MTR Corporation Limited

Consultancy Agreement No. NEX/2102 Express Rail Link Preliminary Design for XRL Tunnels & Associated Structures

Working Paper No. 39 Sewerage Impact Assessment for Environmental Impact Assessment Study Northern Package

January 2009

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Contents

DRAWINGS AND FIGURES

APPENDICES

List of Abbreviations

AAJV	Arup-Atkins Joint Venture
ACL	Atkins China Ltd
AEL	Airport Express Line
ARUP	Ove Arup & Partners HK Ltd
BD	Buildings Department
CEDD	Civil Engineering and Development Department
CLP	China Light and Power
DSD	Drainage Services Department
DSM	MTRCL Design Standard Manual
EAP	Emergency Access Point
EEP	Emergency Evacuation Point
EIA	Environmental Impact Assessment
ERS	Emergency Rescue Station
EVA	Emergency Vehicular Access
GEO	Geotechnical Engineering Office
GIU	Geotechnical Information Unit
HGV	Huang Gang Park Ventilation Building (VB0)
HKSAR	Hong Kong Special Administrative Region
HTW	Hoi Ting Road Works Area
HyD	Highways Department
KCV	Kwai Chung Ventilation Building (VB6)
KSL	Kowloon Southern Link
KTW	Kam Tin Road Works Area
LKM	Lam Kam Road Magazine
MD	Marine Department
MKV	Mong Kok West Ventilation Building (VB8)
MLW	Mei Lai Road Works Area
MPV	Mai Po Ventilation Building (VB1)
MTRCL	MTR Corporation Limited
NAC	Nam Cheong Station
NB	North Bound Track
NCB	Nam Cheong Barge Point
NCV	Nam Cheong Ventilation Building (VB7)
NPW	Nam Cheong Park Works Area

NTV	Ngau Tam Mei Ventilation Building (VB2)
PHV	Pat Heung Ventilation Building (VB4)
PLA	Peoples Liberation Army
RCB	Rambler Channel Barge Point
RDO	Railway Development Office
SB	South Bound Track
SKM	So Kwun Wat Magazine
SSS	Shek Kong Stabling Sidings
SLB	Siu Lam Barge Point
SMV	Shing Mun Ventilation Building (VB5)
SYW	Shek Yam Works Area
TCL	Tung Chung Line
TMB	Tuen Mun Barge Point
TUW	Tse Uk Tsuen Works Area
TWL	Tsuen Wan Line
URA	Urban Redevelopment Authority
VB	Ventilation Building
WKT	West Kowloon Terminus
WR	West Rail Line
WSD	Water Supplies Department
X310	Huang Gang Park to Mai Po Tunnels
X311	Mai Po to Ngau Tam Mei Tunnels
X312	Ngau Tam Mei to Tai Kong Po Tunnels
X313	Tai Kong Po to ERS Tunnels
X314	ERS to Tse Uk Tsuen Tunnels
X315	Tse Uk Tsuen to Shek Yam Tunnels
X316	Shek Yam to Mei Lai Road Tunnels
X317	Mei Lai Road to Nam Cheong Tunnels
X318	Nam Cheong to Mongkok West Tunnels
XRL	Express Rail Link

1 Introduction

1.1 Proponent's Requirement

A request has been made by the Mass Transit Railway Corporation Limited (MTRCL) to prepare Sewerage Impact Assessment (SIA) Report(s) for the Northern Section which would form part of the Environmental Impact Assessment for approval by the EPD, as required, in connection with both planning approvals and engineering requirements.

1.2 Background

The Express Rail Link (XRL) project comprises approximately 27km of tunnel from the Huang Gang Ventilation Shaft (HGV) north of the boundary between the Shenzhen Special Economic Zone (Shenzhen SEZ) and the Hong Kong Special Administrative Region (Hong Kong SAR) to a new terminus station in West Kowloon. In addition, the project also includes eight ventilation buildings (VB), two ventilation adits and six ventilation shafts, an Emergency Rescue Station (ERS), the Shek Kong Stabling Sidings (SSS) with an integrated first line maintenance facility and other associated buildings and facilities. The system will carry long-haul services to numerous destinations in the Mainland as well as shuttle services to various locations in the Pearl River Delta.

The Preliminary Design alignment runs from approximately 150m north of the Shenzhen River, the boundary between the Shenzhen SEZ and the Hong Kong SAR, to the new terminus station in West Kowloon.

This SIA Study is for XRL railway alignment's northern section; from the boundary between the Shenzhen SEZ and the Hong Kong SAR (CH 115+930) to the southern slopes of Tai Mo Shan (Chainage 131+500). The northern section will be approximately 15.6km long and will also include VB1, VB2, EAP3, VB4 and SSS.

1.3 Scope of SIA Study

The ventilation building VB1, VB2, EAP3, VB4 and SSS will generate foul water during the operation stage. The main objective of this sewerage impact assessment (SIA) Study is to assess and mitigate the impact of proposed discharging of foul water into public sewerage system. The alignment of the northern section of the XRL has been shown in Figure 1.

This working paper has been structured as following:

- Section 2 presents the overall description of the existing sewerage catchment area and introduce the extent of the study area;
- Section 3 presents the design assumption and criteria made in estimating the sewage flow;
- Section 4 presents the sewage flow figures generated by the proposed railway works;
- Section 5 describes the existing and committed sewerage infrastructure associated with this project;
- Section 6 presents the sewerage impact assessment due to proposed works;
- Section 7 present intended sewage disposal strategy;
- Section 8 present fallback sewage disposal strategy;
- Section 9 present evaluation of sewerage strategies and recommendation;
- Section 10 present environmental impact assessment;
- Section 11 summaries the conclusions.

2 Sewerage Catchment Area

2.1 Overall Description

The northern section of the proposed XRL railway alignment fell within the study area of Feasibility Study on "Review of Yuen Long and Kam Tin Sewerage and Sewage Treatment Requirements" under Agreement No. CE 55/95. One of the main objectives of the feasibility study was to assess the hydraulic adequacy of existing sewerage infrastructure to cope with the additional flows from future developments, and also to provide sewerage infrastructures in the areas currently not served by any public sewer. After implementation of the planned sewerage improvement works, the sewerage generated within the study area will be conveyed to Yuen Long Sewage Treatment Works (YLSTW) or to San Wai Sewage Treatment Works (SWSTW) for treatment before its disposal into Deep Bay and Urmston Road respectively.

2.2 Study Area

The northern section of XRL which is subject of this sewerage impact assessment spreads across North West New Territories and also fell within the sewage catchment area of YLSTW. The sewage generated from VB1, VB2, EAP3, VB4 and SSS is proposed to be discharged into the public sewers for its treatment at YLSTW before disposal into Deep Bay.

Currently, there is no public sewer in the vicinity of the VBs or SSS. However, EPD planned a sewerage system, and part of which is in construction stage (Kam Tin Trunk Sewerage Phase 1) and the remainder in design stage (Kam Tin Trunk Sewerage Phase 2 and Ngau Tam Mei Phase 1). After completion of these planned sewerage works, the public sewer would be available in the vicinity of VBs and SSS. The planned sewerage works in Kam Tin, Ngau Tam Mei and San Tin areas are shown in Figure 2.

3 Design Assumption and Criteria

There are three major sources of sewage generated from XRL facilities along the northern section of the proposed XRL alignment. They are the toilet sanitary waste and floor drain generated at the ventilation building (VB), foul water from the tunnel, track wash down and adit and, the foul water from SSS. The sewage flow from SSS comprised of foul water from number of facilities including kitchen, toilets, shower and changing room, plant room and train discharge etc.

3.1 Design Assumption and Criteria

This SIA has been carried out as per the guideline set out in the MTRC DSM, DSD Sewerage Manual (SM) Part 1, EPD Practice Note PRoPECC PN 5/93 and Institution of Plumbing (IOP) Engineering Services Design Guide.

3.1.1 Ventilation Buildings

The toilet sanitary waste and floor drain generated at the ventilation building are classified as foul water under the DSM. The ventilation buildings will be provided with a foul water drainage system that will collect foul water flows generated at the ventilation building for its conveyance and discharge to the nearby public sewerage system.

As the SM cannot cover the foul water discharge estimation for this kind of development, IOP Design Guide is adopted to estimate the sewage flows from ventilation building. The discharge rate for each appliance within the ventilation building is extracted from the IOP Design Guide and is listed below in Table 3.1.

Table 3.1: Foul Water Discharge Rate for Appliance of VBs and at SSS

Appliance	Discharge Unit (l/s)
Wash Basin	0.3
WC	1.8
Urinal	0.4
Sink	1.3
Shower	0.4
Floor Drain	0.3

3.1.2 Railway Tunnel and Ventilation Adit

Under the MTRC DSM, the foul water is defined as the groundwater seepages that ingress through the tunnel structures, fire protection water discharges and track wash down flows. The discharge rate of such foul water is shown below in Table 3.2.

Table 3.2: Foul Water Discharge Rate for Tunnel Foul Water

Type of Foul Water	Foul Water Discharge Rate	DSM Clause
Fire Protection Water	15 l/s	7.8.2.2.3(b)
Groundwater Seepages	1.5 l/m/day	4.9.3.9
Track Washdown Flow	7 l/s	4.9.3.11

The foul water drainage system comprises a drainage trackform and surface drainage system that will convey foul water discharges to a foul water drainage system. The foul water discharge will be conveyed to foul water line sumps at the lowest point of the tunnel alignment for onward conveyance via pressurised mains through the ventilation adits for discharge to the public sewerage system. EAP3 is the outlet for the pressurised main for the proposed northern section of the proposed XRL. Oil interceptors will be required at EAP3 to remove any oil from the railway tunnel and ventilation adit foul water discharges that are pumped to ground level at ventilation building before conveying to sewerage system. But, the sewage flow due to fire protection will only occur during emergency.

3.1.3 Shek Kong Stabling Siding (SSS)

The sewage flows will be generated from kitchen, toilets, shower and changing room, plant room, train discharge and other facilities at SSS. The estimation of sewage flows excluding kitchen and train discharge is being done as per IOP design guide lines which depends upon discharge flow rate and frequency use.

The train discharge is estimated based on 16 cars per train and maximum of 4 trains discharge out in 2 hours. Further, the capacity of tank in the train is assumed as 0.5m^3. This will result in a maximum train discharge of 5 l/s. The possibility is very low that 4 trains discharge out at a time and all tanks are full.

Whereas, the estimation of foul water from kitchen area is carried out according to EPD's requirements as stipulated under Practice Note ProPECC PN 5/93.

4 Development and Flow Projections

4.1 Flow Projections for the Planned Sewerage Works in Study Area

As described in Section 2.1, the northern section of the proposed XRL railway alignment falls within the sewage catchment area of YLSTW. Sewerage Master Plan (SMP) (1999) for the areas were developed more than ten years ago. Most of the information stated in the SMP is outdated with population, land uses and recent development over the past 10 years not covered by the SMP. Based on the information received and discussions with DSD, the sewerage improvement works are currently in construction stage under PWP Item No. 215DS are based upon the 2016 planning population. Whereas, the planned sewerage improvement works currently in design stage under PWP Item No. 235DS are based upon the planning population in year 2030. These works are shown in Figure 2.

Table 4.1 below provide a summary of design capacity of the associated pumping stations which may have adverse impact due to proposed discharging of foul water from VBs and SSS.

Table 4.1: Design Capacity of Associated Pumping Station

PWP Item No.	Sewerage Facilities	Design Capacity (l/s)
215DS	Kam Tin SPS	620
215DS	Nam Sang Wai SPS	1476

4.2 Flow Generated by the XRL Works

4.2.1 Ventilation Buildings

The foul water generated at the ventilation building is toilet sanitary waste and floor drain. As there is basement for ventilation building VB1, VB2 and EAP3, a pump sump would be provided at the basement to collect the foul water from floor drain. The foul water would then be pumped to the ground level for discharge to the public sewerage system.

VB4 will be located at ground level with no basement and therefore toilet sanitary waste and floor drain foul water will be discharge to the public sewerage system by gravity.

Calculation for the foul water generated at the ventilation buildings along the northern section of the proposed XRL alignment is attached in Appendix A and listed below in Table 4.2.

Table 4.2: Foul Water Discharge Rate for the Ventilation Building Foul Water Drainage System

Ventilation Building	Toilet Sanitary Waste (l/s)	Floor Drain (l/s)	Total from Ventilation Building (l/s)
VB1	1.5	3	4.5
VB2	1.5	3	4.5
EAP3	1.5	3	4.5
VB4	1.5	1.2	1.8#

Note:# - Refer to the calculation in Appendix A

4.2.2 Railway Tunnel and Ventilation Adit

As discussed in Section 3.1.2, the foul water from railway tunnel and ventilation adit mainly consist of groundwater seepages that ingress through the tunnel structures, fire protection water discharges and track wash down flow. The fire hydrant system has discharge of 15 litres/second and is the largest of these discharges. This flow will only be generated for fire fighting and is used as the design flow from railway tunnel and ventilation adit for the sewerage impact assessment.

A design pump rate of the foul water line sumps is 17 litres/second, which means 17 litres/second of railway tunnel and ventilation adit foul water will be discharged to the public sewerage system at outlet of EAP3. However, during normal circumstances, only seepage water will be pumped out from the tunnel.

4.2.3 Estimated Total Flow from Ventilation Buildings along Northern Section

Estimated total foul water generated at ventilation buildings for the northern section of the proposed XRL alignment to be discharged to the future public sewerage system is listed below in Table 4.3

Table 4.3: Foul Water Discharge Rate from the VBs along northern section of the proposed XRL alignment

Ventilation Building	From Ventilation Building (l/s)	From the Tunnel Foul Drainage System (l/s)	Total Discharge Rate to the Public Sewerage System (l/s)
VB1	4.5	N/A	4.5
VB2	4.5	N/A	4.5
EAP3	4.5	17	21.5
VB4	1.8	N/A	1.8

4.2.4 Estimated Flow from SSS

The foul water at SSS will be generated from kitchen, toilets, shower and changing room, plant room, train discharge and other facilities. As mentioned in section 3.1.3, the foul water estimation excluding kitchen and train discharge is being done as per IOP design guide lines. Whereas, the foul water discharge estimation from the kitchen is carried out as per EPD practice note and train discharge based upon number of trains, cars, time of servicing and tank capacity.

A summary of the foul water discharges from SSS is presented below in Table 4.4.

Table 4.4: Foul Water Discharge Rate from SSS along northern section of the proposed XRL railway alignment

Location within SSS	Foul water flow rate (l/s)	Source
Main Building	2.00	Kitchen
Main Building	6.27	Toilet, Shower, Changing Room and Plant Room
IBP/Infrastructure Building Plant	2.14	Toilet and plant room
RMS/Running Maintenance Shed	1.1	Plant Room
RMS	3.0	Cleansing water inside the maintenance tack to be collected to the nearby sump and the discharge flow rate for each sump is 3L/s and total 4 nos. of sump pump have to be provided for four maintenance track.
RMS	5.0	Train discharge
Loco Shed	1.37	Toilet and plant room
Wheel Lathe	0.67	Plant room
DG Store	0.72	Plant Room
Gate House	0.77	Toilet
Traction Power Substation	0.99	Toilet and Plant Room
Train Wash Plant	0.3	Plant Room
EEP at Shunt Neck	0.3	Wastewater for staircase
ERS VBs	0.47	Plant Room
Total	**25.1**	**Shek Kong Stabling Siding (SSS)**

Apart from the above listed flows, 22.5 l/s of flows as detailed below from ERS will be generated only during emergency when there is a fire in the tunnel. As this flow will only be generated during emergency and therefore proposed to be discharged into nearby stormwater drainage system after passing through the grease interceptor.

Table 4.5: Foul Water Discharge Rate from Emergency Rescue Station (ERS) at SSS along northern section of the proposed XRL railway alignment

Location within SSS	Foul water flow rate (l/s)	Source
Emergency Rescue Station	22.5	1 no. water sump pit with 2 no. pump sump (1 duty & 1 standby) with the design discharge flow rate of 22.5l/s located at South end of ERS but it only happen when there is a fire within the tunnel.

5 Existing and Committed Sewerage Infrastructure

5.1 Existing Sewerage System in the Area

Under the current situation, there is no public sewer available within Kam Tin or Ngau Tam Mei. The sewage in these areas is treated and disposed of by means of privately owned sewage treatment plants or septic tanks and soak away systems.

The nearest sewerage system, which is still far away from XRL facilities would be Kam Tin Trunk Sewerage Phase 1 and may only be available in late 2009 the earliest, based upon DSD's programme. After completion of these sewerage works, the sewage from the respective catchment area will be conveyed to YLSTW or to SWSTW for treatment to secondary level before its final disposal into Deep Bay and Urmston Road.

5.2 Planned Sewerage System in the Area

In 1999, the Government completed a feasibility study on "Review of Yuen Long and Kam Tin Sewerage and Sewage Treatment Requirements", which recommended sewerage improvement package to provide trunk sewer system in Ngau Tam Mei, San Tin, Kam Tin and Yuen Long areas and to upgrade relevant sewerage facilities including San Wei STW and Ha Tsuen Sewage Pumping Station in North West New Territories (NWNT) sewerage network, and effluent pumping station as well as effluent pipeline connecting the existing YLSTW to SWSTW. Upon completion of this project, the treated effluent from YLSTW will be discharged via the Yuen Long effluent pipeline to the NWNT sewer tunnel and ultimately to the Urmston Road outfall. The planned sewerage improvement works within the vicinity of SSS and VBs are shown in Figure 2.

As shown in Figure 2, the proposed SSS, EAP3 and VB4 are within the proposed Kam Tin Trunk Sewerage Phase 2 catchment area. Whereas, the proposed VB1 and VB2 are within the proposed Ngau Tam Mei and San Tin Sewerage Phase 1 catchment area. Both of these works forms part of the Cat B Public Works project which will be implemented under PWP Item No. 235DS. As per DSD's latest programme, these works are scheduled to commence in 2010 for completion in 2014. Upon completion of these sewerage improvement works, the sewerage from SSS, VB1, VB2, EAP3 and VB4 can be conveyed to YLSTW via the Yuen Long and Kam Trunk Phase 1 Trunk Sewer scheduled for completion in 2009. The planned sewerage works in the vicinity of XRL are listed below in Table 5.1.

Table 5.1: Main Sewerage Improvement Schemes in the Study Area

PWP Item	Project Description	Tentative Program
215DS	Kam Tin Trunk Sewerage Phase 1	12/05-12/09
235DS	Kam Tin Trunk Sewerage Phase 2	10/10-10/14
235DS	Ngau Tam Mei/San Tin Trunk Sewerage Phase 1	06/10-03/14

5.3 Sewerage System from VBs, SSS to Public Sewer

Figure 3 shows the proposed sewerage system from XRL facilities within northern section to the public sewer. Oil interceptors will be installed at EAP3 to remove any oil from the railway tunnel and ventilation adit foul water discharges that are pumped to ground level for discharging into public sewer.

As shown in Figure 3, the sewage generated from SSS and EAP3 is proposed to be discharged into the planned 375mm diameter and 525mm diameter public sewer along Kam

Tin Road and Kam Tai Road respectively. Whereas, the sewage from VB4 is proposed to be discharged into the planned 450mm diameter sewer along Kam Sheung Road. After completion of planned sewerage improvement works under PWP Item No. 235DS, the sewage from EAP3, VB4 and SSS will be conveyed to YLSTW through the sewerage works currently under construction as part of PWP Item No. 215DS.

Whereas, the sewage from VB1 and VB2 is proposed to be discharged into the planned 525mm diameter and 450mm diameter trunk sewer along Castle Peak Road and Chun Shin Road respectively, which are scheduled to commence for construction in 2010 with target completion in 2014. After completion of planned sewerage improvement works, the sewage from VB1 and VB2 would be able to convey to YLSTW for the treatment and disposal.

Table 5.2 below provide a brief summary of the proposed connection from ventilation buildings to public sewerage system.

Table 5.2: Proposed connection from VBs and SSS to the Public Sewer

XRL Buildings	Location of future Public Sewerage System	Downstream pipe diameter (mm)
VB1	Castle Peak Road	525
VB2	Chun Shin Road	450
EAP3	Kam Tai Road	575
VB4	Kam Sheung Road	450
Shek Kong Stabling Siding (SSS)	Kam Tin Road	375

5.4 Sewerage Treatment Facilities

As mentioned in Section 2.2, the northern section of XRL subject of this SIA falls within the Sewerage Catchment Boundary of YLSTW. Although, YLSTW does not reserve any capacity for the sewage flows from this project, however it has some spare capacity. The existing intake flow to the treatment works is about 20,000 m³/d whereas the design capacity is 70,000 m^3/d. It is also noted that the design capacity of for YLSTW is subject to review as there is a need for land redeployment within the site for modification of treatment process. Further, the projected flow up to 2030 is about 46,000m³/d and therefore this can be considered that YLSTW has spare capacity which can be used for the XRL proposed development.

In the future, the sewage within Kam Tin area will be collected at the Kam Tin SPS for its pumping all the way towards Nam Sang Wai SPS across Kam Tin River. Whereas, the sewage from San Tin and Ngau Tam Mei will be collected at Ngau Tam Mei SPS for pumping towards Nam Sang Wai SPS. Finally, the sewage from Kam Tin, San Tin/Ngau Tam Mei will be collected at Nam Sang Wai SPS for its pumping to YLSTW. The overall future sewerage system is shown in Figure 2.

The design pumping capacity of Kam Tin SPS and Nam Sang Wai SPS provided by DSD is listed below in the following Table 5.3.

Table 5.3: Capacity of Kam Tin and Nam Sang Wai Sewage Pumping Station

Pumping Station	Design Capacity (l/s)	Commission date (year)
Kam Tin SPS	620	2009
Nam Sang Wai SPS	1476	2009

6 Sewerage Impact Assessment

As mentioned in the previous section, there is no existing public sewerage system within the vicinity of VB1, VB2, EAP3, VB4 and SSS. However, sewerage improvement works have been proposed as part of the long term strategy to improve the water quality of drainage system and Deep Bay. Phase 1 of sewerage improvement works in Kam Tin and Au Tau is currently in progress and scheduled for completion late 2009. Whereas, Phase 2 of sewerage improvement works within Kam Tin and Phase 1 of sewerage improvement works within Ngau Tam Mei and San Tin is in design stage, and scheduled for completion in 2014.

As per "Review of Yuen Long and Kam Tin Sewerage and Sewage Treatment Requirements" study, the proposed sewerage improvement works are designed for the population projection data for the year 2016. Table 6.1 below presents the increase in flows due to XRL facilities at Kam Tin and Nam Sang Wai SPS which are due for commissioning in late 2009.

Table 6.1: Assessment due to Additional Foul Water Discharges on Sewage Pumping Station

Sewage Pumping Station	Design Capacity (l/s)	Relevant XRL facilities	Additional Flow (l/s)	Percentage Increase to the design capacity
Kam Tin SPS	620	EAP3, VB4 and SSS	48.4	7.8
Nam Sang Wai SPS	1476	VB1, VB2, EAP3, VB4 and SSS	57.4	3.9

It can be seen from above table that increase in flow is minimal as compared to the design capacity. Therefore, it can be considered that there would be negligible impact on the proposed sewerage system with the addition of sewage flow from XRL facilities.

As, Phase 2 works within Kam Tin and Phase 1 works in Ngau Tam Mei/San Tin including Tsui Tsan Tin SPS, Ng Ka Tsuen SPS, Pang Ka Tsuen SPS and Ngau Tam Mei SPS are in the design stage, necessary provision could be made in the design of the sewerage works by considering additional flows from XRL facilities.

Prior to the completion of sewerage improvement works as mentioned in Section 5.2, the sewage from VB1, VB2, EAP3, VB4 and SSS will be stored in a holding tank and then tank-away to YLSTW for treatment and disposal. As the programme of 235DS might be deferred, in addition to storage and tank away, appropriate interim measures which would be more cost-effective in the longer term would be considered in the detailed design stage.

7 Intended Sewage Disposal Strategy

As per current implementation programme of XRL, the project is scheduled for commissioning in 2015. Whereas, according to DSD's latest implementation programme for PWP Item No. 235DS, the trunk sewer in Kam Tin and Ngau Tem Mei may be available by the end 2014. The original programme for the commissioning of Phase 2 of Kam Tin and Phase 1 of Ngau Tam Mei and San Tin Sewerage Improvement works was in 2012. EPD and DSD advised that the implementation of these sewerage improvement works is delayed due to objections from Rural Committee Members in Kam Tin and San Tin area.

However, there is still 1 year float for the completion of sewerage works to tie in with the commissioning of XRL. Therefore, it is considered that public sewerage facilities would be available before the commissioning of XRL near to VBs and SSS to convey the sewage generated from XRL facilities along the Northern Section. Further, the proposed sewerage system in Kam Tin and Ngau Tem Mei is in design stage and therefore should be able to take into account of the sewage flows from VBs and SSS.

At this stage, there is neither any existing sewerage system nor detailed design of the future trunk sewer and therefore an indicative alignment of future sewer connection from SSS and VBs to public sewer has been developed and is shown in Figure 3. The detailed design will subject to further consultation and agreement with Government departments at detailed design stage.

A 150mm diameter sewer of 1 in 100 gradient will have the discharge carrying capacity as 13.7 l/s and is sufficient to convey the sewage flow from VB1, VB2 and VB4 to the future public sewer. Whereas, a 200mm diameter sewer of 1 in 100 gradient with discharge carrying capacity as 29 l/s is sufficient to convey the sewage flow from EAP3 and SSS to public sewer separately. The design of connection sewer will be confirmed during detailed design stage.

8 Conclusions

8.1 Conclusions

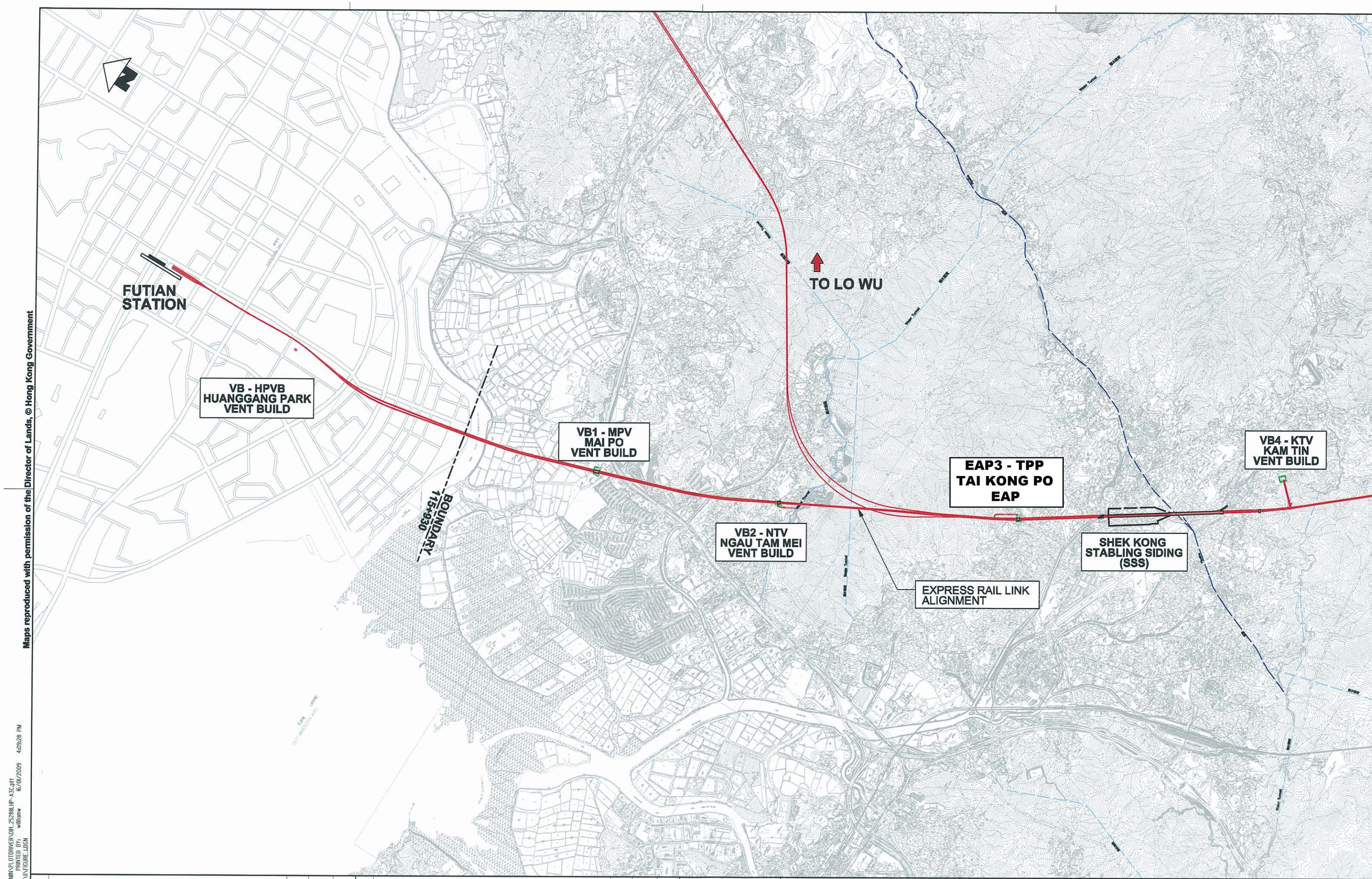
The commissioning of XRL is scheduled in 2015 whereas public sewer would be available by the end of 2014 according to DSD's latest programme. Therefore, the intended sewerage strategy for XRL would tie in with the proposed sewerage improvement works in Kam Tin and Ngau Tam Mei.

Regarding sewerage impact assessment, there is negligible impact on sewerage system currently in construction stage. Whereas, additional flows from proposed XRL facilities should be considered for the design of planned sewerage system under PWP Item No. 235DS.

According to the estimated sewage flow from XRL facilities, there would be negligible impact on the proposed sewerage system with the addition of sewage flow from XRL facilities.

Prior to the completion of proposed sewerage system, sewage from VB1, VB2, EAP3, VB4 and SSS will be stored in a holding tank and then tank-away by licenced collector for discharge in YLSTW for treatment and disposal. Appropriate interim measures which would be more cost-effective in the longer term would be considered in the detailed design stage.

Figures



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REV	DESCRIPTION	BY	DATE	APPROVED

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DATE	24/NOV/2008

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MTR

EXPRESS RAIL LINK

ORIGINATOR
Arup Atkins JV
Supported by TFP Farrells, DLS, SIYUAN, Knight Frank, Team 73

CADD REF. FIGURE_1.DGN

TITLE
NEX-2102
PRELIMINARY DESIGN
PROPOSED RAILWAY ALIGNMENT FOR NORTHERN SECTION

SCALE 1 : 20000(A1)

DRAWING NO. FIGURE 1

REV.

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235DS 06/10-03/14
2B-1T
NGAN TAM MEI / SAN TIN
TRUNK SEWERAGE PHASE 2
(CAT B FUNDED
UNDER 2005 RAE)

525 DIA.

450 DIA.

VB1

VB2

VB3

VB4

SSS

EXPRESS RAIL LINK ALIGNMENT

PROPOSED NGAU TAM MEI SPS
DESIGN FLOW = 566 l/s

235DS 06/10-03/14
2A-2T
NGAN TAM MEI / SAN TIN
TRUNK SEWERAGE PHASE 1
(CAT B FUNDED
UNDER 2005 RAE)

PROPOSED SHA PO SPS
ADWF = 8,795 m³/day
DESIGN FLOW = 392 l/s

PROPOSED NAM SANG WAI SPS
ADWF = 42,009 m³/day
DESIGN FLOW = 1476 l/s

YUEN LONG STW

235DS 06/10-03/14
1B-1T
KAM TIN TRUNK
SEWERAGE PHASE 2
(CAT B FUNDED
UNDER 2005 RAE)

PROPOSED PANG KA TSUEN SPS
DESIGN FLOW = 146 l/s

PROPOSED TSUI TSAN TIN SPS
DESIGN FLOW = 170 l/s

PROPOSED NG KA TSUEN SPS
DESIGN FLOW = 407 l/s

PROPOSED KAM TIN SPS
ADWF = 16,221 m³/day
DESIGN FLOW = 620 l/s

215DS 12/05-05/09
1A-1T
KAM TIN TRUNK
SEWERAGE PHASE 1
(CAT A
CONSTRUCTION IN PROGRESS)

LEGEND

- PROPOSED TRUNK SEWER UNDER PWP ITEM NO. 215DS (12/05-05/09)
- PROPOSED TWIN RISING MAINS UNDER PWP ITEM NO. 215DS (12/05-05/09)
- PROPOSED TRUNK SEWER UNDER PWP ITEM NO. 235DS (06/10-03/14)
- PROPOSED TWIN RISING MAINS UNDER PWP ITEM NO. 235DS (06/10-03/14)

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REV	DESCRIPTION	BY	DATE	APPROVED

REV	DESCRIPTION	BY	DATE	APPROVED

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DESIGNED	AK
CHECKED	MT
APPROVED	JM
DATE	24/NOV/2008

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EXPRESS RAIL LINK

ORIGINATOR
Arup Atkins JV
Supported by
TFP Farrells, DLS, SIYUAN,
Knight Frank, Team 73

CADD REF. FIGURE_2.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
KEY PLAN OF THE FUTURE YUEN LONG AND KAM TIN SEWERAGE WITHIN THE VICINITY OF EXPRESS RAIL LINK

SCALE 1 : 20000(A1) | DRAWING NO. FIGURE 2 | REV.

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235DS 06/10-03/14
2B-1T
NGAN TAM MEI / SAN TIN
TRUNK SEWERAGE PHASE 2
(CAT B FUNDED
UNDER 2005 RAE)

EXPRESS RAIL LINK
ALIGNMENT

525 DIA.
VB1
450 DIA.
VB2
VB3
675 DIA.
SSS
450 DIA.
VB4

PROPOSED NGAU TAM MEI SPS
DESIGN FLOW = 566 l/s

235DS 06/10-03/14
2A-2T
NGAN TAM MEI / SAN TIN
TRUNK SEWERAGE PHASE 1
(CAT B FUNDED
UNDER 2005 RAE)

PROPOSED SHA PO SPS
ADWF = 8,795 m³/day
DESIGN FLOW = 392 l/s

PROPOSED NAM SANG WAI SPS
ADWF = 42,009 m³/day
DESIGN FLOW = 1476 l/s

YUEN LONG STW

235DS 06/10-03/14
1B-1T
KAM TIN TRUNK
SEWERAGE PHASE 2
(CAT B FUNDED
UNDER 2005 RAE)

525 DIA.

PROPOSED PANG KA TSUEN SPS
DESIGN FLOW = 146 l/s

PROPOSED TSUI TSAN TIN SPS
DESIGN FLOW = 170 l/s

PROPOSED NG KA TSUEN SPS
DESIGN FLOW = 407 l/s

PROPOSED KAM TIN SPS
ADWF = 16,221 m³/day
DESIGN FLOW = 620 l/s

215DS 12/05-05/09
1A-1T
KAM TIN TRUNK
SEWERAGE PHASE 1
(CAT A
CONSTRUCTION IN PROGRESS)

LEGEND

- PROPOSED TRUNK SEWER UNDER PWP ITEM NO. 215DS (12/05-05/09)
- PROPOSED TWIN RISING MAINS UNDER PWP ITEM NO. 215DS (12/05-05/09)
- PROPOSED TRUNK SEWER UNDER PWP ITEM NO. 235DS (06/10-03/14)
- PROPOSED TWIN RISING MAINS UNDER PWP ITEM NO. 235DS (06/10-03/14)
- PROPOSED SEWER UNDER XRL

REV	DESCRIPTION	BY	DATE	APPROVED

REV	DESCRIPTION	BY	DATE	APPROVED

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EXPRESS RAIL LINK

ORIGINATOR
Arup Atkins JV
Supported by
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Knight Frank, Team 73

CADD REF. FIGURE_3.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
PROPOSED SEWER WORKS
UNDER EXPRESS RAIL LINK

SCALE 1 : 20000(A1)
DRAWING NO. FIGURE 3
REV.

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1/16/2009

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839000 N

838800 N

824000 E

LEGEND:

PROPOSED SEWAGE PIPE WITH MANHOLE

PUBLIC SEWERAGE SYSTEM

FOUL WATER DISCHARGE MANHOLE

TERMINAL MANHOLE AT WORK SITE BOUNDARY
TERMINAL MANHOLE SIZE AND DETAIL TO BE AS SHOWN ON THE DSD STANDARD DRAWINGS FOR TERMINAL MANHOLE.

OIL SEPARATOR CHAMBER

225mm DIAMETER VITRIFIED PIPE AT 1:100 FALL

PROPOSED CONNECTION OF NEWSEWERAGE WITH PROPOSED PUBLIC SEWERAGE SYSTEM (PWP No.235DS /PACKAGE 2B-IT)

SGJ1011301
SGJ1011300
SGJ1011304
SGJ1011430
SGJ1011421
SGJ10114

SMH1020311 CL 6.32 A1 4.39-600 X1 4.39-600
SMH1020313 CL 6.47 X1 4.47-375
SMH1020312 CL 5.98 A1 4.17-450 A2 4.33-375 A3 4.33-450 X1 4.17-600
SMH1020327 CL 6.54 A1 4.58-600 X1 4.58-600
SMH1020329 CL 6.49 X1 4.69
SMH1020314 CL 5.44 A1 4.11-600 X1 3.84-600
SMH1020328 CL 6.11 A1 4.20-450 A2 4.20 X1 4.20-450
SMH1020333 CL 6.05 A1 4.22-450 X1 4.22-450
SMH1020330 CL 6.57 A1 4.73-600 X1 4.73-600
SMH1020332 CL 6.57 X1 4.77-225
SMH1020331 CL 6.22 A1 4.31-450 A2 4.46-225 X1 4.31-450
SMH1020323 CL 5.42 X1 3.98-375
SMH1020325 CL 5.61

SWD1024696 SWD1024694 SWD1024693 SWD1024692 SWD1024691 SWD1024690 SWD1024689 SWD1024688 SWD1024687 SWD1024686 SWD1024684 SWD1024707 SWD1024697 SWD1024674

1117+400 1117+500 1117+600

露天貨倉 Open Storage
溫黛娜徑 VENTURA AVENUE
蒙尼卡徑 SANTA MONICA AVENUE
遊樂場 playground
雅逸居

0 5 10 15 20 25
METRES
1 : 500

REV	DESCRIPTION	BY	DATE	APPROVED	REV	DESCRIPTION	BY	DATE	APPROVED

DRAWN	LW
DESIGNED	PL
CHECKED	AL
APPROVED	JM
DATE	24/NOV/2008

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EXPRESS RAIL LINK

ORIGINATOR
Arup Atkins JV

Supported by
TFP Farrells, DLS, SIYUAN, Knight Frank, Team 73

CADD REF. FIGURE 5.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
VB1 - MPV
MAI PO VENTILIATION BUILDING-
PROPOSED FOUL WATER DRAINAGE

SCALE 1 : 500 (A1)

DRAWING NO. FIGURE 5

REV. –

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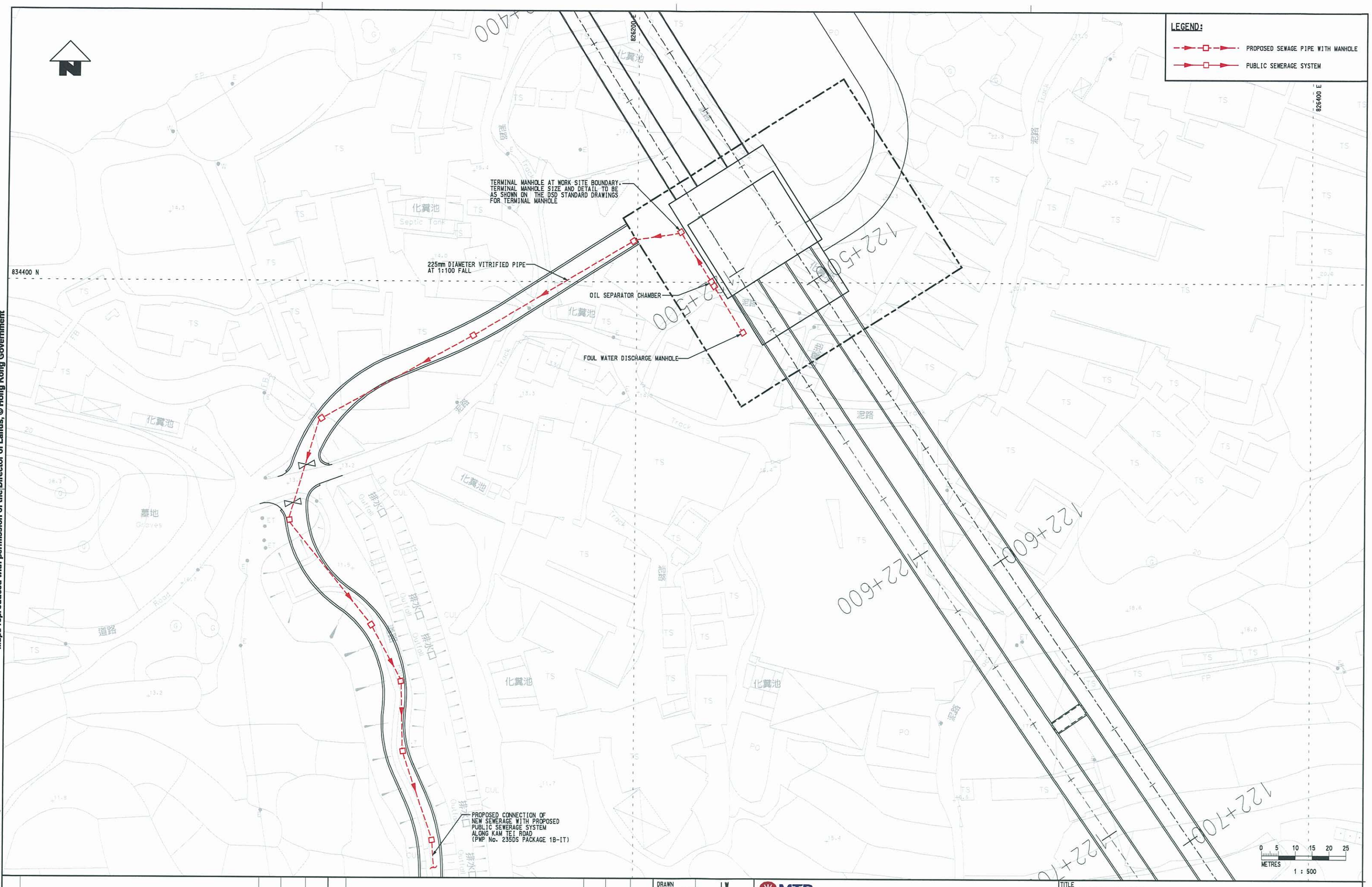

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REV	DESCRIPTION	BY	DATE	APPROVED

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ORIGINATOR
Arup Atkins JV
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CADD REF. FIGURE 7.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
VB3 - TPV
TAI KONG PO VENTILIATION BUILDING-
PROPOSED FOUL WATER DRAINAGE

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	FIGURE 7	–

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832200 N

828200 E

828400 E

832000 N

PROPOSED CONNECTION OF NEW SEWERAGE WITH PROPOSED PUBLIC SEWERAGE SYSTEM ALONG KAM SHEUNG ROAD (PWP No. 335DS PACKAGE 1B-IT)

225mm DIAMETER VITRIFIED PIPE AT 1:100 FALL

TERMINAL MANHOLE AT WORK SITE BOUNDARY. TERMINAL MANHOLE SIZE AND DETAIL TO BE AS SHOWN ON THE DSD STANDARD DRAWINGS FOR TERMINAL MANHOLE

FOUL WATER DISCHARGE MANHOLE

LEGEND:

- PROPOSED SEWAGE PIPE WITH MANHOLE
- PUBLIC SEWERAGE SYSTEM

0 5 10 15 20 25
METRES
1 : 500

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ORIGINATOR

Arup Atkins JV

Supported by TFP Farrells, DLS, SIYUAN, Knight Frank, Team 73

CADD REF. FIGURE 8.dgn

TITLE

NEX-2102

PRELIMINARY DESIGN

VB4 - PHV

PAT HEUNG VENTILIATION BUILDING-

PROPOSED FOUL WATER DRAINAGE

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	FIGURE 8	–

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LEGEND:

- SEWAGE PIPELINE 225mm DIA. VITRIFIED CLAY WITH MANHOLE
- SEWAGE PIPELINE 300mm DIA. VITRIFIED CLAY WITH MANHOLE
- PROPOSED BOX CULVERT
- REPROFILED STREAM
- CONCRETE CHANNEL

FOR CONTINUATION SEE FIGURE 10
MATCH LINE

ACCESS ROAD

CONNECTION TO BE MADE BETWEEN SSS FOUL WATER DRAINAGE TERMINAL MANHOLE AND NEW SEWERAGE SYSTEM PROPOSED ALONG KAM TIN ROAD UNDER THE YUEN LONG AND KAM TIN SEWERAGE

TRAIN SEWAGE OFFLOADING HOLDING TANK

HOLDING TANK DISCHARGE MANHOLE

0 10 20 30 40 50
METRES
1 : 1000

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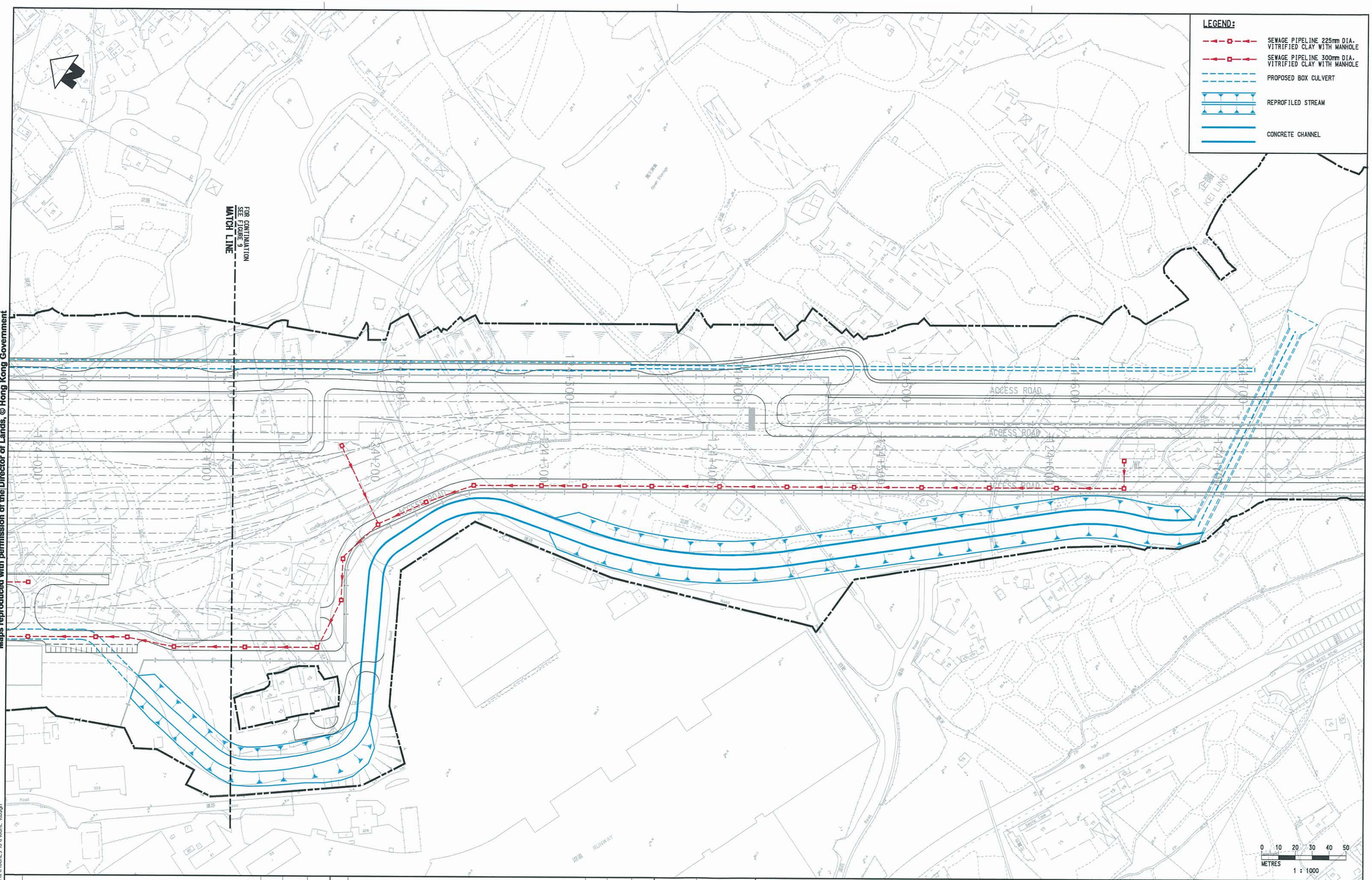
ORIGINATOR
Arup Atkins JV
Supported by TFP Farrells, DLS, SIYUAN, Knight Frank, Team 73

CADD REF. FIGURE 9.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
SHEK KONG STABLING SIDING AND EMERGENCY RESCUE STATION
FOUL WATER DRAINAGE
SHEET 1 OF 2

SCALE	DRAWING NO.	REV.
1 : 1000 (A1)	FIGURE 9	–



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DESIGNED	PL
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APPROVED	JM
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EXPRESS RAIL LINK

ORIGINATOR
Arup Atkins JV

Supported by
TFP Farrells, DLS, SIYUAN, Knight Frank, Team 73

CADD REF. FIGURE 10.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
SHEK KONG STABLING SIDING AND EMERGENCY RESCUE STATION
FOUL WATER DRAINAGE
SHEET 2 OF 2

SCALE 1 : 1000 (A1)

DRAWING NO. FIGURE 10

REV. –

Appendix A

Calculations

ARUP

Job No.	Sheet No.	Rev.
		FPD

Member/Location

Job Title: NEX-2102 Express Rail Link

Drg. Ref.

Calculation: Calculation for Foul Water Discharge at Each Ventilation Building

Made by: RC Date: 2008-12-01 Chd.

Operation Hour	19
Storage capacity (Hour)	24

Frequency of use *	Usage per hour	Loading unit (LU)
Low	3	1
Medium	6	2
High	12	4

* According to Plumbing Engineering Services Design Guide

Tunnel Foul Water Drainage System

Designation No.	Sump Location	Outlet Location	Floor Drain *		Total Discharge (L/s)	@Inflow rate (L/s)	Design Pump rate (L/s)
			No. of FD	Discharge Unit (L/s)			
Tunnel Foul Water Drainage	TUNNEL AT 122 + 200	VB 3	N/A	N/A	15	7.5	8.5
Tunnel Foul Water Drainage	TUNNEL AT 124 + 400	ERS	N/A	N/A	15	7.5	8.5

Ventilation Building (Southern Section of XRL)

Designation No.	Location	Foul Water Generated from Ventilation Builsing			Total Discharge (L/s)
		WC (L/s)	Washbasin (L/s)	**Floor Drain	
Ventilation Building Gravity Foul Water Syste	VB1	1.8	0.3	N/A	1.5
Ventilation Building Gravity Foul Water Syste	VB2	1.8	0.3	N/A	1.5
Ventilation Building Gravity Foul Water Syste	VB3	1.8	0.3	N/A	1.5
Ventilation Building Gravity Foul Water Syste	VB4	1.8	0.3	1.2	1.8

Designation No.	Sump Location	Outlet Location	Floor Drain *		Total Discharge (L/s)	@Inflow rate (L/s)	Design Pump rate (L/s)
			No. of FD	Discharge Unit (L/s)			
Ventilation Building Floor Drainage	VB 1	VB 1	15	0.3	4.5	1.1	3
Ventilation Building Floor Drainage	VB 2	VB 2	9	0.3	2.7	0.8	3
Ventilation Building Floor Drainage	VB 3	VB 3	9	0.3	2.7	0.8	3

Total Discharge at Ventilation Building

Discharge Location	Tunnel Foul Water Drainage System	Ventilation Building Gravity Foul Water System	Ventilation Building Floor Drainage	Total Discharge (L/s)
VB1	N/A	1.5	3	4.5
VB2	N/A	1.5	3	4.5
VB3	17	1.5	3	21.5
VB4	N/A	1.8	N/A	1.8

Required Tank Capacity = No. of Fitments x Loading Unit * Operation Hour

** Floor Drain to gravity system and Total Discharge = $\sqrt{}$WC + Wahbasin + Fllor Drain

* No. of Fitment is count as if it connects to Sump tank

@ Inflow rate for ventilation building = 0.5 x $\sqrt{}$Total Discharge; 2 duty pump will be provided for tunnel foul water sump pits so Inflow rate is half of the total discharge

ARUP

Job No.	Sheet No.	Rev.
		FPD

Member/Location

Job Title: NEX-2102 Express Rail Link

Drg. Ref.

Calculation: Calculation for Design Pump Rate Required at Each Ventilation Building

Made by: RC Date: 2008-12-01 Chd.

Operation Hour	19
Storage capacity (Hour)	24

Frequency of use *	Usage per hour	Loading unit (LU)
Low	3	1
Medium	6	2
High	12	4

* According to Plumbing Engineering Services Design Guide

Designation No.	Sump Location	Outlet Location	Floor Drain *		Total Discharge (L/s)	@ Inflow rate (L/s)	Design Pump rate (L/s
			No. of FD	Discharge Unit (L/s)			
Tunnel Foul Water Drainage	TUNNEL AT 122 + 200	VB 3	N/A	N/A	15	7.5	8.5
Tunnel Foul Water Drainage	TUNNEL AT 124 + 400	ERS	N/A	N/A	15	7.5	8.5
Tunnel Foul Water Drainage	TUNNEL AT 133 + 100	VB 5	N/A	N/A	15	7.5	8.5
Tunnel Foul Water Drainage	TUNNEL AT 139 + 850	VB 8	N/A	N/A	15	7.5	8.5
Ventilation Building Floor Drainag	VB 1	VB 1	15	0.3	1.1	1.5	3
Ventilation Building Floor Drainag	VB 2	VB 2	9	0.3	0.8	1.5	3
Ventilation Building Floor Drainag	VB 3	VB 3	9	0.3	0.8	1.5	3
Ventilation Building Floor Drainag	VB 5	VB 5	13	0.3	1.0	1.5	3
Ventilation Building Floor Drainag	VB 7	VB 7	9	0.3	0.8	1.5	3
Ventilation Building Floor Drainag	VB 8	VB 8	11	0.3	0.9	1.5	3

Required Tank Capacity = No. of Fitments x Loading Unit * Operation Hour

* No. of Fitment is count as if it connects to Sump tank

@ Inflow rate for ventilation building = 0.5 x √Total Discharge; 2 duty pump will be provided for tunnel foul water sump pits so Inflow rate is half of the total discharge

ARUP

Job No.	Sheet No.	Rev.
		FPD

Member/Location

Job Title: NEX-2102 Express Rail Link

Drg. Ref.

Calculation: Calculation for Sewage Flow from Kichen Area

Made by: RC Date: 2008-12-01 Chd.

According to EPD Practice Note ProPECC PN 5/93, the discharge flow rate from kitchen is determined by the kitchen wetted area and the following assumption:

1. Wetted kitchen floor area: $120m^2$
2. Daily water consumption is assumed as $0.5m^3/m^2$ (by EPD)
3. Peaking Factor: 2.29 (by EPD)
4. Retention period: 20 minutes (by EPD)
5. Operating period of kitchen: 19 hours/day (by MTRCL DSM)

As a result, the peaking discharge rate = 2 l/s