11-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV02	0.50	28-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	1040
BH-ENV02	1.00	28-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV02	1.10	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV3A	0.50	11-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV3A	0.80	12-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV4A	0.50	29-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV4A	1.00	29-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV4A	1.80	29-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV05	0.50	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV05	1.00	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV05	2.50	3-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV06	0.50	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV06	0.73	11-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV07	0.50	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV07	1.00	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV07	1.50	28-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV8A	0.50	11-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV8A	0.85	12-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV09	0.50	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV09	0.90	28-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV10	0.50	27-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV10	1.00	28-Jun-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV10	3.00	11-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV11	0.50	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV11	1.00	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV11	3.00	3-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV12	0.50	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV12	1.00	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV12	2.20	3-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV13	0.50	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500
BH-ENV13	1.00	2-Jul-13	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<5	<200	<500

Note: BBC= Below ground surface

LOR= Level of Reporting

Summary Tables of The Laboratory Testing Results - Groundwater

			SVOC										Petroleum Carbon Ranges		
Parameters			Acenaphthene	Acenaphthylene	Anthracene	Benzo(b)fluoranthene	Chrysene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
Unit			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR			2	2	2	1	1	2	2	2	2	2	20	500	500
RBRGs of Urban Residentail			10000000*	1410000	10000000*	539	58100	10000000*	10000000*	61700	10000000*	10000000*	82200	714000	12800
Saturation Limit			4240	3930	43.4	1.5	1.6	206	1980	31000	1000	135	5230	2800	2800
Sample Location	Sampling Depth (m bgs)	Date of Sampling													
BH-ENV02	1.15	2-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	1200
BH-ENV3A	0.85	12-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV4A	1.85	29-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV05	2.73	3-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV07	1.60	2-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV8A	0.90	12-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV09	1.00	2-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV10	2.20	16-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500
BH-ENV12	2.30	3-Jul-13	<2.0	<2.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<20	<500	<500

Note: bgs= below ground surface

LOR= Level of Reporting

Appendix 10.05

Laboratory Chemical Testing Report by ALS Technichem (HK) Pty Ltd

ALS Environmental

CEDD Contract No. GE/2012/24

Chemical and Biological Testing (Service Contract)

Service Order No. GE/2012/24.11

Agreement No. CE 43/2011(DS)
Relocation of Sha Tin Sewage Treatment Works to Caverns – Feasibility Study
Provision of Chemical and Biological Testing Service

Laboratory Chemical Testing Report (Final Report)

Prepared for

Civil Engineering and Development Department

Prepared By

ALS Technichem (HK) Pty Ltd

August 23, 2013

CEDD Contract No. GE/2012/24

Chemical and Biological Testing (Service Contract)

Service Order No. GE/2012/24.11

Agreement No. CE 43/2011(DS)
Relocation of Sha Tin Sewage Treatment Works to Caverns – Feasibility Study
Provision of Chemical and Biological Testing Service

Laboratory Chemical Testing Report (Final Report)

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Date: August 23, 2013

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Section 1

Summary Reports

Summary of Soil Analytical Results

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

		Analytes	Total Petroleum Hydrocarbons (TPH)		
			C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
		Units	mg/kg	mg/kg	mg/kg
		LOR	5	200	500
ALS Lab ID	Sample ID	Sampling Date			
HK1317305002	BH-ENV05/ 0.5M	27/06/2013	<5	<200	<500
HK1317305003	BH-ENV06/ 0.5M	27/06/2013	<5	<200	<500
HK1317305004	BH-ENV07/ 0.5M	27/06/2013	<5	<200	<500
HK1317305005	BH-ENV09/ 0.5M	27/06/2013	<5	<200	<500
HK1317305006	BH-ENV10/ 0.5M	27/06/2013	<5	<200	<500
HK1317305008	BH-ENV05/ 1.0M	27/06/2013	<5	<200	<500
HK1317305009	BH-ENV07/ 1.0M	27/06/2013	<5	<200	<500
HK1317464001	BH-ENV10/ 1.0M	28/06/2013	<5	<200	<500
HK1317464002	BH-ENV02/ 0.5M	28/06/2013	<5	<200	1040
HK1317464003	BH-ENV02/ 1.0M	28/06/2013	<5	<200	<500
HK1317464004	BH-ENV09/ 0.9M	28/06/2013	<5	<200	<500
HK1317464005	BH-ENV07/ 1.5M	28/06/2013	<5	<200	<500
HK1317464006	BH-ENV07/ 1.5M(A)	28/06/2013	<5	<200	<500
HK1317464007	BH-ENV07/ 1.5M(B)	28/06/2013	<5	<200	<500
HK1317593001	BH-ENV12/ 0.5M	2/07/2013	<5	<200	<500
HK1317593002	BH-ENV11/ 0.5M	2/07/2013	<5	<200	<500
HK1317593003	BH-ENV13/ 0.5M	2/07/2013	<5	<200	<500
HK1317593004	BH-ENV01/ 0.5M	2/07/2013	<5	<200	<500
HK1317593005	BH-ENV12/ 1.0M	2/07/2013	<5	<200	<500
HK1317593006	BH-ENV11/ 1.0M	2/07/2013	<5	<200	<500
HK1317593007	BH-ENV13/ 1.0M	2/07/2013	<5	<200	<500
HK1317598001	BH-ENV11/ 3.0M	3/07/2013	<5	<200	<500
HK1317598002	BH-ENV12/ 2.2M	3/07/2013	<5	<200	<500
HK1317598003	BH-ENV5/ 2.5M	3/07/2013	<5	<200	<500
HK1317598004	BH-ENV2/ 1.1M	3/07/2013	<5	<200	<500
HK1318887002	BH-ENV3A 0.80M	12/07/2013	<5	<200	<500
HK1318887004	BH-ENV8A 0.85M	12/07/2013	<5	<200	<500
HK1318896001	BH-ENV10 3.0M	11/07/2013	<5	<200	<500
HK1318896002	BH-ENV06 0.73M	11/07/2013	<5	<200	<500
HK1318896003	BH-ENV01 0.83M	11/07/2013	<5	<200	<500
HK1318896004	BH-ENV3A 0.5M	11/07/2013	<5	<200	<500
HK1318896005	BH-ENV8A 0.5M	11/07/2013	<5	<200	<500
HK1320318001	BH-ENV4A 0.5M	29/07/2013	<5	<200	<500
HK1320318002	BH-ENV4A 1.0M	29/07/2013	<5	<200	<500
HK1320318003	BH-ENV4A 1.8M	29/07/2013	<5	<200	<500

Summary of Soil Analytical Results

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

			Polycyclic Aromatic Hydrocarbons (PAHs)															
		Analytes	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
		LOR	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
ALS Lab ID	Sample ID	Sampling Date																
HK1317305002	BH-ENV05/ 0.5M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317305003	BH-ENV06/ 0.5M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317305004	BH-ENV07/ 0.5M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317305005	BH-ENV09/ 0.5M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317305006	BH-ENV10/ 0.5M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317305008	BH-ENV05/ 1.0M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317305009	BH-ENV07/ 1.0M	27/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464001	BH-ENV10/ 1.0M	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464002	BH-ENV02/ 0.5M	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464003	BH-ENV02/ 1.0M	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464004	BH-ENV09/ 0.9M	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464005	BH-ENV07/ 1.5M	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464006	BH-ENV07/ 1.5M(A)	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317464007	BH-ENV07/ 1.5M(B)	28/06/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593001	BH-ENV12/ 0.5M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593002	BH-ENV11/ 0.5M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593003	BH-ENV13/ 0.5M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593004	BH-ENV01/ 0.5M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593005	BH-ENV12/ 1.0M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593006	BH-ENV11/ 1.0M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317593007	BH-ENV13/ 1.0M	2/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317598001	BH-ENV11/ 3.0M	3/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317598002	BH-ENV12/ 2.2M	3/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317598003	BH-ENV5/ 2.5M	3/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1317598004	BH-ENV2/ 1.1M	3/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318887002	BH-ENV3A 0.80M	12/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318887004	BH-ENV8A 0.85M	12/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318896001	BH-ENV10 3.0M	11/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318896002	BH-ENV06 0.73M	11/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318896003	BH-ENV01 0.83M	11/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318896004	BH-ENV3A 0.5M	11/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1318896005	BH-ENV8A 0.5M	11/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1320318001	BH-ENV4A 0.5M	29/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1320318002	BH-ENV4A 1.0M	29/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
HK1320318003	BH-ENV4A 1.8M	29/07/2013	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500

Summary of Water Analytical Results

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

		Analytes	Total Petroleum Hydrocarbons (TPH)		
		Units	C6 - C8 Fraction	C9 - C16 Fraction	C17 - C35 Fraction
		LOR	µg/L	µg/L	µg/L
			20	500	500
ALS Lab ID	Sample ID	Sampling Date			
HK1317305011	TRIP BLANK	27/06/2013	<20	--	--
HK1317464008	EQUIPMENT BLANK	28/06/2013	<20	<500	<500
HK1317593008	BH-ENV07 (G.W) 1.6M	2/07/2013	<20	<500	<500
HK1317593009	BH-ENV09 (G.W) 1.0M	2/07/2013	<20	<500	<500
HK1317593010	BH-ENV02 (G.W) 1.15M	2/07/2013	<20	<500	1200
HK1317598005	BH-ENV12 (G.W) 2.3M	3/07/2013	<20	<500	<500
HK1317598006	BH-ENV5 (G.W) 2.73M	3/07/2013	<20	<500	<500
HK1318887001	BH-ENV3A (GW) 0.85M	12/07/2013	<20	<500	<500
HK1318887003	BH-ENV8A (GW) 0.9M	12/07/2013	<20	<500	<500
HK1319351001	BH-ENV10 (GW) 2.2M	17/07/2013	<20	<500	<500
HK1320318004	BH-ENV4A 1.85M (G.W)	29/07/2013	<20	<500	<500

Summary of Water Analytical Results

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

		Analytes	Polycyclic Aromatic Hydrocarbons (PAHs)															
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
		Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		LOR	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2
ALS Lab ID	Sample ID	Sampling Date																
HK1317305011	TRIP BLANK	27/06/2013	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HK1317464008	EQUIPMENT BLANK	28/06/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0
HK1317593008	BH-ENV07 (G.W) 1.6M	2/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1317593009	BH-ENV09 (G.W) 1.0M	2/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1317593010	BH-ENV02 (G.W) 1.15M	2/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1317598005	BH-ENV12 (G.W) 2.3M	3/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1317598006	BH-ENV5 (G.W) 2.73M	3/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1318887001	BH-ENV3A (GW) 0.65M	12/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1318887003	BH-ENV8A (GW) 0.9M	12/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1319351001	BH-ENV10 (GW) 2.2M	17/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--
HK1320318004	BH-ENV4A 1.85M (G.W)	29/07/2013	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	<1.0	<1.0	--	--	--	--	--

Summary of Water Analytical Results

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

		Analytes	Monocyclic Aromatic Hydrocarbons (MAH)					
			Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Xylenes (Total)
		Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		LOR	5	5	5	10	5	20
ALS Lab ID	Sample ID	Sampling Date						
HK1317305011	TRIP BLANK	27/06/2013	<5.0	<5.0	<5.0	<10	<5.0	<20
HK1317464008	EQUIPMENT BLANK	28/06/2013	--	--	--	--	--	--
HK1317593008	BH-ENV07 (G.W) 1.6M	2/07/2013	--	--	--	--	--	--
HK1317593009	BH-ENV09 (G.W) 1.0M	2/07/2013	--	--	--	--	--	--
HK1317593010	BH-ENV02 (G.W) 1.15M	2/07/2013	--	--	--	--	--	--
HK1317598005	BH-ENV12 (G.W) 2.3M	3/07/2013	--	--	--	--	--	--
HK1317598006	BH-ENV5 (G.W) 2.73M	3/07/2013	--	--	--	--	--	--
HK1318887001	BH-ENV3A (GW) 0.85M	12/07/2013	--	--	--	--	--	--
HK1318887003	BH-ENV8A (GW) 0.9M	12/07/2013	--	--	--	--	--	--
HK1319351001	BH-ENV10 (GW) 2.2M	17/07/2013	--	--	--	--	--	--
HK1320318004	BH-ENV4A 1.85M (G.W)	29/07/2013	--	--	--	--	--	--

Section 2

Certificate of Analysis

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 8
Contact	: MR SUN NG	Contact	: Fung Lim Chee, Richard	Work Order	: HK1317305
Address	: GEOTECHNICAL PROJECTS DIVISION, GEOTECHNICAL ENGINEERING OFFICE, 23/F., KWUN TONG VIEW, 410 KWUN TONG ROAD, KOWLOON, HONG KONG	Address	: 11/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong	Amendment	: 1
E-mail	: sunng@cedd.gov.hk	E-mail	: Richard.Fung@alsglobal.com		
Telephone	: ----	Telephone	: +852 2610 1044		
Facsimile	: ----	Facsimile	: +852 2610 2021		
Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 27-JUN-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H025602			No. of samples received	: 11
Site	: SHA TIN SEWAGE TREATMENT PLANT			No. of samples analysed	: 8

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Hong Kong Accreditation Service (HKAS) has accedited this laboratory (ALS Technichem (HK) Pty Ltd) under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS Directory of Accredited Laboratories. The results shown in this certificate were determined by this laboratory in accordance with its terms of accreditation.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 04-JUL-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1317305**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Soil sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV05/ 0.5M	BH-ENV06/ 0.5M	BH-ENV07/ 0.5M	BH-ENV09/ 0.5M	BH-ENV10/ 0.5M
				Client sampling date / time: [27-JUN-2013]	[27-JUN-2013]	[27-JUN-2013]	[27-JUN-2013]	[27-JUN-2013]
				HK1317305-002	HK1317305-003	HK1317305-004	HK1317305-005	HK1317305-006
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	5.4	3.1	15.5	18.7	9.9
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5	<5	<5	<5
C9 - C16 Fraction	----	200	mg/kg	<200	<200	<200	<200	<200
C17 - C35 Fraction	----	500	mg/kg	<500	<500	<500	<500	<500
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	104	102	101	93.0	108
4-Terphenyl-d14	1718-51-0	0.1	%	103	101	100	100	90.8
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	90.0	91.4	91.4	89.8	89.9
Toluene-D8	2037-26-5	0.1	%	101	103	99.8	104	98.5
4-Bromofluorobenzene	460-00-4	0.1	%	100	97.3	99.7	99.8	96.2

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV05/ 1.0M Client sampling date / time: [27-JUN-2013] HK1317305-008	Client sample ID: BH-ENV07/ 1.0M Client sampling date / time: [27-JUN-2013] HK1317305-009			
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	13.4	16.1			
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500			
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500			
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500			
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500			
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500			
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500			
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500			
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500			
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500			
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500			
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500			
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500			
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500			
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500			
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500			
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500			
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5			
C9 - C16 Fraction	----	200	mg/kg	<200	<200			
C17 - C35 Fraction	----	500	mg/kg	<500	<500			
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	108	102			
4-Terphenyl-d14	1718-51-0	0.1	%	104	98.8			
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	90.6	90.1			
Toluene-D8	2037-26-5	0.1	%	99.7	99.4			
4-Bromofluorobenzene	460-00-4	0.1	%	96.9	97.0			

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: TRIP BLANK Client sampling date / time: [27-JUN-2013] HK1317305-011
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)				
C6 - C8 Fraction	----	20	µg/L	<20
EP-074_SR-A: Monocyclic Aromatic Hydrocarbons (MAH)				
Benzene	71-43-2	5.0	µg/L	<5.0
Toluene	108-88-3	5.0	µg/L	<5.0
Ethylbenzene	100-41-4	5.0	µg/L	<5.0
meta- & para-Xylene	108-38-3 106-42-3	10	µg/L	<10
ortho-Xylene	95-47-6	5.0	µg/L	<5.0
Xylenes (Total)	----	20	µg/L	<20
EP-080_SRS: TPH(Volatile)/BTEX Surrogate				Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**97.8**
Toluene-D8	2037-26-5	0.1	%	**103**
4-Bromofluorobenzene	460-00-4	0.1	%	**96.2**
EP-074_SR-S: VOC Surrogates				Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**97.8**
Toluene-D8	2037-26-5	0.1	%	**103**
4-Bromofluorobenzene	460-00-4	0.1	%	**96.2**

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2946160)								
HK1317305-001	BH-ENV04/ 0.5M	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	7.2	6.7	6.9
HK1317350-002	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	12.3	12.3	0.0
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2945371)								
HK1317305-001	BH-ENV04/ 0.5M	Naphthalene	91-20-3	500	µg/kg	<500	<500	0.0
		Acenaphthylene	208-96-8	500	µg/kg	<500	<500	0.0
		Acenaphthene	83-32-9	500	µg/kg	<500	<500	0.0
		Fluorene	86-73-7	500	µg/kg	<500	<500	0.0
		Phenanthrene	85-01-8	500	µg/kg	<500	<500	0.0
		Anthracene	120-12-7	500	µg/kg	<500	<500	0.0
		Fluoranthene	206-44-0	500	µg/kg	<500	<500	0.0
		Pyrene	129-00-0	500	µg/kg	<500	<500	0.0
		Benz(a)anthracene	56-55-3	500	µg/kg	<500	<500	0.0
		Chrysene	218-01-9	500	µg/kg	<500	<500	0.0
		Benzo(b)fluoranthene	205-99-2	500	µg/kg	<500	<500	0.0
		Benzo(k)fluoranthene	207-08-9	500	µg/kg	<500	<500	0.0
		Benzo(a)pyrene	50-32-8	500	µg/kg	<500	<500	0.0
		Indeno(1.2.3.cd)pyrene	193-39-5	500	µg/kg	<500	<500	0.0
		Dibenz(a.h)anthracene	53-70-3	500	µg/kg	<500	<500	0.0
		Benzo(g.h.i)perylene	191-24-2	500	µg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)								
HK1317305-001	BH-ENV04/ 0.5M	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945372)								
HK1317305-001	BH-ENV04/ 0.5M	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)								
HK1317305-011	TRIP BLANK	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0
EP-074_SR-A: Monocyclic Aromatic Hydrocarbons (MAH) (QC Lot: 2945160)								
HK1317270-001	Anonymous	Benzene	71-43-2	0.5	µg/L	<0.5	<0.5	0.0
		Toluene	108-88-3	0.5	µg/L	31.4	33.2	5.7
		Ethylbenzene	100-41-4	0.5	µg/L	<0.5	<0.5	0.0
		ortho-Xylene	95-47-6	0.5	µg/L	<0.5	<0.5	0.0
		meta- & para-Xylene	108-38-3 106-42-3	1	µg/L	<1	<1	0.0
		Xylenes (Total)	----	2	µg/L	<2	<2	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report					
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2945371)											
Naphthalene	91-20-3	25	µg/kg	----	25 µg/kg	90.0	----	63	117	----	----
				<50	----	----	----	----	----	----	----
Acenaphthylene	208-96-8	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.8	----	54	119	----	----
Acenaphthene	83-32-9	25	µg/kg	----	25 µg/kg	82.6	----	59	122	----	----
				<50	----	----	----	----	----	----	----
Fluorene	86-73-7	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	84.8	----	60	126	----	----
Phenanthrene	85-01-8	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.3	----	60	127	----	----
Anthracene	120-12-7	25	µg/kg	----	25 µg/kg	97.4	----	56	124	----	----
				<50	----	----	----	----	----	----	----
Fluoranthene	206-44-0	25	µg/kg	----	25 µg/kg	97.3	----	61	132	----	----
				<50	----	----	----	----	----	----	----
Pyrene	129-00-0	25	µg/kg	----	25 µg/kg	101	----	61	133	----	----
				<50	----	----	----	----	----	----	----
Benz(a)anthracene	56-55-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	94.7	----	57	124	----	----
Chrysene	218-01-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	99.5	----	60	128	----	----
Benzo(b)fluoranthene	205-99-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	94.8	----	48	135	----	----
Benzo(k)fluoranthene	207-08-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.6	----	58	133	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	96.7	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	25	µg/kg	----	25 µg/kg	80.7	----	48	134	----	----
				<50	----	----	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	86.0	----	50	137	----	----
Benzo(g.h.i)perylene	191-24-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	91.8	----	55	140	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	87.2	----	69	139	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945372)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	62.2	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	53.7	----	43	99	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	90.0	----	76	1134	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-074_SR-A: Monocyclic Aromatic Hydrocarbons (MAH) (QC Lot: 2945160)											
Benzene	71-43-2	0.5	µg/L	<0.5	2 µg/L	106	----	58	126	----	----
Toluene	108-88-3	0.5	µg/L	<0.5	2 µg/L	101	----	63	124	----	----
Ethylbenzene	100-41-4	0.5	µg/L	<0.5	2 µg/L	93.0	----	62	123	----	----
meta- & para-Xylene	108-38-3 106-42-3	1	µg/L	<1	4 µg/L	102	----	66	126	----	----
ortho-Xylene	95-47-6	0.5	µg/L	<0.5	2 µg/L	99.7	----	62	125	----	----
Xylenes (Total)	----	2	µg/L	<2	6 µg/L	102	----	65	126	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)										
HK1317305-002	BH-ENV05/ 0.5M	**C6 - C8 Fraction**	----	4.5 mg/kg	88.4	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945372)										
HK1317305-002	BH-ENV05/ 0.5M	**C9 - C16 Fraction**	----	32 mg/kg	74.5	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	73.4	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115
EP-074_SR-S: VOC Surrogates			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 8
Contact	: MR SUN NG	Contact	: Fung Lim Chee, Richard	Work Order	: HK1317464
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Telephone	: ----	Telephone	: +852 2610 1044		
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Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 28-JUN-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H 025603			No. of samples received	: 8
Site	: SHA TIN SEWAGE TREATMENT PLANT			No. of samples analysed	: 8

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 08-JUL-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1317464**

Sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

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Hong Kong Accreditation Service (HKAS) has accedited this laboratory (ALS Technichem (HK) Pty Ltd) under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS Directory of Accredited Laboratories. The results shown in this certificate were determined by this laboratory in accordance with its terms of accreditation.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV10/ 1.0M	BH-ENV02/ 0.5M	BH-ENV02/ 1.0M	BH-ENV09/ 0.9M	BH-ENV07/ 1.5M
				Client sampling date / time: [28-JUN-2013]	[28-JUN-2013]	[28-JUN-2013]	[28-JUN-2013]	[28-JUN-2013]
				HK1317464-001	HK1317464-002	HK1317464-003	HK1317464-004	HK1317464-005
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	16.0	11.7	12.8	14.0	19.2
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5	<5	<5	<5
C9 - C16 Fraction	----	200	mg/kg	<200	<200	<200	<200	<200
C17 - C35 Fraction	----	500	mg/kg	<500	1040	<500	<500	<500
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	99.5	97.9	84.9	99.5	95.7
4-Terphenyl-d14	1718-51-0	0.1	%	91.6	86.6	89.0	94.2	87.4
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	97.3	101	99.3	99.5	97.6
Toluene-D8	2037-26-5	0.1	%	97.6	98.5	98.5	98.7	97.5
4-Bromofluorobenzene	460-00-4	0.1	%	94.5	92.1	94.9	93.7	95.0

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV07/ 1.5M(A)	BH-ENV07/ 1.5M(B)			
				Client sampling date / time: [28-JUN-2013]	[28-JUN-2013]			
				HK1317464-006	HK1317464-007			
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	16.7	18.7			
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500			
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500			
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500			
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500			
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500			
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500			
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500			
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500			
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500			
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500			
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500			
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500			
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500			
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500			
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500			
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500			
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5			
C9 - C16 Fraction	----	200	mg/kg	<200	<200			
C17 - C35 Fraction	----	500	mg/kg	<500	<500			
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	95.0	102			
4-Terphenyl-d14	1718-51-0	0.1	%	86.3	93.5			
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	98.1	95.8			
Toluene-D8	2037-26-5	0.1	%	97.7	98.2			
4-Bromofluorobenzene	460-00-4	0.1	%	95.4	95.6			

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: EQUIPMENT BLANK Client sampling date / time: [28-JUN-2013] HK1317464-008
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)				
Naphthalene	91-20-3	2.0	µg/L	<2.0
Acenaphthylene	208-96-8	2.0	µg/L	<2.0
Acenaphthene	83-32-9	2.0	µg/L	<2.0
Fluorene	86-73-7	2.0	µg/L	<2.0
Phenanthrene	85-01-8	2.0	µg/L	<2.0
Anthracene	120-12-7	2.0	µg/L	<2.0
Fluoranthene	206-44-0	2.0	µg/L	<2.0
Pyrene	129-00-0	2.0	µg/L	<2.0
Benz(a)anthracene	56-55-3	2.0	µg/L	<2.0
Chrysene	218-01-9	1.0	µg/L	<1.0
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0
Benzo(a)pyrene	50-32-8	2.0	µg/L	<2.0
Indeno(1.2.3.cd)pyrene	193-39-5	2.0	µg/L	<2.0
Dibenz(a.h)anthracene	53-70-3	2.0	µg/L	<2.0
Benzo(g.h.i)perylene	191-24-2	2.0	µg/L	<2.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)				
C6 - C8 Fraction	----	20	µg/L	<20
C9 - C16 Fraction	----	500	µg/L	<500
C17 - C35 Fraction	----	500	µg/L	<500
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates				Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	**51.2**
4-Terphenyl-d14	1718-51-0	0.1	%	**82.8**
EP-080_SRS: TPH(Volatile)/BTEX Surrogate				Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**110**
Toluene-D8	2037-26-5	0.1	%	**99.2**
4-Bromofluorobenzene	460-00-4	0.1	%	**95.3**

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2950514)								
HK1317385-001	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	7.9	7.7	3.0
HK1317606-001	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	31.6	31.7	0.4
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2950554)								
HK1317606-001	Anonymous	Fluoranthene	206-44-0	150	µg/kg	<150	<150	0.0
		Pyrene	129-00-0	150	µg/kg	<150	<150	0.0
		Benz(a)anthracene	56-55-3	150	µg/kg	<150	<150	0.0
		Chrysene	218-01-9	150	µg/kg	<150	<150	0.0
		Benzo(b)fluoranthene	205-99-2	150	µg/kg	<150	<150	0.0
		Benzo(k)fluoranthene	207-08-9	150	µg/kg	<150	<150	0.0
		Benzo(a)pyrene	50-32-8	150	µg/kg	<150	<150	0.0
		Indeno(1.2.3.cd)pyrene	193-39-5	150	µg/kg	<150	<150	0.0
		Dibenz(a.h)anthracene	53-70-3	150	µg/kg	<150	<150	0.0
		Benzo(g.h.i)perylene	191-24-2	150	µg/kg	<150	<150	0.0
		Naphthalene	91-20-3	50	µg/kg	<50	<50	0.0
		Acenaphthylene	208-96-8	50	µg/kg	<50	<50	0.0
		Acenaphthene	83-32-9	50	µg/kg	<50	<50	0.0
		Fluorene	86-73-7	50	µg/kg	<50	<50	0.0
		Phenanthrene	85-01-8	50	µg/kg	<50	<50	0.0
		Anthracene	120-12-7	50	µg/kg	<50	<50	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)								
HK1317305-001	Anonymous	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)								
HK1317593-001	Anonymous	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)								
HK1317305-011	Anonymous	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2950554)											
Naphthalene	91-20-3	25	µg/kg	----	25 µg/kg	86.6	----	63	117	----	----
				<50	----	----	----	----	----	----	----
Acenaphthylene	208-96-8	25	µg/kg	----	25 µg/kg	79.2	----	54	119	----	----
				<50	----	----	----	----	----	----	----
Acenaphthene	83-32-9	25	µg/kg	----	25 µg/kg	92.5	----	59	122	----	----
				<50	----	----	----	----	----	----	----
Fluorene	86-73-7	25	µg/kg	----	25 µg/kg	96.6	----	60	126	----	----

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2950554) - Continued											
Fluorene	86-73-7	50	µg/kg	<50	----	----	----	----	----	----	----
Phenanthrene	85-01-8	25	µg/kg	----	25 µg/kg	98.9	----	60	127	----	----
				<50	----	----	----	----	----	----	----
Anthracene	120-12-7	25	µg/kg	----	25 µg/kg	97.9	----	56	124	----	----
				<50	----	----	----	----	----	----	----
Fluoranthene	206-44-0	25	µg/kg	----	25 µg/kg	93.6	----	61	132	----	----
				<50	----	----	----	----	----	----	----
Pyrene	129-00-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	91.6	----	61	133	----	----
Benz(a)anthracene	56-55-3	25	µg/kg	----	25 µg/kg	99.0	----	57	124	----	----
				<50	----	----	----	----	----	----	----
Chrysene	218-01-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	90.0	----	60	128	----	----
Benzo(b)fluoranthene	205-99-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	90.8	----	48	135	----	----
Benzo(k)fluoranthene	207-08-9	25	µg/kg	----	25 µg/kg	96.7	----	58	133	----	----
				<50	----	----	----	----	----	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	86.3	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	90.0	----	48	134	----	----
Dibenz(a.h)anthracene	53-70-3	25	µg/kg	----	25 µg/kg	101	----	50	137	----	----
				<50	----	----	----	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	25	µg/kg	----	25 µg/kg	102	----	55	140	----	----
				<50	----	----	----	----	----	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	87.2	----	69	139	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	92.1	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	95.3	----	43	99	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2950617)											
Naphthalene	91-20-3	0.2	µg/L	<0.2	0.5 µg/L	77.0	----	34	106	----	----
Acenaphthylene	208-96-8	0.2	µg/L	<0.2	0.5 µg/L	70.3	----	38	92	----	----
Acenaphthene	83-32-9	0.2	µg/L	<0.2	0.5 µg/L	71.9	----	34	100	----	----
Fluorene	86-73-7	0.2	µg/L	<0.2	0.5 µg/L	75.5	----	31	99	----	----
Phenanthrene	85-01-8	0.2	µg/L	<0.2	0.5 µg/L	76.7	----	34	98	----	----
Anthracene	120-12-7	0.2	µg/L	<0.2	0.5 µg/L	63.7	----	42	102	----	----
Fluoranthene	206-44-0	0.2	µg/L	<0.2	0.5 µg/L	74.0	----	55	105	----	----
Pyrene	129-00-0	0.2	µg/L	<0.2	0.5 µg/L	87.7	----	55	107	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2950617) - Continued											
Benz(a)anthracene	56-55-3	0.2	µg/L	<0.2	0.5 µg/L	94.4	----	45	107	----	----
Chrysene	218-01-9	0.2	µg/L	<0.2	0.5 µg/L	94.9	----	65	121	----	----
Benzo(b)fluoranthene	205-99-2	0.2	µg/L	<0.2	0.5 µg/L	95.4	----	52	102	----	----
Benzo(k)fluoranthene	207-08-9	0.2	µg/L	<0.2	0.5 µg/L	104	----	66	121	----	----
Benzo(a)pyrene	50-32-8	0.2	µg/L	<0.2	0.5 µg/L	90.8	----	55	115	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.2	µg/L	<0.2	0.5 µg/L	99.0	----	40	127	----	----
Dibenz(a.h)anthracene	53-70-3	0.2	µg/L	<0.2	0.5 µg/L	100	----	41	109	----	----
Benzo(g.h.i)perylene	191-24-2	0.2	µg/L	<0.2	0.5 µg/L	94.8	----	47	115	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	90.0	----	76	1134	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945439)											
C9 - C16 Fraction	----	0.5	mg/L	<0.5	0.21 mg/L	52.6	----	12	112	----	----
C17 - C35 Fraction	----	0.5	mg/L	<0.5	0.60 mg/L	49.6	----	4	130	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)										
HK1317305-002	Anonymous	C6 - C8 Fraction	----	4.5 mg/kg	88.4	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)										
HK1317593-002	Anonymous	C9 - C16 Fraction	----	32 mg/kg	85.0	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	78.3	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%) Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates - Continued			
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 9
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Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 02-JUL-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H025604			No. of samples received	: 10
Site	: SHA TIN SEWAGE TREATMENT PLANT			No. of samples analysed	: 10

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 08-JUL-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1317593**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV12/ 0.5M	BH-ENV11/ 0.5M	BH-ENV13/ 0.5M	BH-ENV01/ 0.5M	BH-ENV12/ 1.0M
				Client sampling date / time: [02-JUL-2013]	[02-JUL-2013]	[02-JUL-2013]	[02-JUL-2013]	[02-JUL-2013]
				HK1317593-001	HK1317593-002	HK1317593-003	HK1317593-004	HK1317593-005
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	8.7	13.8	11.9	6.8	16.6
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5	<5	<5	<5
C9 - C16 Fraction	----	200	mg/kg	<200	<200	<200	<200	<200
C17 - C35 Fraction	----	500	mg/kg	<500	<500	<500	<500	<500
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	77.4	83.6	91.0	77.1	82.2
4-Terphenyl-d14	1718-51-0	0.1	%	74.6	88.6	94.7	80.4	87.9
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	97.3	98.2	96.5	96.0	101
Toluene-D8	2037-26-5	0.1	%	98.0	99.2	98.4	96.9	98.5
4-Bromofluorobenzene	460-00-4	0.1	%	96.0	96.1	95.8	94.2	96.4

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV11/ 1.0M	BH-ENV13/ 1.0M			
				Client sampling date / time: [02-JUL-2013]	[02-JUL-2013]			
				HK1317593-006	HK1317593-007			
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	15.2	15.0			
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500			
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500			
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500			
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500			
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500			
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500			
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500			
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500			
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500			
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500			
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500			
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500			
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500			
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500			
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500			
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500			
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5			
C9 - C16 Fraction	----	200	mg/kg	<200	<200			
C17 - C35 Fraction	----	500	mg/kg	<500	<500			
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	80.4	81.2			
4-Terphenyl-d14	1718-51-0	0.1	%	83.2	85.9			
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	94.1	97.4			
Toluene-D8	2037-26-5	0.1	%	98.7	98.6			
4-Bromofluorobenzene	460-00-4	0.1	%	96.5	96.3			

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV07 (G.W) 1.6M	BH-ENV09 (G.W) 1.0M	BH-ENV02 (G.W) 1.15M		
				Client sampling date / time: [02-JUL-2013]	[02-JUL-2013]	[02-JUL-2013]		
				HK1317593-008	HK1317593-009	HK1317593-010		
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	2.0	µg/L	<2.0	<2.0	<2.0		
Acenaphthylene	208-96-8	2.0	µg/L	<2.0	<2.0	<2.0		
Acenaphthene	83-32-9	2.0	µg/L	<2.0	<2.0	<2.0		
Fluorene	86-73-7	2.0	µg/L	<2.0	<2.0	<2.0		
Phenanthrene	85-01-8	2.0	µg/L	<2.0	<2.0	<2.0		
Anthracene	120-12-7	2.0	µg/L	<2.0	<2.0	<2.0		
Fluoranthene	206-44-0	2.0	µg/L	<2.0	<2.0	<2.0		
Pyrene	129-00-0	2.0	µg/L	<2.0	<2.0	<2.0		
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0		
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	<1.0		
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	20	µg/L	<20	<20	<20		
C9 - C16 Fraction	----	500	µg/L	<500	<500	<500		
C17 - C35 Fraction	----	500	µg/L	<500	<500	1200		
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	83.9	58.3	61.4		
4-Terphenyl-d14	1718-51-0	0.1	%	103	106	95.0		
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	104	108	104		
Toluene-D8	2037-26-5	0.1	%	102	100	101		
4-Bromofluorobenzene	460-00-4	0.1	%	96.7	95.3	96.8		

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2953305)								
HK1317598-004	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	19.7	19.8	0.0
HK1317598-001	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	18.6	17.5	5.7
EA/ED: Physical and Aggregate Properties (QC Lot: 2953306)								
HK1317593-005	BH-ENV12/ 1.0M	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	16.6	17.2	3.2
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2950554)								
HK1317606-001	Anonymous	Fluoranthene	206-44-0	150	µg/kg	<150	<150	0.0
		Pyrene	129-00-0	150	µg/kg	<150	<150	0.0
		Benz(a)anthracene	56-55-3	150	µg/kg	<150	<150	0.0
		Chrysene	218-01-9	150	µg/kg	<150	<150	0.0
		Benzo(b)fluoranthene	205-99-2	150	µg/kg	<150	<150	0.0
		Benzo(k)fluoranthene	207-08-9	150	µg/kg	<150	<150	0.0
		Benzo(a)pyrene	50-32-8	150	µg/kg	<150	<150	0.0
		Indeno(1.2.3.cd)pyrene	193-39-5	150	µg/kg	<150	<150	0.0
		Dibenz(a.h)anthracene	53-70-3	150	µg/kg	<150	<150	0.0
		Benzo(g.h.i)perylene	191-24-2	150	µg/kg	<150	<150	0.0
		Naphthalene	91-20-3	50	µg/kg	<50	<50	0.0
		Acenaphthylene	208-96-8	50	µg/kg	<50	<50	0.0
		Acenaphthene	83-32-9	50	µg/kg	<50	<50	0.0
		Fluorene	86-73-7	50	µg/kg	<50	<50	0.0
		Phenanthrene	85-01-8	50	µg/kg	<50	<50	0.0
		Anthracene	120-12-7	50	µg/kg	<50	<50	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)								
HK1317305-001	Anonymous	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)								
HK1317593-001	BH-ENV12/ 0.5M	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950620)								
HK1317593-001	BH-ENV12/ 0.5M	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)								
HK1317305-011	Anonymous	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2950554)											
Naphthalene	91-20-3	25	µg/kg	----	25 µg/kg	86.6	----	63	117	----	----
				<50	----	----	----	----	----	----	----
Acenaphthylene	208-96-8	25	µg/kg	----	25 µg/kg	79.2	----	54	119	----	----

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report LOR	Unit	Result	Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report: Spike Concentration	Spike Recovery (%) LCS	Spike Recovery (%) DCS	Recovery Limits (%) Low	Recovery Limits (%) High	RPD (%) Value	RPD (%) Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2950554) - Continued											
Acenaphthylene	208-96-8	50	µg/kg	<50	----	----	----	----	----	----	----
Acenaphthene	83-32-9	25	µg/kg	----	25 µg/kg	92.5	----	59	122	----	----
				<50	----	----	----	----	----	----	----
Fluorene	86-73-7	25	µg/kg	----	25 µg/kg	96.6	----	60	126	----	----
				<50	----	----	----	----	----	----	----
Phenanthrene	85-01-8	25	µg/kg	----	25 µg/kg	98.9	----	60	127	----	----
				<50	----	----	----	----	----	----	----
Anthracene	120-12-7	25	µg/kg	----	25 µg/kg	97.9	----	56	124	----	----
				<50	----	----	----	----	----	----	----
Fluoranthene	206-44-0	25	µg/kg	----	25 µg/kg	93.6	----	61	132	----	----
				<50	----	----	----	----	----	----	----
Pyrene	129-00-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	91.6	----	61	133	----	----
Benz(a)anthracene	56-55-3	25	µg/kg	----	25 µg/kg	99.0	----	57	124	----	----
				<50	----	----	----	----	----	----	----
Chrysene	218-01-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	90.0	----	60	128	----	----
Benzo(b)fluoranthene	205-99-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	90.8	----	48	135	----	----
Benzo(k)fluoranthene	207-08-9	25	µg/kg	----	25 µg/kg	96.7	----	58	133	----	----
				<50	----	----	----	----	----	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	86.3	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	90.0	----	48	134	----	----
Dibenz(a.h)anthracene	53-70-3	25	µg/kg	----	25 µg/kg	101	----	50	137	----	----
				<50	----	----	----	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	25	µg/kg	----	25 µg/kg	102	----	55	140	----	----
				<50	----	----	----	----	----	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	87.2	----	69	139	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	92.1	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	95.3	----	43	99	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950620)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	89.0	----	69	139	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report LOR	Unit	Result	Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report: Spike Concentration	Spike Recovery (%) LCS	Spike Recovery (%) DCS	Recovery Limits (%) Low	Recovery Limits (%) High	RPD (%) Value	RPD (%) Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2950617)											
Naphthalene	91-20-3	0.2	µg/L	<0.2	0.5 µg/L	77.0	----	34	106	----	----
Acenaphthylene	208-96-8	0.2	µg/L	<0.2	0.5 µg/L	70.3	----	38	92	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2950617) - Continued											
Acenaphthene	83-32-9	0.2	µg/L	<0.2	0.5 µg/L	71.9	----	34	100	----	----
Fluorene	86-73-7	0.2	µg/L	<0.2	0.5 µg/L	75.5	----	31	99	----	----
Phenanthrene	85-01-8	0.2	µg/L	<0.2	0.5 µg/L	76.7	----	34	98	----	----
Anthracene	120-12-7	0.2	µg/L	<0.2	0.5 µg/L	63.7	----	42	102	----	----
Fluoranthene	206-44-0	0.2	µg/L	<0.2	0.5 µg/L	74.0	----	55	105	----	----
Pyrene	129-00-0	0.2	µg/L	<0.2	0.5 µg/L	87.7	----	55	107	----	----
Chrysene	218-01-9	0.2	µg/L	<0.2	0.5 µg/L	94.9	----	65	121	----	----
Benzo(b)fluoranthene	205-99-2	0.2	µg/L	<0.2	0.5 µg/L	95.4	----	52	102	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	90.0	----	76	1134	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945439)											
C9 - C16 Fraction	----	0.5	mg/L	<0.5	0.21 mg/L	52.6	----	12	112	----	----
C17 - C35 Fraction	----	0.5	mg/L	<0.5	0.60 mg/L	49.6	----	4	130	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945367)										
HK1317305-002	Anonymous	C6 - C8 Fraction	----	4.5 mg/kg	88.4	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)										
HK1317593-002	BH-ENV11/ 0.5M	C9 - C16 Fraction	----	32 mg/kg	85.0	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	78.3	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950620)										
HK1317593-002	BH-ENV11/ 0.5M	C6 - C8 Fraction	----	4.5 mg/kg	97.9	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%) Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 7
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Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 03-JUL-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H025605			No. of samples received	: 6
Site	: SHA TIN SEWAGE TREATMENT PLANT			No. of samples analysed	: 6

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 08-JUL-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1317598**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV11/ 3.0M Client sampling date / time: [03-JUL-2013] HK1317598-001	BH-ENV12/ 2.2M [03-JUL-2013] HK1317598-002	BH-ENV5/ 2.5M [03-JUL-2013] HK1317598-003	BH-ENV2/ 1.1M [03-JUL-2013] HK1317598-004	
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	18.6	23.7	18.9	19.7	
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5	<5	<5	
C9 - C16 Fraction	----	200	mg/kg	<200	<200	<200	<200	
C17 - C35 Fraction	----	500	mg/kg	<500	<500	<500	<500	
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	92.7	101	94.4	96.4	
4-Terphenyl-d14	1718-51-0	0.1	%	85.7	90.8	87.4	91.0	
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	99.3	98.7	96.8	98.2	
Toluene-D8	2037-26-5	0.1	%	97.7	97.9	98.1	98.8	
4-Bromofluorobenzene	460-00-4	0.1	%	95.6	95.3	95.1	95.0	

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV12 (G.W) 2.3M Client sampling date / time: [03-JUL-2013] HK1317598-005	Client sample ID: BH-ENV5 (G.W) 2.73M Client sampling date / time: [03-JUL-2013] HK1317598-006			
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	2.0	µg/L	<2.0	<2.0			
Acenaphthylene	208-96-8	2.0	µg/L	<2.0	<2.0			
Acenaphthene	83-32-9	2.0	µg/L	<2.0	<2.0			
Fluorene	86-73-7	2.0	µg/L	<2.0	<2.0			
Phenanthrene	85-01-8	2.0	µg/L	<2.0	<2.0			
Anthracene	120-12-7	2.0	µg/L	<2.0	<2.0			
Fluoranthene	206-44-0	2.0	µg/L	<2.0	<2.0			
Pyrene	129-00-0	2.0	µg/L	<2.0	<2.0			
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0			
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0			
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	20	µg/L	<20	<20			
C9 - C16 Fraction	----	500	µg/L	<500	<500			
C17 - C35 Fraction	----	500	µg/L	<500	<500			
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	**81.8**	**70.1**			
4-Terphenyl-d14	1718-51-0	0.1	%	**95.3**	**113**			
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**108**	**99.7**			
Toluene-D8	2037-26-5	0.1	%	**102**	**100**			
4-Bromofluorobenzene	460-00-4	0.1	%	**97.1**	**97.8**			

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2953306)								
HK1317593-005	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	16.6	17.2	3.2
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2945371)								
HK1317305-001	Anonymous	Naphthalene	91-20-3	500	µg/kg	<500	<500	0.0
		Acenaphthylene	208-96-8	500	µg/kg	<500	<500	0.0
		Acenaphthene	83-32-9	500	µg/kg	<500	<500	0.0
		Fluorene	86-73-7	500	µg/kg	<500	<500	0.0
		Phenanthrene	85-01-8	500	µg/kg	<500	<500	0.0
		Anthracene	120-12-7	500	µg/kg	<500	<500	0.0
		Fluoranthene	206-44-0	500	µg/kg	<500	<500	0.0
		Pyrene	129-00-0	500	µg/kg	<500	<500	0.0
		Benz(a)anthracene	56-55-3	500	µg/kg	<500	<500	0.0
		Chrysene	218-01-9	500	µg/kg	<500	<500	0.0
		Benzo(b)fluoranthene	205-99-2	500	µg/kg	<500	<500	0.0
		Benzo(k)fluoranthene	207-08-9	500	µg/kg	<500	<500	0.0
		Benzo(a)pyrene	50-32-8	500	µg/kg	<500	<500	0.0
		Indeno(1.2.3.cd)pyrene	193-39-5	500	µg/kg	<500	<500	0.0
		Dibenz(a.h)anthracene	53-70-3	500	µg/kg	<500	<500	0.0
		Benzo(g.h.i)perylene	191-24-2	500	µg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)								
HK1317593-001	Anonymous	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950620)								
HK1317593-001	Anonymous	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)								
HK1317305-011	Anonymous	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2945371)											
Naphthalene	91-20-3	25	µg/kg	----	25 µg/kg	90.0	----	63	117	----	----
				<50	----	----	----	----	----	----	----
Acenaphthylene	208-96-8	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.8	----	54	119	----	----
Acenaphthene	83-32-9	25	µg/kg	----	25 µg/kg	82.6	----	59	122	----	----
				<50	----	----	----	----	----	----	----
Fluorene	86-73-7	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	84.8	----	60	126	----	----

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2945371) - Continued											
Phenanthrene	85-01-8	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.3	----	60	127	----	----
Anthracene	120-12-7	25	µg/kg	----	25 µg/kg	97.4	----	56	124	----	----
				<50	----	----	----	----	----	----	----
Fluoranthene	206-44-0	25	µg/kg	----	25 µg/kg	97.3	----	61	132	----	----
				<50	----	----	----	----	----	----	----
Pyrene	129-00-0	25	µg/kg	----	25 µg/kg	101	----	61	133	----	----
				<50	----	----	----	----	----	----	----
Benz(a)anthracene	56-55-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	94.7	----	57	124	----	----
Chrysene	218-01-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	99.5	----	60	128	----	----
Benzo(b)fluoranthene	205-99-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	94.8	----	48	135	----	----
Benzo(k)fluoranthene	207-08-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.6	----	58	133	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	96.7	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	25	µg/kg	----	25 µg/kg	80.7	----	48	134	----	----
				<50	----	----	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	86.0	----	50	137	----	----
Benzo(g.h.i)perylene	191-24-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	91.8	----	55	140	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	92.1	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	95.3	----	43	99	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950620)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	89.0	----	69	139	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2950617)											
Naphthalene	91-20-3	0.2	µg/L	<0.2	0.5 µg/L	77.0	----	34	106	----	----
Acenaphthylene	208-96-8	0.2	µg/L	<0.2	0.5 µg/L	70.3	----	38	92	----	----
Acenaphthene	83-32-9	0.2	µg/L	<0.2	0.5 µg/L	71.9	----	34	100	----	----
Fluorene	86-73-7	0.2	µg/L	<0.2	0.5 µg/L	75.5	----	31	99	----	----
Phenanthrene	85-01-8	0.2	µg/L	<0.2	0.5 µg/L	76.7	----	34	98	----	----
Anthracene	120-12-7	0.2	µg/L	<0.2	0.5 µg/L	63.7	----	42	102	----	----
Fluoranthene	206-44-0	0.2	µg/L	<0.2	0.5 µg/L	74.0	----	55	105	----	----
Pyrene	129-00-0	0.2	µg/L	<0.2	0.5 µg/L	87.7	----	55	107	----	----
Chrysene	218-01-9	0.2	µg/L	<0.2	0.5 µg/L	94.9	----	65	121	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2950617) - Continued											
Benzo(b)fluoranthene	205-99-2	0.2	µg/L	<0.2	0.5 µg/L	95.4	----	52	102	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945385)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	90.0	----	76	1134	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2945439)											
C9 - C16 Fraction	----	0.5	mg/L	<0.5	0.21 mg/L	52.6	----	12	112	----	----
C17 - C35 Fraction	----	0.5	mg/L	<0.5	0.60 mg/L	49.6	----	4	130	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950614)										
HK1317593-002	Anonymous	C9 - C16 Fraction	----	32 mg/kg	85.0	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	78.3	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2950620)										
HK1317593-002	Anonymous	C6 - C8 Fraction	----	4.5 mg/kg	97.9	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 7
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Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 12-JUL-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H025607			No. of samples received	: 4
Site	: ----			No. of samples analysed	: 4

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 17-JUL-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1318887**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV3A 0.80M	BH-ENV8A 0.85M			
				Client sampling date / time: [12-JUL-2013]	[12-JUL-2013]			
				HK1318887-002	HK1318887-004			
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	21.2	18.8			
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500			
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500			
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500			
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500			
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500			
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500			
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500			
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500			
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500			
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500			
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500			
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500			
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500			
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500			
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500			
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500			
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5			
C9 - C16 Fraction	----	200	mg/kg	<200	<200			
C17 - C35 Fraction	----	500	mg/kg	<500	<500			
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	91.4	72.5			
4-Terphenyl-d14	1718-51-0	0.1	%	98.4	97.6			
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	94.5	99.0			
Toluene-D8	2037-26-5	0.1	%	99.3	99.6			
4-Bromofluorobenzene	460-00-4	0.1	%	98.1	99.2			

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV3A (GW) 0.85M Client sampling date / time: [12-JUL-2013] HK1318887-001	Client sample ID: BH-ENV8A (GW) 0.9M Client sampling date / time: [12-JUL-2013] HK1318887-003			
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	2.0	µg/L	<2.0	<2.0			
Acenaphthylene	208-96-8	2.0	µg/L	<2.0	<2.0			
Acenaphthene	83-32-9	2.0	µg/L	<2.0	<2.0			
Fluorene	86-73-7	2.0	µg/L	<2.0	<2.0			
Phenanthrene	85-01-8	2.0	µg/L	<2.0	<2.0			
Anthracene	120-12-7	2.0	µg/L	<2.0	<2.0			
Fluoranthene	206-44-0	2.0	µg/L	<2.0	<2.0			
Pyrene	129-00-0	2.0	µg/L	<2.0	<2.0			
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0			
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0			
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	20	µg/L	<20	<20			
C9 - C16 Fraction	----	500	µg/L	<500	<500			
C17 - C35 Fraction	----	500	µg/L	<500	<500			
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	**70.2**	**52.6**			
4-Terphenyl-d14	1718-51-0	0.1	%	**92.8**	**104**			
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**99.8**	**107**			
Toluene-D8	2037-26-5	0.1	%	**103**	**100**			
4-Bromofluorobenzene	460-00-4	0.1	%	**101**	**98.8**			

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2966734)								
HK1318730-021	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	16.6	16.2	2.5
HK1318730-026	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	16.3	16.3	0.0
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2966697)								
HK1318970-001	Anonymous	Fluoranthene	206-44-0	150	µg/kg	333	317	4.9
		Pyrene	129-00-0	150	µg/kg	402	364	10.0
		Benz(a)anthracene	56-55-3	150	µg/kg	243	230	5.5
		Chrysene	218-01-9	150	µg/kg	234	228	2.7
		Benzo(b)fluoranthene	205-99-2	150	µg/kg	485	495	2.1
		Benzo(k)fluoranthene	207-08-9	150	µg/kg	228	204	10.7
		Benzo(a)pyrene	50-32-8	150	µg/kg	371	336	9.9
		Indeno(1.2.3.cd)pyrene	193-39-5	150	µg/kg	355	349	1.8
		Dibenz(a.h)anthracene	53-70-3	150	µg/kg	<150	<150	0.0
		Benzo(g.h.i)perylene	191-24-2	150	µg/kg	348	350	0.7
		Naphthalene	91-20-3	50	µg/kg	<50	<50	0.0
		Acenaphthylene	208-96-8	50	µg/kg	<50	<50	0.0
		Acenaphthene	83-32-9	50	µg/kg	<50	<50	0.0
		Fluorene	86-73-7	50	µg/kg	<50	<50	0.0
		Phenanthrene	85-01-8	50	µg/kg	114	117	2.3
		Anthracene	120-12-7	50	µg/kg	55	56	2.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966700)								
HK1318887-002	BH-ENV3A 0.80M	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966727)								
HK1318887-002	BH-ENV3A 0.80M	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2968462)								
HK1318887-001	BH-ENV3A (GW) 0.85M	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2966697)											
Naphthalene	91-20-3	25	µg/kg	----	25 µg/kg	102	----	63	117	----	----
				<50	----	----	----	----	----	----	----
Acenaphthylene	208-96-8	25	µg/kg	----	25 µg/kg	91.0	----	54	119	----	----
				<50	----	----	----	----	----	----	----
Acenaphthene	83-32-9	25	µg/kg	----	25 µg/kg	95.1	----	59	122	----	----
				<50	----	----	----	----	----	----	----
Fluorene	86-73-7	50	µg/kg	<50	----	----	----	----	----	----	----

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2966697) - Continued											
Fluorene	86-73-7	25	µg/kg	----	25 µg/kg	92.4	----	60	126	----	----
Phenanthrene	85-01-8	25	µg/kg	----	25 µg/kg	97.7	----	60	127	----	----
				<50	----	----	----	----	----	----	----
Anthracene	120-12-7	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	91.4	----	56	124	----	----
Fluoranthene	206-44-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	99.1	----	61	132	----	----
Pyrene	129-00-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	101	----	61	133	----	----
Benz(a)anthracene	56-55-3	25	µg/kg	----	25 µg/kg	100	----	57	124	----	----
				<50	----	----	----	----	----	----	----
Chrysene	218-01-9	25	µg/kg	----	25 µg/kg	97.8	----	60	128	----	----
				<50	----	----	----	----	----	----	----
Benzo(b)fluoranthene	205-99-2	25	µg/kg	----	25 µg/kg	101	----	48	135	----	----
				<50	----	----	----	----	----	----	----
Benzo(k)fluoranthene	207-08-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	108	----	58	133	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	94.8	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	25	µg/kg	----	25 µg/kg	99.3	----	48	134	----	----
				<50	----	----	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	97.6	----	50	137	----	----
Benzo(g.h.i)perylene	191-24-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	89.8	----	55	140	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966700)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	96.5	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	89.0	----	43	99	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966727)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	89.9	----	69	139	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2966724)											
Naphthalene	91-20-3	0.2	µg/L	<0.2	0.5 µg/L	70.9	----	34	106	----	----
Acenaphthylene	208-96-8	0.2	µg/L	<0.2	0.5 µg/L	82.8	----	38	92	----	----
Acenaphthene	83-32-9	0.2	µg/L	<0.2	0.5 µg/L	81.4	----	34	100	----	----
Fluorene	86-73-7	0.2	µg/L	<0.2	0.5 µg/L	70.7	----	31	99	----	----
Phenanthrene	85-01-8	0.2	µg/L	<0.2	0.5 µg/L	75.7	----	34	98	----	----
Anthracene	120-12-7	0.2	µg/L	<0.2	0.5 µg/L	79.4	----	42	102	----	----
Fluoranthene	206-44-0	0.2	µg/L	<0.2	0.5 µg/L	94.3	----	55	105	----	----
Pyrene	129-00-0	0.2	µg/L	<0.2	0.5 µg/L	96.7	----	55	107	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2966724) - Continued											
Chrysene	218-01-9	0.2	µg/L	<0.2	0.5 µg/L	98.3	----	65	121	----	----
Benzo(b)fluoranthene	205-99-2	0.2	µg/L	<0.2	0.5 µg/L	97.4	----	52	102	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966725)											
C9 - C16 Fraction	----	0.5	mg/L	<0.5	0.21 mg/L	49.4	----	12	112	----	----
C17 - C35 Fraction	----	0.5	mg/L	<0.5	0.60 mg/L	50.9	----	4	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2968462)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	85.9	----	76	1134	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966700)										
HK1318887-004	BH-ENV8A 0.85M	C9 - C16 Fraction	----	32 mg/kg	73.7	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	74.2	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966727)										
HK1318887-004	BH-ENV8A 0.85M	C6 - C8 Fraction	----	4.5 mg/kg	91.1	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 6
Contact	: MR SUN NG	Contact	: Fung Lim Chee, Richard	Work Order	: HK1318896
Address	: GEOTECHNICAL PROJECTS DIVISION, GEOTECHNICAL ENGINEERING OFFICE, 23/F., KWUN TONG VIEW, 410 KWUN TONG ROAD, KOWLOON, HONG KONG	Address	: 11/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong	Amendment	: 1
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Telephone	: ----	Telephone	: +852 2610 1044		
Facsimile	: ----	Facsimile	: +852 2610 2021		
Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 12-JUL-2013
Order number	: GE/2012/24.11			Issue Date	: 22-AUG-2013
C-O-C number	: H025606			No. of samples received	: 5
Site	: ----			No. of samples analysed	: 5

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 19-AUG-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1318896**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Sample(s) were received in a chilled condition.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

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Hong Kong Accreditation Service (HKAS) has accedited this laboratory (ALS Technichem (HK) Pty Ltd) under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS Directory of Accredited Laboratories. The results shown in this certificate were determined by this laboratory in accordance with its terms of accreditation.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV10 3.0M	BH-ENV06 0.73M	BH-ENV01 0.83M	BH-ENV3A 0.5M	BH-ENV8A 0.5M
			Client sampling date / time	[11-JUL-2013]	[11-JUL-2013]	[11-JUL-2013]	[11-JUL-2013]	[11-JUL-2013]
				HK1318896-001	HK1318896-002	HK1318896-003	HK1318896-004	HK1318896-005
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	18.5	17.9	16.3	15.5	16.1
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500	<0.500	<0.500	<0.500
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5	<5	<5	<5
C9 - C16 Fraction	----	200	mg/kg	<200	<200	<200	<200	<200
C17 - C35 Fraction	----	500	mg/kg	<500	<500	<500	<500	<500
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	107	87.0	84.6	88.9	84.0
4-Terphenyl-d14	1718-51-0	0.1	%	110	96.6	96.2	98.1	89.4
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	93.5	95.6	92.5	96.4	98.8
Toluene-D8	2037-26-5	0.1	%	97.6	98.8	98.6	98.3	99.4
4-Bromofluorobenzene	460-00-4	0.1	%	101	96.8	97.7	96.6	98.6

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2966734)								
HK1318730-021	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	16.6	16.2	2.5
HK1318730-026	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	16.3	16.3	0.0
EA/ED: Physical and Aggregate Properties (QC Lot: 3018791)								
HK1318896-001	BH-ENV10 3.0M	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	18.5	18.2	1.8
HK1322092-002	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	9.6	9.5	1.1
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2966697)								
HK1318970-001	Anonymous	Fluoranthene	206-44-0	150	µg/kg	333	317	4.9
		Pyrene	129-00-0	150	µg/kg	402	364	10.0
		Benz(a)anthracene	56-55-3	150	µg/kg	243	230	5.5
		Chrysene	218-01-9	150	µg/kg	234	228	2.7
		Benzo(b)fluoranthene	205-99-2	150	µg/kg	485	495	2.1
		Benzo(k)fluoranthene	207-08-9	150	µg/kg	228	204	10.7
		Benzo(a)pyrene	50-32-8	150	µg/kg	371	336	9.9
		Indeno(1.2.3.cd)pyrene	193-39-5	150	µg/kg	355	349	1.8
		Dibenz(a.h)anthracene	53-70-3	150	µg/kg	<150	<150	0.0
		Benzo(g.h.i)perylene	191-24-2	150	µg/kg	348	350	0.7
		Naphthalene	91-20-3	50	µg/kg	<50	<50	0.0
		Acenaphthylene	208-96-8	50	µg/kg	<50	<50	0.0
		Acenaphthene	83-32-9	50	µg/kg	<50	<50	0.0
		Fluorene	86-73-7	50	µg/kg	<50	<50	0.0
		Phenanthrene	85-01-8	50	µg/kg	114	117	2.3
		Anthracene	120-12-7	50	µg/kg	55	56	2.0
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 3013444)								
HK1318896-001	BH-ENV10 3.0M	Naphthalene	91-20-3	500	µg/kg	<500	<500	0.0
		Acenaphthylene	208-96-8	500	µg/kg	<500	<500	0.0
		Acenaphthene	83-32-9	500	µg/kg	<500	<500	0.0
		Fluorene	86-73-7	500	µg/kg	<500	<500	0.0
		Phenanthrene	85-01-8	500	µg/kg	<500	<500	0.0
		Anthracene	120-12-7	500	µg/kg	<500	<500	0.0
		Fluoranthene	206-44-0	500	µg/kg	<500	<500	0.0
		Pyrene	129-00-0	500	µg/kg	<500	<500	0.0
		Benz(a)anthracene	56-55-3	500	µg/kg	<500	<500	0.0
		Chrysene	218-01-9	500	µg/kg	<500	<500	0.0
		Benzo(b)fluoranthene	205-99-2	500	µg/kg	<500	<500	0.0
		Benzo(k)fluoranthene	207-08-9	500	µg/kg	<500	<500	0.0
		Benzo(a)pyrene	50-32-8	500	µg/kg	<500	<500	0.0
		Indeno(1.2.3.cd)pyrene	193-39-5	500	µg/kg	<500	<500	0.0
		Dibenz(a.h)anthracene	53-70-3	500	µg/kg	<500	<500	0.0
		Benzo(g.h.i)perylene	191-24-2	500	µg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966700)								
HK1318887-002	Anonymous	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966727)								
HK1318887-002	Anonymous	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 3004350)								
HK1321360-001	Anonymous	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 3004354)								
HK1321360-001	Anonymous	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2966697)											
Naphthalene	91-20-3	25	µg/kg	---- <50	25 µg/kg ----	102 ----	---- ----	63 ----	117 ----	---- ----	---- ----
Acenaphthylene	208-96-8	25	µg/kg	---- <50	25 µg/kg ----	91.0 ----	---- ----	54 ----	119 ----	---- ----	---- ----
Acenaphthene	83-32-9	25	µg/kg	---- <50	25 µg/kg ----	95.1 ----	---- ----	59 ----	122 ----	---- ----	---- ----
Fluorene	86-73-7	50	µg/kg	<50 ----	---- 25 µg/kg	---- 92.4	---- ----	---- 60	---- 126	---- ----	---- ----
Phenanthrene	85-01-8	25	µg/kg	---- <50	25 µg/kg ----	97.7 ----	---- ----	60 ----	127 ----	---- ----	---- ----
Anthracene	120-12-7	50	µg/kg	<50 ----	---- 25 µg/kg	---- 91.4	---- ----	---- 56	---- 124	---- ----	---- ----
Fluoranthene	206-44-0	50	µg/kg	<50 ----	---- 25 µg/kg	---- 99.1	---- ----	---- 61	---- 132	---- ----	---- ----
Pyrene	129-00-0	50	µg/kg	<50 ----	---- 25 µg/kg	---- 101	---- ----	---- 61	---- 133	---- ----	---- ----
Benz(a)anthracene	56-55-3	25	µg/kg	---- <50	25 µg/kg ----	100 ----	---- ----	57 ----	124 ----	---- ----	---- ----
Chrysene	218-01-9	25	µg/kg	---- <50	25 µg/kg ----	97.8 ----	---- ----	60 ----	128 ----	---- ----	---- ----
Benzo(b)fluoranthene	205-99-2	25	µg/kg	---- <50	25 µg/kg ----	101 ----	---- ----	48 ----	135 ----	---- ----	---- ----
Benzo(k)fluoranthene	207-08-9	50	µg/kg	<50 ----	---- 25 µg/kg	---- 108	---- ----	---- 58	---- 133	---- ----	---- ----
Benzo(a)pyrene	50-32-8	25	µg/kg	---- <50	25 µg/kg ----	94.8 ----	---- ----	50 ----	124 ----	---- ----	---- ----
Indeno(1.2.3.cd)pyrene	193-39-5	25	µg/kg	---- <50	25 µg/kg ----	99.3 ----	---- ----	48 ----	134 ----	---- ----	---- ----
Dibenz(a.h)anthracene	53-70-3	50	µg/kg	<50 ----	---- 25 µg/kg	---- 97.6	---- ----	---- 50	---- 137	---- ----	---- ----
Benzo(g.h.i)perylene	191-24-2	50	µg/kg	<50 ----	---- 25 µg/kg	---- 89.8	---- ----	---- 55	---- 140	---- ----	---- ----

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 3013444)											
Naphthalene	91-20-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	102	----	63	117	----	----
Acenaphthylene	208-96-8	25	µg/kg	----	25 µg/kg	101	----	54	119	----	----
				<50	----	----	----	----	----	----	----
Acenaphthene	83-32-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	100	----	59	122	----	----
Fluorene	86-73-7	25	µg/kg	----	25 µg/kg	103	----	60	126	----	----
				<50	----	----	----	----	----	----	----
Phenanthrene	85-01-8	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	102	----	60	127	----	----
Anthracene	120-12-7	25	µg/kg	----	25 µg/kg	99.4	----	56	124	----	----
				<50	----	----	----	----	----	----	----
Fluoranthene	206-44-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	101	----	61	132	----	----
Pyrene	129-00-0	25	µg/kg	----	25 µg/kg	101	----	61	133	----	----
				<50	----	----	----	----	----	----	----
Benz(a)anthracene	56-55-3	25	µg/kg	----	25 µg/kg	97.3	----	57	124	----	----
				<50	----	----	----	----	----	----	----
Chrysene	218-01-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	99.5	----	60	128	----	----
Benzo(b)fluoranthene	205-99-2	25	µg/kg	----	25 µg/kg	99.3	----	48	135	----	----
				<50	----	----	----	----	----	----	----
Benzo(k)fluoranthene	207-08-9	25	µg/kg	----	25 µg/kg	100	----	58	133	----	----
				<50	----	----	----	----	----	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	101	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	92.2	----	48	134	----	----
Dibenz(a.h)anthracene	53-70-3	25	µg/kg	----	25 µg/kg	92.9	----	50	137	----	----
				<50	----	----	----	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	96.2	----	55	140	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966700)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	96.5	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	89.0	----	43	99	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966727)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	89.9	----	69	139	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 3004350)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	93.2	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	67.7	----	43	99	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 3004354)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	85.5	----	69	139	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966700)										
HK1318887-004	Anonymous	C9 - C16 Fraction	----	32 mg/kg	73.7	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	74.2	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966727)										
HK1318887-004	Anonymous	C6 - C8 Fraction	----	4.5 mg/kg	91.1	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 3004350)										
HK1321360-002	Anonymous	C9 - C16 Fraction	----	32 mg/kg	69.7	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	71.0	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 3004354)										
HK1321360-002	Anonymous	C6 - C8 Fraction	----	4.5 mg/kg	80.8	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

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ANALYTICAL CHEMISTRY & TESTING SERVICES

HOKLAS 066 TEST

CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 7
Contact	: MR SUN NG	Contact	: Fung Lim Chee, Richard	Work Order	: HK1320318
Address	: GEOTECHNICAL PROJECTS DIVISION, GEOTECHNICAL ENGINEERING OFFICE, 23/F., KWUN TONG VIEW, 410 KWUN TONG ROAD, KOWLOON, HONG KONG	Address	: 11/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong	Amendment	: 1
E-mail	: sunng@cedd.gov.hk	E-mail	: Richard.Fung@alsglobal.com		
Telephone	: ----	Telephone	: +852 2610 1044		
Facsimile	: ----	Facsimile	: +852 2610 2021		
Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 29-JUL-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H025609			No. of samples received	: 4
Site	: ----			No. of samples analysed	: 4

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	Senior Chemist - Organics	Organics
Ng Chun Hoi, Michael	Chemist - Inorganics	Inorganics

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 02-AUG-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1320318**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on a dry weight basis.

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV4A 0.5M	BH-ENV4A 1.0M	BH-ENV4A 1.8M		
				Client sampling date / time: [29-JUL-2013]	[29-JUL-2013]	[29-JUL-2013]		
				HK1320318-001	HK1320318-002	HK1320318-003		
EA/ED: Physical and Aggregate Properties								
EA055: Moisture Content (dried @ 103° C)	----	0.1	%	16.1	15.9	10.0		
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	0.500	mg/kg	<0.500	<0.500	<0.500		
Acenaphthylene	208-96-8	0.500	mg/kg	<0.500	<0.500	<0.500		
Acenaphthene	83-32-9	0.500	mg/kg	<0.500	<0.500	<0.500		
Fluorene	86-73-7	0.500	mg/kg	<0.500	<0.500	<0.500		
Phenanthrene	85-01-8	0.500	mg/kg	<0.500	<0.500	<0.500		
Anthracene	120-12-7	0.500	mg/kg	<0.500	<0.500	<0.500		
Fluoranthene	206-44-0	0.500	mg/kg	<0.500	<0.500	<0.500		
Pyrene	129-00-0	0.500	mg/kg	<0.500	<0.500	<0.500		
Benz(a)anthracene	56-55-3	0.500	mg/kg	<0.500	<0.500	<0.500		
Chrysene	218-01-9	0.500	mg/kg	<0.500	<0.500	<0.500		
Benzo(b)fluoranthene	205-99-2	0.500	mg/kg	<0.500	<0.500	<0.500		
Benzo(k)fluoranthene	207-08-9	0.500	mg/kg	<0.500	<0.500	<0.500		
Benzo(a)pyrene	50-32-8	0.500	mg/kg	<0.500	<0.500	<0.500		
Indeno(1.2.3.cd)pyrene	193-39-5	0.500	mg/kg	<0.500	<0.500	<0.500		
Dibenz(a.h)anthracene	53-70-3	0.500	mg/kg	<0.500	<0.500	<0.500		
Benzo(g.h.i)perylene	191-24-2	0.500	mg/kg	<0.500	<0.500	<0.500		
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	5	mg/kg	<5	<5	<5		
C9 - C16 Fraction	----	200	mg/kg	<200	<200	<200		
C17 - C35 Fraction	----	500	mg/kg	<500	<500	<500		
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates							Surrogate control limits listed at end of this report.	
2-Fluorobiphenyl	321-60-8	0.1	%	93.6	99.9	100		
4-Terphenyl-d14	1718-51-0	0.1	%	89.3	91.2	89.6		
EP-080_SRS: TPH(Volatile)/BTEX Surrogate							Surrogate control limits listed at end of this report.	
Dibromofluoromethane	1868-53-7	0.1	%	97.1	97.2	98.6		
Toluene-D8	2037-26-5	0.1	%	102	101	102		
4-Bromofluorobenzene	460-00-4	0.1	%	91.3	92.5	91.4		

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV4A 1.85M (G.W)				
				Client sampling date / time: [29-JUL-2013]				
				HK1320318-004				
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	2.0	µg/L	<2.0				
Acenaphthylene	208-96-8	2.0	µg/L	<2.0				
Acenaphthene	83-32-9	2.0	µg/L	<2.0				
Fluorene	86-73-7	2.0	µg/L	<2.0				
Phenanthrene	85-01-8	2.0	µg/L	<2.0				
Anthracene	120-12-7	2.0	µg/L	<2.0				
Fluoranthene	206-44-0	2.0	µg/L	<2.0				
Pyrene	129-00-0	2.0	µg/L	<2.0				
Chrysene	218-01-9	1.0	µg/L	<1.0				
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0				
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	20	µg/L	<20				
C9 - C16 Fraction	----	500	µg/L	<500				
C17 - C35 Fraction	----	500	µg/L	<500				
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	**77.4**				
4-Terphenyl-d14	1718-51-0	0.1	%	**87.0**				
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**102**				
Toluene-D8	2037-26-5	0.1	%	**102**				
4-Bromofluorobenzene	460-00-4	0.1	%	**94.0**				

Laboratory Duplicate (DUP) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Aggregate Properties (QC Lot: 2989534)								
HK1320290-001	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	10.7	10.2	4.8
HK1320290-002	Anonymous	EA055: Moisture Content (dried @ 103°C)	----	0.1	%	10.4	10.8	3.8
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2987270)								
HK1320132-001	Anonymous	Naphthalene	91-20-3	500	µg/kg	<500	<500	0.0
		Acenaphthylene	208-96-8	500	µg/kg	<500	<500	0.0
		Acenaphthene	83-32-9	500	µg/kg	<500	<500	0.0
		Fluorene	86-73-7	500	µg/kg	<500	<500	0.0
		Phenanthrene	85-01-8	500	µg/kg	<500	<500	0.0
		Anthracene	120-12-7	500	µg/kg	<500	<500	0.0
		Fluoranthene	206-44-0	500	µg/kg	<500	<500	0.0
		Pyrene	129-00-0	500	µg/kg	<500	<500	0.0
		Benz(a)anthracene	56-55-3	500	µg/kg	<500	<500	0.0
		Chrysene	218-01-9	500	µg/kg	<500	<500	0.0
		Benzo(b)fluoranthene	205-99-2	500	µg/kg	<500	<500	0.0
		Benzo(k)fluoranthene	207-08-9	500	µg/kg	<500	<500	0.0
		Benzo(a)pyrene	50-32-8	500	µg/kg	<500	<500	0.0
		Indeno(1.2.3.cd)pyrene	193-39-5	500	µg/kg	<500	<500	0.0
		Dibenz(a.h)anthracene	53-70-3	500	µg/kg	<500	<500	0.0
		Benzo(g.h.i)perylene	191-24-2	500	µg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979725)								
HK1319666-001	Anonymous	C9 - C16 Fraction	----	200	mg/kg	<200	<200	0.0
		C17 - C35 Fraction	----	500	mg/kg	<500	<500	0.0
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979732)								
HK1319666-001	Anonymous	C6 - C8 Fraction	----	5	mg/kg	<5	<5	0.0

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979735)								
HK1319666-003	Anonymous	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2987270)											
Naphthalene	91-20-3	25	µg/kg	----	25 µg/kg	99.4	----	63	117	----	----
				<50	----	----	----	----	----	----	----
Acenaphthylene	208-96-8	25	µg/kg	----	25 µg/kg	100	----	54	119	----	----
				<50	----	----	----	----	----	----	----
Acenaphthene	83-32-9	25	µg/kg	----	25 µg/kg	93.0	----	59	122	----	----
				<50	----	----	----	----	----	----	----
Fluorene	86-73-7	50	µg/kg	<50	----	----	----	----	----	----	----

Matrix: SOIL

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs) (QC Lot: 2987270) - Continued											
Fluorene	86-73-7	25	µg/kg	----	25 µg/kg	102	----	60	126	----	----
Phenanthrene	85-01-8	25	µg/kg	----	25 µg/kg	95.8	----	60	127	----	----
				<50	----	----	----	----	----	----	----
Anthracene	120-12-7	25	µg/kg	----	25 µg/kg	90.1	----	56	124	----	----
				<50	----	----	----	----	----	----	----
Fluoranthene	206-44-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	99.2	----	61	132	----	----
Pyrene	129-00-0	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	101	----	61	133	----	----
Benz(a)anthracene	56-55-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	93.7	----	57	124	----	----
Chrysene	218-01-9	25	µg/kg	----	25 µg/kg	99.8	----	60	128	----	----
				<50	----	----	----	----	----	----	----
Benzo(b)fluoranthene	205-99-2	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	96.2	----	48	135	----	----
Benzo(k)fluoranthene	207-08-9	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	96.1	----	58	133	----	----
Benzo(a)pyrene	50-32-8	25	µg/kg	----	25 µg/kg	96.7	----	50	124	----	----
				<50	----	----	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	25	µg/kg	----	25 µg/kg	85.9	----	48	134	----	----
				<50	----	----	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	50	µg/kg	<50	----	----	----	----	----	----	----
				----	25 µg/kg	94.2	----	50	137	----	----
Benzo(g.h.i)perylene	191-24-2	25	µg/kg	----	25 µg/kg	94.8	----	55	140	----	----
				<50	----	----	----	----	----	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979725)											
C9 - C16 Fraction	----	200	mg/kg	<200	32 mg/kg	63.1	----	53	104	----	----
C17 - C35 Fraction	----	500	mg/kg	<500	90 mg/kg	53.9	----	43	99	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979732)											
C6 - C8 Fraction	----	5	mg/kg	<5	4.5 mg/kg	89.1	----	69	139	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2989863)											
Naphthalene	91-20-3	0.2	µg/L	<0.2	0.5 µg/L	96.1	----	54	110	----	----
Acenaphthylene	208-96-8	0.2	µg/L	<0.2	0.5 µg/L	97.3	----	54	103	----	----
Acenaphthene	83-32-9	0.2	µg/L	<0.2	0.5 µg/L	89.6	----	56	102	----	----
Fluorene	86-73-7	0.2	µg/L	<0.2	0.5 µg/L	97.3	----	50	105	----	----
Phenanthrene	85-01-8	0.2	µg/L	<0.2	0.5 µg/L	96.8	----	53	106	----	----
Anthracene	120-12-7	0.2	µg/L	<0.2	0.5 µg/L	93.2	----	54	107	----	----
Fluoranthene	206-44-0	0.2	µg/L	<0.2	0.5 µg/L	99.1	----	63	118	----	----
Pyrene	129-00-0	0.2	µg/L	<0.2	0.5 µg/L	101	----	67	120	----	----

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
						LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2989863) - Continued											
Chrysene	218-01-9	0.2	µg/L	<0.2	0.5 µg/L	95.7	----	61	123	----	----
Benzo(b)fluoranthene	205-99-2	0.2	µg/L	<0.2	0.5 µg/L	95.6	----	55	112	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979735)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	79.1	----	76	1134	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2989864)											
C9 - C16 Fraction	----	0.5	mg/L	<0.5	0.21 mg/L	46.3	----	12	112	----	----
C17 - C35 Fraction	----	0.5	mg/L	<0.5	0.60 mg/L	40.3	----	4	130	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
					MS	MSD	Low	High	Value	Control Limit
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979725)										
HK1319666-002	Anonymous	C9 - C16 Fraction	----	32 mg/kg	65.9	----	50	130	----	----
		C17 - C35 Fraction	----	90 mg/kg	60.0	----	50	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2979732)										
HK1319666-002	Anonymous	C6 - C8 Fraction	----	4.5 mg/kg	94.0	----	50	130	----	----

Surrogate Control Limits

Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	80	120
Toluene-D8	2037-26-5	81	117
4-Bromofluorobenzene	460-00-4	74	121

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

ALS Technichem (HK) Pty Ltd

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

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CERTIFICATE OF ANALYSIS

Client	: CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	Laboratory	: ALS Technichem HK Pty Ltd	Page	: 1 of 3
Contact	: MR SUN NG	Contact	: Fung Lim Chee, Richard	Work Order	: HK1319351
Address	: GEOTECHNICAL PROJECTS DIVISION, GEOTECHNICAL ENGINEERING OFFICE, 23/F., KWUN TONG VIEW, 410 KWUN TONG ROAD, KOWLOON, HONG KONG	Address	: 11/F., Chung Shun Knitting Centre, 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong	Amendment	: 1
E-mail	: sunng@cedd.gov.hk	E-mail	: Richard.Fung@alsglobal.com		
Telephone	: ----	Telephone	: +852 2610 1044		
Facsimile	: ----	Facsimile	: +852 2610 2021		
Project	: RELOCATION OF SHA TIN SEWERAGE TREATMENT WORKS TO CAVERNS	Quote number	: ----	Date Samples Received	: 17-JUL-2013
Order number	: GE/2012/24.11			Issue Date	: 15-AUG-2013
C-O-C number	: H025608			No. of samples received	: 1
Site	: ----			No. of samples analysed	: 1

General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. The completion date of analysis is: 18-JUL-2013

Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

Specific comments for Work Order: **HK1319351**

Project Name: Agreement No. CE 43/2011 (DS) Relocation of Sha Tin Sewerage Treatment Works to Caverns - Feasibility Study.

Sample(s) were received in a chilled condition.

Water sample(s) analysed and reported on an as received basis.

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Hong Kong Accreditation Service (HKAS) has accedited this laboratory (ALS Technichem (HK) Pty Ltd) under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS Directory of Accredited Laboratories. The results shown in this certificate were determined by this laboratory in accordance with its terms of accreditation.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in the Electronic Transactions Ordinance of Hong Kong, Chapter 553, Section 6.

Signatories	*Position*	*Authorised results for*
Anh Ngoc Huynh	**Senior Chemist - Organics**	**Organics**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: BH-ENV10 (GW) 2.2M				
				Client sampling date / time: [17-JUL-2013]				
				HK1319351-001				
EP-076A: Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	91-20-3	2.0	µg/L	<2.0				
Acenaphthylene	208-96-8	2.0	µg/L	<2.0				
Acenaphthene	83-32-9	2.0	µg/L	<2.0				
Fluorene	86-73-7	2.0	µg/L	<2.0				
Phenanthrene	85-01-8	2.0	µg/L	<2.0				
Anthracene	120-12-7	2.0	µg/L	<2.0				
Fluoranthene	206-44-0	2.0	µg/L	<2.0				
Pyrene	129-00-0	2.0	µg/L	<2.0				
Chrysene	218-01-9	1.0	µg/L	<1.0				
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0				
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH)								
C6 - C8 Fraction	----	20	µg/L	<20				
C9 - C16 Fraction	----	500	µg/L	<500				
C17 - C35 Fraction	----	500	µg/L	<500				
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates								Surrogate control limits listed at end of this report.
2-Fluorobiphenyl	321-60-8	0.1	%	**50.5**				
4-Terphenyl-d14	1718-51-0	0.1	%	**96.2**				
EP-080_SRS: TPH(Volatile)/BTEX Surrogate								Surrogate control limits listed at end of this report.
Dibromofluoromethane	1868-53-7	0.1	%	**102**				
Toluene-D8	2037-26-5	0.1	%	**101**				
4-Bromofluorobenzene	460-00-4	0.1	%	**97.8**				

Laboratory Duplicate (DUP) Report

Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report				
				LOR	Unit	Original Result	Duplicate Result	RPD (%)
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2968462)								
HK1318887-001	Anonymous	C6 - C8 Fraction	----	0.02	mg/L	<0.02	<0.02	0.0

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: WATER

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
		LOR	Unit	Result		LCS	DCS	Low	High	Value	Control Limit
EP-076: Polycyclic Aromatics Hydrocarbons (PAHs) (QC Lot: 2972735)											
Naphthalene	91-20-3	0.2	µg/L	<0.2	0.5 µg/L	81.6	----	34	106	----	----
Acenaphthylene	208-96-8	0.2	µg/L	<0.2	0.5 µg/L	85.9	----	38	92	----	----
Acenaphthene	83-32-9	0.2	µg/L	<0.2	0.5 µg/L	74.0	----	34	100	----	----
Fluorene	86-73-7	0.2	µg/L	<0.2	0.5 µg/L	81.6	----	31	99	----	----
Phenanthrene	85-01-8	0.2	µg/L	<0.2	0.5 µg/L	84.6	----	34	98	----	----
Anthracene	120-12-7	0.2	µg/L	<0.2	0.5 µg/L	83.5	----	42	102	----	----
Fluoranthene	206-44-0	0.2	µg/L	<0.2	0.5 µg/L	102	----	55	105	----	----
Pyrene	129-00-0	0.2	µg/L	<0.2	0.5 µg/L	102	----	55	107	----	----
Chrysene	218-01-9	0.2	µg/L	<0.2	0.5 µg/L	83.3	----	65	121	----	----
Benzo(b)fluoranthene	205-99-2	0.2	µg/L	<0.2	0.5 µg/L	80.0	----	52	102	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2966725)											
C9 - C16 Fraction	----	0.5	mg/L	<0.5	0.21 mg/L	49.4	----	12	112	----	----
C17 - C35 Fraction	----	0.5	mg/L	<0.5	0.60 mg/L	50.9	----	4	130	----	----
EP-071HK_SR: Total Petroleum Hydrocarbons (TPH) (QC Lot: 2968462)											
C6 - C8 Fraction	----	0.02	mg/L	<0.02	0.03 mg/L	85.9	----	76	1134	----	----

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

Surrogate Control Limits

Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP-076S: Polycyclic Aromatics Hydrocarbons (PAHs) Surrogates			
2-Fluorobiphenyl	321-60-8	50	130
4-Terphenyl-d14	1718-51-0	50	130
EP-080_SRS: TPH(Volatile)/BTEX Surrogate			
Dibromofluoromethane	1868-53-7	86	118
Toluene-D8	2037-26-5	88	110
4-Bromofluorobenzene	460-00-4	86	115

Section 3

Summary of Sample Receipt Condition, Analysis Date and Method Reference

Summary of Sample Receipt Condition, Analysis Date and Method Reference

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

ALS Lab ID	Client Sample ID	Sampling Date	Sampling Time	Receipt Details			Storage Condition*	Testing Date		
				Date	Time	Condition		TPHs	VOCs	PAHs
HK1317305002	BH-ENV05/ 0.5M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305003	BH-ENV06/ 0.5M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305004	BH-ENV07/ 0.5M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305005	BH-ENV09/ 0.5M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305006	BH-ENV10/ 0.5M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305008	BH-ENV05/ 1.0M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305009	BH-ENV07/ 1.0M	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	--	4/07/2013
HK1317305011	TRIP BLANK	27/06/2013	0:00	27/06/2013	18:00	Ambient	4°C	2/07/2013	2/07/2013	2/07/2013
HK1317464001	BH-ENV10/ 1.0M	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464002	BH-ENV02/ 0.5M	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464003	BH-ENV02/ 1.0M	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464004	BH-ENV09/ 0.9M	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464005	BH-ENV07/ 1.5M	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464006	BH-ENV07/ 1.5M(A)	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464007	BH-ENV07/ 1.5M(B)	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317464008	EQUIPMENT BLANK	28/06/2013	0:00	28/06/2013	16:15	Ambient	4°C	5/07/2013	--	5/07/2013
HK1317593001	BH-ENV12/ 0.5M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593002	BH-ENV11/ 0.5M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593003	BH-ENV13/ 0.5M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593004	BH-ENV01/ 0.5M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593005	BH-ENV12/ 1.0M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593006	BH-ENV11/ 1.0M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593007	BH-ENV13/ 1.0M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317593008	BH-ENV07 (G.W) 1.6M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	5/07/2013
HK1317593009	BH-ENV09 (G.W) 1.0M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	5/07/2013
HK1317593010	BH-ENV02 (G.W) 1.15M	2/07/2013	0:00	2/07/2013	16:45	Ambient	4°C	5/07/2013	--	5/07/2013

***Container for sample storage:** 250mL Glass Jar with Teflon Lined Lid (for Chemical Testing) & High Density Polyethylene Bags (for Biological Testing)

Summary of Sample Receipt Condition, Analysis Date and Method Reference

Date of Issue: 23/08/2013
Client: Civil Engineering and Development Department
Service Order No.: GE/2012/24.11
Project: Agreement No. CE43/2011 (DS) Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Provision of Chemical and Biological Testing Service

ALS Lab ID	Client Sample ID	Sampling Date	Sampling Time	Receipt Details			Storage Condition*	Testing Date		
				Date	Time	Condition		TPHs	VOCs	PAHs
HK1317598001	BH-ENV11/ 3.0M	3/07/2013	0:00	3/07/2013	16:30	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317598002	BH-ENV12/ 2.2M	3/07/2013	0:00	3/07/2013	16:30	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317598003	BH-ENV5/ 2.5M	3/07/2013	0:00	3/07/2013	16:30	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317598004	BH-ENV2/ 1.1M	3/07/2013	0:00	3/07/2013	16:30	Ambient	4°C	5/07/2013	--	8/07/2013
HK1317598005	BH-ENV12 (G.W) 2.3M	3/07/2013	0:00	3/07/2013	16:30	Ambient	4°C	5/07/2013	--	5/07/2013
HK1317598006	BH-ENV5 (G.W) 2.73M	3/07/2013	0:00	3/07/2013	16:30	Ambient	4°C	5/07/2013	--	5/07/2013
HK1318887001	BH-ENV3A (GW) 0.85M	12/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	16/07/2013
HK1318887002	BH-ENV3A 0.80M	12/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	17/07/2013
HK1318887003	BH-ENV8A (GW) 0.9M	12/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	16/07/2013
HK1318887004	BH-ENV8A 0.85M	12/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	17/07/2013
HK1318896001	BH-ENV10 3.0M	11/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	15/08/2013	--	16/08/2013
HK1318896002	BH-ENV06 0.73M	11/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	17/07/2013
HK1318896003	BH-ENV01 0.83M	11/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	17/07/2013
HK1318896004	BH-ENV3A 0.5M	11/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	17/07/2013
HK1318896005	BH-ENV8A 0.5M	11/07/2013	0:00	12/07/2013	16:00	Ambient	4°C	16/07/2013	--	17/07/2013
HK1319351001	BH-ENV10 (GW) 2.2M	17/07/2013	0:00	17/07/2013	12:15	Ambient	4°C	18/07/2013	--	18/07/2013
HK1320318001	BH-ENV4A 0.5M	29/07/2013	0:00	29/07/2013	15:15	Ambient	4°C	30/07/2013	--	2/08/2013
HK1320318002	BH-ENV4A 1.0M	29/07/2013	0:00	29/07/2013	15:15	Ambient	4°C	30/07/2013	--	2/08/2013
HK1320318003	BH-ENV4A 1.8M	29/07/2013	0:00	29/07/2013	15:15	Ambient	4°C	30/07/2013	--	2/08/2013
HK1320318004	BH-ENV4A 1.85M (G.W)	29/07/2013	0:00	29/07/2013	15:15	Ambient	4°C	30/07/2013	--	1/08/2013

***Container for sample storage:** 250mL Glass Jar with Teflon Lined Lid (for Chemical Testing) & High Density Polyethylene Bags (for Biological Testing)

Section 4

Chain of Custody (COC) Form

CHAIN OF CUSTODY DOCUMENTATION

H 025602

Revised for 27/6

ALS Laboratory Group

CLIENT: CEDD GE2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr. Sun Ng	PHONE
PROJECT ID: S 24.11 Relocation of STSTWTC	EMAIL REPORT TO: keali@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water) | CONTAINER INFORMATION

ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	SVOC	PCR	C6-C8 Fraction	BTEX
1	BH-ENV04/0.5m	S	27/6		250ml	1	✓	✓		
2	BH-ENV05/0.5m	"	"		"	1	✓	✓		
3	BH-ENV06/0.5m	"	"		"	1	✓	✓		
4	BH-ENV07/0.5m	"	"		"	1	✓	✓		
5	BH-ENV09/0.5m	"	"		"	1	✓	✓		
6	BH-ENV10/0.5m	"	"		"	1	✓	✓		
7	BH-ENV04/1.0m	"	"		"	1	✓	✓		
8	BH-ENV05/1.0m	"	"		"	1	✓	✓		
9	BH-ENV07/1.0m	"	"		"	1	✓	✓		
10	Field Blank	L	"		1L	1	✓	✓		
11	Trip Blank	L	"		~~1L~~ 40ml	1			✓	✓

RELINQUISHED BY:

Name: Chui Chung Keung	Date: 27/6/2013	Name: Leo Leung ALS	Date: 27/6/13
Of:	Time:	Of:	Time: 1850
Name:	Date:	Name:	Date:
Of:	Time:	Of:	Time:

RECEIVED BY

METHOD OF SHIPMENT
Con' Note No:
Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

ALS Laboratory Group

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YELLOW - CUSTOMER COPY
PINK - BOOK COPY

CHAIN OF CUSTODY DOCUMENTATION

H 025603

ALS Laboratory Group

CLIENT: CEDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr Sun Ng.	PHONE
PROJECT ID: S 24.11 Relocation of STSTWTC	EMAIL REPORT TO: kenli@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION			
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	SVOC	PCR
1	BH-ENV10/1.0m	S	28/6		250ml	1	✓	✓
2	BH-ENV02/0.5m	"	"		"	1	✓	✓
3	BH-ENV02/1.0m	"	"		"	1	✓	✓
4	BH-ENV09/0.9m	"	"		"	1	✓	✓
5	BH-ENV07/1.5m	"	"		"	1	✓	✓
6	BH-ENV07/1.5m (A)	"	"		"	1	✓	✓
7	BH-ENV07/1.5m (B)	"	"		"	1	✓	✓
8	Equipment Blank	W	"		1L	1	✓	✓

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name: Chiu Chung Keung	Date: 28/06/2013	Name: Lau Wong	Date: 28/6/13	Con' Note No:
Of:	Time:	Of: ALS	Time: 1615	
Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

ALS Laboratory Group

WHITE - LAB COPY
YELLOW - CUSTOMER COPY
PINK - BOOK COPY

CHAIN OF CUSTODY DOCUMENTATION

H 025604

ALS Laboratory Group

CLIENT: CEDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr Sun Ng.	PHONE
PROJECT ID: S 24.11 Relocation of STSTWTC	EMAIL REPORT TO: kenli@civiltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		SVOC	PCB
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles		
1	BH-ENV 12/0.5m	S	2/7		250ml	1	/	/
2	BH-ENV 11/0.5m	"	"		"	1	/	/
3	BH-ENV 13/0.5m	"	"		"	1	/	/
4	BH-ENV 01/0.5m	"	"		"	1	/	/
5	BH-ENV 12/1.0m	"	"		"	1	/	/
6	BH-ENV 11/1.0m)	"	"		"	1	/	/
7	BH-ENV 13 (1.0m)	"	"		"	1	/	/
8	(1.6m) BH-ENV 07 (GW)	Water	"		1L	1	/	/
9	(1.0m) BH-ENV 09 (GW)	"	"		"	1	/	/
10	(1.15m) BH-ENV 02 (GW)	"	"		"	1	/	/

RELINQUISHED BY:			RECEIVED BY			METHOD OF SHIPMENT
Name: Chow Sik Ming	Date: 2-7-2013		Name:	Date: 2-7 2013		Con' Note No:
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CHAIN OF CUSTODY DOCUMENTATION

H 025605

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CLIENT: CEDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr Sun Ng	PHONE
PROJECT ID: S 24.11 Relocation of STSTWTC	EMAIL REPORT TO: kenli@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES(note - suite codes must be listed to attract suite prices)

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Intact: Yes No (N/A)
SAMPLE TEMPERATURE
CHILLED: (Yes) No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		SVOC	PCB										
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles												
1	BH-ENV11/3.0m	S	3/7		250ml	1	✓	✓										
2	BH-ENV12/2.2m	"	"		"	1	✓	✓										
3	BH-ENV5/2.5m	"	"		"	1	✓	✓										
4	BH-ENV2/1.1m	"	"		"	1	✓	✓										
5	BH-ENV12/2.3m(GW)	Water	"		1L	1	✓	✓										
6	BH-ENV5/2.73m(GW)	"	"		"	1	✓	✓										

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Name: Chow Sik Ming	Date: 3-7-2013	Name: [illegible]	Date: 3/7/2013	Con' Note No:
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Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

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CLIENT: CEDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr. Sun Ng	PHONE
PROJECT ID: S24.11 Relocation of ST STW7C	EMAIL REPORT TO: kenli@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES(note - suite codes must be listed to attract suite prices)

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		SVOC	PCB										
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles												
1	BH-ENV3A/0.85m(GW)	Water	12/7		1L	1	✓	✓										
2	BH-ENV3A/0.80m	S	"		250ml	1	✓	✓										
3	BH-ENV8A/0.9m(GW)	Water	"		1L	1	✓	✓										
4	BH-ENV8A/0.85m	S	"		250ml	1	✓	✓										

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name: Chris Chung Kenng	Date: 12/07/2013	Name:	Date: 12/7/13	Con' Note No:
Of: Driltech Ground Engg. Co Ltd	Time:	Of: ALS	Time: 16:00	
Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

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CLIENT: CEDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr. Sun Ng	PHONE
PROJECT ID: S 24.11 Relocation of ST STWTC	EMAIL REPORT TO: kenli@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

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Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		SVOC	PCR										
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles												
1	BH-ENV10 13.0m	S	11/7		250 ml	1	✓	✓										0h hold.
2	BH-ENV06/0.73m	"	"		"	1	✓	✓										
3	BH-ENV01/0.83m	"	"		"	1	✓	✓										
4	BH-ENV3A/0.5m	"	"		"	1	✓	✓										
5	BH-ENV8A/0.5m	"	"		"	1	✓	✓										
	~~BH-ENV~~																	

RELINQUISHED BY:			RECEIVED BY			METHOD OF SHIPMENT
Name: Chan Chung Keung	Date: 11/07/2013		Name: Ketsu	Date: 12-7-2013		Con' Note No:
Of: Drill Tech Ground Engg. Ltd	Time:		Of: ALS Hk	Time: 16:00		
Name:	Date:		Name:	Date:		Transport Co:
Of:	Time:		Of:	Time:		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

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CLIENT: CEDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr Sun Ng	PHONE
PROJECT ID: S24.11 Relocation of ST STWTP	EMAIL REPORT TO: kenl@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES(note - suite codes must be listed to attract suite prices)

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COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		Silac	PCR										
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles												
1	BH-ENV10/22m(G.W)	Water	17/7		1L	2	✓	✓										

RELINQUISHED BY:		RECEIVED BY		METHOD OF SHIPMENT
Name: Chow Sik Ming	Date: 17-7-2013	Name: Ketsu	Date: 17-7-2013	Con' Note No:
Of:	Time:	Of: ALS clk	Time: 12:15	
Name:	Date:	Name:	Date:	Transport Co:
Of:	Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

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H 025609

ALS Laboratory Group

CLIENT: EDD GE 2013/24.11	SAMPLER:
ADDRESS / OFFICE:	MOBILE:
PROJECT MANAGER (PM): Mr Sum Ng.	PHONE
PROJECT ID: S24.11 Relocation of STSTWTL	EMAIL REPORT TO: ~~Kenli@driltech.com.hk~~ kenli@driltech.com.hk
SITE: Sha Tin Sewage Treatment Plant P.O. NO.:	EMAIL INVOICE TO: (if different to report)
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

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SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected"
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		SVOC	PCR
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles		
	BH-ENV4A/0.5m	S	29/7		250ml	1	✓	✓
	BH-ENV4A/1.0m	〃	〃		〃	1	✓	✓
	BH-ENV4A/1.8m	〃	〃		〃	1	✓	✓
	BH-ENV4A/1.8m(G.W)	Water	〃		1L	2	✓	✓

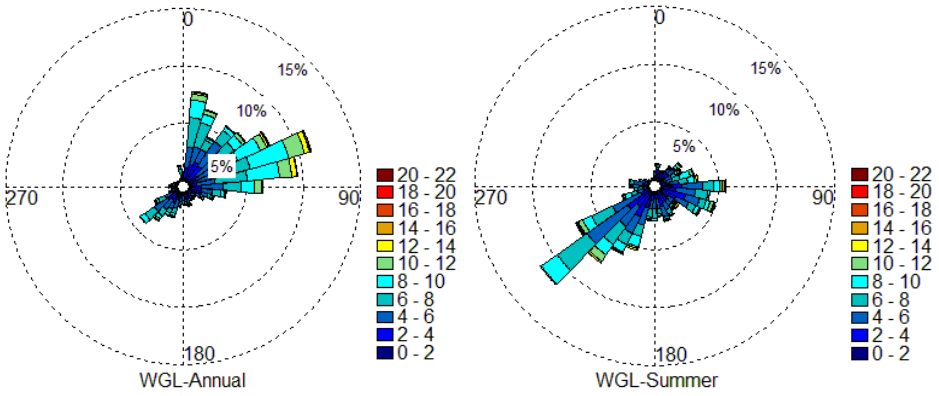
RELINQUISHED BY:			RECEIVED BY			METHOD OF SHIPMENT
Name: Chow Sik Ming	Date: 29-7-2013		Name:	Date: 29-7-13		Con' Note No:
Of:	Time:		Of: ALS	Time: 15:15		
Name:	Date:		Name:	Date:		Transport Co:
Of:	Time:		Of:	Time:		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soil; B = Unpreserved Bag.

Appendix 12.01

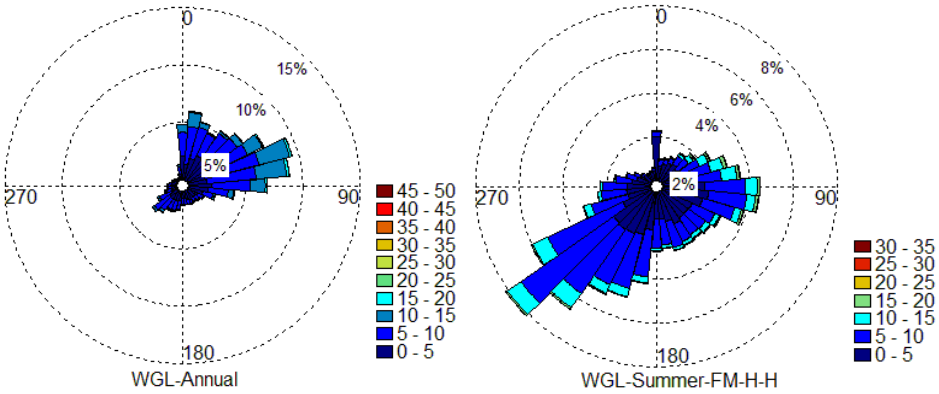
Wind Rose

Appendix 12.01 – Wind Rose



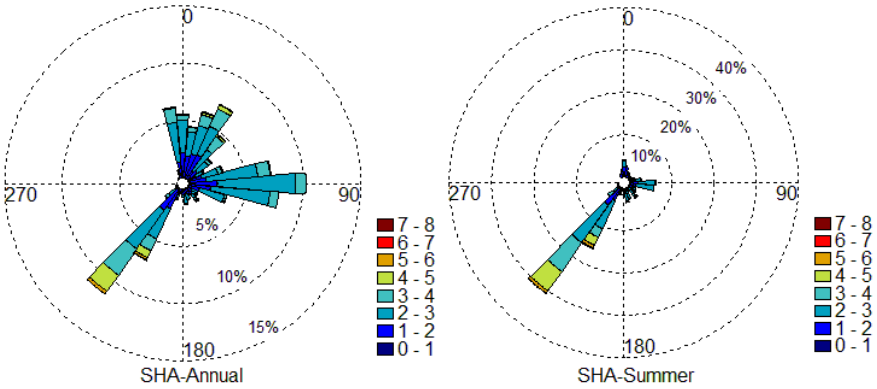
(a) Annual wind (b) Summer wind

Wind roses of daily mean wind at WGL station (13 years' data).



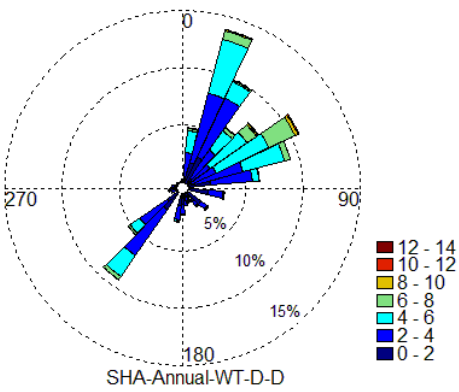
(a) Annual wind (b) Summer wind

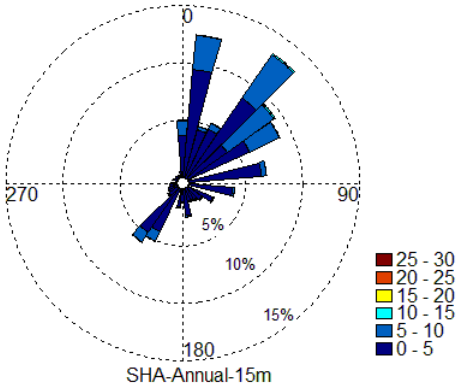
Wind roses of hourly mean wind at WGL station (23 years' data).



(a) Annual wind (b) Summer wind

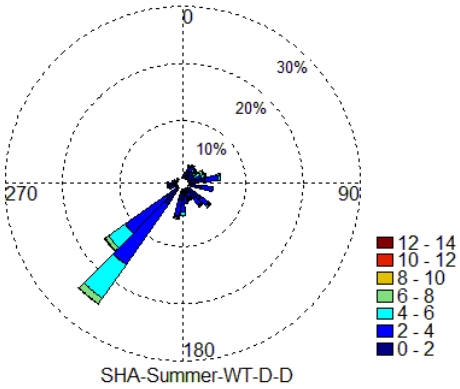
Wind roses of daily mean wind at SHA station (13 years' data).

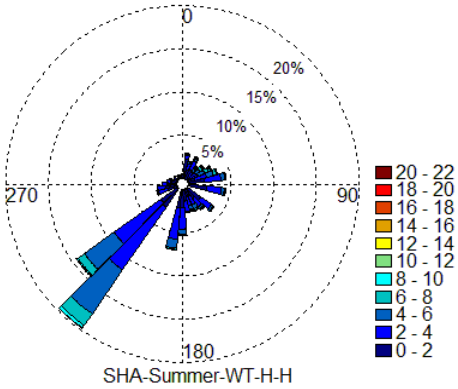




(a) Daily mean wind (b) Hourly mean wind

Wind roses of annual winds through wind tunnel test.





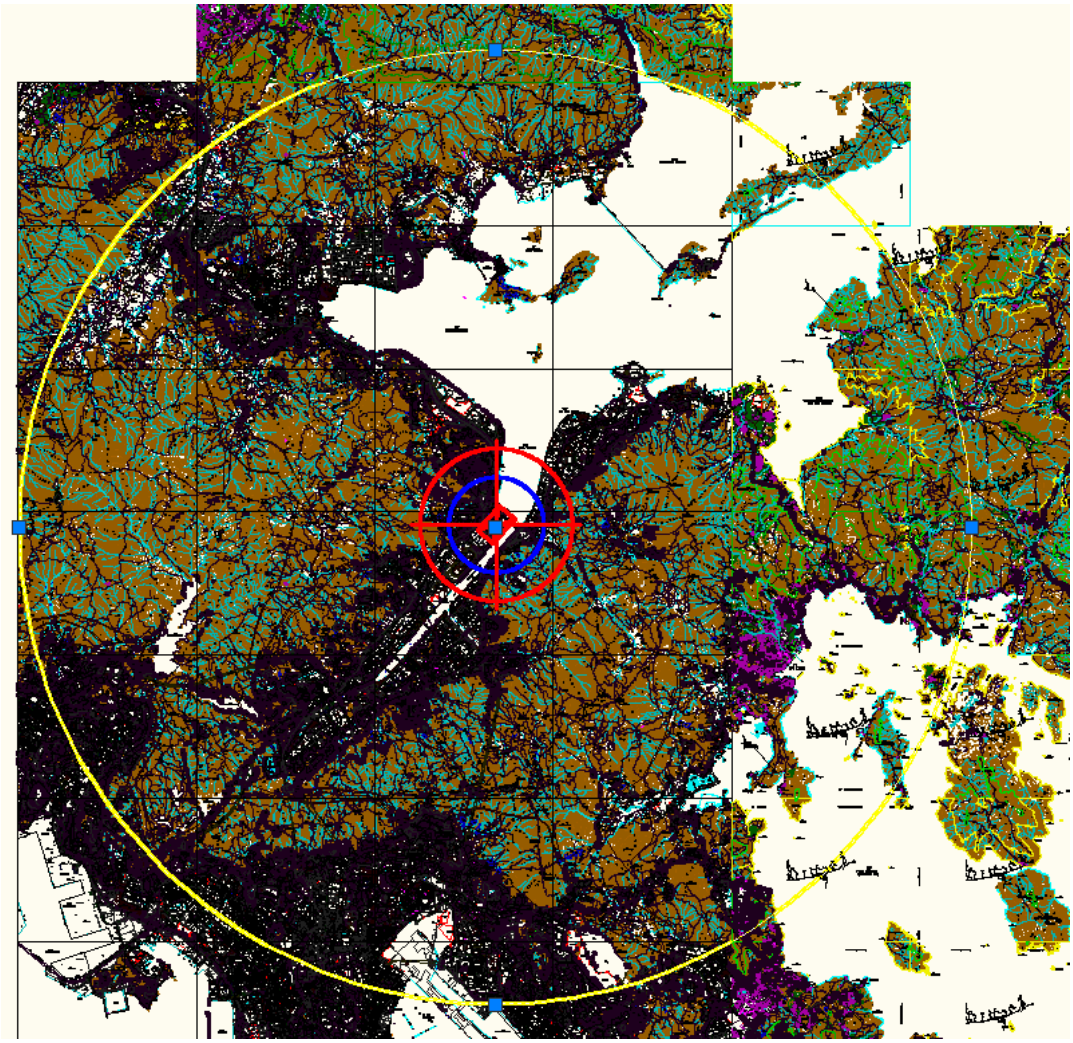
(a) Daily mean wind (b) Hourly mean wind

Wind roses of summer winds through wind tunnel test.

Appendix 12.02

Extent of Site Wind Availability Study Area

Appendix 12.02 – Extent of Site Wind Availability Study Area

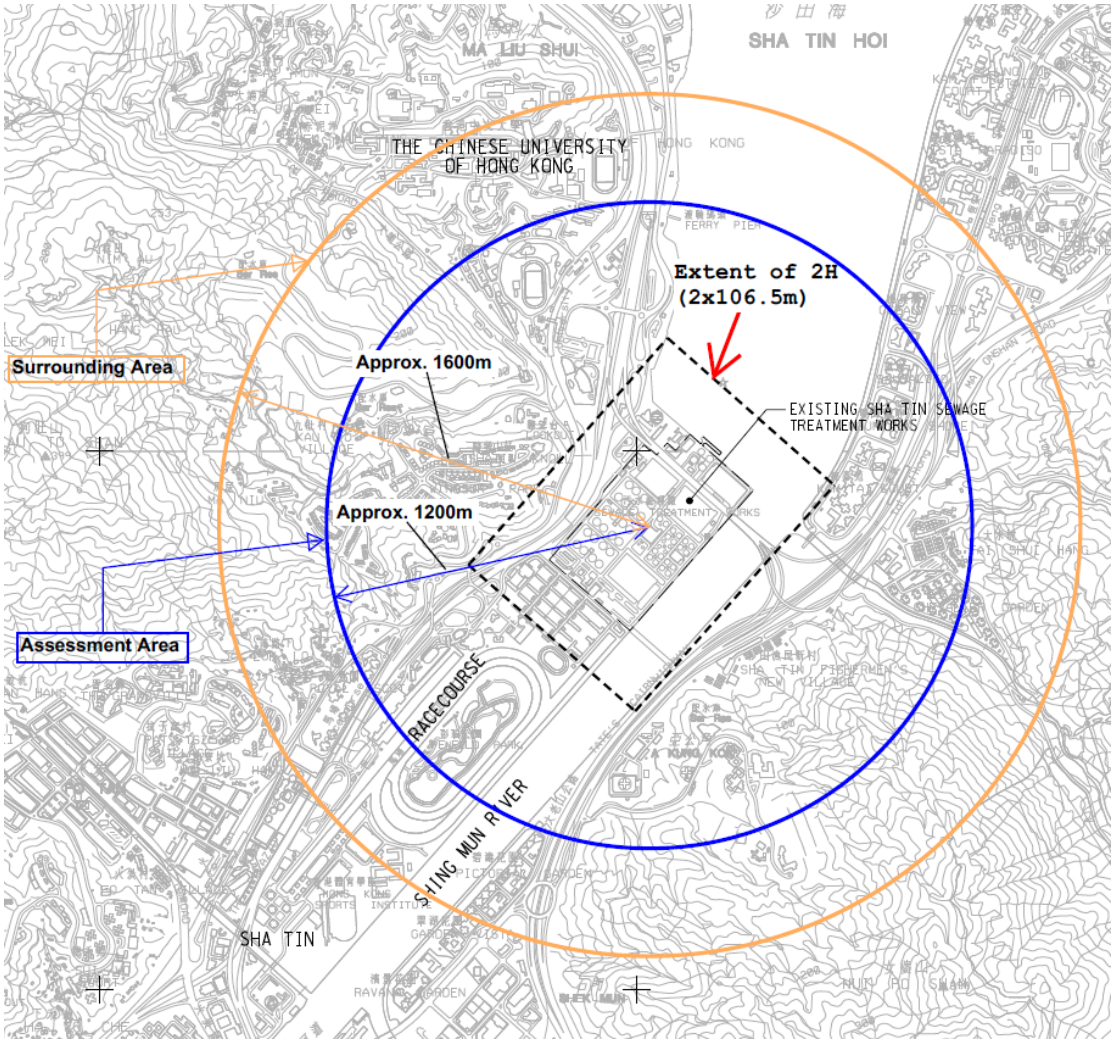


Surrounding area for the SWAS wind tunne test (region constrained by yellow circle)

Appendix 12.03

Extent of Initial AVA Study

Appendix 12.03 – Extent of Initial AVA Study



Surrounding area for the initial AVA study

Appendix 12.04

Report of the AVA Study (prepared by City University of Hong Kong)

Report of the AVA Study for the Project entitled

"Wind Tunnel Test for Relocation of Sha Tin Sewage Treatment Works to Caverns-Feasibility Study"

City University of Hong Kong
Department of Civil and Architectural Engineering

27/11/2013

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Abbreviations

“AVA”	Air Ventilation Assessment
“STSTW”	the Sha Tin Sewage Treatment Works
“PDA”	Potential Development Area
“EE”	Expert Evaluation
“VR”	Velocity Ratio
“LVR”	Local spatial average Velocity Ratio stipulated in the Technical Circular 1/06
“SVR”	Site spatial average Velocity Ratio stipulated in the Technical Circular 1/06
“CityU”	City University of Hong Kong
“BLWT”	Boundary Layer Wind Tunnel
“WGL”	Waglan Island meteorological station
“HKO”	Hong Kong Observatory
“G/IC”	Government, Institution or Community
“SAVR”	Spatial Average Velocity Ratio of all the test points in each zone

1. Introduction

This report aims to demonstrate the wind tunnel test results for the Air Ventilation Assessment (AVA) study of the project entitled “Wind Tunnel Test for Relocation of Sha Tin Sewage Treatment Works to Caverns-Feasibility Study”.

This study is conducted in accordance to the “Housing, Planning and Lands Bureau technical circular No. 1/06 Environment, Transport and Works Bureau technical circular No. 1/06 (refer to Technical Circular No. 1/06, hereafters) ” and the “Urban Design Guidelines (Chapter 11 of the Hong Kong Planning Standards and Guidelines)”. Wind tunnel tests involved are conducted in accordance to the relevant technical guidelines stipulated in AWES QAM-1-2001 (Australasian Wind Engineering Society Quality Assurance Manual), and Guide of wind tunnel test for building structures in Japan.

1.1. Location of the PDA

The Sha Tin Sewage Treatment Works (STSTW) is under consideration of relocating to nearby caverns to vacate more building lands for residential purpose. According to the items stipulated in the Technical Circular No. 1/06, AVA studies to major government projects and for the planning studies for new development areas should be required to assess the impacts of the proposal on the pedestrian wind environment.

Location of the potential development area (PDA) of the captioned project is shown in Figure 1. This area (delineated by the red rectangle) lies along a NE-SW orientation. It is bounded by Sha Tin Hoi to its northeast and Shing Mun River along its southeastern boundary, and abuts the Sha Tin Racecourse in the southwest. From Figure 1a, areas on the other side of Shing Mun River opposite the PDA are

dominated by hills and mountains. In particular, the mountains/hills parallel to the Shing Mun River form a canyon aisle which, as will be discussed later, would result in dominant influence to the local wind climate.

1.2. Introduction of AVA study

Being one of the most densely populated cities in the world, Hong Kong simultaneously has the subtropical climate with hot and humid summer. Therefore, Hong Kong needs more wind for thermal relief and comfort in the built environment. To enhance and improve the long-term wind environment in this city, it is important to optimize urban design for more wind penetration, especially to the public realm.

To promote better layout of the building blocks in the city through examination of its air ventilation impact as one of the considerations for all major development or redevelopment proposals and in future planning, the Government has issued some special guidelines such as the Technical Circular No. 1/06, and the Urban Design Guidelines. The later stipulates a number of qualitative guidelines to promote air ventilation for the planning design. Areas of new development should be planned with due regard to the said guidelines.

1.2.1. Contents of AVA study

According to the Technical Circular No. 1/06, two or three stages may be considered for the AVA study: Expert Evaluation (EE) and the Initial and/or Detailed AVA study.

The expert evaluation aims to qualitatively estimate the prevailing wind directions and magnitudes of the site, and to identify obvious problem areas and propose mitigation measures, etc. This is particularly useful for large sites and/or sites with specific and unique wind features, issues, concerns and problems.

The EE study is based on the site wind availability data. These data can be

determined through SWAS (site wind availability study) wind tunnel test. It is also advisable to make reference to the Hong Kong Observatory Waglan Island wind data as well as reasonable wind data of nearby weather stations.

The Initial/Detailed AVA study will refine and substantiate the EE study and aims to give a quantitative estimate of wind performance at the pedestrian level. The AVA wind tunnel test is conducted based on the SWAS results.

1.2.2. Indicator for AVA

The indicator to index the wind performance for the AVA is the wind velocity ratio (VR). It is defined as V_p/V_∞ where V_∞ stands for the gradient wind speed (typically as that at a height of 400-600 m above city center), V_p represents the wind velocity at the pedestrian level (2 m above local ground). This indicator reflects how much of the wind availability of a location could be experienced and enjoyed by pedestrians on ground, taking into account the surrounding buildings and topography and the proposed development.

It is a common practice in wind engineering study to account for wind coming from 16 main directions. The velocity ratio can then be calculated by:

$$VR_w = \sum_{i=1}^{16} F_i \times VR_i. \quad (1)$$

where VR_i is the velocity ratio of wind from direction i; F_i is the probability of wind coming from direction i. Thus, VR_w is the weighted average of VR_i by the wind occurrence frequency.

Given the general weak wind conditions in Hong Kong, the higher the wind velocity ratio, the less likely would be the impact of the proposed development on the wind availability.

1.2.3. Project, Assessment and Surrounding Areas

Since the AVA study of this project is conducted through wind tunnel tests, physical models for both SWAS and Initial Study should be required. For the SWAS, a 1:4000 topographical model is fabricated which covers all the main topographical features within a distance of 10 km (or 2.5 m in the wind tunnel) in radius from the geometric center of PDA, as delineated by the yellow circle in Figure 1a. For the Initial Study, the physical model should cover the Project, the Assessment and the Surrounding Areas.

The Project Area (or PDA), as shown in Figure 1b, is defined by the project site boundaries and includes all open areas within the project that pedestrians are likely to access.

The Assessment Area of the project includes the project's surrounding at least up to a perpendicular distance H from the project boundary, H being the height of the tallest building on site. Occasionally, it may be necessary to include an assessment area larger than that defined above so that special surrounding features and open spaces are not omitted. The surrounding area should include the region at least up to a perpendicular distance of 2H from the project boundary.

1.2.4. Test points

Test points are the locations where wind VRs are tested and reported. Two main types of test points should be specified for AVA study: Perimeter and Overall.

Perimeter test points are positioned on the project site boundary, especially where junctions of all roads leading to the project site, main entrances to the project, and at corners of the project site exist. They are used to provide data for the Site Air Ventilation Assessment, and to assess the "immediate" effect of the project to the Assessment Area. Typically, 30 to 50 perimeter test points well spaced-out and

located will suffice.

Overall test points are evenly distributed and positioned in the open spaces, on the streets and places of the project and Assessment Areas where pedestrians frequently access. This group of test points, together with the perimeter test points, will be used for the Local Air Ventilation Assessment. For practical reasons, around 50 to 80 test points may be adequate for typical development sites.

1.2.5. Reporting of AVA results

The VR values of all test points should be reported individually. Meanwhile, two ratios may also be reported: Site spatial average Velocity Ratio (SVR), and Local spatial average Velocity Ratio (LVR), which help to give a simple quantity to summarize the overall impact on the wind environment for easy comparison.

For the Site Air Ventilation Assessment, the SVR of all perimeter test points may be reported. This provides information on how the development proposal impacts the wind environment of its immediate vicinity.

For the Local Air Ventilation Assessment, the LVR of all perimeter and overall test points may be reported. This provides information on how the development proposal impacts the wind environment of its local area.

2. Wind tunnel test for SWAS

2.1. BLWT facility at CityU

The boundary layer wind tunnel (BLWT) at City University of Hong Kong (CityU) is a re-circulating flow tunnel. It is driven by a centrifugal compressor with a maximum capacity of 400000 m^3/h, and the maximum wind speed is in excess of 20 m/s. The overall length of this facility is about 20 m. The width and height of

working section is 4.2 m (the turntable is 2 m in radius) and 2 m, respectively.

The tunnel is constructed with all the standard features, e.g., the expansion, contraction, honey-combs and screens in the settling chamber to stabilize the flow. Figure 2a shows the setups of the flow generating and developing sections.

To enhance the operation of the wind tunnel, there are three special features built into this facility: (a) There is a blockage-tolerance roof over the test section so that larger models can be tested without causing undue blockage effect; (b) Remote control roughness elements are installed downstream the contraction to facilitate boundary layer generation through adjusting the overhanging height of these elements; (3) Valves are incorporated at the expansion section to better control flow at very low wind speed (below 1 m/s).

The BLWT at CityU is equipped with a suit of Cobra Probe system for the detection of velocity at the test section. The setup of the Cobra Probe system is shown in Figure 2b. It consists of the support frame, the Cobra Probe and the recording system.

The support frame where the Cobra probe is fixed can be positioned with a spatial resolution of 0.01 mm through remote control. The recording system is capable of providing a maximum sampling frequency of 2000 Hz. The Cobra Probe is able to measure 3D wind velocity. Definitions of the wind components and the angles involved are shown in Figure 3.

2.2. Topographical model and test points

In consideration of the corresponding items stipulated in the Technical Circular No. 1/06 and the working capacity of the BLWT at CityU, the test model is produced with a scale of 1:4000 so as to cover the topographical features within an area of not smaller than 10 km in radius away from the PDA.

The coordinate of the radius center of the model in the Auto-CAD map of HK is (840050.2, 829731.7).

A photo of the fabricated model is shown in Figure 4a. The existing developments within the surrounding areas are also modeled, as shown in Figure 4b.

Wind tunnel measurements are taken at 22.5° intervals for the full 360° azimuth (i.e. 16 wind directions) at the geometric center of the PDA. The wind direction is defined positive along clockwise from the north.

For each wind direction, mean wind speeds, turbulence intensities, and yaw angles are determined at 9 different height levels, equivalent to 15, 50, 100, 150, 200, 250, 300, 400 and 500 m in prototype scale.

2.3. Approach wind field

The approach wind field (mean wind profile, turbulence intensity profile, and longitudinal turbulence spectrum) in the wind tunnel is adjusted according to the stipulations of the national wind load code of GB 50009-2012 (China), the local wind load code of Hong Kong, and the Japanese wind load code of AIJ-2004.

The power law is adopted to depict the mean wind profile:

$$U(z) = U_{ref}(z / z_{ref})^{\alpha}. \quad (2)$$

where α is the power exponent; U_{ref} is the reference mean wind speed at the reference height of z_{ref}.

For the turbulence profile, item stipulated in the AIJ-2004 wind code is adopted:

$$I(z) = 0.1(z / z_G)^{-\alpha-0.05}. \quad (3)$$

where z_G stands for the gradient height, and α is the same as the power exponent in Equation 2. For this project, α is selected as 0.15.

For the wind turbulence spectrum, the von Karman model is adopted. A

reproduction of the adjusted approach wind field depicted by these discussed parameters in the BLWT at CityU is shown in Figure 5.

2.4. Test results

The directional vertical profiles of mean longitudinal wind speed, turbulence intensity, and yaw angle are shown in Figures 6-8, respectively.

To determine the wind rose at the PDA, field measurements at the Waglan Island Station of Hong Kong Observatory is adopted. Wind roses of both annual and summer winds at the Waglan Island Station (refer to as WGL) are shown in Figure 9.

The methodology to calculate the wind rose based on the field measurements from WGL and the wind tunnel test for the PDA is depicted in Figure 10.

The obtained wind roses at the PDA for both annual and summer winds are shown in Figures 11-12, and Tables 1-2.

For the speed profiles, it can be seen that all the wind speeds at the lower height levels in the 16 directions above the PDA are lower than the reference values due to the existence of the topography. Thus, the air ventilation performances at the studied area for both annual and summer winds are directly influenced by these topographic features. Wind speeds in the directions of 0°-67.5° are relatively larger than others, due to the smoother upwind exposure of seawater. Speed values in the directions of 90°-112.5°, 157.5-202.5° and 292.5° are decreased evidently, due to the sheltering effect of upwind mountains, such as the Tai Lo Shan, and the Lion Rock. Results in other directions may be regarded as transitional conditions of these two mentioned cases. As will be discussed later, the sheltering effect especially in the directions of 90°-112.5°, and 157.5-202.5° would result in evident influence on the air ventilation performance of some test points at the PDA in terms of the VR values.

For the turbulence intensity, vertical profiles in the directions of 22.5° and 45°

are very similar to the reference condition with the values below 20%. From Figure 1, these two sections correspond to open sea upwind exposure. Thus, the results are affected little by surrounding topographical features. By contrast, results in the other directions turn to be quite different, and the turbulence intensity values become considerably larger. The values in the directions of 67.5° and 135° clockwise to 360° (0°) are generally in a range of 20%-30%, while those in the directions of 90° and 112.5° are even much larger with a range of 30%-40%. These directions correspond to hilly upwind exposures. Thus, wind flows are severely disturbed by these mountainous topographic features before arriving to the PDA. This situation is even more severe in the directions of 90° and 112.5°, since the disturbed upwind wind flows reaching to the PDA may be further obstructed and disturbed by the Kau To Shan which is located quite near to the PDA, as shown in Figure 1c.

Results of the yaw angles reflect the topographical effects on horizontal wind direction. Generally, the mountains/hills would force the surface wind to move forward in parallel to their orientation, or along the opening direction of the canyon formed by them.

From Figure 8, the yaw angles in the directions of 0°, 112.5°, 135°, 157.5°, 202.5°, 315°, and 337.5° are negative, which means the corresponding wind directions of upwind flows would get larger (or rotate clockwise to some extent). The most significant condition happens in the section of 135°. As can be seen from Figure 1c, the PDA is just located at a valley area (including the Shan Tin Hoi, and the Sha Tin Racecourse) formed by surrounding mountains. Thus, the local wind flows are guided to trend parallel to the orientation of the valley.

Results in other directions are positive. Thus, the mean wind directions of corresponding upwind flows would become smaller when they pass through the PDA. The most evident case happens in the section of 180°. The typical changes of

yaw angles in the two sections of 135° and 180° may be possibly due to the special topographic setups around the Kau To Shan as marked in Figure 1c.

It is noted that resolution of the mean wind direction of the field measurements of surface wind at Waglan Island Station from HKO is 10°, compared to the sectional width of 22.5° in this study. Thus, when calculating the wind rose information at the PDA using the method shown in Figure 10, even if the yaw angles at varied levels may differ with each evidently, the angle differences may not be large enough to make the modified wind directions lie in other azimuth sections. This is why the calculated marginal probabilities of each azimuth section at different height levels (Table 1) differ little with each other (results at some levels are even the same).

Wind climate characteristics at the pedestrian level may be deduced based on the test results at the lower height levels, i.e., 15 m above ground. It can be seen that the prevailing directions of the annual wind are north-northeast (NNE), and east-northeast (ENE). For the summer wind, the prevailing direction turns to be SW only.

These prevailing wind directions demonstrate a trend of keeping parallel to the mountains' orientation, or the opening direction of the canyon aisle, reflecting the fact that the local climate at the PDA is strongly influenced by surrounding topography.

Conditions of summer prevailing winds at higher levels are similar to those at the pedestrian level. But there are relatively more winds at higher heights from WSW, SSW, and ESE than those at the 15 m height. For the annual wind, it is found that winds may also blow frequently from the NE and E directions. Generally, for both summer and annual winds, wind speeds get larger and larger with height, since the obstruction and drag effects caused by local topography and ground roughness

turn to be weaker and weaker. At 500 m height level, the wind becomes similar to those at WGL. But there are still some differences (Figure 9, Figure 11i, and Figure 12i), reflecting the fact that wind flows at a much higher level of 500m above the studied area are still influenced by surrounding topography.

3. Suggestions for the planning design of potential developments at the PDA

Being one of the most densely populated cities in the world, Hong Kong simultaneously has the subtropical climate with hot and humid summer. Therefore, Hong Kong needs more wind for thermal relief and comfort in the built environment.

To enhance and improve the long-term wind environment in this city, it is important to optimize urban design for more wind penetration, especially to the public realm.

The Urban Design Guidelines stipulates a number of qualitative guidelines to improve air ventilation for the planning design. The qualitative guidelines can be referred to Chapter 11 Urban Design Guidelines of the Hong Kong Planning Standards and Guidelines.

4. AVA Wind tunnel test

For this project, a 1:800 AVA test model in a pattern of the maximum option design is fabricated which covers all the main topographical features and civil structures, e.g., buildings and bridges within a distance of 1.6 km (or 2 m in the wind tunnel) in radius from the PDA. Here, a scale of 1:800 (rather than 1:400) is adopted to enable the model to cover more topographical features.

The modeled AVA test area is depicted in Figure 1 by the red circle. Area delineated by the blue circle in Figure 1b represents the assessment area. A photo of the AVA model is shown in Figure 13.

4.1. Test points

As introduced previously, test points are the locations where wind VRs are tested and reported. Two main types of test points should be specified for AVA study: Perimeter and Overall.

Perimeter test points are positioned on the project site boundary, especially where junctions of all roads leading to the project site, main entrances to the project, and at corners of the project site exist. Overall test points may be evenly distributed and positioned in the open spaces, on the streets and places of the project and assessment areas where pedestrians frequently access.

There are 44 perimeter test points are considered for this project, as shown by the red solid circles in Zone A of Figure 14. These points are equally distributed along the project boundary lines with a center-to-center distance of 50 m in full-scale.

There are 159 overall test points are considered in this project, as shown by the green (in Zone A) and cyan (other zones) points in Figure 14. For description convenience, the assessment area is divided into seven zones, which are denoted as A, B, C, D, E, F, G, respectively.

4.2. Approach wind field

The approach wind field is adjusted according to the SWAS wind tunnel test results. The 16 directional approach wind fields are categorized into 3 groups: the one consisting of 0° and 135° (refer to as G1); the one consisting of 180° and 202.5°

(G2); and the one consisting of the left directions (G3). Details of these three kinds of approach wind fields are shown in Figure 15 and Table 4.

It is noted that the speed profiles and turbulence intensity profiles may be hardly adjusted to keep simultaneously consistent with those from SWAS, since (1) the local wind fields are influenced severely by surrounding irregular mountains and (2) the adopted wind tunnel belongs to a passive control type. In such cases, simulation of the speed profiles takes priority to that of the turbulence profiles.

In order to match the mean wind speeds between the 1:4000 scaled topographical model and the 1:800 scaled proximity model, wind speed scaling factors for each wind direction are needed. The scaling factor is defined as a ratio of MBL1/MBL2, with MBL1 standing for the scalar average of speeds at all the 9 height levels in a directional profile obtained from the SWAS tests; MBL2 standing for the speed average of the approach wind speed profile for the AVA study:

$$SF_i = MBL1_i / MBL2_i, i = 1, 2, ...16. \quad (4)$$

The mean wind speed based on 9 height level records is adopted to decrease the uncertainty of the result at a single level. The directional values of the scaling factor are listed in Table 5.

4.3. AVA test results

In this project, the mean wind speeds measured at 1 m height level in the tunnel scale (or 800 m in a prototype scale) are adopted as the V_∞ values. We didn't select those measured at 400m-500m as the gradient speeds, since it was found that mean wind speed at these relatively lower heights were still influenced by surrounding topographic effects, and the directional measurements at these heights changed from one section to another. By contrast, directional mean wind speeds measured at 800m height demonstrated little difference among varied sections, reflecting that mean

wind flows there were influenced little by surrounding topographic effects.

The directional VR values can be then calculated based on the measurements at the gradient height level V_∞ and pedestrian level V_p. These directional values are further modified by multiplying the corresponding scaling factors (Table 5), to obtain the VR values involved in Equation 1. To compute VR_w, the marginal occurrence frequencies of each direction at the 15 m height level listed in Tables 1 and 2 are adopted to sand for those at the pedestrian level.

$$VR_w = \sum_{i=1}^{16} F_i \times VR_i \times SF_i. \quad (5)$$

The VR values of each test position with and without installation of the potential developments at the PDA are listed in Tables 5 to 21. VR_w values for both annual and summer wind conditions are also provided in these tables, and shown in Figure 16 as well. Figure 17 compares the VR results between the case with potential developments and the one without the potential developments; while Figure 18 compares the VR_w results between these two cases.

4.3.1. Overall performance

For the case with the potential developments, the calculated SVR is 0.29 and 0.24 for annual winds and summer winds, respectively; while the LVR is 0.28 and 0.23 for these two wind conditions.

The minimum and maximum VR_w values with the installation of developments for annual winds are 0.12 and 0.51 at F1 and B30, respectively, where VR_w values without these development are almost the same (0.12 and 0.54).

The minimum and maximum values with the developments for summer winds are 0.10 and 0.42 at A7 and B30, respectively, where the VR_w values without the development are 0.10 and 0.43.

For the case with installation of potential developments at the PDA, the number of test points where VR_w values are lower than 0.20 is 27 and 57 for annual winds and summer winds. Among them, there are 5 (annual) and 16 (summer) points with the VR_w values lower than 0.15.

The SAVR values for each zone area with the potential developments are: 0.26 (annual) & 0.22 (summer) for Zone A, 0.32 & 0.27 for Zone B, 0.29 & 0.22 for Zone C, 0.24 & 0.23 for Zone D, 0.29 & 0.24 for Zone E, 0.30 & 0.24 for Zone F, and 0.21 & 0.19 for Zone G, as listed in Table 21. For Zone C, D, E, F, and G, results without installation of the potential developments are almost the same with those with the developments. But for Zone A and Zone B, results turn to be a bit larger; and the SVR values are 0.35 (annual) & 0.29 (summer) for Zone A, and 0.39 (annual) & 0.30 (summer) for Zone B, respectively. This reflects that the potential developments at the PDA may influence the air ventilation performances at both Zone A and Zone B.

4.3.2. Results in Zones C, D, E, F, G

The influence of the potential developments on the air ventilation performance at PDA and surrounding areas can be determined through comparing the two kinds of VR_w/VR results with/without the potential developments. In Figure 17 and Figure 8, the directional VR values (Figure 17) and the VRw (Figure 18) values with the potential developments in each zone as depicted in the abscissa axis, while those without the potential developments are depicted in the vertical coordinate. If the potential developments would result in non-ignorable influence on the air ventilation performance at one zone, then the distribution of the depicted results will deviate from the “y=x” pattern. On the contrary, if the depicted results follow such a “y=x” distribution pattern, then the potential developments may result in ignorable

influence on the air ventilation performance in the studied zone.

From Figures 17 & 18, the directional VR values and the VR_w values for the cases with and without installation of potential developments in Zone C (also see Tables 11 & 12), Zone D (Tables 13 & 14), Zone E (Tables 15 & 16), Zone F (Tables 17 & 18), and Zone G (Tables 19 & 20) are distributed consistently around "y=x". Thus, the potential developments may result in negligible influence on the air ventilation performances in these areas.

The relatively smaller VR_w values of test points beyond this influenced area, such as F1 and G3, may be attributed to the surrounding topographical and/or proximity features rather than these potential developments at the PDA.

4.3.3. Results in Zones A, B

For the case with the installation of potential developments at Zone A and Zone B, there are 17 (annual) and 38 (summer) test points whose VR_w values are smaller than 0.20, with the minimum VR_w values of 0.14 for annual winds and 0.10 for summer winds.

4.3.3.1. Results at Zone B

Results with and without the installation of potential developments are also compared in Figure 17 (for directional VR values) and Figure 18 (for VRw values). As can be seen, most depicted points are distributed around the "y=x" line, but some points deviate from it evidently. This demonstrates the fact that the potential developments may only influence the air ventilation performances at limited region of this zone.

From Table 9 (results with potential developments) and Table 10 (results without potential developments), the four critical points with the lowest VR_w values under

summer wind conditions are B3, B4, B18, and B19. VR_w values at B3 are 0.24 (annual) & 0.19 (summer) for the case with developments, and 0.35 & 0.25 for the case without developments. Those at B4 are 0.19 & 0.19, and 0.36 & 0.27 for these two cases, respectively. Results of the case with developments at both B18 and B19 are similar to their counterparts in the case without developments. At B18, the VR_w values are 0.26 & 0.18, and 0.27 & 0.18; while at B19, the VR_w values are 0.18 & 0.13, and 0.20 & 0.14, respectively.

Besides B3 and B4, there are also 5 test points where the air ventilation performances are influenced relatively evidently by the potential developments in this area: B5, B8, B9, B10, and B16. These 7 points are concentrated at the border area between Zone A and Zone B, as delineated by the red lines in Figure 19. The VR_w values at B5 are 0.20 (annual) & 0.22 (summer) for the case with developments, and 0.37 & 0.29 for the case without developments. Results at B8 are 0.24 & 0.25, and 0.38 & 0.30; those at B9 are 0.23 & 0.24, and 0.37 & 0.30; the ones at B10 are 0.22 & 0.20, and 0.34 & 0.25; results at B16 are 0.26 & 0.27, and 0.39 & 0.32, respectively.

It is found that the VR_w values for summer winds at these points (B3, B4, B5, B8, B9, B10, B16) are affected much more slightly than those for annual winds. The reason lies in that the most prevailing wind direction during summer season is SW. As shown in Figure 19, the potential developments in this case are located at the downwind side of Zone B, and the shielding effect due to the development obstructions becomes much weaker.

4.3.3.2. Results at Zone A

For annual winds, test points with the lowest VR_w values in this zone are P27 (0.14), P28 (0.14), and A44 (0.14). For summer winds, test points with relatively lower

VR_w values are: A4 (0.10), A7 (0.10), P7 (0.12), P3 (0.13), A12 (0.13), A3 (0.14), A5 (0.14), A6 (0.14), A8 (0.14), A11 (0.14), and A21 (0.14). These points are marked in Figure 19 (delineated by the black lines).

It is noted that P27, P28 and A44 are located near with each other (Figure 19). For P27, VR values in directions of 0°-67.5°, 180°, and 247.5° are lower than those in other directions, due to the influence of the Indoor G/IC Facility on its right-hand side. For P28 and A44, these two points are located between the two G/IC Facilities. Meanwhile, there are also a few buildings in their NNE and ENE. Thus, wind flows around this place in the directions of, such as, 22.5°, 45°, 135°, and 180°, may be disturbed by these structures. Phenomena of flow separation and stagnation may occur, which result in the decrease of local wind speed at the pedestrian level.

The five points of A3, A4, A5, A6, and A7 are located quite near with each other and are distributed between the Retail Shopping Center and the Community/Culture Facilities (Figure 19). Due to the sheltering effect of surrounding mountains (Figure 1), and either or both of these two potential structures, the VR values at these points and A8 in the directions of 90°-112.5° (mainly for annual wind condition), and 157.5°-292.5° (for both annual and summer wind conditions) are decreased evidently (Table 7). This accounts for the relatively poor air ventilation performance at these areas, especially for the summer wind case.

A11, A12, and A21 are the other three points that need relatively more considerations. From Table 7, for A11, the VR values in the directions of 90°-112.5°, and 157.5°-247.5° are no so large compared to other directional values. On the one hand, this should be attributed to the decreased approach wind speed as mentioned above. On the other hand, it should be also related to the obstruction effect of the Retail Shopping Center (especially in directions of 157.5°-225°) and some upwind potential buildings (such as in 180° and 247.5°).

For A12, the directional VR values in 90°-112.5°, 157.5°-292.5° are lower than the average level. The relatively poor performance in these directions may be mainly attributed to the shielding of surrounding mountains and the obstruction of upwind potential buildings.

A21 is located almost at the center of the PDA. Air flows, disturbed by surrounding mountains and thus with decreased mean speed, reach to this place and are further influenced by nearby potential buildings. From Table 7, the tested VR values in the directions of 90°-180°, 247.5°, and 292.5°-337.5° are lower than the average level.

Besides the above analyzed test points, other positions where the air ventilation may be influenced evidently by the potential developments include: A13 in summer wind case; A30, A36, A38, and A43 in annual wind case.

For A13, the poor performance of VR_W is due to the small VR values in directions of 225°-292.5°. The main reason lies in that this point is located quite near to the Community/Culture Facilities (Figure 19). Thus, the local wind flows are obstructed by the structure body.

For A30, A36, A38, and A43, the situations are similar to that at A21. These tested places are surrounded by a number of potential buildings. Thus, wind flows would be interfered by these structures, resulting to the typical air ventilation performance over a built-up terrain.

4.4. Possible measures to improve AVA Performance

From the above discussions, air ventilation at some places within or near the PDA may be influenced by the potential developments evidently. To enhance the long-term wind environment in these areas, it is important to optimize urban design for more wind penetration, especially to the public realm. For better air ventilation

performance, the following improvement measures may be considered:

(1) The width of main streets/roads can be designed in a gradient pattern, i.e., the two roads (or the inner parts of these two roads) passing through A21, as marked in Figure 19, can be relatively wider than those left. As reflected by the tunnel test results, the air ventilation performance at the central area of the PDA (e.g., A21) suffers from the relatively high density of potential developments. It is assumed that phenomena of flow separation and stagnant due to these developments may be more severe at the central areas. Thus, by widening the roads/streets passing through the central area, the mobility performance of local flow may be improved.

(2) There are some potential developments which are located quite near or directly connected to their neighbors, i.e., the buildings marked by the magenta rectangles in Figure 19. These marked clustered structures are aligned in an orientation perpendicular to the most prevailing summer wind direction (SW). Thus, they may result in severe obstruction of surrounding air flows (e.g., air ventilation performance at A34 suffers from the clustered buildings besides it). Thus, it is suggested to keep suitable gaps between these building blocks. The gaps for enhancing air permeability should be at a face perpendicular to the prevailing wind.

(3) From Figure 17, the two G/IC Facilities, Retail Shopping Center, and the Community/ Culture Facilities are large in size and are featured by irregular profiles. These structural characteristics may result in negative influences (disturbance, obstruction) on the local air ventilation performance. Thus, streamlined design for these four structures can be adopted.

5. Conclusions

In this report, the wind tunnel test procedures and the main results for the AVA study of the captioned project have been presented.

Wind characteristics at the considered site are estimated based on the 1:4000 scale topographic model. Vertical profiles of mean wind speed, turbulence intensity, and yaw angle are provided. Wind rose information for both annual wind and summer wind at 9 different height levels above the PDA is determined. It is found that the surrounding topographical features may influence the local wind climate evidently.

Based on the obtained site wind characteristics and the Urban Design Guidelines, some suggestions for the planning design of potential developments at the PDA are provided for the improvement of the local air ventilation performance.

For the Initial AVA study, air ventilation performances at 203 test points are examined based on the 1:800 scale proximity model. By comparing results from the two cases with/without the installation of potential developments, it is found that the potential developments may influence the air ventilation performance within the PDA and at the border areas (i.e., the region delineated by red lines in Figure 19), but they may result in neglectable influence in the regions located farther away from the boundaries of PDA (i.e., Zone C, Zone D, Zone E, Zone F, Zone G, and the southwestern part of Zone B). A number of test points with relatively lower VR values are recognized and analyzed. Some possible improvement measures are provided.

6. Reference

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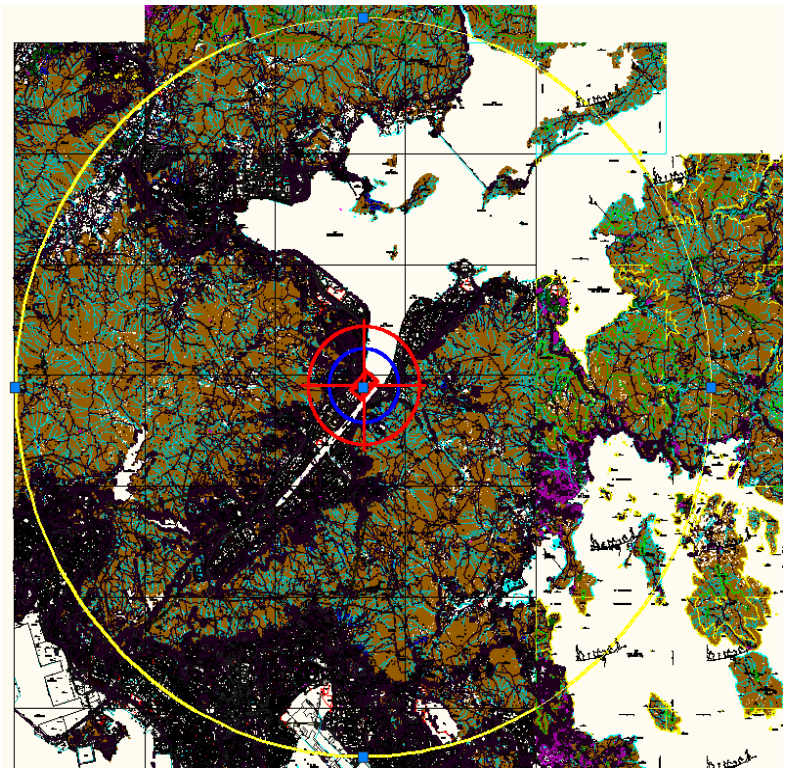
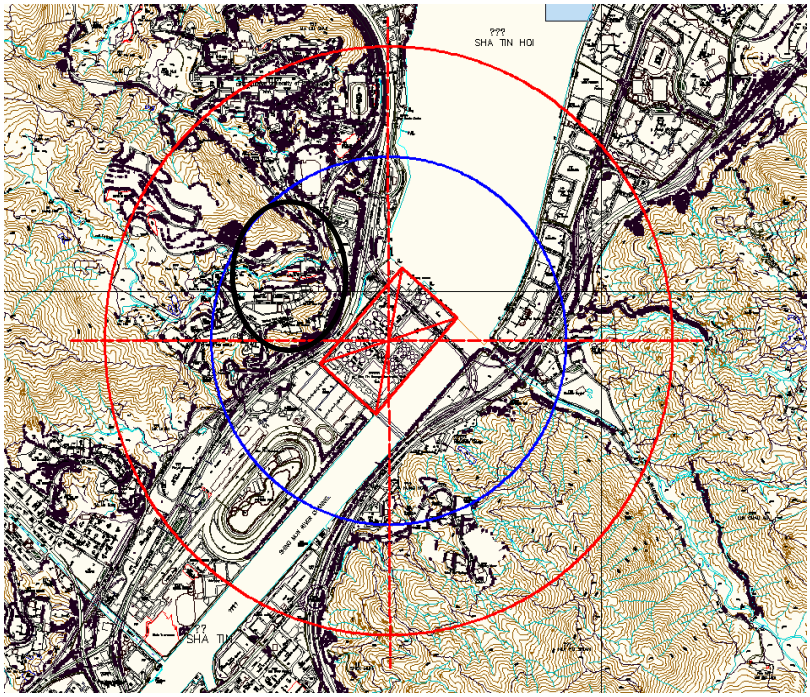
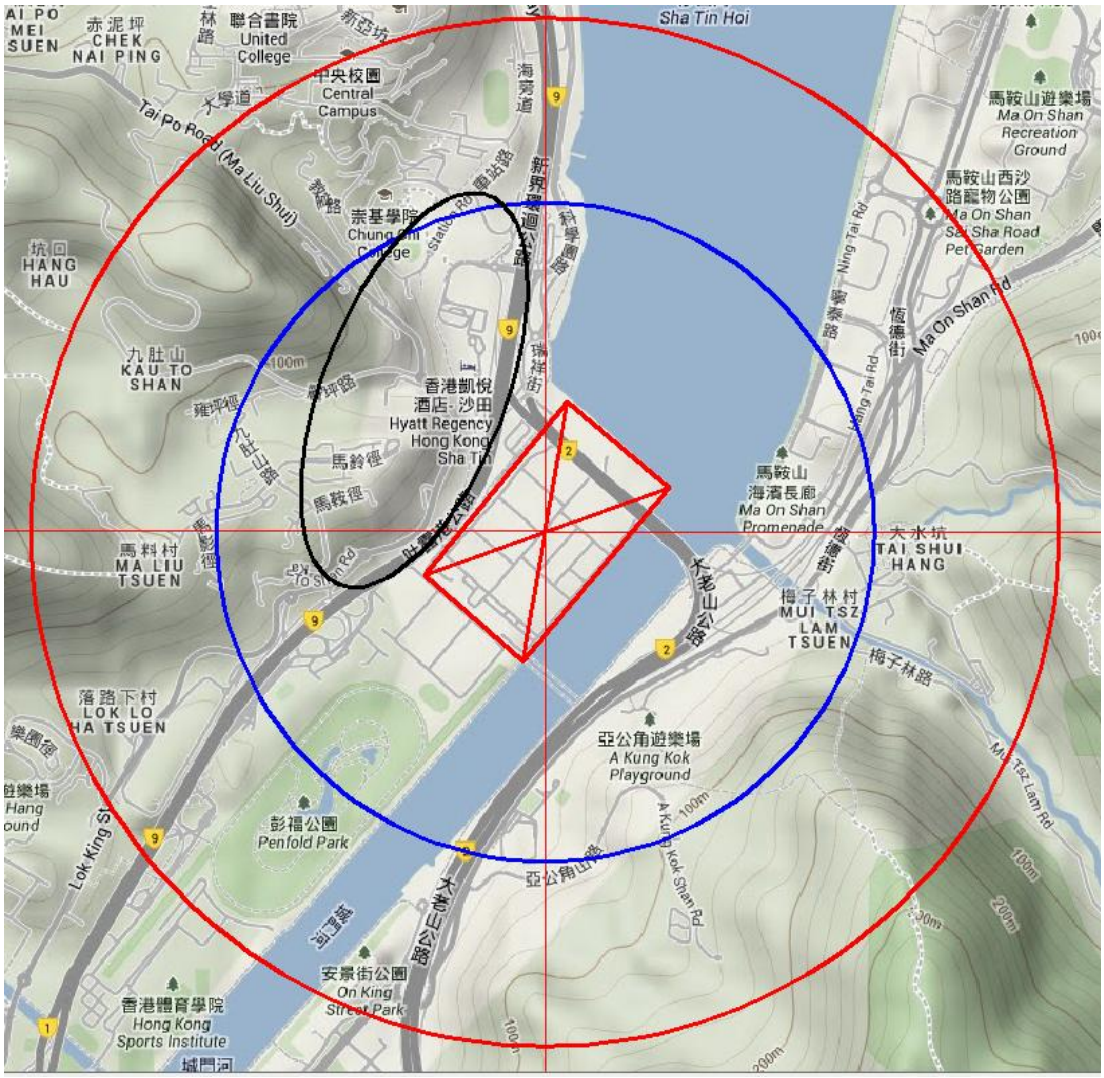


(a)



(b)

Figure 1. (a) Overview and (b) zoomed view-1 of topographic maps around the PDA (red rectangular): area constrained by the yellow circle stands for the SWAS model coverage; area constrained by the blue circle stands for AVA assessment area; area delineated by black ellipse stands for the Kau To Shan.

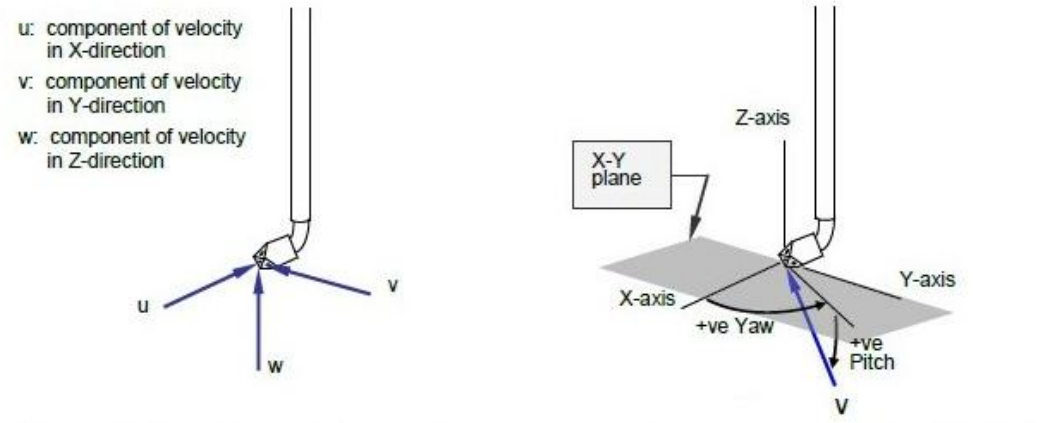


(c)

Figure 1. (c) Zoomed view-2 of topographic maps around the PDA (red rectangular). Area constrained by the yellow circle stands for the SWAS model coverage; the one constrained by the red circle represents the proximity model coverage; area constrained by the blue circle stands for AVA assessment area; area delineated by black ellipse stands for the Kau To Shan.

(a) **(b)**

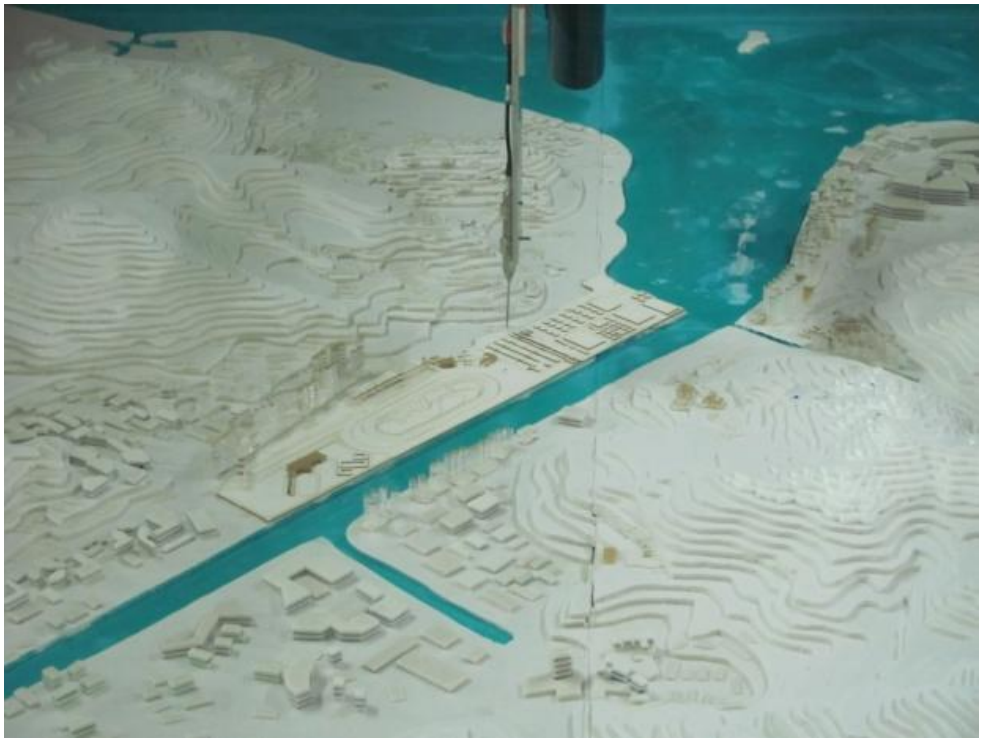
Figure 2. BLWT facility at CityU. (a): wind generating and developing sections (b): Cobra probe system.



Note: Yaw angle is technically 'azimuth' (rotation angle about the z-axis); and Pitch is technically 'elevation' (the angle between the flow velocity vector V and the X-Y plane).

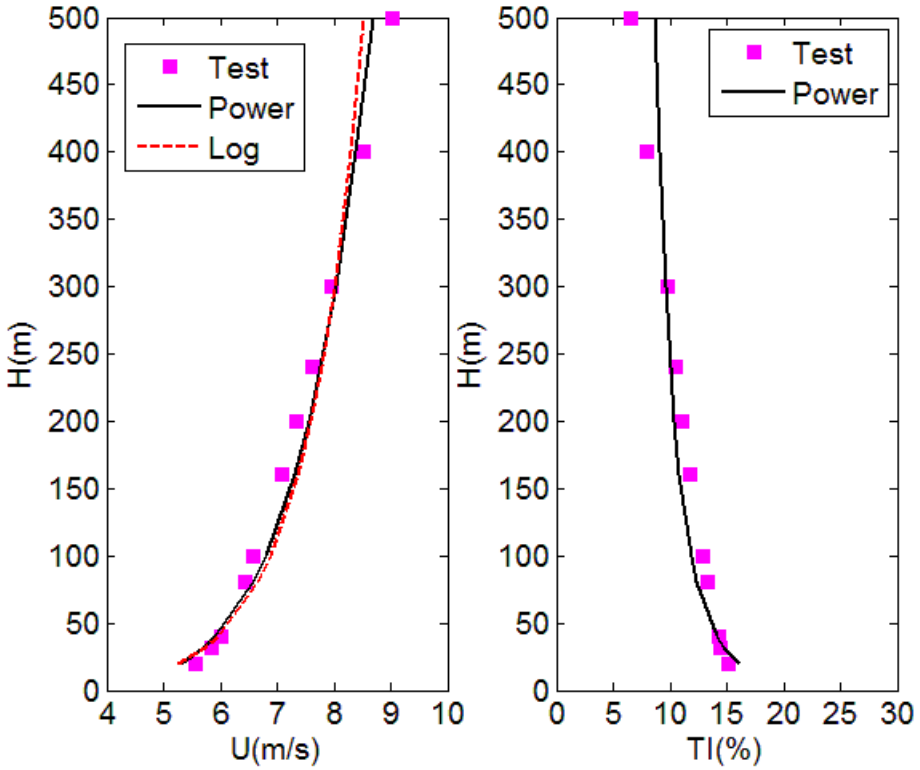
Figure 3. Definitions of wind components and angles for the Cobra Probe (Manual of Cobra Probe-Getting Started: Series 100 Cobra Probe (v3.7), p8).

(a)

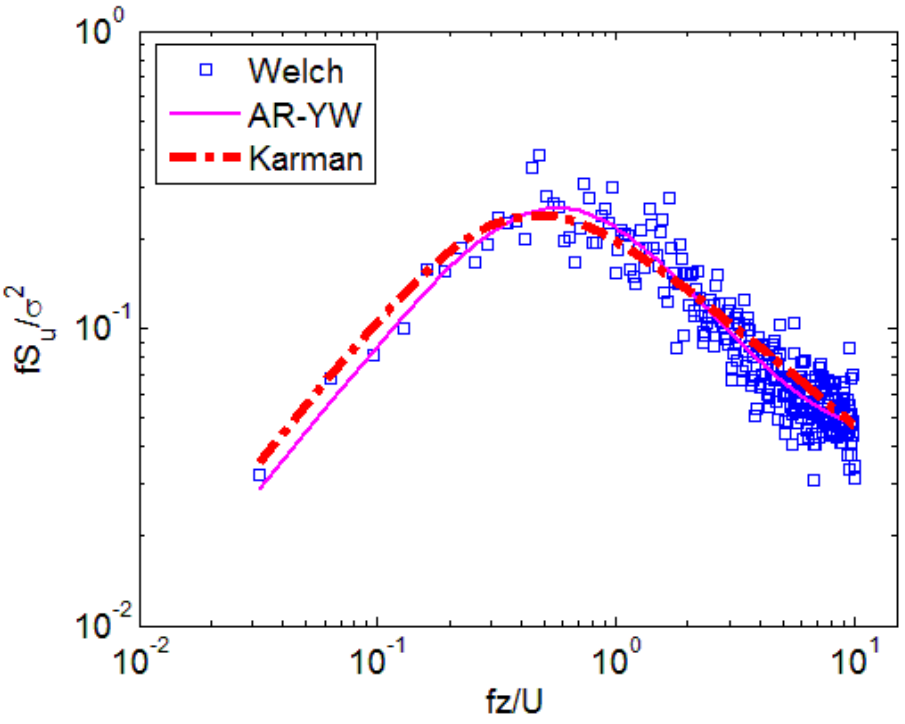


(b)

Figure 4. SWAS model installed in the wind tunnel at (a) overview and (b) zoomed view.

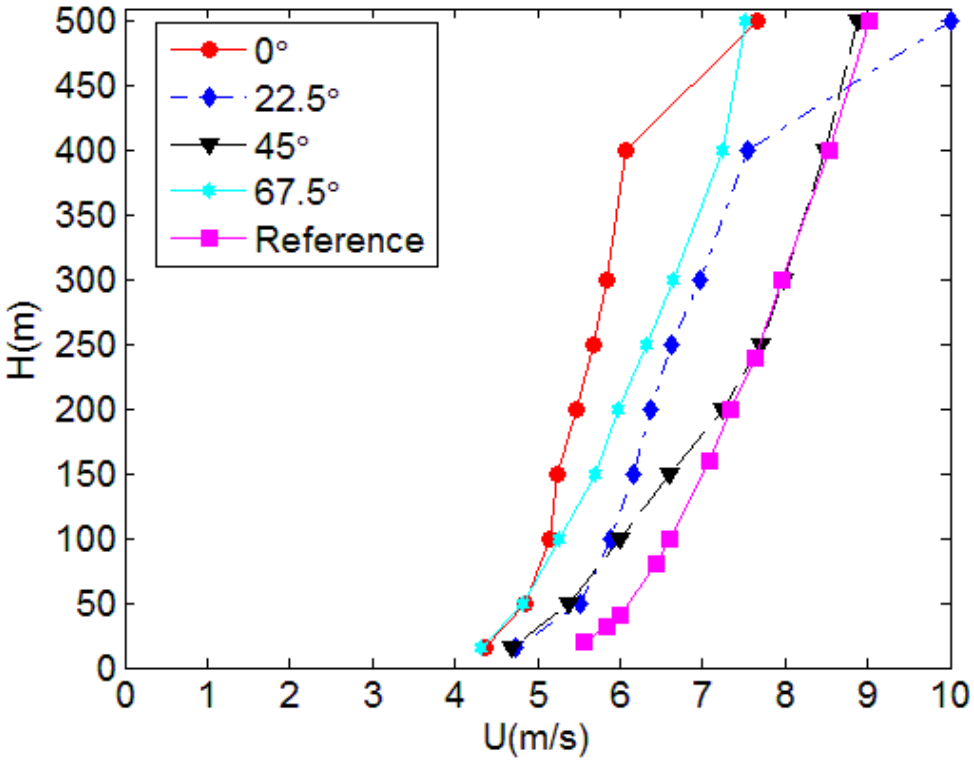


(a)

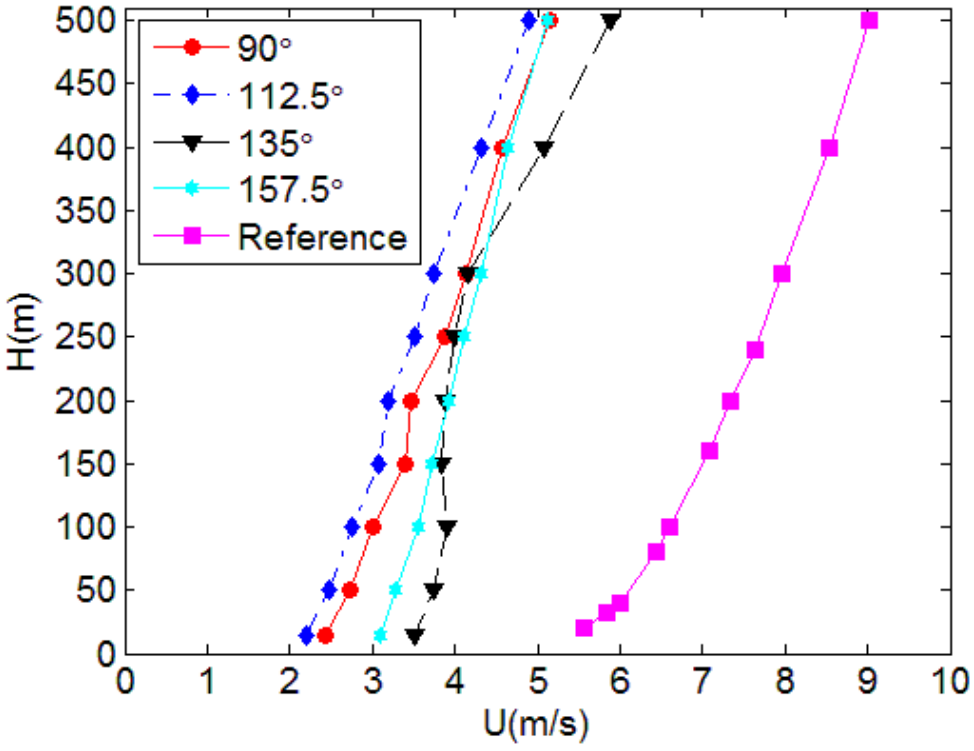


(b)

Figure 5. Approaching wind filed for 1:4000 scaled models: (a) wind profiles and (b) turbulence spectrum.

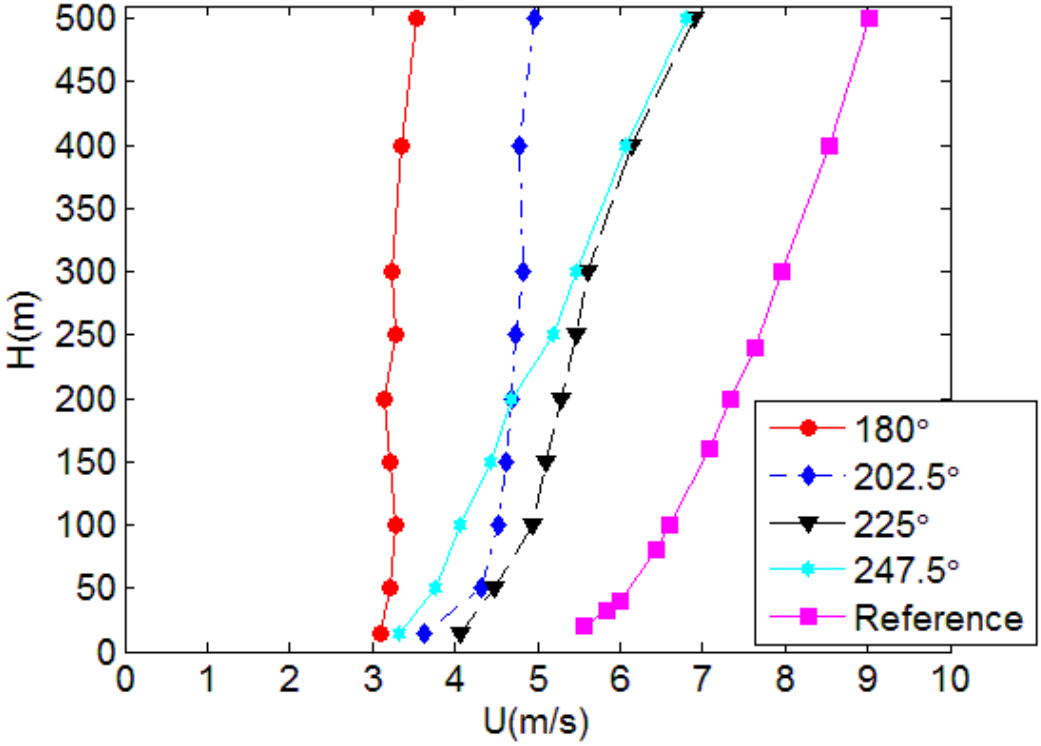


(a)

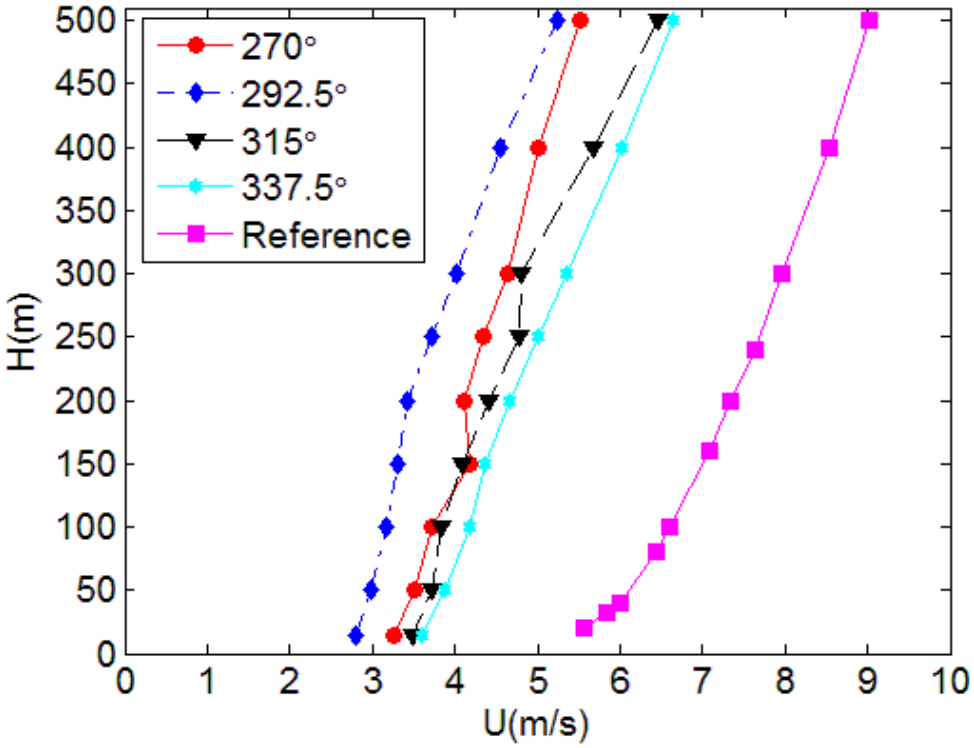


(b)

Figure 6. Directional vertical profiles of mean longitudinal wind speed for (a) 0°, 22.5°, 45°, 67.5° and (b) 90°, 112.5°, 135°, 157.5°.

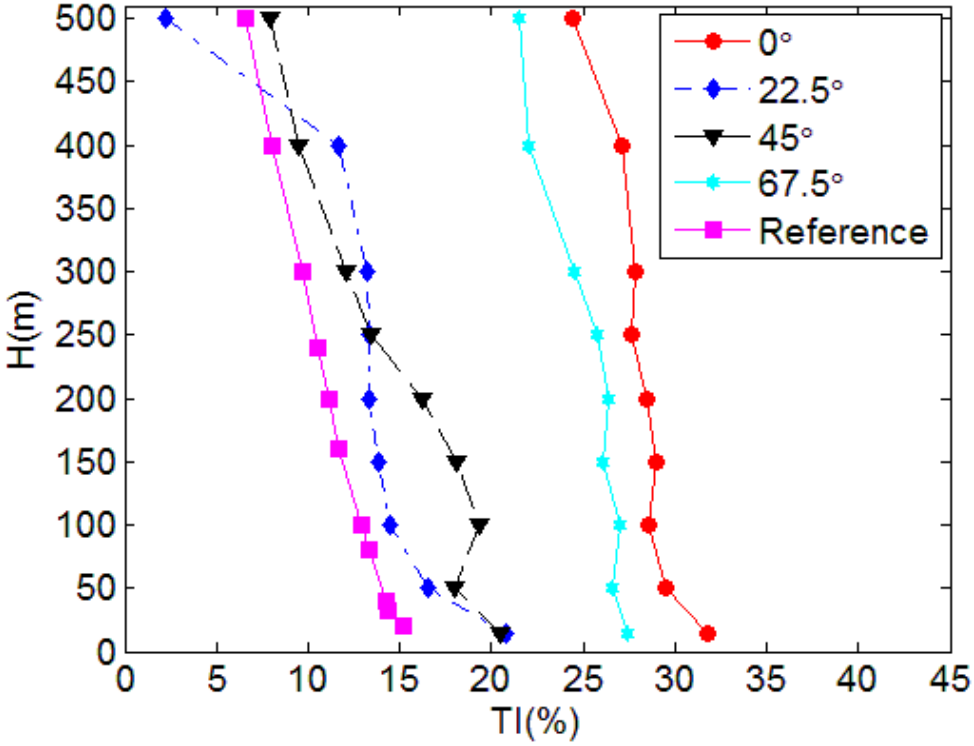


(c)

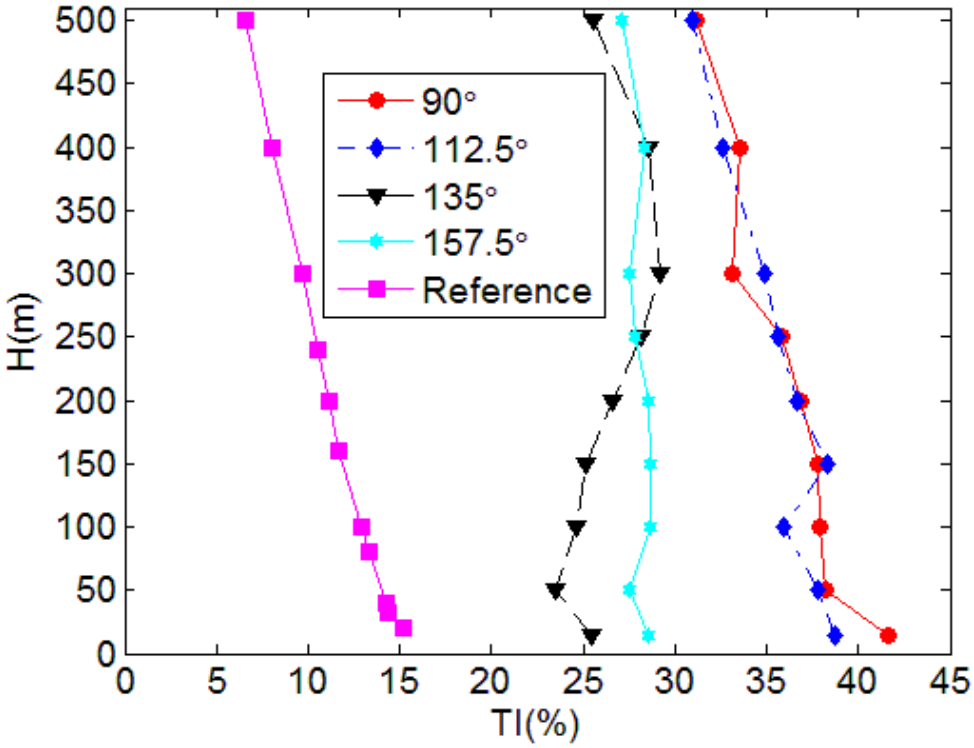


(d)

Figure 6. Directional vertical profiles of mean longitudinal wind speed for (c) 180°, 202.5°, 225°, 247.5° and (d) 270°, 292.5°, 315°, 337.5°.

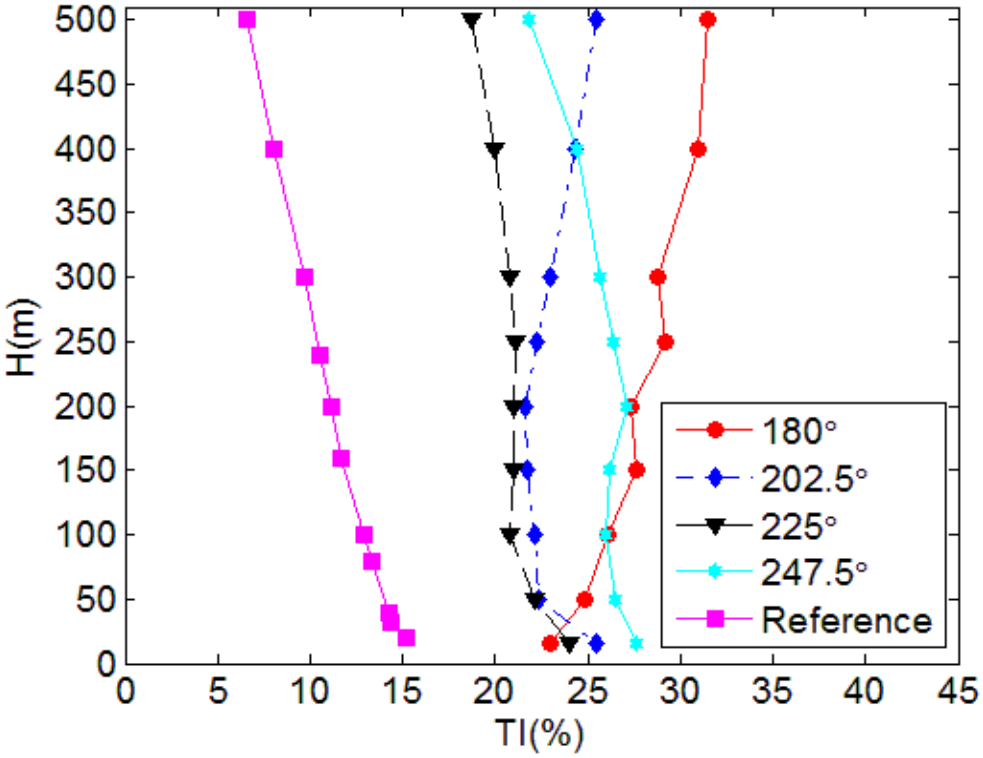


(a)

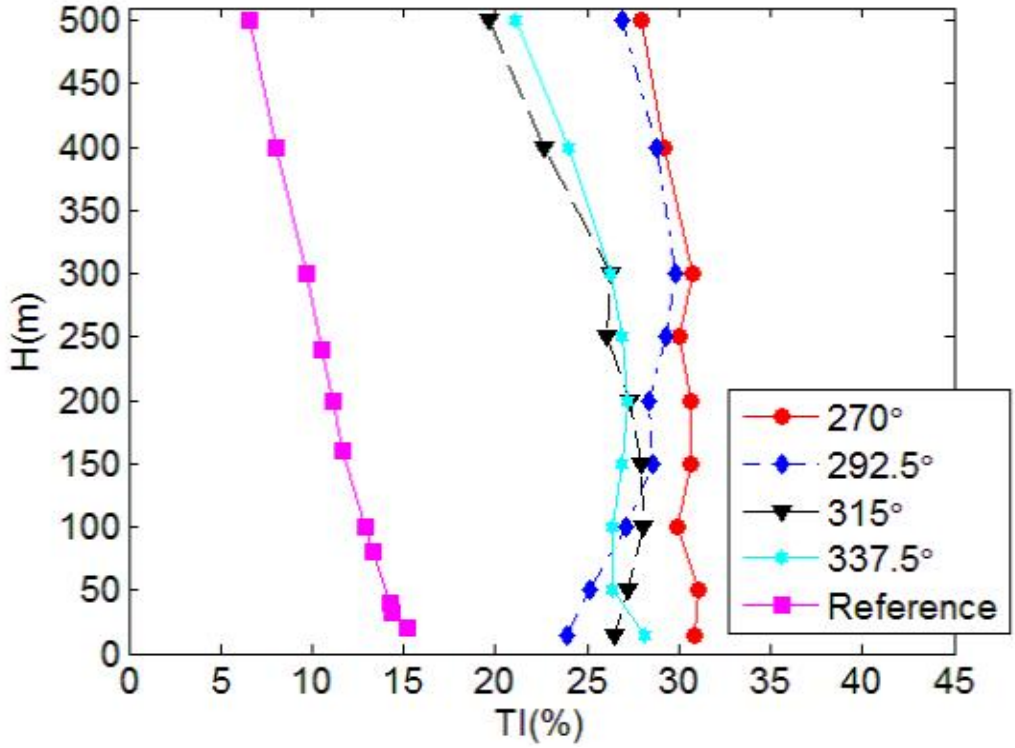


(b)

Figure 7. Directional vertical profiles of turbulence intensity for (a) 0°, 22.5°, 45°, 67.5° and (b) 90°, 112.5°, 135°, 157.5°.

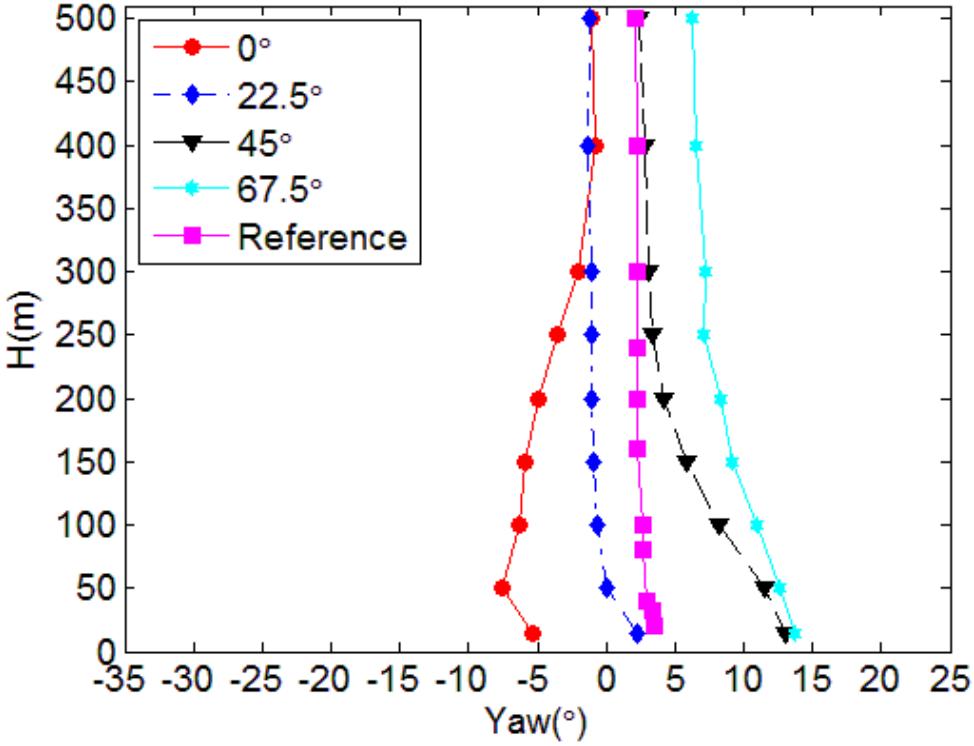


(c)

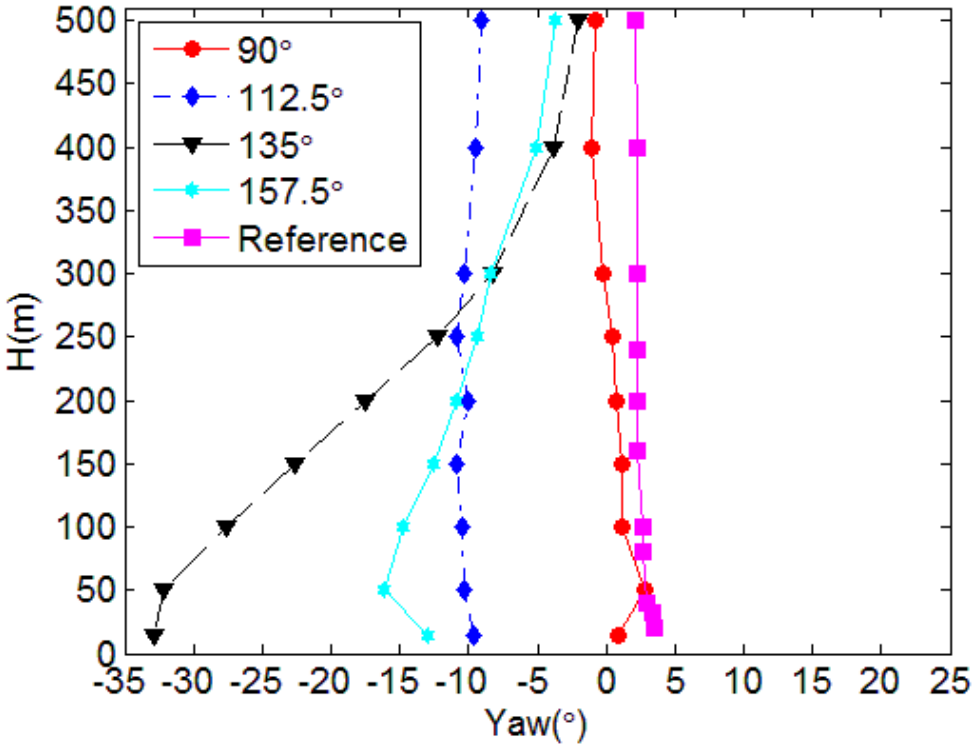


(d)

Figure 7. Directional vertical profiles of turbulence intensity for (c) 180°, 202.5°, 225°, 247.5° and (d) 270°, 292.5°, 315°, 337.5°.

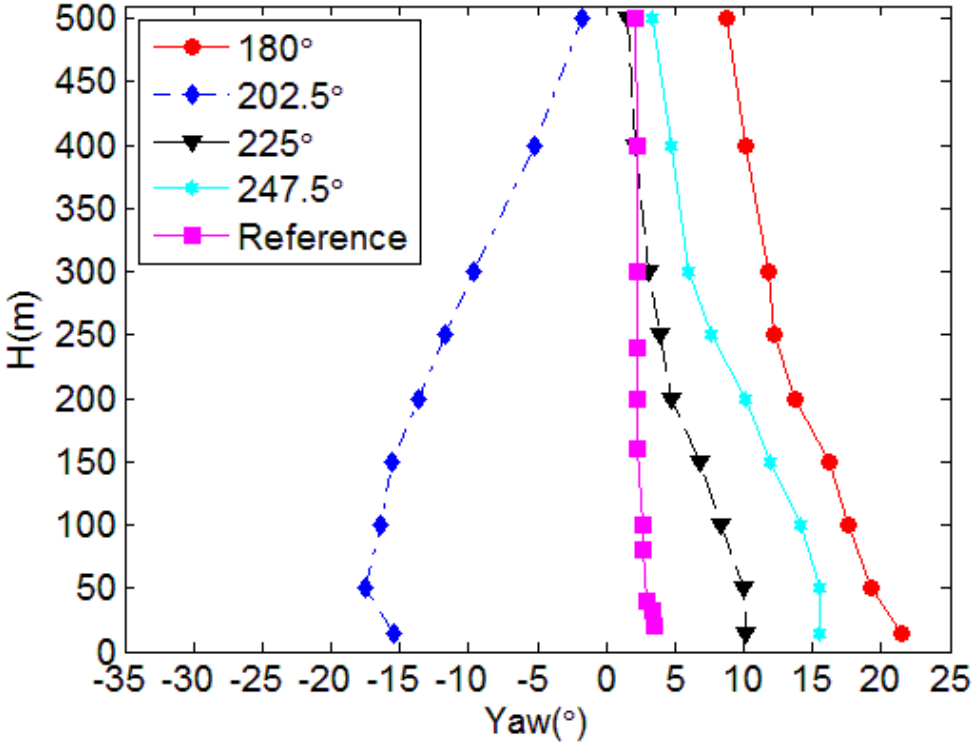


(a)

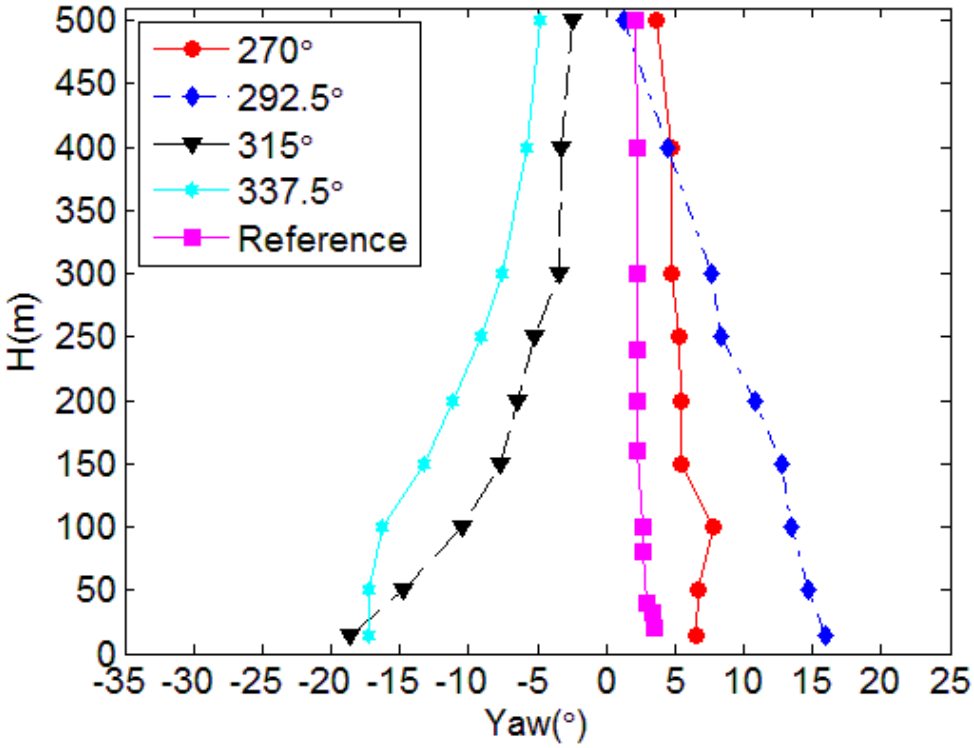


(b)

Figure 8. Directional vertical profiles of yaw angle for (a) 0°, 22.5°, 45°, 67.5° and (b) 90°, 112.5°, 135°, 157.5°.

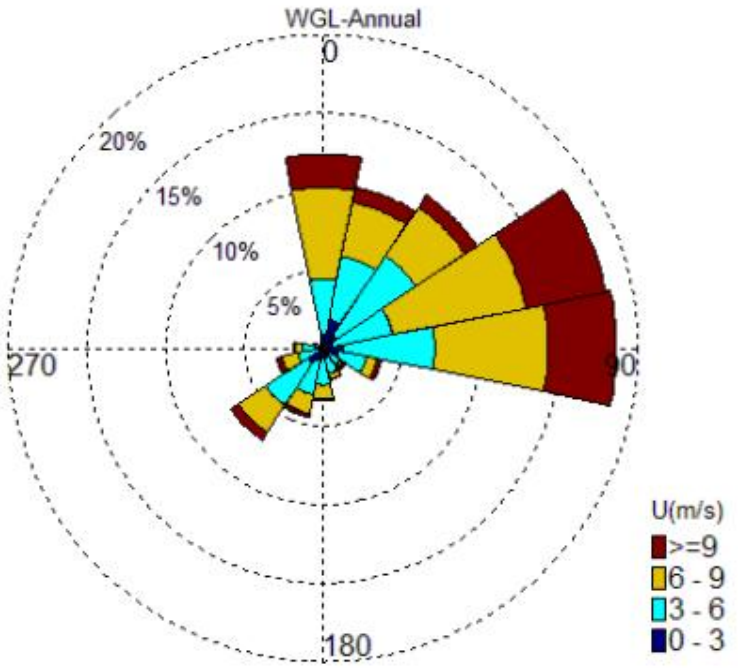


(c)

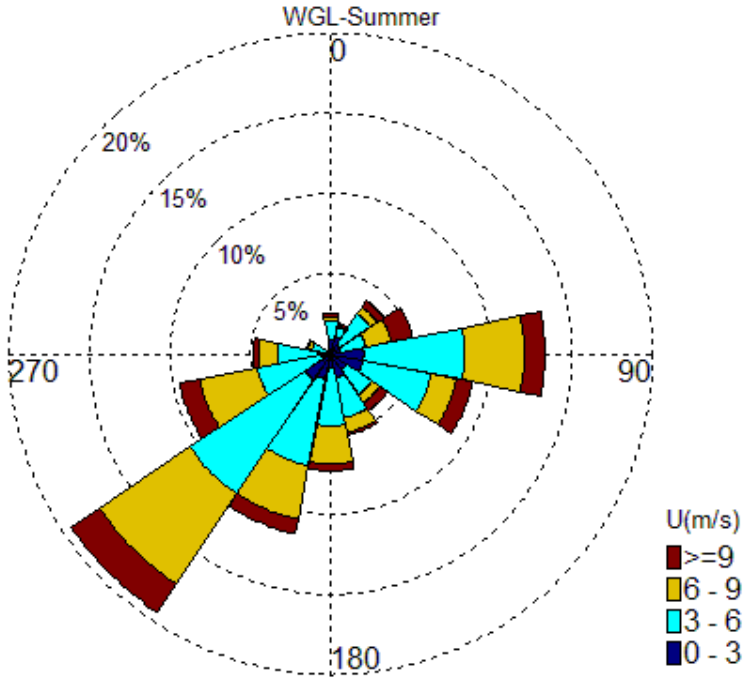


(d)

Figure 8. Directional vertical profiles of yaw angle for (c) 180°, 202.5°, 225°, 247.5° and (d) 270°, 292.5°, 315°, 337.5°.



(a)



(b)

Figure 9. Wind roses of mean wind velocity at the WGL station under (a) annual wind condition and (b) summer wind condition.

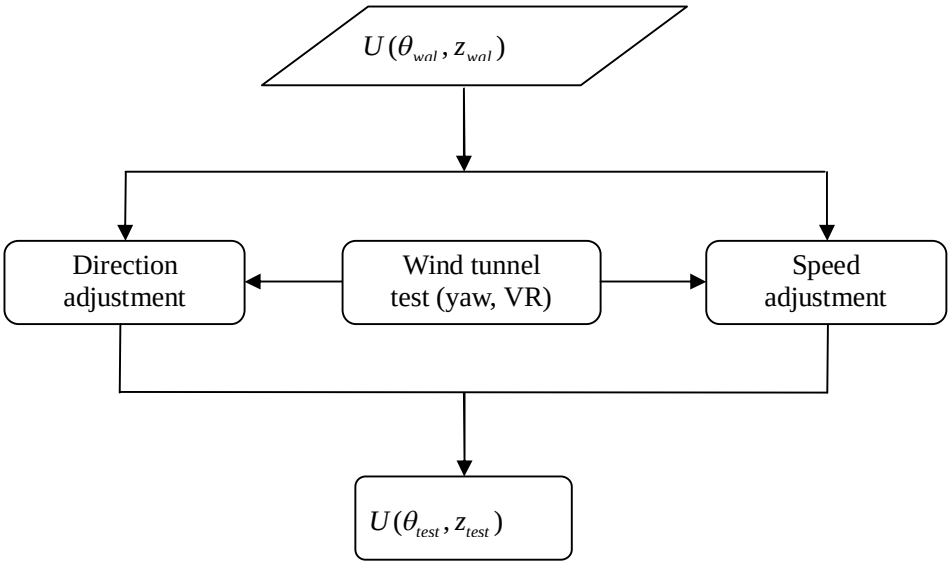
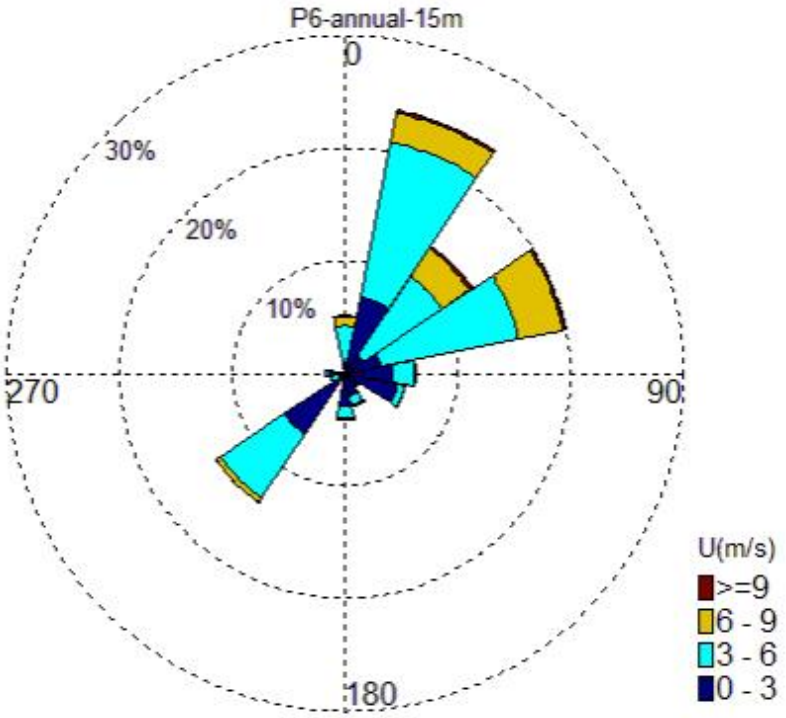
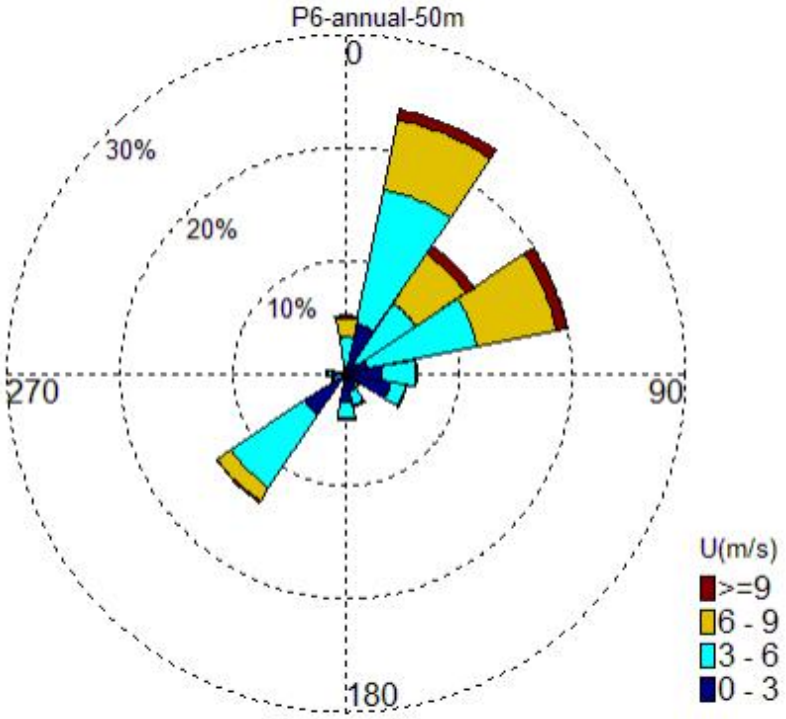


Figure 10. Flow chart of the assessment of wind rose at a test place based on WGL data.

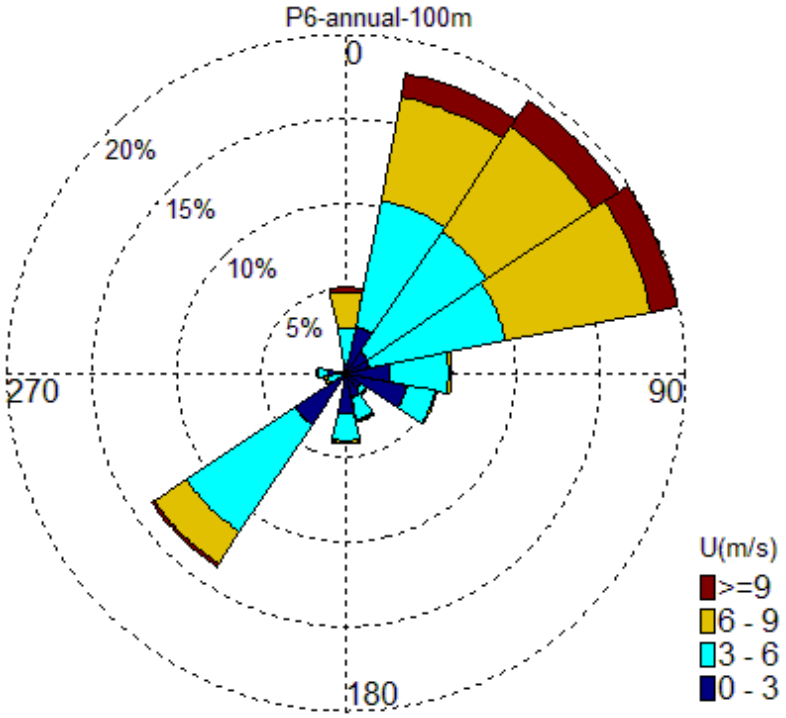


(a)

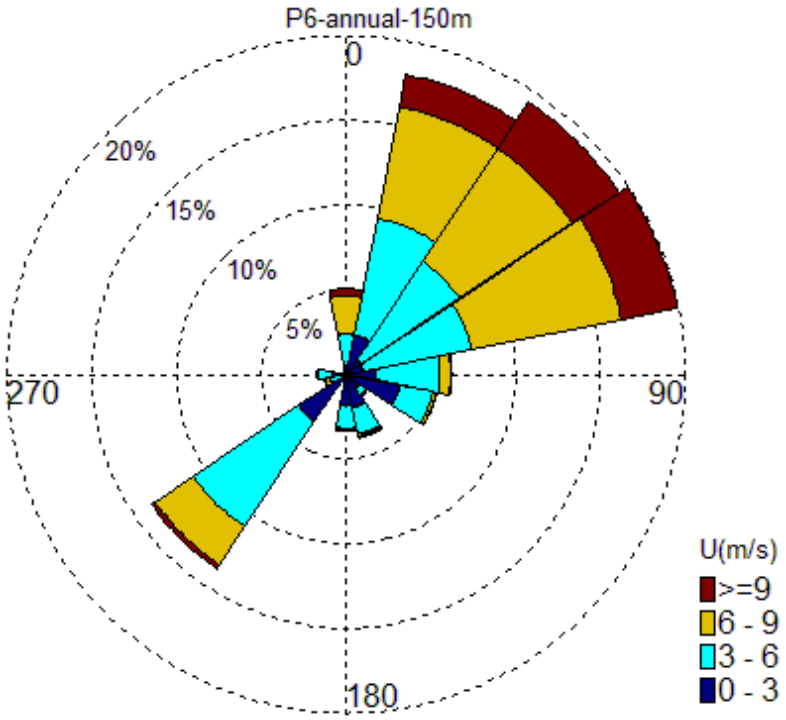


(b)

Figure 11. Wind roses above the geometric center of the PDA for annual winds at (a) 15 m and (b) 50 m.

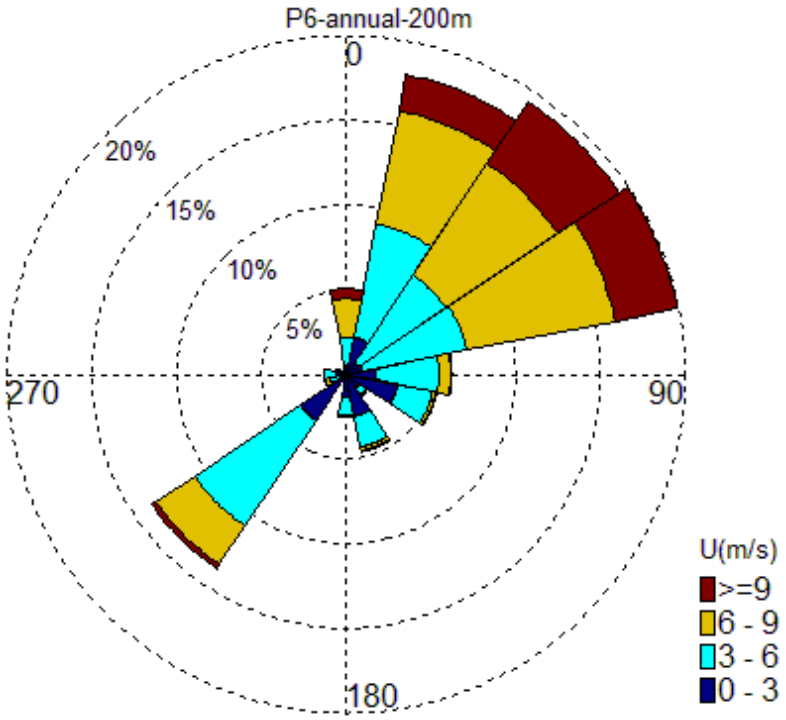


(c)

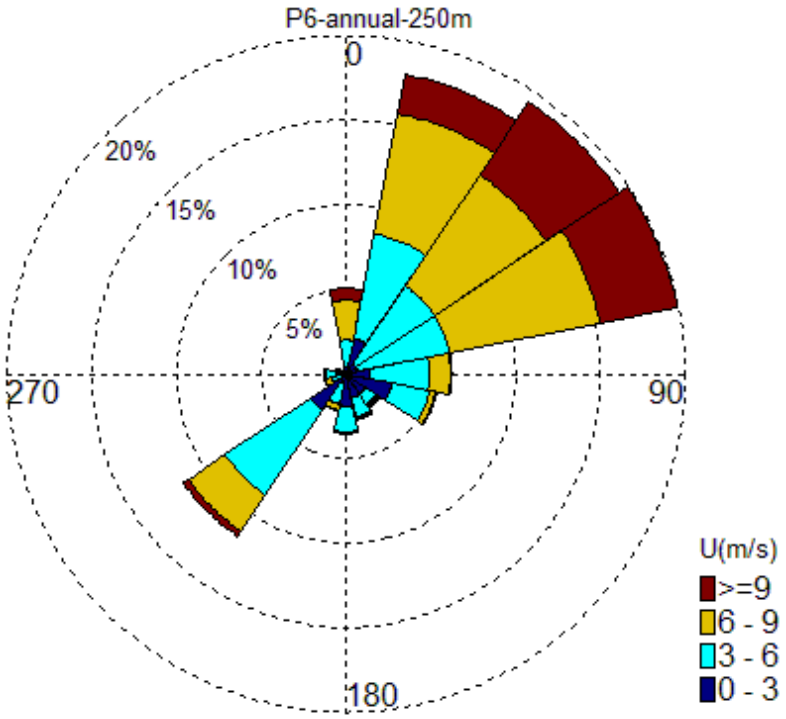


(d)

Figure 11. Wind roses above the geometric center of the PDA for annual winds at (c) 100 m and (d) 150 m.

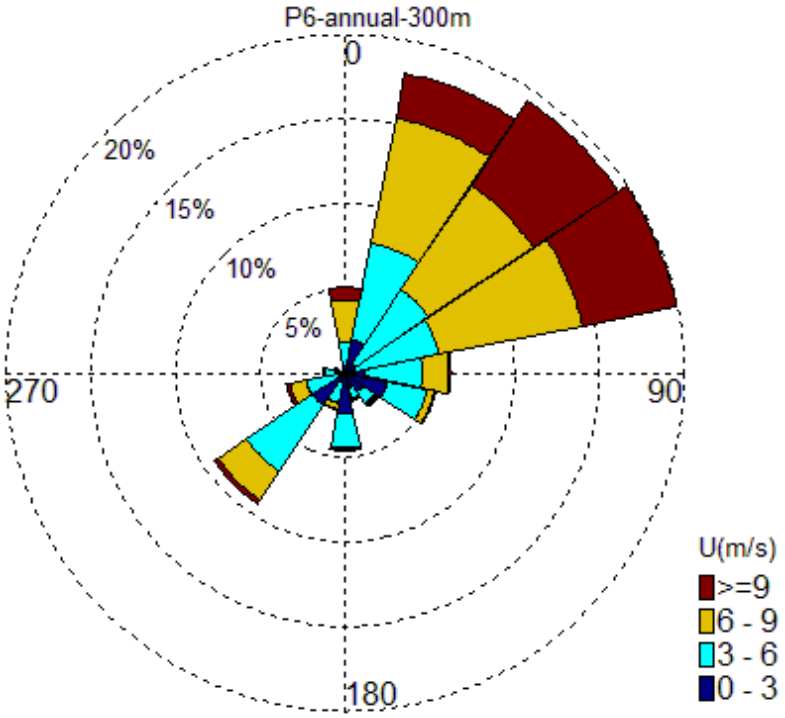


(e)

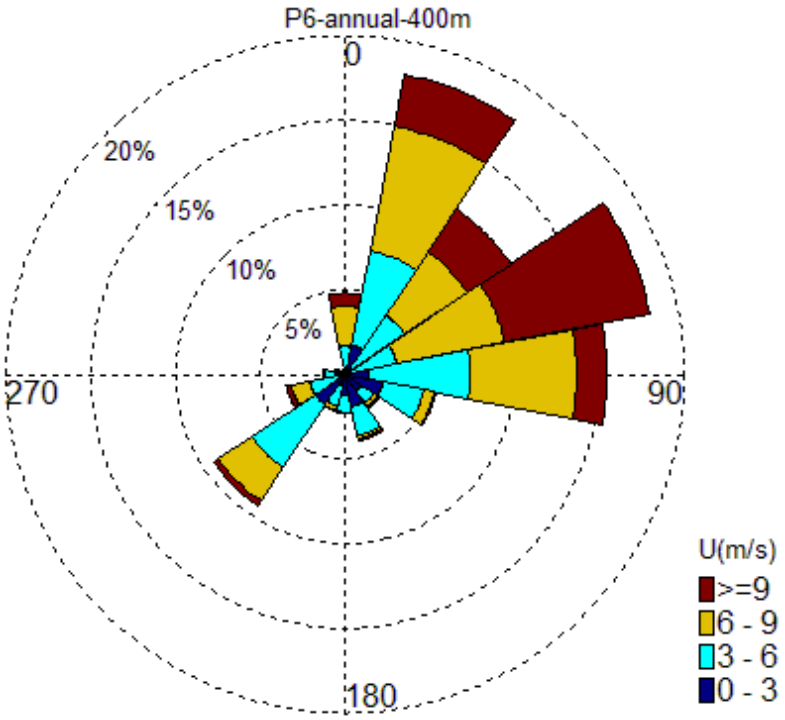


(f)

Figure 11. Wind roses above the geometric center of the PDA for annual winds at (e) 200 m and (f) 250 m.

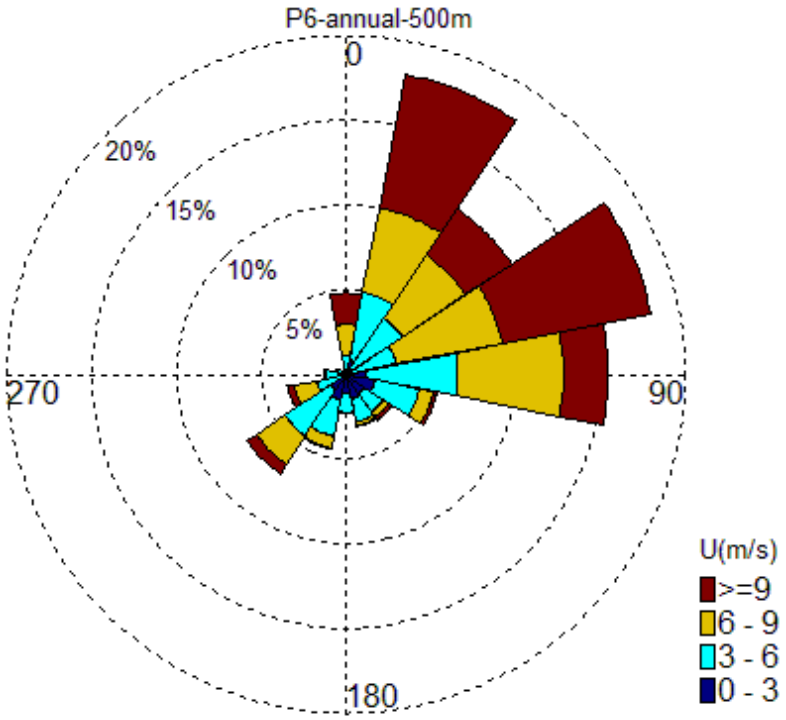


(g)



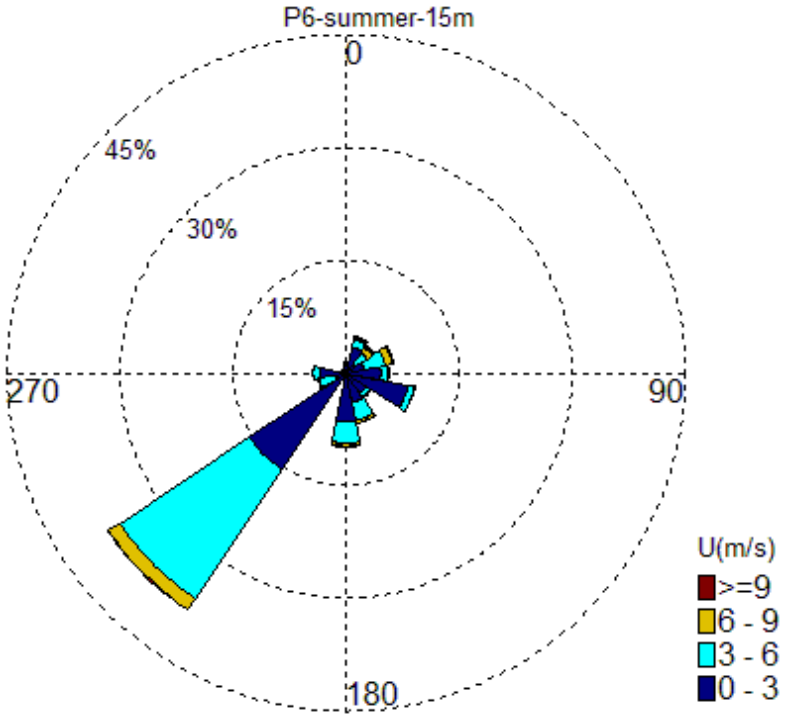
(h)

Figure 11. Wind roses above the geometric center of the PDA for annual winds at (g) 300 m and (h) 400 m.

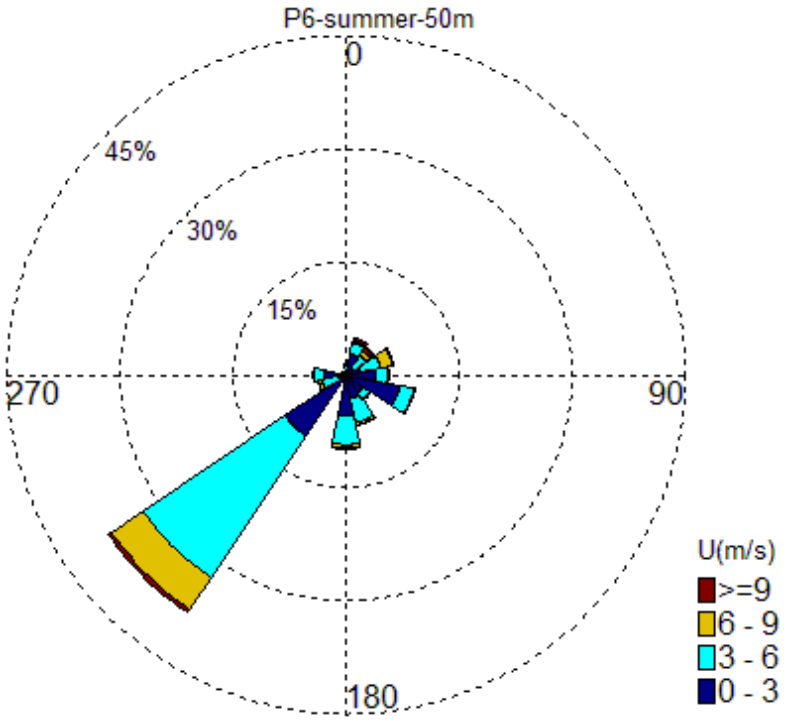


(i)

Figure 11. (i) Wind roses above the geometric center of the PDA for annual winds at 500 m.

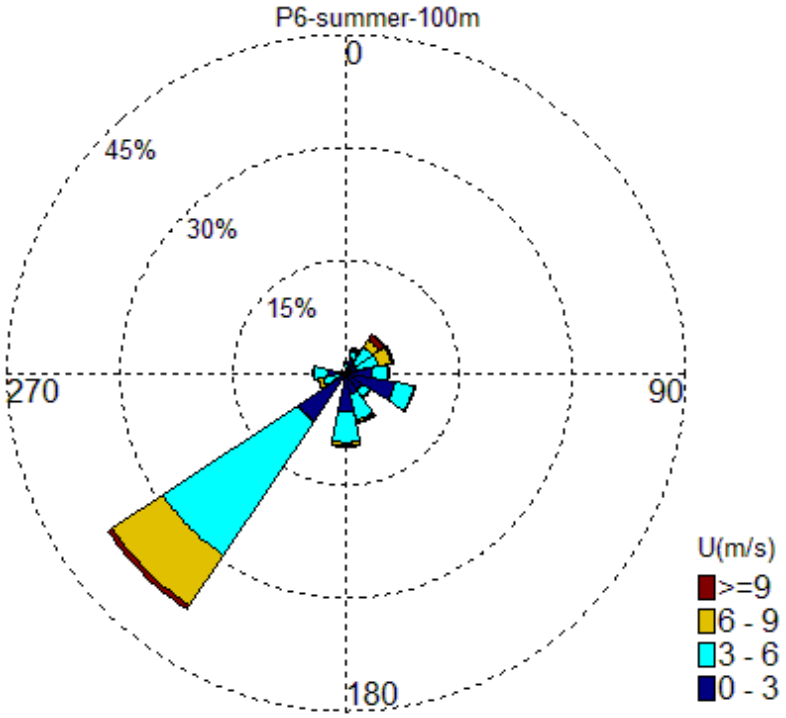


(a)

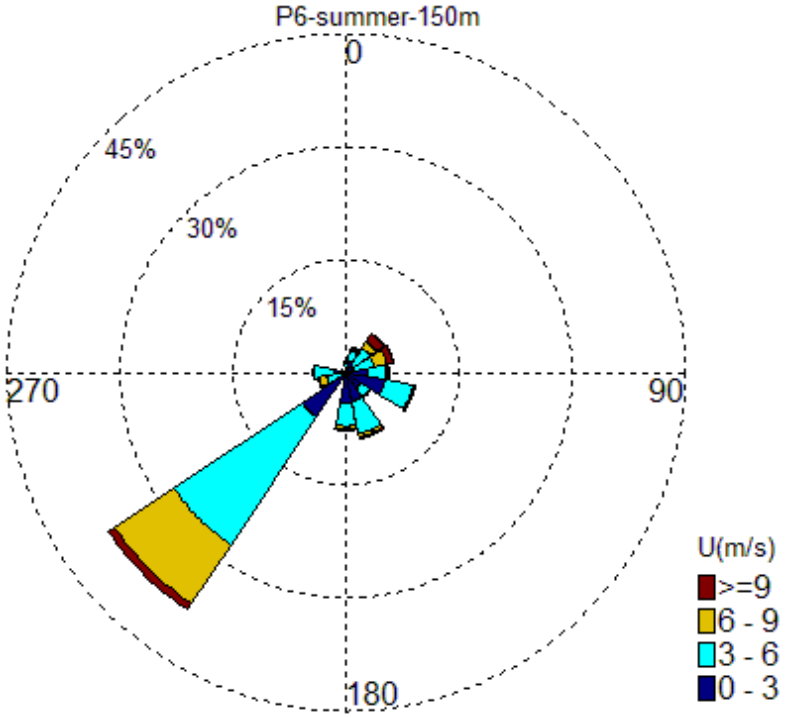


(b)

Figure 12. Wind roses above the geometric center of the PDA for summer winds at (a) 15 m and (b) 50 m.

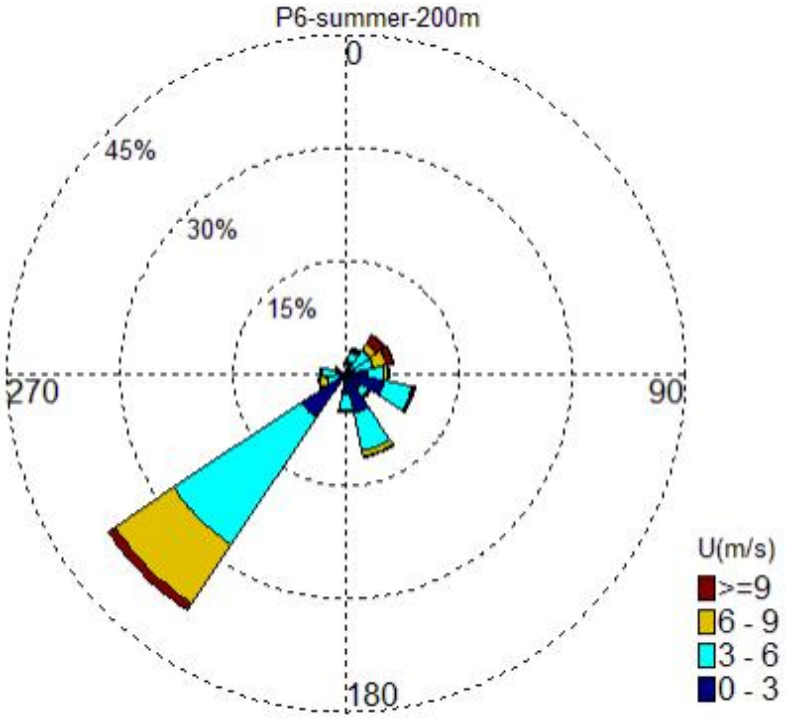


(c)

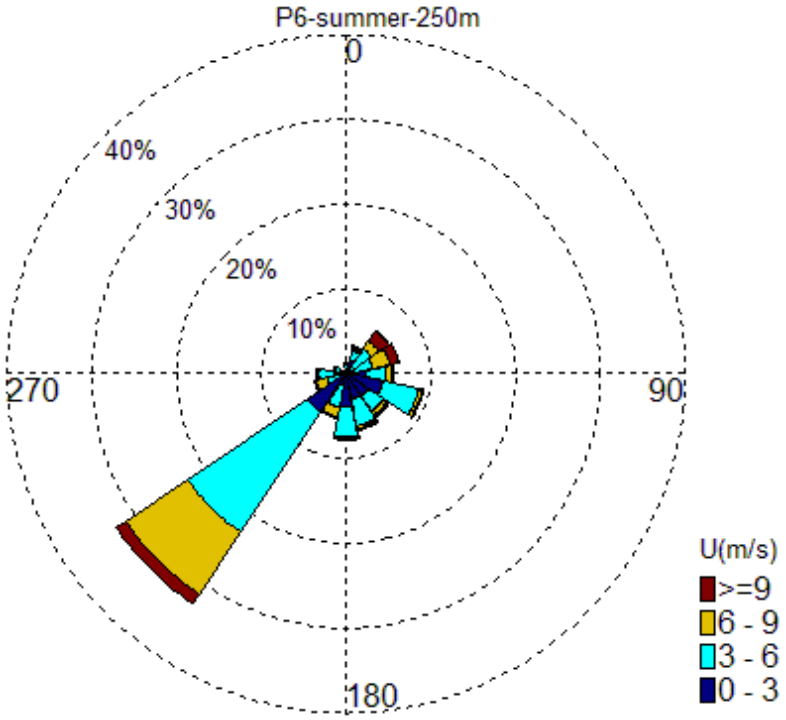


(d)

Figure 12. Wind roses above the geometric center of the PDA for summer winds at (c) 100 m and (d) 150 m.

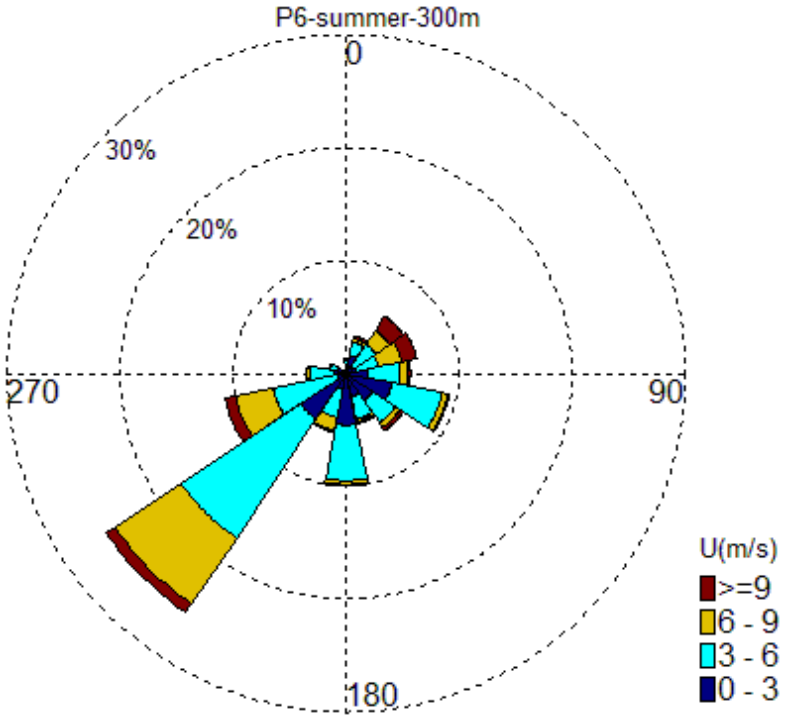


(e)

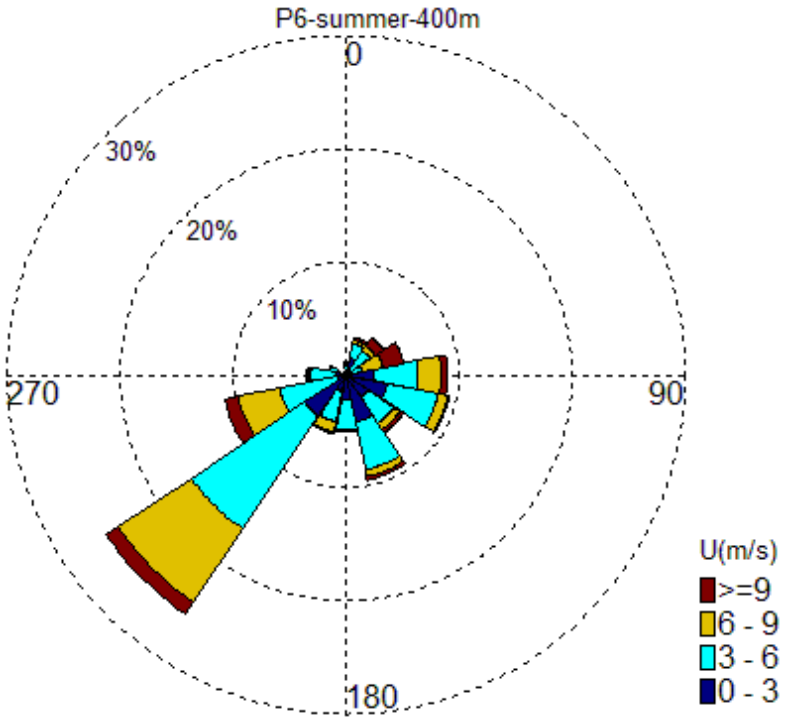


(f)

Figure 12. Wind roses above the geometric center of the PDA for summer winds at (e) 200 m and (f) 250 m.

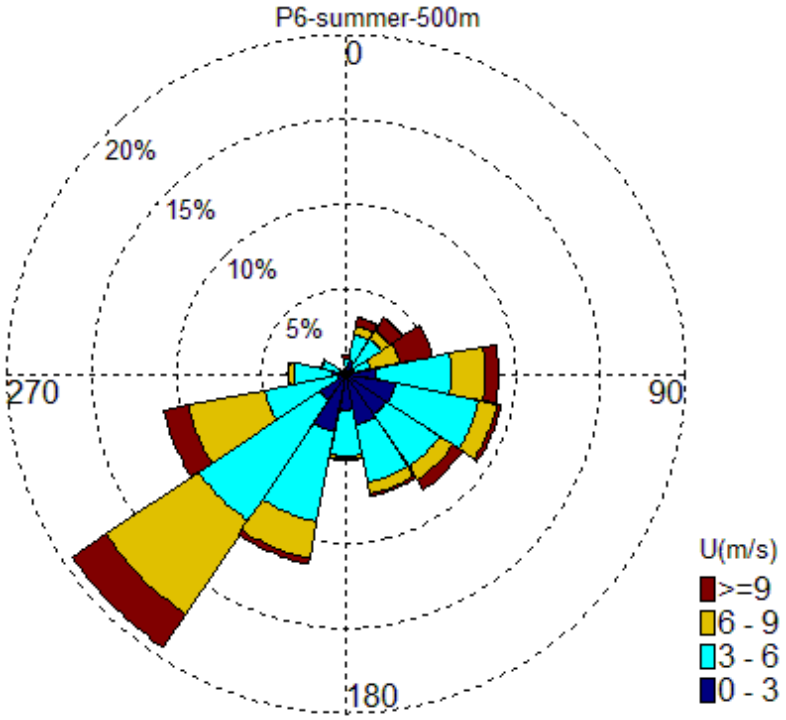


(g)



(h)

Figure 12. Wind roses above the geometric center of the PDA for summer winds at (g) 300 m and (h) 400 m.



(i)

Figure 12. (i) Wind roses above the geometric center of the PDA for summer winds at 500 m.

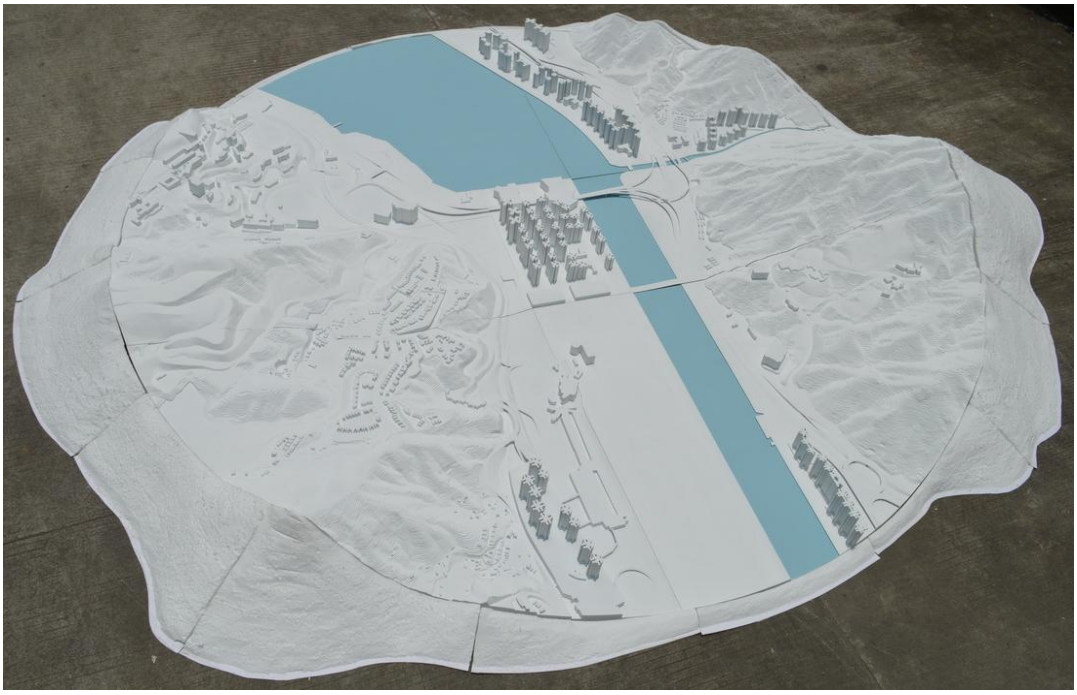


Figure 13. AVA wind tunnel model with a scale of 1:800.

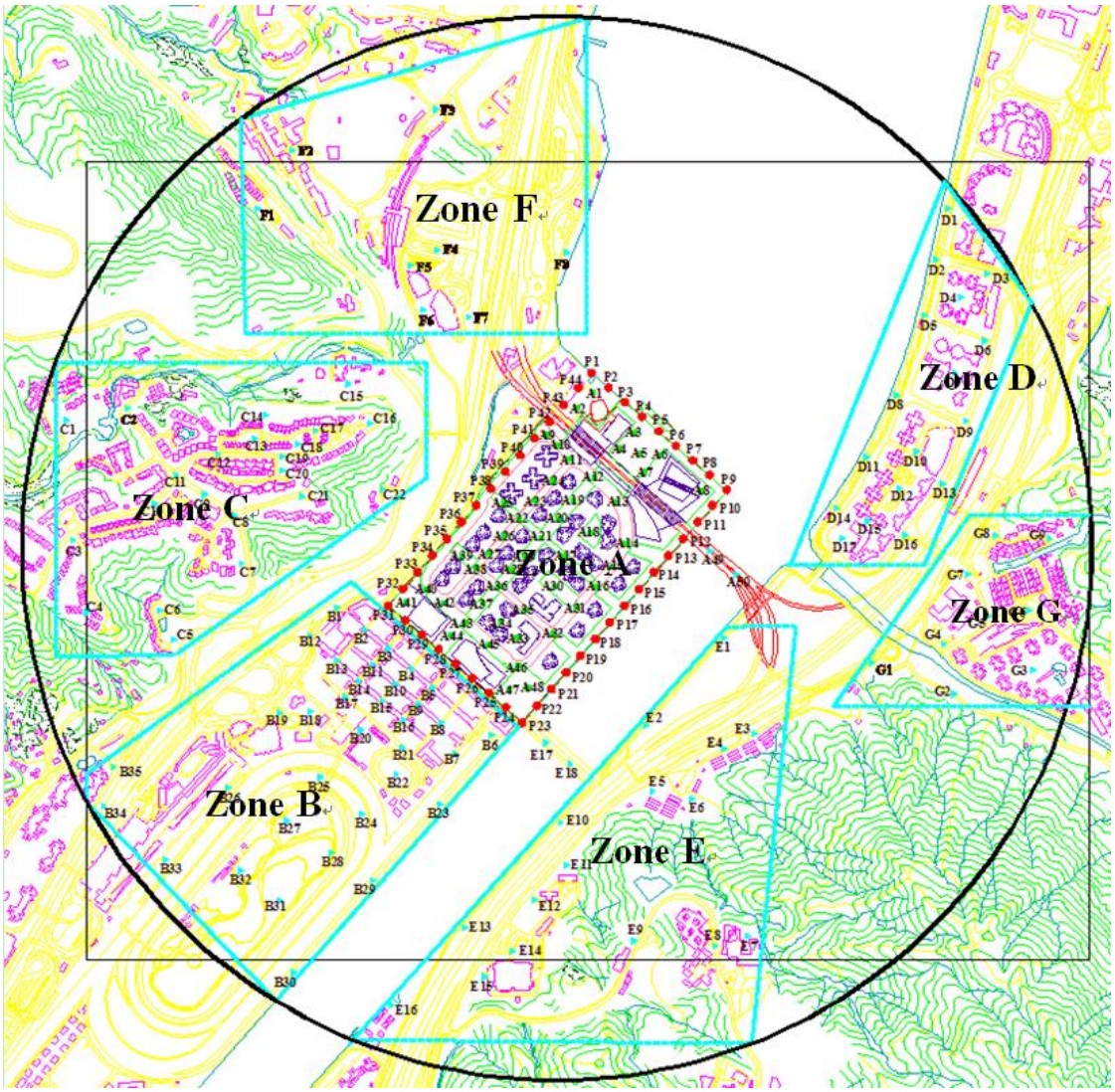


Figure 14. (a) Overview of locations of test points.

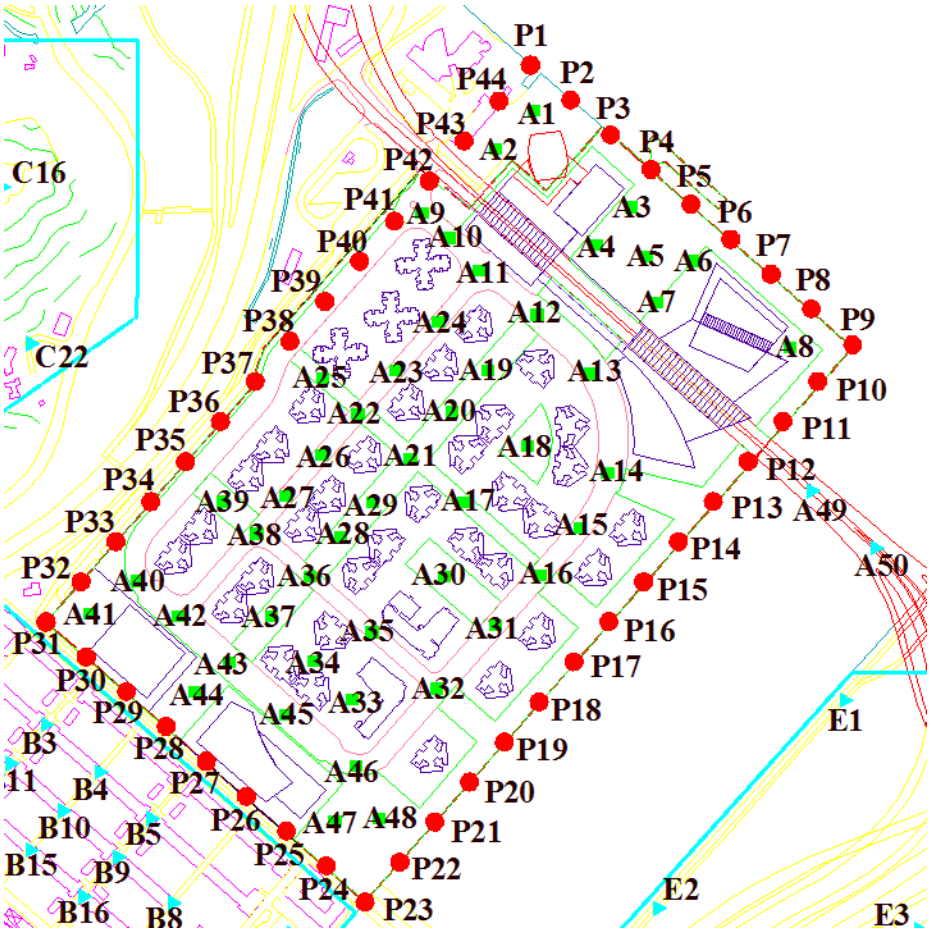


Figure 14. (b) Locations of test points at Zone A.

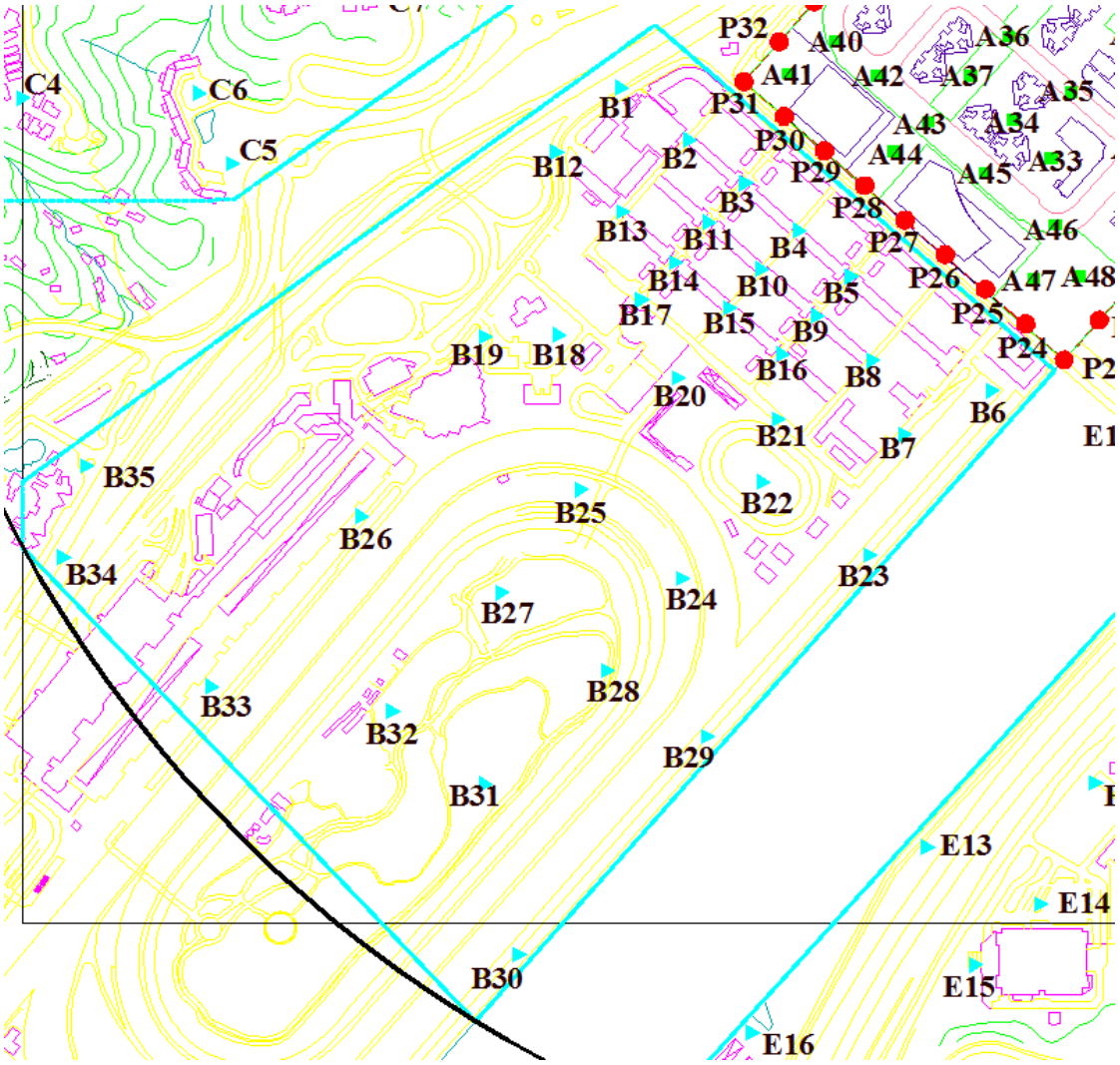


Figure 14. (c) Locations of test points at Zone B.

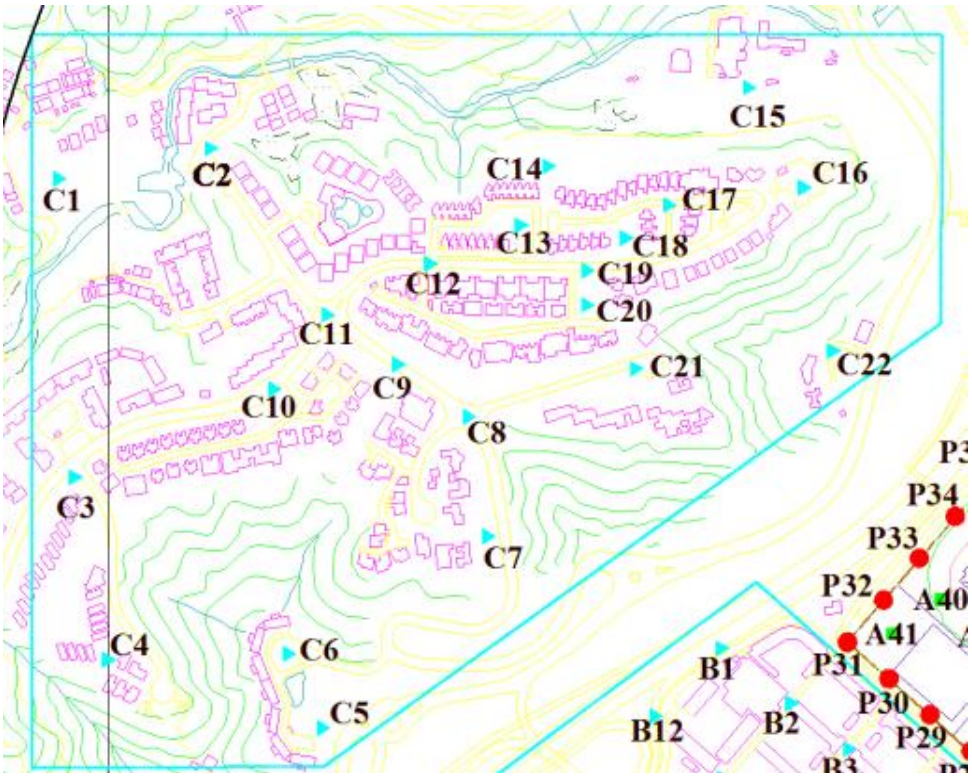


Figure 14. (d) Locations of test points at Zone C.

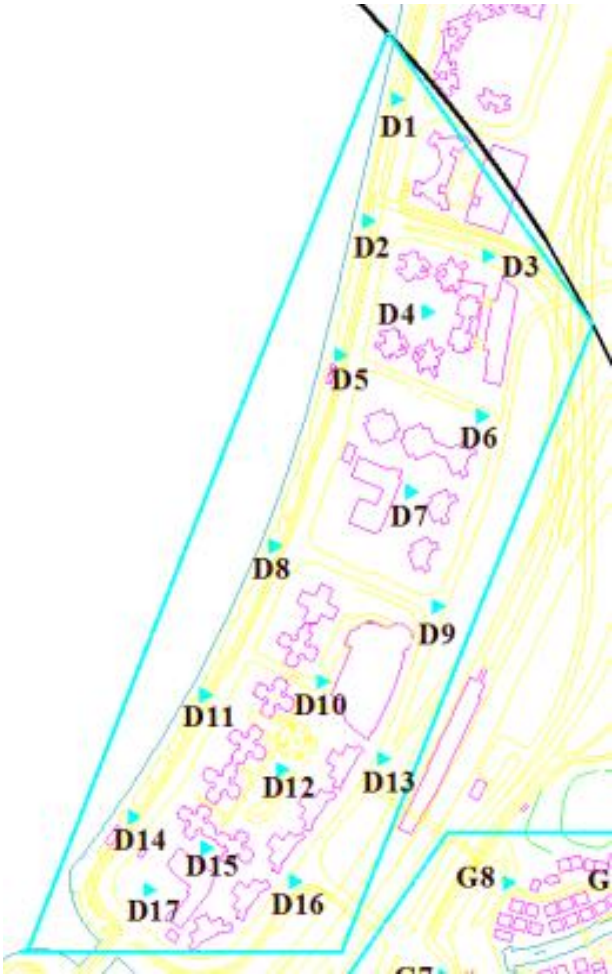
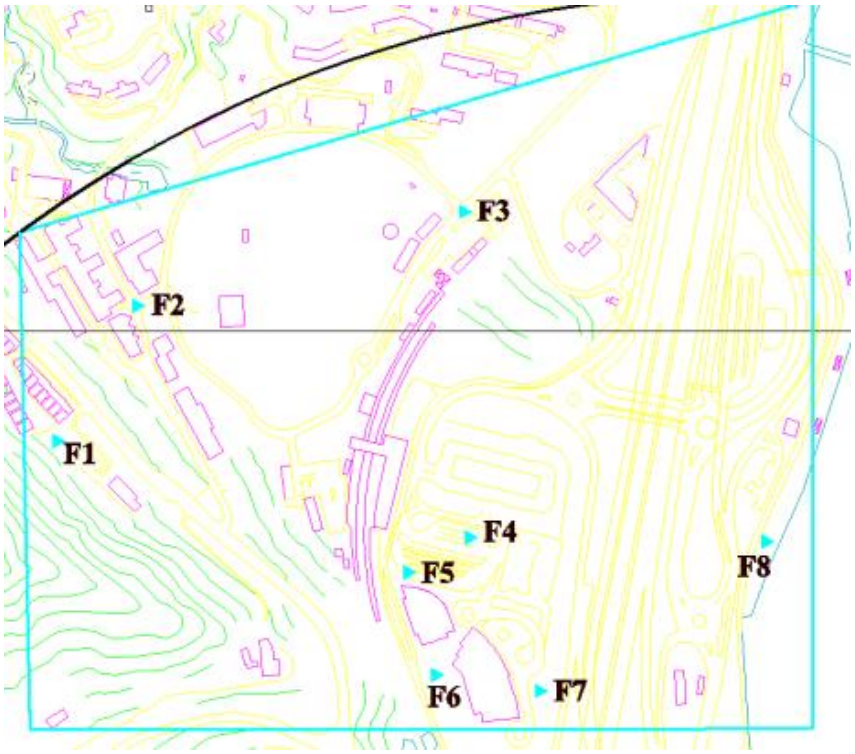
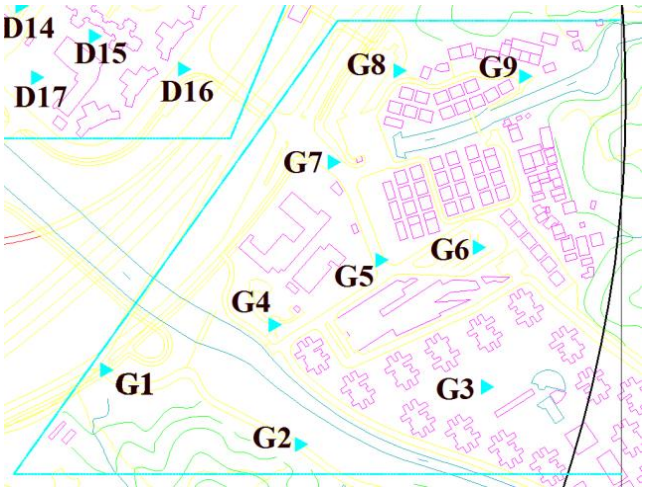


Figure 14. (e) Locations of test points at Zone D.



(f)



(g)

Figure 14. Locations of test points at (f) Zone F and (g) Zone G.

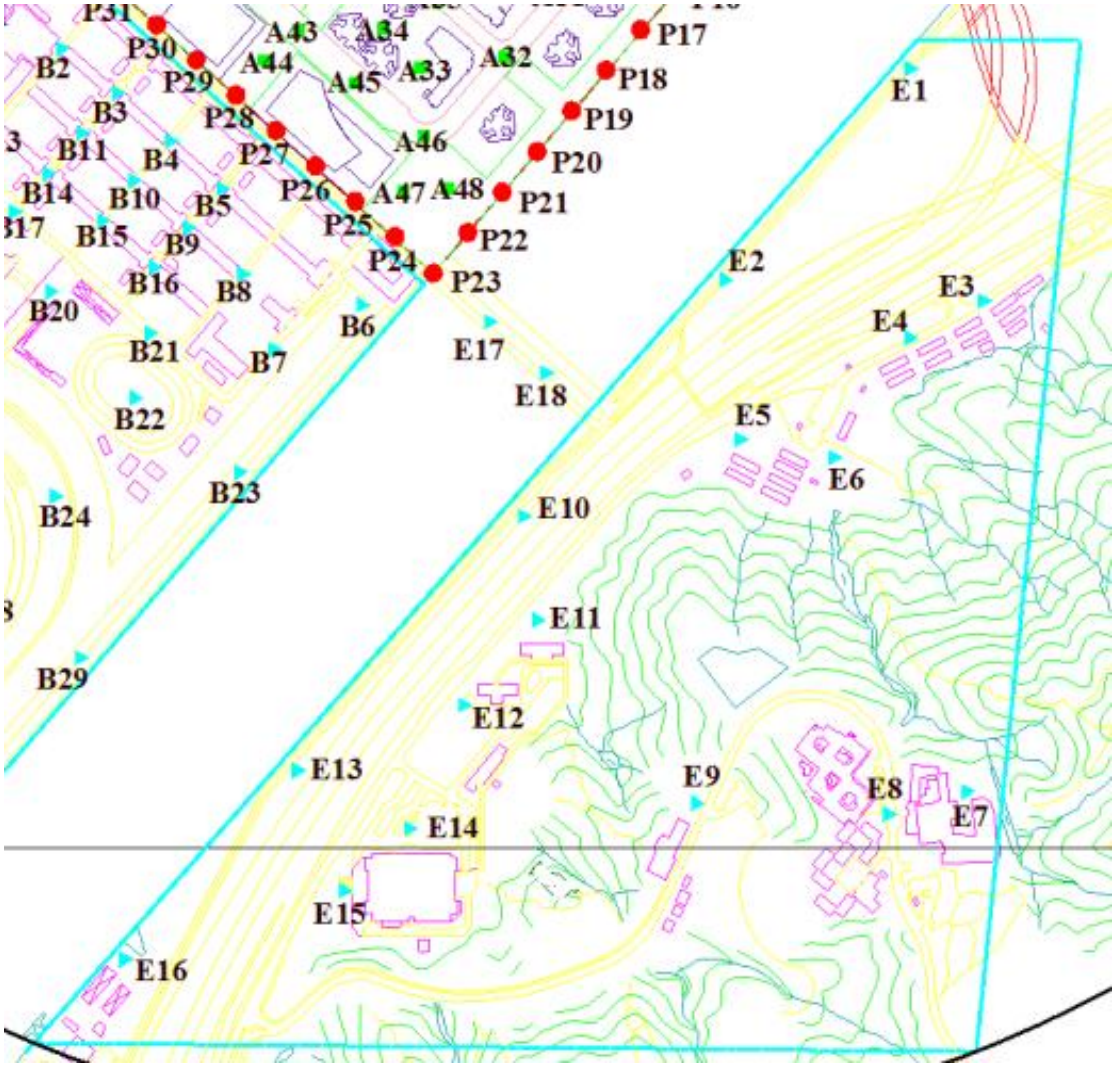


Figure 14. (h) Locations of test points at Zone E

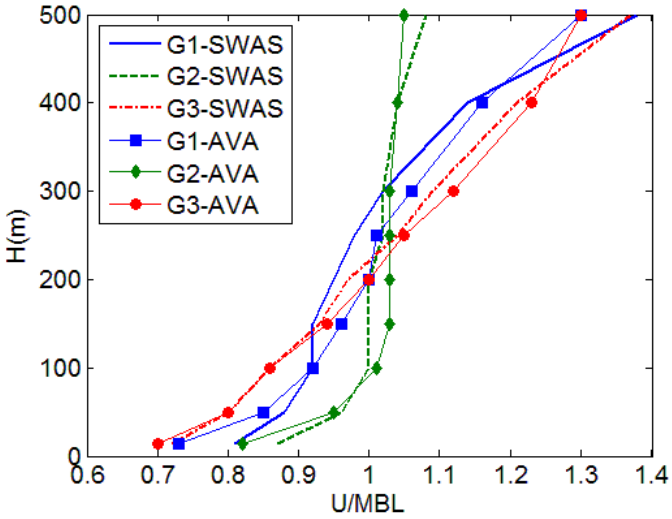


Figure 15. Mean speed profiles of different kinds of approach wind fields for AVA (MBL stands for the mean value of all the speeds at the 9 height levels).

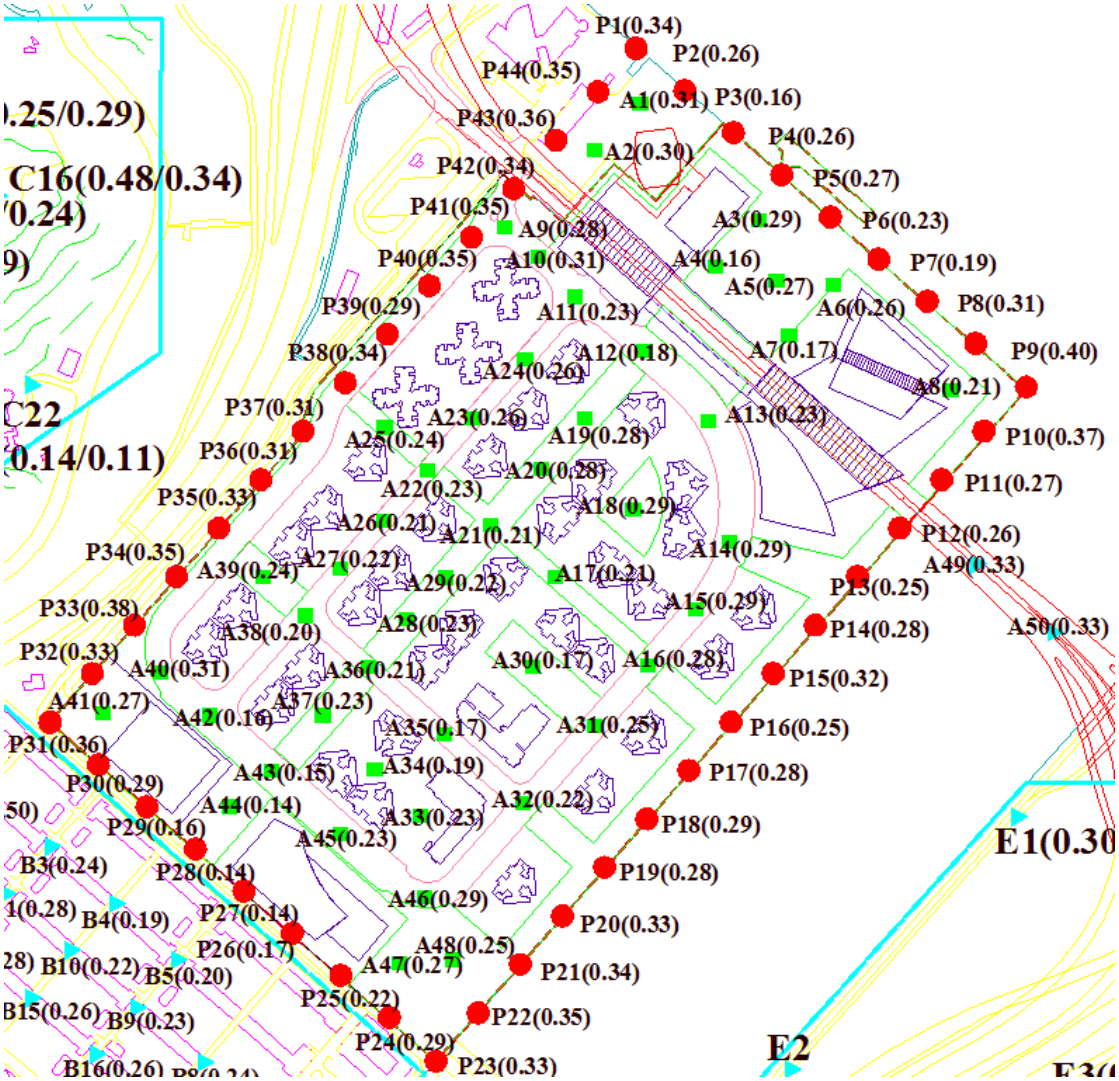


Figure 16. (a1) VRw values with installation of potential developments at PDA for annual wind condition for Zone A.

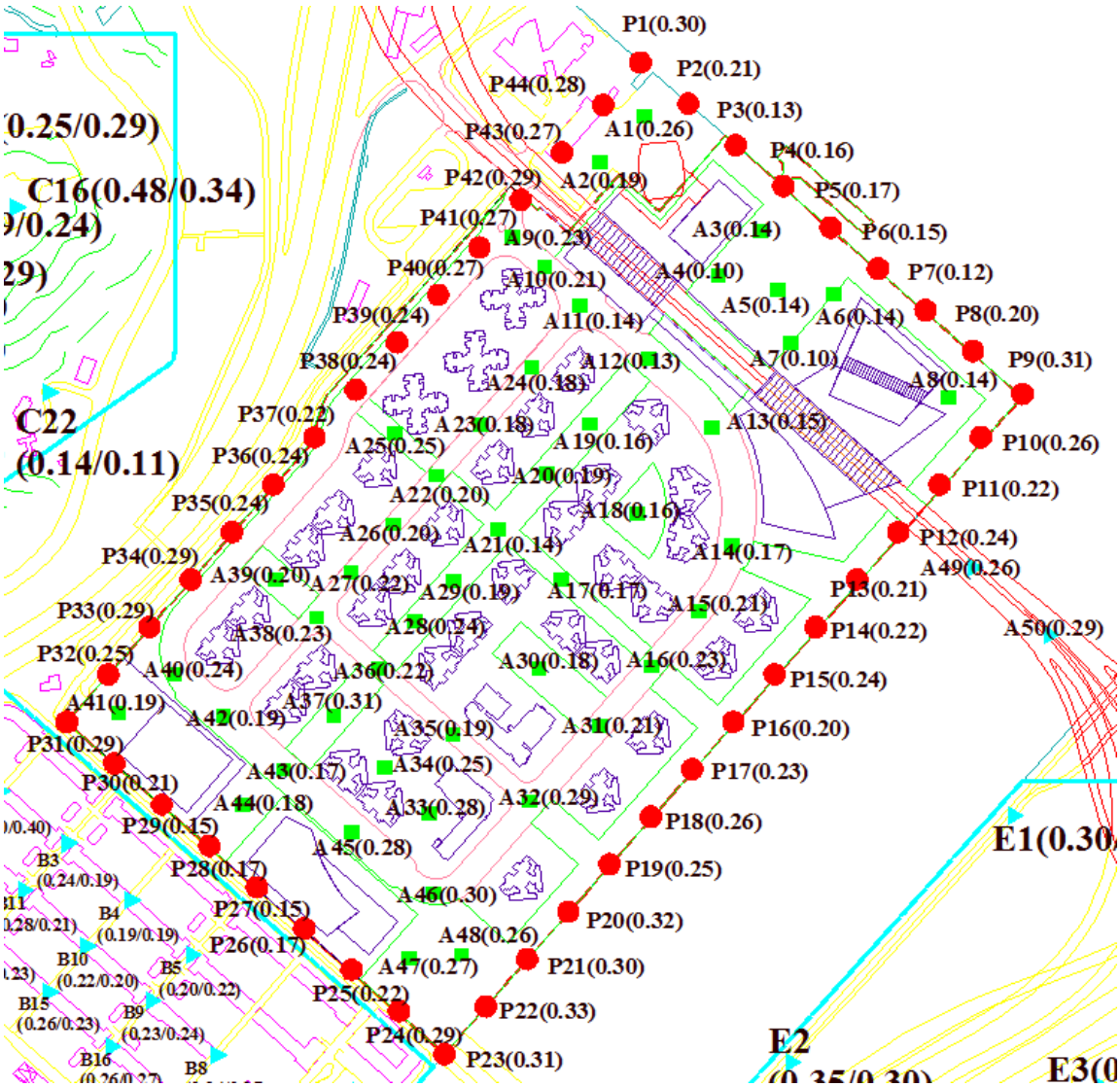


Figure 16. (a2) VRw values with installation of potential developments at PDA for summer wind condition for Zone A.

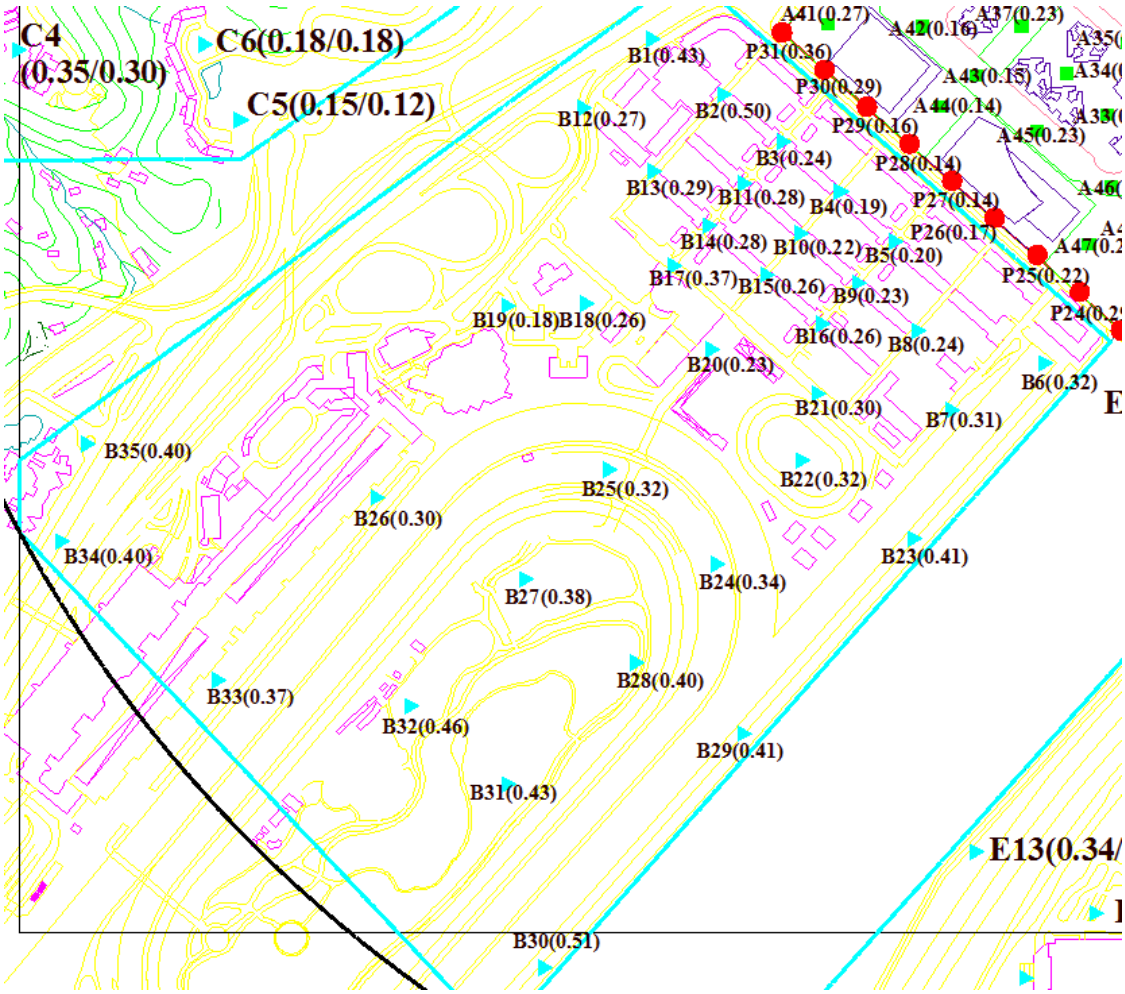


Figure 16. (b1) VRw values with installation of potential developments at PDA for annual wind condition for Zone B.

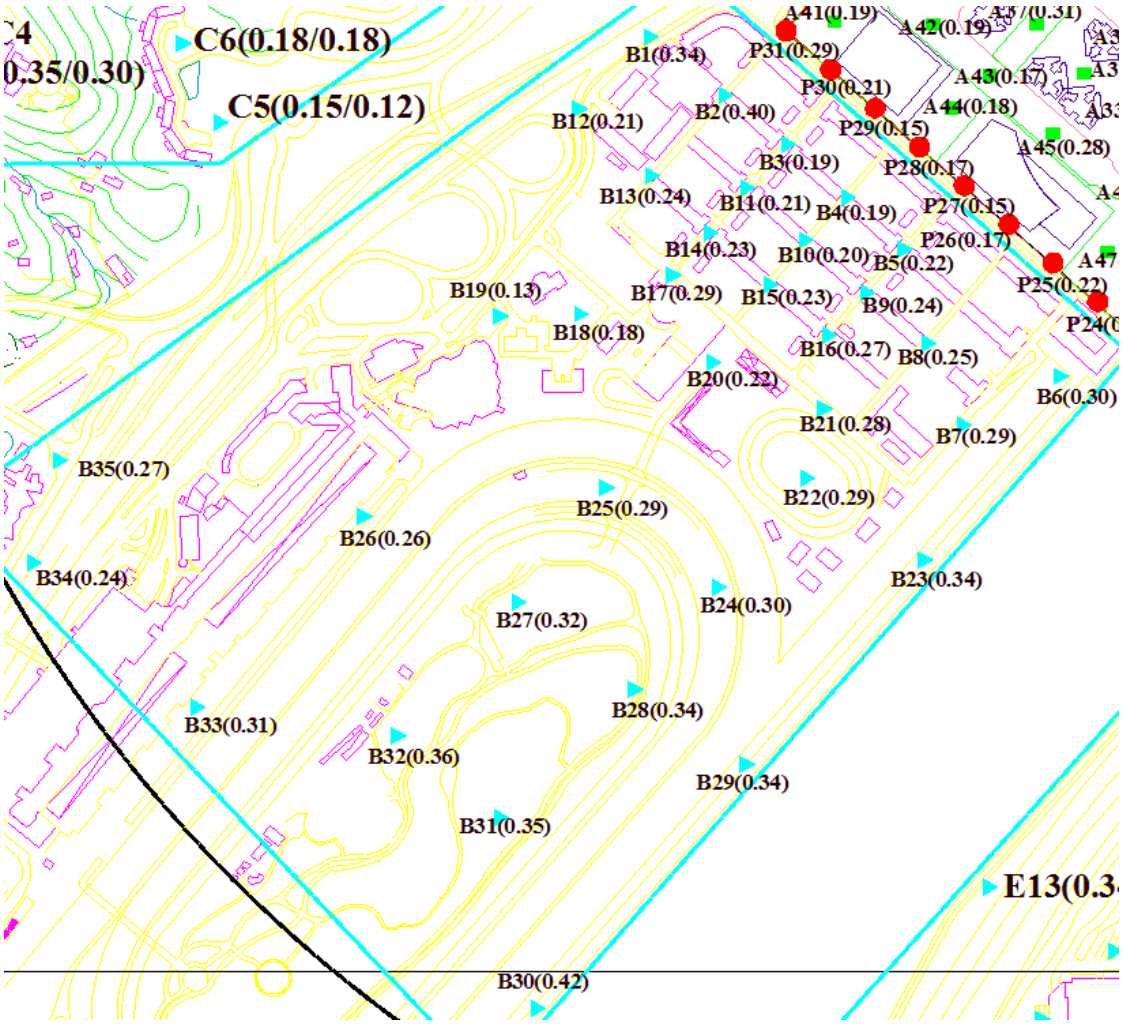
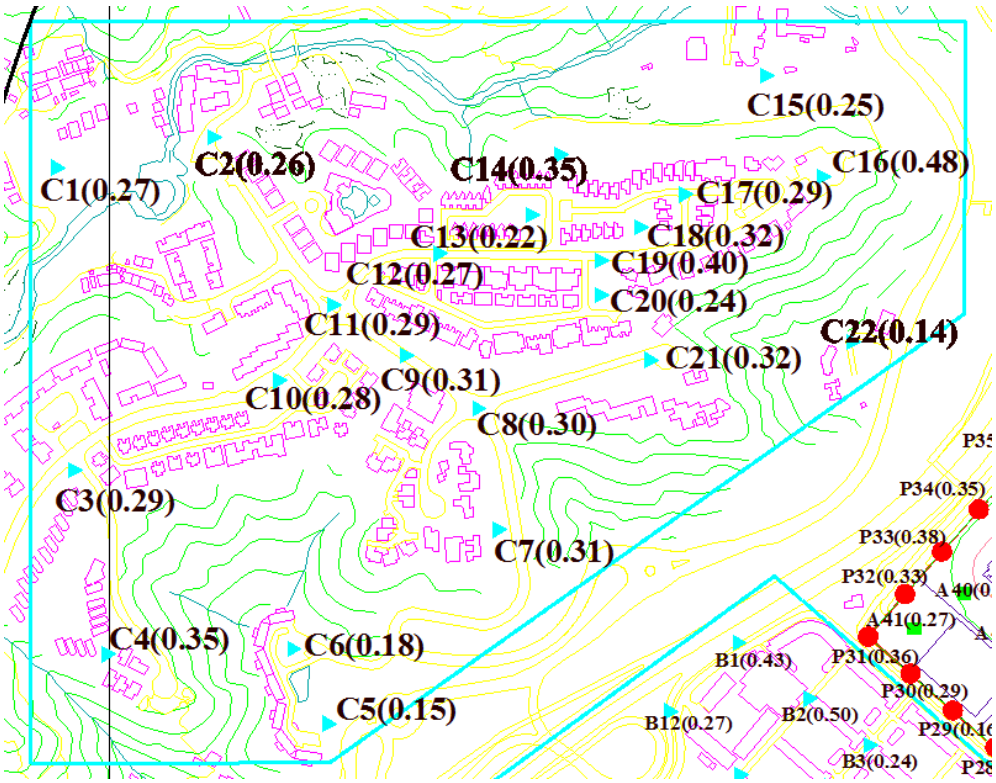
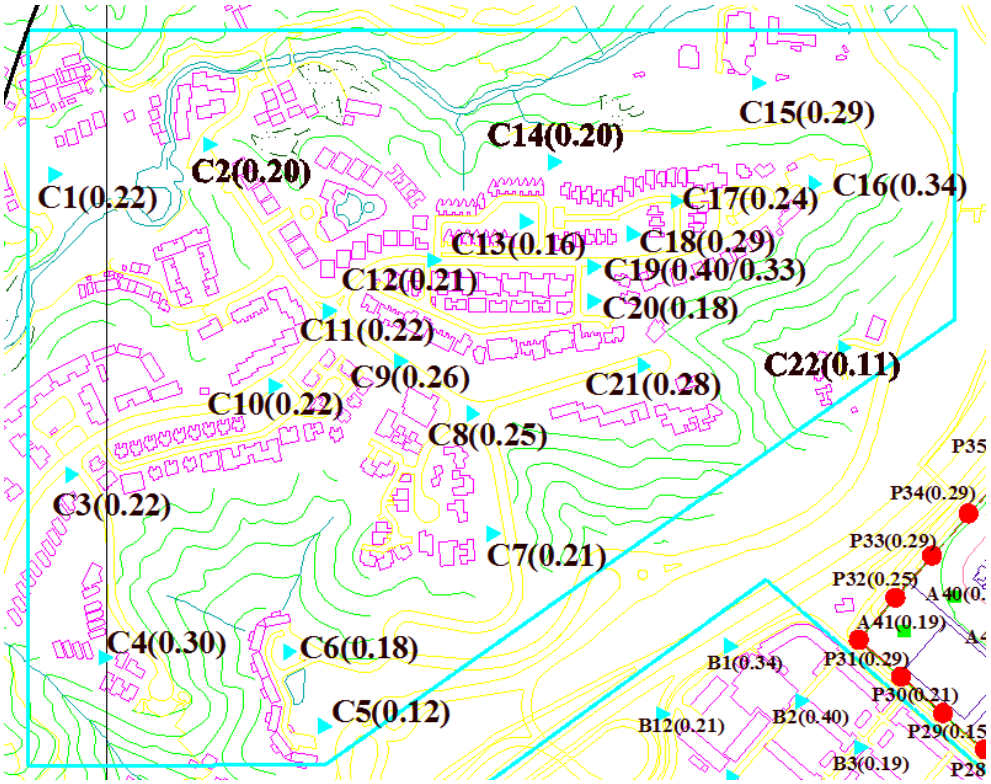


Figure 16. (b2) VRw values with installation of potential developments at PDA for summer wind condition for Zone B.

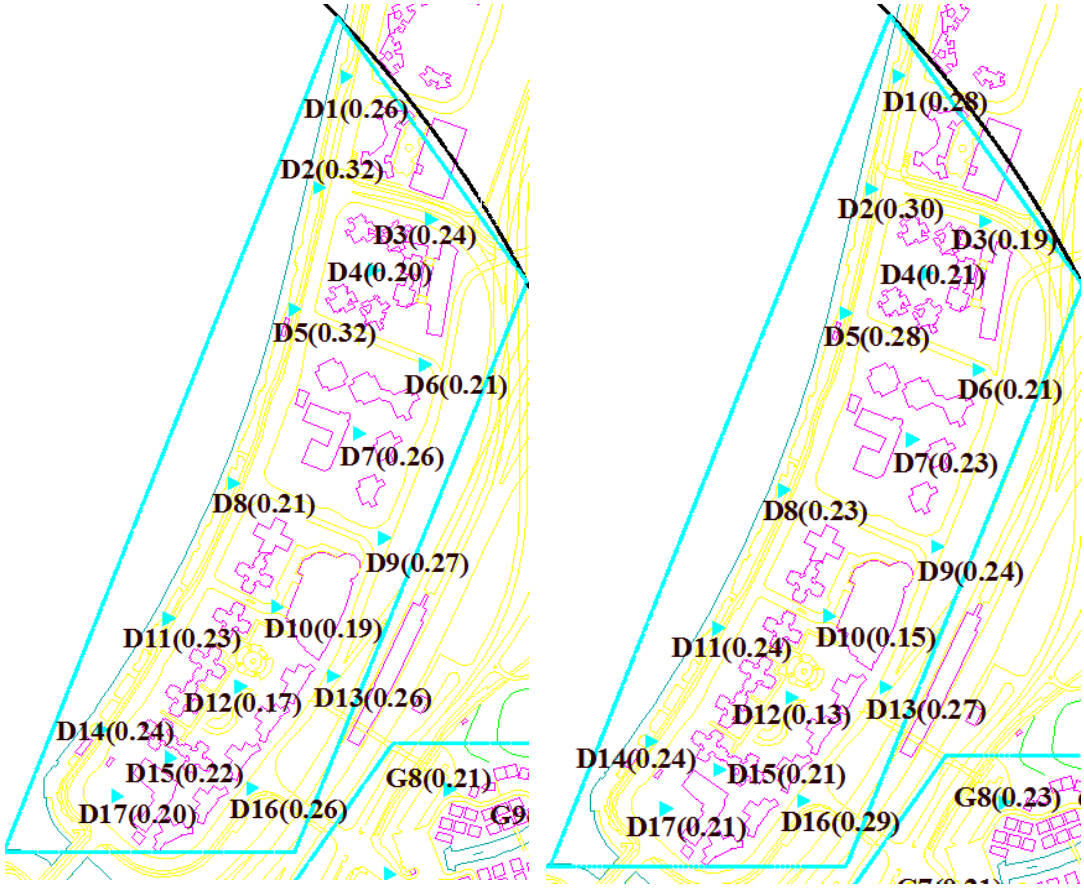


(c1)



(c2)

Figure 16. VRw values with installation of potential developments at PDA for both (c1) annual and (c2) summer wind conditions for Zone C.



(d1) **(d2)**

Figure 16. VRw values with installation of potential developments at PDA for both (d1) annual and (d2) summer wind conditions for Zone D.

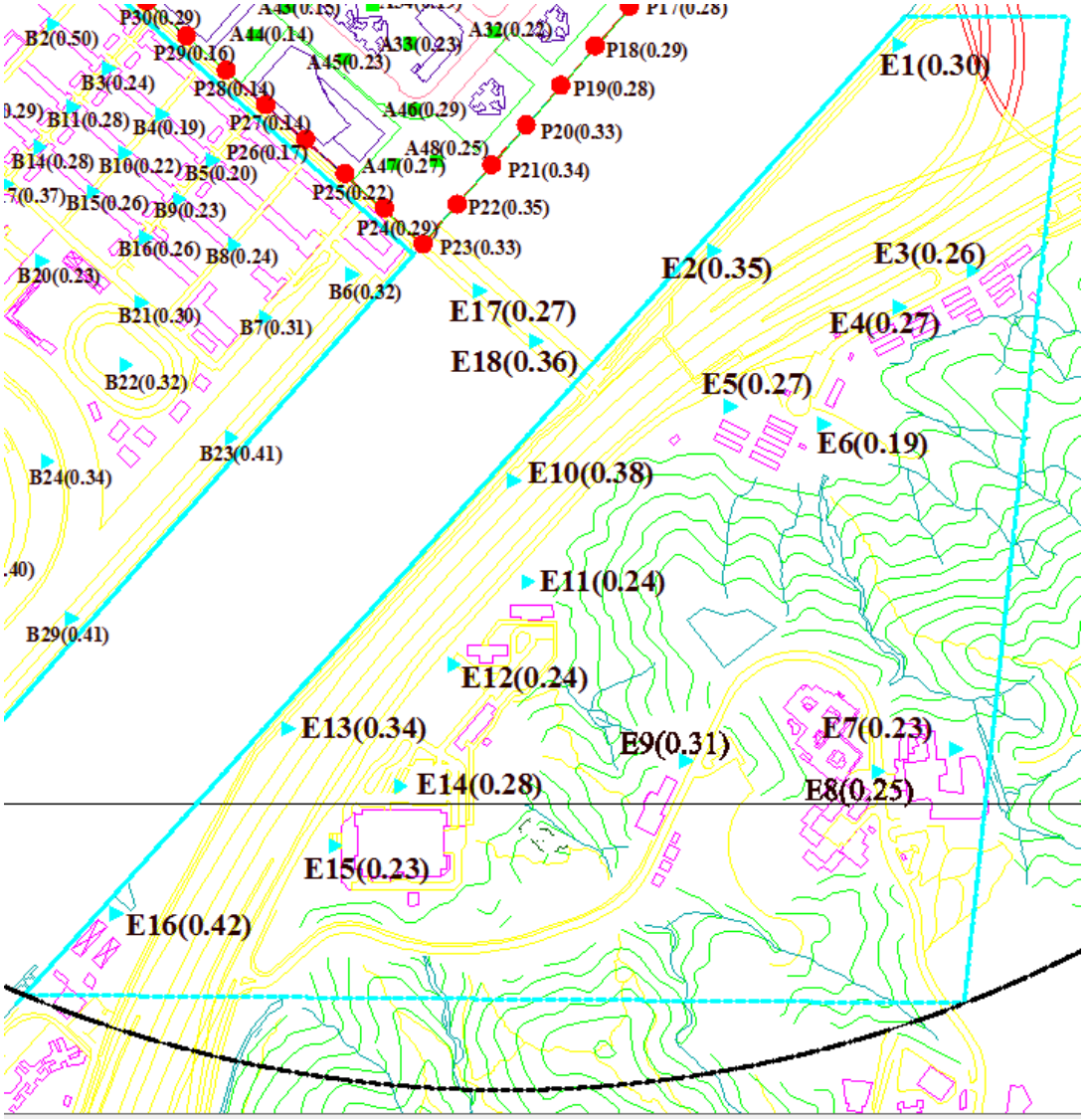


Figure 16. (e1) VRw values with installation of potential developments at PDA for annual wind condition for Zone E.

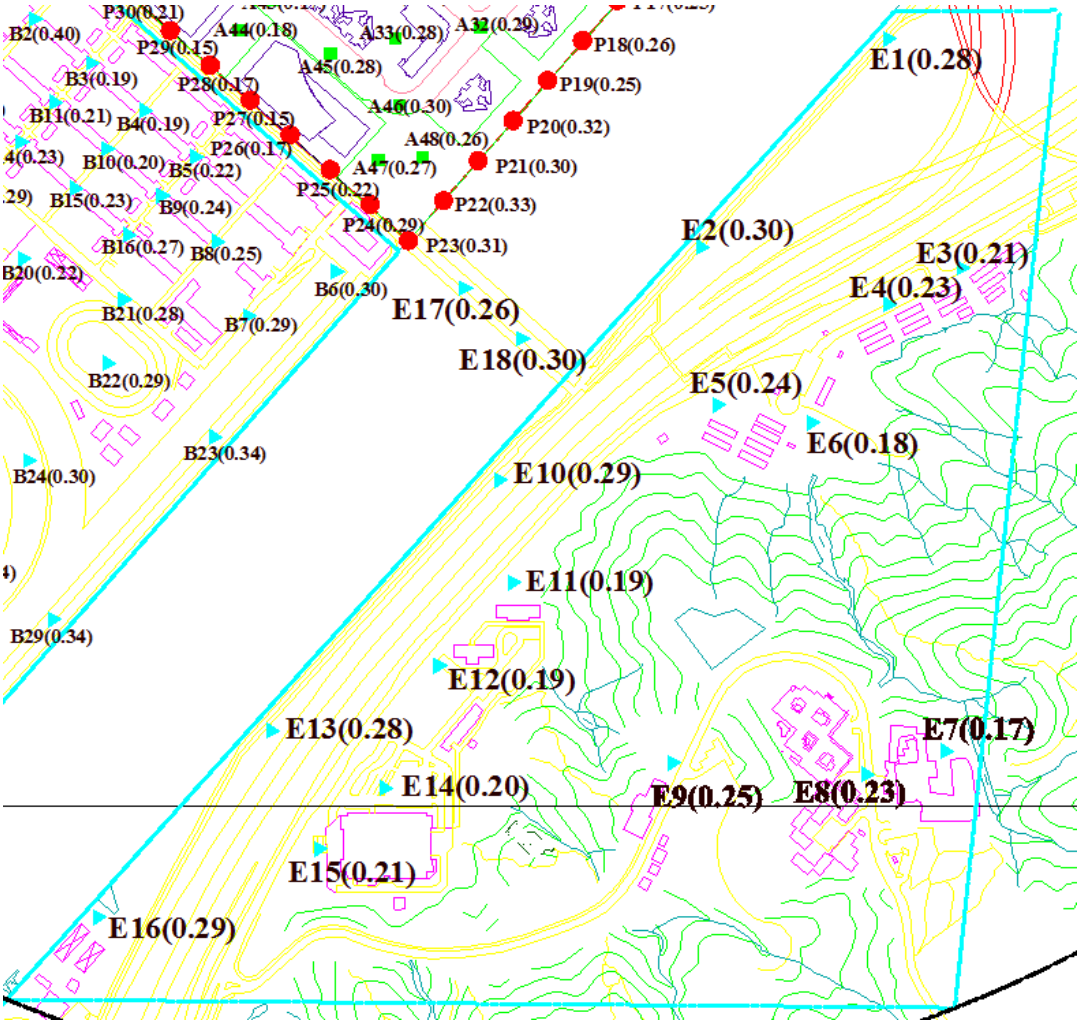
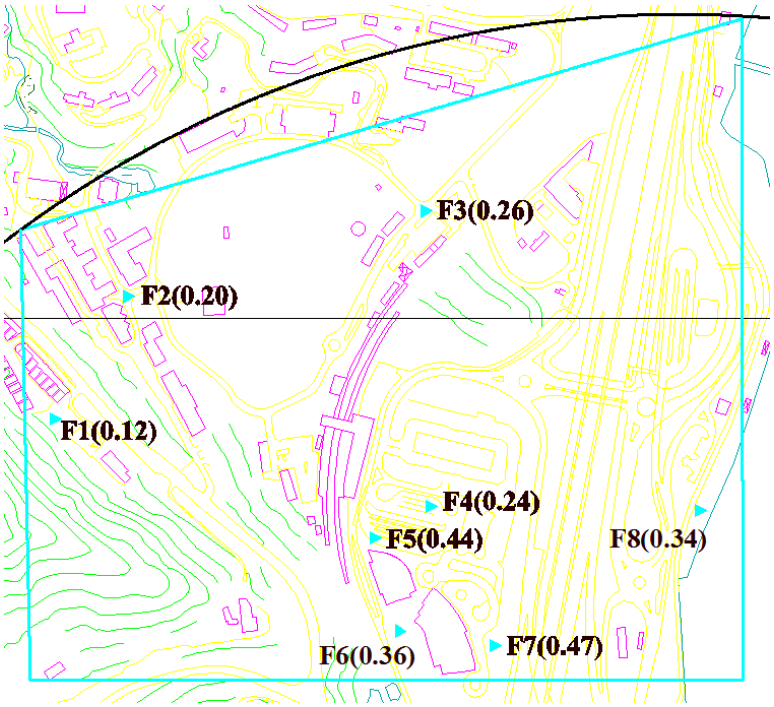
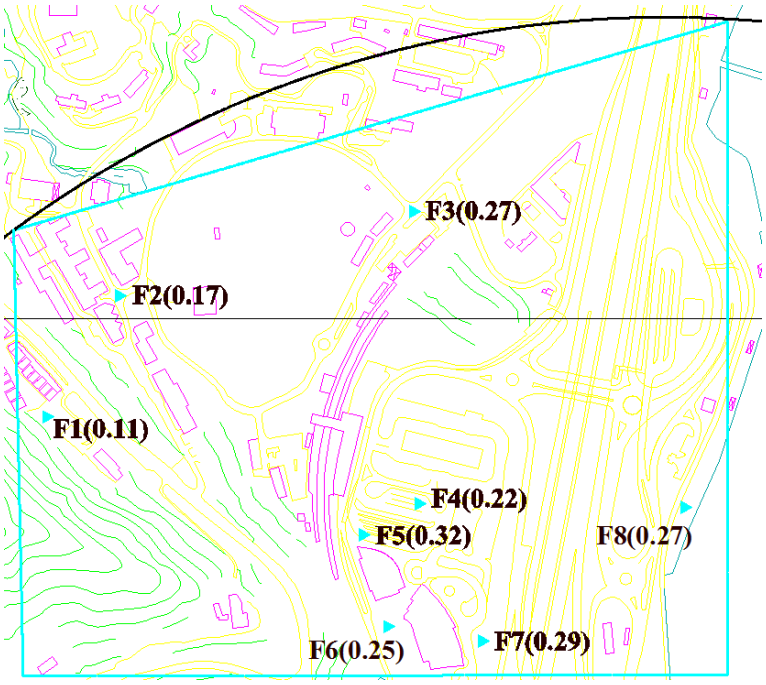


Figure 16. (e2) VRw values with installation of potential developments at PDA for summer wind condition for Zone E.

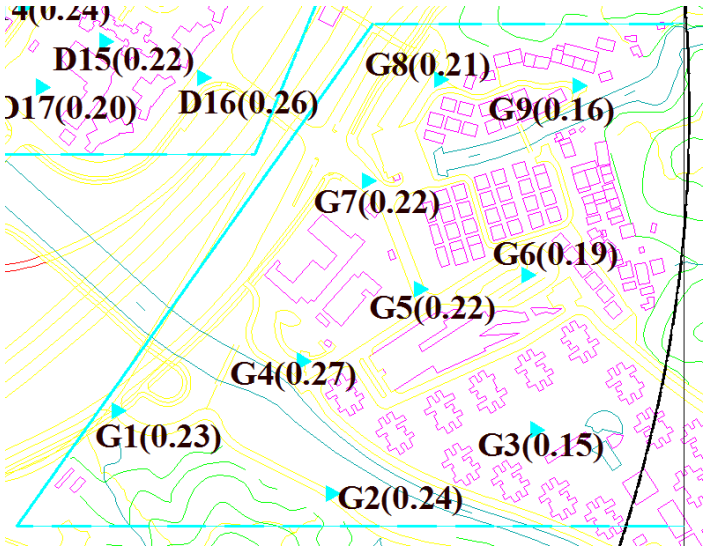


(f1)

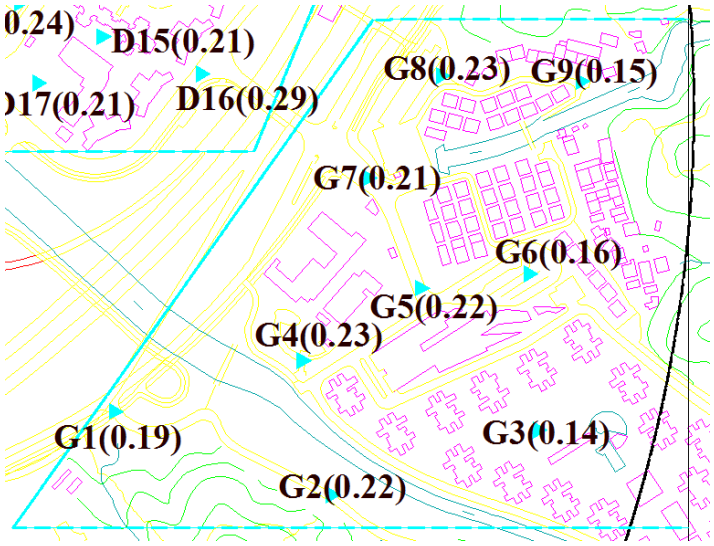


(f2)

Figure 16. VRw values with installation of potential developments at PDA for both (f1) annual and (f2) summer wind conditions for Zone F.

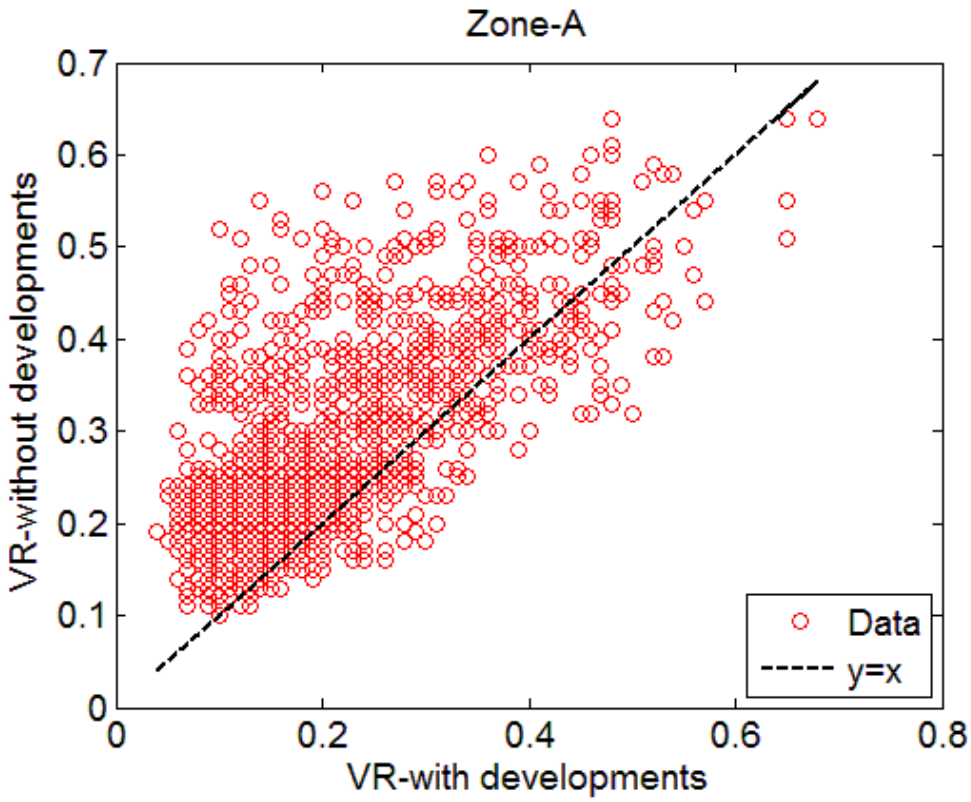


(g1)

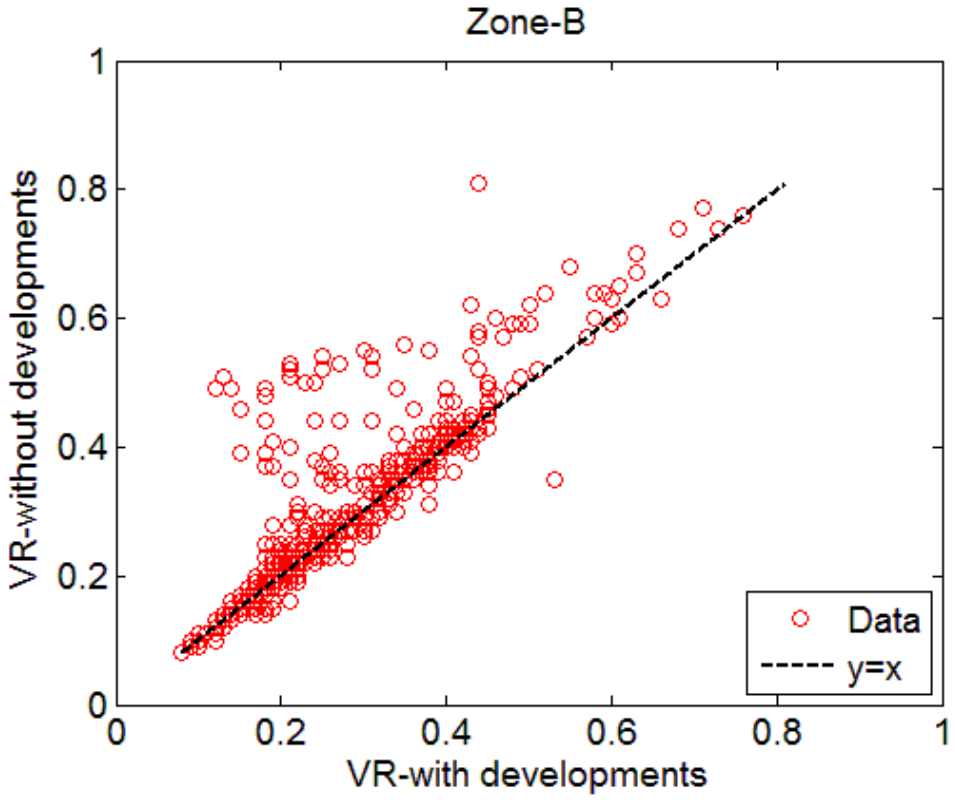


(g2)

Figure 16. VRw values with installation of potential developments at PDA for both (g1) annual and (g2) summer wind conditions for Zone G.

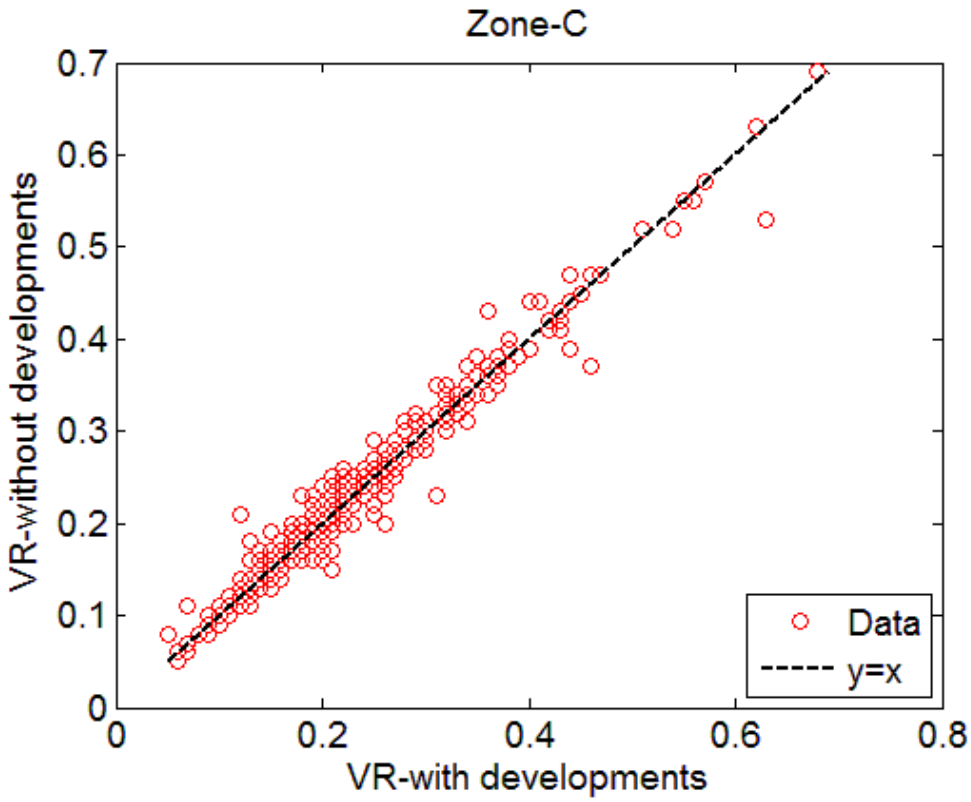


(a)

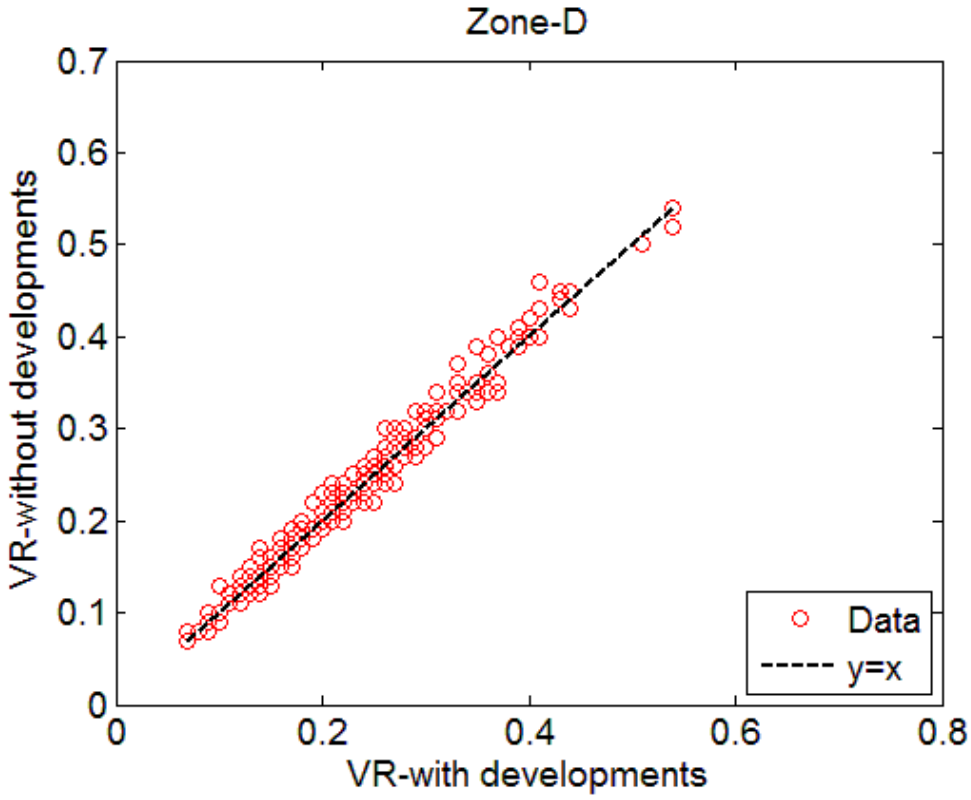


(b)

Figure 17. Comparison of VR results with/without potential developments at PDA for (a) Zone A and (b) Zone B.

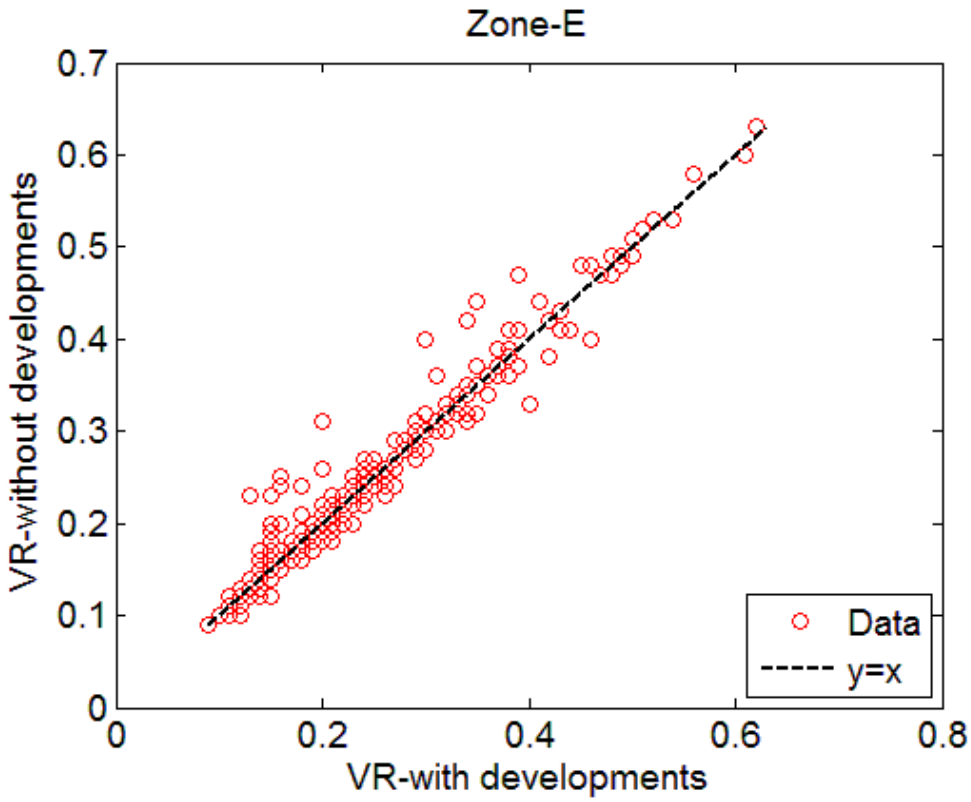


(c)

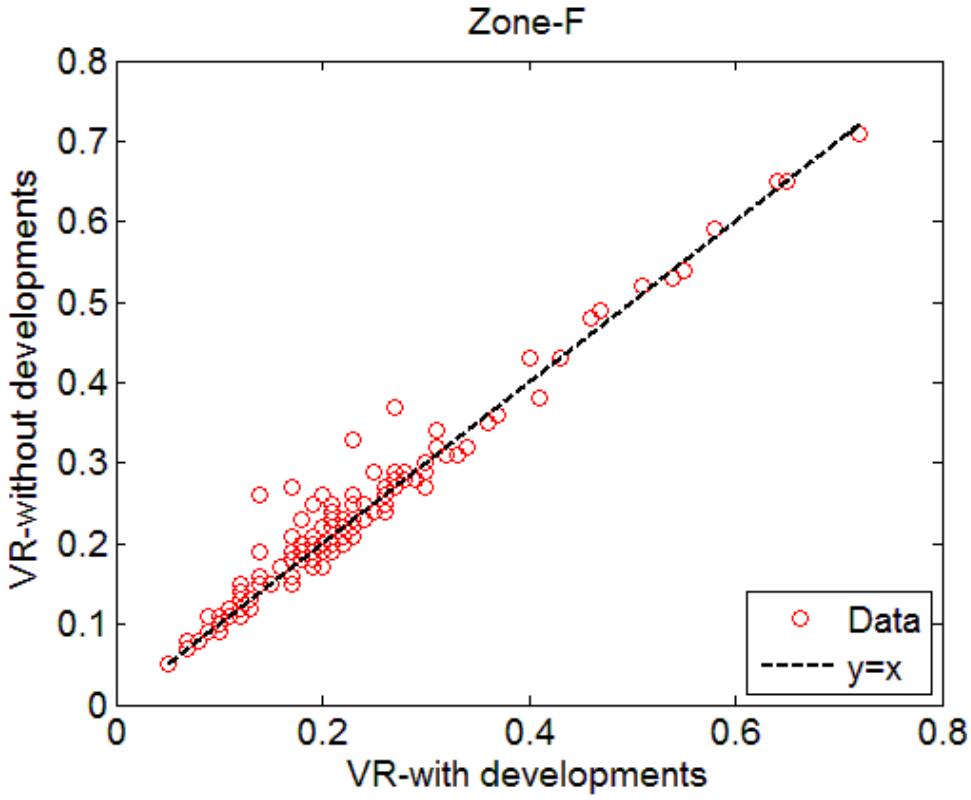


(d)

Figure 17. Comparison of VR results with/without potential developments at PDA for (c) Zone C and (d) Zone D.

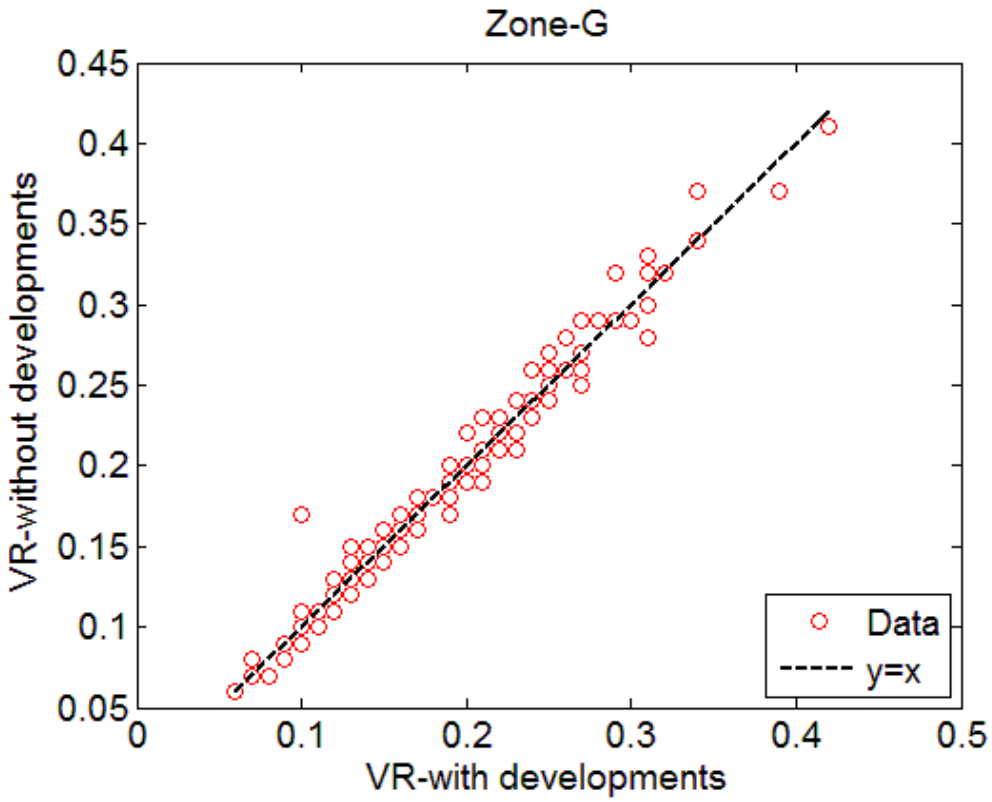


(e)



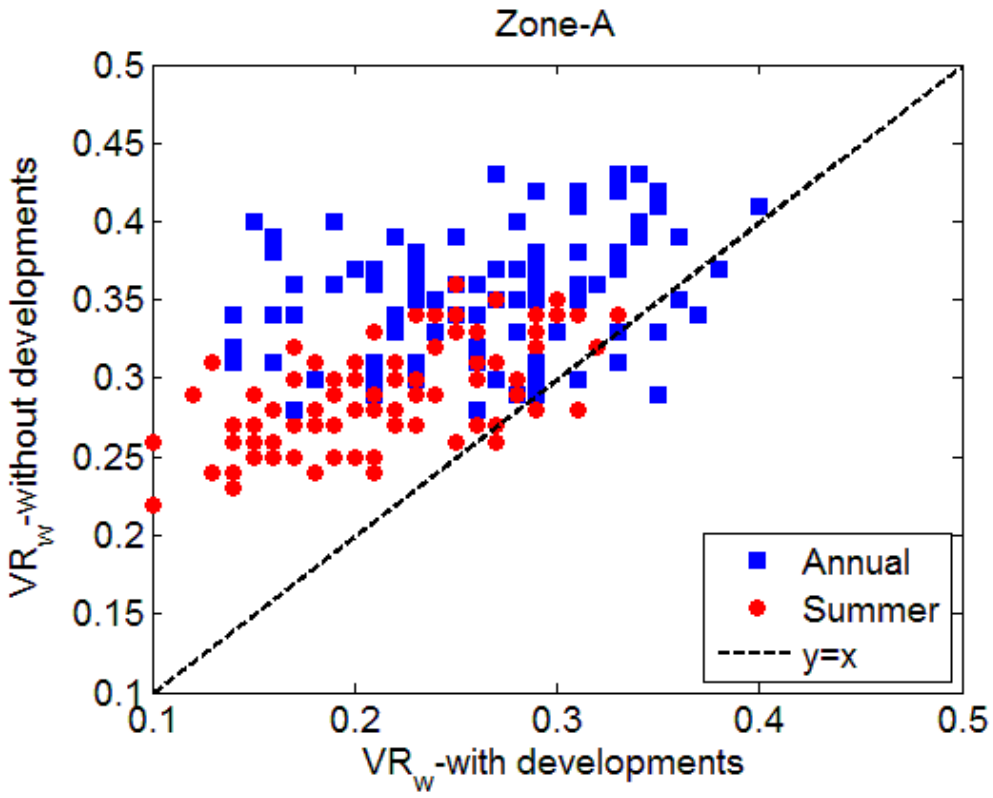
(f)

Figure 17. Comparison of VR results with/without potential developments at PDA for (e) Zone E and (f) Zone F.

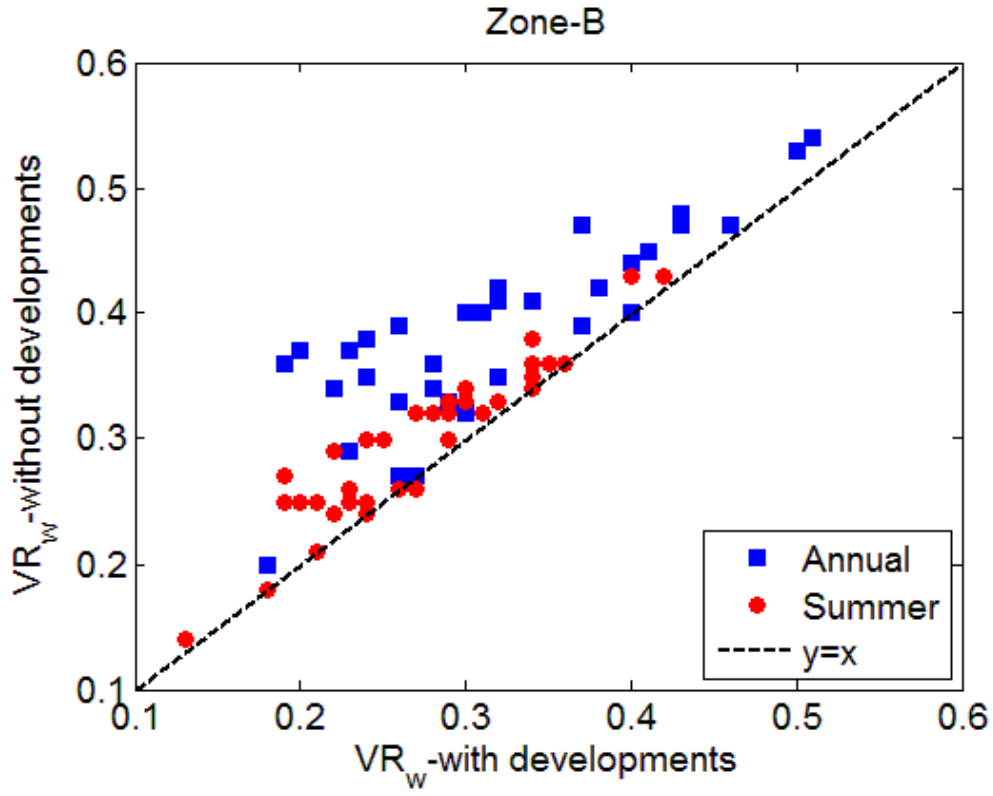


(g)

Figure 17. Comparison of VR results with/without potential developments at PDA for (g) Zone G.

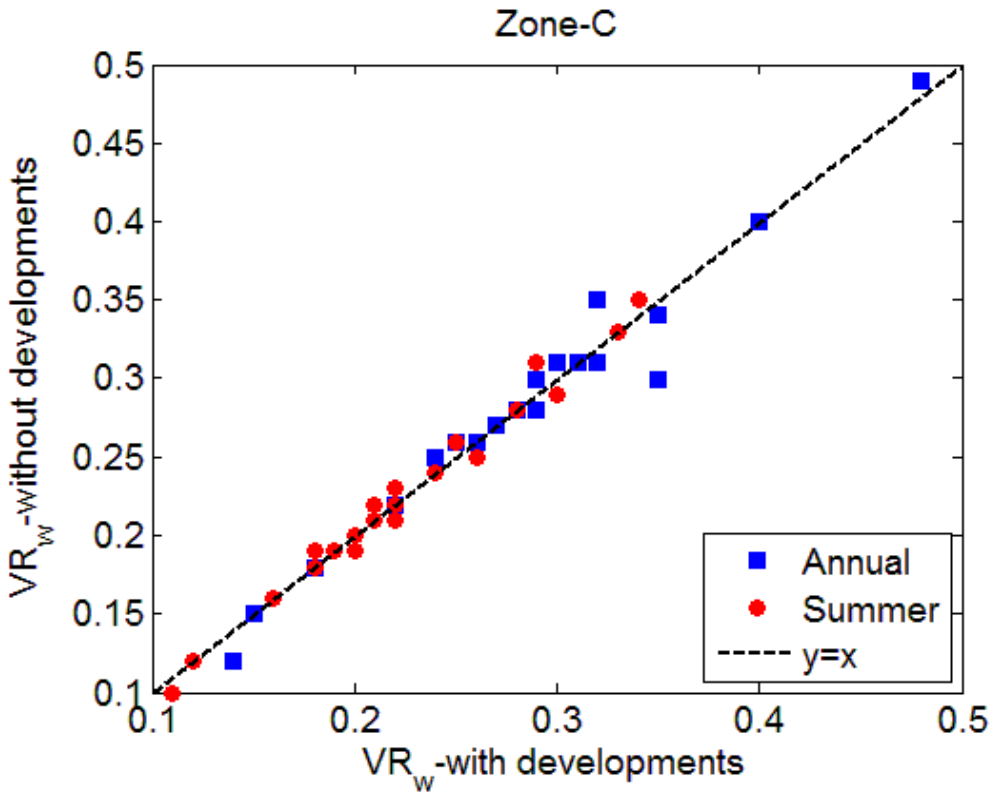


(a)

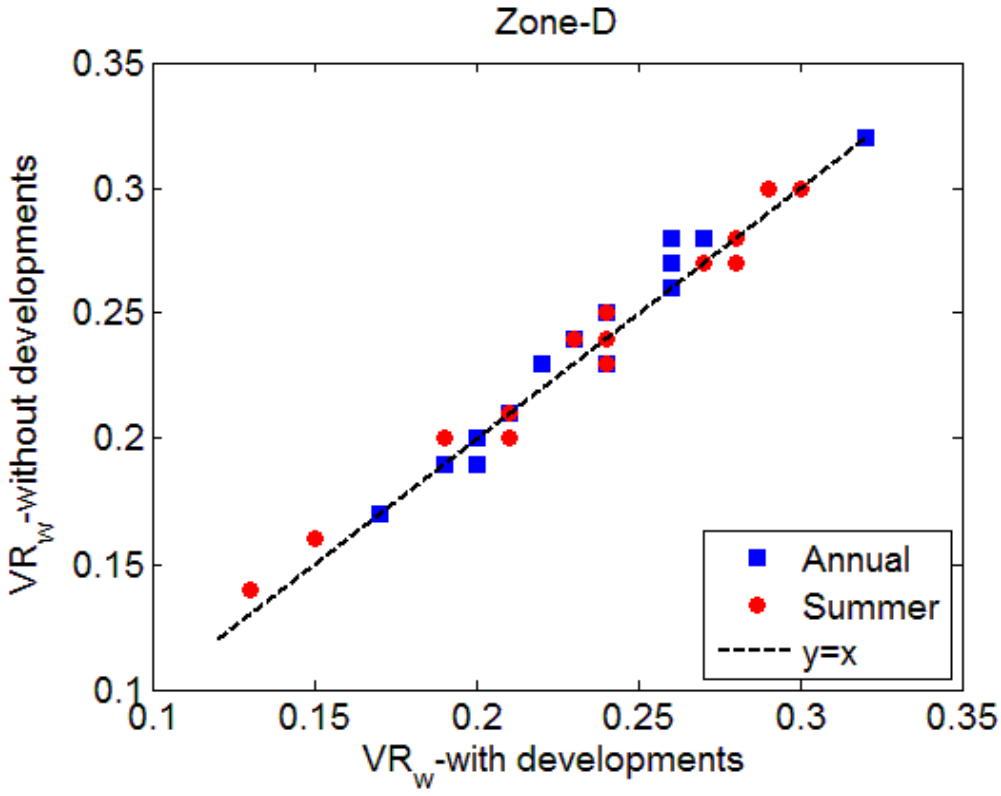


(b)

Figure 18. Comparison of VRw results with/without potential developments at PDA for (a) Zone A and (b) Zone B.

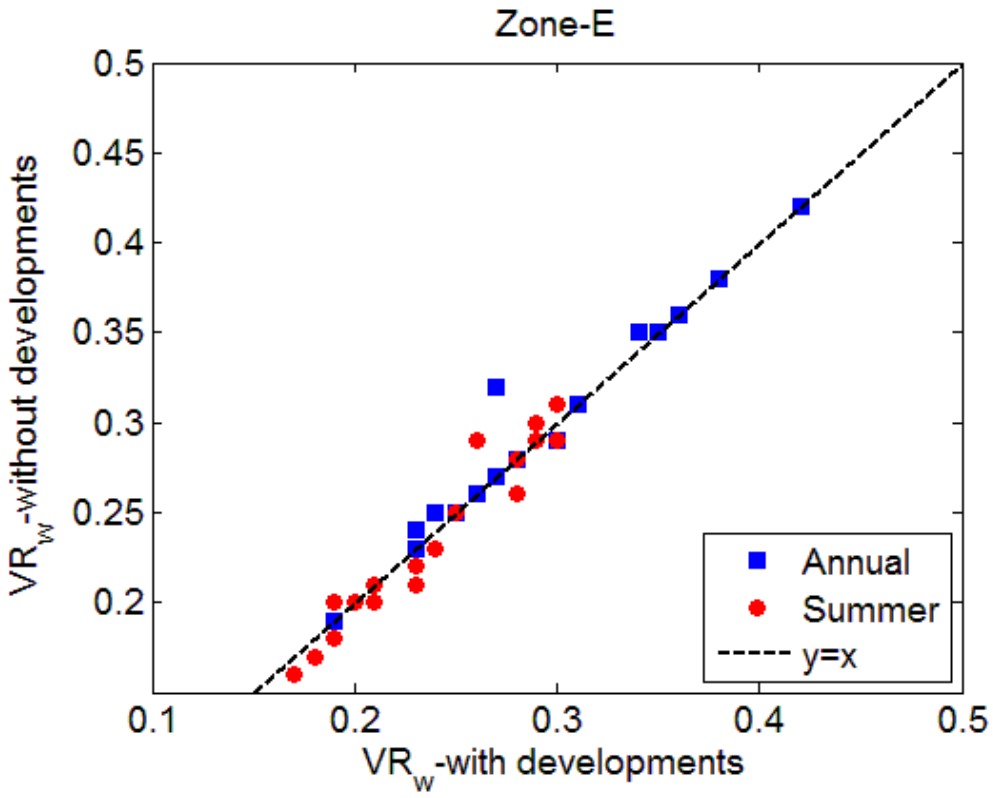


(c)

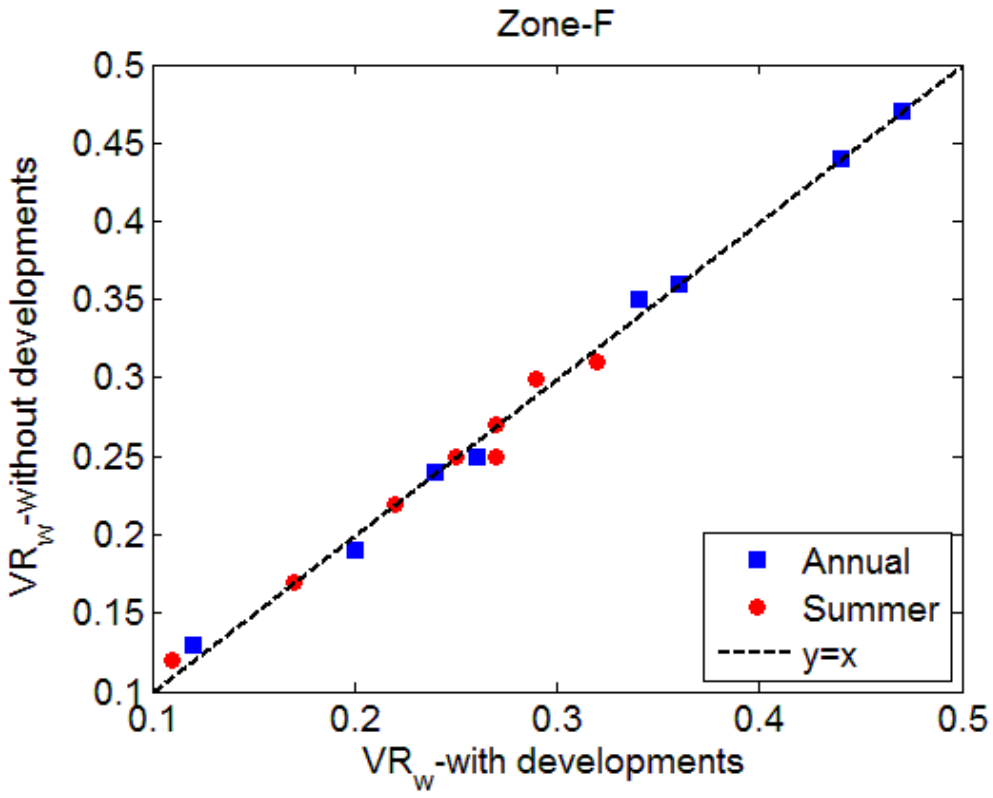


(d)

Figure 18. Comparison of VRw results with/without potential developments at PDA for (c) Zone C and (d) Zone D.

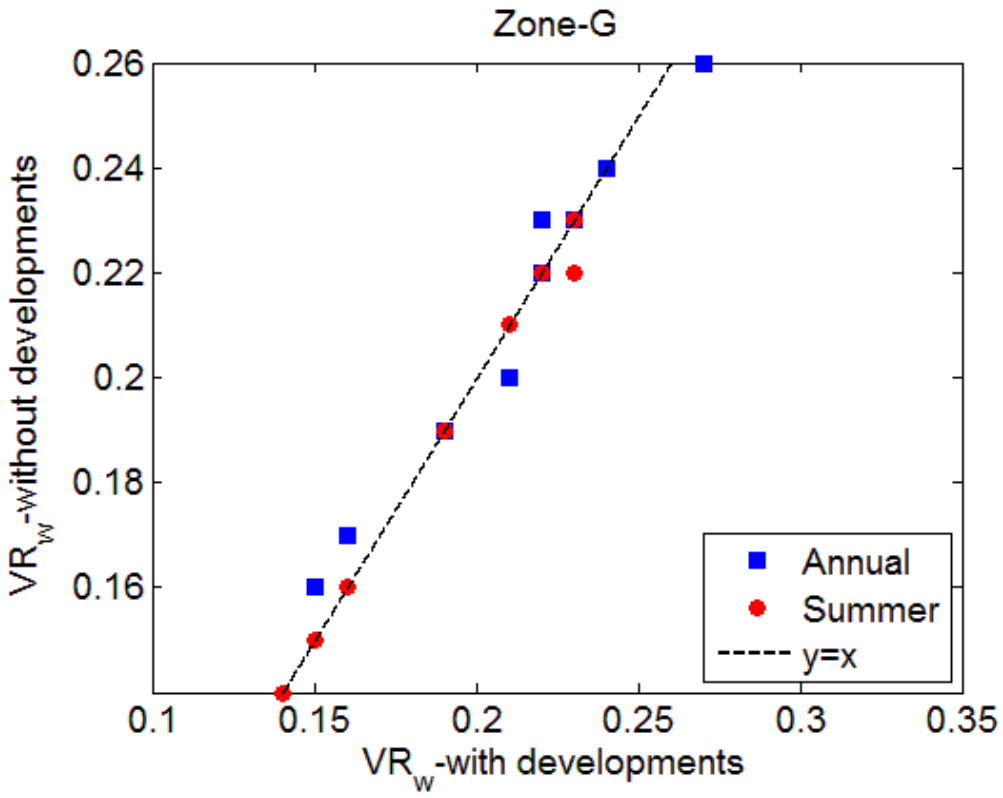


(e)



(f)

Figure 18. Comparison of VRw results with/without potential developments at PDA for (e) Zone E and (f) Zone F.



(g)

Figure 18. Comparison of VRw results with/without potential developments at PDA for (g) Zone G.

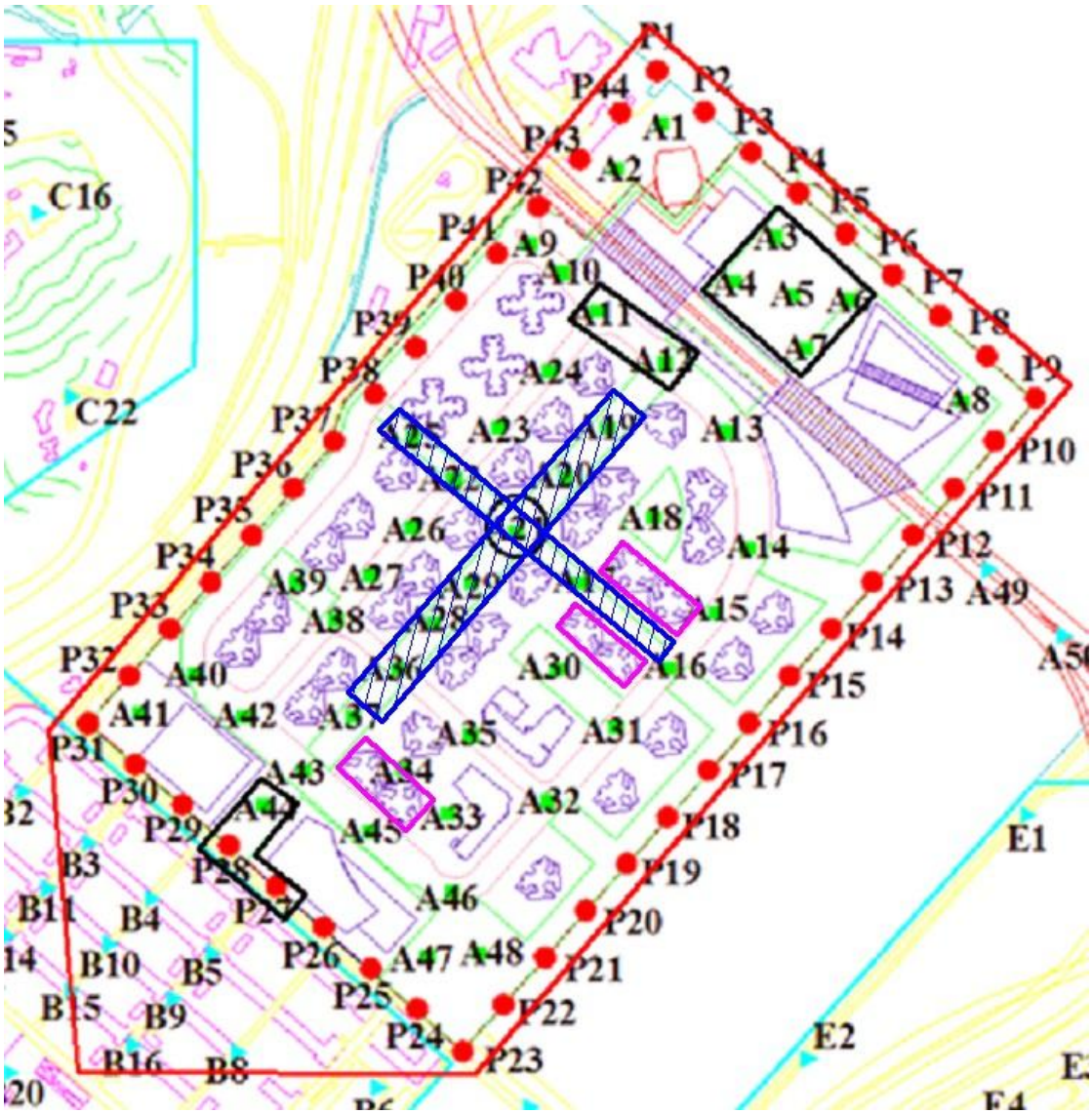


Figure 19. Air ventilation performance influenced area by the potential development at the PDA (influenced area is delineated by the red lines. In Zone A, test points marked in black correspond to the lowest VRw values in this zone (typically lower than 0.15); rectangles with lattice stand for the roads (or road sections) to be widened for the improvement of air ventilation performance; buildings marked by magenta rectangles are clustered structures that may result in negative influence on local air ventilation performance.

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
15m	0	0.11	0.30	0.62	0.82	1.29	1.08	0.75	0.11	0.04	0.00	5.12
	22.5	0.09	2.58	4.24	5.06	4.99	3.92	2.35	0.52	0.06	0.00	23.80
	45	0.00	0.54	1.36	2.35	3.18	2.90	2.71	0.43	0.09	0.02	13.58
	67.5	0.04	0.88	2.26	3.61	4.78	4.11	3.61	0.54	0.09	0.00	19.92
	90	0.37	1.57	2.26	1.42	0.49	0.09	0.04	0.00	0.00	0.00	6.24
	112.5	0.77	2.62	1.33	0.47	0.15	0.04	0.04	0.00	0.00	0.00	5.44
	135	0.22	0.73	0.30	0.17	0.06	0.00	0.02	0.02	0.00	0.00	1.53
	157.5	0.11	0.88	1.01	0.65	0.17	0.02	0.09	0.04	0.00	0.00	2.97
	180	0.26	1.46	1.25	0.69	0.32	0.04	0.11	0.06	0.00	0.00	4.20
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.22	2.73	3.53	3.59	2.17	1.03	0.47	0.04	0.00	0.00	13.79
	247.5	0.00	0.19	0.47	0.28	0.22	0.13	0.02	0.00	0.00	0.00	1.31
	270	0.15	0.58	0.73	0.17	0.06	0.02	0.00	0.00	0.00	0.00	1.72
	292.5	0.06	0.09	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.22
	315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	337.5	0.02	0.11	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.17
	Sum	2.41	15.28	19.43	19.30	17.90	13.38	10.24	1.76	0.28	0.02	100.00
50m	0	0.04	0.28	0.37	0.60	0.82	1.08	1.51	0.37	0.04	0.02	5.12
	22.5	0.00	1.42	3.01	3.89	4.20	4.07	5.25	1.70	0.19	0.06	23.80
	45	0.00	0.28	0.82	1.57	2.17	2.58	4.35	1.57	0.13	0.11	13.58
	67.5	0.04	0.37	1.53	2.39	3.64	3.89	5.94	1.96	0.17	0.00	19.92
	90	0.22	0.99	1.89	1.53	1.20	0.28	0.11	0.02	0.00	0.00	6.24
	112.5	0.45	2.17	1.38	0.97	0.26	0.13	0.09	0.00	0.00	0.00	5.44

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
50m	135	0.11	0.62	0.39	0.22	0.13	0.02	0.02	0.02	0.00	0.00	1.53
	157.5	0.04	0.75	0.80	0.93	0.24	0.09	0.06	0.04	0.02	0.00	2.97
	180	0.13	1.16	1.27	0.82	0.47	0.15	0.09	0.09	0.02	0.00	4.20
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.11	1.68	2.62	3.59	2.50	1.72	1.33	0.22	0.02	0.00	13.79
	247.5	0.00	0.11	0.28	0.41	0.19	0.19	0.11	0.02	0.00	0.00	1.31
	270	0.13	0.45	0.69	0.32	0.09	0.02	0.02	0.00	0.00	0.00	1.72
	292.5	0.02	0.09	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.22
	315	0.02	0.11	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.15
	337.5	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	Sum	1.31	10.48	15.12	17.28	15.90	14.22	18.89	6.00	0.60	0.19	100.00
100m	0	0.02	0.22	0.34	0.45	0.71	0.88	1.66	0.67	0.06	0.04	5.06
	22.5	0.00	0.97	1.81	2.22	2.37	3.03	5.12	2.11	0.34	0.06	18.03
	45	0.00	0.34	1.12	2.26	3.01	3.29	5.72	3.14	0.34	0.11	19.34
	67.5	0.02	0.24	1.14	1.94	2.90	3.36	6.58	3.38	0.28	0.09	19.92
	90	0.15	0.80	1.61	1.61	1.16	0.69	0.15	0.06	0.00	0.00	6.24
	112.5	0.34	1.85	1.46	1.01	0.49	0.17	0.06	0.04	0.00	0.00	5.44
	135	0.04	0.56	0.45	0.22	0.13	0.09	0.00	0.04	0.00	0.00	1.53
	157.5	0.04	0.71	0.71	1.01	0.26	0.09	0.09	0.04	0.02	0.00	2.97
	180	0.06	1.10	1.27	0.67	0.62	0.28	0.02	0.15	0.02	0.00	4.20
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.06	1.23	2.37	2.97	2.71	1.98	1.98	0.47	0.02	0.00	13.79
	247.5	0.00	0.06	0.26	0.34	0.26	0.19	0.17	0.02	0.00	0.00	1.31

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
100m	270	0.06	0.41	0.62	0.39	0.15	0.06	0.02	0.00	0.00	0.00	1.72
	292.5	0.02	0.09	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.22
	315	0.02	0.06	0.04	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.15
	337.5	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.09
	Sum	0.86	8.65	13.32	15.15	14.78	14.11	21.60	10.13	1.10	0.30	100.00
150m	0	0.02	0.22	0.30	0.43	0.52	0.88	1.79	0.80	0.06	0.04	5.06
	22.5	0.00	0.75	1.64	1.96	2.41	2.62	5.51	2.56	0.47	0.11	18.03
	45	0.00	0.26	0.80	1.66	2.47	2.86	5.79	4.52	0.75	0.24	19.34
	67.5	0.00	0.13	0.88	1.59	2.00	2.93	6.63	5.01	0.60	0.15	19.92
	90	0.06	0.60	1.12	1.55	1.14	1.05	0.62	0.09	0.00	0.00	6.24
	112.5	0.22	1.42	1.59	0.90	0.75	0.32	0.15	0.09	0.00	0.00	5.44
	135	0.04	0.43	0.52	0.24	0.13	0.13	0.00	0.02	0.02	0.00	1.53
	157.5	0.04	0.90	1.03	1.10	0.37	0.15	0.09	0.11	0.04	0.00	3.83
	180	0.02	0.88	0.97	0.62	0.43	0.26	0.06	0.09	0.00	0.00	3.33
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.06	1.14	2.15	2.73	2.60	2.13	2.24	0.67	0.06	0.00	13.79
	247.5	0.00	0.02	0.22	0.34	0.24	0.17	0.28	0.04	0.00	0.00	1.31
	270	0.06	0.37	0.41	0.60	0.15	0.09	0.02	0.02	0.00	0.00	1.72
	292.5	0.02	0.09	0.04	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.22
	315	0.02	0.06	0.04	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.15
	337.5	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.09
	Sum	0.58	7.29	11.75	13.79	13.23	13.60	23.17	14.03	2.02	0.54	100.00
200m	0	0.02	0.19	0.26	0.39	0.54	0.75	1.76	0.95	0.13	0.06	5.06

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
200m	22.5	0.00	0.69	1.55	1.91	2.24	2.65	5.36	2.97	0.56	0.11	18.03
	45	0.00	0.13	0.67	1.57	2.09	2.60	5.44	5.38	1.12	0.34	19.34
	67.5	0.00	0.11	0.88	1.38	1.96	2.93	6.50	5.23	0.80	0.15	19.92
	90	0.06	0.60	1.10	1.48	1.20	1.01	0.67	0.11	0.00	0.00	6.24
	112.5	0.22	1.38	1.53	0.88	0.86	0.32	0.17	0.09	0.00	0.00	5.44
	135	0.02	0.45	0.52	0.24	0.11	0.11	0.04	0.02	0.02	0.00	1.53
	157.5	0.04	1.25	1.23	1.23	0.43	0.19	0.15	0.11	0.04	0.00	4.67
	180	0.02	0.58	0.75	0.52	0.39	0.15	0.02	0.06	0.00	0.00	2.50
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.04	1.10	2.11	2.71	2.65	2.15	2.19	0.77	0.04	0.02	13.79
	247.5	0.00	0.00	0.19	0.37	0.26	0.17	0.28	0.04	0.00	0.00	1.31
	270	0.02	0.26	0.37	0.41	0.15	0.06	0.04	0.00	0.00	0.00	1.31
	292.5	0.06	0.17	0.19	0.13	0.04	0.02	0.00	0.00	0.00	0.00	0.62
	315	0.02	0.04	0.06	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.15
	337.5	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.09
	Sum	0.54	6.97	11.45	13.23	12.91	13.12	22.63	15.75	2.71	0.69	100.00
250m	0	0.00	0.19	0.26	0.39	0.49	0.67	1.79	1.01	0.19	0.06	5.06
	22.5	0.00	0.56	1.59	1.79	2.19	2.30	5.34	3.53	0.60	0.13	18.03
	45	0.00	0.13	0.56	1.29	1.79	2.47	5.31	5.90	1.53	0.37	19.34
	67.5	0.00	0.11	0.60	1.27	1.68	2.58	6.17	6.28	1.05	0.17	19.92
	90	0.02	0.54	0.82	1.38	1.25	0.90	1.16	0.13	0.04	0.00	6.24
	112.5	0.17	0.93	1.66	0.95	0.88	0.43	0.34	0.04	0.04	0.00	5.44
	135	0.02	0.67	0.69	0.45	0.17	0.15	0.13	0.06	0.04	0.00	2.39

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
250m	157.5	0.02	0.71	0.71	0.69	0.32	0.15	0.11	0.04	0.02	0.00	2.78
	180	0.04	0.71	1.14	0.86	0.52	0.15	0.04	0.06	0.00	0.00	3.53
	202.5	0.00	0.17	0.43	0.54	0.37	0.32	0.30	0.11	0.00	0.00	2.24
	225	0.04	0.82	1.70	2.00	2.17	1.87	2.09	0.77	0.06	0.02	11.55
	247.5	0.00	0.00	0.13	0.26	0.32	0.17	0.32	0.09	0.02	0.00	1.31
	270	0.02	0.24	0.24	0.56	0.15	0.04	0.04	0.02	0.00	0.00	1.31
	292.5	0.06	0.15	0.22	0.11	0.06	0.00	0.02	0.00	0.00	0.00	0.62
	315	0.02	0.02	0.09	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.15
	337.5	0.00	0.02	0.04	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.09
	Sum	0.43	5.96	10.86	12.52	12.39	12.22	23.17	18.07	3.61	0.75	100.00
300m	0	0.00	0.19	0.24	0.39	0.43	0.60	1.76	1.18	0.19	0.06	5.06
	22.5	0.00	0.45	1.53	1.61	2.17	2.04	5.44	3.85	0.71	0.22	18.03
	45	0.00	0.09	0.54	1.18	1.72	2.39	5.08	6.09	1.83	0.43	19.34
	67.5	0.00	0.06	0.52	1.14	1.57	2.32	5.62	6.95	1.51	0.24	19.92
	90	0.00	0.43	0.71	1.29	1.20	0.90	1.44	0.22	0.04	0.00	6.24
	112.5	0.15	0.86	1.53	1.10	0.69	0.60	0.39	0.09	0.04	0.00	5.44
	135	0.02	0.65	0.62	0.49	0.19	0.15	0.15	0.06	0.04	0.00	2.39
	157.5	0.00	0.45	0.45	0.32	0.17	0.15	0.04	0.09	0.02	0.00	1.70
	180	0.06	0.99	1.33	1.23	0.69	0.13	0.11	0.06	0.00	0.00	4.60
	202.5	0.00	0.17	0.43	0.49	0.39	0.34	0.30	0.11	0.00	0.00	2.24
	225	0.04	0.65	1.61	1.64	1.76	1.29	1.59	0.69	0.04	0.00	9.32
	247.5	0.00	0.13	0.24	0.47	0.69	0.82	0.84	0.30	0.04	0.02	3.55
	270	0.02	0.22	0.24	0.49	0.19	0.09	0.04	0.02	0.00	0.00	1.31

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
300m	292.5	0.06	0.13	0.22	0.11	0.09	0.00	0.02	0.00	0.00	0.00	0.62
	315	0.02	0.02	0.09	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.15
	337.5	0.00	0.02	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.09
	Sum	0.39	5.51	10.28	12.01	11.98	11.83	22.83	19.73	4.48	0.97	100.00
400m	0	0.00	0.13	0.22	0.30	0.45	0.56	1.68	1.23	0.17	0.06	4.80
	22.5	0.00	0.45	1.31	1.53	2.19	1.96	5.25	4.26	0.82	0.26	18.03
	45	0.00	0.02	0.28	0.97	1.14	1.83	3.29	3.12	0.90	0.19	11.75
	67.5	0.00	0.06	0.30	0.54	1.03	1.16	3.92	7.66	2.88	0.75	18.31
	90	0.00	0.41	0.93	1.70	2.07	2.30	4.43	3.16	0.45	0.00	15.45
	112.5	0.13	0.62	1.51	1.12	0.62	0.71	0.49	0.17	0.06	0.00	5.44
	135	0.00	0.47	0.65	0.43	0.34	0.13	0.19	0.09	0.04	0.04	2.39
	157.5	0.02	0.93	0.99	1.08	0.43	0.24	0.19	0.09	0.02	0.02	4.00
	180	0.04	0.47	0.71	0.62	0.34	0.04	0.02	0.04	0.00	0.00	2.30
	202.5	0.00	0.19	0.52	0.54	0.41	0.26	0.28	0.04	0.00	0.00	2.24
	225	0.02	0.60	1.51	1.51	1.66	1.31	1.79	0.86	0.06	0.00	9.32
	247.5	0.00	0.09	0.28	0.37	0.65	0.75	0.97	0.37	0.06	0.02	3.55
	270	0.00	0.22	0.24	0.41	0.24	0.13	0.06	0.02	0.00	0.00	1.31
	292.5	0.04	0.13	0.19	0.13	0.09	0.02	0.02	0.00	0.00	0.00	0.62
	315	0.02	0.00	0.11	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.15
	337.5	0.00	0.09	0.02	0.09	0.04	0.04	0.02	0.02	0.02	0.00	0.34
	Sum	0.28	4.88	9.75	11.32	11.70	11.45	22.61	21.15	5.51	1.36	100.00
500m	0	0.00	0.04	0.17	0.24	0.28	0.39	1.20	1.81	0.54	0.13	4.80
	22.5	0.00	0.04	0.86	1.18	1.20	1.66	3.18	6.02	2.69	1.18	18.03

Table 1. Percentage occurrence of annual winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
500m	45	0.00	0.02	0.26	0.77	1.14	1.79	3.25	3.23	1.05	0.24	11.75
	67.5	0.00	0.06	0.30	0.54	1.03	1.08	3.83	7.51	3.14	0.82	18.31
	90	0.00	0.34	0.75	1.36	2.11	2.02	4.52	3.68	0.62	0.04	15.45
	112.5	0.09	0.52	1.12	1.25	0.71	0.71	0.73	0.24	0.04	0.04	5.44
	135	0.00	0.39	0.93	0.67	0.43	0.26	0.28	0.15	0.09	0.06	3.25
	157.5	0.02	0.67	0.77	0.71	0.49	0.19	0.24	0.04	0.00	0.00	3.14
	180	0.04	0.45	0.65	0.67	0.39	0.04	0.02	0.04	0.00	0.00	2.30
	202.5	0.02	0.41	1.10	0.90	0.80	0.49	0.60	0.19	0.00	0.00	4.52
	225	0.00	0.26	0.86	0.75	1.25	1.23	1.48	1.08	0.13	0.00	7.04
	247.5	0.00	0.06	0.22	0.37	0.62	0.54	1.05	0.56	0.09	0.04	3.55
	270	0.00	0.13	0.30	0.26	0.41	0.11	0.09	0.02	0.00	0.00	1.31
	292.5	0.04	0.09	0.15	0.15	0.09	0.09	0.02	0.00	0.00	0.00	0.62
	315	0.02	0.00	0.06	0.04	0.02	0.00	0.00	0.00	0.02	0.00	0.17
	337.5	0.00	0.09	0.02	0.06	0.02	0.04	0.04	0.00	0.04	0.00	0.32
	Sum	0.24	3.57	8.52	9.92	10.99	10.63	20.55	24.57	8.46	2.56	100.00

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
15m	0	0.25	0.25	0.42	0.25	0.08	0.00	0.08	0.00	0.08	0.00	1.44
	22.5	0.08	1.95	1.44	0.59	0.25	0.25	0.17	0.25	0.00	0.00	5.00
	45	0.00	0.42	1.02	1.10	0.59	0.17	0.76	0.25	0.08	0.08	4.49
	67.5	0.00	1.10	1.27	0.93	1.27	0.68	1.02	0.08	0.00	0.00	6.36
	90	0.76	2.12	1.69	0.59	0.25	0.17	0.08	0.00	0.00	0.00	5.68
	112.5	1.36	4.32	2.71	0.59	0.17	0.08	0.08	0.00	0.00	0.00	9.32
	135	0.25	1.95	1.02	0.42	0.17	0.00	0.08	0.08	0.00	0.00	3.98
	157.5	0.25	1.78	1.95	1.78	0.59	0.08	0.34	0.08	0.00	0.00	6.86
	180	0.34	3.47	2.71	1.78	0.85	0.17	0.34	0.17	0.00	0.00	9.83
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.00	6.02	9.41	9.92	7.12	3.64	1.69	0.17	0.00	0.00	37.97
	247.5	0.00	0.42	1.10	1.02	0.76	0.42	0.08	0.00	0.00	0.00	3.81
	270	0.25	1.19	2.12	0.51	0.25	0.08	0.00	0.00	0.00	0.00	4.41
	292.5	0.08	0.25	0.17	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.59
	315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	337.5	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	Sum	3.64	25.51	27.03	19.58	12.37	5.76	4.75	1.10	0.17	0.08	100.00
50m	0	0.08	0.34	0.34	0.25	0.17	0.08	0.08	0.00	0.00	0.08	1.44
	22.5	0.00	1.19	1.61	1.02	0.42	0.08	0.34	0.25	0.08	0.00	5.00
	45	0.00	0.34	0.51	1.02	0.76	0.51	0.59	0.51	0.08	0.17	4.49
	67.5	0.00	0.68	1.19	0.85	1.19	0.76	1.36	0.25	0.08	0.00	6.36
	90	0.42	1.61	1.78	0.93	0.51	0.17	0.25	0.00	0.00	0.00	5.68
	112.5	0.68	3.56	3.05	1.36	0.42	0.08	0.17	0.00	0.00	0.00	9.32

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
50m	135	0.08	1.44	1.19	0.76	0.25	0.08	0.08	0.08	0.00	0.00	3.98
	157.5	0.00	1.53	1.61	2.20	0.85	0.25	0.25	0.17	0.00	0.00	6.86
	180	0.17	2.46	2.88	1.78	1.44	0.51	0.34	0.17	0.08	0.00	9.83
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.00	2.97	6.78	10.08	6.95	5.59	4.75	0.76	0.08	0.00	37.97
	247.5	0.00	0.17	0.85	1.02	0.59	0.68	0.42	0.08	0.00	0.00	3.81
	270	0.25	0.68	2.03	0.93	0.34	0.08	0.08	0.00	0.00	0.00	4.41
	292.5	0.00	0.17	0.34	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.59
	315	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sum	1.69	17.37	24.15	22.29	13.90	8.90	8.73	2.29	0.42	0.25	100.00
100m	0	0.00	0.42	0.25	0.25	0.17	0.08	0.00	0.08	0.00	0.08	1.36
	22.5	0.00	0.68	1.36	0.34	0.42	0.08	0.25	0.08	0.17	0.00	3.39
	45	0.00	0.34	0.85	1.36	1.02	0.59	0.59	0.85	0.34	0.17	6.10
	67.5	0.00	0.42	1.02	1.02	0.59	1.27	1.10	0.85	0.08	0.00	6.36
	90	0.25	1.36	1.78	1.19	0.51	0.34	0.08	0.17	0.00	0.00	5.68
	112.5	0.51	3.14	2.97	1.61	0.68	0.25	0.08	0.08	0.00	0.00	9.32
	135	0.08	1.27	1.27	0.68	0.25	0.25	0.00	0.17	0.00	0.00	3.98
	157.5	0.00	1.53	1.36	2.29	0.93	0.25	0.34	0.17	0.00	0.00	6.86
	180	0.08	2.29	2.88	1.69	1.53	0.76	0.08	0.42	0.08	0.00	9.83
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.00	1.95	5.76	8.22	7.37	5.93	6.95	1.69	0.08	0.00	37.97
	247.5	0.00	0.08	0.76	0.68	0.93	0.68	0.59	0.08	0.00	0.00	3.81

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
100m	270	0.17	0.59	1.69	1.19	0.42	0.25	0.08	0.00	0.00	0.00	4.41
	292.5	0.00	0.17	0.25	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.59
	315	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	Sum	1.10	14.49	22.29	20.68	14.83	10.76	10.17	4.66	0.76	0.25	100.00
150m	0	0.00	0.42	0.17	0.25	0.25	0.00	0.08	0.08	0.00	0.08	1.36
	22.5	0.00	0.51	1.10	0.76	0.42	0.08	0.25	0.08	0.17	0.00	3.39
	45	0.00	0.17	0.68	0.93	1.27	0.76	0.76	0.76	0.51	0.25	6.10
	67.5	0.00	0.17	0.93	1.02	0.59	1.02	1.27	1.27	0.08	0.00	6.36
	90	0.08	1.02	1.78	1.19	0.59	0.51	0.25	0.25	0.00	0.00	5.68
	112.5	0.17	2.71	2.37	2.37	0.93	0.42	0.17	0.17	0.00	0.00	9.32
	135	0.08	0.85	1.44	0.76	0.34	0.34	0.00	0.08	0.08	0.00	3.98
	157.5	0.00	1.86	2.03	2.54	1.36	0.51	0.34	0.25	0.08	0.00	8.98
	180	0.00	1.86	2.20	1.53	0.93	0.59	0.25	0.34	0.00	0.00	7.71
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.00	1.78	5.34	7.37	6.86	6.19	7.71	2.46	0.25	0.00	37.97
	247.5	0.00	0.00	0.59	0.76	0.76	0.51	1.02	0.17	0.00	0.00	3.81
	270	0.17	0.42	1.10	1.78	0.42	0.34	0.08	0.08	0.00	0.00	4.41
	292.5	0.00	0.17	0.17	0.17	0.08	0.00	0.00	0.00	0.00	0.00	0.59
	315	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	Sum	0.51	12.20	20.00	21.44	14.83	11.27	12.20	6.02	1.19	0.34	100.00
200m	0	0.00	0.34	0.25	0.25	0.25	0.00	0.08	0.08	0.00	0.08	1.36

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
200m	22.5	0.00	0.51	1.10	0.68	0.42	0.08	0.34	0.08	0.17	0.00	3.39
	45	0.00	0.00	0.76	0.85	1.02	1.10	0.76	0.76	0.42	0.42	6.10
	67.5	0.00	0.17	0.93	0.85	0.76	0.93	1.27	1.36	0.08	0.00	6.36
	90	0.08	1.02	1.78	1.10	0.68	0.42	0.34	0.25	0.00	0.00	5.68
	112.5	0.17	2.71	2.20	2.20	1.27	0.34	0.25	0.17	0.00	0.00	9.32
	135	0.08	0.85	1.44	0.76	0.34	0.25	0.08	0.08	0.08	0.00	3.98
	157.5	0.00	2.71	2.63	3.05	1.44	0.68	0.59	0.25	0.08	0.00	11.44
	180	0.00	1.19	1.61	1.02	0.93	0.17	0.08	0.25	0.00	0.00	5.25
	202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	225	0.00	1.69	5.34	7.03	7.03	6.36	7.37	2.88	0.17	0.08	37.97
	247.5	0.00	0.00	0.42	0.85	0.85	0.51	1.02	0.17	0.00	0.00	3.81
	270	0.08	0.34	1.02	1.19	0.42	0.25	0.17	0.00	0.00	0.00	3.47
	292.5	0.08	0.25	0.51	0.42	0.17	0.08	0.00	0.00	0.00	0.00	1.53
	315	0.00	0.17	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	Sum	0.51	11.95	20.17	20.25	15.59	11.19	12.37	6.36	1.02	0.59	100.00
250m	0	0.00	0.34	0.25	0.25	0.25	0.00	0.08	0.08	0.00	0.08	1.36
	22.5	0.00	0.42	1.19	0.68	0.34	0.17	0.34	0.08	0.17	0.00	3.39
	45	0.00	0.00	0.68	0.85	1.02	1.02	0.85	0.85	0.34	0.51	6.10
	67.5	0.00	0.17	0.76	0.93	0.68	0.59	1.61	1.53	0.00	0.08	6.36
	90	0.00	1.02	1.36	1.19	1.02	0.17	0.68	0.17	0.08	0.00	5.68
	112.5	0.17	1.86	2.37	2.29	1.44	0.59	0.42	0.08	0.08	0.00	9.32
	135	0.08	1.36	1.69	1.27	0.59	0.34	0.42	0.25	0.08	0.00	6.10

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
250m	157.5	0.00	1.44	1.61	1.78	0.85	0.59	0.34	0.08	0.08	0.00	6.78
	180	0.00	1.36	2.54	1.95	1.36	0.25	0.08	0.25	0.00	0.00	7.80
	202.5	0.00	0.17	1.27	1.02	0.76	0.76	1.02	0.34	0.00	0.00	5.34
	225	0.00	1.44	3.98	5.34	6.10	5.59	6.95	2.88	0.25	0.08	32.63
	247.5	0.00	0.00	0.25	0.76	0.68	0.59	1.10	0.34	0.08	0.00	3.81
	270	0.08	0.25	0.68	1.61	0.42	0.17	0.17	0.08	0.00	0.00	3.47
	292.5	0.08	0.25	0.51	0.34	0.25	0.00	0.08	0.00	0.00	0.00	1.53
	315	0.00	0.08	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	Sum	0.42	10.17	19.41	20.25	15.76	10.85	14.15	7.03	1.19	0.76	100.00
300m	0	0.00	0.34	0.25	0.25	0.25	0.00	0.08	0.08	0.00	0.08	1.36
	22.5	0.00	0.34	1.27	0.59	0.42	0.17	0.34	0.00	0.08	0.17	3.39
	45	0.00	0.00	0.59	0.76	1.19	0.59	1.27	0.68	0.51	0.51	6.10
	67.5	0.00	0.08	0.76	0.76	0.85	0.42	1.69	1.36	0.34	0.08	6.36
	90	0.00	0.76	1.19	1.44	0.76	0.59	0.68	0.17	0.08	0.00	5.68
	112.5	0.17	1.69	2.29	2.37	1.36	0.76	0.51	0.08	0.08	0.00	9.32
	135	0.08	1.36	1.44	1.36	0.76	0.25	0.51	0.25	0.08	0.00	6.10
	157.5	0.00	1.02	1.10	0.93	0.51	0.59	0.17	0.17	0.08	0.00	4.58
	180	0.00	1.86	2.71	2.97	1.69	0.25	0.25	0.25	0.00	0.00	10.00
	202.5	0.00	0.17	1.27	0.93	0.85	0.76	1.02	0.34	0.00	0.00	5.34
	225	0.00	1.10	3.73	4.24	4.75	3.73	5.34	2.46	0.17	0.00	25.51
	247.5	0.00	0.17	0.59	1.44	1.86	2.54	2.97	1.10	0.17	0.08	10.93
	270	0.08	0.17	0.76	1.36	0.59	0.25	0.17	0.08	0.00	0.00	3.47

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
300m	292.5	0.08	0.17	0.51	0.42	0.25	0.00	0.08	0.00	0.00	0.00	1.53
	315	0.00	0.08	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	Sum	0.42	9.32	18.64	19.92	16.10	10.93	15.08	7.03	1.61	0.93	100.00
400m	0	0.00	0.17	0.17	0.25	0.25	0.00	0.08	0.08	0.00	0.08	1.10
	22.5	0.00	0.34	1.19	0.68	0.25	0.34	0.25	0.08	0.08	0.17	3.39
	45	0.00	0.00	0.25	0.76	0.85	0.68	0.42	0.34	0.51	0.17	3.98
	67.5	0.00	0.00	0.42	0.17	0.51	0.34	1.27	1.61	0.42	0.42	5.17
	90	0.00	0.76	1.61	1.86	1.36	0.76	1.61	0.68	0.34	0.00	8.98
	112.5	0.17	1.10	2.46	1.95	1.61	1.02	0.68	0.17	0.17	0.00	9.32
	135	0.00	1.02	1.36	1.19	1.10	0.42	0.42	0.34	0.17	0.08	6.10
	157.5	0.00	1.86	2.37	2.46	1.10	0.76	0.59	0.25	0.00	0.08	9.49
	180	0.00	0.93	1.27	1.44	1.10	0.08	0.08	0.17	0.00	0.00	5.08
	202.5	0.00	0.25	1.27	1.27	0.93	0.51	0.93	0.17	0.00	0.00	5.34
	225	0.00	1.02	3.39	3.73	4.58	3.73	5.68	3.22	0.17	0.00	25.51
	247.5	0.00	0.08	0.68	1.02	1.86	2.37	3.22	1.36	0.25	0.08	10.93
	270	0.00	0.25	0.68	1.19	0.68	0.34	0.25	0.08	0.00	0.00	3.47
	292.5	0.08	0.17	0.34	0.51	0.25	0.08	0.08	0.00	0.00	0.00	1.53
	315	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.17	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.34
	Sum	0.25	8.14	17.80	18.56	16.44	11.44	15.59	8.56	2.12	1.10	100.00
500m	0	0.00	0.08	0.08	0.25	0.17	0.25	0.08	0.08	0.00	0.08	1.10
	22.5	0.00	0.08	0.68	0.85	0.59	0.17	0.42	0.34	0.00	0.25	3.39

Table 2. Percentage occurrence of summer winds above the PDA (%)

	Azimuth(°)	0-1m/s	1-2m/s	2-3m/s	3-4m/s	4-5m/s	5-6m/s	6-8m/s	8-11m/s	11-14m/s	>14m/s	Sum
500m	45	0.00	0.00	0.25	0.59	0.85	0.76	0.51	0.34	0.42	0.25	3.98
	67.5	0.00	0.00	0.42	0.17	0.51	0.34	1.27	1.44	0.59	0.42	5.17
	90	0.00	0.76	1.02	1.86	1.53	1.02	1.53	0.85	0.42	0.00	8.98
	112.5	0.17	0.93	1.86	1.86	1.78	1.36	0.85	0.34	0.08	0.08	9.32
	135	0.00	0.85	2.03	1.61	1.10	1.02	0.76	0.42	0.25	0.17	8.22
	157.5	0.00	1.27	1.78	1.78	1.19	0.51	0.68	0.17	0.00	0.00	7.37
	180	0.00	0.85	1.27	1.36	1.27	0.08	0.08	0.17	0.00	0.00	5.08
	202.5	0.00	0.68	2.80	2.29	1.95	1.19	1.78	0.76	0.00	0.00	11.44
	225	0.00	0.25	1.61	1.86	3.22	3.47	4.75	3.81	0.42	0.00	19.41
	247.5	0.00	0.08	0.42	0.93	1.86	1.61	3.39	2.12	0.34	0.17	10.93
	270	0.00	0.17	0.68	0.76	1.19	0.25	0.34	0.08	0.00	0.00	3.47
	292.5	0.08	0.08	0.17	0.51	0.34	0.25	0.08	0.00	0.00	0.00	1.53
	315	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	337.5	0.00	0.17	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.34
	Sum	0.25	6.27	15.42	16.78	17.54	12.29	16.53	10.93	2.54	1.44	100.00

Table 3. Three kinds of approach wind fields for the AVA study (SWAS stands for the target results obtained from the SWAS test; AVA stands for the adjusted approach fields. Speed profiles herein are normalized by the MBL which is defined as the mean values of all the speeds at the considered 9 levels)

		z(m)	**14**	**50**	**100**	**150**	**200**	**250**	**300**	**400**	**500**
SWAS	**G1**	**U_{norm}**	0.81	0.88	0.92	0.92	0.95	0.98	1.02	1.14	1.38
		Iuu	0.29	0.27	0.27	0.27	0.28	0.28	0.29	0.28	0.25
	G2	**U_{norm}**	0.87	0.96	1.00	1.00	1.00	1.02	1.02	1.04	1.08
		Iuu	0.24	0.24	0.24	0.25	0.24	0.26	0.26	0.28	0.29
	G3	**U_{norm}**	0.72	0.80	0.86	0.93	0.97	1.04	1.09	1.21	1.37
		Iuu	0.28	0.27	0.26	0.26	0.26	0.26	0.26	0.25	0.23
AVA	**G1**	**U_{norm}**	0.73	0.85	0.92	0.96	1.00	1.01	1.06	1.16	1.30
		Iuu	0.23	0.19	0.18	0.18	0.17	0.18	0.18	0.18	0.16
	G2	**U_{norm}**	0.82	0.95	1.01	1.03	1.03	1.03	1.03	1.04	1.05
		Iuu	0.15	0.13	0.11	0.11	0.10	0.10	0.10	0.10	0.11
	G3	**U_{norm}**	0.70	0.80	0.86	0.94	1.00	1.05	1.12	1.23	1.30
		Iuu	0.27	0.25	0.24	0.23	0.23	0.22	0.20	0.17	0.13

Note: G1 includes: 0°, 135°; G2 includes: 180°, 202.5°; G3 includes: the other 12 directions.

Table 4. Directional scaling factors of mean wind speeds between the SWAS model and the AVA model

Section	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
U_{SWAS}(m/s)	5.59	6.64	7.00	5.99	3.64	3.35	4.22	3.98	3.26	4.56	5.33	4.87	4.26	3.69	4.59	4.86
U_{AVA}(m/s)	4.57	5.04	5.04	5.04	5.04	5.04	4.57	5.04	6.02	6.02	5.04	5.04	5.04	5.04	5.04	5.04
Factor	1.22	1.32	1.39	1.19	0.722	0.665	0.923	0.790	0.542	0.758	1.06	0.966	0.845	0.732	0.911	0.964

Note: $U_{SWAS,}$ U_{AVA} stand for the mean values of all the speeds at the 9 tested levels of each azimuth.

Table 5. VR values of perimeter test points in Zone-A with installation of potential developments at the PDA

Dir.	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22
0	0.29	0.22	0.24	0.40	0.42	0.26	0.31	0.57	0.68	0.65	0.27	0.31	0.43	0.34	0.33	0.18	0.24	0.23	0.24	0.22	0.25	0.25
22.5	0.41	0.30	0.20	0.42	0.43	0.33	0.27	0.54	0.65	0.65	0.41	0.34	0.35	0.39	0.49	0.35	0.35	0.37	0.35	0.38	0.40	0.42
45	0.48	0.37	0.20	0.35	0.36	0.31	0.24	0.37	0.45	0.43	0.30	0.26	0.26	0.35	0.45	0.35	0.38	0.36	0.38	0.42	0.45	0.45
67.5	0.33	0.28	0.17	0.24	0.24	0.24	0.20	0.24	0.28	0.25	0.22	0.21	0.21	0.25	0.29	0.23	0.29	0.26	0.27	0.30	0.33	0.33
90	0.21	0.17	0.10	0.13	0.15	0.13	0.10	0.14	0.17	0.14	0.12	0.11	0.11	0.12	0.12	0.12	0.14	0.14	0.18	0.19	0.25	0.27
112.5	0.18	0.16	0.10	0.12	0.13	0.12	0.09	0.12	0.15	0.13	0.11	0.11	0.12	0.13	0.13	0.15	0.16	0.16	0.20	0.21	0.23	0.22
135	0.28	0.23	0.19	0.21	0.20	0.21	0.17	0.32	0.26	0.23	0.18	0.22	0.20	0.20	0.19	0.24	0.20	0.23	0.19	0.23	0.18	0.22
157.5	0.18	0.12	0.15	0.12	0.17	0.10	0.13	0.12	0.22	0.12	0.17	0.12	0.16	0.11	0.16	0.10	0.16	0.10	0.17	0.12	0.17	0.11
180	0.12	0.09	0.08	0.12	0.15	0.12	0.08	0.18	0.29	0.26	0.27	0.26	0.23	0.26	0.24	0.20	0.21	0.21	0.18	0.23	0.14	0.16
202.5	0.24	0.08	0.07	0.13	0.20	0.15	0.09	0.20	0.30	0.25	0.22	0.27	0.21	0.21	0.23	0.16	0.26	0.26	0.29	0.47	0.34	0.39
225	0.36	0.22	0.10	0.10	0.10	0.11	0.09	0.16	0.35	0.28	0.26	0.33	0.25	0.25	0.26	0.21	0.25	0.33	0.28	0.44	0.37	0.43
247.5	0.32	0.29	0.13	0.12	0.12	0.11	0.08	0.10	0.14	0.12	0.11	0.17	0.12	0.13	0.14	0.14	0.16	0.24	0.21	0.35	0.31	0.37
270	0.28	0.29	0.19	0.17	0.18	0.17	0.14	0.14	0.18	0.11	0.09	0.11	0.11	0.11	0.11	0.10	0.11	0.18	0.17	0.21	0.26	0.29
292.5	0.18	0.21	0.17	0.17	0.18	0.19	0.18	0.21	0.26	0.13	0.13	0.09	0.09	0.08	0.08	0.08	0.08	0.12	0.13	0.14	0.22	0.26
315	0.22	0.28	0.29	0.27	0.28	0.28	0.27	0.34	0.41	0.23	0.22	0.14	0.13	0.12	0.10	0.11	0.10	0.12	0.13	0.13	0.25	0.33
337.5	0.19	0.22	0.21	0.28	0.27	0.23	0.25	0.37	0.44	0.33	0.24	0.18	0.18	0.19	0.14	0.12	0.13	0.12	0.13	0.12	0.14	0.18
Annual: VR_w	***0.34***	***0.26***	***0.16***	***0.26***	***0.27***	***0.23***	***0.19***	***0.31***	***0.40***	***0.37***	***0.27***	***0.26***	***0.25***	***0.28***	***0.32***	***0.25***	***0.28***	***0.29***	***0.28***	***0.33***	***0.34***	***0.35***
Summer: VR_w	***0.30***	***0.21***	***0.13***	***0.16***	***0.17***	***0.15***	***0.12***	***0.20***	***0.31***	***0.26***	***0.22***	***0.24***	***0.21***	***0.22***	***0.24***	***0.20***	***0.23***	***0.26***	***0.25***	***0.32***	***0.30***	***0.33***

Table 5. VR values of perimeter test points in Zone-A with installation of potential developments at the PDA

Dir.	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44
0	0.21	0.19	0.16	0.15	0.13	0.16	0.28	0.46	0.39	0.40	0.45	0.36	0.36	0.33	0.31	0.44	0.27	0.27	0.25	0.29	0.31	0.27
22.5	0.39	0.28	0.18	0.13	0.10	0.09	0.19	0.53	0.48	0.48	0.57	0.47	0.48	0.45	0.46	0.55	0.40	0.47	0.48	0.46	0.52	0.45
45	0.43	0.37	0.24	0.20	0.12	0.11	0.15	0.31	0.52	0.48	0.53	0.48	0.47	0.46	0.47	0.48	0.46	0.56	0.52	0.42	0.52	0.51
67.5	0.32	0.31	0.24	0.20	0.16	0.13	0.12	0.14	0.30	0.25	0.31	0.30	0.28	0.29	0.27	0.25	0.24	0.34	0.34	0.31	0.34	0.34
90	0.27	0.27	0.26	0.19	0.20	0.17	0.15	0.13	0.13	0.09	0.12	0.13	0.13	0.13	0.12	0.11	0.11	0.18	0.18	0.17	0.20	0.21
112.5	0.21	0.22	0.19	0.16	0.16	0.15	0.16	0.17	0.17	0.11	0.11	0.09	0.10	0.09	0.09	0.08	0.07	0.11	0.13	0.14	0.17	0.18
135	0.22	0.18	0.15	0.13	0.14	0.14	0.15	0.14	0.17	0.16	0.15	0.13	0.12	0.12	0.11	0.11	0.11	0.09	0.15	0.20	0.18	0.24
157.5	0.20	0.18	0.17	0.13	0.15	0.18	0.14	0.20	0.25	0.20	0.18	0.22	0.12	0.12	0.08	0.11	0.06	0.10	0.05	0.09	0.08	0.14
180	0.19	0.16	0.12	0.11	0.11	0.16	0.11	0.18	0.23	0.20	0.27	0.26	0.19	0.14	0.13	0.13	0.13	0.11	0.10	0.12	0.11	0.12
202.5	0.37	0.34	0.22	0.14	0.16	0.21	0.15	0.18	0.30	0.31	0.40	0.44	0.31	0.25	0.22	0.19	0.21	0.20	0.16	0.20	0.20	0.20
225	0.38	0.36	0.27	0.19	0.15	0.21	0.15	0.21	0.34	0.30	0.35	0.37	0.30	0.29	0.26	0.29	0.34	0.35	0.33	0.40	0.33	0.34
247.5	0.35	0.34	0.25	0.17	0.13	0.15	0.13	0.13	0.21	0.17	0.16	0.18	0.16	0.19	0.17	0.19	0.21	0.18	0.27	0.30	0.25	0.29
270	0.24	0.23	0.20	0.17	0.15	0.19	0.15	0.16	0.23	0.14	0.14	0.15	0.16	0.18	0.17	0.20	0.21	0.23	0.29	0.28	0.24	0.26
292.5	0.24	0.24	0.21	0.18	0.17	0.18	0.16	0.16	0.17	0.14	0.15	0.16	0.16	0.19	0.18	0.20	0.18	0.18	0.22	0.19	0.14	0.16
315	0.37	0.30	0.30	0.26	0.28	0.25	0.28	0.25	0.23	0.19	0.20	0.19	0.19	0.20	0.19	0.22	0.19	0.19	0.18	0.17	0.16	0.18
337.5	0.21	0.19	0.18	0.18	0.20	0.22	0.28	0.30	0.26	0.24	0.26	0.22	0.21	0.22	0.18	0.26	0.19	0.22	0.18	0.19	0.18	0.17
Annual: VR_w	***0.33***	***0.29***	***0.22***	***0.17***	***0.14***	***0.14***	***0.16***	***0.29***	***0.36***	***0.33***	***0.38***	***0.35***	***0.33***	***0.31***	***0.31***	***0.34***	***0.29***	***0.35***	***0.35***	***0.34***	***0.36***	***0.35***
Summer: VR_w	***0.31***	***0.29***	***0.22***	***0.17***	***0.15***	***0.17***	***0.15***	***0.21***	***0.29***	***0.25***	***0.29***	***0.29***	***0.24***	***0.24***	***0.22***	***0.24***	***0.24***	***0.27***	***0.27***	***0.29***	***0.27***	***0.28***

Table 6. VR values of perimeter test points in Zone-A without installation of potential developments at the PDA

Dir.	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22
0	0.45	0.44	0.44	0.43	0.46	0.49	0.57	0.55	0.64	0.51	0.50	0.56	0.46	0.40	0.41	0.38	0.39	0.35	0.43	0.36	0.45	0.40
22.5	0.59	0.50	0.56	0.46	0.50	0.56	0.57	0.58	0.64	0.55	0.50	0.53	0.51	0.50	0.48	0.50	0.48	0.50	0.51	0.51	0.50	0.54
45	0.60	0.51	0.52	0.40	0.45	0.45	0.42	0.40	0.45	0.39	0.40	0.36	0.39	0.40	0.43	0.45	0.46	0.47	0.50	0.51	0.51	0.55
67.5	0.40	0.30	0.30	0.22	0.25	0.25	0.22	0.23	0.27	0.25	0.26	0.24	0.26	0.28	0.30	0.31	0.32	0.32	0.36	0.34	0.35	0.37
90	0.23	0.18	0.18	0.14	0.15	0.16	0.14	0.14	0.16	0.14	0.14	0.13	0.13	0.13	0.14	0.16	0.17	0.20	0.22	0.24	0.25	0.27
112.5	0.17	0.16	0.15	0.13	0.15	0.15	0.14	0.13	0.15	0.13	0.14	0.13	0.15	0.17	0.19	0.22	0.22	0.23	0.24	0.23	0.23	0.23
135	0.26	0.24	0.23	0.22	0.24	0.24	0.26	0.23	0.30	0.27	0.34	0.28	0.30	0.27	0.26	0.24	0.23	0.19	0.20	0.17	0.18	0.17
157.5	0.24	0.19	0.20	0.17	0.20	0.19	0.19	0.17	0.20	0.16	0.17	0.18	0.19	0.19	0.19	0.20	0.20	0.20	0.21	0.20	0.21	0.23
180	0.25	0.23	0.25	0.23	0.24	0.25	0.24	0.25	0.26	0.24	0.23	0.27	0.26	0.26	0.27	0.25	0.26	0.23	0.25	0.20	0.22	0.18
202.5	0.32	0.35	0.39	0.36	0.39	0.39	0.33	0.30	0.35	0.29	0.31	0.31	0.35	0.34	0.37	0.37	0.39	0.38	0.40	0.40	0.41	0.45
225	0.39	0.29	0.35	0.28	0.37	0.33	0.36	0.33	0.44	0.31	0.39	0.34	0.43	0.36	0.44	0.37	0.44	0.37	0.45	0.37	0.44	0.42
247.5	0.32	0.32	0.28	0.25	0.25	0.25	0.21	0.21	0.24	0.21	0.26	0.23	0.29	0.28	0.30	0.30	0.32	0.31	0.34	0.33	0.35	0.37
270	0.27	0.26	0.27	0.25	0.27	0.28	0.25	0.25	0.28	0.23	0.26	0.23	0.27	0.24	0.25	0.23	0.24	0.24	0.24	0.23	0.24	0.27
292.5	0.18	0.19	0.21	0.19	0.22	0.21	0.21	0.21	0.27	0.21	0.23	0.22	0.25	0.26	0.23	0.25	0.22	0.23	0.22	0.21	0.21	0.23
315	0.27	0.28	0.30	0.27	0.31	0.30	0.30	0.30	0.39	0.31	0.35	0.29	0.30	0.28	0.25	0.26	0.24	0.27	0.27	0.30	0.30	0.40
337.5	0.26	0.27	0.29	0.27	0.30	0.31	0.32	0.34	0.42	0.34	0.35	0.35	0.30	0.29	0.27	0.29	0.25	0.28	0.26	0.27	0.24	0.30
Annual: VR_w	***0.43***	***0.36***	***0.38***	***0.31***	***0.35***	***0.36***	***0.36***	***0.36***	***0.41***	***0.34***	***0.35***	***0.34***	***0.36***	***0.35***	***0.36***	***0.36***	***0.37***	***0.37***	***0.40***	***0.38***	***0.40***	***0.41***
Summer: VR_w	***0.34***	***0.28***	***0.31***	***0.26***	***0.30***	***0.29***	***0.29***	***0.28***	***0.34***	***0.27***	***0.31***	***0.29***	***0.33***	***0.30***	***0.34***	***0.31***	***0.34***	***0.31***	***0.36***	***0.32***	***0.35***	***0.34***

Table 6. VR values of perimeter test points in Zone-A without installation of potential developments at the PDA

Dir.	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44
0	0.50	0.43	0.36	0.37	0.34	0.33	0.32	0.32	0.28	0.30	0.32	0.32	0.32	0.36	0.35	0.40	0.33	0.40	0.31	0.34	0.36	0.42
22.5	0.57	0.51	0.43	0.44	0.40	0.42	0.44	0.44	0.41	0.55	0.44	0.53	0.48	0.55	0.51	0.50	0.45	0.37	0.33	0.51	0.49	0.58
45	0.54	0.49	0.43	0.45	0.41	0.43	0.48	0.51	0.59	0.64	0.58	0.61	0.55	0.60	0.54	0.54	0.50	0.47	0.38	0.56	0.50	0.57
67.5	0.36	0.34	0.30	0.33	0.29	0.33	0.35	0.38	0.46	0.45	0.39	0.42	0.36	0.42	0.36	0.37	0.33	0.28	0.25	0.40	0.32	0.40
90	0.27	0.24	0.23	0.22	0.20	0.19	0.19	0.20	0.25	0.21	0.17	0.20	0.17	0.21	0.19	0.19	0.18	0.16	0.15	0.23	0.18	0.22
112.5	0.21	0.20	0.18	0.19	0.18	0.19	0.20	0.21	0.25	0.18	0.17	0.16	0.16	0.18	0.16	0.17	0.15	0.17	0.14	0.15	0.16	0.16
135	0.19	0.19	0.17	0.17	0.16	0.15	0.15	0.16	0.22	0.16	0.18	0.16	0.20	0.22	0.23	0.26	0.21	0.26	0.21	0.26	0.30	0.27
157.5	0.24	0.21	0.21	0.19	0.20	0.20	0.21	0.21	0.26	0.23	0.23	0.24	0.24	0.27	0.26	0.24	0.24	0.22	0.24	0.22	0.19	0.23
180	0.23	0.20	0.18	0.17	0.18	0.18	0.18	0.21	0.24	0.27	0.26	0.27	0.26	0.27	0.26	0.27	0.24	0.25	0.24	0.28	0.22	0.23
202.5	0.43	0.42	0.38	0.35	0.32	0.29	0.25	0.30	0.33	0.41	0.40	0.43	0.41	0.43	0.40	0.43	0.38	0.39	0.36	0.39	0.31	0.28
225	0.42	0.36	0.33	0.30	0.30	0.27	0.26	0.31	0.39	0.38	0.32	0.37	0.31	0.39	0.33	0.38	0.33	0.40	0.33	0.39	0.25	0.36
247.5	0.37	0.34	0.27	0.23	0.19	0.16	0.15	0.17	0.25	0.22	0.21	0.22	0.20	0.23	0.21	0.22	0.22	0.22	0.27	0.29	0.24	0.30
270	0.24	0.20	0.19	0.16	0.18	0.17	0.21	0.22	0.26	0.23	0.16	0.20	0.16	0.20	0.18	0.21	0.21	0.23	0.24	0.26	0.22	0.26
292.5	0.22	0.17	0.19	0.15	0.17	0.15	0.17	0.17	0.19	0.18	0.13	0.15	0.13	0.15	0.15	0.16	0.16	0.16	0.17	0.17	0.15	0.17
315	0.39	0.29	0.30	0.25	0.28	0.25	0.27	0.26	0.25	0.24	0.19	0.18	0.15	0.18	0.15	0.17	0.18	0.19	0.21	0.22	0.24	0.26
337.5	0.35	0.27	0.26	0.24	0.24	0.22	0.24	0.23	0.26	0.22	0.17	0.20	0.19	0.23	0.20	0.22	0.20	0.19	0.20	0.20	0.23	0.25
Annual: VR_w	***0.42***	***0.38***	***0.33***	***0.34***	***0.31***	***0.32***	***0.34***	***0.36***	***0.39***	***0.43***	***0.37***	***0.41***	***0.37***	***0.42***	***0.38***	***0.39***	***0.35***	***0.33***	***0.29***	***0.40***	***0.35***	***0.42***
Summer: VR_w	***0.35***	***0.31***	***0.28***	***0.27***	***0.26***	***0.25***	***0.25***	***0.28***	***0.34***	***0.33***	***0.29***	***0.32***	***0.29***	***0.34***	***0.30***	***0.32***	***0.29***	***0.31***	***0.27***	***0.33***	***0.26***	***0.33***

Table 7. VR values of overall test points in Zone-A with installation of potential developments at the PDA

Dir.	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17
0	0.20	0.27	0.34	0.18	0.36	0.36	0.24	0.23	0.18	0.33	0.37	0.24	0.36	0.34	0.27	0.23	0.16
22.5	0.38	0.48	0.52	0.24	0.49	0.51	0.28	0.39	0.34	0.45	0.35	0.24	0.37	0.45	0.44	0.43	0.30
45	0.45	0.44	0.46	0.25	0.42	0.36	0.23	0.27	0.44	0.48	0.35	0.21	0.27	0.42	0.40	0.35	0.30
67.5	0.31	0.26	0.24	0.15	0.22	0.16	0.16	0.16	0.27	0.29	0.19	0.18	0.22	0.29	0.27	0.24	0.19
90	0.19	0.15	0.14	0.11	0.13	0.12	0.09	0.09	0.16	0.15	0.10	0.11	0.11	0.12	0.12	0.13	0.09
112.5	0.18	0.12	0.12	0.11	0.11	0.10	0.07	0.10	0.13	0.13	0.09	0.12	0.13	0.11	0.15	0.16	0.11
135	0.23	0.14	0.17	0.18	0.16	0.11	0.12	0.19	0.16	0.19	0.14	0.19	0.20	0.17	0.19	0.15	0.12
157.5	0.10	0.09	0.08	0.11	0.08	0.10	0.06	0.13	0.08	0.06	0.07	0.07	0.13	0.08	0.09	0.15	0.10
180	0.08	0.06	0.09	0.06	0.10	0.12	0.12	0.13	0.08	0.07	0.05	0.07	0.14	0.14	0.19	0.17	0.21
202.5	0.12	0.09	0.10	0.12	0.13	0.14	0.15	0.13	0.14	0.17	0.09	0.11	0.22	0.24	0.31	0.34	0.47
225	0.31	0.20	0.07	0.06	0.07	0.08	0.06	0.10	0.30	0.23	0.12	0.13	0.11	0.15	0.23	0.27	0.18
247.5	0.32	0.16	0.09	0.06	0.10	0.10	0.08	0.07	0.26	0.20	0.13	0.08	0.07	0.09	0.13	0.17	0.10
270	0.32	0.18	0.10	0.08	0.11	0.12	0.11	0.07	0.27	0.23	0.18	0.10	0.08	0.07	0.09	0.12	0.11
292.5	0.19	0.12	0.10	0.10	0.12	0.12	0.12	0.09	0.20	0.20	0.19	0.11	0.12	0.06	0.06	0.08	0.10
315	0.22	0.14	0.15	0.15	0.18	0.17	0.19	0.14	0.15	0.26	0.22	0.13	0.21	0.12	0.09	0.09	0.08
337.5	0.18	0.15	0.17	0.13	0.18	0.18	0.17	0.17	0.16	0.24	0.24	0.14	0.24	0.20	0.16	0.15	0.10
Annual: VR_w	***0.31***	***0.30***	***0.29***	***0.16***	***0.27***	***0.26***	***0.17***	***0.21***	***0.28***	***0.31***	***0.23***	***0.18***	***0.23***	***0.29***	***0.29***	***0.28***	***0.21***
Summer: VR_w	***0.26***	***0.19***	***0.14***	***0.10***	***0.14***	***0.14***	***0.10***	***0.14***	***0.23***	***0.21***	***0.14***	***0.13***	***0.15***	***0.17***	***0.21***	***0.23***	***0.17***

Table 7. VR values of overall test points in Zone-A with installation of potential developments at the PDA

Dir.	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	A33	A34
0	0.39	0.34	0.33	0.24	0.32	0.35	0.33	0.49	0.37	0.26	0.17	0.24	0.11	0.17	0.11	0.07	0.08
22.5	0.54	0.45	0.43	0.34	0.35	0.40	0.40	0.28	0.28	0.34	0.30	0.33	0.16	0.34	0.22	0.11	0.10
45	0.40	0.42	0.44	0.29	0.28	0.39	0.40	0.20	0.24	0.24	0.29	0.32	0.20	0.32	0.21	0.26	0.16
67.5	0.24	0.24	0.23	0.15	0.14	0.23	0.21	0.18	0.13	0.12	0.14	0.15	0.18	0.25	0.21	0.30	0.24
90	0.12	0.12	0.11	0.08	0.08	0.11	0.12	0.11	0.07	0.07	0.09	0.09	0.10	0.13	0.15	0.19	0.14
112.5	0.12	0.09	0.07	0.09	0.08	0.07	0.09	0.10	0.07	0.07	0.11	0.11	0.13	0.16	0.17	0.22	0.19
135	0.15	0.13	0.10	0.09	0.09	0.11	0.15	0.11	0.09	0.10	0.11	0.10	0.12	0.17	0.14	0.15	0.13
157.5	0.14	0.05	0.10	0.06	0.09	0.04	0.08	0.09	0.14	0.12	0.19	0.09	0.13	0.09	0.16	0.11	0.19
180	0.15	0.09	0.16	0.13	0.10	0.07	0.08	0.14	0.15	0.22	0.23	0.18	0.16	0.17	0.15	0.20	0.23
202.5	0.32	0.11	0.15	0.16	0.21	0.15	0.18	0.18	0.26	0.32	0.39	0.29	0.44	0.29	0.33	0.40	0.40
225	0.11	0.15	0.21	0.15	0.27	0.22	0.20	0.37	0.28	0.31	0.34	0.25	0.24	0.25	0.37	0.42	0.36
247.5	0.07	0.09	0.11	0.10	0.20	0.13	0.15	0.26	0.17	0.19	0.19	0.13	0.15	0.16	0.24	0.23	0.22
270	0.06	0.12	0.12	0.14	0.23	0.16	0.20	0.28	0.20	0.19	0.18	0.14	0.09	0.13	0.19	0.18	0.17
292.5	0.06	0.09	0.10	0.11	0.19	0.14	0.18	0.24	0.19	0.16	0.11	0.11	0.07	0.10	0.14	0.10	0.12
315	0.09	0.12	0.11	0.10	0.19	0.20	0.21	0.28	0.21	0.14	0.09	0.09	0.07	0.11	0.14	0.09	0.11
337.5	0.17	0.18	0.17	0.12	0.18	0.22	0.23	0.29	0.22	0.16	0.10	0.11	0.07	0.11	0.11	0.08	0.07
Annual: VR_w	***0.29***	***0.28***	***0.28***	***0.21***	***0.23***	***0.26***	***0.26***	***0.24***	***0.21***	***0.22***	***0.23***	***0.22***	***0.17***	***0.25***	***0.22***	***0.23***	***0.19***
Summer: VR_w	***0.16***	***0.16***	***0.19***	***0.14***	***0.20***	***0.18***	***0.18***	***0.25***	***0.20***	***0.22***	***0.24***	***0.19***	***0.18***	***0.21***	***0.25***	***0.28***	***0.25***

Table 7. VR values of overall test points in Zone-A with installation of potential developments at the PDA

Dir.	A35	A36	A37	A38	A39	A40	A41	A42	A43	A44	A45	A46	A47	A48	(A49)	(A50)	
0	0.09	0.13	0.09	0.15	0.47	0.47	0.36	0.18	0.09	0.14	0.10	0.15	0.18	0.17	0.48	0.48	
22.5	0.13	0.22	0.20	0.20	0.39	0.56	0.47	0.21	0.12	0.12	0.12	0.28	0.23	0.21	0.52	0.48	
45	0.19	0.21	0.23	0.18	0.21	0.36	0.36	0.14	0.16	0.11	0.27	0.36	0.34	0.31	0.39	0.36	
67.5	0.20	0.20	0.21	0.17	0.15	0.16	0.17	0.10	0.16	0.11	0.28	0.31	0.31	0.27	0.24	0.22	
90	0.13	0.11	0.12	0.09	0.09	0.08	0.08	0.07	0.09	0.09	0.18	0.22	0.24	0.26	0.10	0.10	
112.5	0.13	0.15	0.15	0.13	0.10	0.10	0.10	0.12	0.12	0.12	0.21	0.24	0.22	0.22	0.09	0.12	
135	0.13	0.12	0.13	0.11	0.12	0.14	0.12	0.13	0.12	0.13	0.14	0.19	0.21	0.19	0.17	0.22	
157.5	0.08	0.19	0.14	0.18	0.13	0.23	0.09	0.21	0.11	0.18	0.12	0.22	0.13	0.11	0.17	0.18	
180	0.18	0.19	0.26	0.20	0.21	0.23	0.14	0.22	0.20	0.14	0.19	0.19	0.19	0.17	0.26	0.26	
202.5	0.25	0.43	0.53	0.36	0.27	0.30	0.19	0.34	0.41	0.21	0.46	0.31	0.39	0.37	0.27	0.31	
225	0.25	0.30	0.50	0.34	0.23	0.27	0.22	0.25	0.23	0.25	0.41	0.40	0.35	0.34	0.33	0.38	
247.5	0.17	0.16	0.29	0.19	0.19	0.17	0.13	0.16	0.16	0.15	0.28	0.25	0.29	0.29	0.18	0.29	
270	0.16	0.15	0.24	0.19	0.23	0.19	0.14	0.16	0.14	0.16	0.23	0.26	0.20	0.22	0.11	0.15	
292.5	0.11	0.13	0.17	0.18	0.24	0.20	0.14	0.15	0.13	0.15	0.19	0.21	0.16	0.19	0.14	0.15	
315	0.08	0.14	0.12	0.21	0.30	0.28	0.20	0.22	0.15	0.19	0.18	0.24	0.18	0.21	0.24	0.28	
337.5	0.08	0.11	0.07	0.18	0.31	0.31	0.23	0.17	0.10	0.14	0.10	0.17	0.13	0.13	0.30	0.32	
Annual: VR_w	***0.17***	***0.21***	***0.23***	***0.20***	***0.24***	***0.31***	***0.27***	***0.16***	***0.15***	***0.14***	***0.23***	***0.29***	***0.27***	***0.25***	***0.33***	***0.33***	
Summer: VR_w	***0.19***	***0.22***	***0.31***	***0.23***	***0.20***	***0.24***	***0.19***	***0.19***	***0.17***	***0.18***	***0.28***	***0.30***	***0.27***	***0.26***	***0.26***	***0.29***	

Table 8. VR values of overall test points in Zone-A without installation of potential developments at the PDA

Dir.	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17
0	0.43	0.37	0.38	0.37	0.41	0.42	0.38	0.48	0.26	0.26	0.35	0.36	0.36	0.33	0.32	0.34	0.31
22.5	0.49	0.46	0.43	0.45	0.45	0.48	0.42	0.46	0.37	0.42	0.41	0.45	0.46	0.41	0.42	0.44	0.41
45	0.49	0.44	0.39	0.40	0.39	0.40	0.36	0.35	0.38	0.44	0.43	0.38	0.38	0.35	0.37	0.41	0.39
67.5	0.30	0.30	0.21	0.23	0.21	0.21	0.21	0.20	0.23	0.25	0.25	0.21	0.22	0.24	0.27	0.30	0.27
90	0.17	0.17	0.13	0.14	0.14	0.13	0.13	0.12	0.13	0.14	0.15	0.12	0.12	0.11	0.11	0.13	0.12
112.5	0.15	0.13	0.13	0.12	0.13	0.12	0.11	0.12	0.12	0.12	0.12	0.11	0.11	0.14	0.16	0.18	0.15
135	0.24	0.24	0.21	0.26	0.22	0.23	0.22	0.28	0.25	0.19	0.24	0.21	0.25	0.23	0.22	0.22	0.20
157.5	0.18	0.18	0.16	0.17	0.16	0.17	0.14	0.16	0.22	0.17	0.19	0.17	0.18	0.17	0.17	0.18	0.17
180	0.22	0.21	0.22	0.21	0.21	0.22	0.21	0.21	0.24	0.20	0.23	0.22	0.24	0.22	0.22	0.24	0.21
202.5	0.33	0.29	0.33	0.25	0.36	0.34	0.28	0.27	0.34	0.29	0.34	0.37	0.39	0.36	0.37	0.39	0.37
225	0.29	0.26	0.26	0.30	0.28	0.33	0.23	0.34	0.33	0.26	0.33	0.28	0.34	0.30	0.30	0.37	0.29
247.5	0.31	0.23	0.21	0.20	0.20	0.20	0.18	0.17	0.22	0.23	0.22	0.20	0.20	0.21	0.22	0.25	0.18
270	0.26	0.23	0.23	0.23	0.22	0.23	0.20	0.21	0.24	0.23	0.24	0.23	0.23	0.20	0.19	0.21	0.17
292.5	0.17	0.16	0.16	0.16	0.17	0.18	0.16	0.19	0.16	0.16	0.17	0.17	0.18	0.20	0.20	0.19	0.18
315	0.27	0.26	0.26	0.28	0.27	0.27	0.25	0.28	0.22	0.16	0.23	0.21	0.22	0.21	0.19	0.20	0.17
337.5	0.26	0.22	0.24	0.25	0.25	0.27	0.24	0.30	0.19	0.17	0.21	0.22	0.22	0.22	0.23	0.22	0.20
Annual: VR_w	***0.35***	***0.33***	***0.29***	***0.31***	***0.30***	***0.32***	***0.28***	***0.31***	***0.29***	***0.30***	***0.31***	***0.30***	***0.31***	***0.29***	***0.30***	***0.33***	***0.30***
Summer: VR_w	***0.27***	***0.25***	***0.24***	***0.26***	***0.24***	***0.27***	***0.22***	***0.26***	***0.27***	***0.24***	***0.27***	***0.24***	***0.27***	***0.25***	***0.25***	***0.29***	***0.25***

Table 8. VR values of overall test points in Zone-A without installation of potential developments at the PDA

Dir.	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	A33	A34
0	0.34	0.32	0.30	0.31	0.34	0.31	0.34	0.35	0.41	0.35	0.42	0.36	0.37	0.35	0.40	0.36	0.41
22.5	0.42	0.41	0.40	0.39	0.41	0.39	0.44	0.44	0.49	0.46	0.51	0.45	0.46	0.46	0.50	0.46	0.52
45	0.39	0.38	0.37	0.38	0.42	0.37	0.43	0.44	0.50	0.46	0.50	0.45	0.45	0.44	0.50	0.47	0.52
67.5	0.26	0.24	0.24	0.26	0.27	0.24	0.26	0.29	0.33	0.32	0.36	0.32	0.33	0.32	0.37	0.34	0.39
90	0.13	0.13	0.12	0.13	0.14	0.13	0.14	0.15	0.16	0.15	0.16	0.15	0.14	0.15	0.18	0.19	0.18
112.5	0.14	0.12	0.13	0.14	0.13	0.12	0.13	0.14	0.17	0.17	0.20	0.18	0.19	0.21	0.23	0.21	0.23
135	0.25	0.23	0.23	0.19	0.21	0.20	0.25	0.21	0.23	0.19	0.22	0.21	0.22	0.20	0.19	0.16	0.18
157.5	0.19	0.18	0.17	0.18	0.19	0.19	0.19	0.21	0.23	0.22	0.23	0.21	0.20	0.19	0.21	0.21	0.24
180	0.25	0.22	0.21	0.20	0.21	0.21	0.23	0.22	0.24	0.22	0.25	0.22	0.24	0.22	0.25	0.21	0.25
202.5	0.39	0.36	0.35	0.34	0.30	0.31	0.35	0.33	0.35	0.32	0.41	0.38	0.43	0.42	0.44	0.41	0.43
225	0.36	0.29	0.31	0.27	0.29	0.27	0.33	0.30	0.36	0.30	0.38	0.31	0.38	0.34	0.42	0.34	0.41
247.5	0.21	0.20	0.18	0.17	0.15	0.19	0.21	0.20	0.21	0.19	0.22	0.19	0.23	0.27	0.31	0.26	0.25
270	0.22	0.22	0.20	0.17	0.16	0.20	0.23	0.20	0.21	0.17	0.22	0.19	0.22	0.20	0.23	0.19	0.22
292.5	0.19	0.19	0.17	0.17	0.14	0.17	0.17	0.18	0.18	0.17	0.19	0.19	0.19	0.20	0.21	0.18	0.19
315	0.20	0.20	0.17	0.16	0.14	0.17	0.20	0.18	0.19	0.17	0.21	0.18	0.20	0.20	0.25	0.24	0.26
337.5	0.22	0.21	0.19	0.19	0.17	0.20	0.21	0.21	0.22	0.21	0.24	0.22	0.23	0.23	0.24	0.21	0.24
Annual: VR_w	***0.31***	***0.29***	***0.29***	***0.29***	***0.30***	***0.28***	***0.32***	***0.33***	***0.37***	***0.34***	***0.38***	***0.34***	***0.36***	***0.34***	***0.39***	***0.36***	***0.40***
Summer: VR_w	***0.28***	***0.25***	***0.25***	***0.23***	***0.25***	***0.24***	***0.28***	***0.26***	***0.30***	***0.27***	***0.32***	***0.27***	***0.31***	***0.29***	***0.34***	***0.29***	***0.34***

Table 8. VR values of overall test points in Zone-A without installation of potential developments at the PDA

Dir.	A35	A36	A37	A38	A39	A40	A41	A42	A43	A44	A45	A46	A47	A48	(A49)	(A50)	
0	0.36	0.38	0.34	0.37	0.35	0.34	0.33	0.35	0.36	0.31	0.36	0.42	0.41	0.38	0.53	0.45	
22.5	0.48	0.47	0.46	0.49	0.48	0.54	0.45	0.51	0.51	0.43	0.46	0.54	0.55	0.50	0.48	0.44	
45	0.47	0.47	0.47	0.51	0.50	0.60	0.55	0.55	0.53	0.45	0.49	0.54	0.57	0.52	0.34	0.30	
67.5	0.35	0.34	0.35	0.36	0.34	0.42	0.40	0.38	0.40	0.34	0.37	0.39	0.41	0.36	0.24	0.22	
90	0.17	0.15	0.16	0.16	0.16	0.18	0.18	0.17	0.20	0.17	0.21	0.22	0.29	0.28	0.11	0.10	
112.5	0.22	0.20	0.20	0.19	0.17	0.20	0.20	0.20	0.22	0.20	0.22	0.23	0.24	0.24	0.11	0.13	
135	0.18	0.18	0.16	0.19	0.18	0.17	0.17	0.17	0.18	0.15	0.17	0.20	0.20	0.17	0.25	0.26	
157.5	0.21	0.23	0.23	0.24	0.24	0.25	0.24	0.25	0.26	0.23	0.23	0.23	0.25	0.23	0.15	0.15	
180	0.22	0.24	0.22	0.24	0.24	0.26	0.24	0.25	0.25	0.22	0.22	0.24	0.22	0.22	0.24	0.22	
202.5	0.42	0.40	0.38	0.36	0.38	0.41	0.39	0.36	0.41	0.37	0.41	0.44	0.43	0.44	0.29	0.29	
225	0.35	0.36	0.32	0.36	0.31	0.37	0.33	0.34	0.38	0.31	0.35	0.43	0.41	0.38	0.39	0.37	
247.5	0.24	0.20	0.19	0.20	0.19	0.21	0.20	0.20	0.23	0.19	0.25	0.33	0.37	0.36	0.33	0.35	
270	0.19	0.20	0.18	0.21	0.17	0.22	0.19	0.21	0.23	0.18	0.20	0.24	0.25	0.23	0.26	0.24	
292.5	0.19	0.17	0.16	0.18	0.16	0.18	0.16	0.18	0.19	0.16	0.18	0.21	0.21	0.20	0.20	0.19	
315	0.22	0.21	0.21	0.21	0.18	0.25	0.23	0.25	0.29	0.24	0.27	0.30	0.35	0.32	0.31	0.26	
337.5	0.23	0.22	0.20	0.23	0.20	0.23	0.20	0.22	0.24	0.20	0.22	0.25	0.27	0.25	0.33	0.31	
Annual: VR_w	***0.36***	***0.36***	***0.35***	***0.37***	***0.35***	***0.41***	***0.37***	***0.39***	***0.40***	***0.34***	***0.37***	***0.42***	***0.43***	***0.39***	***0.33***	***0.31***	
Summer: VR_w	***0.30***	***0.30***	***0.28***	***0.30***	***0.28***	***0.32***	***0.29***	***0.30***	***0.32***	***0.27***	***0.30***	***0.35***	***0.35***	***0.33***	***0.30***	***0.28***	

Table 9. VR values of overall test points in Zone-B with installation of potential developments at the PDA

Dir.	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)	(B8)	(B9)	(B10)	(B11)	(B12)	(B13)	(B14)	(B15)	(B16)	(B17)	(B18)
0	0.34	0.53	0.38	0.35	0.25	0.18	0.18	0.19	0.34	0.38	0.38	0.18	0.28	0.32	0.41	0.41	0.31	0.22
22.5	0.49	0.66	0.40	0.18	0.12	0.35	0.31	0.18	0.14	0.27	0.45	0.30	0.37	0.40	0.36	0.21	0.40	0.37
45	0.68	0.71	0.21	0.13	0.21	0.43	0.44	0.31	0.24	0.15	0.25	0.44	0.40	0.24	0.19	0.27	0.44	0.41
67.5	0.46	0.43	0.15	0.18	0.25	0.33	0.35	0.27	0.27	0.21	0.21	0.32	0.26	0.24	0.24	0.26	0.52	0.25
90	0.22	0.28	0.18	0.21	0.24	0.30	0.27	0.26	0.25	0.24	0.24	0.18	0.20	0.28	0.25	0.25	0.33	0.15
112.5	0.23	0.27	0.18	0.18	0.19	0.21	0.19	0.18	0.19	0.19	0.19	0.16	0.16	0.19	0.18	0.18	0.21	0.12
135	0.22	0.28	0.15	0.16	0.17	0.19	0.17	0.16	0.17	0.17	0.16	0.15	0.15	0.16	0.17	0.17	0.17	0.12
157.5	0.25	0.30	0.17	0.21	0.19	0.21	0.20	0.20	0.21	0.21	0.17	0.15	0.16	0.17	0.23	0.23	0.18	0.14
180	0.27	0.30	0.16	0.17	0.17	0.18	0.18	0.16	0.19	0.17	0.16	0.15	0.16	0.16	0.21	0.19	0.18	0.14
202.5	0.42	0.37	0.19	0.25	0.27	0.39	0.38	0.31	0.30	0.27	0.22	0.24	0.21	0.29	0.36	0.36	0.18	0.22
225	0.37	0.45	0.18	0.21	0.26	0.37	0.36	0.31	0.30	0.21	0.20	0.21	0.28	0.25	0.23	0.34	0.32	0.17
247.5	0.25	0.28	0.13	0.15	0.19	0.34	0.33	0.26	0.22	0.14	0.14	0.13	0.15	0.14	0.16	0.23	0.16	0.11
270	0.26	0.32	0.19	0.21	0.18	0.22	0.19	0.18	0.17	0.20	0.21	0.17	0.20	0.25	0.15	0.16	0.26	0.13
292.5	0.23	0.28	0.17	0.19	0.19	0.21	0.18	0.17	0.19	0.18	0.19	0.13	0.17	0.19	0.18	0.17	0.21	0.09
315	0.29	0.39	0.26	0.32	0.30	0.34	0.29	0.30	0.30	0.30	0.28	0.15	0.22	0.29	0.30	0.30	0.30	0.13
337.5	0.32	0.42	0.28	0.30	0.27	0.22	0.27	0.26	0.30	0.30	0.30	0.19	0.25	0.31	0.34	0.32	0.33	0.15
Annual: VR_w	***0.43***	***0.50***	***0.24***	***0.19***	***0.20***	***0.32***	***0.31***	***0.24***	***0.23***	***0.22***	***0.28***	***0.27***	***0.29***	***0.28***	***0.26***	***0.26***	***0.37***	***0.26***
Summer: VR_w	***0.34***	***0.40***	***0.19***	***0.19***	***0.22***	***0.30***	***0.29***	***0.25***	***0.24***	***0.20***	***0.21***	***0.21***	***0.24***	***0.23***	***0.23***	***0.27***	***0.29***	***0.18***

Table 9. VR values of overall test points in Zone-B with installation of potential developments at the PDA

Dir.	(B19)	(B20)	(B21)	(B22)	(B23)	(B24)	(B25)	(B26)	(B27)	(B28)	(B29)	(B30)	(B31)	(B32)	(B33)	(B34)	(B35)	
0	0.19	0.16	0.39	0.33	0.31	0.31	0.33	0.16	0.32	0.38	0.40	0.44	0.39	0.35	0.16	0.20	0.43	
22.5	0.24	0.25	0.25	0.30	0.49	0.34	0.33	0.35	0.45	0.44	0.48	0.55	0.50	0.60	0.41	0.61	0.60	
45	0.20	0.23	0.38	0.44	0.58	0.50	0.34	0.40	0.47	0.61	0.63	0.73	0.63	0.58	0.59	0.76	0.43	
67.5	0.20	0.27	0.33	0.35	0.43	0.40	0.42	0.36	0.45	0.46	0.42	0.57	0.48	0.51	0.41	0.34	0.45	
90	0.14	0.22	0.24	0.26	0.26	0.22	0.27	0.21	0.21	0.18	0.18	0.38	0.26	0.25	0.23	0.24	0.40	
112.5	0.10	0.15	0.17	0.16	0.19	0.15	0.16	0.18	0.16	0.17	0.18	0.29	0.24	0.25	0.26	0.30	0.25	
135	0.10	0.12	0.17	0.17	0.20	0.16	0.17	0.14	0.18	0.18	0.20	0.25	0.22	0.21	0.17	0.15	0.15	
157.5	0.09	0.19	0.20	0.21	0.23	0.19	0.19	0.15	0.17	0.20	0.21	0.26	0.19	0.19	0.12	0.13	0.16	
180	0.08	0.18	0.18	0.16	0.19	0.17	0.20	0.18	0.20	0.20	0.18	0.27	0.19	0.17	0.23	0.21	0.34	
202.5	0.23	0.39	0.35	0.36	0.42	0.36	0.34	0.36	0.40	0.39	0.37	0.45	0.42	0.43	0.41	0.25	0.37	
225	0.13	0.27	0.37	0.38	0.42	0.38	0.38	0.32	0.41	0.42	0.42	0.48	0.40	0.43	0.39	0.17	0.16	
247.5	0.09	0.15	0.28	0.32	0.39	0.34	0.26	0.18	0.30	0.38	0.41	0.45	0.41	0.36	0.25	0.16	0.20	
270	0.12	0.10	0.16	0.18	0.23	0.20	0.14	0.14	0.19	0.22	0.25	0.25	0.24	0.21	0.14	0.15	0.32	
292.5	0.08	0.09	0.15	0.15	0.17	0.14	0.14	0.11	0.14	0.15	0.16	0.16	0.15	0.14	0.10	0.10	0.12	
315	0.13	0.13	0.23	0.24	0.31	0.23	0.23	0.15	0.19	0.20	0.22	0.37	0.20	0.19	0.17	0.12	0.19	
337.5	0.16	0.14	0.27	0.26	0.33	0.29	0.29	0.17	0.25	0.30	0.33	0.43	0.29	0.26	0.24	0.18	0.18	
Annual: VR_w	***0.18***	***0.23***	***0.30***	***0.32***	***0.41***	***0.34***	***0.32***	***0.30***	***0.38***	***0.40***	***0.41***	***0.51***	***0.43***	***0.46***	***0.37***	***0.40***	***0.40***	
Summer: VR_w	***0.13***	***0.22***	***0.28***	***0.29***	***0.34***	***0.30***	***0.29***	***0.26***	***0.32***	***0.34***	***0.34***	***0.42***	***0.35***	***0.36***	***0.31***	***0.24***	***0.27***	

Table 10. VR values of overall test points in Zone-B without installation of potential developments at the PDA

Dir.	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)	(B8)	(B9)	(B10)	(B11)	(B12)	(B13)	(B14)	(B15)	(B16)	(B17)	(B18)
0	0.33	0.35	0.31	0.35	0.35	0.44	0.39	0.37	0.35	0.34	0.31	0.17	0.29	0.29	0.36	0.41	0.27	0.20
22.5	0.51	0.63	0.44	0.48	0.49	0.56	0.54	0.49	0.49	0.44	0.46	0.28	0.37	0.41	0.46	0.52	0.47	0.37
45	0.74	0.77	0.53	0.51	0.51	0.54	0.52	0.52	0.50	0.46	0.52	0.42	0.49	0.44	0.41	0.53	0.81	0.47
67.5	0.60	0.62	0.39	0.37	0.37	0.38	0.38	0.35	0.36	0.35	0.40	0.34	0.39	0.38	0.30	0.36	0.64	0.25
90	0.31	0.30	0.20	0.23	0.23	0.29	0.26	0.26	0.24	0.25	0.24	0.18	0.21	0.29	0.24	0.25	0.32	0.14
112.5	0.28	0.27	0.19	0.20	0.20	0.21	0.19	0.18	0.19	0.19	0.20	0.16	0.18	0.19	0.18	0.18	0.21	0.11
135	0.23	0.23	0.16	0.17	0.16	0.18	0.16	0.17	0.16	0.17	0.16	0.14	0.15	0.16	0.16	0.17	0.15	0.13
157.5	0.26	0.31	0.18	0.23	0.23	0.24	0.22	0.23	0.23	0.23	0.18	0.14	0.16	0.17	0.23	0.24	0.19	0.13
180	0.27	0.31	0.18	0.20	0.20	0.21	0.18	0.18	0.20	0.19	0.18	0.15	0.16	0.18	0.22	0.21	0.20	0.15
202.5	0.40	0.42	0.28	0.29	0.36	0.44	0.42	0.36	0.36	0.29	0.29	0.27	0.25	0.34	0.37	0.39	0.25	0.25
225	0.42	0.49	0.23	0.28	0.34	0.40	0.38	0.36	0.34	0.24	0.24	0.22	0.27	0.27	0.24	0.38	0.35	0.16
247.5	0.29	0.30	0.14	0.17	0.22	0.35	0.33	0.29	0.23	0.16	0.15	0.14	0.15	0.15	0.16	0.26	0.16	0.11
270	0.29	0.32	0.18	0.21	0.17	0.21	0.20	0.17	0.17	0.19	0.20	0.18	0.19	0.24	0.15	0.15	0.23	0.12
292.5	0.24	0.25	0.15	0.18	0.15	0.19	0.15	0.16	0.15	0.17	0.16	0.14	0.14	0.18	0.14	0.16	0.16	0.10
315	0.30	0.36	0.24	0.29	0.27	0.34	0.27	0.28	0.26	0.27	0.25	0.15	0.19	0.27	0.26	0.28	0.29	0.13
337.5	0.33	0.40	0.25	0.27	0.26	0.30	0.28	0.27	0.28	0.28	0.28	0.19	0.24	0.29	0.30	0.30	0.31	0.15
Annual: VR_w	***0.48***	***0.53***	***0.35***	***0.36***	***0.37***	***0.42***	***0.40***	***0.38***	***0.37***	***0.34***	***0.36***	***0.27***	***0.33***	***0.34***	***0.33***	***0.39***	***0.47***	***0.27***
Summer: VR_w	***0.38***	***0.43***	***0.25***	***0.27***	***0.29***	***0.34***	***0.32***	***0.30***	***0.30***	***0.25***	***0.25***	***0.21***	***0.25***	***0.26***	***0.25***	***0.32***	***0.33***	***0.18***

Table 10. VR values of overall test points in Zone-B without installation of potential developments at the PDA

Dir.	(B19)	(B20)	(B21)	(B22)	(B23)	(B24)	(B25)	(B26)	(B27)	(B28)	(B29)	(B30)	(B31)	(B32)	(B33)	(B34)	(B35)	
0	0.25	0.15	0.38	0.35	0.44	0.33	0.32	0.16	0.33	0.36	0.42	0.43	0.40	0.33	0.15	0.21	0.39	
22.5	0.25	0.27	0.54	0.55	0.59	0.49	0.36	0.36	0.50	0.57	0.59	0.68	0.59	0.63	0.43	0.60	0.59	
45	0.25	0.50	0.55	0.58	0.60	0.62	0.42	0.44	0.57	0.65	0.67	0.74	0.70	0.64	0.64	0.76	0.44	
67.5	0.24	0.36	0.37	0.40	0.45	0.44	0.44	0.39	0.49	0.48	0.43	0.57	0.49	0.52	0.42	0.35	0.47	
90	0.15	0.22	0.24	0.26	0.26	0.22	0.26	0.21	0.22	0.18	0.17	0.37	0.25	0.24	0.23	0.22	0.41	
112.5	0.11	0.15	0.17	0.16	0.19	0.15	0.16	0.17	0.17	0.17	0.19	0.29	0.24	0.24	0.25	0.29	0.25	
135	0.11	0.13	0.16	0.17	0.18	0.17	0.15	0.15	0.17	0.18	0.20	0.25	0.21	0.22	0.17	0.14	0.14	
157.5	0.09	0.20	0.21	0.22	0.24	0.20	0.18	0.14	0.17	0.19	0.22	0.26	0.19	0.18	0.12	0.12	0.16	
180	0.08	0.19	0.19	0.17	0.18	0.18	0.22	0.19	0.20	0.21	0.18	0.27	0.20	0.18	0.23	0.21	0.34	
202.5	0.27	0.41	0.38	0.37	0.43	0.36	0.36	0.37	0.40	0.40	0.37	0.45	0.41	0.44	0.43	0.25	0.36	
225	0.13	0.28	0.39	0.40	0.44	0.40	0.38	0.32	0.42	0.41	0.42	0.49	0.43	0.43	0.39	0.17	0.17	
247.5	0.09	0.17	0.29	0.33	0.39	0.34	0.26	0.18	0.31	0.37	0.40	0.43	0.40	0.35	0.25	0.16	0.21	
270	0.10	0.10	0.17	0.18	0.23	0.20	0.15	0.13	0.20	0.22	0.24	0.24	0.24	0.22	0.13	0.15	0.29	
292.5	0.08	0.10	0.14	0.15	0.17	0.14	0.13	0.11	0.14	0.15	0.16	0.15	0.15	0.13	0.09	0.11	0.12	
315	0.13	0.13	0.22	0.24	0.29	0.22	0.22	0.15	0.18	0.20	0.20	0.39	0.22	0.21	0.18	0.12	0.18	
337.5	0.15	0.14	0.26	0.25	0.33	0.27	0.27	0.17	0.23	0.29	0.32	0.41	0.29	0.25	0.24	0.20	0.17	
Annual: VR_w	***0.20***	***0.29***	***0.40***	***0.41***	***0.45***	***0.41***	***0.35***	***0.32***	***0.42***	***0.44***	***0.45***	***0.54***	***0.47***	***0.47***	***0.39***	***0.40***	***0.40***	
Summer: VR_w	***0.14***	***0.24***	***0.32***	***0.33***	***0.36***	***0.33***	***0.30***	***0.26***	***0.33***	***0.34***	***0.35***	***0.43***	***0.36***	***0.36***	***0.32***	***0.24***	***0.26***	

Table 11. VR values of overall test points in Zone-C with installation of potential developments at the PDA

Dir.	(C1)	(C2)	(C3)	(C4)	C5	C6	(C7)	(C8)	(C9)	(C10)	C11
0	0.22	0.23	0.27	0.21	0.13	0.16	0.21	0.23	0.22	0.27	0.26
22.5	0.25	0.21	0.33	0.32	0.18	0.19	0.43	0.40	0.43	0.28	0.37
45	0.34	0.26	0.41	0.57	0.20	0.21	0.44	0.22	0.54	0.38	0.45
67.5	0.38	0.47	0.34	0.42	0.15	0.19	0.32	0.36	0.21	0.36	0.29
90	0.25	0.28	0.27	0.26	0.12	0.15	0.19	0.24	0.15	0.19	0.18
112.5	0.20	0.19	0.30	0.22	0.11	0.17	0.28	0.27	0.22	0.22	0.22
135	0.22	0.16	0.24	0.32	0.11	0.16	0.19	0.23	0.24	0.20	0.25
157.5	0.20	0.18	0.14	0.15	0.05	0.07	0.20	0.20	0.22	0.16	0.12
180	0.08	0.09	0.09	0.14	0.10	0.17	0.28	0.28	0.26	0.14	0.10
202.5	0.14	0.16	0.29	0.46	0.11	0.16	0.21	0.23	0.26	0.26	0.28
225	0.21	0.17	0.18	0.37	0.13	0.22	0.13	0.23	0.25	0.21	0.20
247.5	0.19	0.23	0.22	0.21	0.12	0.15	0.12	0.25	0.24	0.30	0.26
270	0.22	0.26	0.19	0.15	0.08	0.09	0.07	0.18	0.17	0.22	0.19
292.5	0.18	0.17	0.20	0.17	0.08	0.10	0.08	0.17	0.16	0.20	0.17
315	0.20	0.18	0.26	0.17	0.11	0.11	0.14	0.29	0.35	0.24	0.28
337.5	0.19	0.21	0.17	0.18	0.12	0.13	0.24	0.34	0.32	0.22	0.30
Annual: VR_w	***0.27***	***0.26***	***0.29***	***0.35***	***0.15***	***0.18***	***0.31***	***0.30***	***0.31***	***0.28***	***0.29***
Summer: VR_w	***0.22***	***0.20***	***0.22***	***0.30***	***0.12***	***0.18***	***0.21***	***0.25***	***0.26***	***0.22***	***0.22***

Table 11. VR values of overall test points in Zone-C with installation of potential developments at the PDA

Dir.	(C12)	(C13)	(C14)	(C15)	(C16)	(C17)	(C18)	(C19)	(C20)	(C21)	(C22)
0	0.19	0.20	0.26	0.21	0.42	0.25	0.27	0.31	0.23	0.21	0.10
22.5	0.28	0.30	0.44	0.31	0.68	0.32	0.35	0.39	0.31	0.33	0.13
45	0.34	0.29	0.63	0.33	0.62	0.38	0.40	0.56	0.34	0.44	0.20
67.5	0.37	0.23	0.46	0.29	0.51	0.33	0.36	0.55	0.27	0.37	0.21
90	0.23	0.12	0.15	0.18	0.27	0.17	0.22	0.29	0.13	0.20	0.09
112.5	0.18	0.11	0.07	0.14	0.20	0.15	0.17	0.21	0.13	0.18	0.07
135	0.17	0.16	0.09	0.13	0.25	0.19	0.18	0.25	0.15	0.19	0.10
157.5	0.15	0.14	0.12	0.12	0.24	0.23	0.24	0.24	0.14	0.19	0.10
180	0.14	0.12	0.13	0.17	0.27	0.25	0.24	0.25	0.14	0.21	0.09
202.5	0.14	0.10	0.14	0.21	0.43	0.30	0.34	0.36	0.18	0.32	0.12
225	0.18	0.16	0.17	0.17	0.33	0.24	0.34	0.35	0.17	0.33	0.11
247.5	0.24	0.18	0.22	0.23	0.34	0.25	0.28	0.38	0.16	0.30	0.07
270	0.23	0.13	0.18	0.21	0.31	0.22	0.21	0.29	0.14	0.22	0.06
292.5	0.21	0.11	0.12	0.16	0.25	0.18	0.17	0.21	0.12	0.15	0.06
315	0.27	0.14	0.14	0.15	0.26	0.19	0.23	0.23	0.19	0.17	0.07
337.5	0.28	0.16	0.14	0.19	0.32	0.20	0.21	0.27	0.18	0.18	0.08
Annual: VR_w	***0.27***	***0.22***	***0.35***	***0.25***	***0.48***	***0.29***	***0.32***	***0.40***	***0.24***	***0.32***	***0.14***
Summer: VR_w	***0.21***	***0.16***	***0.20***	***0.19***	***0.34***	***0.24***	***0.29***	***0.33***	***0.18***	***0.28***	***0.11***

Table 12. VR values of overall test points in Zone-C without installation of potential developments at the PDA

Dir.	(C1)	(C2)	(C3)	(C4)	C5	C6	(C7)	(C8)	(C9)	(C10)	C11
0	0.23	0.22	0.25	0.20	0.14	0.16	0.17	0.23	0.21	0.28	0.26
22.5	0.26	0.21	0.34	0.33	0.17	0.18	0.43	0.39	0.42	0.28	0.38
45	0.33	0.25	0.44	0.57	0.19	0.21	0.47	0.23	0.52	0.37	0.45
67.5	0.40	0.47	0.35	0.41	0.16	0.20	0.34	0.37	0.21	0.36	0.31
90	0.25	0.28	0.28	0.25	0.12	0.15	0.21	0.26	0.14	0.19	0.19
112.5	0.21	0.19	0.30	0.22	0.11	0.17	0.28	0.29	0.21	0.21	0.24
135	0.22	0.14	0.25	0.30	0.11	0.15	0.20	0.22	0.25	0.19	0.24
157.5	0.18	0.17	0.13	0.15	0.08	0.11	0.22	0.21	0.22	0.15	0.21
180	0.08	0.09	0.09	0.14	0.11	0.17	0.28	0.28	0.26	0.13	0.10
202.5	0.14	0.16	0.28	0.47	0.11	0.14	0.19	0.23	0.23	0.27	0.27
225	0.20	0.17	0.19	0.35	0.12	0.20	0.13	0.24	0.24	0.21	0.17
247.5	0.21	0.20	0.24	0.20	0.12	0.16	0.13	0.27	0.25	0.28	0.24
270	0.25	0.20	0.23	0.13	0.08	0.10	0.07	0.23	0.19	0.26	0.19
292.5	0.19	0.17	0.20	0.16	0.08	0.10	0.08	0.19	0.17	0.22	0.18
315	0.20	0.18	0.24	0.17	0.10	0.12	0.13	0.31	0.34	0.25	0.31
337.5	0.21	0.21	0.17	0.17	0.12	0.13	0.23	0.35	0.30	0.23	0.30
Annual: VR_w	***0.27***	***0.26***	***0.30***	***0.34***	***0.15***	***0.18***	***0.31***	***0.31***	***0.31***	***0.28***	***0.30***
Summer: VR_w	***0.22***	***0.20***	***0.23***	***0.29***	***0.12***	***0.18***	***0.22***	***0.26***	***0.25***	***0.22***	***0.21***

Table 12. VR values of overall test points in Zone-C without installation of potential developments at the PDA

Dir.	(C12)	(C13)	(C14)	(C15)	(C16)	(C17)	(C18)	(C19)	(C20)	(C21)	(C22)
0	0.19	0.20	0.24	0.25	0.42	0.22	0.29	0.23	0.23	0.20	0.09
22.5	0.28	0.29	0.39	0.32	0.69	0.32	0.38	0.38	0.32	0.32	0.11
45	0.33	0.29	0.53	0.34	0.63	0.37	0.44	0.55	0.34	0.44	0.16
67.5	0.37	0.23	0.37	0.32	0.52	0.33	0.43	0.55	0.28	0.36	0.15
90	0.22	0.12	0.13	0.20	0.28	0.17	0.24	0.29	0.14	0.19	0.08
112.5	0.19	0.12	0.07	0.17	0.24	0.15	0.19	0.21	0.16	0.19	0.07
135	0.17	0.15	0.08	0.18	0.29	0.16	0.19	0.21	0.17	0.18	0.10
157.5	0.15	0.16	0.11	0.12	0.26	0.24	0.26	0.26	0.15	0.20	0.09
180	0.14	0.12	0.12	0.16	0.26	0.26	0.24	0.24	0.13	0.20	0.09
202.5	0.14	0.09	0.14	0.20	0.41	0.28	0.31	0.34	0.16	0.31	0.14
225	0.19	0.15	0.16	0.16	0.33	0.24	0.35	0.36	0.18	0.33	0.11
247.5	0.26	0.17	0.23	0.22	0.37	0.25	0.30	0.39	0.18	0.31	0.07
270	0.25	0.12	0.19	0.19	0.35	0.21	0.24	0.29	0.15	0.26	0.06
292.5	0.22	0.11	0.13	0.16	0.27	0.19	0.18	0.22	0.13	0.19	0.05
315	0.28	0.15	0.14	0.17	0.28	0.22	0.23	0.24	0.19	0.20	0.06
337.5	0.27	0.16	0.15	0.19	0.35	0.20	0.23	0.27	0.19	0.20	0.08
Annual: VR_w	***0.27***	***0.22***	***0.30***	***0.26***	***0.49***	***0.28***	***0.35***	***0.40***	***0.25***	***0.31***	***0.12***
Summer: VR_w	***0.21***	***0.16***	***0.19***	***0.19***	***0.35***	***0.24***	***0.31***	***0.33***	***0.19***	***0.28***	***0.10***

Table 13. VR values of overall test points in Zone-D with installation of potential developments at the PDA

Dir.	(D1)	(D2)	(D3)	(D4)	(D5)	(D6)	(D7)	(D8)	(D9)	(D10)	(D11)	(D12)	(D13)	(D14)	(D15)	(D16)	(D17)
0	0.44	0.40	0.15	0.22	0.41	0.15	0.13	0.30	0.21	0.26	0.33	0.22	0.29	0.54	0.15	0.18	0.54
22.5	0.28	0.29	0.24	0.17	0.30	0.20	0.27	0.22	0.22	0.15	0.25	0.13	0.22	0.37	0.18	0.16	0.26
45	0.21	0.51	0.33	0.31	0.43	0.29	0.36	0.16	0.33	0.21	0.17	0.22	0.27	0.15	0.30	0.33	0.12
67.5	0.23	0.30	0.29	0.20	0.39	0.25	0.33	0.17	0.40	0.29	0.21	0.26	0.31	0.13	0.31	0.33	0.13
90	0.18	0.24	0.24	0.14	0.15	0.16	0.17	0.19	0.18	0.22	0.15	0.16	0.18	0.08	0.15	0.20	0.07
112.5	0.13	0.16	0.16	0.09	0.12	0.12	0.11	0.12	0.16	0.10	0.08	0.12	0.21	0.08	0.10	0.17	0.07
135	0.15	0.16	0.13	0.09	0.17	0.18	0.17	0.27	0.24	0.26	0.13	0.21	0.37	0.13	0.24	0.31	0.17
157.5	0.14	0.21	0.14	0.11	0.13	0.12	0.14	0.11	0.15	0.11	0.11	0.09	0.15	0.11	0.10	0.15	0.11
180	0.13	0.14	0.13	0.09	0.15	0.08	0.14	0.12	0.19	0.08	0.14	0.07	0.14	0.16	0.10	0.10	0.12
202.5	0.30	0.25	0.17	0.14	0.28	0.21	0.18	0.15	0.26	0.13	0.29	0.11	0.36	0.34	0.24	0.35	0.33
225	0.41	0.39	0.16	0.28	0.36	0.23	0.27	0.32	0.24	0.11	0.39	0.12	0.36	0.37	0.26	0.44	0.31
247.5	0.27	0.35	0.35	0.25	0.24	0.41	0.27	0.29	0.27	0.26	0.28	0.13	0.13	0.25	0.25	0.32	0.15
270	0.41	0.35	0.30	0.29	0.29	0.38	0.31	0.26	0.39	0.28	0.14	0.11	0.13	0.17	0.26	0.18	0.20
292.5	0.18	0.18	0.19	0.13	0.17	0.21	0.18	0.20	0.22	0.23	0.13	0.11	0.17	0.22	0.25	0.15	0.26
315	0.16	0.16	0.13	0.09	0.16	0.14	0.14	0.18	0.19	0.22	0.16	0.16	0.26	0.29	0.24	0.16	0.30
337.5	0.21	0.22	0.16	0.16	0.25	0.17	0.15	0.19	0.18	0.26	0.20	0.20	0.29	0.41	0.18	0.13	0.43
Annual: VR_w	***0.26***	***0.32***	***0.24***	***0.20***	***0.32***	***0.21***	***0.26***	***0.21***	***0.27***	***0.19***	***0.23***	***0.17***	***0.26***	***0.24***	***0.22***	***0.26***	***0.20***
Summer: VR_w	***0.28***	***0.30***	***0.19***	***0.21***	***0.28***	***0.21***	***0.23***	***0.23***	***0.24***	***0.15***	***0.24***	***0.13***	***0.27***	***0.24***	***0.21***	***0.29***	***0.21***

Table 14. VR values of overall test points in Zone-D without installation of potential developments at the PDA

Dir.	(D1)	(D2)	(D3)	(D4)	(D5)	(D6)	(D7)	(D8)	(D9)	(D10)	(D11)	(D12)	(D13)	(D14)	(D15)	(D16)	(D17)
0	0.45	0.40	0.15	0.21	0.43	0.15	0.13	0.28	0.21	0.24	0.35	0.21	0.28	0.52	0.15	0.17	0.54
22.5	0.27	0.29	0.24	0.16	0.30	0.20	0.29	0.21	0.22	0.15	0.25	0.13	0.23	0.34	0.18	0.16	0.24
45	0.21	0.50	0.34	0.29	0.45	0.28	0.38	0.16	0.34	0.23	0.18	0.22	0.28	0.14	0.32	0.35	0.13
67.5	0.22	0.32	0.32	0.20	0.40	0.25	0.37	0.18	0.42	0.29	0.24	0.26	0.32	0.14	0.34	0.34	0.13
90	0.17	0.23	0.22	0.13	0.14	0.16	0.17	0.22	0.18	0.24	0.15	0.17	0.18	0.08	0.13	0.23	0.07
112.5	0.12	0.15	0.15	0.09	0.12	0.12	0.11	0.14	0.15	0.13	0.08	0.14	0.21	0.08	0.10	0.19	0.07
135	0.16	0.15	0.15	0.08	0.18	0.19	0.18	0.26	0.25	0.27	0.13	0.22	0.40	0.12	0.26	0.31	0.17
157.5	0.13	0.20	0.14	0.11	0.13	0.13	0.14	0.11	0.16	0.12	0.11	0.10	0.16	0.11	0.10	0.16	0.12
180	0.14	0.13	0.13	0.09	0.14	0.08	0.14	0.12	0.19	0.08	0.12	0.08	0.16	0.15	0.09	0.10	0.11
202.5	0.31	0.26	0.16	0.14	0.28	0.20	0.17	0.15	0.25	0.12	0.32	0.11	0.34	0.34	0.24	0.35	0.32
225	0.40	0.39	0.18	0.30	0.36	0.23	0.28	0.32	0.24	0.11	0.39	0.12	0.36	0.35	0.25	0.43	0.29
247.5	0.24	0.34	0.39	0.26	0.25	0.46	0.30	0.32	0.30	0.28	0.29	0.13	0.14	0.22	0.26	0.32	0.14
270	0.40	0.33	0.32	0.29	0.28	0.39	0.32	0.28	0.41	0.30	0.17	0.11	0.14	0.15	0.30	0.19	0.20
292.5	0.18	0.17	0.19	0.13	0.17	0.22	0.20	0.21	0.24	0.25	0.13	0.12	0.17	0.23	0.27	0.16	0.27
315	0.16	0.16	0.13	0.09	0.16	0.13	0.14	0.18	0.19	0.21	0.17	0.15	0.26	0.27	0.25	0.16	0.31
337.5	0.22	0.20	0.15	0.16	0.24	0.16	0.15	0.18	0.19	0.26	0.20	0.19	0.29	0.40	0.18	0.12	0.44
Annual: VR_w	***0.26***	***0.32***	***0.25***	***0.20***	***0.32***	***0.21***	***0.28***	***0.21***	***0.28***	***0.19***	***0.24***	***0.17***	***0.27***	***0.23***	***0.23***	***0.27***	***0.19***
Summer: VR_w	***0.27***	***0.30***	***0.20***	***0.21***	***0.28***	***0.21***	***0.24***	***0.24***	***0.24***	***0.16***	***0.25***	***0.14***	***0.27***	***0.23***	***0.21***	***0.30***	***0.20***

Table 15. VR values of overall test points in Zone-E with installation of potential developments at the PDA

Dir.	(E1)	(E2)	(E3)	(E4)	(E5)	(E6)	(E7)	(E8)	(E9)	(E10)	(E11)	(E12)	(E13)	(E14)	(E15)	(E16)	(E17)	(E18)
0	0.49	0.48	0.31	0.34	0.27	0.16	0.45	0.48	0.62	0.46	0.33	0.34	0.30	0.21	0.39	0.39	0.20	0.40
22.5	0.44	0.49	0.33	0.35	0.33	0.19	0.42	0.38	0.32	0.56	0.38	0.35	0.51	0.41	0.34	0.50	0.35	0.54
45	0.27	0.36	0.36	0.36	0.34	0.25	0.21	0.21	0.50	0.48	0.30	0.29	0.46	0.47	0.25	0.52	0.31	0.42
67.5	0.21	0.29	0.25	0.24	0.26	0.20	0.14	0.16	0.26	0.33	0.17	0.20	0.25	0.21	0.15	0.61	0.23	0.29
90	0.18	0.26	0.22	0.23	0.19	0.14	0.09	0.12	0.18	0.20	0.14	0.14	0.15	0.14	0.17	0.20	0.21	0.22
112.5	0.18	0.21	0.16	0.17	0.16	0.14	0.09	0.13	0.20	0.17	0.12	0.15	0.16	0.16	0.11	0.21	0.16	0.19
135	0.23	0.18	0.16	0.14	0.15	0.14	0.13	0.18	0.21	0.16	0.12	0.15	0.16	0.15	0.11	0.18	0.15	0.16
157.5	0.15	0.16	0.12	0.14	0.12	0.13	0.10	0.17	0.14	0.17	0.11	0.14	0.19	0.13	0.13	0.17	0.15	0.18
180	0.20	0.19	0.13	0.15	0.12	0.12	0.09	0.15	0.13	0.16	0.14	0.14	0.25	0.11	0.22	0.14	0.15	0.15
202.5	0.28	0.28	0.15	0.16	0.24	0.17	0.19	0.24	0.20	0.22	0.18	0.19	0.20	0.20	0.26	0.29	0.35	0.26
225	0.34	0.36	0.20	0.24	0.29	0.20	0.19	0.29	0.28	0.34	0.20	0.21	0.33	0.20	0.26	0.30	0.35	0.37
247.5	0.37	0.39	0.30	0.32	0.34	0.21	0.14	0.22	0.24	0.38	0.19	0.22	0.31	0.19	0.17	0.26	0.36	0.38
270	0.24	0.27	0.24	0.25	0.24	0.17	0.13	0.18	0.23	0.25	0.15	0.17	0.19	0.14	0.13	0.14	0.23	0.25
292.5	0.13	0.20	0.15	0.16	0.19	0.15	0.11	0.19	0.19	0.17	0.11	0.13	0.14	0.10	0.11	0.16	0.21	0.20
315	0.20	0.16	0.12	0.12	0.28	0.20	0.25	0.43	0.47	0.26	0.16	0.23	0.21	0.19	0.18	0.24	0.32	0.29
337.5	0.31	0.24	0.19	0.19	0.14	0.14	0.38	0.37	0.45	0.18	0.14	0.27	0.31	0.26	0.25	0.43	0.16	0.15
Annual: VR_w	***0.30***	***0.35***	***0.26***	***0.27***	***0.27***	***0.19***	***0.23***	***0.25***	***0.31***	***0.38***	***0.24***	***0.24***	***0.34***	***0.28***	***0.23***	***0.42***	***0.27***	***0.36***
Summer: VR_w	***0.28***	***0.30***	***0.21***	***0.23***	***0.24***	***0.18***	***0.17***	***0.23***	***0.25***	***0.29***	***0.19***	***0.19***	***0.28***	***0.20***	***0.21***	***0.29***	***0.26***	***0.30***

Table 16. VR values of overall test points in Zone-E without installation of potential developments at the PDA

Dir.	(E1)	(E2)	(E3)	(E4)	(E5)	(E6)	(E7)	(E8)	(E9)	(E10)	(E11)	(E12)	(E13)	(E14)	(E15)	(E16)	(E17)	(E18)
0	0.49	0.47	0.31	0.32	0.27	0.17	0.48	0.49	0.63	0.40	0.32	0.42	0.40	0.20	0.47	0.41	0.31	0.33
22.5	0.41	0.48	0.32	0.32	0.33	0.18	0.42	0.39	0.33	0.58	0.41	0.35	0.52	0.44	0.35	0.51	0.44	0.53
45	0.24	0.34	0.36	0.36	0.35	0.25	0.22	0.21	0.49	0.49	0.32	0.31	0.48	0.47	0.26	0.53	0.36	0.38
67.5	0.23	0.31	0.25	0.27	0.25	0.21	0.15	0.17	0.26	0.34	0.17	0.19	0.25	0.21	0.15	0.60	0.25	0.29
90	0.19	0.25	0.23	0.22	0.19	0.14	0.09	0.12	0.19	0.20	0.13	0.14	0.15	0.14	0.17	0.20	0.21	0.21
112.5	0.18	0.21	0.15	0.17	0.15	0.15	0.09	0.13	0.19	0.17	0.12	0.15	0.17	0.17	0.11	0.21	0.16	0.18
135	0.23	0.16	0.17	0.13	0.14	0.14	0.13	0.17	0.21	0.15	0.11	0.14	0.16	0.15	0.12	0.18	0.15	0.15
157.5	0.16	0.15	0.12	0.12	0.11	0.12	0.10	0.16	0.15	0.17	0.11	0.14	0.20	0.12	0.14	0.18	0.18	0.18
180	0.19	0.20	0.12	0.12	0.12	0.10	0.09	0.15	0.13	0.20	0.14	0.16	0.26	0.11	0.22	0.15	0.19	0.20
202.5	0.29	0.29	0.17	0.15	0.24	0.17	0.19	0.25	0.21	0.23	0.21	0.19	0.21	0.19	0.23	0.30	0.37	0.26
225	0.31	0.34	0.19	0.22	0.27	0.19	0.18	0.28	0.28	0.34	0.20	0.21	0.32	0.21	0.26	0.30	0.37	0.39
247.5	0.36	0.37	0.28	0.30	0.31	0.19	0.14	0.22	0.22	0.36	0.19	0.20	0.30	0.17	0.17	0.24	0.36	0.38
270	0.24	0.26	0.23	0.24	0.23	0.16	0.12	0.18	0.22	0.24	0.14	0.16	0.19	0.14	0.13	0.14	0.20	0.24
292.5	0.23	0.20	0.16	0.15	0.18	0.14	0.11	0.17	0.18	0.16	0.10	0.12	0.14	0.10	0.11	0.15	0.18	0.18
315	0.26	0.25	0.12	0.13	0.28	0.22	0.24	0.43	0.47	0.26	0.16	0.24	0.20	0.17	0.19	0.23	0.32	0.30
337.5	0.30	0.26	0.18	0.17	0.15	0.17	0.38	0.37	0.48	0.24	0.17	0.29	0.31	0.25	0.27	0.41	0.24	0.23
Annual: VR_w	***0.29***	***0.35***	***0.26***	***0.27***	***0.27***	***0.19***	***0.23***	***0.25***	***0.31***	***0.38***	***0.25***	***0.25***	***0.35***	***0.28***	***0.24***	***0.42***	***0.32***	***0.36***
Summer: VR_w	***0.26***	***0.29***	***0.20***	***0.21***	***0.23***	***0.17***	***0.16***	***0.22***	***0.25***	***0.30***	***0.18***	***0.20***	***0.28***	***0.20***	***0.21***	***0.29***	***0.29***	***0.31***

Table 17. VR values of overall test points in Zone-F with installation of potential developments at the PDA

Dir.	(F1)	(F2)	(F3)	(F4)	(F5)	F6	(F7)	(F8)
0	0.17	0.21	0.27	0.23	0.36	0.30	0.46	0.31
22.5	0.13	0.23	0.27	0.24	0.51	0.43	0.64	0.40
45	0.12	0.26	0.32	0.29	0.65	0.58	0.72	0.47
67.5	0.10	0.18	0.20	0.28	0.54	0.43	0.55	0.37
90	0.07	0.12	0.12	0.17	0.27	0.19	0.26	0.19
112.5	0.09	0.18	0.22	0.17	0.23	0.15	0.21	0.17
135	0.20	0.31	0.32	0.26	0.19	0.21	0.28	0.26
157.5	0.23	0.21	0.24	0.18	0.17	0.14	0.27	0.20
180	0.12	0.22	0.20	0.12	0.25	0.17	0.25	0.19
202.5	0.08	0.13	0.24	0.22	0.41	0.17	0.14	0.23
225	0.10	0.12	0.34	0.25	0.33	0.22	0.21	0.30
247.5	0.05	0.08	0.14	0.18	0.30	0.28	0.21	0.22
270	0.07	0.13	0.20	0.19	0.23	0.27	0.19	0.19
292.5	0.07	0.09	0.16	0.14	0.11	0.12	0.12	0.17
315	0.11	0.10	0.18	0.21	0.16	0.21	0.23	0.22
337.5	0.16	0.11	0.19	0.18	0.19	0.20	0.23	0.19
Annual: VR_w	***0.12***	***0.20***	***0.26***	***0.24***	***0.44***	***0.36***	***0.47***	***0.34***
Summer: VR_w	***0.11***	***0.17***	***0.27***	***0.22***	***0.32***	***0.25***	***0.29***	***0.27***

Table 18. VR values of overall test points in Zone-F without installation of potential developments at the PDA

Dir.	(F1)	(F2)	(F3)	(F4)	(F5)	F6	(F7)	(F8)
0	0.27	0.19	0.28	0.25	0.35	0.30	0.48	0.34
22.5	0.13	0.23	0.29	0.25	0.52	0.43	0.65	0.43
45	0.12	0.24	0.31	0.28	0.65	0.59	0.71	0.49
67.5	0.11	0.19	0.20	0.28	0.53	0.43	0.54	0.36
90	0.08	0.11	0.12	0.16	0.27	0.18	0.26	0.19
112.5	0.11	0.18	0.22	0.16	0.22	0.15	0.20	0.16
135	0.26	0.32	0.31	0.27	0.21	0.25	0.29	0.25
157.5	0.23	0.23	0.25	0.23	0.21	0.26	0.37	0.22
180	0.14	0.22	0.17	0.13	0.24	0.18	0.29	0.25
202.5	0.08	0.12	0.23	0.21	0.38	0.15	0.19	0.33
225	0.09	0.12	0.32	0.24	0.31	0.20	0.22	0.29
247.5	0.05	0.08	0.15	0.19	0.27	0.29	0.23	0.21
270	0.07	0.13	0.19	0.19	0.21	0.28	0.20	0.17
292.5	0.07	0.09	0.17	0.16	0.12	0.13	0.15	0.19
315	0.12	0.10	0.18	0.23	0.17	0.24	0.26	0.23
337.5	0.17	0.11	0.17	0.20	0.18	0.22	0.25	0.19
Annual: VR_w	***0.13***	***0.19***	***0.25***	***0.24***	***0.44***	***0.36***	***0.47***	***0.35***
Summer: VR_w	***0.12***	***0.17***	***0.25***	***0.22***	***0.31***	***0.25***	***0.30***	***0.27***

Table 19. VR values of overall test points in Zone-G with installation of potential developments at the PDA

Dir.	(G1)	(G2)	(G3)	(G4)	(G5)	(G6)	(G7)	G8	(G9)
0	0.19	0.23	0.10	0.14	0.15	0.16	0.16	0.13	0.11
22.5	0.25	0.25	0.16	0.27	0.22	0.24	0.20	0.17	0.16
45	0.32	0.25	0.17	0.42	0.29	0.23	0.31	0.31	0.22
67.5	0.27	0.26	0.19	0.32	0.25	0.23	0.25	0.22	0.19
90	0.23	0.31	0.14	0.12	0.12	0.12	0.13	0.15	0.12
112.5	0.16	0.25	0.11	0.12	0.12	0.10	0.13	0.12	0.10
135	0.24	0.39	0.16	0.15	0.16	0.13	0.21	0.16	0.17
157.5	0.15	0.19	0.12	0.16	0.18	0.15	0.17	0.10	0.13
180	0.10	0.12	0.08	0.11	0.12	0.07	0.13	0.12	0.07
202.5	0.14	0.13	0.06	0.18	0.13	0.09	0.15	0.20	0.09
225	0.16	0.19	0.15	0.29	0.27	0.17	0.24	0.31	0.16
247.5	0.26	0.22	0.15	0.30	0.34	0.20	0.34	0.34	0.16
270	0.27	0.28	0.14	0.25	0.27	0.24	0.31	0.22	0.12
292.5	0.21	0.29	0.14	0.13	0.10	0.13	0.13	0.19	0.13
315	0.20	0.31	0.21	0.16	0.21	0.14	0.21	0.24	0.14
337.5	0.14	0.18	0.15	0.20	0.16	0.14	0.17	0.15	0.13
Annual: VR_w	***0.23***	***0.24***	***0.15***	***0.27***	***0.22***	***0.19***	***0.22***	***0.21***	***0.16***
Summer: VR_w	***0.19***	***0.22***	***0.14***	***0.23***	***0.22***	***0.16***	***0.21***	***0.23***	***0.15***

Table 20. VR values of overall test points in Zone-G without installation of potential developments at the PDA

Dir.	(G1)	(G2)	(G3)	(G4)	(G5)	(G6)	(G7)	G8	(G9)
0	0.17	0.21	0.10	0.13	0.15	0.16	0.15	0.13	0.10
22.5	0.24	0.25	0.16	0.25	0.23	0.23	0.19	0.16	0.16
45	0.32	0.27	0.18	0.41	0.32	0.22	0.33	0.30	0.23
67.5	0.27	0.28	0.20	0.32	0.27	0.21	0.26	0.21	0.20
90	0.24	0.28	0.15	0.12	0.13	0.11	0.15	0.14	0.13
112.5	0.15	0.25	0.11	0.12	0.12	0.09	0.13	0.11	0.11
135	0.26	0.37	0.17	0.15	0.16	0.14	0.19	0.16	0.17
157.5	0.15	0.18	0.11	0.16	0.18	0.15	0.17	0.17	0.13
180	0.10	0.12	0.07	0.10	0.11	0.07	0.13	0.12	0.08
202.5	0.13	0.12	0.06	0.18	0.13	0.08	0.15	0.19	0.09
225	0.16	0.19	0.14	0.29	0.26	0.16	0.23	0.28	0.16
247.5	0.26	0.22	0.14	0.29	0.34	0.20	0.34	0.37	0.16
270	0.26	0.29	0.15	0.24	0.29	0.26	0.32	0.22	0.12
292.5	0.23	0.29	0.13	0.14	0.10	0.12	0.13	0.20	0.13
315	0.22	0.32	0.20	0.16	0.21	0.14	0.21	0.24	0.14
337.5	0.15	0.18	0.15	0.19	0.16	0.13	0.17	0.16	0.13
Annual: VR_w	***0.23***	***0.24***	***0.16***	***0.26***	***0.23***	***0.19***	***0.22***	***0.20***	***0.17***
Summer: VR_w	***0.19***	***0.22***	***0.14***	***0.23***	***0.22***	***0.16***	***0.21***	***0.22***	***0.15***

Table 21. SAVR values of each zone of the assessment area

Conditions		Zone-A	Zone-B	Zone-C	Zone-D	Zone-E	Zone-F	Zone-G
With developments	**Annual**	0.26	0.32	0.29	0.24	0.29	0.30	0.21
	Summer	0.22	0.27	0.22	0.23	0.24	0.24	0.19
Without developments	**Annual**	0.35	0.39	0.28	0.24	0.29	0.30	0.21
	Summer	0.29	0.30	0.23	0.23	0.24	0.24	0.19

Appendix 13.01

Summary of Materials in Boreholes

Appendix 13.01: Summary of Materials in Boreholes

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
GIU Contract 02636: PWD Contract No 572/77 - Shatin To Tai Po																							
02636_BH001	Drillhole	839835.87	829835.27	5.58	07/06/1978	19.68		0.00 to 9.14	9.14 to 14.78		14.78 to 17.22	17.22	2.46	9.14	5.64	0.00	2.44	-3.56	-9.20		-11.64	-14.1	GRANITE
02636_BH002	Drillhole	839864.76	830073.37	1.23	22/06/1978	15.09			0.00 to 11.02		11.02 to 11.02	11.02	4.07		11.02	0.00	0.00		-9.79		-9.79	-13.86	GRANITE
02636_BH003	Drillhole	839896.04	830066.76	4.73	14/06/1978	23.34		0.00 to 6.10	6.10 to 15.24		15.24 to 19.05	19.05	4.29	6.10	9.14	0.00	3.81	-1.37	-10.51		-14.32	-18.61	GRANITE
02636_BH004	Drillhole	839962.68	830091.92	5.23	24/06/1978	25.32		0.00 to 16.79	16.79 to 20.22		20.22 to 25.32*			16.79	3.43	0.00	5.10*	-11.56	-14.99			-20.09	GRANITE
02636_BH005	Drillhole	839858.41	830176.94	0.74	23/06/1978	23.37		0.00 to 1.73	1.73 to 13.61	13.61 to 16.56	16.56 to 19.35	19.35	4.02	1.73	11.88	2.95	2.79	-0.99	-12.87	-15.82	-18.61	-22.63	GRANITE
02636_BH006	Drillhole	839886.20	830185.63	-0.08	01/07/1978	21.54			0.00 to 13.92	13.92 to 17.53	17.53 to 17.53	17.53	4.01		13.92	3.61	0.00		-14.00	-17.61	-17.61	-21.62	GRANITE
02636_BH007	Drillhole	839946.21	830184.26	-3.15	17/06/1978	17.60			0.00 to 13.56	13.56 to 16.54	16.54 to 17.60*				13.56	2.98	1.06*		-16.71	-19.69		-20.75	GRANITE
02636_BH008	Drillhole	839995.55	830183.95	-6.83	05/07/1978	23.88			0.00 to 7.71	7.71 to 16.54	16.54 to 22.35	22.35	1.53		7.71	8.83	5.81		-14.54	-23.37	-29.18	-30.71	GRANITE
GIU Report No. 03189C:																							
03189C_BH54	Drillhole	840178.90	829662.50	5.80	21/10/1981	11.00		0.00 to 8.00	8.00 to 11.00 *					8.00	3.00 *			-2.20	-5.20 *			-5.2	
03189C_BH55	Drillhole	840180.60	829671.20	5.60	20/10/1981	11.00		0.00 to 6.00	6.00 to 11.00 *					6.00	5.00 *			-0.40	-5.40 *			-5.4	
03189C_BH56	Drillhole	840187.10	829665.50	5.90	20/10/1981	11.00		0.00 to 5.40	5.40 to 11.00 *					5.40	5.60 *			0.50	-5.10 *			-5.1	
03189C_BH57	Drillhole	840183.50	829645.30	5.80	22/10/1981	11.00		0.00 to 6.60	6.60 to 11.00 *					6.60	4.40 *			-0.80	-5.20 *			-5.2	
03189C_BH58	Drillhole	840169.00	829628.80	6.50	23/10/1981	11.00		0.00 to 8.40	8.40 to 11.00 *					8.40	2.60 *			-1.90	-4.50 *			-4.5	
03189C_BH59	Drillhole	840145.30	829838.10	5.30	06/11/1981	11.00		0.00 to 11.00 *						11.00 *				-5.70 *				-5.7	
03189C_BH60	Drillhole	840166.20	829749.80	5.10	30/10/1981	11.00		0.00 to 7.30	7.30 to 11.00 *					7.30	3.70 *			-2.20	-5.90 *			-5.9	
03189C_BH61	Drillhole	840205.40	829795.20	4.80	25/10/1981	11.00		0.00 to 7.00	7.00 to 11.00 *					7.00	4.00 *			-2.20	-6.20 *			-6.2	
03189C_BH62	Drillhole	840169.50	829780.80	5.00	27/10/1981	11.00		0.00 to 5.00	5.00 to 11.00 *					5.00	6.00 *			0.00	-6.00 *			-6	
03189C_BH63	Drillhole	840195.60	829810.50	4.80	24/10/1981	11.00		0.00 to 11.00 *						11.00 *				-6.20 *				-6.2	
03189C_BH64	Drillhole	840217.30	829783.50	5.00	28/10/1981	11.00		0.00 to 11.00 *						11.00 *				-6.00 *				-6	
03189C_BH65	Drillhole	840174.00	829842.80	4.60	01/11/1981	11.00		0.00 to 4.50	4.50 to 11.00 *					4.50	6.50 *			0.10	-6.40 *			-6.4	
03189C_BH66	Drillhole	840105.70	829793.00	4.60	05/11/1981	11.00		0.00 to 11.00 *						11.00 *				-6.40 *				-6.4	
03189C_BH67	Drillhole	840110.20	829881.50	4.90	03/11/1981	11.00		0.00 to 11.00 *						11.00 *				-6.10 *				-6.1	
03189C_BH68	Drillhole	840141.30	829900.20	4.60	02/11/1981	11.00		0.00 to 8.00	8.00 to 11.00 *					8.00	3.00 *			-3.40	-6.40 *			-6.4	
GIU Report No. 03189: Shatin Sewage Treatment Works, Stage 2																							
03189_BH01	Drillhole	839942.00	829839.40	6.10	12/05/1981	28.00		0.00 to 14.50	14.50 to 19.50	19.50 to 26.00	26.00 to 28.00*			14.50	5.00	6.50	2.00*	-8.40	-13.40	-19.90		-21.9	Granite
03189_BH02	Drillhole	839968.90	829818.10	5.50	26/01/1981	10.40		0.00 to 9.00	9.00 to 10.40 *					9.00	1.40 *			-3.50	-4.90 *			-4.9	
03189_BH03	Drillhole	840000.50	829791.00	5.40	28/01/1981	12.50		0.00 to 9.80	9.80 to 12.50 *					9.80	2.70 *			-4.40	-7.10 *			-7.1	
03189_BH04	Drillhole	840024.80	829766.80	5.50	30/01/1981	14.50		0.00 to 12.50	12.50 to 14.50 *					12.50	2.00 *			-7.00	-9.00 *			-9	
03189_BH05	Drillhole	839976.80	829879.00	6.20	20/01/1981	17.50		0.00 to 15.80	15.80 to 17.50 *					15.80	1.70 *			-9.60	-11.30 *			-11.3	
03189_BH06	Drillhole	840010.00	829864.70	5.50	22/01/1981	19.00		0.00 to 18.00	18.00 to 19.00 *					18.00	1.00 *			-12.50	-13.50 *			-13.5	
03189_BH07	Drillhole	840039.40	829835.20	5.00	29/01/1981	15.00		0.00 to 14.00	14.00 to 15.00 *					14.00	1.00 *			-9.00	-10.00 *			-10	
03189_BH08	Drillhole	840065.20	829812.20	5.60	22/05/1981	31.00		0.00 to 17.50	17.50 to 19.00	19.00 to 25.00	25.00 to 31.00*			17.50	1.50	6.00	6.00*	-11.90	-13.40	-19.40		-25.4	Granite
03189_BH09	Drillhole	840073.60	829873.50	10.20	03/02/1981	15.10		0.00 to 15.10 *						15.10 *				-4.90 *				-4.9	
03189_BH09A	Drillhole	840072.50	829876.70	10.10	16/02/1981	17.10		0.00 to 15.70	15.70 to 17.10 *					15.70	1.40 *			-5.60	-7.00 *			-7	
03189_BH10	Drillhole	840096.50	829853.70	9.50	20/02/1981	21.50		0.00 to 19.50	19.50 to 21.50 *					19.50	2.00 *			-10.00	-12.00 *			-12	
03189_BH11	Drillhole	840113.10	829918.90	4.90	07/01/1981	25.70		0.00 to 9.00	9.00 to 19.00	19.00 to 25.70 *				9.00	10.00	6.70 *		-4.10	-14.10	-20.80 *		-20.8	
03189_BH12	Drillhole	840138.90	829896.20	5.00	13/01/1981	28.50		0.00 to 6.50	6.50 to 21.00	21.00 to 26.40	26.40 to 28.50*			6.50	14.50	5.40	2.10*	-1.50	-16.00	-21.40		-23.5	Granite
03189_BH13	Drillhole	840004.20	829910.00	5.70	04/05/1981	20.00		0.00 to 17.00	17.00 to 20.00 *					17.00	3.00 *			-11.30	-14.30 *			-14.3	
03189_BH14	Drillhole	840115.80	829684.90	4.50	03/04/1981	19.50		0.00 to 9.00	9.00 to 15.00	15.00 to 19.50 *				9.00	6.00	4.50 *		-4.50	-10.50	-15.00 *		-15	
03189_BH15	Drillhole	840142.20	829667.20	5.30	17/03/1981	30.10		0.00 to 12.10	12.10 to 19.00	19.00 to 24.40	24.40 to 30.10*			12.10	6.90	5.40	5.70*	-6.80	-13.70	-19.10		-24.8	Granite
03189_BH16	Drillhole	840162.20	829643.70	4.60	17/02/1981	9.00		0.00 to 8.00	8.00 to 9.00 *					8.00	1.00 *			-3.40	-4.40 *			-4.4	
03189_BH17	Drillhole	840184.90	829623.80	4.90	05/03/1981	38.10		0.00 to 8.50	8.50 to 17.10	17.10 to 34.50	34.50 to 37.20	37.20	0.90	8.50	8.60	17.40	2.70	-3.60	-12.20	-29.60	-32.30	-33.2	Granite
03189_BH18	Drillhole	840181.90	829666.20	4.40	10/02/1981	15.40		0.00 to 4.40	4.40 to 15.40 *					4.40	11.00 *			0.00	-11.00 *			-11	
03189_BH19	Drillhole	840203.20	829646.90	4.50	12/02/1981	17.40		0.00 to 16.30	16.30 to 17.40 *					16.30	1.10 *			-11.80	-12.90 *			-12.9	

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
03189_BH20	Drillhole	840154.20	829729.00	6.30	30/03/1981	17.50		0.00 to 11.00	11.00 to 17.50 *					11.00	6.50 *			-4.70	-11.20 *			-11.2	
03189_BH21	Drillhole	840219.00	829676.40	5.40	10/04/1981	18.00		0.00 to 9.00	9.00 to 16.00	16.00 to 18.00 *				9.00	7.00	2.00 *		-3.60	-10.60	-12.60 *		-12.6	
03189_BH22	Drillhole	840188.30	829740.50	5.60	19/02/1981	33.50		0.00 to 10.00	10.00 to 17.50	17.50 to 27.50	27.50 to 27.50	27.50	6.00	10.00	7.50	10.00	0.00	-4.40	-11.90	-21.90	-21.90	-27.9	Granite
03189_BH23	Drillhole	840234.70	829702.10	5.50	21/02/1981	22.00		0.00 to 11.50	11.50 to 17.10	17.10 to 22.00 *				11.50	5.60	4.90 *		-6.00	-11.60	-16.50 *		-16.5	
03189_BH24	Drillhole	840201.10	829847.00	4.60	25/04/1981	28.30		0.00 to 4.00	4.00 to 18.00	18.00 to 23.00	23.00 to 26.30	26.30	2.00	4.00	14.00	5.00	3.30	0.60	-13.40	-18.40	-21.70	-23.7	Granite
03189_BH25	Drillhole	840292.00	829767.10	5.70	25/02/1981	22.00		0.00 to 16.00	16.00 to 16.50	16.50 to 22.00 *				16.00	0.50	5.50 *		-10.30	-10.80	-16.30 *		-16.3	
03189_BH26	Drillhole	840162.10	829795.50	5.40	22/04/1981	22.00		0.00 to 7.00	7.00 to 18.00	18.00 to 22.00 *				7.00	11.00	4.00 *		-1.60	-12.60	-16.60 *		-16.6	
03189_BH27	Drillhole	840187.90	829672.90	4.50	04/03/1981	6.40		0.00 to 5.20	5.20 to 6.40 *					5.20	1.20 *			-0.70	-1.90 *			-1.9	
03189_BH28	Drillhole	840174.20	829672.50	4.30	13/03/1981	4.50		0.00 to 3.50	3.50 to 4.50 *					3.50	1.00 *			0.80	-0.20 *			-0.2	
03189_BH29	Drillhole	840188.18	829655.90	4.40	14/03/1981	4.50		0.00 to 3.50	3.50 to 4.50 *					3.50	1.00 *			0.90	-0.10 *			-0.1	
03189_BH30	Drillhole	840165.10	829776.90	5.00	16/04/1981	17.80		0.00 to 7.10	7.10 to 17.20	17.20 to 17.80 *				7.10	10.10	0.60 *		-2.10	-12.20	-12.80 *		-12.8	
03189_BH31	Drillhole	840189.50	829804.50	4.90	20/04/1981	18.20		0.00 to 7.50	7.50 to 18.00	18.00 to 18.20 *				7.50	10.50	0.20 *		-2.60	-13.10	-13.30 *		-13.3	
03189_BH32	Drillhole	840083.50	829917.10	5.20	01/09/1981	20.30		0.00 to 12.80	12.80 to 20.00	20.00 to 20.30 *				12.80	7.20	0.30 *		-7.60	-14.80	-15.10 *		-15.1	
03189_BH33	Drillhole	839997.30	829818.70	4.90	25/08/1981	21.30		0.00 to 13.00	13.00 to 21.00	21.00 to 21.30 *				13.00	8.00	0.30 *		-8.10	-16.10	-16.40 *		-16.4	
03189_BH34	Drillhole	840186.80	829649.00	4.40	09/04/1981	6.00		0.00 to 4.50	4.50 to 6.00 *					4.50	1.50 *			-0.10	-1.60 *			-1.6	
03189_BH35	Drillhole	840170.40	829663.40	4.10	08/04/1981	7.50		0.00 to 6.00	6.00 to 7.50 *					6.00	1.50 *			-1.90	-3.40 *			-3.4	
03189_BH36	Drillhole	840153.00	829671.90	4.30	27/03/1981	8.10		0.00 to 6.60	6.60 to 8.10 *					6.60	1.50 *			-2.30	-3.80 *			-3.8	
03189_BH37	Drillhole	840141.40	829688.90	4.20	30/03/1981	8.20		0.00 to 6.60	6.60 to 8.20 *					6.60	1.60 *			-2.40	-4.00 *			-4	
03189_BH38	Drillhole	839962.20	829862.20	6.20	21/08/1981	19.00		0.00 to 18.50	18.50 to 19.00 *					18.50	0.50 *			-12.30	-12.80 *			-12.8	
03189_BH39	Drillhole	839988.10	829839.30	5.40	23/08/1981	18.50		0.00 to 18.30	18.30 to 18.50 *					18.30	0.20 *			-12.90	-13.10 *			-13.1	
03189_BH40	Drillhole	840093.70	829896.80	5.20	31/08/1981	8.30		0.00 to 8.30 *						8.30 *				-3.10 *				-3.1	
03189_BH41	Drillhole	840119.40	829874.10	5.50	29/08/1981	8.20		0.00 to 8.20 *						8.20 *				-2.70 *				-2.7	
03189_BH42	Drillhole	840138.60	829775.60	5.50	03/06/1981	9.50		0.00 to 8.00	8.00 to 9.50 *					8.00	1.50 *			-2.50	-4.00 *			-4	
03189_BH43	Drillhole	840179.20	829821.70	5.50	08/06/1981	15.50		0.00 to 14.00	14.00 to 15.50 *					14.00	1.50 *			-8.50	-10.00 *			-10	
03189_BH44	Drillhole	840161.40	829755.70	5.10	05/06/1981	10.70		0.00 to 9.20	9.20 to 10.70 *					9.20	1.50 *			-4.10	-5.60 *			-5.6	
03189_BH45	Drillhole	840181.30	829778.30	5.40	16/06/1981	12.50		0.00 to 7.70	7.70 to 12.50 *					7.70	4.80 *			-2.30	-7.10 *			-7.1	
03189_BH46	Drillhole	840201.30	829801.30	5.30	13/06/1981	15.70		0.00 to 14.20	14.20 to 15.70 *					14.20	1.50 *			-8.90	-10.40 *			-10.4	
03189_BH47	Drillhole	839750.90	829573.90	5.90	09/07/1981	24.60		0.00 to 13.60	13.60 to 18.00	18.00 to 22.50	22.50 to 22.70	22.70	1.90	13.60	4.40	4.50	0.20	-7.70	-12.10	-16.60	-16.80	-18.7	Granite
03189_BH48	Drillhole	839764.40	829583.00	5.60	18/07/1981	24.80		0.00 to 10.00	10.00 to 17.50	17.50 to 22.00	22.00 to 23.00	23.00	1.80	10.00	7.50	4.50	1.00	-4.40	-11.90	-16.40	-17.40	-19.2	Granite
03189_BH49	Drillhole	839760.50	829563.30	5.80	03/08/1981	25.90		0.00 to 15.50	15.50 to 16.00		16.00 to 25.90*			15.50	0.50	0.00	9.90*	-9.70	-10.20			-20.1	Granite
03189_BH50	Drillhole	839739.60	829561.20	6.20	11/08/1981	24.60		0.00 to 10.00	10.00 to 20.00	20.00 to 22.60	22.60 to 24.60*			10.00	10.00	2.60	2.00*	-3.80	-13.80	-16.40		-18.4	VOLCANIC
03189_BH51	Drillhole	839957.90	829401.30	6.50	22/06/1981	32.70		0.00 to 17.00	17.00 to 17.50	17.50 to 30.70	30.70 to 32.70*			17.00	0.50	13.20	2.00*	-10.50	-11.00	-24.20		-26.2	Granite
03189_BH52	Drillhole	840167.80	829660.20	6.00	04/09/1981	4.70		0.00 to 4.70 *						4.70 *				1.30 *				1.3	
03189_BH53	Drillhole	840165.80	829802.80	5.20	22/09/1981	14.00		0.00 to 8.00	8.00 to 14.00 *					8.00	6.00 *			-2.80	-8.80 *			-8.8	
GIU Report No. 03254: Shatin Sewage Treatment Works																							
03254_BH71	Drillhole	840082.40	829916.90	5.60	22/02/1982	15.00		0.00 to 13.70	13.70 to 15.00 *					13.70	1.30 *			-8.10	-9.40 *			-9.4	
03254_BH72	Drillhole	840128.10	829856.70	5.60	12/02/1982	18.00		0.00 to 16.00	16.00 to 18.00 *					16.00	2.00 *			-10.40	-12.40 *			-12.4	
03254_BH73	Drillhole	840089.40	829812.40	5.60	11/02/1982	19.00		0.00 to 16.00	16.00 to 19.00 *					16.00	3.00 *			-10.40	-13.40 *			-13.4	
03254_BH74	Drillhole	840154.30	829835.00	5.90	13/02/1982	15.00		0.00 to 13.60	13.60 to 15.00 *					13.60	1.40 *			-7.70	-9.10 *			-9.1	
03254_BH75	Drillhole	840137.60	829815.80	6.10	09/02/1982	11.00		0.00 to 8.60	8.60 to 11.00 *					8.60	2.40 *			-2.50	-4.90 *			-4.9	
03254_BH76	Drillhole	840166.60	829832.30	5.40	16/02/1982	16.00		0.00 to 15.00	15.00 to 16.00 *					15.00	1.00 *			-9.60	-10.60 *			-10.6	
03254_BH77	Drillhole	840152.40	829815.90	6.10	08/02/1982	11.00		0.00 to 8.90	8.90 to 11.00 *					8.90	2.10 *			-2.80	-4.90 *			-4.9	
03254_BH78	Drillhole	840139.90	829801.40	5.50	10/02/1982	11.00		0.00 to 8.50	8.50 to 11.00 *					8.50	2.50 *			-3.00	-5.50 *			-5.5	
03254_BH79	Drillhole	840126.20	829786.60	5.50	12/02/1982	16.00		0.00 to 13.80	13.80 to 16.00 *					13.80	2.20 *			-8.30	-10.50 *			-10.5	
03254_BH80	Drillhole	840187.60	829831.80	5.30	16/02/1982	8.00		0.00 to 6.50	6.50 to 8.00 *					6.50	1.50 *			-1.20	-2.70 *			-2.7	
03254_BH81	Drillhole	840169.60	829811.70	5.50	06/02/1982	13.00		0.00 to 11.60	11.60 to 13.00 *					11.60	1.40 *			-6.10	-7.50 *			-7.5	
03254_BH82	Drillhole	840151.90	829790.60	5.40	15/02/1982	13.00		0.00 to 11.00	11.00 to 13.00 *					11.00	2.00 *			-5.60	-7.60 *			-7.6	
03254_BH83	Drillhole	840176.40	829795.20	5.30	05/02/1982	13.00		0.00 to 11.40	11.40 to 13.00 *					11.40	1.60 *			-6.10	-7.70 *			-7.7	
03254_BH84	Drillhole	840151.30	829765.90	5.50	18/02/1982	13.00		0.00 to 10.20	10.20 to 13.00 *					10.20	2.80 *			-4.70	-7.50 *			-7.5	
03254_BH85	Drillhole	840211.60	829810.80	6.10	17/02/1982	17.00		0.00 to 15.60	15.60 to 17.00 *					15.60	1.40 *			-9.50	-10.90 *			-10.9	
03254_BH86	Drillhole	840189.00	829785.50	5.80	19/02/1982	14.00		0.00 to 11.20	11.20 to 14.00 *					11.20	2.80 *			-5.40	-8.20 *			-8.2	
03254_BH87	Drillhole	840176.90	829769.60	5.40	20/01/1982	11.00		0.00 to 9.00	9.00 to 11.00 *					9.00	2.00 *			-3.60	-5.60 *			-5.6	

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
03254_BH88	Drillhole	840202.30	829772.90	5.40	20/02/1982	14.00		0.00 to 11.30	11.30 to 14.00 *					11.30	2.70 *			-5.90	-8.60 *			-8.6	
03254_BH89	Drillhole	840189.60	829757.90	5.30	19/01/1982	14.00		0.00 to 12.30	12.30 to 14.00 *					12.30	1.70 *			-7.00	-8.70 *			-8.7	
03254_BH90	Drillhole	840126.10	829670.40	6.10	18/01/1982	11.00		0.00 to 9.00	9.00 to 11.00 *					9.00	2.00 *			-2.90	-4.90 *			-4.9	
03254_BH91	Drillhole	840116.30	829660.10	6.80	16/01/1982	14.00		0.00 to 12.00	12.00 to 14.00 *					12.00	2.00 *			-5.20	-7.20 *			-7.2	
03254_BH92	Drillhole	840134.30	829899.50	5.50	19/02/1982	10.00		0.00 to 7.70	7.70 to 10.00 *					7.70	2.30 *			-2.20	-4.50 *			-4.5	
03254_BH93	Drillhole	840135.20	829892.70	5.50	18/02/1982	8.00		0.00 to 6.80	6.80 to 8.00 *					6.80	1.20 *			-1.30	-2.50 *			-2.5	
03254_BH94	Drillhole	840142.00	829893.10	5.50	19/02/1982	10.00		0.00 to 8.80	8.80 to 10.00 *					8.80	1.20 *			-3.30	-4.50 *			-4.5	
03254_BH95	Drillhole	839735.70	829619.30	6.70	09/02/1982	11.00		0.00 to 9.20	9.20 to 11.00 *					9.20	1.80 *			-2.50	-4.30 *			-4.3	
03254_BH96	Drillhole	839747.50	829609.70	6.70	07/02/1982	8.00		0.00 to 6.50	6.50 to 8.00 *					6.50	1.50 *			0.20	-1.30 *			-1.3	
03254_BH97	Drillhole	839759.70	829598.60	6.70	06/02/1982	8.00		0.00 to 6.40	6.40 to 8.00 *					6.40	1.60 *			0.30	-1.30 *			-1.3	
GIU Report No. 05728: Ma On Shan Pumping Station & Rising Mains, Sha Tin New Town																							
05728_HAZ_22	Drillhole	840107.30	829210.60	-2.80	14/07/1984	27.40			0.00 to 3.00	3.00 to 16.00	16.00 to 22.20	22.20	5.20		3.00	13.00	6.20		-5.80	-18.80	-25.00	-30.2	Granite
05728_HAZ_23	Drillhole	840088.70	829240.60	-2.00	12/07/1984	23.10			0.00 to 7.70	7.70 to 20.00	20.00 to 23.10*				7.70	12.30	3.10*		-9.70	-22.00		-25.1	Granite
05728_HAZ_24	Drillhole	840058.20	829251.90	-2.20	27/06/1984	31.70			0.00 to 8.00	8.00 to 23.50	23.50 to 26.40	26.40	5.30		8.00	15.50	2.90		-10.20	-25.70	-28.60	-33.9	Granite
05728_HAZ_25	Drillhole	840028.00	829267.90	-2.60	09/07/1984	24.00			0.00 to 7.60	7.60 to 23.00	23.00 to 24.00*				7.60	15.40	1.00*		-10.20	-25.60		-26.6	Granite
05728_HAZ_26	Drillhole	840008.90	829297.70	-3.40	02/07/1984	34.00			0.00 to 7.40	7.40 to 20.00	20.00 to 29.00	29.00	5.00		7.40	12.60	9.00		-10.80	-23.40	-32.40	-37.4	Granite
05728_HAZ_27	Drillhole	839984.80	829318.20	-4.70	06/07/1984	28.50			0.00 to 6.40	6.40 to 20.00	20.00 to 23.90	23.90	4.60		6.40	13.60	3.90		-11.10	-24.70	-28.60	-33.2	Granite
GIU Report No. 05908: Ma On Shan Pumping Station																							
05908_HAZ_28	Drillhole	839960.90	829341.70	5.30	11/08/1984	36.30		0.00 to 16.50		16.50 to 31.40	31.40 to 31.40	31.40	4.90	16.50		14.90	0.00	-11.20		-26.10	-26.10	-31	Granite
05908_HAZ_30	Drillhole	839885.30	829409.00	5.50	01/08/1984	52.60		0.00 to 16.50		16.50 to 28.80	28.80 to 48.30	48.30	4.30	16.50		12.30	19.50	-11.00		-23.30	-42.80	-47.1	Granite
GIU Report No. 09636: Marine Disposal of Sludges in Shatin Area - Land Boreholes																							
09636_LBH1	Drillhole	840233.80	829973.20	5.80	27/05/1987	26.50		0.00 to 18.80	18.80 to 23.80	23.80 to 26.50 *				18.80	5.00	2.70 *		-13.00	-18.00	-20.70 *		-20.7	
GIU Report No. 09737: T6 Trunk Road																							
09737_B09	Drillhole	840455.32	829651.86	-3.40	17/09/1987	21.15			0.00 to 5.50	5.50 to 13.10	13.10 to 16.07	16.07	5.08		5.50	7.60	2.97		-8.90	-16.50	-19.47	-24.55	GRANITE
09737_B10	Drillhole	840467.20	829671.82	-4.05	14/09/1987	23.23			0.00 to 3.00	3.00 to 10.45	10.45 to 16.20	16.20	7.03		3.00	7.45	5.75		-7.05	-14.50	-20.25	-27.28	GRANITE
09737_B11	Drillhole	840383.19	829723.72	-3.40	09/09/1987	30.59			0.00 to 7.00	7.00 to 18.75	18.75 to 23.63	23.63	6.96		7.00	11.75	4.88		-10.40	-22.15	-27.03	-33.99	GRANITE
09737_B12	Drillhole	840392.48	829733.90	-3.20	05/09/1987	28.34			0.00 to 7.00	7.00 to 20.30	20.30 to 21.85	21.85	6.49		7.00	13.30	1.55		-10.20	-23.50	-25.05	-31.54	GRANITE
GIU Report No. 09739: Marine Disposal of Sludge in Shatin - Marine boreholes																							
09739_MBH1	Drillhole	840264.35	830031.64	-7.00	27/08/1987	21.27			0.00 to 10.40	10.40 to 12.30	12.30 to 13.05	13.05	8.22		10.40	1.90	0.75		-17.40	-19.30	-20.05	-28.27	Granite
09739_MBH2	Drillhole	840301.53	830000.97	-6.15	03/09/1987	16.15			0.00 to 11.50	11.50 to 11.70	11.70 to 12.43	12.43	3.72		11.50	0.20	0.73		-17.65	-17.85	-18.58	-22.3	Granite
GIU Report No. 10445: Shatin New Town ST II Trunk Road T6																							
10445_B13	Drillhole	840333.20	829767.30	5.40	19/09/1987	43.70		0.00 to 15.50	15.50 to 19.00	19.00 to 28.50	28.50 to 30.70	30.70	13.00	15.50	3.50	9.50	2.20	-10.10	-13.60	-23.10	-25.30	-38.3	Granite
10445_B14	Drillhole	840315.00	829802.20	5.40	11/09/1987	34.90		0.00 to 15.50	15.50 to 16.00	16.00 to 27.60	27.60 to 27.60	27.60	7.30	15.50	0.50	11.60	0.00	-10.10	-10.60	-22.20	-22.20	-29.5	Granite
10445_B15	Drillhole	840270.00	829821.60	5.40	25/09/1987	36.40		0.00 to 15.00	15.00 to 19.00	19.00 to 26.60	26.60 to 26.60	26.60	9.80	15.00	4.00	7.60	0.00	-9.60	-13.60	-21.20	-21.20	-31	Granite
10445_B16	Drillhole	840239.80	829868.20	5.30	05/09/1987	36.20		0.00 to 9.00	9.00 to 17.50	17.50 to 27.50	27.50 to 29.30	29.30	6.90	9.00	8.50	10.00	1.80	-3.70	-12.20	-22.20	-24.00	-30.9	Granite
10445_B17	Drillhole	840197.60	829884.10	5.50	01/10/1987	34.90		0.00 to 9.50	9.50 to 19.00	19.00 to 27.70	27.70 to 27.70	27.70	7.20	9.50	9.50	8.70	0.00	-4.00	-13.50	-22.20	-22.20	-29.4	Granite
10445_B17A	Drillhole	840200.80	829885.70	5.50	02/09/1987	3.50		0.00 to 3.50 *						3.50 *				2.00 *				2	
10445_B18	Drillhole	840178.80	829921.60	5.30	03/09/1987	35.20		0.00 to 18.00	18.00 to 21.50	21.50 to 27.00	27.00 to 29.70	29.70	5.50	18.00	3.50	5.50	2.70	-12.70	-16.20	-21.70	-24.40	-29.9	Granite
10445_B19	Drillhole	840134.80	829944.00	5.60	28/09/1987	38.00		0.00 to 16.50	16.50 to 20.30	20.30 to 29.50	29.50 to 31.90	31.90	6.10	16.50	3.80	9.20	2.40	-10.90	-14.70	-23.90	-26.30	-32.4	Granite
10445_B20	Drillhole	840105.20	829984.90	5.30	21/08/1987	35.30		0.00 to 15.70	15.70 to 20.00	20.00 to 26.60	26.60 to 26.60	26.60	8.70	15.70	4.30	6.60	0.00	-10.40	-14.70	-21.30	-21.30	-30	Granite
10445_B21	Drillhole	840068.10	830003.00	5.60	19/09/1987	37.90		0.00 to 15.00	15.00 to 19.00	19.00 to 30.00	30.00 to 31.00	31.00	6.90	15.00	4.00	11.00	1.00	-9.40	-13.40	-24.40	-25.40	-32.3	Granite
10445_B22	Drillhole	840049.40	830038.20	5.80	20/08/1987	49.80		0.00 to 20.00	20.00 to 21.00	21.00 to 27.00	27.00 to 31.00	31.00	18.80	20.00	1.00	6.00	4.00	-14.20	-15.20	-21.20	-25.20	-44	Granite
10445_B23	Drillhole	840008.00	830057.50	5.70	12/09/1987	38.60		0.00 to 17.00	17.00 to 20.80	20.80 to 30.40	30.40 to 30.40	30.40	8.20	17.00	3.80	9.60	0.00	-11.30	-15.10	-24.70	-24.70	-32.9	Granite
10445_B24	Drillhole	839945.40	830120.00	6.30	08/09/1987	34.50		0.00 to 12.00	12.00 to 21.50	21.50 to 25.50	25.50 to 28.00	28.00	6.50	12.00	9.50	4.00	2.50	-5.70	-15.20	-19.20	-21.70	-28.2	Granite
10445_B25	Drillhole	839930.50	830146.60	5.20	17/09/1987	37.40		0.00 to 10.00	10.00 to 20.00	20.00 to 25.00	25.00 to 29.30	29.30	8.10	10.00	10.00	5.00	4.30	-4.80	-14.80	-19.80	-24.10	-32.2	Granite

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
10445_B26	Drillhole	840020.60	830071.60	5.80	09/09/1987	37.10		0.00 to 16.50	16.50 to 18.00	18.00 to 29.50	29.50 to 33.00	33.00	4.10	16.50	1.50	11.50	3.50	-10.70	-12.20	-23.70	-27.20	-31.3	Granite
10445_B27	Drillhole	839998.80	830108.60	5.90	21/09/1987	34.80		0.00 to 17.00	17.00 to 21.00	21.00 to 27.40	27.40 to 28.20	28.20	6.60	17.00	4.00	6.40	0.80	-11.10	-15.10	-21.50	-22.30	-28.9	Granite
10445_B28	Drillhole	839981.40	830149.90	5.80	23/09/1987	33.10		0.00 to 16.90	16.90 to 20.90	20.90 to 25.30	25.30 to 25.30	25.30	7.80	16.90	4.00	4.40	0.00	-11.10	-15.10	-19.50	-19.50	-27.3	Granite
10445_B29	Drillhole	839971.30	830189.50	5.70	03/10/1987	43.10		0.00 to 18.50	18.50 to 21.00	21.00 to 28.50	28.50 to 35.00	35.00	8.10	18.50	2.50	7.50	6.50	-12.80	-15.30	-22.80	-29.30	-37.4	Granite
GIU Report No. 12898: Tolo Harbour Effluent Export Scheme (Tai Po STW to Sha Tin STW)																							
12898_BH61	Drillhole	840124.97	830114.57	5.08	19/09/1989	25.00		0.00 to 17.50	17.50 to 20.45	20.45 to 25.00 *				17.50	2.95	4.55 *		-12.42	-15.37	-19.92 *		-19.92	
12898_BH62	Drillhole	840065.59	830045.21	5.15	14/09/1989	15.00		0.00 to 15.00 *						15.00 *				-9.85 *				-9.85	
12898_BH63	Drillhole	840013.64	830001.76	5.63	18/09/1989	33.20		0.00 to 18.00	18.00 to 20.50	20.50 to 25.50	25.50 to 28.20	28.20	5.00	18.00	2.50	5.00	2.70	-12.37	-14.87	-19.87	-22.57	-27.57	GRANITE
12898_BH64	Drillhole	839986.13	829969.28	5.88	07/09/1989	33.20		0.00 to 18.00	18.00 to 20.95	20.95 to 23.80	23.80 to 27.60	27.60	5.60	18.00	2.95	2.85	3.80	-12.12	-15.07	-17.92	-21.72	-27.32	Granite
12898_BH65	Drillhole	840002.26	829958.20	5.64	26/08/1989	32.35		0.00 to 18.00	18.00 to 19.90	19.90 to 25.30	25.30 to 27.30	27.30	5.05	18.00	1.90	5.40	2.00	-12.36	-14.26	-19.66	-21.66	-26.71	Granite
12898_BH66	Drillhole	840028.81	829987.28	5.63	22/08/1989	15.00		0.00 to 15.00 *						15.00 *				-9.37 *				-9.37	
12898_BH67	Drillhole	839871.58	829817.51	5.50	19/09/1989	26.00		0.00 to 14.50		14.50 to 16.95	16.95 to 21.00	21.00	5.00	14.50	0.00	2.45	4.05	-9.00		-11.45	-15.50	-20.5	Granite
12898_BH68	Drillhole	839753.45	829629.96	5.36	23/09/1989	29.35		0.00 to 13.30	13.30 to 20.80	20.80 to 22.50	22.50 to 24.15	24.15	5.20	13.30	7.50	1.70	1.65	-7.94	-15.44	-17.14	-18.79	-23.99	Granite
12898_BH69	Drillhole	839929.83	829487.30	5.17	14/09/1989	15.00		0.00 to 11.50	11.50 to 15.00 *					11.50	3.50 *			-6.33	-9.83 *			-9.83	
12898_BH70	Drillhole	839957.90	829360.98	6.67	18/09/1989	29.95		0.00 to 16.20	16.20 to 19.50	19.50 to 20.00				16.20	3.30	0.50		-9.53	-12.83	-13.33		-23.28	
12898_BH70A	Drillhole	839955.17	829363.97	6.73	23/09/1989	35.65		0.00 to 15.30	15.30 to 20.15	20.15 to 30.65	30.65 to 30.65	30.65	5.00	15.30	4.85	10.50	0.00	-8.57	-13.42	-23.92	-23.92	-28.92	Granite
12898_BH71	Drillhole	839860.06	829450.24	6.61	22/08/1989	39.26		0.00 to 18.50	18.50 to 19.35	19.35 to 28.50	28.50 to 36.01	36.01	3.25	18.50	0.85	9.15	7.51	-11.89	-12.74	-21.89	-29.40	-32.65	Granite
12898_BH72	Drillhole	839869.27	829464.57	6.61	01/09/1989	38.35		0.00 to 16.20	16.20 to 19.45	19.45 to 28.30	28.30 to 33.25	33.25	5.10	16.20	3.25	8.85	4.95	-9.59	-12.84	-21.69	-26.64	-31.74	Granite
12898_BH73	Drillhole	839884.83	829450.80	6.56	08/09/1989	37.90		0.00 to 15.50	15.50 to 17.95	17.95 to 28.50	28.50 to 32.90	32.90	5.00	15.50	2.45	10.55	4.40	-8.94	-11.39	-21.94	-26.34	-31.34	Granite
12898_BH89	Drillhole	840019.15	829310.34	-3.40	08/09/1989	38.14	0.00 to 0.50	0.50 * to 8.00		8.00 to 20.50	20.50 to 34.25	34.25	3.89	7.50 *	0.00	12.50	13.75	-11.40		-23.90	-37.65	-41.54	Granite
12898_BH90	Drillhole	840095.11	829250.30	-3.80	16/09/1989	31.07	0.00 to 0.50		0.50 * to 8.00	8.00 to 21.00	21.00 to 25.43	25.43	5.64		7.50 *	13.00	4.43		-11.80	-24.80	-29.23	-34.87	Granite
GIU Report No. 16236: Sha Tin Water Supply Stage II, Sha Tin Salt Water Pumping Station in Area 47 Proposed Site Investigation																							
16236_BH01	Drillhole	840130.99	830045.00	5.86	12/02/1992	31.69		0.00 to 19.00	19.00 to 22.00	22.00 to 28.64	28.64 to 28.64	28.64	3.05	19.00	3.00	6.64	0.00	-13.14	-16.14	-22.78	-22.78	-25.83	Granite
16236_BH02	Drillhole	840116.03	830038.02	5.80	30/01/1992	30.00		0.00 to 17.00	17.00 to 20.50	20.50 to 30.00 *				17.00	3.50	9.50 *		-11.20	-14.70	-24.20 *		-24.2	
16236_BH03	Drillhole	840149.41	830071.19	5.86	18/02/1992	30.00		0.00 to 19.50	19.50 to 23.20	23.20 to 30.00 *				19.50	3.70	6.80 *		-13.64	-17.34	-24.14 *		-24.14	
16236_BH04	Drillhole	840133.98	830044.13	5.91	09/01/1992	33.23		0.00 to 15.00	15.00 to 21.00	21.00 to 27.81	27.81 to 27.81	27.81	5.42	15.00	6.00	6.81	0.00	-9.09	-15.09	-21.90	-21.90	-27.32	Granite
16236_BH05	Drillhole	840163.20	830067.08	5.89	25/01/1992	37.50		0.00 to 19.00	19.00 to 22.70	22.70 to 32.65	32.65 to 32.65	32.65	4.85	19.00	3.70	9.95	0.00	-13.11	-16.81	-26.76	-26.76	-31.61	Granite
16236_BH06	Drillhole	840153.92	830059.08	5.80	27/01/1992	34.21		0.00 to 19.00	19.00 to 22.00	22.00 to 28.70	28.70 to 28.70	28.70	5.51	19.00	3.00	6.70	0.00	-13.20	-16.20	-22.90	-22.90	-28.41	Granite
16236_BH07	Drillhole	840146.00	830047.00	5.89	15/01/1992	35.23		0.00 to 19.00	19.00 to 22.00	22.00 to 29.20	29.20 to 29.20	29.20	6.03	19.00	3.00	7.20	0.00	-13.11	-16.11	-23.31	-23.31	-29.34	Granite
16236_BH08	Drillhole	840131.00	830027.00	5.64	09/01/1992	30.00		0.00 to 18.00	18.00 to 23.10	23.10 to 30.00 *				18.00	5.10	6.90 *		-12.36	-17.46	-24.36 *		-24.36	
16236_BH09	Drillhole	840146.60	830033.46	5.66	18/01/1992	30.00		0.00 to 19.00	19.00 to 21.20	21.20 to 30.00 *				19.00	2.20	8.80 *		-13.34	-15.54	-24.34 *		-24.34	
16236_BH10	Drillhole	840187.49	830059.89	5.48	19/02/1993	34.53		0.00 to 19.00	19.00 to 24.00	24.00 to 29.80	29.80 to 29.80	29.80	4.73	19.00	5.00	5.80	0.00	-13.52	-18.52	-24.32	-24.32	-29.05	Granite
16236_BH11	Drillhole	840164.79	830048.70	5.83	17/02/1992	36.68		0.00 to 19.00	19.00 to 20.30	20.30 to 29.90	29.90 to 32.00	32.00	4.68	19.00	1.30	9.60	2.10	-13.17	-14.47	-24.07	-26.17	-30.85	Granite
16236_BH12	Drillhole	840152.51	830039.53	5.66	20/01/1992	40.00		0.00 to 19.00	19.00 to 21.00	21.00 to 30.65	30.65 to 35.80	35.80	4.20	19.00	2.00	9.65	5.15	-13.34	-15.34	-24.99	-30.14	-34.34	Granite
16236_BH13	Drillhole	840104.98	830025.98	5.68	16/01/1992	40.00		0.00 to 16.00	16.00 to 23.00	23.00 to 29.65	29.65 to 37.50	37.50	2.50	16.00	7.00	6.65	7.85	-10.32	-17.32	-23.97	-31.82	-34.32	Granite
GIU Report No. 19389: Shatin Sewage Treatment works, Alteration Works for Septic Tank Sludge Reception																							
19389_BH1	Drillhole	840276.50	829729.09	6.04	01/08/1994	33.00		0.00 to 16.70	16.70 to 17.50	17.50 to 26.02	26.02 to 27.70	27.70	5.30	16.70	0.80	8.52	1.68	-10.66	-11.46	-19.98	-21.66	-26.96	GRANITE
19389_BH2	Drillhole	840268.11	829730.46	5.89	15/07/1994	34.00		0.00 to 16.70	16.70 to 17.50	17.50 to 27.15	27.15 to 29.05	29.05	4.95	16.70	0.80	9.65	1.90	-10.81	-11.61	-21.26	-23.16	-28.11	GRANITE
19389_BH3	Drillhole	840280.39	829738.11	5.97	21/07/1994	31.98		0.00 to 15.50		15.50 to 26.34	26.34 to 26.64	26.64	5.34	15.50		10.84	0.30	-9.53		-20.37	-20.67	-26.01	GRANITE
GIU Report No. 22093: Shatin New Town Stage II Road T6 and Interchange																							
22093_C01	Drillhole	839845.00	829976.00	5.98	07/01/1988	24.16		0.00 to 5.50	5.50 to 10.00	10.00 to 12.30	12.30 to 18.90	18.90	5.26	5.50	4.50	2.30	6.60	0.48	-4.02	-6.32	-12.92	-18.18	Granite
22093_C02	Drillhole	839849.00	830036.00	5.92	05/01/1988	14.10		0.00 to 4.40	4.40 to 5.30	5.30 to 5.80	5.80 to 8.60	8.60	5.50	4.40	0.90	0.50	2.80	1.52	0.62	0.12	-2.68	-8.18	Granite
22093_C03	Drillhole	839853.00	830095.00	5.83	31/12/1987	15.73		0.00 to 5.60		5.60 to 8.70	8.70 to 10.30	10.30	5.43	5.60	0.00	3.10	1.60	0.23		-2.87	-4.47	-9.9	Granite
22093_C04	Drillhole	839863.00	830160.00	5.63	09/01/1988	30.39		0.00 to 5.60	5.60 to 18.00	18.00 to 21.20	21.20 to 25.15	25.15	5.24	5.60	12.40	3.20	3.95	0.03	-12.37	-15.57	-19.52	-24.76	Granite
22093_C05	Drillhole	839847.00	830201.00	5.53	13/01/1988	27.68		0.00 to 12.30	12.30 to 17.00	17.00 to 20.00	20.00 to 22.50	22.50	5.18	12.30	4.70	3.00	2.50	-6.77	-11.47	-14.47	-16.97	-22.15	Granite

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
GIU Report No. 24736: RHKJC Shatin New Stables																							
24736_BH1	Drillhole	839938.43	829311.67	7.08	23/06/1993	36.33		0.00 to 17.30		17.30 to 28.70	28.70 to 31.05	31.05	5.28	17.30	0.00	11.40	2.35	-10.22		-21.62	-23.97	-29.25	RHYOLITE
24736_BH2	Drillhole	839914.25	829332.40	7.14	23/06/1993	37.32		0.00 to 19.00	19.00 to 20.45	20.45 to 29.95	29.95 to 32.20	32.20	5.12	19.00	1.45	9.50	2.25	-11.86	-13.31	-22.81	-25.06	-30.18	RHYOLITE
24736_BH3	Drillhole	839930.33	829353.28	7.18	23/06/1993	39.52		0.00 to 20.45		20.45 to 30.40	30.40 to 33.80	33.80	5.72	20.45	0.00	9.95	3.40	-13.27		-23.22	-26.62	-32.34	RHYOLITE
GIU Report No. 28030: Shatin Sewage Treatment Works, Stage III, Ground Investigation																							
28030_BH19	Drillhole	840124.58	830015.37	5.63	16/12/1997	38.37		0.00 to 19.30	19.30 to 20.90	20.90 to 27.75	27.75 to 27.75	27.75	10.62	19.30	1.60	6.85	0.00	-13.67	-15.27	-22.12	-22.12	-32.74	TUFF (?)
28030_BH20	Drillhole	840158.05	829951.58	5.50	03/01/1998	32.60		0.00 to 11.50	11.50 to 21.50	21.50 to 27.22	27.22 to 27.22	27.22	5.38	11.50	10.00	5.72	0.00	-6.00	-16.00	-21.72	-21.72	-27.1	GRANITE
28030_BH21	Drillhole	840167.08	830021.68	6.00	26/12/1997	37.17		0.00 to 19.00	19.00 to 25.00	25.00 to 31.70	31.70 to 31.70	31.70	5.47	19.00	6.00	6.70	0.00	-13.00	-19.00	-25.70	-25.70	-31.17	TUFF (?)
28030_BH22B	Drillhole	840240.71	829893.60	6.37	29/12/1997	34.23		0.00 to 21.70		21.70 to 28.85	28.85 to 28.85	28.85	5.38	21.70	0.00	7.15	0.00	-15.33		-22.48	-22.48	-27.86	RHYOLITE
28030_BH23	Drillhole	840265.32	829920.35	6.54	08/01/1998	33.86		0.00 to 16.55	16.55 to 17.40	17.40 to 28.35	28.35 to 28.35	28.35	5.51	16.55	0.85	10.95	0.00	-10.01	-10.86	-21.81	-21.81	-27.32	RHYOLITE
28030_BH24	Drillhole	840320.65	829852.15	6.55	08/01/1998	38.26		0.00 to 16.46	16.46 to 18.00	18.00 to 29.50	29.50 to 33.10	33.10	5.16	16.46	1.54	11.50	3.60	-9.91	-11.45	-22.95	-26.55	-31.71	GRANITE
28030_BH25	Drillhole	840346.27	829886.93	6.41	16/12/1997	37.66		0.00 to 17.05		17.05 to 27.30	27.30 to 32.51	32.51	5.15	17.05	0.00	10.25	5.21	-10.64		-20.89	-26.10	-31.25	GRANITE
28030_BH26	Drillhole	840349.70	829799.59	5.69	16/12/1997	33.12		0.00 to 14.80	14.80 to 15.82	15.82 to 27.58	27.58 to 27.58	27.58	5.54	14.80	1.02	11.76	0.00	-9.11	-10.13	-21.89	-21.89	-27.43	GRANITE
28030_BH27	Drillhole	840383.02	829837.67	5.67	30/12/1997	39.04		0.00 to 11.95	11.95 to 15.30	15.30 to 27.46	27.46 to 28.54	28.54	10.50	11.95	3.35	12.16	1.08	-6.28	-9.63	-21.79	-22.87	-33.37	GRANITE
GIU Report No. 28451: Shatin Sewage Treatment Works, Stage III, Ground Investigation (Phase II)																							
28451_BH01	Drillhole	840010.72	829935.59	6.07	22/04/1998	35.62		0.00 to 19.50	19.50 to 20.50	20.50 to 25.10	25.10 to 25.30	25.30	10.32	19.50	1.00	4.60	0.20	-13.43	-14.43	-19.03	-19.23	-29.55	GRANITE
28451_BH02	Drillhole	840017.71	829913.40	6.40	29/04/1998	31.27		0.00 to 18.65	18.65 to 21.15	21.15 to 25.64	25.64 to 25.64	25.64	5.63	18.65	2.50	4.49	0.00	-12.25	-14.75	-19.24	-19.24	-24.87	GRANITE
28451_BH03	Drillhole	840055.58	829956.57	6.29	23/04/1998	33.99		0.00 to 19.40	19.40 to 21.10	21.10 to 28.51	28.51 to 28.51	28.51	5.48	19.40	1.70	7.41	0.00	-13.11	-14.81	-22.22	-22.22	-27.7	GRANITE
28451_BH04	Drillhole	840040.17	829890.38	6.20	06/05/1998	31.17		0.00 to 19.20	19.20 to 22.50	22.50 to 25.53	25.53 to 25.53	25.53	5.64	19.20	3.30	3.03	0.00	-13.00	-16.30	-19.33	-19.33	-24.97	GRANITE
28451_BH05	Drillhole	840077.95	829937.14	6.10	29/04/1998	32.25		0.00 to 15.70	15.70 to 20.50	20.50 to 26.95	26.95 to 26.95	26.95	5.30	15.70	4.80	6.45	0.00	-9.60	-14.40	-20.85	-20.85	-26.15	GRANITE
28451_BH06	Drillhole	840083.04	829910.87	6.34	12/05/1998	38.68		0.00 to 17.10	17.10 to 20.45	20.45 to 33.40	33.40 to 33.40	33.40	5.28	17.10	3.35	12.95	0.00	-10.76	-14.11	-27.06	-27.06	-32.34	GRANITE
28451_BH07	Drillhole	840078.21	829853.73	5.93	09/04/1998	30.90		0.00 to 15.00	15.00 to 20.20	20.50 to 25.30	25.30 to 25.30	25.30	5.60	15.00	5.20	4.80	0.00	-9.07	-14.27	-19.37	-19.37	-24.97	GRANITE
28451_BH08	Drillhole	840117.29	829895.74	5.59	15/04/1998	33.78		0.00 to 14.70	14.70 to 20.00	21.00 to 28.08	28.08 to 28.32	28.32	5.46	14.70	5.30	7.08	0.24	-9.11	-14.41	-22.49	-22.73	-28.19	GRANITE
28451_BH09	Drillhole	840128.59	829850.11	4.94	14/04/1998	34.24		0.00 to 18.00	18.00 to 22.00	22.00 to 27.82	27.82 to 28.23	28.23	6.01	18.00	4.00	5.82	0.41	-13.06	-17.06	-22.88	-23.29	-29.3	GRANITE
28451_BH10	Drillhole	840097.91	829752.90	5.55	01/05/1998	38.83		0.00 to 13.59	13.59 to 18.40	18.40 to 27.60	27.60 to 27.60	27.60	11.23	13.59	4.81	9.20	0.00	-8.04	-12.85	-22.05	-22.05	-33.28	GRANITE
28451_BH11	Drillhole	840110.36	829739.17	5.34	12/05/1998	31.40		0.00 to 9.30	9.30 to 16.90	16.90 to 25.80	25.80 to 25.80	25.80	5.60	9.30	7.60	8.90	0.00	-3.96	-11.56	-20.46	-20.46	-26.06	GRANITE
28451_BH12	Drillhole	840149.36	829707.84	5.60	01/05/1998	34.06		0.00 to 10.60	10.60 to 16.60	16.60 to 28.42	28.42 to 28.42	28.42	5.64	10.60	6.00	11.82	0.00	-5.00	-11.00	-22.82	-22.82	-28.46	GRANITE
28451_BH13	Drillhole	840165.09	829694.97	5.24	09/05/1998	34.80		0.00 to 7.90	7.90 to 18.35	18.35 to 28.10	28.10 to 28.10	28.10	6.70	7.90	10.45	9.75	0.00	-2.66	-13.11	-22.86	-22.86	-29.56	MYLONITE
28451_BH14	Drillhole	840157.64	829847.56	5.36	12/05/1998	32.05		0.00 to 13.00	13.00 to 21.10	21.10 to 27.00	27.00 to 27.00	27.00	5.05	13.00	8.10	5.90	0.00	-7.64	-15.74	-21.64	-21.64	-26.69	GRANITE
28451_BH15	Drillhole	840220.30	829843.71	5.20	11/05/1998	32.13		0.00 to 8.30	8.30 to 19.50	19.50 to 26.85	26.85 to 26.85	26.85	5.28	8.30	11.20	7.35	0.00	-3.10	-14.30	-21.65	-21.65	-26.93	GRANITE
28451_BH16	Drillhole	840219.11	829793.92	5.84	23/04/1998	33.80		0.00 to 11.50	11.50 to 18.50	18.50 to 28.20	28.20 to 28.20	28.20	5.60	11.50	7.00	9.70	0.00	-5.66	-12.66	-22.36	-22.36	-27.96	GRANITE
28451_BH17	Drillhole	840274.05	829793.24	5.84	05/05/1998	38.55		0.00 to 12.50	12.50 to 17.00	17.00 to 27.75	27.75 to 27.75	27.75	10.80	12.50	4.50	10.75	0.00	-6.66	-11.16	-21.91	-21.91	-32.71	GRANITE
28451_BH18	Drillhole	840272.48	829744.80	5.98	18/04/1998	33.82		0.00 to 18.10		18.10 to 27.60	27.60 to 27.60	27.60	6.22	18.10	0.00	9.50	0.00	-12.12		-21.62	-21.62	-27.84	GRANITE
GIU Report No. 30479: Shatin Sewage Treatment Works, Stage III, Ground Investigation (Phase III)																							
30479_BH28	Drillhole	839771.13	829524.56	6.72	29/04/1999	32.50		0.00 to 18.00	18.00 to 20.00	20.00 to 26.50	26.50 to 27.00	27.00	5.50	18.00	2.00	6.50	0.50	-11.28	-13.28	-19.78	-20.28	-25.78	GRANITE
30479_BH29	Drillhole	839787.68	829505.74	6.80	07/05/1999	33.12		0.00 to 19.50	19.50 to 20.75	20.75 to 26.90	26.90 to 26.90	26.90	6.22	19.50	1.25	6.15	0.00	-12.70	-13.95	-20.10	-20.10	-26.32	GRANITE
30479_BH30	Drillhole	839972.84	829410.23	6.26	04/05/1999	35.45		0.00 to 16.00	16.00 to 18.00	18.00 to 29.05	29.05 to 30.20	30.20	5.25	16.00	2.00	11.05	1.15	-9.74	-11.74	-22.79	-23.94	-29.19	GRANITE
30479_BH31	Drillhole	839940.88	829907.49	5.81	27/04/1999	28.10		0.00 to 18.10	18.10 to 19.45	19.45 to 22.90	22.90 to 22.90	22.90	5.20	18.10	1.35	3.45	0.00	-12.29	-13.64	-17.09	-17.09	-22.29	GRANITE
GIU Report No. 31019: Widening of T6 Bridge, Sha Tin, Ground Investigation																							
31019_BH1	Drillhole	839964.67	829990.46	5.96	02/02/2000	47.17		0.00 to 18.50	18.50 to 19.30	19.30 to 31.65	31.65 to 37.04	37.04	10.13	18.50	0.80	12.35	5.39	-12.54	-13.34	-25.69	-31.08	-41.21	GRANITE
31019_BH2	Drillhole	839933.03	829985.52	6.01	22/01/2000	35.20		0.00 to 17.80	17.80 to 21.20	21.20 to 24.42	24.42 to 24.42	24.42	10.78	17.80	3.40	3.22	0.00	-11.79	-15.19	-18.41	-18.41	-29.19	GRANITE
GIU Report No. 34221: Proposed New Laboratory Building at Shatin Sewage Treatment Works																							
34221_DH1	Drillhole	839772.08	829541.30	6.55	09/12/2000	31.15		0.00 to 17.50	17.50 to 23.50	23.50 to 26.13	26.13 to 26.13	26.13	5.02	17.50	6.00	2.63	0.00	-10.95	-16.95	-19.58	-19.58	-24.6	Granite
34221_DH2	Drillhole	839793.27	829530.50	6.55	01/12/2000	32.49		0.00 to 16.50	16.50 to 21.70	21.70 to 27.26	27.26 to 27.26	27.26	5.23	16.50	5.20	5.56	0.00	-9.95	-15.15	-20.71	-20.71	-25.94	Granite
34221_DH3	Drillhole	839803.24	829501.25	6.42	06/12/2000	36.15		0.00 to 18.70	18.70 to 23.40	23.40 to 29.95	29.95 to 31.04	31.04	5.11	18.70	4.70	6.55	1.09	-12.28	-16.98	-23.53	-24.62	-29.73	Granite

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
34221_DH4	Drillhole	839760.93	829527.95	6.37	06/12/2000	31.17		0.00 to 19.10	19.10 to 23.10	23.10 to 25.85	25.85 to 25.85	25.85	5.32	19.10	4.00	2.75	0.00	-12.73	-16.73	-19.48	-19.48	-24.8	Granite
34221_DH5	Drillhole	839806.99	829485.41	6.44	11/12/2000	40.32		0.00 to 13.20	13.20 to 21.20	21.20 to 34.88	34.88 to 35.10	35.10	5.22	13.20	8.00	13.68	0.22	-6.76	-14.76	-28.44	-28.66	-33.88	Granite
34221_DH6	Drillhole	839753.09	829545.49	6.62	01/12/2000	32.81		0.00 to 17.30	17.30 to 23.30	23.30 to 25.30	25.30 to 27.73	27.73	5.08	17.30	6.00	2.00	2.43	-10.68	-16.68	-18.68	-21.11	-26.19	Granite
GIU Report No. 34386: Marine Police District & Divisional Headquarters and Operational Base, Ma Liu Shui																							
34386_DH1	Drillhole	840065.08	830169.81	5.73	04/05/2001	34.93		0.00 to 22.71		22.71 to 29.79	29.79 to 29.79	29.79	5.14	22.71	0.00	7.08	0.00	-16.98		-24.06	-24.06	-29.2	Granite
34386_DH2	Drillhole	840060.17	830138.06	4.97	14/05/2001	32.44		0.00 to 17.50	17.50 to 19.44	19.44 to 26.96	26.96 to 26.96	26.96	5.48	17.50	1.94	7.52	0.00	-12.53	-14.47	-21.99	-21.99	-27.47	Granite
34386_DH3	Drillhole	840042.36	830111.07	4.88	19/05/2001	33.96		0.00 to 17.10	17.10 to 18.72	18.72 to 25.65	25.65 to 25.65	25.65	8.31	17.10	1.62	6.93	0.00	-12.22	-13.84	-20.77	-20.77	-29.08	Granite
34386_DH4	Drillhole	840105.13	830137.99	4.92	14/05/2001	32.73		0.00 to 21.05		21.05 to 27.38	27.38 to 27.38	27.38	5.35	21.05	0.00	6.33	0.00	-16.13		-22.46	-22.46	-27.81	Granite
34386_DH5	Drillhole	840106.27	830103.96	0.00	04/05/2001	40.70		0.00 to 20.68		20.68 to 28.03	28.03 to 35.55	35.55	5.15	20.68	0.00	7.35	7.52	-15.61		-22.96	-30.48	-35.63	Granite
GIU Report No. 37431: Marine Police District & Divisional Headquarters and Operational Base, Ma Liu Shui, Sha Tin																							
37431_BH06	Drillhole	840047.26	830160.98	5.79	08/03/2003	30.00		0.00 to 17.50	17.50 to 20.00	20.00 to 30.00 *				17.50	2.50	10.00 *		-11.71	-14.21	-24.21 *		-24.21	
37431_BH07	Drillhole	840046.45	830143.20	5.12	21/03/2003	27.83		0.00 to 17.70	17.70 to 19.70	19.70 to 26.73	26.73 to 27.83*			17.70	2.00	7.03	1.10*	-12.58	-14.58	-21.61		-22.71	GRANITE
37431_BH08	Drillhole	840079.70	830157.53	4.96	28/03/2003	21.45		0.00 to 18.80	18.80 to 21.00	21.00 to 21.45 *				18.80	2.20	0.45 *		-13.84	-16.04	-16.49 *		-16.49	
37431_BH09	Drillhole	840067.49	830091.94	4.65	11/03/2003	20.08		0.00 to 16.80	16.80 to 19.00	19.00 to 20.08 *				16.80	2.20	1.08 *		-12.15	-14.35	-15.43 *		-15.43	
37431_BH10	Drillhole	840084.11	830067.48	4.98	17/03/2003	20.00		0.00 to 17.50	17.50 to 19.50	19.50 to 20.00 *				17.50	2.00	0.50 *		-12.52	-14.52	-15.02 *		-15.02	
37431_BH11	Drillhole	840063.21	830051.54	5.11	22/03/2003	20.00		0.00 to 18.10	18.10 to 20.00 *					18.10	1.90 *			-12.99	-14.89 *			-14.89	
GIU Report No. 42038: Shatin Sewage Treatment Works Stage I & II Installation of Groundwater Sampling Wells																							
42038_W01	Drillhole	839842.60	829652.55	5.93	23/05/2005	10.00	7.35 to 10.00	0.00 to 7.35 *						7.35 *				-1.42 *				-4.07	
42038_W02	Drillhole	839952.91	829689.78	6.58	02/06/2005	10.00	7.00 to 10.00	0.00 to 7.00 *						7.00 *				-0.42 *				-3.42	
42038_W03	Drillhole	839912.10	829833.96	5.61	28/05/2005	10.00	7.00 to 10.00	0.00 to 7.00 *						7.00 *				-1.39 *				-4.39	
42038_W04	Drillhole	840030.96	829780.58	6.53	31/05/2005	10.17	6.95 to 10.17	0.00 to 6.95 *						6.95 *				-0.42 *				-3.64	
42038_W05	Drillhole	839927.85	829493.26	5.60	28/05/2005	10.00	6.00 to 10.00	0.00 to 6.00 *						6.00 *				-0.40 *				-4.4	
42038_W06	Drillhole	839976.75	829449.85	5.82	31/05/2005	10.00	6.00 to 10.00	0.00 to 6.00 *						6.00 *				-0.18 *				-4.18	
42038_W07	Drillhole	839910.03	829594.04	5.58	26/05/2005	10.00	7.00 to 10.00	0.00 to 7.00 *						7.00 *				-1.42 *				-4.42	
42038_W08	Drillhole	840024.08	829442.94	5.93	01/06/2005	10.00	7.75 to 10.00	0.00 to 7.75 *						7.75 *				-1.82 *				-4.07	
42038_W09	Drillhole	839979.99	829623.32	5.56	21/05/2005	10.08	7.00 to 10.08	0.00 to 7.00 *						7.00 *				-1.44 *				-4.52	
42038_W10	Drillhole	840045.13	829567.14	5.63	25/05/2005	10.00	6.00 to 10.00	0.00 to 6.00 *						6.00 *				-0.37 *				-4.37	
42038_W11	Drillhole	840088.34	829533.51	5.43	26/05/2005	10.00	6.00 to 10.00	0.00 to 6.00 *						6.00 *				-0.57 *				-4.57	
42038_W12	Drillhole	840050.62	829620.43	6.36	04/06/2005	10.00	7.00 to 10.00	0.00 to 7.00 *						7.00 *				-0.64 *				-3.64	
42038_W13	Drillhole	840131.15	829552.80	6.68	07/06/2005	10.00	7.00 to 10.00	0.00 to 7.00 *						7.00 *			0.00*	-0.32 *				-3.32	
42038_W14	Drillhole	840199.87	829620.19	6.53	08/06/2005	10.00	7.70 to 10.00	0.00 to 7.70 *						7.70 *				-1.17 *				-3.47	
42038_W15	Drillhole	840136.66	829826.69	5.85	07/06/2005	10.20	9.00 to 10.20	0.00 to 9.00 *						9.00 *				-3.15 *				-4.35	
42038_W16	Drillhole	840164.11	829730.15	5.67	18/05/2005	10.00	6.40 to 10.00	0.00 to 6.40 *						6.40 *				-0.73 *				-4.33	
42038_W17	Drillhole	840229.02	829672.09	5.63	18/05/2005	10.00	7.50 to 10.00	0.00 to 7.50 *						7.50 *				-1.87 *				-4.37	
42038_W18	Drillhole	840260.74	829809.71	5.65	10/06/2005	10.20	7.00 to 10.20	0.00 to 7.00 *						7.00 *				-1.35 *				-4.55	
GIU Report No. 44237: Uprating of Sha Tin Salt Water Supply System, Sha Tin Seafront No. 2 Salt Water Pumping Station																							
44237_DH01	Drillhole	840155.08	830033.02	5.68	24/08/2006	34.90		0.00 to 17.50	17.50 to 19.10	19.10 to 28.20	28.20 to 29.39	29.39	5.51	17.50	1.60	9.10	1.19	-11.82	-13.42	-22.52	-23.71	-29.22	GRANITE
44237_DH02	Drillhole	840160.73	830039.81	5.67	19/09/2006	36.19		0.00 to 18.00	18.00 to 19.00	19.00 to 29.80	29.80 to 29.99	29.99	6.20	18.00	1.00	10.80	0.19	-12.33	-13.33	-24.13	-24.32	-30.52	GRANITE
44237_DH03	Drillhole	840171.17	830051.86	5.68	24/08/2006	35.63		0.00 to 21.40		21.40 to 29.00	29.00 to 30.40	30.40	5.23	21.40	0.00	7.60	1.40	-15.72		-23.32	-24.72	-29.95	GRANITE
44237_DH04	Drillhole	840162.05	830029.88	5.63	05/09/2006	35.01		0.00 to 17.10	17.10 to 18.70	18.70 to 29.60	29.60 to 29.60	29.60	5.41	17.10	1.60	10.90	0.00	-11.47	-13.07	-23.97	-23.97	-29.38	GRANITE
44237_DH05	Drillhole	840170.55	830042.98	5.62	24/08/2006	40.09		0.00 to 18.95	18.95 to 20.63	20.63 to 28.50	28.50 to 35.71	35.71	4.38	18.95	1.68	7.87	7.21	-13.33	-15.01	-22.88	-30.09	-34.47	GRANITE
44237_DH06	Drillhole	840179.75	830052.58	5.61	24/08/2006	36.14		0.00 to 18.20	18.20 to 19.20	19.20 to 29.80	29.80 to 30.95	30.95	5.19	18.20	1.00	10.60	1.15	-12.59	-13.59	-24.19	-25.34	-30.53	GRANITE
44237_DH07	Drillhole	840159.43	830023.34	5.63	24/08/2006	34.52		0.00 to 18.20	18.20 to 20.87	20.87 to 29.05	29.05 to 29.05	29.05	5.47	18.20	2.67	8.18	0.00	-12.57	-15.24	-23.42	-23.42	-28.89	GRANITE
44237_DH08	Drillhole	840168.95	830034.36	5.60	24/08/2006	37.80		0.00 to 18.00	18.00 to 18.50	18.50 to 28.50	28.50 to 31.60	31.60	6.20	18.00	0.50	10.00	3.10	-12.40	-12.90	-22.90	-26.00	-32.2	GRANITE
44237_DH09	Drillhole	840179.04	830044.42	5.59	24/08/2006	36.62		0.00 to 18.50	18.50 to 19.95	19.95 to 29.45	29.45 to 31.31	31.31	5.31	18.50	1.45	9.50	1.86	-12.91	-14.36	-23.86	-25.72	-31.03	GRANITE
44237_DH10	Drillhole	840189.05	830054.71	5.53	24/09/2006	34.62		0.00 to 17.90	17.90 to 19.85	19.85 to 28.50	28.50 to 29.35	29.35	5.27	17.90	1.95	8.65	0.85	-12.37	-14.32	-22.97	-23.82	-29.09	GRANITE
GIU Report No. 44617: Sha Tin Sewage Treatment Works Stage I & II, Geotechnical Instrumentation for Monitoring of Ground Settlement Shatin																							
44617_EXT1	Drillhole	839799.66	829670.97	6.81	28/12/2006	24.02		0.00 to 9.50	9.50 to 21.50	21.50 to 22.69	22.69 to 22.69	22.69	1.33	9.50	12.00	1.19	0.00	-2.69	-14.69	-15.88	-15.88	-17.21	GRANITE

Borehole No.	Hole Type	Easting	Northing	Ground level (m PD)	Drilling Date	Hole Depth (m BGL)	Depth (m BGL)					Rock head (m BGL)	Thickness rock proved (m)	Thickness (m)				Level to base (m PD)			Rock head Level (m PD)	Base of borehole (m PD)	Geology below superficial deposits
							No Recovery	Fill	Marine Deposits	Alluvium	Saprolite			Fill	Marine Deposit	Alluvium	Saprolite	Fill	Marine Deposits	Alluvium			
44617_EXT2	Drillhole	839852.76	829650.41	6.13	28/12/2006	26.00		0.00 to 8.00	8.00 to 22.00	22.00 to 24.30	24.30 to 24.60	24.60	1.40	8.00	14.00	2.30	0.30	-1.87	-15.87	-18.17	-18.47	-19.87	GRANITE
44617_EXT3	Drillhole	839920.76	829609.94	5.61	29/12/2006	20.55		0.00 to 14.90	14.90 to 18.85	18.85 to 20.55 *				14.90	3.95	1.70 *		-9.29	-13.24	-14.94 *		-14.94	
44617_EXT3A	Drillhole	839926.56	829718.25	6.28	16/01/2007	28.86		0.00 to 13.50	13.50 to 21.50	21.50 to 27.00	27.00 to 27.40	27.40	1.46	13.50	8.00	5.50	0.40	-7.22	-15.22	-20.72	-21.12	-22.58	GRANITE
44617_EXT4	Drillhole	839964.02	829744.18	5.93	02/01/2007	24.80		0.00 to 18.70	18.70 to 23.00	23.00 to 23.57	23.57 to 23.57	23.57	1.23	18.70	4.30	0.57	0.00	-12.77	-17.07	-17.64	-17.64	-18.87	GRANITE
44617_EXT5	Drillhole	840044.06	829771.24	5.99	02/01/2007	30.20		0.00 to 14.00	14.00 to 17.10	17.10 to 28.59	28.59 to 28.93	28.93	1.27	14.00	3.10	11.49	0.34	-8.01	-11.11	-22.60	-22.94	-24.21	GRANITE
44617_EXT6	Drillhole	840163.83	829727.69	5.62	02/01/2007	29.00		0.00 to 8.80	8.80 to 15.90	15.90 to 27.60	27.60 to 27.60	27.60	1.40	8.80	7.10	11.70	0.00	-3.18	-10.28	-21.98	-21.98	-23.38	GRANITE
44617_EXT7	Drillhole	840234.55	829678.44	6.01	02/01/2007	32.18		0.00 to 11.55	11.55 to 16.00	16.00 to 29.20	29.20 to 31.15	31.15	1.03	11.55	4.45	13.20	1.95	-5.54	-9.99	-23.19	-25.14	-26.17	GRANITE
44617_INC1	Drillhole	839827.93	829718.95	5.58	16/01/2007	16.43		0.00 to 9.50	9.50 to 13.50		13.50 to 16.43*			9.50	4.00	0.00	2.93*	-3.92	-7.92			-10.85	GRANITE
44617_INC2	Drillhole	839830.51	829663.30	6.39	10/01/2007	25.27		0.00 to 9.20	9.20 to 22.56	22.56 to 24.00	24.00 to 24.00	24.00	1.27	9.20	13.36	1.44	0.00	-2.81	-16.17	-17.61	-17.61	-18.88	GRANITE
44617_INC3	Drillhole	839846.47	829624.78	6.18	30/12/2006	29.23		0.00 to 8.20	8.20 to 21.60	22.10 to 26.40	26.40 to 27.93	27.93	1.30	8.20	13.40	4.30	1.53	-2.02	-15.42	-20.22	-21.75	-23.05	GRANITE
44617_INC4	Drillhole	839881.18	829592.10	6.56	02/01/2007	42.51		0.00 to 13.30	13.30 to 19.30	19.30 to 27.10	27.10 to 41.38	41.38	1.13	13.30	6.00	7.80	14.28	-6.74	-12.74	-20.54	-34.82	-35.95	GRANITE
44617_INC5	Drillhole	839934.81	829685.47	6.66	03/01/2007	27.35		0.00 to 18.90	18.90 to 22.60	22.60 to 26.15	26.15 to 26.15	26.15	1.20	18.90	3.70	3.55	0.00	-12.24	-15.94	-19.49	-19.49	-20.69	GRANITE
44617_INC6	Drillhole	839977.67	829730.52	5.71	29/12/2006	30.64		0.00 to 17.68	17.68 to 22.50	22.50 to 29.30	29.30 to 29.43	29.43	1.21	17.68	4.82	6.80	0.13	-11.97	-16.79	-23.59	-23.72	-24.93	GRANITE
44617_INC8	Drillhole	840081.63	829793.09	5.98	03/01/2007	28.33		0.00 to 17.30	17.30 to 19.30	19.30 to 27.09	27.09 to 27.09	27.09	1.24	17.30	2.00	7.79	0.00	-11.32	-13.32	-21.11	-21.11	-22.35	GRANITE
44617_INC9	Drillhole	840184.68	829717.67	5.53	03/01/2007	28.32		0.00 to 9.80	9.80 to 15.80	15.80 to 26.35	26.35 to 26.81	26.81	1.51	9.80	6.00	10.55	0.46	-4.27	-10.27	-20.82	-21.28	-22.79	GRANITE
44617_PIE1	Drillhole	839841.98	829655.94	6.14	28/12/2006	25.75		0.00 to 11.20	11.20 to 23.60	23.60 to 24.05	24.05 to 24.60	24.60	1.15	11.20	12.40	0.45	0.55	-5.06	-17.46	-17.91	-18.46	-19.61	GRANITE
44617_PIE2	Drillhole	839970.85	829736.79	5.71	29/12/2006	28.27		0.00 to 20.80		20.80 to 26.90	26.90 to 26.90	26.90	1.37	20.80	0.00	6.10	0.00	-15.09		-21.19	-21.19	-22.56	GRANITE
GIU Report No. 46663: Proposed Deodourizer Concrete Plinths and Ultraviolet Disinfection Chamber at Sha Tin Sewage Treatment Works Sha Tin																							
46663_BH01	Drillhole	839991.56	829918.02	5.93	27/09/2007	36.11		0.00 to 17.90	17.90 to 19.00	19.00 to 25.93	25.93 to 25.93	25.93	10.18	17.90	1.10	6.93	0.00	-11.97	-13.07	-20.00	-20.00	-30.18	GRANITE
46663_BH02	Drillhole	839984.54	829911.72	5.86	25/09/2007	37.51		0.00 to 16.80	16.80 to 19.80	19.80 to 27.35	27.35 to 27.35	27.35	10.16	16.80	3.00	7.55	0.00	-10.94	-13.94	-21.49	-21.49	-31.65	GRANITE
46663_BH03	Drillhole	839974.45	829823.55	6.43	20/10/2007	38.49		0.00 to 10.50	10.50 to 22.70	22.70 to 27.50	27.50 to 27.81	27.81	10.68	10.50	12.20	4.80	0.31	-4.07	-16.27	-21.07	-21.38	-32.06	GRANITE
46663_BH04	Drillhole	839980.41	829818.91	6.35	08/10/2007	38.62		0.00 to 14.30	14.30 to 24.00	24.00 to 28.00	28.00 to 28.00	28.00	10.62	14.30	9.70	4.00	0.00	-7.95	-17.65	-21.65	-21.65	-32.27	GRANITE
46663_BH05	Drillhole	839906.24	829744.36	6.48	20/10/2007	34.74		0.00 to 16.60	16.60 to 21.70	21.70 to 23.50	23.50 to 23.50	23.50	11.24	16.60	5.10	1.80	0.00	-10.12	-15.22	-17.02	-17.02	-28.26	GRANITE
46663_BH06	Drillhole	839910.57	829740.38	6.54	24/10/2007	33.50		0.00 to 14.15	14.15 to 20.57	20.57 to 23.20	23.20 to 23.40	23.40	10.10	14.15	6.42	2.63	0.20	-7.61	-14.03	-16.66	-16.86	-26.96	GRANITE
46663_BH07	Drillhole	839821.10	829644.44	6.63	06/10/2007	36.40		0.00 to 11.60	11.60 to 21.60	21.60 to 25.30	25.30 to 25.30	25.30	11.10	11.60	10.00	3.70	0.00	-4.97	-14.97	-18.67	-18.67	-29.77	GRANITE
46663_BH08	Drillhole	839825.66	829640.48	6.54	20/10/2007	36.91		0.00 to 9.00	9.00 to 23.00	23.00 to 24.05	24.05 to 26.42	26.42	10.49	9.00	14.00	1.05	2.37	-2.46	-16.46	-17.51	-19.88	-30.37	GRANITE
46663_BH09	Drillhole	839884.57	829433.34	7.05	28/09/2007	45.73		0.00 to 15.00	15.00 to 18.10	18.10 to 31.20	31.20 to 35.64	35.64	10.09	15.00	3.10	13.10	4.44	-7.95	-11.05	-24.15	-28.59	-38.68	GRANITE
46663_BH10	Drillhole	839889.13	829439.45	6.65	04/10/2007	44.12		0.00 to 18.00	18.00 to 19.00	19.00 to 29.80	29.80 to 33.50	33.50	10.62	18.00	1.00	10.80	3.70	-11.35	-12.35	-23.15	-26.85	-37.47	GRANITE
46663_BH11	Drillhole	839893.00	829444.02	6.59	03/10/2007	43.08		0.00 to 20.40		20.40 to 30.90	30.90 to 31.55	31.55	11.53	20.40	0.00	10.50	0.65	-13.81		-24.31	-24.96	-36.49	GRANODIORITE
46663_BH12	Drillhole	839971.13	829458.00	5.83	19/11/2007	51.93		0.00 to 13.00	13.00 to 18.80	18.80 to 28.63	28.63 to 37.60	37.60	14.33	13.00	5.80	9.83	8.97	-7.17	-12.97	-22.80	-31.77	-46.1	GRANITE
46663_BH13	Drillhole	839977.55	829452.20	5.92	09/11/2007	47.05		0.00 to 13.60	13.60 to 17.50	17.50 to 28.05	28.05 to 32.38	32.38	14.67	13.60	3.90	10.55	4.33	-7.68	-11.58	-22.13	-26.46	-41.13	GRANITE
46663_BH14	Drillhole	840043.88	829590.65	5.60	06/10/2007	60.60		0.00 to 7.80	7.80 to 17.90	17.90 to 33.70	33.70 to 36.10	36.10	24.50	7.80	10.10	15.80	2.40	-2.20	-12.30	-28.10	-30.50	-55.00	GRANITE
46663_BH15	Drillhole	840053.21	829586.31	5.88	06/10/2007	44.63		0.00 to 12.30	12.30 to 17.80	17.80 to 33.76	33.76 to 34.06	34.06	10.57	12.30	5.50	15.96	0.30	-6.42	-11.92	-27.88	-28.18	-38.75	GRANITE
46663_BH16	Drillhole	840054.54	829579.60	5.59	08/10/2007	44.85		0.00 to 15.30	15.30 to 18.85	18.85 to 31.50	31.50 to 33.88	33.88	10.97	15.30	3.55	12.65	2.38	-9.71	-13.26	-25.91	-28.29	-39.26	GRANITE
46663_BH17	Drillhole	840061.94	829573.65	5.63	23/10/2007	41.75		0.00 to 10.20	10.20 to 18.00	18.00 to 30.50	30.50 to 31.32	31.32	10.43	10.20	7.80	12.50	0.82	-4.57	-12.37	-24.87	-25.69	-36.12	GRANITE
46663_BH18	Drillhole	840197.35	829701.87	5.52	26/10/2007	35.93		0.00 to 10.20	10.20 to 16.80	16.80 to 25.70	25.70 to 25.70	25.70	10.23	10.20	6.60	8.90	0.00	-4.68	-11.28	-20.18	-20.18	-30.41	GRANITE
46663_BH19	Drillhole	840188.14	829710.31	5.59	23/10/2007	36.37		0.00 to 12.70	12.70 to 15.80	15.80 to 26.00	26.00 to 26.00	26.00	10.37	12.70	3.10	10.20	0.00	-7.11	-10.21	-20.41	-20.41	-30.78	GRANITE
46663_BH20	Drillhole	840324.00	829815.72	6.04	09/10/2007	38.83		0.00 to 10.70	10.70 to 16.50	16.50 to 27.30	27.30 to 27.55	27.55	11.28	10.70	5.80	10.80	0.25	-4.66	-10.46	-21.26	-21.51	-32.79	GRANITE
46663_BH21	Drillhole	840334.18	829806.95	6.13	05/10/2007	49.13		0.00 to 14.30	14.30 to 18.30	18.30 to 28.60	28.60 to 29.84	29.84	19.29	14.30	4.00	10.30	1.24	-8.17	-12.17	-22.47	-23.71	-43	GRANITE
46663_BH22	Drillhole	840263.91	829944.49	5.88	06/10/2007	45.76		0.00 to 18.50		18.50 to 35.00	35.00 to 35.15	35.15	10.61	18.50	0.00	16.50	0.15	-12.62		-29.12	-29.27	-39.88	GRANITE
46663_BH23	Drillhole	840269.53	829951.02	5.92	04/10/2007	39.38		0.00 to 17.40	17.40 to 20.70	20.70 to 28.60	28.60 to 28.60	28.60	10.78	17.40	3.30	7.90	0.00	-11.48	-14.78	-22.68	-22.68	-33.46	GRANITE
46663_BH24	Drillhole	840117.69	829933.39	6.03	25/09/2007	38.99		0.00 to 11.50	11.50 to 20.00	20.00 to 28.20	28.20 to 28.97	28.97	10.02	11.50	8.50	8.20	0.77	-5.47	-13.97	-22.17	-22.94	-32.96	GRANITE
46663_BH25	Drillhole	840119.70	829931.88	6.03	11/10/2007	39.10		0.00 to 12.80	12.80 to 19.45	19.45 to 28.43	28.43 to 28.43	28.43	10.67	12.80	6.65	8.98	0.00	-6.77	-13.42	-22.40	-22.40	-33.07	GRANITE
46663_BH26	Drillhole	839961.67	829471.28	5.77	09/11/2007	46.68		0.00 to 9.60	9.60 to 18.40	18.40 to 28.20	28.20 to 36.45	36.45	10.23	9.60	8.80	9.80	8.25	-3.83	-12.63	-22.43	-30.68	-40.91	TUFF AND GRANITE
46663_BH27	Drillhole	839971.64	829462.83	5.76	09/11/2007	46.40		0.00 to 11.30	11.30 to 16.40	16.40 to 28.47	28.47 to 34.87	34.87	11.53	11.30	5.10	12.07	6.40	-5.54	-10.64	-22.71	-29.11	-40.64	GRANITE
GIU Report No. 52095: Improvement of Storm Water Quality at Shatin Racecourse																							
52095_BH01	Drillhole	839892.10	829334.40	7.15	26/07/2004	25.13		0.00 to 12.65	12.65 to 17.20	17.20 to 25.13 *				12.65	4.55	7.93 *		-5.50	-10.05	-17.98 *	-17.98		
52095_BH02	Drillhole	839880.50	829312.60	8.91	29/07/2004	25.20		0.00 to 18.35	18.35 to 20.50	20.50 to 25.20 *				18.35	2.15	4.70 *		-9.44	-11.59	-16.29 *	-16.29		
52095_BH03	Drillhole	839646.00	829306.70	7.73	22/07/2004	25.60		0.00 to 20.86	20.86 to 22.90	22.90 to 25.60 *				20.86	2.04	2.70 *		-13.13	-15.17	-17.87 *	-17.87		

Appendix 13.02

Summary of Water Level Readings from Standpipes at STSTW Site

Appendix 13.02: Summary of Water Level Readings from Standpipes at STSTW Site

Hole No.	Easting	Northing	Ground Level	Piezo Tip Depth (m BGL)	Piezo Level (m PD)	Monitoring Dates		Water Depth (m BGL)			Water level (m PD)			Geology at tip depth
						Start	End	Minimum	Average	Maximum	Highest	Average	Lowest	
GIU Report No. 31019: Widening of T6 Bridge, Sha Tin, Ground Investigation														
31019_BH1	839964.67	829990.46	5.96	37	-31.04	19/02/2000	26/02/2000	0.35	0.45	0.52	5.61	5.51	5.44	III-V GRANITE *1
31019_BH2	839933.03	829985.52	6.01	24	-17.99	01/02/2000	17/02/2000	4.3	4.42	4.52	1.71	1.59	1.49	ALL
GIU Report No. 37431: Marine Police District & Divisional Headquarters and Operational Base, Ma Liu Shui, Sha Tin														
37431_BH08	840079.7	830157.53	4.96	20	-15.04	08/04/2003	15/04/2003	2.63	2.66	2.69	2.33	2.30	2.27	MD
GIU Report No. 42038: Shatin Sewage Treatment Works Stage I & II Installation of Groundwater Sampling Wells														
42038_W01	839842.6	829652.55	5.93	9.5	-3.57	15/07/2005	22/07/2005	1.09	1.19	1.28	4.84	4.74	4.65	FILL
42038_W02	839952.91	829689.78	6.58	9.5	-2.92	15/07/2005	22/07/2005	2.31	2.44	2.56	4.27	4.14	4.02	FILL
42038_W03	839912.1	829833.96	5.61	9.5	-3.89	15/07/2005	22/07/2005	1.9	2.02	2.14	3.71	3.59	3.47	FILL
42038_W04	840030.96	829780.58	6.53	9.5	-2.97	15/07/2005	22/07/2005	2.68	2.76	2.85	3.85	3.77	3.68	FILL
42038_W05	839927.85	829493.26	5.6	9.5	-3.9	15/07/2005	22/07/2005	1.63	1.67	1.71	3.97	3.93	3.89	FILL
42038_W06	839976.75	829449.85	5.82	9.5	-3.68	15/07/2005	22/07/2005	2.05	2.13	2.21	3.77	3.69	3.61	FILL
42038_W07	839910.03	829594.04	5.58	9.5	-3.92	15/07/2005	22/07/2005	1.59	1.64	1.69	3.99	3.94	3.89	FILL
42038_W08	840024.08	829442.94	5.93	9.5	-3.57	15/07/2005	22/07/2005	3.35	3.39	3.45	2.58	2.54	2.48	FILL
42038_W09	839979.99	829623.32	5.56	9.5	-3.94	15/07/2005	22/07/2005	2.01	2.11	2.21	3.55	3.45	3.35	FILL
42038_W10	840045.13	829567.14	5.63	9.5	-3.87	15/07/2005	22/07/2005	2.24	2.32	2.4	3.39	3.31	3.23	FILL
42038_W11	840088.34	829533.51	5.43	9.5	-4.07	15/07/2005	22/07/2005	2.07	2.15	2.25	3.36	3.28	3.18	FILL
42038_W12	840050.62	829620.43	6.36	9.5	-3.14	15/07/2005	22/07/2005	2.24	2.32	2.39	4.12	4.04	3.97	FILL
42038_W13	840131.15	829552.8	6.68	9.5	-2.82	15/07/2005	22/07/2005	2.99	3.05	3.12	3.69	3.63	3.56	FILL
42038_W14	840199.87	829620.19	6.53	9.5	-2.97	16/06/2005	23/06/2005	3.24	3.29	3.35	3.29	3.24	3.18	FILL
42038_W15	840136.66	829826.69	5.85	9.5	-3.65	15/07/2005	22/07/2005	2.19	2.25	2.33	3.66	3.60	3.52	FILL
42038_W16	840164.11	829730.15	5.67	9.5	-3.83	16/06/2005	23/06/2005	1.7	1.74	1.78	3.97	3.93	3.89	FILL
42038_W17	840229.02	829672.09	5.63	9.5	-3.87	16/06/2005	23/06/2005	2.63	2.69	2.75	3	2.94	2.88	FILL
42038_W18	840260.74	829809.71	5.65	9.5	-3.85	16/06/2005	23/06/2005	2.56	2.64	2.72	3.09	3.01	2.93	FILL
GIU Report No. 44237: Uprating of Sha Tin Salt Water Supply System, Sha Tin Seafront No. 2 Salt Water Pumping Station														
44237_DH07	840159.43	830023.34	5.63	20	-14.37	10/10/2006	17/10/2006	3.72	3.76	3.8	1.91	1.87	1.83	MD
44237_DH07	840159.43	830023.34	5.63	28	-22.37	10/10/2006	17/10/2006	3.62	3.78	3.85	2.01	1.85	1.78	ALL
44237_DH09	840179.04	830044.42	5.59	25	-19.41	21/09/2006	28/09/2006	3	3.47	3.78	2.59	2.12	1.81	ALL
44237_DH09	840179.04	830044.42	5.59	30.5	-24.91	21/09/2006	28/09/2006	2.93	3.21	3.51	2.66	2.38	2.08	IV GRANITE
GIU Report No. 44617: Sha Tin Sewage Treatment Works Stage I & II, Geotechnical Instrumentation for Monitoring of Ground Settlement Shatin														
44617_PIE1	839841.98	829655.94	6.14	10	-3.86	12/01/2007	19/01/2007	3.49	3.67	3.8	2.65	2.47	2.34	FILL
44617_PIE1	839841.98	829655.94	6.14	14.8	-8.66	12/01/2007	19/01/2007	4.22	4.26	4.28	1.92	1.88	1.86	MD
44617_PIE2	839970.85	829736.79	5.71	18	-12.29	18/01/2007	25/01/2007	0.6	2.32	2.82	5.11	3.39	2.89	FILL
44617_PIE2	839970.85	829736.79	5.71	22	-16.29	18/01/2007	25/01/2007	3.88	4.06	4.14	1.83	1.65	1.57	ALL

Appendix 13.03

Aerial Photograph Interpretation report for Sha Tin Sewage Treatment Works Site

Aerial Photograph Interpretation report for Sha Tin Sewage Treatment Works Site

Summary

The Sha Tin Sewage Treatment Works Site (herein after STSTW and Study Area) is a stretch of reclaimed land of 28 hectare in size located at the foot of Kau To Shan. The Study Area is bounded by Shui Chong Street and Sha Tin Hoi (Tide Cove) to the north, by Shing Mun River Channel and a bicycle track to the south. The reclamation at the Study Area began in 1974 and was completed in 1981. The STSTW was constructed in three stages, with stage I and stage II spanned from 1979 to 1982, 1982 to 1986 respectively, whilst stage III began in 2001 and was largely completed by 2005. The construction of the UV disinfection chamber began in 2008. The A Kung Kok portal of the THEES tunnel was constructed between 1990 and 1993

Development History

The Tai Po Road and KCRC East Rail, opened in 1902 and 1910 respectively, were constructed generally along the original coastline prior to the large scale reclamation for the Sha Tin New Town Development in the 1970's. Reclamation at the Study Area began in 1974, covering from the southwestern corner of the Study Area to Fo Tan Area, with fill material largely originated from a granitic ridge south of Kau To Hang. The reclamation for the majority of the Study Area began in 1976, with fill material originated from a volcanic spur on the northern side of Kau To Hang. The construction for the STSTW began before the reclamation was completed.

Building constructed in stage I include: staff quarters blocks A, B and C, the administration building and workshop, the northern block of the inlet works, twelve septic tanks, two return activated sludge (RAS) pumping stations, primary sedimentation tanks and aeration tanks, the power house and two fuel oil tanks, a transformer compound, the water reclamation house, the surplus activated sludge (SAS) thickening house, two sludge holding tanks, two biogas tanks and four digestors.

During the stage II extension of the STSTW, the number of septic tanks, primary sedimentation tanks and aeration tanks, sludge holding tanks, biogas tanks and digestors were doubled. The staff quarters blocks D and E, a second workshop and transformer compound, a third return activated sludge (RAS) pumping stations and the southern block of the inlet works were also added in this stage.

In between stage II and stage III, four sludge storage tanks, a sludge transfer pumping station and a pier were added next to the water reclamation house between 1990 and 1991. An effluent pumping station was added at the northwestern corner of the study area and new pipelines were also laid between the inlet works and the effluent pumping station between 1991 and 1993. The WSD Sha Tin Seafront Saltwater Pumping Station was constructed between 1993 and 1994 immediately next to the northwestern corner of the study area.

In stage III extension, the number of primary sedimentation tanks and aeration tanks were increased by five-sixth and the number of digestors by three quarters. The surplus activated sludge (SAS) thickening house was expanded by two-third. A boiler house was added next to the power house. The final sedimentation tanks, two return activated sludge (RAS) pumping stations, sludge dewatering house, air blower house, transformer and switchgear house and laboratory and information centre were also constructed in this stage. The construction of the UV disinfection chamber began in 2008 and was completed in 2010.

Observation

Year	Photo No.	Elevation	Observation
6/11/1945	Y742	20000	Single photo covering the area northwest to the present day Sha Tin Sewage Treatment Works Site (herein after Study Area). Tai Po Road and KCRC East Rail Line and the associated slopes were formed prior to 1945. Agricultural activities were observed along the Kau To Hang and Ma Liu Shui. A footpath was formed on the northern side of Kau To Hang adjoining the Tai Po Road - Ma Liu Shui Section.
24/4/1949	Y2118 and Y2119	5800	Photo covering the coastline from Fo Tan to Ma Liu Shui. The cut and fill slopes along Tai Po Road appeared highly reflective. Study Area was not yet reclaimed and was part of Sha Tin Hoi (Tide Cove).
28/12/1956	Y3891 and Y3892	16700	No significant change at the Study Area. Chung Chi Road was formed. Construction of the Chinese University of Hong Kong was in progress.
26/1/1963	Y8767, Y8768 and Y8769	3900	No significant change at the Study Area. Slope cutting was observed above the Study Area at Kau To Shan. Construction of the Chinese University of Hong Kong was in progress.
2/2/1963	Y9347, Y9348 and Y9349	3900	No significant change at the Study Area.
26/2/1963	Y9268, Y9269 and Y9270	8000	No significant change at the Study Area. Construction of the Chinese University of Hong Kong was in progress.
16/12/1964	Y12389, Y12390 and Y12391	1800	No significant change at the Study Area.
16/12/1964	Y12451, Y12452, Y12453, Y12454, Y12455 and Y12456	1800	Photo covering the coastline from Fo Tan to Ma Liu Shui. No significant change at the Study Area. Construction of the Chinese University of Hong Kong was in progress.
1968	Y14488 and Y14489	2000	Photo covering the present day Racecourse station area. Reclamation off the coast of Lok Lo Ha was completed. Tai Po Road - Sha Tin Section was modified and shifted east on to the new reclamation. Rail tracks were laid and a train yard was constructed at the Racecourse station.
20/12/1973	(Blank)7940 and (Blank)7941	12500	No significant change at the Study Area. The Seaview Villa was constructed. Construction of the Chinese University of Hong Kong was completed.
28/2/1974	(Blank)8246	12500	No significant change at the Study Area. Excavation began at Kau To Shan.
25/11/1974	(Blank)10080, (Blank)10081 and (Blank)10082	12500	Reclamation began at the southwestern corner of the Study Area (present day stables area of the Racecourse and the DSD staff quarters and information centre of the STSTW). Fill material possibly originated from the excavation of the Kau To Shan to the northwest of the Study Area. Extensive excavation and reclamation was observed on either side of Sha Tin Hoi (Tide Cove).
19/12/1975	(Blank)11756 and (Blank)11757	12500	The reclamation between the site of Sha Tin Sewage Treatment Works and the Fo Tan Station was almost completed.
28/8/1976	(Blank)15205 and (Blank)15206	2400	Partial coverage of the northeastern portion of the Study Area. Lai Ping Road was being formed along the existing footpath on the northern side of Kau To Hang. A road was cut on the spur northeast of Seaview Villa above the Tai Po Road and along the southern side of Kau To Hang, connecting to the Study Area by elevated driveways above Tai Po Road and the

Year	Photo No.	Elevation	Observation
			East Rail and a fill ramp formed in front of Seaview Villa.
9/12/1977	(Blank)19896 and (Blank)19897	12500	The reclamation has extended to the present day northern limit of the Study Area. Kau To Shan Road was formed and the previously excavated area was converted into a series of cut platforms. An access road was observed connecting Lai Ping Road and a series of road cuts, fill ramps and elevated driveways across Kau To Hang, Tai Po Road and the East Rail, providing a transportation route between the new excavation to the north across Kau To Hang and the Study Area. Extensive excavation and reclamation was in progress in Sha Tin Hoi (Tide Cove). The Sha Tin Racecourse was under construction. Tai Po Road - Sha Tin Section at the Racecourse was being modified.
10/1/1978	(Blank)20709 and (Blank)20710	12500	No significant change at the Study Area. Tai Po Road - Sha Tin Section at the Racecourse was being modified. The reclamation on the northern side of Shing Mun River was almost completed, whilst the reclamation on the southern side was still in progress.
29/11/1979	(Blank)28204 and (Blank)28205	10000	The reclamation of the Study Area has extended to the present day northern boundary of the Shing Mun River Channel. The construction of the Sha Tin Sewage Treatment Works began. The staff quarters blocks A, B, and C, administration building and a workshop was being constructed at the southern portion of the Study Area. The construction of the septic tanks began. The Sha Tin Racecourse was completed. Tai Po Road - Sha Tin Section at the Racecourse was being modified.
18/6/1980	(Blank)30757 and (Blank)30758	4000	The reclamation of the Study Area was in the final stage. The construction of the Sha Tin Sewage Treatment Works continued. The construction of staff quarters blocks A, B, and C, administration building and workshop were in progress. More septic tanks and two return activated sludge (RAS) pumping stations (No. 1 and No. 2) were being constructed. The transportation route between the excavation and the Study Area was cut off. The elevated driveways across Tai Po Road and the East Rail were removed and the fill ramp in front of the Seaview Villa was leveled. Ma On Path, Ma Ling Path, Ma Lok Path, Ma Ying Path and Monte Path were formed. Tai Po Road - Sha Tin Section at the Racecourse was being modified.
27/10/1981	(Blank)39218 and (Blank)39219	10000	The reclamation of the Study Area was generally completed, with the location of the present day WSD Sha Tin Seafront Saltwater Pumping Station being the last to be filled. The construction of the Sha Tin Sewage Treatment Works continued. The construction of staff quarters blocks A, B, and C, administration building, workshop and the northern block of the inlet works were nearly completed. Twelve septic tanks and return activated sludge (RAS) pumping stations (No. 1 and No. 2) were constructed. The primary sedimentation tanks and aeration tanks were nearly completed. The power house and two fuel oil tanks were completed. The transformer compound was constructed next to the power house. The surplus activated sludge (SAS) thickening house was being constructed and two sludge holding tanks, two biogas tanks

Year	Photo No.	Elevation	Observation
			and four digestors were being built on its southwestern side. The water reclamation house was constructed at the northern portion of the Study Area. The remainder of the cut off spurs between the East Rail Line and the Study Area were leveled, whilst the spur northeast of Seaview Villa was being further cut back.
15/11/1981	(Blank)39698, (Blank)39699, (Blank)39700 and (Blank)39701	2000	Low flight photo covering the Study Area. No significant change.
10/10/1982	(Blank)44629 and (Blank)44630	10000	The phase I construction of the Sha Tin Sewage Treatment Works was nearly completed. The staff quarters blocks A, B, and C, the administration building, workshop and the northern block of the inlet works were completed. The primary sedimentation tanks and aeration tanks were completed. The surplus activated sludge (SAS) thickening house, two sludge holding tanks and four digestors were completed, whilst two biogas tanks were still being constructed. The spur northeast of Seaview Villa was cut off and that section of the East Rail was no longer in tunnel. Further reclamation was observed along the coastline north of Ma On Shan.
28/9/1983	(Blank)50019 and (Blank)50020	6500	The phase II construction of the Sha Tin Sewage Treatment began. Two biogas tanks were completed. Four septic tanks were being added between the existing septic tanks and the staff quarters. The southern block of the inlet works was being constructed. Groundwork began along the southwestern edge of the primary sedimentation tanks and aeration tanks for further expansion. Groundwork for more septic tanks, a return activated sludge (RAS) pumping station (No. 3) and a second set of primary sedimentation tanks and aeration tanks began north of the power house. New reclamation began to the east of the East Rail Line between the Study Area and Chinese University. Reclamation along the coastline north of Ma On Shan continued.
22/12/1983	(Blank)52213, (Blank)52214 and (Blank)52215	10000	The construction of Shui Chong Street, Tolo Highway and the staff quarters blocks D and E began. The primary sedimentation tanks and aeration tanks were being expanded by one-third along the southwestern edge. Two sludge holding tanks were being added next to the existing tanks. More digestors are being constructed to the north of the surplus activated sludge (SAS) thickening house. The construction for the southern block of the inlet works continued. Further reclamation was in progress east of the East Rail Line between the Study Area and Chinese University and along the coastline north of A Kung Kok and Ma On Shan. Reclamation along the coastline north of Ma On Shan continued.
29/8/1984	(Blank)55993, (Blank)55994 and (Blank)55995	4000	Shui Chong Street was formed. The construction of the Tolo Highway, staff quarters blocks D and E and the southern block of the inlet works continued. Eight more septic tanks and the return activated sludge (RAS) pumping station (No. 3) were completed. The construction for the digestors and the second set of primary sedimentation tanks and aeration tanks were in progress. A ferry terminal and a pier were constructed at the

Year	Photo No.	Elevation	Observation
			present day location of the Marine Outer Waters District Headquarters and Marine North Division of the Police Department. The reclamation to the east of the East Rail Line between the Study Area and Chinese University continued. Reclamation along the coastline north of Ma On Shan continued.
1/10/1985	(Blank)67276 and (Blank)67277	10000	The construction of the Tolo Highway, staff quarters blocks D and E and the southern block of the inlet works were completed. A workshop was added between the existing workshop and the inlet works. Two sludge holding tanks were completed. Four digestors were completed to the northeast of the surplus activated sludge (SAS) thickening house. The construction for two biogas gas tanks began next to the existing ones. Another transformer compound was constructed next to the existing one, roughly half its size, near the power house. The second set of primary sedimentation tanks and aeration tanks were completed. Sui Cheung Street was formed and Kiu Ha Road was being constructed. The reclamation to the east of the East Rail Line between the Study Area and Chinese University was completed and a bicycle track was constructed along the western edge of the new reclamation, crossing the Tolo Highway by a bridge next to the southern portion of the Study Area. The reclamation on the western side of the Mui Tsz Lam valley was completed whilst further reclamation along the coastline north of Ma On Shan was in progress.
28/4/1986	A4847 and A4848	4000	Fair stereo coverage of the Study Area. Kiu Ha Road was formed. The construction of the biogas tanks were in progress. A bridge across the Shing Mun River was being constructed from A Kung Kok to the southern boundary of the Study Area. Reclamation along the coastline north of Ma On Shan was in progress.
21/12/1986	A8095, A8096 and A8097	10000	The phase II construction of the Sha Tin Sewage Treatment Works was completed. The biogas tanks were completed. The bridge across the Shing Mun River was completed, connecting to a new section of bicycle track along the southern boundary of the Study Area, which was being extended along the western edge of the Study Area parallel to Shui Chong Street. Reclamation along the coastline north of Ma On Shan continued.
16/1/1988	A12008, A12009 and A12010	10000	No significant change at the Study Area. An L-shaped temporary structure was constructed at the junction of Shui Chong Street and Kiu Ha Road next to the ferry terminal. Reclamation along the coastline north of Ma On Shan continued.
6/5/1988	A13988, A13989 and A13990	4000	No significant change at the Study Area. The fill slopes in front of the Seaview Villa and at the junction of Tai Po Road and Kau To Shan Road was being modified. Reclamation along the coastline north of Ma On Shan continued.
17/1/1989	A16196 and A16197	4000	No significant change at the Study Area. Further reclaimation along the coastline north of Ma On Shan to the east of Mui Tsz Lam observed.
20/11/1989	A19334 and A19335	10000	The construction for the Tate's Cairn Highway was in progress. Three temporary structures were added within the northern

Year	Photo No.	Elevation	Observation
			portion of the Study Area on along the northern side of Kiu Ha Road. The Hong Kong Police Traffic New Territories South Ma Liu Shui Weigh Station was constructed at the junction of Kiu Ha Road and Shui Chong Street. Tai Po Road - Ma Liu Shui section was straightened at the Seaview Villa and at the junction of Tai Po Road and Kau To Shan Road and the associated slopes were modified. Further reclaimation along the coastline north of Ma On Shan to the east of Mui Tsz Lam observed.
26/11/1990	A24066, A24067 and A24068	4000	A temporary structure was constructed at the open space outside the power house. Four sludge storage tanks and a sludge transfer pumping station were being constructed near the water reclamation house at the northern portion of the Study Area. A pier was constructed next to the new sludge storage tanks. The construction for the Tate's Cairn Highway continued. The THEES Tunnel Portal was under construction. Further reclaimation along the coastline of north of Tai Shui Hang was in progress.
3/12/1990	A24314 and A24315	10000	No significant change at the Study Area. The construction for the Tate's Cairn Highway continued. The THEES Tunnel Portal was under construction. Further reclaimation along the coastline of north of Tai Shui Hang was in progress.
19/9/1991	A27101, A27102 and A27103	4000	The construction for the sludge storage tanks and sludge transfer pumping station were completed. Possible construction for new pipelines observed along the northwestern edge of the Study Area parallel Shui Chong Street. Construction for the effluent pumping station began. The bridge piers for a second bridge was being constructed across Shing Mun River Channel between A Kung Kok and the southeastern corner of the Study Area near the inlet works parallel the existing bicycle track bridge. The construction for the Tate's Cairn Highway was completed. The slope works at cut slope feature No. 7SE-A/C271 above the THEES portal was completed. The THEES portal was in progress. Reclaimation along the coastline of north of Tai Shui Hang continued.
19/10/1991	A28281 and A28282	10000	The construction of the effluent pumping station and pipelines along the northwestern edge of the Study Area continued. The construction of the bridge deck of the second bridge from A Kung Kok to the Study Area began. The THEES portal was in progress. Reclaimation along the coastline of north of Tai Shui Hang continued.
9/1/1992	CN2727, CN2728, CN2729 and CN2730	5000	Coloured low flight coverage of the Study Area. The construction of the effluent pumping station and pipelines along the northwestern edge of the Study Area continued. The construction for new pipelines began between the inlet works and the primary sedimentation tanks and aeration tanks at the southern portion of the Study Area. The construction of the bridge deck of the second bridge from A Kung Kok to the Study Area was in progress. Reclaimation along the coastline of north of Tai Shui Hang continued.
15/4/1992	A30157, A30158 and A30159	4000	The construction of the effluent pumping station, pipelines and bridge deck of the second bridge from A Kung Kok to the Study Area continued. The L-shaped temporary structure at the junction of Shui Chong Street and Kiu Ha Road next to the

Year	Photo No.	Elevation	Observation
			ferry terminal was demolished. The THEES portal was in progress. Reclaimation along the coastline of north of Tai Shui Hang continued.
6/10/1992	A31906, A31907 and A31908	4000	The construction of the effluent pumping station and bridge deck of the second bridge from A Kung Kok to the Study Area were completed. The pipelines along the northwestern boundary of the Study Area and between the inlet works and the primary sedimentation tanks and aeration tanks at the southern portion of the Study Area were completed and the ground surface was restored. Another section of new pipelines were being constructed between the septic tanks and workshops and administration building at the southern portion of the Study Area. The THEES portal was in progress. Reclaimation along the coastline of north of Tai Shui Hang continued.
30/5/1993	A34676, A34677, A34678 and A34679	4000	The pipelines between the septic tanks and workshops and administration building at the southern portion of the Study Area were completed and the ground surface was restored. The construction of the WSD Sha Tin Seafront Saltwater Pumping Station began. New slope cutting was observed in the valley west of Kau To Shan Road. The THEES portal was in progress. Reclaimation along the coastline of north of Tai Shui Hang continued.
6/12/1993	CN05605 and CN05606	10000	Coloured high flight stereopair. The construction of the WSD Sha Tin Seafront Saltwater Pumping Station continued. Reclamation along the coastline north of Ma On Shan was completed. Slope cutting in the valley west of Kau To Shan Road continued. The THEES portal was completed. Reclaimation along the coastline north of Tai Shui Hang and Ma On Shan were completed.
17/10/1994	A39070, A39071 and A39072	4000	No significant change at the Study Area. The construction of the WSD Sha Tin Seafront Saltwater Pumping Station was completed. Kau To Shan Road was being extended westward in to the valley. A fill slopes were formed between the slope cut in the valley and Tai Po Road and Tsun King Road was being constructed on the new fill slope connecting to the Royal Ascot.
12/2/1995	CN09743 and CN09744	10000	Hazy high flight coloured stereopair. No significant change at the Study Area. Two roundabouts were constructed at the junction between Tai Po Road - Ma Liu Shui section / Kau To Shan Road and Tai Po Road - Sha Tin section / Tsun King Road respectively.
30/8/1995	CN10699 and CN10700	3500	The temporary structure immediately next to the eastern side of the sludge storage tanks at Kiu Ha Road at the northern portion of the Study Area was demolished.
24/10/1996	CN14935 and CN14936	4000	No significant change at the Study Area.
23/7/1997	CN17750, CN17751 and CN17752	3500	No significant change at the Study Area.
1/11/1997	CN18805 and CN18806	10000	No significant change at the Study Area.
31/7/1998	A48099, A48100 and A48101	3500	The temporary structure at Kiu Ha Road at the northeastern corner of the Study Area was demolished. The temporary structure between the WSD Sha Tin Seafront Saltwater

Year	Photo No.	Elevation	Observation
			Pumping Station and the sludge storage tanks at Kiu Ha Road was expanded.
30/10/1998	A48692, A48693 and A48694	4000	No significant change at the Study Area.
11/11/1998	CN21531 and CN21532	8000	Hazy high flight coloured stereopair. No significant change at the Study Area.
3/9/1999	A49906 and A49907	5500	No significant change at the Study Area.
10/8/2000	CN27835, CN27836 and CN27837	3000	No significant change at the Study Area.
20/9/2001	CW33513 and CW33514	4000	The phase III construction of the Sha Tin Sewage Treatment Work began. Site formation was observed in the northern portion of the Study Area on either side of Kiu Ha Road. The temporary structures at the open space outside the power house and between the sludge storage tanks and the WSD Sha Tin Seafront Saltwater Pumping Station were demolished. A new building was added on the northwestern side of the WSD Sha Tin Seafront Saltwater Pumping Station.
20/11/2001	CW35569, CW35570 and CW35571	8000	The construction for the air blower house and the sludge dewatering house began between the sludge storage tanks and the WSD Sha Tin Seafront Saltwater Pumping Station. The transformer and switchgear house was being constructed opposite the effluent pumping station.
15/8/2002	CW42370 and CW42371	4000	The transformer and switchgear house and air blower house were completed whilst the sludge dewatering house was in progress. Four digestors were being added immediately next to the biogas tanks and existing digestors. The primary sedimentation tanks and aeration tanks between the digestors and Kiu Ha Road were being expanded. Site formation was observed between the staff quarters and the administration building at the southwestern portion of the Study Area.
9/10/2002	CW44830 and CW44831	8000	Construction for the digestors was in progress. The primary sedimentation tanks and aeration tanks between the digestors and Kiu Ha Road were being expanded by one-fold. The construction of the sludge dewatering house was nearly finished. Groundwork for the final sedimentation tanks and the return activated sludge (RAS) pumping station (No. 4) was in progress.
25/9/2003	CW49791 and CW49792	8000	The laboratory and information centre was being constructed between the administration building at the southwestern portion of the Study Area. The surplus activated sludge (SAS) thickening house was being expanded by two-third. A boiler house was being added to the power house. Four digestors were completed immediately next to the biogas tanks. The expansion for the primary sedimentation tanks and aeration tanks between the digestors and Kiu Ha Road were nearly finished. A third set of primary sedimentation tanks and aeration tanks were being constructed on the northern side of Kiu Ha Road next to the sludge storage tanks. The final sedimentation tanks and the return activated sludge (RAS) pumping station (No. 4) were being constructed. The sludge dewatering house was completed. New reclamation was observed along Tolo Highway east of University Station.
25/11/2003	CW52920 and	4000	The laboratory and information centre was in progress. The

Year	Photo No.	Elevation	Observation
	CW52921		expansion of the surplus activated sludge (SAS) thickening house was completed. The boiler house was completed. New digestors were being constructed next to the power house. The final sedimentation tanks were being constructed. The return activated sludge (RAS) pumping station (No. 4) was completed. The third set of primary sedimentation tanks and aeration tanks were being constructed.
4/3/2004	CW55823 and CW55824	4000	The laboratory and information centre was nearly finished. The new digestors, return activated sludge (RAS) pumping station (No. 5), final sedimentation tanks and the third set of primary sedimentation tanks and aeration tanks were being constructed.
11/9/2004	CW59100, CW59101 and CW59102	2000	The laboratory and information centre was completed. The construction for the new digestors was in progress. The final sedimentation tanks, return activated sludge (RAS) pumping station (No. 5) and the third set of primary sedimentation tanks and aeration tanks were nearly finished.
4/10/2004	CW60012, CW60013 and CW60014	8000	The construction for the new digestors was nearly finished. The final sedimentation tanks, return activated sludge (RAS) pumping station (No. 5) and the third set of primary sedimentation tanks and aeration tanks were completed.
21/11/2005	CW68933, CW68934 and CW68935	8000	The construction for the new digestors was completed. The reconstruction for the Marine Outer Waters District Headquarters and Marine North Division of the Police Department at the junction of Kiu Ha Road and Shui Chong Street was in progress.
6/11/2006	CW74334, CW74335 and CW74336	8000	No significant change at the Study Area. The reconstruction for the Marine Outer Waters District Headquarters and Marine North Division of the Police Department was completed.
30/11/2007	CS10141 and CS10142	6000	No significant change at the Study Area.
27/7/2008	CS15988, CS15989 and CS15990	6000	No significant change at the Study Area.
2/12/2008	CS21249, CS21250 and CS21251	6000	Construction of the UV disinfection chamber began.

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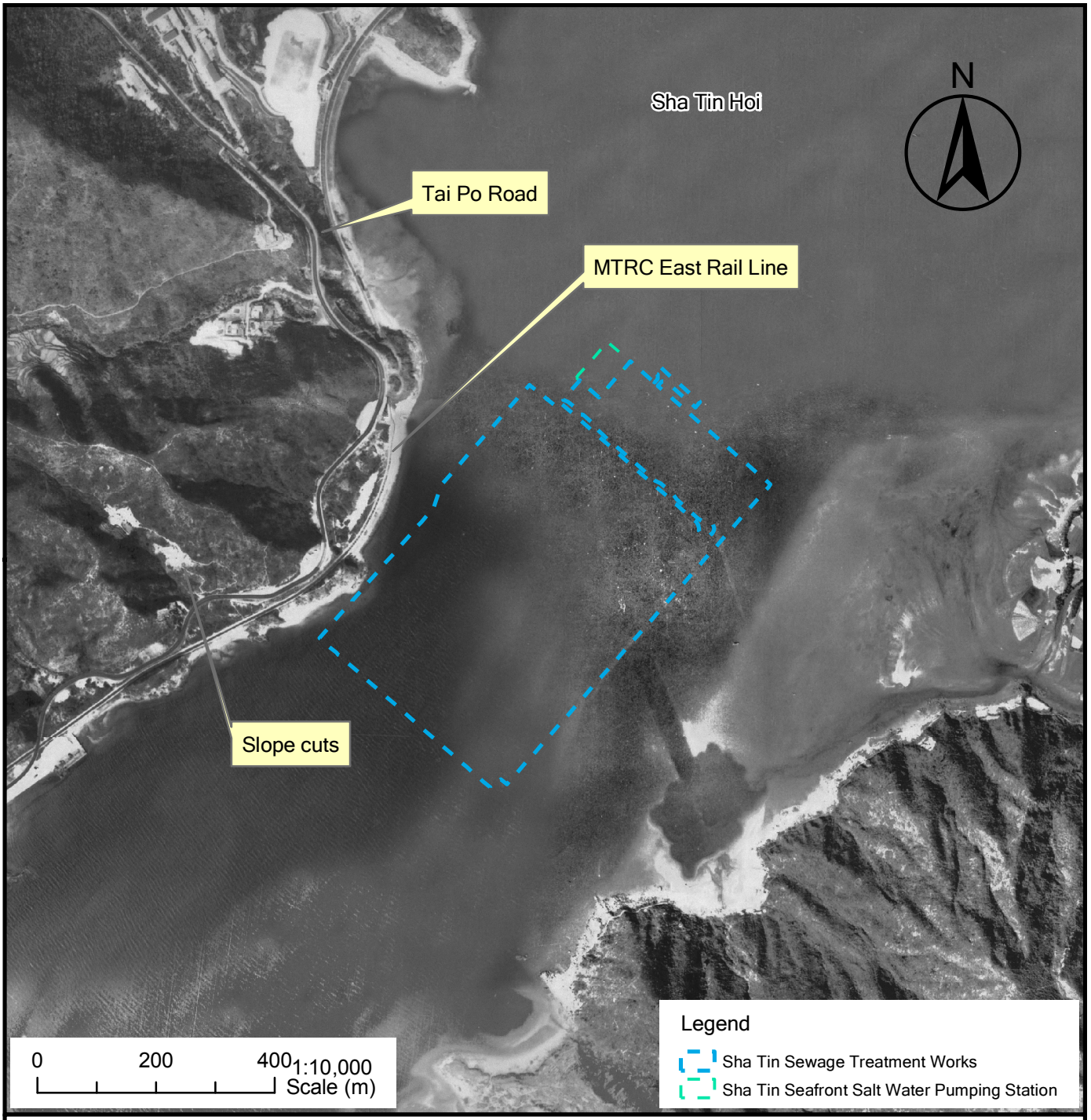

1963 Orthograph

Present day Sha Tin Sewage Treatment Works Site in 1963.

Tai Po Road and MTRC East Rail Line (formerly known as Kowloon-Canton Railway) and the associated slopes were formed prior to 1945.

Slope cutting was observed above the Study Area at Kau To Shan.

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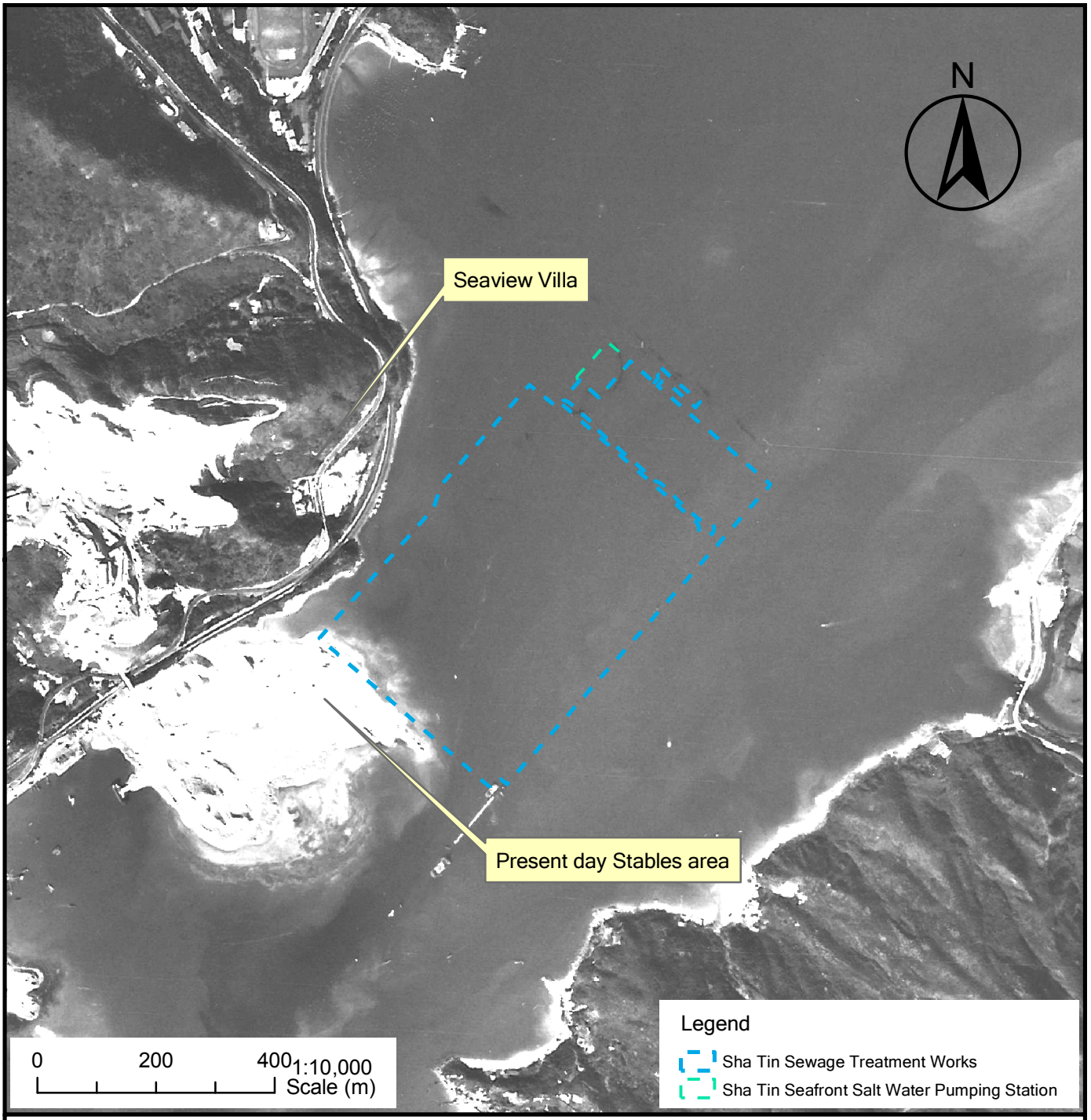

1974 (Blank)10080

Reclamation began at the southwestern corner of the Study Area (present day stables area of the Racecourse and the DSD staff quarters and information centre of the STSTW).

Fill material possibly originated from the excavation of the Kau To Shan to the northwest of the Study Area.

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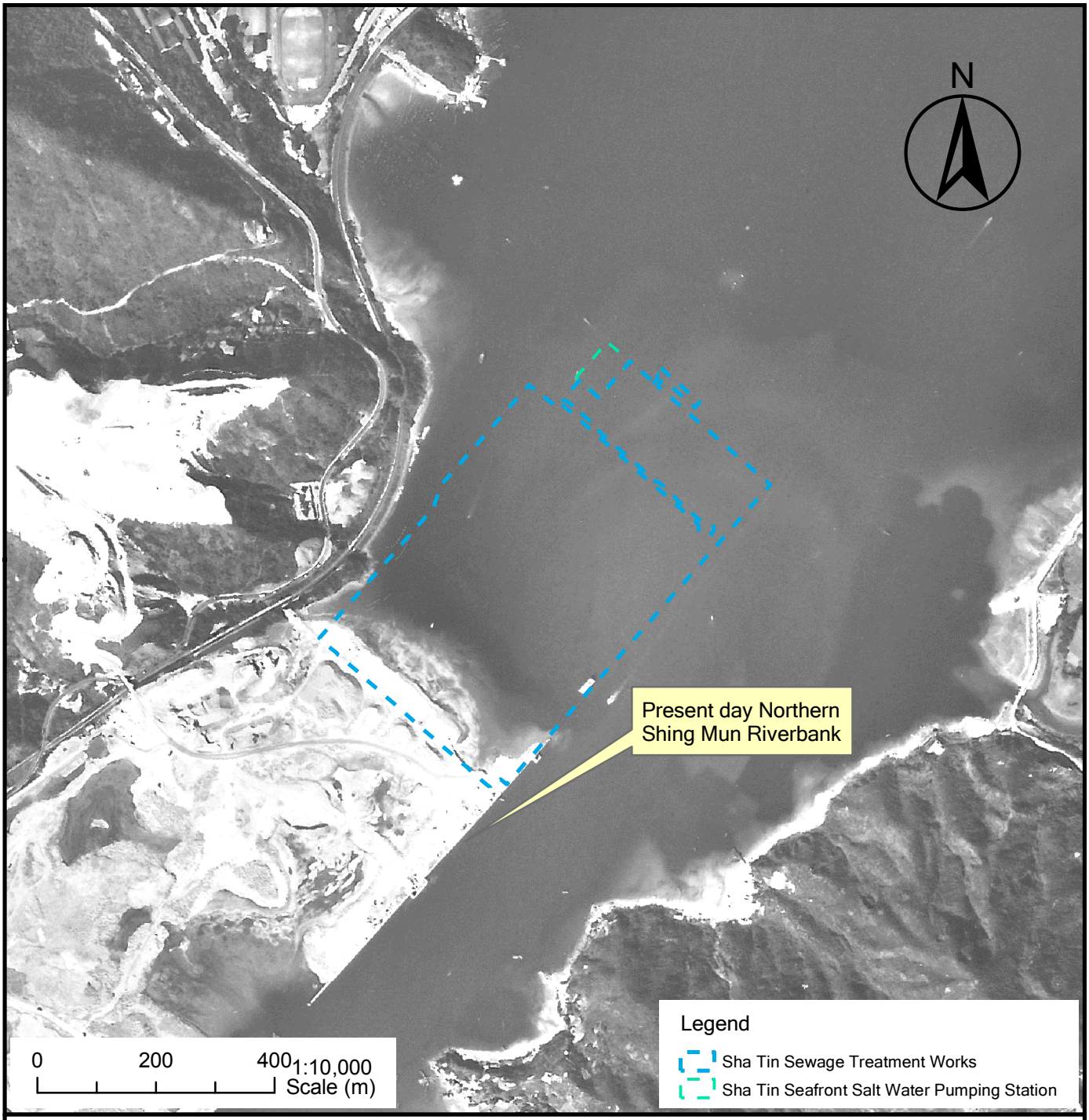

1975 (Blank)11757

The reclamation at the present day Sha Tin Racecourse was almost completed.

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1977 (Blank)19896

The reclamation has extended to the present day northern limit of the Study Area.

Kau To Shan Road was formed and the previously excavated area was converted into a series of cut platforms.

An access road was observed connecting Lai Ping Road and a series of road cuts, fill ramps and elevated driveways across Kau To Hang, Tai Po Road and the East Rail, providing a transportation route between the new excavation to the north across Kau To Hang and the Study Area.

The Sha Tin Racecourse was under construction.

Tai Po Road - Sha Tin Section at the Racecourse was being modified.

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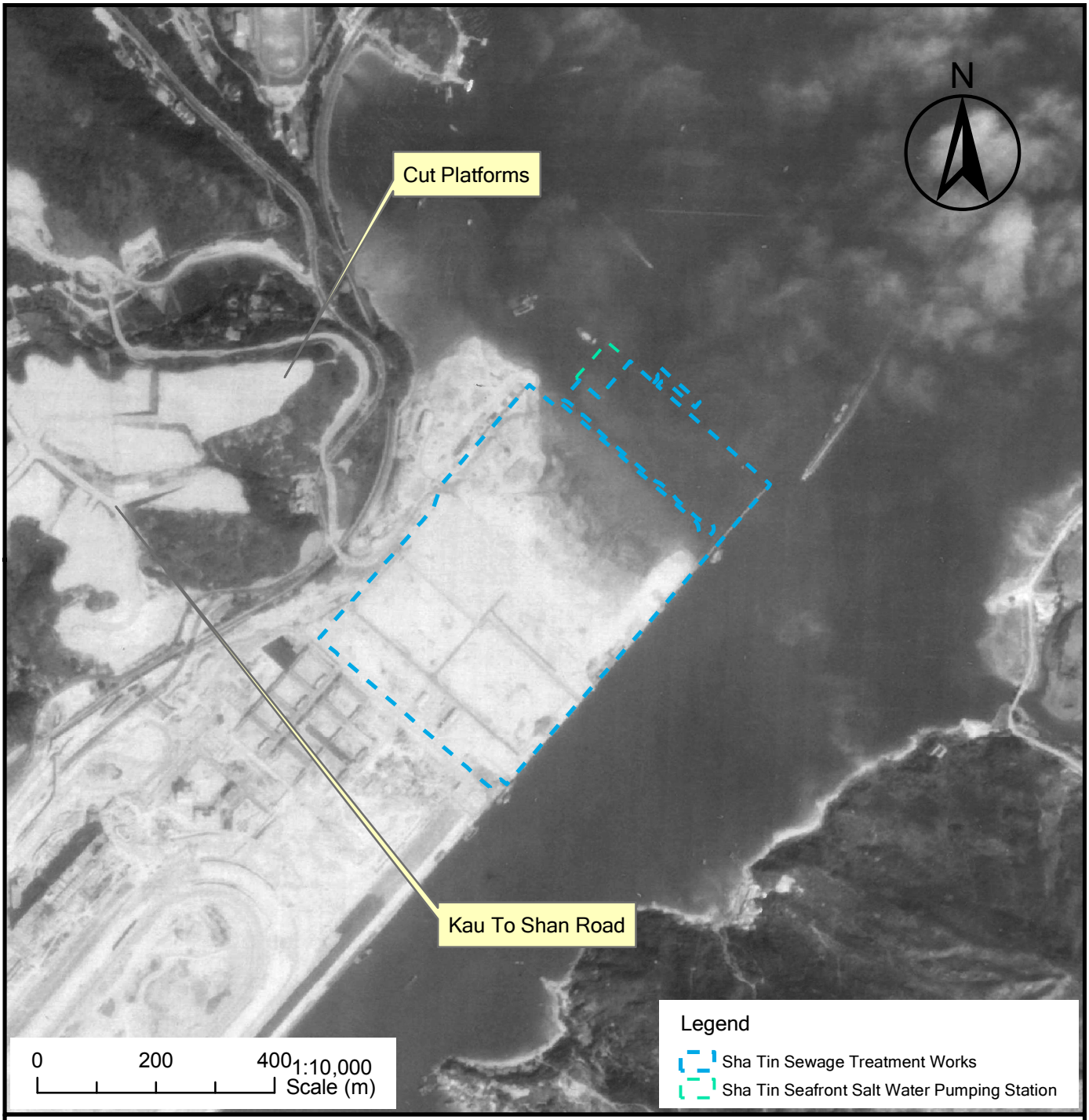

1978 (Blank)20709

The reclamation has proceeded further northeast in the Study Area.

The reclamation on the northern side of Shing Mun River was almost completed.

Tai Po Road - Sha Tin Section at the Racecourse was being modified.

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1979 (Blank)28205

The reclamation of the Study Area has extended to the present day northern boundary of the Shing Mun River Channel.

The construction of the Sha Tin Sewage Treatment Works began. The staff quarters blocks A, B, and C, administration building and a workshop was being constructed at the southern portion of the Study Area.

The construction of the septic tanks began.

The Sha Tin Racecourse was completed.

Tai Po Road - Sha Tin Section at the Racecourse was being modified.

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.:60269233 Date: APR. 2013

AERIAL PHOTOGRAPH INTERPRETATION FOR SHA TIN SEWAGE TREATMENT WORKS

AECOM

60269233/RPR/ Appendix 13.03-06

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Project Management Initials:

1982 Orthograph

The phase I construction of the Sha Tin Sewage Treatment Works was nearly completed.

The staff quarters blocks A, B, and C, the administration building, workshop and the northern block of the inlet works were completed.

The primary sedimentation tanks and aeration tanks were completed.

The surplus activated sludge (SAS) thickening house, two sludge holding tanks and four digestors were completed, whilst two biogas tanks were still being constructed.

The spur northeast of Seaview Villa was cut off and that section of the East Rail was no longer in tunnel.

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Project Management Initials:

1993 Orthograph

The pipelines between the septic tanks and workshops and administration building at the southern portion of the Study Area were completed and the ground surface was restored.

The construction of the WSD Sha Tin Seafront Saltwater Pumping Station began.

New slope cutting was observed in the valley west of Kau To Shan Road.

The THEES portal was completed. The two bridges across Shing Mun River were completed. The Pier to the northeast of the site was completed. Reclamation on the southeast side of Shing Mun River was completed.

Reclamation along the coastline of north of Tai Shui Hang continued.

Major improvements to the roads on both sides of Shing Mun River were completed.

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2009 Orthograph

Construction of the UV disinfection chamber was in progress.

No major changes to the reclamation or infrastructure at the site.

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AGREEMENT NO. CE43/2011 (DS)

RELOCATION OF SHA TIN SEWAGE TREATMENT WORKS TO CAVERNS - FEASIBILITY STUDY

Project No.:60269233 Date: APR. 2013

AERIAL PHOTOGRAPH INTERPRETATION FOR SHA TIN SEWAGE TREATMENT WORKS

AECOM

60269233/RPR/ Appendix 13.03-09

Appendix 14.01

Characterisation Results

SUSTAINABILITY EVALUATION REPORT

CHARACTERISATION RESULTS

Proposal Name: **Planning Review for Vacant Site of STSTW**

Variation Description: **Proposed Development in Vacant Site of STSTW**

Conservation, Environment and Agriculture

Will this initiative result in a change in...	Answer
Agricultural practices, land under cultivation or agricultural inputs and yields (including aquaculture and mariculture)?	No
Air emission control measures?	No
Environmental contamination or emissions including dioxin, asbestos, benzene, radon gas, and radio-active substances?	No
Environmental hygiene practices?	No
Interest and awareness of the population in conservation, wildlife protection and/or environmental protection?	No
The actual, or perceived, value of Hong Kong's habitat, ecological resources or biodiversity?	No
The extent, efficiency or maintenance of the water supply network?	No
The funding/budget available for managed habitat/conservation and country parks?	No
Water conservation, recycling or use of alternative sources to freshwater?	No

Demographics

Will this initiative result in a change in...	Answer
Household size or structure?	No
The availability of, demand for, or wages of skilled and productive workers?	Yes
The number of children of school going age?	No
The total population of Hong Kong?	No

Economics

Will this initiative result in a change in...	Answer
Average disposable income?	No
Income distribution?	No
Overall consumer prices and inflation for basic goods?	No
Overall cost of doing business or return on investment?	No
Savings/liquidity available locally and incentives for capital investment?	No

Education

Will this initiative result in a change in...	Answer
Places available for attaining higher education?	No

The quality of education, the extent of the curriculum or the time spent attending school/university?	No

Energy

Will this initiative result in a change in...	Answer
The amount of electricity used in Hong Kong?	No
The capacity of power generation, or the type of fuel or efficiency of power generators and other industries?	No
The relative price of fossil fuels and/or electricity?	No
The type of fuel used in vehicles or fuel efficiency?	No

Housing

Will this initiative result in a change in...	Answer
The distribution of housing or businesses/places of work?	Yes
The number of vacant housing units?	Yes
The purchase price of land or housing, or the average rental rate?	Yes
The quality of housing construction?	No
The total stock of housing?	Yes
The waiting period for public housing?	Yes

Industry

Will this initiative result in a change in...	Answer
The presence, type or total level of industrial activity (including businesses with environmental discharges or emissions)?	No
The type or efficiency of production technology used in industry (including businesses with environmental discharges or emissions)?	No

Land and Infrastructure

Will this initiative result in a change in...	Answer
Construction activity that may be in proximity to or affect population?	Yes
Construction activity that may impact areas of high ecological value?	No
Construction activity that may impact land in a natural state or land devoted to agriculture/fish farming?	No
Construction activity, demolition or excavation over an extended period?	Yes
Navigable and sheltered water space?	No
Reclamation or dredging activities or a change in marine water flow patterns?	No
The amount of land available for development in non-urban areas?	No
The amount of land available for development in urban areas or urban renewal?	No
The density of development and/or population in urban areas?	No
The extent of drainage, flood protection and soil protection infrastructure?	Yes
The size, number and integrity of water supply catchment areas, reservoirs and catchment drainage works?	No
The total stock of commercial and/or industrial buildings?	Yes

Social/Recreational/Cultural

Will this initiative result in a change in...	Answer
Construction work in proximity to or affecting archaeological sites or antiquities?	No
Exercising or physical fitness?	Yes
Food handling or food hygiene?	No
Government budget for recreation facilities, clubs, open spaces or community building?	Yes
Interest and awareness of the population in healthy living style, dietary or habits?	No
Provision of social services, expenditure on social services/welfare or infrastructure for social services (eg hospital, community centres)?	Yes
Public awareness/interest or government budget for historical/cultural sites or community issues?	No
The interest level, sponsorship, number or quality of community, entertainment or recreational events, or infrastructure for these events?	No
The proportion of elderly in the population and health of this age group?	No
The use of country park or natural areas for recreational purposes?	No

Transport

Will this initiative result in a change in...	Answer
Marine amenities/facilities, port efficiency or marine traffic safety?	No
Road infrastructure or traffic levels in proximity to significant population areas or other receptors?	Yes
The capacity of the airport or number of flights to/from the airport?	No
The ease and/or speed of walking for pedestrians?	Yes
The extent or convenience of the rail and/or public transport network or a change in the cost of its use?	Yes
The extent or convenience of the road network?	No
The mode of public transportation provision (bus/rail) or the transport technology employed?	No
The proximity of residential or other receptors to the airport or its flight path?	No
The public transport network in proximity to significant population?	Yes
The relative costs of public versus private transport?	No
The size of the port, the density of marine traffic or number of vessels using the port?	No
The total number of vehicles or vehicle movements in Hong Kong?	No

Waste and Waste Water

Will this initiative result in a change in...	Answer
The capacity or number of facilities for solid waste treatment, recycling, landfill or public dumps?	No
The extent or coverage of the sewage network, sewered areas or locations of sewage outfalls?	No
The level of private sector recycling activities?	No
Wastewater treatment technology or in the amount of wastewater arising, being treated or discharged?	No

Appendix 14.02

Variation Details

SUSTAINABILITY EVALUATION REPORT

VARIATION DETAILS

Proposal Name: **Planning Review for Vacant Site of STSTW**

Variation Description: **Proposed Development in Vacant Site of STSTW**

Variation Creation Date: Thursday, 25 April, 2013

Variation Assessment Year: 2013

Variation Justification: Proposed Development

Details (specification) of the Variation:

The following indicators have been selected for this scenario

Comp-lete	Indicator Name	Manual/ System	Indicator Description
+	Carbon Dioxide Emitted Per Year	System	Quantity (Tonnes) of carbon dioxide emitted per year
+	Construction Waste	System	Quantity of Construction Waste Requiring Final Disposal Per Capita
+	Cost-Benefit	System	Economic return as determined through cost benefit analysis
+	Criteria Air Pollutants	System	Composite index for Criteria Air Pollutants based on percentage of the Air Quality Objectives
+	Energy Consumption	System	Consumption of energy per unit of output ($ GDP)
+	Excessive Noise	System	Percentage of population exposed to excessive noise
+	Fixed Capital	System	Gross domestic fixed capital formation as a ratio to GDP
+	Freight Costs	System	The cost of road-based freight transport; the cost of charges and operating costs as a ratio to GDP
+	Income Differential	System	Difference between percentage change in the upper quartile of after-tax household income and percentage change in the lower quartile of after-tax household income.
+	Landfill Capacity	System	The total remaining landfill capacity (by volume)
+	Local Freshwater	System	Percentage of demand met by locally-derived freshwater resources
+	Marine Eco-Value	System	Area of Hong Kong of high marine ecological value
+	Marine Water Quality	System	Composite index for marine water quality pollutants based on percentage of the Water Quality Objectives
+	Open Space Shortfall	System	Percentage of population living within districts with a shortfall of required provision of open space
+	River Water Quality	System	Percent of EPD's river monitoring stations ranked 'Excellent' or 'Good' using the EPD River Water Quality Index
+	Significant Landscape Features (Area)	System	Area of Significant Landscape Features
+	Significant Landscape Features (Point)	System	Total number of point-based significant landscape features and old and valuable trees
+	Terrestrial Eco-Value	System	Area of Hong Kong of high terrestrial ecological value
+	Toxic Air Pollutants	System	Composite index for Toxic Air Pollutants based on percentage of Acceptable Risk

+	Travel Distance	System	Average Travel Distances; the distance in kilometers travelled by passengers during morning peak by all major groups of transport modes
+	Travel Speed	System	Average Network Speed; calculated as total passenger kilometers divided by total passenger hours
+	Unemployment Rate	System	Unemployment Rate

Reasons provided for manually adding indicators to the assessment

Indicator Name	Reason

Reasons provided for manually removing indicators from the assessment

Indicator Name	Reason

Assumptions Specific to the variation:

The specifics of the development parameters are presented in the following:
Site Area = 28.4 ha
Gross Site Area = 14.2 ha
Retail GFA = ~ 70,000 sq.m
Hotel GFA = ~ 22,000 sq.m
Domestic GFA = ~ 568,000 sq.m
No. of Flats = ~ 6,816 flats
Estimated Total Population = ~ 19,800 persons
Plot Ratio = ~ 4.65

Proposed road/ infrastructure improvements recommended:
J1 and J2

Non-Quantifiable Issues:

Economic Issues:
Social Issues:
Environment Issues:
Landscape Issues:
Possible relevant issues include:
- Any possible impact on the landscape feature or landscape character of HK (e.g. disruption to skyline/ridgeline/shoreline)?
- Would the project disrupt visual integrity/coherence of the original landscape?
- Any impact on the visibility of special landscape features or landmark?
- Would the variety and rarity of the landscape be diminished?
Other Issues:

Economic Issues:
Stimulating local economy

Social Issues:
Potential objections

Landscape Issues
Visual impact to adjacent resident

Appendix 14.03

Indicator Assessment

SUSTAINABILITY EVALUATION REPORT

INDICATOR ASSESSMENT

Proposal Name: **Planning Review for Vacant Site of STSTW**

Variation: **Proposed Development in Vacant Site of STSTW**

Sustainability Evaluation Report for: **Carbon Dioxide Emitted Per Year**

Indicator: Quantity (Tonnes) of carbon dioxide emitted per year

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2008 is 42000 Kilotonnes per year.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively small which represents a range of 1.00% to 5.00%, or values between 42420 and 44100, because of the growth of population and traffic in the region. With the increased traffic flow within the development, the carbon dioxide emitted from the vehicles will also be increased. Thus the indicator is expected to have a small increase .

Remarks: __

The base value on 31/12/2008 is 42000 Kilotonnes per year.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Construction Waste**

Indicator: Quantity of Construction Waste Requiring Final Disposal Per Capita

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2009 is 0.45 Kg per day per capita.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively small which represents a range of 5.00% to 10.00%, or values between .4725 and .495, because C&D materials would be generated from site formation and construction of the civil structures and access road. Basically, if possible, the excavated material will be used for the filling works. Filling works would include site formation, backfilling and access road construction.

Remarks: __

The base value on 31/12/2009 is 0.45 Kg per day per capita.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Cost-Benefit**

Indicator: Economic return as determined through cost benefit analysis

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2004 is 0 %.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively moderate which represents a range of 10.00% to 15.00%, or values between 0 and 0, because New development in the proposed site will attract people and firms fostering economic activities and employment opportunities. Residents will benefit from the enhanced social features and facilities.

Remarks: —

The base value on 31/12/2004 is 0 %.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Criteria Air Pollutants**

Indicator: Composite index for Criteria Air Pollutants based on percentage of the Air Quality Objectives

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2009 is 92.7 %.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively small which represents a range of 1.00% to 5.00%, or values between 93.627 and 97.335, because the major pollutant sources will be vehicular emission from the road traffic within the development, even with the requirement for the development to set back from the traffic road to maintain a certain distance between the emission sources and the receiver. It is expected that pollution due to the vehicular emission inside/ adjacent to the proposed development would be worsen and thus the indicator is expected to have small increase.

Remarks: —

The base value on 31/12/2009 is 92.7 %.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Energy Consumption**

Indicator: Consumption of energy per unit of output ($ GDP)

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2009 is 0.355734147 Terajoule per Million GDP.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively small which represents a range of 1.00% to 5.00%, or values between .359291488 and .373520854, because Increase in population thus increase in the electricity supply and gas supply.

Remarks: —

The base value on 31/12/2009 is 0.355734147 Terajoule per Million GDP.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Excessive Noise**

Indicator: Percentage of population exposed to excessive noise

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2010 is 17 % of Population.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively small which represents a range of 0.00% to 10.00%, or values between 17 and 18.7, because Introduction of noise sources and population in the development.

Remarks: —

The base value on 31/12/2010 is 17 % of Population.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Fixed Capital**

Indicator: Gross domestic fixed capital formation as a ratio to GDP

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2010 is 21.4 % GDP.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively moderate which represents a range of 5.00% to 15.00%, or values between 22.47 and 24.61, because The development will attract capital from both domestic and foreign investor.

Remarks: __

The base value on 31/12/2010 is 21.4 % GDP.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Freight Costs**

Indicator: The cost of road-based freight transport; the cost of charges and operating costs as a ratio to GDP

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2006 is 2 % GDP.

WITH the proposal:

This indicator is expected to remain the same because the enhanced roadworks between the proposed development and other parts of the territory could only mitigate the traffic impact induced from the increased population and activities in the proposed development, it has insignificant enhancement on the overall freight cost.

Remarks: __

The base value on 31/12/2006 is 2 % GDP.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Income Differential**

Indicator: Difference between percentage change in the upper quartile of after-tax household income and percentage change in the lower quartile of after-tax household income.

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2010 is 2.8 %.

WITH the proposal:

This indicator is expected to remain the same because The proposed planning development would not have any implication on the income differential.

Remarks: __

The base value on 31/12/2010 is 2.8 %.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Landfill Capacity**

Indicator: The total remaining landfill capacity (by volume)

WITHOUT the proposal:

This indicator is expected to decrease and the change is expected to be qualitatively small which represents a range of 3.00% to 5.00%, or values between 70149828.67 and 68703440.45, because __.

Remarks: __

The base value on 31/12/2009 is 72319411 cubic metres.

WITH the proposal:

This indicator is expected to decrease and the change is expected to be qualitatively small which represents a range of 3.00% to 5.00%, or values between 70149828.67 and 68703440.45, because During construction, non-inert materials shall be reused whenever possible and be disposed of at landfills as a last resort. Basically, if possible, the excavated material will be used for the filling works, the volume of materials disposed of at landfill will be estimated in the next stage.

Remarks: __

The base value on 31/12/2009 is 72319411 cubic metres.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Local Freshwater**

Indicator: Percentage of demand met by locally-derived freshwater resources

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2010 is 25.1 % Demand.

WITH the proposal:

This indicator is expected to remain the same because Freshwater would be consumed mainly by the resident and commercial activities within the proposed development. According to the Waterworks Impact Assessment in Section 9 of this report, an additional watermain would be extended from the existing water supply networks for the proposed development to meet the increased water demand. In view of the changes in the percentage of demand met by locally-drived freshwater resources is insignificant, thus the indicator would remain the same.

Remarks: __

The base value on 31/12/2010 is 25.1 % Demand.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Marine Eco-Value**

Indicator: Area of Hong Kong of high marine ecological value

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 30/04/2011 is 66993.1 hectare.

WITH the proposal:

This indicator is expected to remain the same because The proposed planning development would not have any implication on the area with high marine ecological value.

Remarks: __

The base value on 30/04/2011 is 66993.1 hectare.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Marine Water Quality**

Indicator: Composite index for marine water quality pollutants based on percentage of the Water Quality Objectives

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2010 is 83.7 %.

WITH the proposal:

This indicator is expected to remain the same because All sewage will be treated at the relocated STSTW before discharge and the proposed development will not produce any additional pollution loading into Sha Tin Hoi/ Tolo Harbour.

Remarks: __

The base value on 31/12/2010 is 83.7 %.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Open Space Shortfall**

Indicator: Percentage of population living within districts with a shortfall of required provision of open space

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2010 is 45.05 % of population.

WITH the proposal:

This indicator is expected to remain the same because Population will increase as a result of movements into the proposed development from other areas. Based on the development plan, the population in the development will not experience any shortfalls in open space due to sufficient provision of local and district open space. As a result, the indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2010 is 45.05 % of population.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **River Water Quality**

Indicator: Percent of EPD's river monitoring stations ranked 'Excellent' or 'Good' using the EPD River Water Quality Index

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: —

The base value on 31/12/2010 is 84.2 %.

WITH the proposal:

This indicator is expected to remain the same because The proposed planning development would not have any discharge to river. All sewage would be treated at the relocated STSTW before discharge.

Remarks: —

The base value on 31/12/2010 is 84.2 %.

Local / District / Sectoral Impact:

—

Sustainability Evaluation Report for: **Significant Landscape Features (Area)**

Indicator: Area of Significant Landscape Features

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: ___

The base value on 31/12/2008 is 262485.6 hectare.

WITH the proposal:

This indicator is expected to remain the same because The proposed planning development would not have any implication on the significant landscape features.

Remarks: ___

The base value on 31/12/2008 is 262485.6 hectare.

Local / District / Sectoral Impact:

___

Sustainability Evaluation Report for: **Significant Landscape Features (Point)**

Indicator: Total number of point-based significant landscape features and old and valuable trees

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: ___

The base value on 23/11/2011 is 1869 sites.

WITH the proposal:

This indicator is expected to remain the same because The proposed planning development would not have any implication on the significant landscape features.

Remarks: ___

The base value on 23/11/2011 is 1869 sites.

Local / District / Sectoral Impact:

___

Sustainability Evaluation Report for: **Terrestrial Eco-Value**

Indicator: Area of Hong Kong of high terrestrial ecological value

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: ___

The base value on 19/10/2010 is 44696.8 hectare.

WITH the proposal:

This indicator is expected to remain the same because The proposed planning development would not have any implication on the area with high terrestrial ecological value.

Remarks: __

The base value on 19/10/2010 is 44696.8 hectare.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Toxic Air Pollutants**

Indicator: Composite index for Toxic Air Pollutants based on percentage of Acceptable Risk

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2009 is 53 %.

WITH the proposal:

This indicator is expected to remain the same because the implementation of proposed development would not have any contribution to the toxic air pollutants generation in the region.

Remarks: __

The base value on 31/12/2009 is 53 %.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: **Travel Distance**

Indicator: Average Travel Distances; the distance in kilometers travelled by passengers during morning peak by all major groups of transport modes

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2006 is 10.5 Kilometres.

WITH the proposal:

This indicator is expected to remain the same because the enhanced roadworks between the proposed development and other parts of the territory could only mitigate the traffic impact induced from the increased population and activities in the proposed development, it has no impact on the travel distance.

Remarks: __

The base value on 31/12/2006 is 10.5 Kilometres.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: Travel Speed

Indicator: Average Network Speed; calculated as total passenger kilometers divided by total passenger hours

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2006 is 27 Kilometres per Hour.

WITH the proposal:

This indicator is expected to increase and the change is expected to be qualitatively small which represents a range of 0.00% to 5.00%, or values between 27 and 28.35, because With the enhanced roadworks between the proposed development and other parts of the territory, the average travel speed would be increase as the total passenger hours is reduced in light of the improved road networks and efficiency.

Remarks: __

The base value on 31/12/2006 is 27 Kilometres per Hour.

Local / District / Sectoral Impact:

__

Sustainability Evaluation Report for: Unemployment Rate

Indicator: Unemployment Rate

WITHOUT the proposal:

This indicator is expected to remain the same.

Remarks: __

The base value on 31/12/2010 is 4.4 %.

WITH the proposal:

This indicator is expected to decrease and the change is expected to be qualitatively small which represents a range of 1.00% to 5.00%, or values between 4.356 and 4.18, because With the implementation of the proposed planning development, job opportunities will be provided during construction stage. In addition, the proposed commercial building in the proposed planning development provides the opportunity for creation of new employment. As a result , this indicator will have a small decrease.

Remarks: __

The base value on 31/12/2010 is 4.4 %.

Local / District / Sectoral Impact:

—

Appendix 14.04

Social Checklist Questions

SUSTAINABILITY EVALUATION REPORT

CHECKLIST DETAILS

Proposal Name: **Planning Review for Vacant Site of STSTW**

Variation Description: **Proposed Development in Vacant Site of STSTW**

Variation Creation Date: Thursday, 25 April, 2013

Variation Assessment Year: 2013

Details (specification) of the Variation:

Social Checklist

Yes/No		Questions
		Will the proposal possibly affect ...
No	**1**	**the opportunities of such social groups as the elderly, children, youth, women and low income group, to participate in society and to fully develop themselves and not to be discriminated because of health, gender, financial or other constraints?**
No	**2**	**the safety net (in terms of social welfare and housing) for the disadvantaged groups such as the elderly, the infirm, the unemployed, the disabled and families with single parent?**
No	**3**	**the will and ability of the disadvantaged, the poor and the unemployed to achieve self-reliance?**
No	**4**	**family relationship and resilience, as well as family functioning?**
No	**5**	**people's sense of belonging to the society and/or people's involvement in the community as well as social cohesion, mutual support and networking?**
No	**6**	**Will the proposal bring about effects on the physical and / or mental health of the community (such as an increase or a decrease in communicable diseases, cancer and respiratory diseases due to a change in air pollutant levels etc)?**
No	**7**	**Will the potentially adverse health effects likely to be disproportionately greater for the vulnerable groups in the community (including elderly, children, the low income group, the homeless, pregnant women and disabled persons)? If yes, which groups?**
Yes	**8**	**the level of provision, quality and/or variety of sports, recreational or cultural facilities?**

- in what aspect will they be affected?

The provision and quality of recreational facilities will potentially be improved in the proposed development

- will the impact be positive or negative?

positive

- what will be the extent of impact?

Small

Reason :

A waterfront promenade with cycle track would be provided in the proposed development, also, the a water front open plaza and central park would be introduced in the proposed development to enhance its variety of recreational facilities.

- can the proposal be suitably revised in order to avoid the negative impact, if any, while achieving the intended objects?

N/A

- what measures can minimize the adverse impact?

N/A

Yes **9 people's participation in sports, recreational or cultural activities?**

- in what aspect will they be affected?
More people would participate in recreational activities with the provision of a waterfront promenade in the proposed development
- will the impact be positive or negative?
positive
- what will be the extent of impact?
Small
Reason :
There is no existing walkway/ cycletrack along the riverside adjacnet to the site. Thus the provision of new waterfront promenade with cycle track would attract more people in using the recreational facilities.
- can the proposal be suitably revised in order to avoid the negative impact, if any, while achieving the intended objects?
N/A
- what measures can minimize the adverse impact?
N/A

No **10 any archaeological site or buildings of cultural heritage?**

Yes **11 the waiting time for public rental housing?**

- in what aspect will they be affected?
The waiting time for public rental housing would potentially be shorten.
- will the impact be positive or negative?
positive
- what will be the extent of impact?
Very Small
Reason :
With the potential public housing in the proposed development, the supply of public housing would possibly be increase and thus the waiting time for public rental housing would potentially be shorten.
- can the proposal be suitably revised in order to avoid the negative impact, if any, while achieving the intended objects?
N/A
- what measures can minimize the adverse impact?
N/A

Yes **12 the rental level in the private housing market?**

- in what aspect will they be affected?
The rental rate in private housing market would potentailly be decrease.
- will the impact be positive or negative?
positive
- what will be the extent of impact?
Small
Reason :
With the increase in supply of private housing in the proposed development, the rental rate of private housing would possibly decrease.
- can the proposal be suitably revised in order to avoid the negative impact, if any, while achieving the intended objects?
N/A
- what measures can minimize the adverse impact?
N/A

No **13 the average living space per person?**

Yes **14 the number of people residing in inadequate housing?**

- in what aspect will they be affected?

The number of people residing in inadequate housing would potentially decrease.

- will the impact be positive or negative?

positive

- what will be the extent of impact?

Small

Reason :

With the potential provision of public rental housing in the proposed development, more people who currently residing in inadequate housing could possibly moved to public rental housing and thus the number of people residing in inadequate housing would be reduced.

- can the proposal be suitably revised in order to avoid the negative impact, if any, while achieving the intended objects?

N/A

- what measures can minimize the adverse impact?

N/A

No **15 access of people of working age to post-secondary education or above?**

First SD Strategy Checklist

Yes/No	Questions
	Will the proposal possibly affect the area of ...
No	**1 solid waste management?**
No	**2 renewable energy?**
No	**3 urban living space?**

Appendix 14.05

Sustainable Development Strategy Checklist

Appendix 14.05

Checklist Questions on the Three Pilot Areas
under the Government's First Sustainable Development Strategy

Solid Waste Management

Targets

1. To reduce the amount of municipal solid waste generated in Hong Kong by 1% per annum up to the year 2014, based on 2003 levels.
2. To increase the recovery rate of municipal solid waste to 45% by 2009 and 50% by 2014.
3. To reduce the total municipal solid waste disposed of in landfills to less than 25% by 2014.

- Is the amount of municipal solid waste expected to increase, or decrease, or remain with the proposal? What would be the extent of impact?
  The amount of MSW generated will be remained unchanged.

- What are the reasons for the change?
  N/A

- What measures will be taken to facilitate the separation of discarded material, the recovery and reuse of material and the recycling of non-reusable material?
  N/A

- What measures will be taken to avoid generating municipal solid waste and to reduce the amount of municipal solid waste that requires final disposal?
  N/A

- What will be the treatment for the municipal solid waste that requires final disposal? Will advanced technologies and practices be used?
  The municipal solid waste that required final disposal would be disposed to landfill site.

Renewable Energy

Targets

1. To organize more public education programmes on renewable energy and sustainable energy consumption that links these issues to local and global sustainable development.
2. To aim to have between 1 and 2% of Hong Kong's total electricity supply met by power generated from renewable sources by the year 2012, with this target being subject to regular review in the light of advances in technological solutions and emerging sustainability considerations.
3. To develop plans to promote energy efficiency and conservation as part of a sustainable energy policy.

- Is the amount of power generated from renewable sources as a percentage to Hong Kong's total electricity supply expected to increase, or decrease, or remain with the proposal? What would be the extent of impact?

  The amount of power generated from renewable sources as a percentage to Hong Kong's total electricity supply will be remained unchanged.

- What are the reasons for the change?

  N/A.

- How does the proposal help promote the supply and consumption of renewable energy?

  N/A.

- How does the proposal help promote energy efficiency and conservation?

  N/A.

Urban Living Space

Targets

1. To regenerate older urban districts by taking full account of the need for economic viability whilst emphasising the importance of open space provision and retaining local socio-cultural characteristics and heritage buildings.
2. To clarify the relative social, economic and environmental considerations that would need to be addressed in further developing the New Territories, so that stakeholders can regularly give informed views on the merits of development options.
3. To maintain and to review on a regular basis guidelines governing sustainable urban planning and design, with special regard to issues such as buildings affecting view corridors or restricting air flow and the need to proceed in a manner consistent with the overall sustainable development strategy for Hong Kong.

- Apart from economic viability of the proposal, have the following sustainable urban planning and design practices been considered? Please elaborate as appropriate.
  - provision of quality open space (i.e. at ground level)
  - retention of local socio-cultural characteristics
  - retention of heritage structures
  - ecological preservation
  - environmental quality
  - air ventilation impact
  - visual quality
  - landscape impact
  - streetscape improvement

  Environmental Impact Assessment will be conducted under this Project in order to assess and propose mitigation measures for the areas of air, water, landscape and visual, and ecology, etc. Environmental and culture harmony will also be considered during the architectural design of the Project.

- If the proposal involves urban redevelopment, how will it be done through a "people-oriented" approach (e.g. engaging the residents and stakeholders) and how will the "4R" strategy (redevelopment, rehabilitation, preservation and revitalization) be deployed?
  N/A

Appendix 15.01

Risk Register

Agreement No. CE 43/2011 (DS)
Relocation of Sha Tin Sewage Treatment Works to Caverns - Feasibility Study
Risk Register (For Planning Review for Existing STSTW Site)

Risk ID	Identified Risk Item				Existing Control Measures (ECMs)		Initial Risk Analysis									Residual Risk Analysis			Close Out
	Phase	Risk Cat.	Risk Item	Consequences & Additional Comments / Notes	ECMs Already in Place	ECM Owner	Consequence of Risk *with ECMs*	Likelihood of Risk *with ECMs*	Risk Rating *with ECMs*	Treatment Strategy	Possible Treatments (Additional Risk Control Measures RCMs)	Approved for Implement-ation	Risk Treatment Action Plan Ref. No.	Treatment Owner	Timeframe for Implementation	Consequence of Risk *with additional RCMs*	Likelihood of Risk *with additional RCMs*	Risk Rating *with additional RCMs*	Comment/ Status
Note (1)	Note (2)			Note (3)	Note (4)	Note (5)	Note (6)	Note (7)	Note (8)	Note (9)	Note (10)	Note (11)	Note (12)	Note (13)	Note (14)	Note (15)	Note (16)	Note (17)	Note (18)
Engineering Assessment																			
Eng-1	Planning Review	Engineering Assessment	Error/ Omission in Engineering Assessment	♦ Affect Assessment of the development	♦ Design checking and proper QA procedures	DSD/ Consultant	Major	Possible	High	Reduce Likelihood	♦ Acquire competent Engineer in assessment		Eng-1/01	DSD/ Consultant	Investigation Stage	Major	Unlikely	**Medium**	Accept with Monitoring
				♦ Affect the overall schemeing							♦ Allow different level of checking with Experience Engineer								
				♦ Affect the programme															
Eng-2	Planning Review	Engineering Assessment	Variation in Planning Data	♦ Affecr the overall schemeing	♦ Circulation of data to relevant parties for comments and agreement	Consultants	Minor	Unlikely	Low	Accept									
				♦ Affect the programme															
Eng-3	Planning Review	Engineering Assessment	Planning Application cannot be approved	♦ Affect the programme	♦ Early circulation of development planning to relevant parties for comment and agreement	Consultants	Major	Possible	High	Reduce Likelihood	♦ Arrange discussion meeting with relevant parties in advance		Eng-3/01	Consultant	Design Stage	Major	Unlikely	**Medium**	Accept with Monitoring
				♦ Affect the overall schemeing							♦ Allowance in programme								
											♦ To conduct consultation with the public and local resident at appropriate timing								
Eng-4	Planning Review	Engineering Assessment	Interface with other consultanicies/ projects in which scope and extent is uncertained (e.g. reclamation project)	♦ Affect overall development schemeing	♦ Regular design interface meetings	DSD/ Consultants	Major	Possible	High	Reduce Likelihood & Consequence	♦ Advance liaison meeting and workshop in early design stage on the potential interface		Eng-4/01	DSD/ Consultants	Design Stage	Moderate	Unlikely	**Medium**	Accept with Monitoring
				♦ Afftect the programme															

Risk ID	Identified Risk Item				Existing Control Measures (ECMs)		Initial Risk Analysis										Residual Risk Analysis			Close Out
	Phase	Risk Cat.	Risk Item	Consequences & Additional Comments / Notes	ECMs Already in Place	ECM Owner	Consequence of Risk *with ECMs*	Likelihood of Risk *with ECMs*	Risk Rating *with ECMs*	Treatment Strategy	Possible Treatments (Additional Risk Control Measures RCMs)	Approved for Implement-ation	Risk Treatment Action Plan Ref. No.	Treatment Owner	Timeframe for Implementation	Consequence of Risk *with additional RCMs*	Likelihood of Risk *with additional RCMs*	Risk Rating *with additional RCMs*	Comment/ Status
Financial																			
Fin-1	Planning Review	Financial	Project is found financial not viable	♦ Postponement or cancellation of project	♦ Refining planning development scheme and requirement	DSD/ Consultants	Major	Possible	High	Reduce Likehood	♦ Carry out Business Case Study in early stage of planning		Fin-1/01	DSD/ Consultants	Design Stage	Major	Unlikely	**Medium**	Accept with Monitoring
				♦ Affect overall development schemeing							♦ Review and revise the whole development scheme								
				♦ Afftect the programme							♦ Liaise with relevant parties to refining planning requirement								
Fin-2	Planning Review	Financial	No developer interested in project bid	♦ Postponement of project	♦ To conduct market sounding exercise to investigate if the market leading companies are interest in the development	Consultants	Moderate	Unlikely	Medium	Reduce Likelihood	♦ To incorporate in the contact an appropriate level of standards of specification in design for tenderer's pricing.		Fin-2/01	Consultants	Tender Stage	Moderate	Rare	**Low**	Accept
				♦ Afftect the programme															
Community & Society																			
Com-1	Planning Review	Community & Society	Divergent public views and objection raised during public consultation	♦ Implication on overall development programme	♦ PR strategy	DSD/ Consultants	Major	Possible	High	Reduce Likelihood	♦ To identify and resolve major issues or concerns at early stage		Com-1/01	Consultants	Design Stage	Major	Unlikely	**Medium**	Accept with Monitoring
				♦ Adverse publicity on development	♦ Allow more time for early consultation						♦ To conduct consultation with the public and local resident at appropriate timing		Com-1/02	DSD	Investigation Stage				
Com-2	Planning Review	Community & Society	Development cannot meet public's expectations	♦ Public objections	♦ Early consultation	DSD/ Consultants	Major	Possible	High	Reduce Likelihood & Consequence	♦ To identify and resolve major issues or concerns at early stage		Com-2/01	Consultants	Design Stage	Moderate	Unlikely	**Medium**	Accept with Monitoring
					♦ PR strategy						♦ To conduct consultation with the public and local resident at appropriate timing		Com-2/02	DSD	Investigation Stage				
Traffic																			
Tra-1	Planning Review	Traffic	Existing traffic flow capacity not sufficient for the development	♦ Affect overall development scheme and programme	♦ Carry out Traffic Impact Assessment and proposed mitigation measures/ immprovement works to the existing roadworks	Consultants	Moderate	Unlikely	Medium	Reduce Likelihood	♦ Study on existing traffic data in advance in preparing the development scheme		Tra-1/01	Consultants	Planning Review Stage	Moderate	Rare	**Low**	Accept
											♦ Conduct preliminary traffic impact assessment in early stage to facilitate the development planning								
Geotechnical																			
Geo-1	Planning Review	Goetechnical	Insufficient ground conditions information for planning and design	♦ Additional time for foundation design	♦ To conduct ground investigation at preliminary design stage to provide more details for design.	Consultants	Moderate	Possible	Medium	Reduce Consequence & Likelihood	♦ To request further ground investigation in design stages to reconfirm the ground condition		Geo-1/01	Consultants	Design Stage	Minor	Unlikely	**Low**	Accept
											♦ Design Review base on further ground investigation		Geo-1/02	Consultants	Design Stage				

Risk ID	Identified Risk Item				Existing Control Measures (ECMs)		Initial Risk Analysis										Residual Risk Analysis			Close Out
	Phase	Risk Cat.	Risk Item	Consequences & Additional Comments / Notes	ECMs Already in Place	ECM Owner	Consequence of Risk *with ECMs*	Likelihood of Risk *with ECMs*	Risk Rating *with ECMs*	Treatment Strategy	Possible Treatments (Additional Risk Control Measures RCMs)	Approved for Implement-ation	Risk Treatment Action Plan Ref. No.	Treatment Owner	Timeframe for Implementation	Consequence of Risk *with additional RCMs*	Likelihood of Risk *with additional RCMs*	Risk Rating *with additional RCMs*	Comment/ Status
Environmental																			
Env-1	Planning Review	Environmental	EIA unable to be approved	♦ Re-submission of EIA will have significant implication on overall programme	♦ Early circulation and consultation to green group and government authorities	DSD/ Consultants	Major	Possible	High	Reduce Likelihood	♦ To identify and resolve major concerns at design stage		Env-1/01	DSD/ Consultants	Design Stage	Major	Rare	**Low**	Accept
				♦ Substantial design revision is required															
Env-2	Planning Review	Environmental	Land Contamination in the vacant site	♦ Decontamination of site is required	♦ Allowance in programme	DSD/ Consultants	Moderate	Possible	Medium	Accept with Monitoring									
				♦ Affect overall development cost and programme															

Notes:

(1)	**(1)**	Unique identification number for each identified risk	**(7)**	Likelihood that the assessed level of consequence will occur. Level of likelihood derived from risk analysis criteria (taking into account the influence of any Existing Control Measures)	**(13)**	Person / party responsible for implementation of the approved treatment (Additional Risk Control Measure)
(2)	**(2)**	Full description of the risk and outcomes	**(8)**	Level of risk (risk rating) derived from the combination of adjudged level of consequence and the associated (linked) level of likelihood, using the risk analysis matrix	**(14)**	Timeframe / schedule for implementation of the approved treatment (Additional Risk Control Measure)
(3)	**(3)**	Description of the consequences of the risk on project objectives, together with any other additional details as appropriate	**(9)**	The proposed treatment strategy e.g. avoid, mitigate by reducing likelihood, mitigate by reducing consequence, share, transfer, accept	**(15)**	Residual level of consequence derived from risk analysis criteria (taking into account the influence of any approved Additional Risk Control Measures and also the Existing Control Measures)
(4)	**(4)**	Details of Existing Control Measures that will exert a positive influence the risk	**(10)**	Full details of the proposed risk treatment activities (Additional Risk Control Measures)	**(16)**	Residual likelihood that the assessed level of consequence will occur. Level of likelihood derived from risk analysis criteria (taking into account the influence of any approved Additional Risk Control Measures and also the Existing Control Measures)
(5)	**(5)**	Person / party responsible for implementation of the Existing Control Measure	**(11)**	Confirmation of senior management approval for implementation of treatments (Additional Risk Control Measures)	**(17)**	Residual level of risk (residual risk rating) derived from the combination of adjudged level of residual consequence and the associated (linked) residual level of likelihood, using the risk analysis matrix
(6)	**(6)**	Level of consequence derived from risk analysis criteria (taking into account the influence of any Existing Control Measures)	**(12)**	Reference No. for associated Risk Treatment Action Plan (where appropriate)	**(18)**	Any comments on risk issues and report on current status should be entered here

Appendix 15.02

Sample Risk Treatment Action Plan

RISK TREATMENT ACTION PLAN - SAMPLE

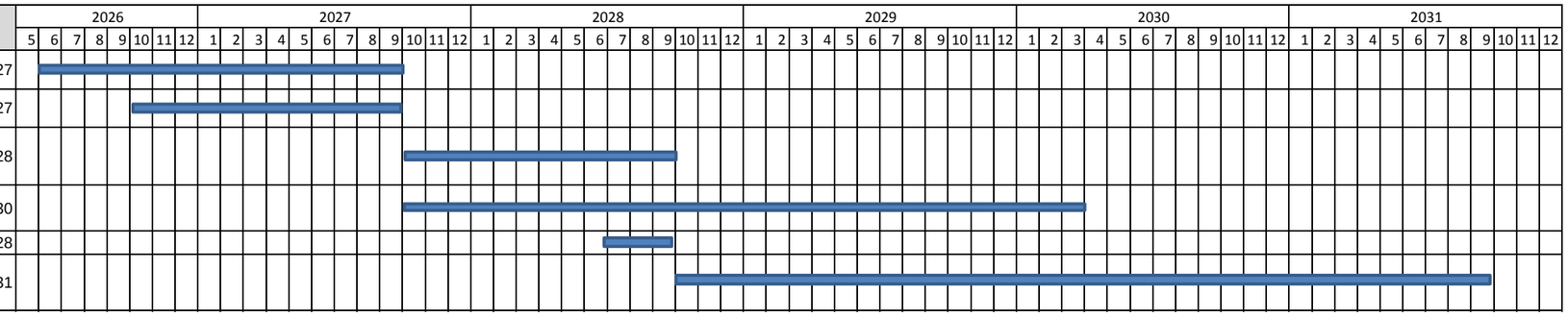
Risk Treatment Action Plan		**Treatment Plan No:**
Project Name: Planning Review for Existing STSTW Site		**Risk ID No:**
Approved and issued by: ***(Project Risk Manager)***	***Issued to for implementation by:*** ***(Risk Treatment Owner)***	**Date Issued:**
Full description of risk: (Example) Error/ Omission in Engineering Assessment		
Summary of likely impacts (consequences) and recommended response and impact:		
Specific details of agreed treatment actions (action plan):		
Approved resource requirements:		
Responsibility:		
Timing:		
Monitoring & reporting requirements:		
Treatment completed by: **(Risk Treatment Owner)** Signature:…….. Date:……..	**Treatment close-out approved by:** **(Project Risk Manager)** Signature:……..	**Date of Completion:**

Appendix 16.01

Implementation Programme

Appendix 16.01 - Implementation Programme

Activity	Duration (month)	Start	Finish
Town Planning Ordinance/Procedure	16	June 2026	September 2027
Decommissioning of the existing STSTW	12	October 2026	September 2027
Demolition of existing STSTW and decontamination (if necessary)	12	October 2027	September 2028
Construction of engineering Infrastructures	30	October 2027	March 2030
Land Sale	3	July 2028	September 2028
Construction for Residential Development (assuming all phases to be implemented in the same	36	October 2028	September 2031



Supplementary Notes to Report on Planning Review for Existing STSTW Site with Increased Population

[This Supplementary Notes shall be read in conjunction with the Report on Planning Review for Existing STSTW Site (Final) issued on 21 January 2014.]

1. Introduction

1.1. Relocating the Sha Tin Sewage Treatment Works (STSTW) to caverns could release about 28 ha of precious land in the urban area of Sha Tin New Town with sea frontage and pleasant environment in the neighbourhood for housing and other beneficial uses. In the Report on Planning Review for Existing STSTW Site (Planning Review Report), a notional "Development Scenario", in consultation with the Planning Department, with the following development parameters solely for the purpose of establishing a business case for the relocation proposal was proposed. Various broad technical assessments were conducted based on these parameters and relevant recommendations were made:

Development Parameters – "Development Scenario"	
Gross Site Area	28.4 ha
Development Site Area	14.2 ha
Non-Domestic GFA	About 70,000 m^2
Domestic GFA	About 570,240 m^2
No. of Flats	About 6,816 flats
Average Flat Size	About 80 m^2
Estimated Total Population	About 19,800 persons
Non-Domestic Plot Ratio*	About 0.5
Domestic Plot Ratio*	About 4.0
Overall Plot Ratio*	About 4.50

1.2. In view of the pressing need to increase housing supply to cope with the expanding population in Hong Kong, there was a later suggestion to use a smaller average flat size but keeping the same domestic GFA area in order to increase the number of flats. Based on the notional "Development Scenario" and depending on the ratio between public housing and private housing, the total number of flats to be generated by the future development at the released site would range from about 8,150 to 10,730, accommodating an estimated total population from 23,600 to 30,100 accordingly as shown in the following table. The total number of flats generated and estimated population is greater than the "Development Scenario" mentioned in the Planning Review Report.

Percentage of Public Housing Flats	**Estimated No. of Public Housing Flats** (average flat size = 45 m^2)	**Estimated No. of Private Housing Flats** (average flat size = 70 m^2)	**Estimated Total No. of Flats**	**Estimated Total Population**
0%	0	8,150	8,150	23,600
10%	850	7,600	8,450	24,500
20%	1,760	7,020	8,780	25,400

30%	2,740	6,390	9,130	26,500
40%	3,800	5,700	9,500	27,600
50%	4,960	4,960	9,920	28,800
60%	6,220	4,150	10,370	30,100

1.3. This Supplementary Notes present a review on the impact, if any, caused from the increase in population exceeding the development parameters indicated in Planning Review Report.

2. Transport and Traffic Assessment

2.1. The average flat size of private flats assumed in this Supplementary Notes is 70m^2 which is less than that assumed in planning review report. Comparison between residential traffic flow in Planning Review Report and estimated trip flow due to the increase in population are provided in the following table. It is expected that 100% private housing is the most critical scenario. Trip generation and attraction under 100% private housing scenario is close to the "Development Scenario" in the Planning Review Report[1].

Percentage of Public Housing Flats	***Estimated No. of Public Housing Flats***	***Estimated No. of Private Housing Flats***	***AM Generation***	***AM Attraction***	***PM Generation***	***PM Attraction***
0%	0	8,150	950	550	390	530
10%	850	7,600	930	540	380	530
20%	1,760	7,020	910	540	380	520
30%	2,740	6,390	880	530	380	510
40%	3,800	5,700	850	520	370	500
50%	4,960	4,960	820	510	370	490
60%	6,220	4,150	780	500	360	480
"Development Scenario" in the Planning Review Report	*0*	*6,816*	*945*	*495*	*415*	*575*

[1] In the Planning Review Report, the housing mixture is not known, therefore 100% private housing were adopted in the board traffic impact assessment which is considered as a conservative approach.

2.2. The traffic improvement and mitigation measures given in the Planning Review Report are still applicable in general. The existing signalized junction at Kiu Ha Road and the roundabouts at Chak Cheung Street have to be improved to cater for the additional traffic flow from the development. The assumption of 30% of low vehicular trip generator adopted in the Planning Review Report is still needed. The traffic flow could be further controlled by other administrative means, such as limiting number of car park, which could be further explored in next stage.

3. Drainage Impact Assessment (DIA)

3.1. Based on the findings in the Planning Review Report, the potential drainage impact incurred by relocation of STSTW is the increase in runoff and peak discharge due to increase in paved area. And it is concluded in the Report that the proposed development can be completed without aggravating flood condition within, upstream and downstream of the site.

3.2. Since the increase in number of flats and estimated population would have no implication on paved area and causing neither changes on runoff volume nor peak discharge, it is considered the findings in the DIA under the Planning Review Report are still applicable.

4. Sewerage Impact Assessment (SIA)

4.1. Based on the findings in the Planning Review Report, the total sewage flow contributed by Average Dry Weather Flow (ADWF) generated by the overall development is 6,715m^3/day, of which 3,800m^3/day is generated from residential unit. And it is concluded that no impact would be envisaged to the relocated STSTW due to the proposed development.

4.2. With the increase in number of flats and population (10,730 and 30,100), the total sewage flow contributed by ADWF generated from residential unit and the overall development is 5,719 m^3/day and 8,634 m^3/day respectively.

4.3. As mentioned in Section 8.5.2 of the Planning Report, an additional 10% contingency is allowed to cater for the update of sewerage project and inherent uncertainties in flow projection for relocated STSTW. The contingency is considered still valid. This 10% allowance of the projected ADWF to STSTW (340,000 m^3/day), which is equivalent to approx. 30,000 m^3/day is considered sufficient to cater for the increased in ADWF (by 1,919 m^3/day) due to increase in population.

4.4. It is considered that the increase in flat numbers and population would have insignificant change to the findings in SIA under Planning Review Report.

5. Waterworks Impact Assessment (WIA)

5.1. Based on the findings in the Planning Review Report, the total fresh water demand and flushing water demand due the proposed development are 14,259 m^3/day and 2,185 m^3/day respectively, of which 4,600 m^3/day and 1,400 m^3/day is generated from residential unit. And it is advised that a new DN450 fresh water main and a new DN150 salt water main are proposed for the proposed development.

5.2. With the increase in number of flats and estimated population (10,730 and 30,100), the fresh water demand and flushing water demand by the proposed development is estimated to be 16,582 m^3/day and 2,892 m^3/day respectively, of which 6,923 m^3/day and 2,107 m^3/day is generated by residential unit. It is advised that a new DN450 fresh water main and a new DN200 salt water main are proposed for the proposed development.

5.3. It is considered that the increase in flat numbers and population would have insignificant change to the findings in WIA under Planning Review Report, except the size of proposed salt water main is increased from DN150 to DN200.

6. Environmental Impact Assessment (EIA)

6.1. Based on the Planning Review Report, various assessments on relevant environmental aspects, including air quality, water quality, waste management, land contamination, ecology and fisheries, cultural heritage and landscape and visual impact was carried out according to the proposed development layout.

6.2. Since the increase in numbers of flats and estimated population would have no implication on the layout of proposed development, as well as the location of relevant sensitive receivers, thus it is considered that they would have insignificant change to the findings in EIA under Planning Review Report.

6.3. Regarding the noise impact due to traffic noise, since the increase in trip generation is small, it is considered that the noise mitigation measures given in the Planning Review Report is still applicable.

7. Air Ventilation Assessment (AVA)

7.1. Based on the Planning Review Report, air ventilation assessment was carried out with the use of wind tunnel test according to the proposed development layout.

7.2. Since the increase in numbers of flats and estimated population would not alter the layout of the proposed development, thus it is considered that the findings in AVA under the Planning Review Report are still applicable.

8. Geotechnical Assessment (GA)

8.1. Based on the Planning Review Report, desktop geotechnical assessment was carried out with the use of aerial photograph interpretation and existing geotechnical record, including boreholes log.

8.2. Since the increase in numbers of flats and estimated population would not alter the layout of the proposed development, thus it is considered that the findings in GA under the Planning Review Report are still applicable.

9. Conclusion

9.1. Based on the findings from the above sections, the total number of flats assumed in this Supplementary Notes would only induce minimal impact. It is considered that the mitigation measures provided in the Planning Review Report are generally applicable. However, detailed impact assessments should be carried out in P&E stage when more information is available.