MTR Corporation Limited

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

Deliverable No. D3.10R Final Hydrogeological Impact Assessment Report (Revision A)

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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
TPV	Tai Kong Po Ventilation Building (VB3)
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 Scope of Report

This Hydrogeological Assessment Report (HAR) is one of the suite of Geotechnical Report submissions required under the scope of consultancy agreement for the Express Rail Link — Preliminary Design Service of XRL Tunnels and Associated Structures (Consultancy Agreement NEX/2102). The other reports within the suite are the Geotechnical Engineering Report (GER), Ground Movements Report (GMR), Geotechnical Instrumentation Report (GIR), Site Impact Assessment Report (SIAR), Natural Terrain Hazard Study Report (NTHSR), Structural Appraisal Report (SAR) and Blasting Assessment Report (BAR).

The main objective of this study is to review the hydrogeological conditions along the alignment of the proposed XRL project, specifically the definition of the existing groundwater and hydrological systems and the determination of typical hydraulic parameters for the various strata encountered. A preliminary qualitative assessment of the impact the proposed construction works may have on the hydrogeological system is also presented, together with recommendations for further studies to be carried out following the completion of additional investigation and monitoring works. This should be read in conjunction with Deliverable D3.1B, the Interim Geotechnical Engineering Report .

Comments from MTR on the Interim Preliminary Design report have, where appropriate, been incorporated in this report.

1.2 Project Background

The Railway Development Strategy 2000 (RDS-2000) identified the Regional Express Line (REL) as one of the future rail corridors required to meet anticipated transport demand in the Hong Kong Special Administrative Region (HKSAR). In November 2004 Government invited KCR to study the viability of this rail link; in July 2005, following the conclusion of their study KCR submitted its report on the matter, the Express Rail Link (ERL) Study Report.

The 2005 ERL study report examined the Hong Kong section of the proposed Hong Kong Guangzhou Express Rail Link, a variant to the REL envisaged in RDS-2000. The ERL study established that the terminus of any Express Rail Link should be located at West Kowloon and that options existed for either a dedicated rail corridor or a shared use corridor that utilized existing / proposed KCR lines, namely West Rail and the Kowloon Southern Link.

In February 2006 KCR were invited to proceed with further planning of ERL; the study brief required examination of shared and dedicated corridor options and also the accommodation of changes in planning requirements within the Mainland to provide for an additional ERL station near Yitian Road, in Shenzhen's Futian District and of the proposed Pearl River Delta Rapid Transit System that was being studied in the Mainland.

In November 2006 KCR appointed Ove Arup & Partners Hong Kong Ltd to carry out a project feasibility study; the final report of which was issued in September 2007. This study concluded that although the shared corridor option was viable in the short term the anticipated demand for cross boundary travel would be such that the shared route would be unable to meet demand in the longer term; consequently, the report recommended that the dedicated option be taken forward.

In May 2008, Arup-Atkins JV was appointed by MTR Corporation Limited to carry out the preliminary design for the XRL tunnels and associated structures from Mai Po to West Kowloon under Consultancy Agreement NEX/2102.

1.3 Project Description

The project comprises approximately 27km of tunnel from the Huang Gang Ventilation Shaft (HGV) north of the Boundary between the Shenzhen Special Economic Zone (SEZ) and the Hong Kong Special Administrative Region to a new terminus station in West Kowloon. In addition the project includes eight ventilation buildings, two ventilation adits and six ventilation shafts, an Emergency Rescue Station, a series of stabling sidings 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 final alignment runs from the Huang Gang Park Ventilation Building in the Shenzhen SEZ to a new terminus station to be constructed in West Kowloon. From Huang Gang Park the alignment proceeds south, as twin single track TBM bored tunnels beneath existing highway corridors to the Shenzhen River, the boundary between the Shenzhen Special Economic Zone and the Hong Kong Special Administrative Region.

Once across the river the alignment traverses beneath the Mai Po Marshes to the east of the Royal Palms development, the site of the Mai Po Ventilation Building and ventilation / construction shaft (formed using cut and cover construction), below San Tin Highway and Maple Gardens before skirting around the new Vineyard development and proceeding to the Ngau Tam Mei Ventilation Building and ventilation / construction shaft (formed using cut and cover construction) located at the northern foot of Kai Kung Leng and the Lam Tsuen Country Park.

From Ngau Tam Mei the alignment continues south, using drill and blast construction techniques, beneath the natural terrain of Kai Kung Leng (Elevation +572mPD), crossing beneath an existing WSD water tunnel with limited separation, before reaching the Tai Kong Po emergency access point and ventilation / construction shaft located on the northern slopes of the semi-rural Kam Tin valley. It is beneath Kai Kung Leng that the stub tunnels for a possible Lo Wu extension are provided.

To the south of Tai Kong Po twin bored tunnels, constructed using TBM, traverse the valley to the 500m (approx) long sub-surface Emergency Rescue Station (ERS) and the adjacent Shek Kong Stabling Sidings (SSS); the ERS being a deep "basement" constructed within a cofferdam. To the south of the ERS the approach tracks to the ERS and sidings are accommodated in an 800m (approx) long cut and cover box.

The southern end of the cut and cover box forms the launch shaft for two short TBM drives which carry the alignment beneath Kam Tin Road, Tse Uk Tsuen village, and the steep northern slopes of Tai Mo Shan, the location of a cut and cover reception shaft. The Pat Heung Ventilation Building is sited to the east of Tse Uk Tsuen and some distance from the alignment; here a ventilation adit rather than a shaft will connect the ventilation building to the running tunnels.

The alignment thereafter continues beneath the natural terrain of Tai Mo Shan (Elevation +957mPD) for some 7km, after which it passes beneath the western end of the Shing Mun Valley. The tunnel in this section is formed using drill and blast techniques. The Shing Mun Ventilation Building, approximately 50m to the west of the drill and blast running tunnels, is sited at an elevation of approximate +98mPD; here the ventilation connection will be via a deep vertical shaft and a short section of adit, both formed using drill and blast construction. From Shing Mun the alignment proceeds below the heavily urbanized and industrialized environment of Kwai Chung where it follows the Castle Peak Road highway corridor. At Shek Yam, a temporary construction adit will provide access from the works area to the drill and blast running tunnels immediately to the west of the site.

On reaching the southern slopes of Lai King Hill the Castle Peak Road takes a more westerly route around the hill while the XRL alignment continues directly beneath, passing below Wonderland Villas. It is in this area that the ventilation adit from the Kwai Chung Ventilation Building connects with the running tunnels.

The alignment continues beneath the Lai Chi Kok Reception Centre and through the congested area in the immediate vicinity of the Lai Chi Kok interchange; here the construction form changes from drill and blast to TBM bored tunnel. Through the Lai Chi Kok area the alignment is severely constrained by the presence of existing underground structures and, of necessity, follows a route which passes beneath the MTR Tsuen Wan Line tunnels, over the proposed DSD Lai Chi Kok drainage scheme between the Route 8 viaduct foundations and through some existing flyover and nullah piled foundations.

Following this congested interchange area, the alignment then traverses beneath the Sham Mong Road corridor, passing to the east of Nam Cheong MTR Station and beneath a number of pile-supported utilities and DSD culverts. At Nam Cheong there are two sections of cut and cover; the first is the launch shaft for the two northbound and two southbound TBM drives which will also form the ventilation shaft for the Nam Cheong

Ventilation Building, while the second will be constructed in order to remove existing piles for the future station development which conflict with the alignment.

Finally, at the southern end of Sham Mong Road the alignment passes under existing commercial and residential buildings in Tai Kok Tsui and below Cherry Street and Hoi Wang Road corridors before entering the West Kowloon Terminus. Immediately to the south of Hoi Ting Road the construction form changes from TBM bored tunnel to cut and cover which is continued for the remainder of the alignment as it approaches the West Kowloon Terminus. This section of cut and cover, in part, will also form the ventilation shaft for the Mong Kok West Ventilation Building.

1.4 Information Reviewed

The existing information obtained and reviewed as part of this study includes the following:

- Drillhole information from Geotechnical Information Unit (GIU) and previous Groundwater Investigation reports;
- Drillhole information and field tests under MTR Contract NEX2108;
- Topographic Survey Data from the Map Sheets 2, 6, 7 and 11 (1: 20000) by the Hong Kong Survey & Mapping Office;
- Geotechnical Area Studies Programme (GASP) Reports I (Hong Kong and Kowloon), II (Central New Territories), IV (North West New Territories) (GCO, 1987 to 1988);
- Geological Map Sheet Nos. 2, 6, 7 and 11 Solid and Superficial Geology (1:20000) by Hong Kong Geological Survey;
- Aerial photographs;
- Hong Kong Observatory (HKO) tidal information;
- Rainfall data from Geotechnical Engineering Office (GEO) and Evaporation data from HKO;
- Other information from Environmental Protection Department (EPD), Agriculture, Fisheries and Conservation Department (AFCD) and World Wide Fund (WWF) for Nature HK.

1.5 Report Limitations

The information provided in this report is for the sole and specific use of MTRC. Any other persons who use any information contained herein do so at their own risk.

Key limitations of this report relate primarily to the uncertainty with respect to the ground and hydrogeological conditions along the alignment and the lack of project specific ground investigation data (drillhole records, groundwater monitoring records, field test results, and laboratory test results) In the absence of project specific ground investigation data much of the analysis has relied upon archival information reported by others, the accuracy of which cannot be guaranteed.

Any persons who intend to use any information contained herein shall assess the applicability of the information and carry out their own interpretation.

1.6 Structure of Report

This report has been organised as follows:

Chapter 1: Project introduction and the report scope;

Chapter 2: Summary of the site conditions along the NEX/2102 tunnel alignment with an overview of the geology and groundwater conditions;

Chapter 3**:** Description of site geology with details of the solid, superficial and structural geology, and geological constraints;

Chapter 4**:** Details of the metrological data available including the rainfall and evaporation data along the proposed XRL alignment;

Chapter 5: Outline of hydrological features and hydro-ecologically significant areas proximate to the alignment;

Chapter 6**:** A summary of the groundwater system, the hydrogeological parameters of aquifer and non-aquifer units and the tide and groundwater relationship;

Chapter 7**:** Details of the construction methodology for the proposed tunnels and associated structures are detailed here;

Chapter 8: Summarises the qualitative impact assessment

Chapter 9, Conclusions and recommendations

2 Site Description

2.1 Topography

The topography of Hong Kong along the XRL alignment is characterised by rugged uplands and steep slopes with deeply dissected valleys; relatively wide, flat bottomed valleys where the natural drainage paths have been trained, and areas of flat, low lying marine reclamation. Table 2.1, below, summarise the topography along the proposed XRL alignment.

Table 2.1: Summary of Topography along the Proposed Alignment

Chainage		Location	Topography
From	To		
116+000	118+000	Mai Po	• Working south from the Boundary crossing at Shenzhen River the ground level remains reasonably flat at about +4mPD as the tunnels pass beneath Mai Po wetlands, a wide and low lying flood plain to the Shenzhen River. • Immediately to the south of the wetlands the alignment crosses San Tin Highway where the ground level rises to approximately +7mPD.
118+000	120+000	Ngau Tam Mei	• South of San Tin Highway, the topography rises to approx. +46mPD as the alignment passes beneath a ridge forming the north-western extremity of Kai Kung Leng before descending to +5mPD as the alignment traverses the wide though relatively short Tam Mei valley. • To the south of Tam Mei valley, the alignment continues beneath Kai Kung Leng, a peak within the Lam Tsuen Country Park.
120+000	122+300	Kai Kung Leng	• The topography at Kai Kung Leng rises to a maximum of +320mPD and then descends to +10mPD where the alignment enters the Kam Tin area near Pat Heung.
122+300	125+400	Shek Kong	• At Kam Tin, the alignment continues across the valley to the east of the Shek Kong airfield, where the ERS and the Shek Kong stabling Sidings will be located, and beneath the Tse Uk Tsuen Village and to the northern slopes of Tai Mo Shan. • The ground level in this area varies between +10mPD to the north of the airfield and +28mPD at the boundaries with Kai Kung Leng and Tai Mo Shan.
125+400	131+800	Tai Mo Shan	• As the alignment traverses beneath Tai Mo Shan the ground level rises rapidly to a maximum of +670mPD before falling steeply to +90mPD as it enters the Sheung Kwai Chung area.
131+800	134+100	Sheung Kwai Chung	• Along the XRL alignment in the Kwai Chung area, the ground level descends to about +15mPD before rising again, initially gradually and then rapidly, towards Lai King Hill (+249mPD).
134+100	136+700	West of Kowloon Reservoir	• From the peak of Lai King Hill the ground level falls gradually to +5mPD towards Lai Chi Kok.
136+700	140+684	West Kowloon	• As the alignment crosses the West Kowloon Reclamation and heads towards the site of the West Kowloon Terminus, the ground level remains relatively level at between +5mPD and +10mPD.

2.2 Site Conditions

With the exception of the natural terrain of Kai Kung Leng, within the Lam Tsuen Country Park, and Tai Mo Shan, itself a Country Park, the area to the north of Tai Mo Shan is a mixture of wet and dry agricultural land, the most important of which is the Mai Po Marshes, interspersed with areas of low density low rise residential and light industrial / commercial development.

The area is intersected by public roads and numerous open nullahs, generally flowing east to west, which drain the western slopes of Kai Kung Leng and the north-western slopes of Tai Mo Shan. Another prominent feature of the area is the Shek Kong airfield and barracks.

With the exception of Lai King Hill the area to the south of Tai Mo Shan is highly urbanized and includes the heavily developed districts of Kwai Chung, Lai Chi Kok, Tai Kok Tsui and Mong Kok. These areas contain numerous multi-storey residential / commercial / industrial buildings, public roads, mass transit infrastructure, educational institutions, public buildings, and nullahs and drainage culverts.

3 Site Geology

3.1 General

The interpretation of the site geology is based on the existing drillhole records and sheet nos. 2, 6, 7 and 11 of the 1:20 000 geological map issued by the GEO. A description of the geology including solid geology, superficial geology, structural geology and geological constraints is summarised in Section 4 of the Final Geotechnical Engineering Report (GER), Deliverable 3.10B.

3.2 Soils and Rocks

The XRL alignment in Hong Kong starts immediately to the north of the Shenzhen River, the boundary between the Shenzhen Special Economic Zone (Shenzhen SEZ) and the Hong Kong Special Administrative Region (Hong Kong SAR), crosses the New Territories and the Kowloon Peninsula until it ends at the West Kowloon Terminus, sited at the southern tip of the West Kowloon Reclamation.

The alignment, as it traverses the region, encounters almost the entire range of soils and rocks in Hong Kong;

- Meta-sediments immediately to the north and south of the Shenzhen River along with isolated Marble blocks;
- Slightly decomposed to fresh volcanics (Tuffs) of Kai Kung Leng and the northern slopes of Tai Mo Shan;
- Highly to completely weathered volcanics in Mai Po and Shek Kong and similarly decomposed intrusions in the Kam Tin valley, Lai Chi Kok, and below the West Kowloon Reclamation;
- Slightly decomposed to fresh intrusives (Granites, Granodiorites and Basalts) on the southern slopes of Tai Mo Shan, Kwai Chung and Lai King Hill.
- Fills, Marine Deposits and Alluvium in Mai Po, Shek Kong, Lai Chi Kok and the West Kowloon Reclamation.

3.3 Additional Investigation Works

In order to better quantify the ground conditions along the alignment a number of additional investigation drillholes have been undertaken. Whilst primarily undertaken to confirm the geological conditions along the alignment a number of these additional drillholes have included in-situ hydrogeological tests (constant/falling head permeability tests in soils and water absorption packer tests in rock) and the installation of groundwater monitoring instrumentation (standpipes and / or piezometers); this information has assisted in the understanding of the hydrogeological conditions along the alignment.

4 Hydrological Conditions

Figure 4.1 shows the distribution of surface hydrographical features, such as rivers, streams, reservoirs and ponds in the vicinity of the proposed XRL alignment.

4.1 Hydrological Setting

4.1.1 North West New Territories (Ch116+000 - Ch118+000)

North West New Territories study area is primarily natural hillside slopes in the west; urban development can be found in the Yuen Long area, and extensive viticulture and large tracts of marsh land in the east.

Within the built-up areas, the principal changes caused by urban development are the channelization, coupled with possible realignment of drainage paths together with the formation of an impervious surface to the ground. This latter item accelerates the rate of run-off after precipitation and reduces groundwater recharge of the underlying strata.

Runoff is removed through a system of storm drains into the main channels; discharges within urban channels are high and the times to peak discharge are short.

Outside the urban areas, disturbance of the natural drainage system consists of the channelization of major streams, the construction of catchwaters, the creation of reservoirs and the provision of additional / supplementary drainage systems.

The surface hydrology in this area consists of two major catchment areas near the proposed XRL alignment, namely Ngau Tam Mei and Shek Kong.

4.1.1.1 Ngau Tam Mei (Ch118+000 - Ch120+000)

This is the smallest of the catchments and is located in the northern part of the study area; The catchment drains the northern part of Kai Keung Leng with the major flow line trending in a westerly direction.

4.1.1.2 Shek Kong (CHh122+300 - Ch125+400)

This is the largest catchment area in the North West New Territories and is located in the southeastern portion of the North West New Territories. The catchment comprises the southern slopes of Kai Keung Leng, Tai To Yan and the western slopes of Tai Mo Shan; the major drainage lines flow west and northwest to intersect the fish pond areas near Kam Tin.

4.1.2 Central New Territories (Ch125+400 - Ch131+800)

The natural drainage regime in this portion of the alignment has been greatly modified by urban development and the need to provide potable water supplies. Major modifications to the drainage system have included the creation of six large reservoirs, the construction of extensive catchwaters, major urban development of foot-slope terrain and the formation of large areas of reclamation. Also, some natural drainage paths are channelized in this area.

The six reservoirs in the vicinity of the proposed alignment are the Shing Mun Reservoir, the Lower Shing Mun Reservoir, Shek Lui Pui Reservoir, Kowloon Reception Reservoir, Kowloon Byewash Reservoir and Kowloon Reservoir. These reservoirs are supplied by an extensive network of catchwaters. With the introduction of numerous water transfer tunnels and aqueducts these works form part of a complex water management system.

4.1.3 Kowloon (Ch131+800 - Ch140+684)

The natural drainage pattern in Kowloon is severely disrupted by extensive urban development. As it is not possible to map the drainage hierarchy within the urban area with any degree of reliability as the exact locations of the major catchment boundaries are uncertain.

Within these extensive built up areas the principal changes caused by urban development are the channelization and possible realignment of the drainage paths, together with the formation of an impervious ground surface. These impervious surfaces prevent precipitation permeating into the underlying strata and recharging the groundwater regime and also accelerate rate of run-off. Runoff is quickly controlled through a system of storm drains which discharge into the main channels. Discharges within urban channels are high and the times to peak discharge are short.

4.1.4 Designated Areas

In the vicinity of the XRL tunnel alignment there are three Sites of Special Scientific Interest (SSSIs) and one Ramsar designated site. All four of these sites are located in the general area of the Mai Po Marshes or Deep Bay.

The register of SSSIs is held by AFCD and Ramsar site (Mai Po and Inner Deep Bay) is managed by the Ramsar Management Authority, chaired by the AFCD. Details of these designated areas are provided in Appendix B to this report and are summarised briefly below:

4.1.4.1 Tsim Bei Tsui

The site is a coastal site of some 2.1 hectares located at Tsim Bei Tsui and just to the south of the Tsim Bei Tsui Police Post in the north-western part of the New Territories. The area includes a protected Egretry, and coastal mudflats and woodland habitats (dwarf mangrove forests) of particular interest.

4.1.4.2 Mai Po Marshes

The Mai Po Marshes cover an area of about 393 hectares of which 209 hectares are Kei Wais (shallow shrimp ponds) and bunds, the remainder being tidal creeks and dwarf mangrove forests; these marshes and ponds are an important wetland habitat for birds.

4.1.4.3 Inner Deep Bay

The Inner Deep Bay area is situated in the North Western part of the New Territories and bordered by the Shenzhen Special Economic Zone to the North. The bay is dissected by the boundary of Hong Kong Special Administrative Region and the portion of the bay covered by the Site of Special Scientific Interest (SSSI) is about 1,036 ha. The major habitat types inside the SSSI include extensive intertidal mudflats of an estuarine nature and a shallow bay. The coastal margins a bounded by a thick belt of coastal mangroves with farmland, fishponds and tidal shrimp ponds predominating inland.

4.1.4.4 Mai Po and Inner Deep Bay (RAMSAR)

Mai Po and Inner Deep Bay were designated as a Ramsar Site on September 1995. The stand of mangrove forest around Deep Bay / Mai Po is the sixth largest remaining along the coast of China while the reed beds are some of the largest in Guangdong Province.

4.2 Rainfall Data

Basic hydrological data along the alignment, in the form of rainfall records, have been obtained from the GEO. The data collected includes readings recorded at rainfall gauges in Mai Po (N33), Shek Kong (N36), Tai Mo Shan (N37 and N14), Shing Mun Reservoir (N40), Kwai Chung (N06), Lai Chi Kok (N04 and K06), Nam Cheong (K10), and Tai Kwok Tsui and Mong Kok West (K01).

Figure 4.2 indicates the locations of the GEO rainfall gauges while Table 4.1, below, provides further details of their locations.

Table 4.1: Summary of Rainfall Gauge Locations

Rain Gauge Number	Rainfall Gauge Location	Easting	Northing	Reduced Level APD (m)
K01	Civil Engineering Building, 101 Princess Margaret Road, Homantin	836346	819525	91
K02	Block 25, Lung Cheung Court, 15-17 Broadcast Drive, Kowloon Tong	836480	822656	92
K06	Carnation House, So Uk Estate, So Uk	834278	822543	82

Rain Gauge Number	Rainfall Gauge Location	Easting	Northing	Reduced Level APD (m)
K10	West Kowloon Northern Sewage Pumping Station , Stone Cutter Island	832392	820905	10
N01	Administration Block, Shatin Water Treatment Works, Shatin	835412	824706	38
N04	Kai Kwong Lau, Cho Yiu Estate, Kwai Chung	831444	822913	96
N14	Wireless Station, Tai Mo Shan, Tai Mo Shan Road, Tsuen Wan	830856	830180	944
N33	Bethel High School, 6 Golden Bamboo Road East, Fairview Park	823229	837363	15
N36	Kadoorie Agricultural Research Centre, Lam Kam Road, Shek Kong	829770	832264	201
N37	Twisk Country Park Management Centre, Route Twisk, Tsuen Wan	828849	829689	474
N38	Po Leung Kuk Lee Shing Pik College, Tsuen Wan	828954	826520	53
N40	Shing Mun Country Park Visitor Centre, Shing Mun Reservoir, Kwai Chung	832828	827280	176

A summary of the average rainfall readings for the above rainfall gauges for the most recent ten year period is provided in Table 4.2, below:

Table 4.2: Monthly Rainfall (mm) Data based on average reading from K01, K06, K10, N04, N06, N14, N33, N36, N37 and N40 stations

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (mm)
1997	48.6	137.3	39.3	138.3	445.4	850.8	1099.0	1041.4	269.9	44.4	6.0	15.3	4135.7
1998	58.3	191.3	60.4	247.7	346.8	851.8	284.1	291.8	220.2	150.8	40.8	22.3	2766.1
1999	7.4	1.8	15.7	131.8	221.0	275.6	208.8	1071.7	377.3	50.5	18.6	39.7	2419.9
2000	83.5	28.0	41.7	491.5	164.6	359.5	355.8	441.0	117.2	166.5	103.0	57.9	2410.1
2001	59.5	13.7	56.6	158.2	234.1	1261.3	870.3	384.5	597.3	7.1	4.8	48.8	3696.1
2002	27.5	8.7	158.2	16.5	358.7	282.0	426.6	598.3	730.4	158.7	30.0	70.5	2866.0
2003	22.0	11.2	44.3	75.5	383.2	594.9	147.9	438.9	531.0	33.0	34.1	0.9	2316.9
2004	59.4	63.9	109.9	127.6	222.9	137.4	416.3	431.6	158.5	3.9	3.1	3.0	1737.5
2005	6.8	23.9	47.3	46.3	509.9	807.5	426.8	1054.8	439.5	11.0	3.4	6.5	3383.6
2006	19.5	50.8	61.7	186.0	455.9	734.6	560.5	393.2	447.2	19.9	103.0	22.2	3054.5
2007	25.7	15.4	24.8	114.3	288.1	570.1	107.5	530.6	120.6	60.2	10.2	29.2	1896.5
2008	46.0	28.0	67.8	227.8	224.0	1446.8	486.0						
Avg.	38.0	49.6	60.0	157.6	330.0	611.4	445.8	607.1	364.5	64.2	32.4	28.7	2789.3

The rainfall data indicates that the drainage catchments along the proposed XRL alignment typically have an average annual rainfall between 1738mm and 4136mm per annum, with the average annual rainfall being about 2800mm per annum.

According to Stormwater Manual, a typical percentage of rainfall loss due to the runoff is in between 35% and 40%. As there is a lack of background information to calculate the runoff, a 40% of rainfall loss for runoff was adopted.

4.3 Evaporation

Although no direct monitoring of evaporation rates has been carried out in close proximately to the alignment, the monitoring undertaken at the Hong Kong Observatory has established average annual evaporation of about 1200mm for the period January 1997 to July 2008. The evaporation rates recorded at the Hong Kong Observatory Station have been summarised in the following table:

Table 4.3: Monthly Evaporation (mm) Data from HKO Station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (mm)
1997	70.9	54.8	75.3	81.7	111.1	96.9	106	130.3	107	105.9	100.5	68.9	1109.3
1998	53.5	47	64.9	95.4	103.9	82	150.4	147.8	117.6	124.7	91.2	80.3	1158.7
1999	73.4	94.9	64.5	114.9	97.6	136.8	130.6	135.2	123	130.6	105.5	86.3	1293.3
2000	72.1	54	94.3	79.9	126.3	144.2	157.6	136.3	145.6	120.6	81.8	72.6	1285.3
2001	59.7	67.4	94.2	71.3	120.9	113.8	129.8	144.6	132.7	124	102.3	80	1240.7
2002	62.3	73.6	85.5	100.7	126	132.7	133.2	129.9	113.9	98.5	94.2	61.2	1211.7
2003	72.5	62.1	74	94.9	117.9	105.5	168.4	128	116	119.8	89.5	92.1	1240.7
2004	70.3	64.6	68.7	97.5	122.5	152.6	132.1	129.2	134.1	145	98.4	99.4	1314.4
2005	64.1	35.1	67.4	77.8	92.4	92	165.8	134.5	127.5	135	93.1	99.4	1184.1
2006	65.8	71.9	64.4	87.2	101	97.7	134.7	133.5	122.3	113.2	78.5	83.4	1153.6
2007	73.6	64.1	62.5	87.5	120.4	126.8	172.3	107.9	129.4	118.1	115	85.8	1263.4
2008	66.4	63.2	92.4	76.7	103	104	132	-	-	-	-	-	-
Avg.	67.1	62.7	75.675	88.8	112.0	115.4	142.8	132.5	124.5	121.4	95.5	82.7	1223.2

4.4 Monthly Water Balance – Rainfall - Runoff – Evaporation (mm)

A comparison of the monthly rainfall averaged across the proximate rainfall gauges for the period from January 1997 to July 2008 against the Hong Kong Observatory evaporation records for the same period suggests that the water balances for catchments in the vicinity of the XRL are likely to be positive between April and September (potential infiltration exceeds evaporation) and negative between October and March (evaporation exceeds potential infiltration); see Table 4.4, below

Table 4.4: Monthly Water Balance – Rainfall less Runoff less Evaporation (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (mm)
1997	-41.75	27.60	-51.70	1.25	156.15	413.55	553.40	494.55	54.95	-79.25	-96.90	-59.75	1701.5
1998	-18.50	67.75	-28.65	53.20	104.15	429.10	20.05	27.25	14.50	-34.25	-66.70	-66.95	716
1999	-68.95	-93.80	-55.10	-35.80	35.00	28.55	-5.35	507.80	103.40	-100.30	-94.33	-62.48	674.8
2000	-22.03	-37.23	-69.27	214.97	-27.55	71.53	55.86	128.30	-75.28	-20.70	-20.00	-37.85	470.7
2001	-24.03	-59.20	-60.25	23.60	19.58	642.98	392.40	86.13	225.68	-119.75	-99.43	-50.74	1390.4
2002	-45.83	-68.36	9.41	-90.80	89.20	36.53	122.75	229.08	324.33	-3.27	-76.20	-18.93	811.3
2003	-59.30	-55.40	-47.40	-49.60	112.00	251.43	-79.65	135.32	202.63	-99.97	-69.05	-91.57	701.4
2004	-34.68	-26.25	-2.75	-20.95	11.23	-70.15	117.69	129.75	-39.03	-142.65	-96.53	-97.60	258.7
2005	-60.04	-20.78	-39.03	-50.03	213.55	392.50	90.28	498.38	136.20	-128.43	-91.08	-95.48	1330.9
2006	-54.08	-41.43	-27.40	24.40	172.55	343.08	201.58	102.43	146.00	-101.25	-16.73	-70.06	478.2
2007	-58.16	-54.88	-47.63	-18.95	52.48	215.28	-107.83	210.45	-57.05	-82.00	-108.90	-68.30	478.2
2008	-38.80	-46.40	-51.72	59.98	31.40	764.08	159.60	-	-	-	-	-	-
Avg.	-43.8	-34.0	-39.3	9.3	80.8	293.2	126.7	231.8	94.2	-82.9	-76.0	-65.4	865.8

Negative number (in Red colour) means evaporation exceeds potential infiltration, i.e. no infiltration into ground; the annual total does not take into negative number, i.e. only sum of positive numbers.

A similar comparison for annual rainfall against evaporation for the same period indicates a positive water balance, year on year, for the period January 1997 to December 2007. The maximum and minimum water balance during this period was +1701.5mm per annum and +258.7mm per annum and an average was some +865.8mm per annum.

5 Groundwater Regime

5.1 Inferred groundwater regime

5.1.1 Hydrogeological Profile

Based on the geological model developed for the alignment the following typical simplified sequence of strata is considered appropriate, with each of the units varying in both composition and thickness where present:

- Superficial deposits (Fill / Alluvium / Marine Deposits / Colluvium)
- Weathered rock (Grade VI to IV saprolite)
- Interface zone (Grade IV / III strata)
- Fresh rock profile (Grade III or better strata)

The main body of groundwater is expected to reside in the weathered rock layers, with comparatively less water residing in the underlying bedrock, or in the overlying superficial soils in the areas of low elevation.

Preliminary groundwater level contours have been prepared based on water level observations during previous drilling programmes (morning water levels) and during the post-installation seven day piezometer / standpipe monitoring data (see Drawings NEX2102/P/000/AAV/C05/170 to NEX2102/P/000/AAV/C05/195) associated with those drilling programmes. Due to the limited data available these contours should be considered as indicative only. The groundwater monitoring data used to compile the groundwater contours is provided in Appendix A to this report.

5.1.2 Groundwater Flow & Aquifers

The primary zones of groundwater storage will be the saprolite horizon located immediately above bedrock which due to their porous nature is more conducive to groundwater infiltration and accumulation. The crystalline nature and low porosity of both the Hong Kong granitic and volcanic rock masses means that these materials do not readily form a large groundwater storage zone and are likely to act as an aquiclude.

Groundwater flow will be controlled by the level of the existing water table and the degree of recharge within each of the drainage catchments along the alignment. Within areas where the saprolite profile is thick and storage aquifers are present groundwater flow within the upper part of the catchment will result from direct infiltration and through flow down to the water table. The rate of groundwater flow will generally be controlled by the permeability of the soil but in areas where the soft ground includes extensive colluvial deposits the through flow may also follow complex drainage networks involving voids, underground channels and soil pipes. Additionally, larger rates of through flow can be anticipated within zones of highly decomposed soil, in particularly within granitic terrain, which often have a higher porosity and permeability than the bounding completely and moderately decomposed strata.

As a consequence of the crystalline nature of both the granitic and volcanic rock masses little to no flow will occur through the bedrock as a result of primary porosity. The predominant factor controlling groundwater flow towards any hard rock portion of the tunnel will therefore be the presence of weakness and jointing within the rock mass and the connectivity of these features to water bodies, in this case the aquifers within the soil mass. The major pathways for such flows will typically be the geological faults that occur at various points along the length of the tunnel and flow within their associated fault disturbed zones. Where these pathways are laterally continuous and connected to aquifers within the soil strata, significant drawdown of groundwater could occur as a result of any uncontrolled inflow and may lead to settlement at the ground surface. Within the remaining rock mass any movement of groundwater will occur as a result of fracture flow between interconnected discontinuities.

In addition to the above typical conditions, the Marine Clay / pond deposits identified at the northern end of the alignment are of low permeability and may inhibit discharge of the groundwater system, acting as confining layers. Where laterally continuous and present overlying the saprolite these layers may result in the formation of artesian groundwater pressures beneath them.

5.1.3 Major Geological Structure

The proposed alignment intersects a number of recorded and inferred geological faults and the geological conditions in these areas can be expected to include zones of deeper weathering and highly fractured rock.

Major faults cutting across the proposed alignment are often sub-vertical or relatively steeply inclined (>70 degrees); however, there is one significant exception, the San Tin Fault near the northern end of the alignment which is a thrust fault dipping at 35-50 degrees.

A summary of properties of the major faults anticipated along the alignment that are likely to have impact on hydrogeological conditions in their vicinity are provided as below:

Table 5.1: Summary of Major Anticipated Faults along the Alignment

Chainage approx.	Location	Fault No & Name	Known Properties
119+680 to 121+700	Kai Kung Leng	Unrecorded	• Strong foliation Zone across North New Territories may result in preferential planes of weakness and groundwater inflow. • Possible presence of unrecorded faults.
126+900 to 127+050	Tai Mo Shan	F6 Sham Tseng Fault	• The fault is part of the Starling Inlet - South Lantau Island Fault Zone. The Fault Zone is composed of five major faults that trend NE and dip 70 to 85° NW. • As-built KCRC West Rail tunnel log suggested the Sham Tseng Fault Zone comprises two major crushed zones of about 5-8m wide.
132+900 to 127+100	Tai Mo Shan	Unrecorded	• Possible presence of intercalated siltstone within the Shing Mun Formation. The varying permeability of the different rock types could present some difficulties regarding groundwater inflow, especially when encountering strata that forms aquifers.
133+450	Sheung Kwai Chung	F7 Lead Mine Pass Fault	• The fault lies along the Shing Mun Jubilee Reservoir and extends NNE up to To Yuen Tung near Tai Po Hui. The fault strike is 010º varying to 020º. • Quartz-fissure veins with mineralization between 0.4m and 400m width are present at the Needle Hill Tungsten Mine. • The Fault extends approximately 7.5km, encountering block-bearing lapilli-ash TUFF and Tuffites in the north to fine-grained GRANITE and GRANODIORITE in the south. • The Fault crossing the tunnel alignment likely to have broken and more weathered rock mass as well as high potential groundwater inflows.
135+750 to 136+600	Lai Chi Kok	F8 Tolo Channel Fault	• The proposed XRL tunnel alignment has to go through the complex Tolo Channel Fault Zone. • The most complete section through the Tolo Channel Fault has been exposed at the entrance to a water tunnel near Sha Tin. There, the fault zone is approximately 30m wide and consists of a steeply dipping zone of quartz BRECCIA, sheared GRANITE and fault gouge. • The fault lies along the Sha Tin Valley and is exposed north of the Kowloon Reservoir. Here the fault strikes 050º and has an associated wide BRECCIA zone with slickensides indicating strike-slip movement. • The published geological map indicates that the fault near the Kowloon Reservoir dips south-east at 70 to 80º.

The hydrogeological conditions associated with the anticipated major faults may have significant impact on those tunnels excavated by the drill and blast method. Close to the faults it is anticipated that the rock mass quality will be highly variable, joints are typically more open, resulting in potentially higher groundwater inflows when the tunnel alignment pass through. Careful pre-excavation probing and grouting regimes may be required in such areas.

The tunnel is also likely to encounter dykes and mineral veins that have been intruded within the Granite or Tuff; these features are likely to be sub-vertical and are commonly associated with faults having been intruded along preferential lines of weakness. They may act as conduit to flow resulting in higher localised inflows and thus greater groundwater drawdown.

Based on the geological data available, Sandstone bands may also be presented in the coarse ash crystal Tuff bedrock. The varying permeability of the different rock types could present some difficulties regarding groundwater inflow, especially when encountering porous strata such as Sandstone, which may form an aquifer.

5.1.4 Inferred Groundwater Levels

As previously discussed, the main body of groundwater is expected to reside in the superficial deposits and weathered rock layers, with significantly less groundwater storage in the underlying bedrock. Preliminary groundwater level contours have been prepared based on water level observations during previous drilling record (morning water levels) and during the post-installation seven day piezometer / standpipe monitoring data (see Drawings NEX2102/P/000/AAV/C05/170 to NEX2102/P/000/AAV/C05/195) associated with those drilling programmes. The groundwater monitoring data used to compile the groundwater contours is provided in Appendix A to this report.

It should be noted that the reliability of the groundwater contours is relatively low at this point due to the following constraints:

- Limited amount of data currently available, which is largely non-specific to this project.
- Use of data from geographically widespread areas rather than monitoring focussed along the alignment.
- Existing data is archival in nature and taken from a variety of projects; as such the groundwater levels recorded were taken at different times and do not, strictly speaking, directly correspond to one another.
- Lack of long-term monitoring means that the range and variability of potential groundwater levels along the alignment is unknown.

Given such constraints the contours presented in this report should be considered as indicative only.

Based on the preliminary groundwater contour plots it is apparent that groundwater flows typically follow the same general pattern as the overlying topography, flowing from areas of high elevation area to the low elevation areas such as the harbour in the south and estuarine marsh areas in the north. Notable groundwater catchment divides can be found along high elevation ridgelines such as those at Kai Kung Leng, Tai Mo Shan, Golden Hill, and Lai King Hill.

The negligible recharge occurring during the dry-season, as indicated by the water balance, suggests that groundwater levels across the region will typically decline between October and March.

5.1.5 Tide and Groundwater Level Relationship

The northern and southern extents of the proposed alignment are located in close proximity to coastal areas. As such any variations in groundwater levels within these areas will occur not only as a result of recharge from the upper catchment but also in response to tidal fluctuations.

In order to better understand the impact of tidal conditions on the ground water conditions a water level monitoring programme was undertaken on 19th August 2008 utilizing those drillholes closest to the Mai Po / Inner Deep Bay estuarine system. The purpose of the monitoring was to establish the magnitude of the tidal influence, if any, on the groundwater regime in the Mai Po area and how this related to tidal cycle. The location of piezometers installed across the Mai Po area is presented in Figure 5.1.

The drillholes were located location in a truck park (824000, 839000) bounded by the Royal Palms to the south, Castle Peak Road (Mai Po) to the east, a floodwater pumping station to the north and shrimp / fish ponds to the west of the site. The site is located approximately 1.2km from the Shenzhen River (tidal estuarine zone). Hourly dipping was carried out from around 9:00am to 6:00pm in piezometers and or standpipes installed in the three drillholes detailed below:

- 2108/XRL/D258
- 2108/XRL/D257
- 2108/XRL/D254

The strata being monitored by the piezometers / standpipes (the response zones) were Fill, Alluvium and Completely Decomposed Meta-Siltstones (Grade V materials).

The high tide level (predicted) at Tsim Bei Tsui on the day of the study was 2.7mPD and occurred at 11:45 (approx) while the subsequent low tide level was some 0.4mPD (estimated) and occurred at approximately 19:20; this corresponds to a tidal variation of some 2.3m. The maximum difference in groundwater level recorded during the 9-hour monitoring period was 0.032m, which is less than 2% of the tidal variation during the same period.

Although these results indicate that there is little tidal influence on the groundwater regime in the Mai Po area it should be noted that the monitoring points were 1.2km from the Shenzhen River, the closest body of tidal water, and the monitoring period was only 9 hours rather than the 24 hours more typically adopted when undertaking such a survey. The field monitoring data and the HKO predicted tide levels are provided in Appendix C to this report.

5.2 Conceptual Groundwater Model

Based on the inferred groundwater contour plots it is apparent the groundwater is flowing from the high elevation area to the low elevation areas such as the harbour in the south and estuarine marsh areas in the north. Groundwater divides can be found at along the principal ridgelines to Kai Kung Leng, Tai Mo Shan, Golden Hill, and Lai King Hill. The groundwater divide acts as a no flow boundary.

The hydrogeological concept for the region is that during the wet season the groundwater recharges from the permeation of rainfall through the superficial deposits and weathered rock below the areas of predominantly natural habitat (vegetated hill slopes) and agricultural land.. The bedrock underneath the weathered rock reduces in permeability with depth such that the base of the model can effectively be assumed as a no flow boundary.

Flow “refraction” is expected to take place with the majority of flow occurring in the higher conductivity layers with flows towards these layers from the adjacent layers of lesser conductivity. This process includes flow from the rock mass to the upper more permeable zones. In general, flow takes place from the upper areas of the model, concentrated in the more conductive layers, towards the lower elevation areas of the model and the sea.

Groundwater recharge at the urban development areas and rock slope areas is expected to be low, a reflection of the high surface runoff rates associated with the predominantly impervious nature of the overlying material.

A similar system applies in the dry season; however, with negligible recharge reduced flows and a decline in the groundwater table are likely to occur. The positions of groundwater divide may also vary slightly, usually on a seasonal basis, in response to changes in local conditions.

The Marine Clay / pond deposits are of low permeability and therefore inhibit the discharge of the system and may act as a confining layer in the low lying areas. The continuity and lateral extent of these impermeable strata may be such that artesian groundwater pressures may arise beneath them.

5.3 Hydraulic Properties

5.3.1 Permeability Characterisation

Records have been obtained and reviewed for 220 falling and constant head permeability tests undertaken in the vicinity of the XRL alignment. The results of these tests are presented in Appendix D to this report and a summary of the hydraulic properties of the various soils and weathered rock is provided in Table 5.2, below:

Table 5.2: Summary of Falling / Constant Head Permeability Test Results

Materials	No. of Sample	Maximum	Minimum
Fill	29	1.54E-4	1.2E-7
Alluvium - Sand	33	3.73E-4	6.11 E-8
Alluvium - Clay	3	6.54E-5	2.13E-7
Colluvium (Debris Flow Deposits)	4	6.66E-7	4.08E-8
Marine Deposits	25	1.10E-4	1.03E-9
Residual Soil	4	1.05E-5	3.74E-7
Grade V Volcanic Rock	19	1.09E-5	6.46E-8
Grade IV/III Volcanic Rock	1	4.01E-6	
Grade III/II Volcanic Rock	1	1.64E-6	
Grade V Granitic Rock	59	9.74E-3	6.41E-9
Grade IV/III Granitic Rock	2	1.68E-5	2.61E-8
Grade III/II Granitic Rock	4	8.36E-6	1.25E-7
Grade V Metamorphic Rock	5	3.89E-6	9.56E-8
Grade IV/III Metamorphic Rock	1	1.94E-7	

In addition to the falling/constant head tests, the records of 85 water absorption packer (Lugeon) tests undertaken in close proximity to the XRL alignment were also retrieved. The water absorption packer tests were generally carried out in Grade II/III rock with most of the tests based on ten metre test lengths. The results of the tests are also presented in Appendix D to this report and are summarised in Table 5.3, below. The permeability of the rock mass has been estimated on the assumption that 1 Lugeon is equivalent to a permeability of $1x10^{-7}$m/s.

Table 5.3: Summary of Packer (Water Absorption) Test Results

Materials	No. of packer tests	Maximum	Minimum
Volcanic	17	5.26E-6	4.0E-8
Granitic	56	2.06E-6	2.0E-9

5.4 Preliminary Design Permeability Profile

A number of previous studies have been conducted into the variations of permeability with depth, in particular within the completely weathered Grade V unit and within the upper partially weathered rock mass zone. Such studies have identified typical variations in the permeability of the strata associated with the following attributes and their particular depth dependencies:

- Porosity development due to leaching of fines (increasing with depth)
- Reduction in clay content with depth - typically from 20% or more at the top to 0 - 5% at base of the saprolite
- Preferential weathering of structure generally reducing with depth below rockhead
- Increase in confinement and reduction in permeability of the rock mass with depth.

Based on the review of the data carried out, the following preliminary design permeability profile is proposed. This data should be subject to further checking and updating following the completion of the on-going ground investigation programme which will include a number of additional site and project specific test results:

Table 5.4: Preliminary Hydrogeological Design Parameters for Soils and Rocks

Soil / Rock Type or Zone	Preliminary Recommended Range for Design Permeability, k (m/s)
Fill	$1e^{-6} – 5e^{-5}$
Alluvium-Sand	$2e^{-6} – 7e^{-5}$
Marine Deposits-Clay	$5e^{-8} – 5e^{-7}$
Marine Deposits-Sand	$1e^{-5} – 1e^{-4}$
CDGranite	$3e^{-7} – 5e^{-6}$
CDGranodiorite	$1e^{-7} – 5e^{-6}$
CDTuff	$3e^{-7} – 5e^{-6}$
HDGranite	$1e^{-7}$ - $1e^{-6}$
M/SDG (Upper 20m of Bedrock Profile)	$5e^{-8} – 5e^{-7}$
M/SDG (20m to 40m below Bedrock Level)	$5e^{-9} – 3e^{-7}$
M/SDG (>40m below Bedrock Level)	$1e^{-9} – 1e^{-7}$
M/SDV (Upper 5m of Bedrock Profile)	$1e^{-7} – 3e^{-6}$
M/SDV (5m to 10m below Bedrock Level)	$7e^{-8} – 1e^{-6}$
M/SDV (10m to 20m below Bedrock Level)	$1e^{-8} – 1e^{-6}$

In determining the above proposed values we have not considered areas of locally enhanced permeability associated with isolated transmissive features. It is anticipated that features will be treated (grouted) following a carefully specified procedure. The values are thus intended to represent upper bound values for the background permeability associated with the typical ground conditions.

6 Envisaged Construction Methodology

6.1 Tunnels

6.1.1 General

Figure 6.1 shows the tunnel construction methods along the proposed XRL alignment. Between the Huang Gang Park in Shenzhen and West Kowloon Terminus in Hong Kong the principal tunnelling elements are as follows:

6.1.2 TBM Bored Tunnels

XRL alignment in Hong Kong includes six TBM bored tunnel sections.

- X310 – Huang Gang Park to Mai Po Tunnels (Ch114+152 to Ch117+385),
- X311 – Mai Po to Ngau Tam Mei Tunnels (Ch117+450 to Ch119+610),
- X313 – Tai Kong Po to ERS Tunnels (Ch122+490 to Ch123+540),
- X314 – ERS to Pat Heung Tunnels (Ch124+912 to Ch125+330),
- X317 – Mei Lai Road to Nam Cheong Tunnels (Ch136+780 to Ch137+760),
- X318 – Nam Cheong to Mong Kok West Tunnels (Ch137+968 to Ch140+380).

The tunnels will be designed as twin bores. As the Huang Gang Park to Mai Po Tunnels will cross the Boundary, the tunnel arrangement needs to be developed so as to comply with the requirements of the relevant authorities on both sides of the Boundary. It should be noted that this report is limited to those works implemented within the Hong Kong SAR and therefore does not extend beyond the Shenzhen River.

It is anticipated that a closed face TBM, either an Earth Pressure Balance Machine (EPBM) or a slurry machine, will be used for these soft ground and mixed ground drives. It is assumed that during excavation the TBM will provide full support to the face of the excavation so as to limit face (volume) losses. The permanent ground support will be in the form of an undrained precast reinforced concrete segmental lining which will be installed at the tailskin of the TBM as it advances so as to provide immediate ground support. In order to further control ground settlement it is anticipated that the overcut annulus will be back-grouted as, or immediately after, the lining (ring) leaves the tailskin of the TBM.

The use of a closed face TBMs in conduction with an “undrained” tunnel lining effectively precludes the ingress of water into the tunnel during and following construction. As a consequence these TBM tunnels will have, in effect, no impact on the hydrogeological conditions.

6.1.3 Drill and Blast Tunnels

XRL alignment in Hong Kong includes three drill and blast running tunnels:

- X312 – Ngau Tam Mei to Tai Kong Po Tunnels (Ch119+640 to Ch122+460);
- X315 – Tse Uk Tsuen to Shek Yam Tunnels (Ch125+355 to Ch132+455);
- X316 – Shek Yam Tunnels to Mei Lai Road Tunnels (Ch132+455 to Ch136+780).

These tunnels will be designed for drill and blast construction with the extent of each advance, excavated by the drill and blast technique, controlled by the prevailing rock conditions and the requirement to maintain blast induced vibrations within permissible limits; which reflect the proximity of vibration sensitive receivers e.g. slopes and other geotechnical features, utilities, heritage sites, buildings and structures.

On completion of each advance (blast), temporary ground support will be installed; this ground support will generally be in the form of rockbolts with, potentially, sprayed concrete (with or without reinforcing mesh). The level of support (rockbolt density / thickness of sprayed concrete / type of reinforcement) will be estimated in accordance with the NGI Q classification system or using numerical modelling. Where the rock is considered poor and / or where water is present in significant quantities the temporary ground support may be increased to include lattice arches, spiling / forepoling, grouting and / or invert closure.

The permanent lining to the drill and blast tunnels will be constructed using cast in-situ concrete and will normally be designed as a “drained” lining with a nominal hydrostatic load varying from 0 to 1Bar. In areas of the tunnel where the inflow of ground water could potentially affect the groundwater table it will be necessary to implement pre-grouting measures within the rock strata surrounding the tunnel prior to excavation to reduce its mass permeability. In particular this measure will be required in areas where the rock cover is low and where compressible soils are saturated and present over a significant depth, A comprehensive grouting strategy should be implemented in these areas such that any transmissive features within the rock mass are identified and treated; in critical areas this may require probing and grouting ahead of the face. It is expected that this measure will be sufficient to control any ground water inflow to the tunnel and hence prevent any significant lowering of the groundwater table near the surface. However, in the event that this is not achieved a further mitigation measure comprising post-grouting works should be implemented to reduce the water inflow further to an acceptable level before the permanent lining is cast.

6.1.4 Cut and Cover Tunnels

The XRL alignment in Hong Kong includes three cut and cover tunnel sections:

- ERS and Shek Kong Stabling Sidings approach tunnels (Ch123+540 to Ch124+912);
- Nam Cheong TBM launch shaft (Ch137+760 to Ch137+968);
- WKT approach tunnels (Ch140+380 to Ch140+540);

These cut and cover tunnels will be formed within retaining wall structures. It is anticipated that construction will be a diaphragm wall cofferdam with internal strutting (props and wailings) to provide the required lateral bracing.

In addition it is anticipated that a further section of cut and cover tunnel, either temporary or permanent, will be constructed at Nam Cheong for the removal of the existing driven piles installed for the proposed above station developments.

The cut and cover tunnel sections will be designed in the permanent condition as “undrained” structures and will be provided with an impermeable lining. No ground water drawdown is therefore expected in the permanent condition. However, ground water drawdown may occur temporarily during their construction to form the necessary excavation for the works. Stiff retaining structures providing lateral ground support are envisaged to create a cofferdam for these works which will most likely comprise either diaphragm walls and/or bored pile walls. In order to mitigate any drawdown effects to the groundwater table outside of the site boundary during the operation of the temporary dewatering works the following measures shall be put in place at each location:-

- Toe grouting shall be applied beneath the toe level of the temporary/permanent cofferdam walls as necessary to lengthen the effective flow path of groundwater from outside and thus control the amount of water inflow to the excavation.
- Recharge wells shall be installed as necessary outside the excavation to pump, water obtained from the excavation back into the ground.

Where practical this drawdown would be limited to 2m within the site area in order to avoid adverse settlement impacts outside.

6.2 Emergency Rescues Station and Shek Kong Stabling Sidings

The sub-surface Emergency Rescue Station (ERS) and the at-grade Shek Kong Stabling Sidings will be located in Shek Kong adjacent to the existing Shek Kong Barracks.

The construction of the ERS together with the associated approach tunnels requires an excavation approximately 1400m long, 28m wide and 24m deep. It is envisaged that a conventional bottom-up construction within a permanent or temporary coffer dam will be adopted. The coffer dam itself may be constructed using diaphragm walling, currently preferred, or bored or sheet-piled walls. A re-evaluation of the preferred approach is recommended on completion of ongoing site investigation works in the area.

The Shek Kong Stabling Sidings is an at-grade facility comprising eight stabling tracks, four running maintenance tracks, two engineering tracks, a traction sub-station, a main building and numerous stores / workshop buildings. The sidings facility will be constructed on a flat platform, part cut part fill, in an area of gently sloping ground. It is anticipated that the buildings within the site, depending on the loadings and ground conditions will be founded on piles or spread footings.

6.3 Shafts

There are six permanent ventilation shafts, five of which will also be used for construction access, and three temporary construction shafts distributed along the Hong Kong Section of the XRL alignment as detailed below:

Permanent ventilation and emergency access shafts

- Mai Po Ventilation Shaft (MPV) (Ch117+418);
- Ngau Tam Mei Ventilation Shaft (NTM) (Ch119+625);
- Tai Kong Po Emergency Access Shaft (PHV) (Ch122+475);
- Shing Mun Ventilation Shaft (SMV) plus connecting adit (Ch132+079);
- Nam Cheong Ventilation Shaft (NCV) (Ch137+864);
- Mong Kok West Ventilation Shaft (MKV) (Ch140+555).

Temporary construction shafts

- TBM Reception Shaft, Tse Uk Tsuen Works Area (TUW) (Ch125+343);
- TBM Reception Shaft, Mei Lei Road (MLW) plus connecting adit (C136+578);
- TBM Reception Shaft, Hoi Ting Road (HTW), included within the West Kowloon cut and cover approach tunnels (see above).

It is anticipated that the shafts at Mai Po, Ngau Tam Mei, Tse Uk Tsuen, Nam Cheong and Mong Kok West will be entirely in soft ground; the remaining shafts identified above will be excavated through both soft ground and rock. While the extent of the soil excavation will differ from shaft to shaft it is expected to be significant in the majority of cases; the exceptions being the Shing Mun and Mei Lei Road shafts where rockhead is expected to be close or very close to surface.

Except the Mei Lai Road construction shaft, the depth of the proposed ventilation and working shafts in soil are generally greater than 20m. Stiff retaining structures providing lateral ground support are envisaged to create a cofferdam for the excavation and construction of the shafts in these areas. The two methods proposed for the retaining structures are diaphragm walls and bored pile walls. In these areas, the excavations for the ventilation shafts and temporary construction shafts will only require temporary dewatering during their construction. In the long term they are designed to be “undrained” with a full hydrostatic head outside. In order to mitigate any drawdown effects to the groundwater table outside of the site boundary during the operation of the temporary dewatering works the following measures shall be put in place at each location:-

- Toe grouting shall be applied beneath the toe level of the temporary/permanent cofferdam walls as necessary to lengthen the effective flow path of groundwater from outside and thus control the amount of water inflow to the excavation.
- Recharge wells shall be installed as necessary outside the excavation to pump, water obtained from the excavation back into the ground.

Where practical this drawdown would be limited to 2m within the site area in order to avoid adverse settlement impacts outside.

Where the shafts are to be excavated through rock temporary ground support will be installed, where necessary, on the completion of each advance (blast). This ground support will generally be in the form of rockbolts with, potentially, sprayed concrete (with or without reinforcing mesh) and will be estimated in accordance with the NGI Q classification system or using numerical modelling. Where the rock is considered poor and / or where water is present in significant quantities the temporary ground support may be increased to include lattice arches.

The permanent lining to those shaft sections will be constructed using cast in-situ concrete and will normally be designed as a “drained” lining with a nominal hydrostatic load of 1Bar. It is anticipated that a short section of un-drained cast in-situ lining will be required immediately below the rockhead to form a cut-off and prevent the drained permanent lining dewatering the rock at the soil rock interface and thus the soil above.

Dewatering may be required during construction stage and any groundwater drawdown outside the site area resulting from such work would typically be limited to 2m.

6.4 Adits

The XRL project will require the construction of a two permanent ventilation adits and one temporary construction adit; the locations of which are detailed below:

- Pat Heung Ventilation Adit (SKV) (Ch125+710);
- Construction adit, Shek Yam Works Area (SYW) (Ch132+460);
- Kwai Chung Ventilation Adit (KCV) (Ch134+647);

These adits are generally be designed as drill and blast tunnels although short sections of soft / poor ground, generally less than 50m in length, are expected at the adit portals.

The excavation, preliminary support and permanent support of these adits are similar to that outlined for the running tunnels in Section 6.1.2 of this report. Soft ground mining techniques in conjunction with heavy ground reinforcement is anticipated for the excavation of these soft / mixed ground sections and will be designed as “undrained” excavations with impermeable linings. Compressed air will be used to prevent ground water ingress during excavation of the soft/mixed ground portions. The construction method for the rock portions of adits will be similar to that proposed for the drill and blast tunnels. These portions of the adits will be designed as “drained” excavations, although pre-excavation grouting will be used in order to control the amount and rate of water ingress into the excavation.

7 Impact Assessment

7.1 Qualitative Impact Assessment

Based on the hydrological and hydrogeological aspects, a preliminary review of the potential impact assessment of the XRL alignment has been summarised in the following table.

Table 7.1: Qualitative Impact Assessment

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
Ch115+930 to Ch117+385 (1455m)	Mai Po	Rural setting with some structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Low lying alluvial plains including several designated wetlands and surface water bodies of environmental and conservation importance. Any groundwater drawdown/ dewatering of surface features could disturb the local ecosystems and result in ground settlement.	TBM tunnel	The use of slurry/EPB TBM construction method and the selection of an impermeable "undrained" tunnel lining (installed prior to the advance of the TBM) should preclude groundwater inflow into the tunnels. No potential water drawdown is anticipated.	Low	Permanent lining to tunnel is impermeable to water. During construction, face pressure of TBM will be maintained to prevent water coming into the excavation.
Ch117+385 to Ch117+450 (65m)			Cut and Cover Shaft	Dewatering may be required during construction phase. Diaphragm wall to be proposed for ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off) Ground settlement due to dewatering during construction has been assessed and found to be acceptable in the Ground Movement Report on the basis that groundwater drawdown outside the site area is limited to 2m. Groundwater drawdown in excess of 2m will necessitate a further review of the estimated ground settlements. It is anticipated that the groundwater level will recover upon the completion of works.	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation.
Ch117+450 to Ch119+610 (2160m)	Ngau Tam Mei	Rural setting with structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Any groundwater drawdown could result in ground settlement.	TBM tunnel	The use of slurry/EPB TBM construction method and the selection of an impermeable "undrained" tunnel lining (installed prior to the advance of the TBM) should preclude groundwater inflow into the tunnels. No potential water drawdown is anticipated.	Low	Permanent lining to tunnel is impermeable to water. During construction, face pressure of TBM will be maintained to prevent water coming into the excavation.
Ch119+610 to Ch119+640 (30m)			Cut & Cover Shaft	Dewatering may be required during the construction phase. A diaphragm walls or secant pile wall is proposed for the ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off) Ground settlement due to dewatering during construction has been assessed and found to be acceptable in the Ground Movement Report on the basis that groundwater drawdown is limited to 2m outside the site area. Groundwater drawdown in excess of 2m will necessitate a further review of the estimated ground settlements. It is expected that the groundwater level will be recovered upon the completion of works.	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation
Ch119+640 to Ch122+460 (2820m)	Kai Kung Leng	Deep hard rock tunnel (between 50-220 mbgl) beneath a largely undeveloped area of natural terrain. Limited potential for adverse impact on surface structures / features. Intersect with Ngau Tam Mei WSD 3.4m Aqueduct Tunnel at Chainage 120500. The clear distance between the	Drill and Blast tunnel	Considering the depth of the tunnels and available rock cover in this area, the majority of the tunnel length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
		proposed tunnel and existing WSD Tunnel is about 20m It is expected that schistose foliations will be present in the mountainous volcanic terrain of Kai Kung Leng. Groundwater resided in the mountainous area may ingress into the “drained” section of the tunnel.		tunnel will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary An ‘observational Method’ is to be adopted to monitor the effects to the groundwater table in the most sensitive areas where the tunnelling works are closest to the surface i.e on the lower reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas. The presence of sedimentary layering of the volcaniclastic rocks and Schistose foliations in the metamorphosed rocks may result in preferential planes of groundwater inflow during tunnelling which will need to be considered when planning the grouting works.		the tunnel excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
Ch122+460 to Ch122+490 (30m)	Tai Kong Po	Rural setting with some structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Low lying alluvial plains with surface water bodies of environmental importance. Any groundwater drawdown could result in ground settlement.	Cut & Cover Shaft	Dewatering may be required during construction phase. Diaphragm wall to be proposed for ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off) Ground settlement due to dewatering during construction has been assessed and found to be acceptable in the Ground Movement Report on the basis that groundwater drawdown is limited to 2m outside the site area. Groundwater drawdown in excess of 2m will necessitate a further review of the	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation..

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
				estimated ground settlements. It is expected that the groundwater level will recover upon the completion of works.		
Ch122+490 to Ch123+540 (1050m)	Shek Kong	Rural setting with some structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Low lying alluvial plains with surface water bodies of environmental importance. Any groundwater drawdown could result in ground settlement.	TBM tunnel	The use of slurry/EPB TBM construction method and the selection of an impermeable “undrained” tunnel lining (installed prior to the advance of the TBM) should preclude groundwater inflow into the tunnels. No potential water drawdown is anticipated.	Low	Permanent lining to tunnel is impermeable to water. During construction, face pressure of TBM will be maintained to prevent water coming into the excavation.
Ch123+540 to Ch124+912 (1372m)	Shek Kong	Rural setting with structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Shek Kong Airfield is in the vicinity of open cut area, approx 80m away. Any groundwater drawdown could result in ground settlement.	Cut and Cover tunnel, ERS & Depot	Dewatering may be required during the construction phase. Diaphragm wall to be proposed for ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off) Ground settlement due to dewatering during construction has been assessed and found to be acceptable in the Ground Movement Report on the basis that groundwater drawdown is limited to 2m outside the site area. Groundwater drawdown in excess of 2m will necessitate a review of the estimated ground settlements around the structure. It is expected that the groundwater level will recover upon the completion of works. The settlement due to dewatering near the runaway of the Shek Kong Airfield has been assessed and found to	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation..

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
				be acceptable (less than 1mm).		
Ch124+912 to Ch125+330 (418m)	Shek Kong	Rural setting with structures along the alignment, mostly comprising low-rise village houses on shallow foundations.	TBM tunnel	The use of slurry/EPB TBM construction method and the selection of an impermeable "undrained" tunnel lining (installed prior to the advance of the TBM) should preclude groundwater inflow into the tunnels. No potential water drawdown is anticipated.	Low	Permanent lining to tunnel is impermeable to water. During construction, face pressure of TBM will be maintained to prevent water coming into the excavation.
Ch125+330 to Ch125+355 (25m)	Tse Uk Tsuen	Rural setting with structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Any groundwater drawdown could result in ground settlement.	Cut & Cover Shaft	Dewatering may be required during construction phase. Diaphragm wall to be proposed for ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off) Ground settlement due to dewatering during construction has been assessed and found to be acceptable in the Ground Movement Report on the basis that groundwater drawdown is limited to 2m outside the site area. Groundwater drawdown in excess of 2m will necessitate a review of the estimated ground settlements around the structure. It is expected that the groundwater level will recover upon the completion of works.	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation.
Ch125+335 to Ch125+700 (3650m) Ch125+700 to Ch125+720 (20m)	Pat Heung	Rural setting with structures along the alignment, mostly comprising low-rise village houses on shallow foundations. Groundwater resided in the mountainous area may ingress into the "drained" section of the tunnel.	Drill and Blast for tunnel & Adit	Considering the depth of the adits and available rock cover in this area, the majority of the adit length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the adit will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary An 'observational Method' is to be adopted to monitor the effects to the groundwater table in the most sensitive areas where the tunnelling works are closest to the surface i.e on the lower reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas.	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the tunnel excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
Ch125+720 to Ch132+067 (6347m)	Tai Mo Shan	Deep hard rock tunnel (between 100-700 mbgl) beneath a largely undeveloped natural terrain area. Limited potential for adverse impact on surface structures / features. Intersect with Tai Lam Chung Catchwater tunnel at Chainage 126000. The clear distance between the proposed tunnel and existing WSD Tunnel is about 50m It is expected that Fault F6 will be presented between CH126900 to CH127050 Groundwater resided in the mountainous area may ingress into the "drained" section of the tunnel.	Drill and Blast tunnel	Considering the depth of the tunnels and available rock cover in this area, the majority of the tunnel length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the tunnel will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary An 'observational Method' is to be adopted to monitor the effects to the groundwater table in the most sensitive areas where the tunnelling works are closest to the surface i.e. on the lower reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the tunnel excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
				to determine the need for further grouting works locally within the most sensitive areas. Transmissive features are anticipated will be required and grouting to seal such features prior to the tunnel excavation intersecting them.		
Ch132+067 to Ch132+090 (23m)	Shing Mun/ Shek Yam	Moderately densely developed area with numerous high rise developments present but these are largely on piled foundations near the entrance of adit. Groundwater resided in the mountainous area may ingress into the "drained" section of the tunnel. Excessive groundwater drawdown could have high impact on surrounding facilities.	Drill and Blast Adit	Considering the depth of the adits and available rock cover in this area, the majority of the adit length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the adit will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary An 'observational Method' is to be adopted to monitor the effects to the groundwater table in the most sensitive areas where the tunnelling works are closest to the surface i.e on the lower reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas. Transmissive features are anticipated will be required and grouting to seal such features prior to the tunnel excavation intersecting them.	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the adit excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
Ch132+090 to Ch134+635 (5160m)	Kwai Chung	Deep hard rock tunnel (between 100-250 mbgl) beneath a moderately densely developed area. Limited potential for adverse impact on surface	Drill and Blast tunnel	Considering the depth of the tunnels and available rock cover in this area, the majority of the tunnel length will be designed to be "drained". Potential drawdown of the	Moderate	A comprehensive programme of pre-excavation probing at locations where

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
		structures / features. Shung Mun Reservoir is located 1140m horizontally from the alignment, It is expected that Unrecorded Fault and Fault F7 will be presented at 132+900 and at 133450 respectively. Groundwater resided in the mountainous area may ingress into the "drained" section of the tunnel.		water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the tunnel will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary. An 'observational Method' is to be adopted to monitor the effects to the groundwater table at the surface in the most sensitive areas where the tunnelling works are closest to the surface i.e on the low reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas. Transmissive features are anticipated will be required and grouting to seal such features prior to the tunnel excavation intersecting them.		any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the tunnel excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
Ch134+635 to Ch134+660 (25m)		Moderately densely developed area with numerous high rise developments present but these are largely on piled foundations near the entrance of adit. Groundwater resided in the mountainous area may ingress into the "drained" section of the tunnel. Excessive groundwater drawdown could have high impact on surrounding facilities.	Drill and Blast Adit	Considering the depth of the adits and available rock cover in this area, the majority of the adit length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the adit will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary An 'observational Method' is to be adopted to monitor the effects to the groundwater	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the adit excavation intersecting them. Post grouting will be undertaken as

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
				table in the most sensitive areas where the tunnelling works are closest to the surface i.e on the lower reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas. Transmissive features are anticipated will be required and grouting to seal such features prior to the tunnel excavation intersecting them.		necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
Ch134+660 to Ch136+570 (1610m)	Kwai Chung /Lai Chi Kok	Deep hard rock tunnel (between 100-300 mbgl) beneath a largely undeveloped natural terrain area. Limited potential for adverse impact on surface structures / features. Kowloon Reception Reservoir is located 400m horizontally from the alignment, It is expected that Fault F8 and weakness zone will be present 135800 and in between 136050 to 136600 respectively.	Drill and Blast tunnel	Considering the depth of the tunnels and available rock cover in this area, the majority of the tunnel length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the tunnel will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary. An 'observational Method' is to be adopted to monitor the effects to the groundwater table at the surface in the most sensitive areas where the tunnelling works are closest to the surface i.e on the low reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas. Transmissive features are anticipated will be required and grouting to seal such features prior to the	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the tunnel excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
				tunnel excavation intersecting them.		
Ch136+570 to Ch136+585 (15m) Ch136+585 to Ch136+780 (195m)	Lai Chi Kok	Densely developed area in a reclamation setting with high groundwater levels. Numerous high rise developments present but these are largely on piled foundations. Groundwater resided in the mountainous area may ingress into the "drained" section of the tunnel. Excessive groundwater drawdown could have high impact on surrounding facilities.	Drill and Blast Adit & Tunnel	Considering the depth of the tunnels and available rock cover in this area, the majority of the tunnel length will be designed to be "drained". Potential drawdown of the water table above rockhead level could result in local settlement and dewatering of any hydrological features that are in hydraulic continuity with groundwater. Groundwater inflows to the tunnel will therefore be controlled through extensive probing, pre-grouting and post grouting works as necessary. An 'observational Method' is to be adopted to monitor the effects to the groundwater table at the surface in the most sensitive areas where the tunnelling works are closest to the surface i.e on the low reaches of the northern and southern faces immediately above the tunnel alignment. The observations will be used to determine the need for further grouting works locally within the most sensitive areas. Transmissive features are anticipated will be required and grouting to seal such features prior to the tunnel excavation intersecting them.	Moderate	A comprehensive programme of pre-excavation probing at locations where any highly transmissive features are anticipated will be required. These features will be pre-grouted prior to the tunnel excavation intersecting them. Post grouting will be undertaken as necessary before the lining is constructed the effectiveness of which shall be monitored at the ground surface.
Ch136+780 to Ch137+760 (980m)	Lai Chi Kok /Nam Cheong	Densely developed area in a reclamation setting with high groundwater levels. Numerous high rise developments present but these are largely on piled foundations. Excessive groundwater drawdown could have high	TBM tunnel	The use of slurry/EPB TBM construction method and the selection of an impermeable "undrained" tunnel lining (installed prior to the advance of the TBM) should preclude groundwater inflow into the tunnels. No potential water drawdown is anticipated.	Low	Permanent lining to tunnel is impermeable to water. During construction, face pressure of TBM will be maintained to prevent water coming into the excavation.

Chainage	Area	Potential Impacts	Construction Method	Qualitative Assessment	Anticipated Level of Risk of Significant Water Inflow	Possible Mitigation Measures (refer to Section 7.3)
		impact on surrounding facilities.				
Ch137+760 to Ch137+968 (208m)	Nam Cheong	Densely developed area in a reclamation setting with high groundwater levels. Numerous high rise developments present but these are largely on piled foundations. Excessive groundwater drawdown could have high impact on surrounding facilities.	Cut and Cover Shaft	Dewatering may be required during construction phase. Diaphragm wall to be proposed for ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off). Ground settlement due to dewatering during construction has been assessed in the Ground Movement Report on the basis that groundwater drawdown is limited to 2m outside of the site area. However, Groundwater drawdown in excess of 2m will necessitate a review of the estimated ground settlements around the structure. It is expected that the groundwater level will recover upon the completion of works.	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation.
Ch137+968 to Ch140+380 (2414m)	Mong Kok West	Densely developed area in a reclamation setting with high groundwater levels. Numerous high rise developments present but these are largely on piled foundations. Excessive groundwater drawdown could have high impact on surrounding facilities.	TBM tunnel	The use of slurry/EPB TBM construction method and the selection of an impermeable "undrained" tunnel lining (installed prior to the advance of the TBM) should preclude groundwater inflow into the tunnels. No potential water drawdown is anticipated.	Low	Permanent lining to tunnel is impermeable to water. During construction, face pressure of TBM will be maintained to prevent water coming into the excavation.
Ch140+380 to Ch140+570 (190m)			Cut and cover Tunnel & Shaft	Dewatering may be required during construction phase. Diaphragm wall to be proposed for ELS with an appropriate groundwater cut-off (panels embedded into rock / sufficient length of toe grouting to / below rockhead level / in soft ground extend panels to form cut-off) Ground settlement due to dewatering during construction has been assessed in the Ground Movement Report on the basis that groundwater drawdown is limited to 2m outside of the site area. However, Groundwater drawdown in excess of 2m will necessitate a review of the estimated ground settlements around the structure. It is expected that the groundwater level will be recovered upon the completion of works.	Low	Ground water level will in adjacent to cofferdam will be monitored. Settlement monitoring will be implemented. Further toe grouting or grouting to back of wall could be exercised to control excessive water inflow into the excavation.

7.2 Key Areas of Concern

The qualitative assessment has highlighted several key areas along the alignment where further assessment is required. Those areas largely relate to the sections of tunnel that will be constructed as cut and cover tunnel, those sections of drained rock tunnel at the interface with the TBM tunnel or cut and cover tunnel / shaft, areas of low cover (Kwai Chung), and where the tunnel works may impact impounding reservoirs.

The cut and cover tunnel sections are typically located in low-lying areas with relatively uniform ground conditions. It is therefore recommended that 2D modelling of the soil conditions be undertaken under a subsequent design phase once there is sufficient data from the project specific ground investigation available to determine the potential effects of the works on the local hydrological conditions. The designer will be expected to mitigate any adverse drawdown of the ground water table through the incorporation of deep cut-off walls with adequate toe length or incorporating a sufficient additional length of toe grouting beneath such that, where practical, the ground water table outside the site is not lowered by more than 2m.

The drill and blast tunnel sections are typically located beneath hillside areas with steep undulating terrain of variable elevation. Given the variability of the overlying ground conditions and in particular the rock and soil strata permeability, the limited ground investigation data and the variation in the rock head levels across the hillside slopes it is not possible to accurately predict the hydrogeological impact of the tunneling works on the groundwater table by calculation or computer modeling. An observational approach is therefore recommended during construction with appropriate mitigation measures implemented as necessary to control the drawdown effects to the surface groundwater table. Appropriate procedures and mitigation measures will therefore be required to be available in order to ensure that any adverse impact of the tunneling works on the ground water table will not occur. The proposed procedures and mitigation measures are described further in Section 7.4 below.

7.3 Water Inflows Criteria

7.3.1 General

There is the possibility that the proposed tunnelling works may result in uncontrolled groundwater inflows into the excavation with the consequent risk of groundwater drawdown. Drawdown could result in settlement of the overlying soil strata and damage to existing surface features such as buildings and utilities. These impacts are mitigated in part by the proximity of the shoreline and the low permeability rock mass. However, appropriate measures will be deployed during the construction of the tunnels and caverns to ensure that groundwater inflow into the excavations is controlled; such measures typically include contractual requirements for the provision of probing and grouting, as required, based on the observed inflow rates.

7.3.2 Tunnel and Adit -

During excavation of the adits and tunnels some degrees of groundwater inflow would be expected; however, such inflows should be kept within predetermined limits. The following groundwater inflow criteria are proposed for tunnel and adit construction for the determination of when pre-grouting and post grouting grouting works are required:

1) Not exceeding 0.5 l/min/m of any probe hole ahead of the excavation face and not more than 2litre/min from any 5m length;
2) Not exceeding 2 l/min through any excavation face;
3) Not exceeding 10 l/min over any 100m length of excavated adit.
4) Not exceeding 1l/min/m after excavation.

Notwithstanding the above criteria it is proposed that the above measurements be supplemented with monitoring of the water table at the ground surface the observations of which will take precedence when determining the necessity for reducing or increasing the amount of post grouting works to be undertaken as detailed in Section 7.4 below.

7.4 Potential Mitigation Measures

7.4.1 General

Whilst the above hazards have been identified in relation to the XRL alignment such hazards could be mitigated through adoption of one or more of the following risk management strategies.

7.4.2 Comprehensive Groundwater Monitoring Strategy

A fundamental requirement in assessing the impact of the construction works is the establishment of a well designed and managed groundwater monitoring programme. This programme should not only include monitoring wells installed, where topography permits, at regular intervals along the alignment but should also target areas of specific interest such as the drill and blast / cut and cover or TBM tunnel interfaces, areas of drained tunnel with low rock cover, fault zones where they may connect with strategic water storage facilities.

Sufficient pre-construction monitoring should be undertaken such that baseline groundwater levels can be established and any seasonal (or other) variations in groundwater level identified. Such pre-existing groundwater variations, once identified, can then be excluded when determining the impact of construction on the local groundwater regime.

A detailed instrumentation and monitoring programme will be developed in detailed design stage to monitor both the proposed works and the impact of those works on the adjacent area.

7.4.3 Pre-excavation Probing and Grouting for Drained Rock Excavations

Groundwater inflows into “drained” rock excavations can typically be maintained within acceptable levels through effective treatment (grouting) of the rock mass to seal transmissive features. This is normally carried out during construction in the form of probe hole drilling ahead of the excavation face, monitoring the inflow of groundwater, if any; where groundwater inflows are sufficiently high grouting would be undertaken (either pre or post excavation, depending on the inflow rate) to seal the rock mass and thereby reduce inflows to an acceptable level.

Such measures are typically enforced through contractual requirements on the number, location and length of probe holes drilled ahead of the excavation face as well as defining the limits on acceptable rates of recorded water inflow over a given length of tunnel before injection grouting is required. In some highly sensitive areas and where grouting has been undertaken ahead of the face additional post grouting / pre-excavation probe holes may be required in order to establish the effectiveness of the grouting programme (groundwater inflow reduced to an acceptable level).

7.4.4 Post Grouting Works for Drained Rock Excavations

Following excavation of the proposed “drained” excavations any observed groundwater drawdown at the surface will be most likely due to inflows of water into the tunnel that have not been sufficiently controlled by the pre-grouting measures. Where this occurs post grouting will be undertaken before the lining is cast. Whilst unlikely to be required in significant measure, such a contingency should be allowed for reduction in permeability of the tunnel surround (by grouting) to limit inflow to acceptable levels. The performance of this post grouting works will be monitored from the surface until any effects on the groundwater table are controlled.

7.4.5 Groundwater Recharge Wells

In areas where temporary groundwater drawdown during construction is considered unavoidable and could result in unacceptable ground settlements that would have adverse effects on buildings, mitigation through provision of temporary recharge wells may be necessary. The requirement for recharge wells should be further investigated during the detailed design.

7.4.6 Adequate Construction Management

Whilst the quantitative assessment identifies several of the construction methods as relatively low risk, such as the undrained TBM excavations, such assumptions are reliant on appropriate construction specifications being in lace and adequate management. It is therefore essential that the contract specification incorporates clauses which reflect the nature of the proposed construction works and that an adequate number of suitably qualified and experienced personnel are provided to supervise those works.

8 Conclusions and Recommendations

8.1 Conclusions

The hydrogeological assessment indicates that the groundwater regime along the proposed alignment largely follows conditions that would be considered typical for Hong Kong, namely:

- The tidal influence programme undertaken in August 2008 indicated there was very little tidal influence on the groundwater regime in the Mai Po Marshes; however, it was also noted that the monitoring stations were some 1.2km from the nearest tidal body and that period of the study was only 9hrs rather than the 24 hours typical of such study.
- Zones of groundwater storage (aquifers) are largely confined to the regolith, with the underlying bedrock comprising a much lower permeability stratum.
- Flow within hard rock portions is controlled by the density and connectivity of discontinuities in the rock mass. Laterally extensive features such as faults may acts as conduits for groundwater with the flow rate within the fault considerably greater than the flow rate in the surrounding rock mass.
- Groundwater flow patterns typically mirror the overlying topography with flow running from areas of high elevation towards valley bases and coastal areas.
- Recharge to the groundwater regime is seasonal and typically occurs mainly within the months of April and September. A simple water balance calculation indicates a positive water balance, year on year, for the period January 1997 to December 2007. The maximum and minimum water quantity from water balance calculations during this period were 3026mm and 426mm, respectively, and the average was 1,566mm.

At present the scope and quality of groundwater monitoring and permeability testing data available is inadequate for purposes other than providing a board overview of the anticipated conditions, in general, along the alignment. As such the key findings of this assessment are constrained to a qualitative assessment of construction related risks.

The qualitative assessment indicates that the predominant risks associated with the project relate to dewatering caused both during construction (largely associated with shafts, cut and cover tunnels and hard rock tunnels) and in the long-term by any “drained” excavations (related only to drill and blast tunnels. Preliminary discussion of suitable mitigations strategies are provided and the need for these should be further explored during the detailed design.

8.2 Recommendations

To achieve a better understanding of the tide and groundwater relationship, it is recommended that groundwater level loggers are installed at the nearest tidal areas (near Mai Po areas).

Further groundwater monitoring and in-situ testing of hydrogeological parameters is required along the XRL alignment and the surrounding areas to provide additional data for the groundwater contour plots and to develop the groundwater model. It is noted that the project specific ground investigation programme (Contract NEX/2108) includes a significant number of drillholes with at least one piezometer installed, which should improve the effectiveness on monitoring changes in ground water level. The monitoring results will provide baseline for control of construction works and as a means of identifying when mitigation measures should be applied. A groundwater monitoring programme will be developed in detailed design stage to monitor the groundwater levels during tunnelling works.

9 References

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Appendix A

Groundwater Level Records from GIU and MTR Contract NEX2108

XRL Summary of 7 day Monitoring Water Level Records from Geological Information Unit (GIU)

BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
10122/D-10	834,918	820,562	4.68	Piezometer	10.00	3.47	3.47	3.47
10122/D-2	834,934	820,599	4.57	Piezometer	10.00	3.33	3.33	3.33
10135/D3	834,833	820,140	3.80	Piezometer	17.50	2.58	2.41	2.11
10374/BH12	826,417	833,503	13.09	Standpipe	10.00	9.07	8.09	7.87
10401/H13-P1	834,339	820,663	3.27	Piezometer	13.50	2.09	2.07	2.05
10401/H13-P2	834,339	820,663	3.27	Piezometer	22.50	2.01	1.99	1.97
10951/F11	834,924	822,569	99.91	Piezometer	9.27	92.87	92.74	92.63
10951/F12	834,916	822,607	126.33	Piezometer	31.75	106.01	105.69	105.36
10951/F14	834,907	822,665	115.72	Piezometer	7.10	111.55	111.47	111.39
10951/F15	835,020	822,607	105.59	Piezometer	11.26	94.09	94.05	94.03
10951/F16	834,868	822,728	127.79	Piezometer	13.49	114.84	114.67	114.53
10951/F17	834,922	822,721	122.18	Piezometer	7.06	119.02	118.96	118.89
10951/F18	834,960	822,721	145.82	Piezometer	32.40	122.37	121.82	121.66
10951/F19	834,876	822,790	136.12	Piezometer	18.80	123.86	123.72	123.41
10951/F20	834,919	822,780	129.04	Piezometer	9.50	124.18	124.02	123.88
10951/F21	834,964	822,797	139.03	Piezometer	11.80	127.03	126.97	126.91
10951/F23	834,820	822,816	124.17	Piezometer	10.11	119.66	119.63	119.60
10951/F24	834,819	822,862	127.10	Piezometer	6.68	124.89	124.85	124.80
10951/F25	834,956	822,871	144.56	Piezometer	24.92	136.50	136.17	135.84
10951/F26	834,923	822,910	172.15	Piezometer	45.70	135.55	135.34	135.02
10951/F27	835,030	822,861	173.42	Piezometer	27.73	150.22	150.07	149.92
10951/F29-A	834,985	822,907	166.83	Piezometer	12.30	150.58	150.47	150.29
10951/F30	834,893	822,963	161.39	Piezometer	20.00	145.93	145.83	145.70
10951/F31	834,942	822,951	179.47	Piezometer	31.70	155.73	155.42	155.10
10951/F32	834,964	822,992	192.78	Piezometer	20.10	174.18	173.99	173.92
10951/F-C-B	834,844	822,872	138.93	Piezometer	17.70	127.46	127.41	127.35
11402/BH1-P	835,265	821,131	7.52	Piezometer	56.70	4.27	4.18	4.12
11402/BH1-S	835,265	821,131	7.52	Standpipe	8.00	4.28	4.23	4.19
11402/BH2	835,276	821,134	20.10	Standpipe	19.50	7.26	6.72	6.55
11689/FBH6	829,052	840,723	6.22	Piezometer	25.00	3.49	3.49	3.49
11786/F45-A	834,821	823,050	155.03	Piezometer	25.00	148.83	148.55	148.38
11786/F45-B	834,821	823,050	155.03	Piezometer	20.00	149.38	149.01	148.84
11786/F46-A	834,834	822,898	136.24	Piezometer	21.25	129.37	129.22	129.16
11786/F46-B	834,834	822,898	136.24	Piezometer	16.65	129.44	129.30	127.39
11786/F47-A	834,729	822,980	162.82	Piezometer	16.60	158.35	156.91	156.32
11786/F47-B	834,729	822,980	162.82	Piezometer	8.00	157.07	157.00	156.97
11997/BH1	832,237	823,625	215.20	Piezometer	11.70	204.95	204.87	204.79
11997/BH11	832,172	823,570	215.50	Piezometer	12.00	205.60	205.56	205.50
11997/BH14	832,326	823,554	212.80	Piezometer	14.00	204.49	204.43	204.38
11997/BH20	832,214	823,541	212.40	Piezometer	15.20	201.12	198.67	198.31
11997/BH22	832,254	823,530	219.90	Piezometer	16.17	211.38	209.33	208.63

XRL Summary of 7 day Monitoring Water Level Records from Geological Information Unit (GIU)

BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
11997/BH23	832,274	823,511	220.00	Piezometer	13.60	211.47	211.45	211.44
11997/BH4	832,302	823,584	216.80	Piezometer	9.27	212.90	212.51	212.36
11997/BH7	832,260	823,578	222.30	Piezometer	12.20	212.38	212.34	212.31
12224/ST4	832,584	826,628	159.40	Piezometer	19.50	151.94	151.94	151.94
12224/ST5	832,612	826,589	171.50	Piezometer		161.83	161.83	161.83
12512/F35-A	834,801	822,612	122.41	Piezometer	28.60	101.41	99.81	99.30
12512/F35-B	834,801	822,612	122.41	Piezometer	23.60	100.41	99.53	99.31
12512/F40	834,893	822,888	154.62	Piezometer	27.50	132.26	131.88	131.42
12519/F58-A	834,866	823,044	169.78	Piezometer	37.35	154.58	154.58	154.58
12519/F58-B	834,866	823,044	169.78	Piezometer	31.94	154.76	154.46	154.38
12519/F59-A	834,868	823,099	179.48	Piezometer	32.90	161.73	161.72	161.71
12519/F59-B	834,868	823,099	179.48	Piezometer	27.28	160.56	160.56	160.56
12519/F60	834,768	823,113	190.54	Piezometer	20.50	172.02	171.87	171.80
12519/F61-A	834,775	823,009	157.06	Piezometer	23.84	148.06	147.96	147.84
12519/F61-B	834,775	823,009	157.06	Piezometer	17.58	143.66	143.65	143.64
12519/F62-A	834,713	822,945	182.19	Piezometer	38.00	155.19	155.02	154.99
12519/F62-B	834,713	822,945	182.19	Piezometer	27.63	159.29	159.27	159.26
12521/F63-A	834,758	822,920	150.65	Piezometer	17.60	139.45	139.45	139.45
12521/F63-B	834,758	822,920	150.65	Piezometer	10.73	140.30	140.30	140.30
12521/F64-A	834,737	822,864	149.42	Piezometer	24.80	129.99	129.28	129.12
12521/F65-A	834,778	822,851	144.98	Piezometer	29.04	125.78	125.78	125.78
12521/F65-B	834,778	822,851	144.98	Piezometer	20.28	125.78	125.78	125.78
12521/F66-A	834,763	822,778	127.90	Piezometer	23.43	112.72	112.60	112.56
12521/F66-B	834,763	822,778	127.90	Piezometer	17.46	113.18	112.98	112.92
12521/F67-A	834,795	822,685	118.10	Piezometer	20.00	104.70	104.68	104.66
12526/F53-A	834,744	822,684	147.48	Piezometer	36.26	118.83	118.83	118.83
12526/F53-B	834,744	822,684	147.48	Piezometer	28.97	120.18	120.17	120.16
12600/F57-A	834,923	823,097	153.45	Piezometer	39.80	23.25	23.24	23.15
12600/F57-B	834,923	823,097	153.45	Piezometer	34.88	130.55	130.48	130.45
13006/BGS260-P1	823,667	839,583	4.56	Piezometer	50.00	3.11	3.05	3.00
13006/BGS260-P2	823,667	839,583	4.56	Piezometer	12.00	2.93	2.83	2.77
13016/BGS28-P1	823,212	839,830	3.40	Piezometer	30.50	2.10	2.06	2.02
13016/BGS28-P2	823,212	839,830	3.40	Piezometer	18.00	2.08	2.00	1.93
13066/BH42	823,956	838,461	3.65	Piezometer	53.80	2.95	2.95	2.95
13066/BH47	823,621	838,230	4.18	Piezometer	28.80	2.27	2.27	2.27
13528/BH103	832,250	823,941	225.84	Piezometer	12.65	216.95	215.03	214.30
13528/BH106	832,275	823,446	218.32	Standpipe	21.95	201.89	201.17	200.90
13528/BH116	832,127	823,841	232.89	Standpipe	14.17	222.14	221.38	221.10
13528/BH117	832,207	823,822	239.26	Standpipe	40.77	204.68	204.01	203.52
13528/BH119	832,308	823,925	230.45	Piezometer	27.50	204.10	203.84	203.75
13528/BH120	832,383	823,883	211.94	Standpipe	27.07	192.34	192.08	191.82

XRL Summary of 7 day Monitoring Water Level Records from Geological Information Unit (GIU)

BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
13528/BH122	832,123	823,924	245.65	Standpipe	26.52	226.16	226.00	225.80
13528/BH25	831,982	823,840	228.78	Standpipe	9.55	220.85	220.46	220.30
13528/BH31	832,031	823,950	231.79	Standpipe	19.20	215.59	214.61	214.23
13528/BH42	832,232	824,032	239.49	Standpipe	23.90	216.96	216.47	215.89
13528/BH44	832,157	824,123	266.21	Standpipe	42.00	230.59	230.59	230.59
13528/BH46	832,184	824,197	258.91	Standpipe	29.57	230.41	230.41	230.41
13528/BH47	832,132	824,100	250.37	Standpipe	16.87	234.07	233.89	233.57
13528/BH49	832,305	824,031	224.09	Standpipe	25.60	204.79	204.23	204.05
13528/BH53	832,180	824,246	234.58	Standpipe	22.56	217.32	216.93	216.73
13528/BH61	832,021	824,055	202.83	Standpipe	22.56	186.23	186.16	186.09
13528/BH63	831,998	823,969	212.56	Standpipe	19.51	200.00	199.94	199.88
13528/BH67	831,928	823,835	198.33	Standpipe	28.96	176.75	174.69	172.73
13528/BH70	831,976	823,664	198.91	Standpipe	10.00	192.31	191.73	191.51
13528/BH76	832,137	823,529	200.73	Standpipe	23.00	180.73	180.59	180.39
13528/BH80	832,231	823,377	187.72	Piezometer	16.76	171.14	170.56	170.45
13528/BH86	832,177	823,345	161.33	Standpipe	21.95	143.95	143.87	143.75
13528/BH89	832,290	823,956	223.71	Standpipe	24.00	204.51	204.46	204.42
13528/BH95	832,363	823,267	157.15	Standpipe	6.53	154.79	154.47	154.25
14065/BH20	832,619	825,750	87.08	Standpipe	17.72	81.21	80.50	80.28
14340/AH11	829,788	843,355	4.82	Piezometer	10.00	0.85	0.85	0.85
14340/AH6	829,792	843,298	4.60	Piezometer	4.00	3.15	3.15	3.15
14340/AH7	829,766	843,270	7.90	Piezometer	10.00	1.24	1.24	1.24
14340/AH9	829,791	843,325	4.77	Piezometer	8.00	1.13	1.13	1.13
14375/B4	832,769	822,430	34.61	Standpipe	31.69	6.66	6.66	6.66
14376/B14	834,777	822,487	106.66	Piezometer	35.00	77.86	77.31	75.51
14390/DH8	834,866	821,436	5.97	Piezometer	47.00	4.91	4.91	4.90
14728/M1	826,370	830,818	88.87	Piezometer	33.00	71.87	63.44	59.87
14728/M3	826,366	830,919	56.84	Piezometer	18.60	46.34	44.62	41.34
14980/A21	832,540	824,976	106.28	Piezometer	6.00	100.28	100.28	100.28
15014/D10	834,918	820,562	4.68	Piezometer	10.00	3.47	3.47	3.47
16180/UKF16	834,982	821,243	22.98	Piezometer	20.00	6.58	6.50	6.48
16295/BH3-P1	832,264	826,632	123.60	Piezometer	26.00	102.31	102.25	102.21
16810/SH6	832,639	825,548	83.67	Standpipe	5.45	78.80	78.77	78.75
17589/D1	824,201	838,160	16.68	Piezometer	15.00	9.93	9.66	9.61
17589/D11	824,166	838,199	14.04	Piezometer	15.00	6.94	6.90	6.88
17589/D13	824,157	838,146	12.49	Piezometer	15.00	5.91	5.85	5.81
17589/D16	824,155	838,092	13.06	Piezometer	15.00	6.34	6.22	6.17
17589/D19	824,137	838,181	12.16	Piezometer	15.00	5.91	5.77	5.53
17589/D22	824,132	838,133	12.18	Piezometer	15.00	5.77	5.69	5.66
17589/D24	824,126	838,081	11.71	Piezometer	15.00	5.33	5.13	5.05
17589/D26	824,123	838,230	11.29	Piezometer	15.00	4.27	4.19	4.14

XRL Summary of 7 day Monitoring Water Level Records from Geological Information Unit (GIU)

BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
17589/D4	824,197	838,100	16.09	Piezometer	15.00	9.40	9.23	9.16
17589/D6	824,174	838,072	13.30	Piezometer	15.00	6.28	6.20	6.16
19179/BH1-P	827,819	831,417	91.54	Piezometer	8.60	86.11	86.08	86.05
19179/BH2-P	827,828	831,437	85.95	Piezometer	12.20	80.54	80.50	80.46
19179/BH3-P	827,750	831,429	91.48	Piezometer	25.75	77.54	77.52	77.50
19179/BH4-P	827,724	831,462	71.57	Piezometer	25.00	66.87	66.83	66.79
19327/DW46	832,588	825,413	70.23	Standpipe	6.20	64.43	64.43	64.43
19508/DH12-A	834,906	822,831	146.25	Standpipe	19.50	127.14	127.04	126.94
19508/DH12-B	834,906	822,831	146.25	Piezometer	22.00	127.15	127.07	126.99
19508/DH15-A	834,854	822,843	133.47	Standpipe	20.50	123.02	122.72	122.65
19508/DH15-B	834,854	822,843	133.47	Piezometer	23.00	122.82	122.66	122.61
19508/DH17	834,811	822,851	124.18	Standpipe	8.13	121.48	121.46	121.44
19508/DH2	834,991	822,932	170.06	Standpipe	16.00	165.69	165.65	165.62
19508/DH24-A	835,020	822,763	167.31	Standpipe	23.42	147.14	147.11	147.09
19508/DH27-A	834,977	822,766	142.27	Standpipe	24.50	125.45	125.40	125.37
19508/DH27-B	834,977	822,766	142.27	Piezometer	26.50	125.60	125.47	125.34
19508/DH36	834,770	822,757	120.77	Standpipe	16.07	110.86	110.83	110.81
19508/DH43-A	834,904	822,695	120.49	Standpipe	5.50	117.07	116.99	116.94
19508/DH43-B	834,904	822,695	120.49	Piezometer	8.00	116.32	116.24	116.18
19508/DH58	834,799	822,643	120.44	Standpipe	22.73	99.01	98.61	98.13
19508/DH64-A	834,985	822,603	100.82	Standpipe	8.00	98.93	98.65	98.44
19508/DH64-B	834,985	822,603	100.82	Piezometer	10.00	98.69	98.17	97.86
19508/DH71	834,874	822,577	89.56	Piezometer	7.80	84.63	84.62	84.61
19508/DH8-A	834,874	822,909	149.10	Standpipe	17.50	131.74	131.70	131.68
19508/DH8-B	834,874	822,909	149.10	Piezometer	20.00	131.70	131.67	131.65
19579/AH12	828,524	840,150	10.01	Piezometer	45.50	7.66	7.66	7.66
19579/AH17	828,446	840,111	10.70	Piezometer	26.50	8.11	8.11	8.11
19579/AH2	828,508	840,223	10.19	Piezometer	53.50	6.77	6.77	6.77
19579/AH22	828,365	840,068	12.19	Piezometer	8.90	7.66	7.66	7.66
19579/AH26	828,572	840,072	9.64	Piezometer	8.90	5.11	5.11	5.11
19579/AH28	828,483	840,034	11.02	Piezometer	23.00	7.15	7.15	7.15
19579/AH30	828,430	839,992	10.60	Piezometer	14.00	7.27	7.27	7.27
19579/AH36	828,385	839,924	11.02	Piezometer	9.20	8.62	8.62	8.62
19579/AH39	828,499	839,925	9.82	Piezometer	16.20	7.35	7.35	7.35
19579/AH9	828,473	840,347	9.36	Piezometer	25.10	6.29	6.29	6.29
19579/BH13	828,336	840,305	12.84	Piezometer	18.50	9.07	9.07	9.07
19579/BH2	828,319	840,391	11.62	Piezometer	35.00	9.17	9.17	9.17
19579/BH4-B	828,416	840,382	10.53	Piezometer	18.50	-5.59	-5.73	-5.87
19579/BH5-B	828,466	840,380	10.29	Piezometer	19.50	-1.85	-1.90	-1.94
19579/BH6	828,299	840,351	13.40	Piezometer	17.50	0.48	0.37	0.31
19579/BH8	828,396	840,345	10.20	Piezometer	32.50	6.96	6.96	6.96

XRL Summary of 7 day Monitoring Water Level Records from Geological Information Unit (GIU)

BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
20882/SED7-A	832,530	825,458	60.69	Piezometer	9.00	52.64	52.60	52.55
20897/DH21-P	834,987	819,674	5.49	Piezometer	11.80	3.11	3.09	3.08
20897/DH21-S	834,987	819,674	5.49	Standpipe	7.00	0.67	0.64	0.62
20897/DH69-P	835,017	819,657	5.49	Piezometer	19.20	1.09	1.04	0.99
20897/DH69-S	835,017	819,657	5.49	Standpipe	8.20	1.19	1.02	0.97
20897/DH72-P	835,026	819,692	5.66	Piezometer	55.00	1.78	-3.62	-33.44
20897/DH72-S	835,026	819,692	5.66	Standpipe	8.20	0.87	0.84	0.80
20901/DH10-S	834,982	819,612	5.49	Standpipe	7.20	0.75	0.73	0.71
20901/DH12-P	835,015	819,562	5.30	Piezometer	16.80	0.68	0.64	0.59
20901/DH12-S	835,015	819,562	5.30	Standpipe	7.70	0.36	0.32	0.25
20901/DH30-P	834,997	819,628	5.24	Piezometer	61.90	1.60	1.56	1.52
20901/DH30-S	834,997	819,628	5.24	Standpipe	8.00	0.45	0.43	0.42
20901/DH7-P	834,994	819,557	5.35	Piezometer	63.40	0.86	0.85	0.84
20901/DH7-S	834,994	819,557	5.35	Standpipe	7.50	0.17	0.15	0.15
2108/XRL/D016	834,952	818,516	6.48	Piezometer	21.38	1.86	1.83	1.78
2108/XRL/D254-P	824,069	838,806	4.18	Piezometer	24.00	3.36	3.26	3.17
2108/XRL/D254-S	824,069	838,806	4.18	Standpipe	4.00	3.66	3.50	3.32
2108/XRL/D256-P	824,066	838,877	4.68	Piezometer	25.00	3.34	3.33	3.31
2108/XRL/D256-S	824,066	838,877	4.68	Standpipe	8.00	3.24	3.22	3.18
2108/XRL/D258-P	823,971	838,939	3.97	Piezometer	34.00	3.12	3.09	3.03
2108/XRL/D258-S	823,971	838,939	3.97	Standpipe	8.50	3.02	2.99	2.93
2108/XRL/EDH17	835,256	818,100	3.95	Piezometer	11.35	1.10	1.02	0.85
2108/XRL/EDH18-P	823,974	838,978	4.03	Piezometer	29.00	3.21	3.13	3.06
2108/XRL/EDH18-S	823,974	838,978	4.03	Standpipe	13.40	2.88	2.81	2.78
2108/XRLD257	823,989	838,902	4.18	Piezometer	24.00	2.90	2.87	2.83
21095/BH1	829,601	828,330	324.12	Piezometer	6.50	320.27	320.24	320.20
21095/BH2	829,532	828,304	312.43	Piezometer	2.00	312.36	312.27	312.18
21095/BH3	829,519	828,222	313.45	Piezometer	2.94	312.76	312.71	312.64
21095/BH4	829,598	828,242	318.27	Piezometer	8.00	313.40	313.36	313.32
21127/DH59-P	834,950	819,753	5.67	Piezometer	13.50	0.65	0.42	0.17
21127/DH59-S	834,950	819,753	5.67	Standpipe	9.70	1.26	0.75	0.38
21127/DH62-P	834,959	819,777	5.77	Piezometer	45.15	0.97	0.29	-1.01
21127/DH62-S	834,959	819,777	5.77	Standpipe	11.70	0.67	0.37	0.19
21127/DH65-P	834,977	819,757	5.34	Piezometer	16.30	0.24	0.16	0.12
21127/DH65-S	834,977	819,757	5.34	Standpipe	9.70	0.58	0.42	0.34
21127/DH71-P	835,008	819,762	5.79	Piezometer	12.50	0.69	0.43	0.36
21127/DH71-S	835,008	819,762	5.79	Standpipe	8.50	1.49	1.18	1.04
21138/DH58-P	834,956	819,704	5.10	Piezometer	45.70	0.12	0.01	-0.03
21138/DH58-S	834,956	819,704	5.10	Standpipe	7.70	0.21	0.18	0.15
21138/DH70-P	835,015	819,713	4.77	Piezometer	17.00	0.12	0.09	0.06
21138/DH70-S	835,015	819,713	4.77	Standpipe	8.20	0.21	0.19	0.17

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BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
21160/DH19-P	835,036	819,566	5.52	Piezometer	15.50	0.62	0.60	0.57
21160/DH19-S	835,036	819,566	5.52	Standpipe	7.70	0.54	0.52	0.50
21160/DH23-P	835,027	819,604	5.42	Piezometer	58.70	1.42	1.38	1.36
21160/DH23-S	835,027	819,604	5.42	Standpipe	7.70	0.52	0.50	0.47
21273/BH1	834,799	820,336	5.08	Piezometer	11.76	2.95	2.93	2.92
21273/BH10	834,845	820,330	5.52	Piezometer	13.55	2.05	2.04	2.04
21273/BH12	834,841	820,303	5.29	Piezometer	16.95	1.54	1.52	1.50
21273/BH3	834,787	820,310	5.12	Piezometer	10.34	4.07	4.06	4.06
21591/DH206	832,766	826,526	175.67	Piezometer	92.00	126.04	125.90	125.79
22255/BH1	829,029	831,157	164.13	Piezometer	9.50	155.37	155.33	155.26
22255/BH2	829,018	831,169	161.80	Piezometer	14.60	150.96	150.87	150.82
22794/DH72P	829,078	822,388	20.98	Casagrande	18.50	15.69	15.33	14.40
24213/S101	832,479	825,791	63.86	Piezometer	8.00	59.03	59.00	58.96
24770/BH1	834,815	820,473	4.51	Piezometer	7.90	3.66	3.57	3.50
24770/BH5	834,821	820,469	4.46	Piezometer	7.20	3.60	3.51	3.46
24770/BH6	834,838	820,472	4.42	Piezometer	10.20	3.34	3.03	2.91
25534/BH9	834,737	821,776	9.10	Piezometer	10.00	6.03	6.03	6.03
26088/BGS36-P1	825,312	841,971	3.65	Piezometer	24.50	2.22	2.14	2.07
26088/BGS36-P2	825,312	841,971	3.65	Piezometer	36.00	2.19	2.14	2.06
26421/DH5/1	829,758	830,889	382.48	Piezometer	24.50	362.68	362.68	362.68
26458/DH12	824,665	837,504	5.69	Piezometer	4.50	4.24	4.21	4.19
26458/DH14	825,485	837,240	9.94	Piezometer	34.90	8.18	8.13	8.10
26459/DH10	828,098	832,347	33.05	Piezometer	23.13	30.96	30.96	30.96
28161/VH1-P	832,851	822,481	35.91	Piezometer	16.80	20.21	20.18	20.14
28639/TS600/DHPZ/003	825,102	831,137	9.85	Piezometer	9.00	8.78	8.78	8.78
29440/BH1-P2	835,358	821,377	34.98	Piezometer	24.00	12.73	12.70	12.68
29440/BH2-P2	835,368	821,387	21.63	Piezometer	14.50	12.53	12.45	12.33
30748/DH49/1/P2	829,755	830,663	426.24	Piezometer	18.00	415.66	415.61	415.59
30748/DH49/2	829,688	830,635	404.89	Piezometer	23.80	384.99	384.96	384.94
3171/ST2-P1	832,277	826,937	131.00	Piezometer	5.90	125.54	125.37	125.12
3171/ST2-P2	832,277	826,937	131.00	Piezometer	10.90	123.04	122.35	121.65
3171/ST3	832,439	826,805	180.60	Piezometer	27.00	165.57	164.86	164.55
3171/ST4	832,584	826,628	159.40	Piezometer	19.50	151.00	149.59	144.25
3171/ST5	832,612	826,589	171.50	Piezometer	10.70	161.00	160.93	160.90
3171/ST6	832,739	826,479	158.50	Piezometer	20.00	152.33	150.16	149.43
3171/ST7	832,807	826,518	174.90	Piezometer	29.00	153.39	152.98	152.85
3255/BH3	833,870	825,408	267.70	Standpipe	15.00	255.10	255.10	255.10
3255/BH4	833,860	825,393	259.20	Standpipe	10.00	253.20	253.11	253.10
3266/DH1	828,827	832,185	60.53	Piezometer	19.80	54.98	54.91	54.86
3266/DH2	828,852	832,176	61.66	Piezometer	19.80	55.81	55.75	55.71
3266/DH3	828,841	832,153	61.52	Piezometer	19.80	56.02	55.96	55.91

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BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
3266/DH4	829,257	832,005	103.96	Piezometer	17.70	95.53	95.44	95.40
3266/DH5	829,273	831,985	103.38	Piezometer	17.50	97.69	97.63	97.58
3266/DH7	829,270	832,016	104.45	Piezometer	13.70	96.50	96.42	96.38
3266/DH8	829,283	832,004	104.55	Piezometer	9.35	98.95	98.90	98.85
32905/DH1-P	828,566	835,475	80.06	Piezometer	60.36	63.31	63.20	63.08
33309/BH24	826,776	834,107	12.54	Standpipe	8.00	12.21	12.17	12.08
33309/BH25-P	826,570	834,062	12.48	Piezometer	30.00	11.84	10.19	9.81
33309/BH25-S	826,570	834,062	12.48	Standpipe	4.00	10.15	9.93	9.82
34093/DH1-P	829,571	832,593	119.00	Piezometer	104.30	107.69	107.50	107.41
36148/DH35-1-P2	828,421	831,657	86.86	Piezometer	13.00	74.58	74.40	74.28
37505/DH45-1-P2	825,203	836,605	83.70	Piezometer	28.00	69.96	69.92	69.89
37505/DH45-4-P2	825,108	836,566	138.66	Piezometer	38.50	100.38	100.31	100.23
37505/DH45-6-P2	825,019	836,592	126.18	Piezometer	45.00	85.90	85.75	85.68
41406/DH3-P	829,404	830,419	415.45	Piezometer	8.00	408.09	407.97	407.90
41406/DH3-S	829,404	830,419	415.45	Standpipe	4.50	411.33	411.30	411.26
4311/BH1	828,033	835,209	72.42	Piezometer	30.00	46.00	45.79	45.60
4311/BH10	828,060	835,203	74.68	Piezometer	22.00	53.28	53.21	53.19
4311/BH11	828,039	835,180	54.63	Piezometer	8.00	47.18	47.13	47.08
4311/BH12	828,091	835,195	54.71	Piezometer	6.85	47.96	47.95	47.94
4311/BH2-P2	828,075	835,209	74.33	Piezometer	28.00	47.92	47.84	47.75
4311/BH3	828,076	835,248	86.40	Piezometer	28.50	61.00	60.82	60.67
4311/BH4	828,091	835,228	72.27	Piezometer	12.00	60.50	60.49	60.48
4311/BH5	828,107	835,267	67.41	Piezometer	5.50	62.27	62.17	62.11
4311/BH7	828,115	835,222	54.73	Piezometer	8.00	52.51	52.49	52.48
4311/BH8	828,088	835,221	73.02	Piezometer	19.50	56.86	55.18	54.00
4311/BH9	828,066	835,182	54.68	Piezometer	10.00	47.25	47.17	47.10
45799/F390/BH1-P	833,892	825,261	266.39	Piezometer	20.00	251.59	251.56	251.54
45799/F390/BH2-P	833,913	825,248	268.98	Piezometer	23.50	252.28	252.15	251.99
5498/DH10-P	834,401	823,942	172.90	Piezometer	24.00	150.20	150.11	150.10
5498/DH10-S	834,401	823,942	172.90	Standpipe	34.50	150.10	150.07	150.00
5498/DH11	834,446	824,102	140.10	Standpipe	10.00	135.10	135.06	135.00
5498/DH15-P	834,408	824,085	162.40	Piezometer	25.00	140.30	140.24	140.20
5498/DH15-S	834,408	824,085	162.40	Standpipe	33.00	140.30	140.30	140.30
5498/DH18-S	834,552	824,419	160.70	Standpipe	22.50	140.90	140.76	140.60
5610/MTL2-L	827,495	842,122	80.90	Piezometer	20.90	65.84	65.84	65.84
6680/DH32-L	834,428	824,144	164.40	Piezometer	32.00	135.50	134.74	134.40
7255/85815/16D-L	831,948	826,992	129.73	Piezometer	20.40	122.14	122.14	122.14
7255/85815/16D-U	831,948	826,992	129.73	Piezometer	6.40	123.33	123.33	123.33
7255/85815/21D	832,040	826,953	129.34	Piezometer	11.68	122.06	122.06	122.05
7255/85815/22D-L	832,046	826,919	120.73	Piezometer	15.00	109.87	109.86	109.85
7255/85815/22D-U	832,046	826,919	120.73	Piezometer	9.50	111.24	111.23	111.21

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7255/85815/23D	832,046	826,874	98.20	Piezometer	4.50	97.35	97.34	97.32
7292/B16	834,719	822,122	10.40	Piezometer	9.96	8.24	8.18	8.09
7386/BH6	832,563	827,299	196.84	Piezometer	5.40	191.63	191.63	191.63
7554/D421	824,075	838,224	4.73	Piezometer	9.70	3.41	3.41	3.41
8681/D8_L	832,700	822,163	45.61	Piezometer	19.15	26.79	26.79	26.79
8681/D9-L	832,734	822,177	47.42	Piezometer	27.15	32.91	32.91	32.91
8681/D9-U	832,734	822,177	47.42	Piezometer	21.55	33.17	33.17	33.17
ERL/DH/205A	834,825	820,009	3.89	Piezometer	22.50	1.64	1.64	1.63
ERL/DH/207	834,844	820,596	4.91	Piezometer	7.30	3.31	3.31	3.30
KSD100/DH003	835,843	817,293	3.92	Standpipe	18.00	2.04	1.63	1.35
KSD100/DH012	835,526	817,372	14.60	Standpipe	35.50	4.05	3.97	3.91
KSD100/DH022	835,442	817,621	3.96	Standpipe	21.00	2.33	2.29	2.26
KSD100/DH038	835,395	817,956	4.23	Piezometer	25.00	2.21	-0.19	-1.91
KSD100/DH067	835,171	818,298	3.69	Standpipe	17.00	2.06	1.57	0.95
KSD100/DH095	834,806	819,337	5.71	Standpipe	17.00	1.11	0.94	0.74
KSD100/DH114	834,481	820,117	5.24	Standpipe	15.00	2.03	1.68	1.21
KSD100/DH130-SP	835,243	818,330	3.75	Standpipe	12.00	1.34	1.19	1.02
KSD100/DH130-SPIE	835,243	818,330	3.75	Piezometer	22.60	1.34	1.19	1.00
KSD100/DH131-SP	835,192	818,421	4.50	Standpipe	11.00	1.57	1.44	1.01
KSD100/DH131-SPIE	835,192	818,421	4.50	Piezometer	32.60	1.62	1.17	1.03
KSD100/DH134-SP	835,195	818,537	3.86	Standpipe	7.00	1.21	1.19	1.18
KSD100/DH134-SPIE	835,195	818,537	3.86	Piezometer	20.00	1.41	1.40	1.39
KSD100/DHE053	835,327	818,111	4.29	Standpipe	24.50	1.84	1.53	1.18
KSD100/DHE073	835,068	818,573	4.99	Standpipe	18.00	1.70	1.56	1.39
KSD100/DHE090	834,915	819,088	5.58	Standpipe	20.00	0.73	0.61	0.43
KSD100/DHE096	834,790	819,370	5.70	Standpipe	22.00	1.17	0.89	0.71
KSD100/DHE106	834,634	819,766	6.93	Standpipe	24.00	1.75	1.67	1.57
KSD100/DHE110	834,570	819,928	6.93	Standpipe	30.50	2.40	2.07	1.65
KSD100/DHE120	834,317	820,394	12.46	Standpipe	25.00	1.56	1.53	1.50
KSD100/DHEPZ052-SP	835,337	818,061	4.18	Standpipe	8.00	1.96	1.90	1.84
KSD100/DHEPZ052-SPI	835,337	818,061	4.18	Piezometer	17.00	2.04	1.86	1.74
KSD100/DHEPZ072	835,151	818,463	3.92	Standpipe	27.00	1.60	1.43	1.24
KSD100/DHEPZ113	834,518	820,085	3.58	Standpipe	8.00	2.16	1.83	1.50
KSD100/DHPZ013-SP	835,522	817,407	14.69	Standpipe	12.50	4.28	4.23	4.17
KSD100/DHPZ013-SPIE	835,522	817,407	14.69	Piezometer	24.50	6.26	6.22	6.17
KSD100/DHPZ039-SPIE	835,381	817,946	5.33	Piezometer	21.00	1.79	0.74	-0.16
KSD100/DHPZ042A	835,471	817,679	4.07	Standpipe	28.00	2.75	2.71	2.62
KSD100/DHPZ082	835,130	818,599	4.90	Standpipe	7.00	1.62	1.45	1.17
KSD100/DHPZ102	834,698	819,612	5.69	Standpipe	20.00	1.54	0.99	0.42
NCS/BH13-P	833,949	820,895	5.61	Piezometer	94.50	2.60	2.60	2.60
NCS/BH17-P	834,029	820,809	5.70	Piezometer	27.00	2.00	2.00	2.00

XRL Summary of 7 day Monitoring Water Level Records from Geological Information Unit (GIU)

BH	Easting	Northing	Datum mPD	Installation	Installation Tip Depth (m)	Maximum Water Level mPD	Average Water Level mPD	Minimum Water Level mPD
NCS/BH19-P	834,066	820,769	5.74	Piezometer	30.50	2.26	2.26	2.26
NCS/BH1-P	833,737	821,010	6.27	Piezometer	26.00	1.73	1.73	1.73
NCS/BH21-P	834,035	820,736	5.27	Piezometer	29.50	1.08	1.08	1.08
NCS/BH26-P	833,781	821,002	6.13	Piezometer	23.00	1.80	1.80	1.80
NCS/BH33-P	833,798	820,959	5.72	Piezometer	21.00	0.73	0.73	0.73
NCS/BH36-P	833,848	820,919	6.00	Piezometer	23.00	1.67	1.67	1.67
NCS/BH39-P	833,862	820,903	5.60	Piezometer	25.00	1.41	1.41	1.41
NCS/BH48-P	833,921	820,850	5.64	Piezometer	28.00	1.26	1.26	1.26
NCS/BH4-P	833,776	821,058	6.11	Piezometer	36.00	2.09	2.09	2.09
NCS/BH51-P	833,974	820,827	5.70	Piezometer	28.00	1.82	1.82	1.82
NCS/BH54-P	833,978	820,793	6.80	Piezometer	36.00	1.55	1.55	1.55
NCS/BH57-P	834,030	820,770	6.50	Piezometer	32.00	1.72	1.72	1.72
NCS/BH8-P	833,834	821,010	5.82	Piezometer	31.00	1.42	1.42	1.42
NCS/BH9-P	833,884	820,975	5.45	Piezometer	30.00	2.30	2.30	2.30

XRL Summary Table of Water Level Records from Drilling Logs

BH	Easting	Northing	Drilling Water Level mPD	BH	Easting	Northing	Drilling Water Level mPD
10139 / D57	833,131	821,780	1.71	2605 / HE46	832,916	821,969	2.95
10142 / DP22	833,692	821,224	1.37	2642 / MT1065	832,785	821,940	2.70
10142 / DP23	833,667	821,193	1.50	26458 / DH11	824,540	837,653	4.80
10145 / BHT5	832,248	823,874	204.55	27323 / V1	831,528	826,559	77.18
10374 / BH24	826,614	833,473	6.40	27323 / V2	831,511	826,532	69.07
10961 / TB1	834,021	820,898	1.52	27452 / LCK1	832,839	822,216	19.66
11067 / BH11	833,913	821,022	0.93	28505 or 28503 / TS100/DHPZ/019	824,653	837,590	3.49
12071 / BH1	826,944	832,642	16.67	28505 or 28503 / TS100/DHPZ/020	824,701	837,748	9.12
12071 / BH2	826,964	832,650	17.15	2858 / G17	825,006	836,374	226.00
12071 / BH3	827,003	832,673	15.99	28648 / DH5	827,602	832,350	25.89
12071 / BH4	827,018	832,646	17.71	28648 / DH6	827,726	832,412	25.72
12071 / BH5	827,054	832,645	17.72	2877 / D3	825,743	834,975	147.00
12071 / BH6	826,946	832,685	15.77	29081 / BH2	831,546	826,605	88.20
12330 / BH1	834,760	820,173	2.90	2979 / D1	831,689	825,863	30.00
12330 / BH2	834,754	820,200	2.77	30734 / 96075/CCW/02(P)	832,656	822,419	36.35
12330 / BH3	834,789	820,185	2.48	30748 / DH49/1	829,755	830,663	416.09
12330 / BH4	834,785	820,167	2.64	30748 / DH49/2	829,688	830,635	386.42
12330 / BH8	834,776	820,175	2.41	30806 / BH1	833,293	821,564	4.02
12671 / IIA/8P	823,580	840,271	2.68	30806 / BH2	833,292	821,577	4.04
13013 / BH1	832,078	824,647	48.25	30806 / BH4	833,272	821,571	4.46
13013 / BH18	832,151	824,687	69.08	30806 / BH6	833,251	821,585	2.77
13013 / BH6	832,122	824,596	60.10	30806 / BH7	833,251	821,599	3.07
13528 / BH100	832,473	823,338	183.03	3171 / ST9	832,675	822,655	89.80
13528 / BH101	832,442	823,390	185.87	33236 / DH3	831,481	826,954	145.92
13528 / BH109	832,362	823,508	199.30	33236 / DH4	831,491	826,956	157.73
13528 / BH111	832,358	823,540	195.54	33309 / BH24	826,776	834,107	11.54
13528 / BH118	832,296	823,884	213.39	33309 / BH25	826,570	834,062	11.68
13528 / BH120	832,383	823,883	194.74	33310 / BH1	832,746	822,631	57.64
13528 / BH39	832,219	824,076	230.29	33310 / BH2	832,748	822,670	68.78
13528 / BH42	832,232	824,032	218.48	3335N / D-225	824,142	838,594	3.82
13528 / BH43	832,236	824,101	222.67	3363 / T1	834,821	820,119	2.66
13528 / BH46	832,184	824,197	251.82	3363 / T2	834,822	820,126	2.95
13528 / BH49	832,305	824,031	208.75	33704 / DH2	824,820	836,640	69.94
13528 / BH51	832,281	824,167	229.69	34794 / BH1	833,416	821,403	5.51
13528 / BH52	832,326	824,167	208.53	34794 / BH10	833,456	821,448	0.41
13528 / BH53	832,180	824,246	216.57	34794 / BH11	833,430	821,405	-0.09
13528 / BH98	832,411	823,254	150.89	34794 / BH2	833,443	821,387	0.11
14744 / DH1	830,738	827,702	207.65	34794 / BH3	833,443	821,455	0.20
14744 / DH2	830,753	827,703	206.68	34794 / BH4	833,479	821,434	-1.09
14744 / DH3	830,768	827,704	203.87	34794 / BH5	833,419	821,424	1.70
15999 / CS1	834,955	819,951	1.70	34794 / BH6	833,443	821,411	2.44
16210 / WKM96	834,868	819,926	-3.98	34794 / BH7	833,430	821,445	-3.88
16215 / BA11	834,769	819,880	-6.79	34794 / BH8	833,450	821,435	-3.20
16215 / BA12	834,974	819,449	-6.80	34794 / BH9	833,467	821,424	-0.10
16215 / BA3A	834,866	819,210	-10.53	36188 / WK32/BH2	833,399	821,399	3.12
16215 / BA3B	834,864	819,209	-10.47	37492 / BH24A	826,777	834,093	11.80
16215 / BA4	835,001	819,076	-8.60	37492 / BH25A	826,565	834,054	9.83
16221 / WBD1	832,966	821,783	-1.19	37505 / DH/45/3	825,124	836,646	77.74
16223 / DH1	834,382	820,620	-11.11	37505 / DH/45/5	825,016	836,639	79.74
16223 / DH4	834,500	820,429	-5.66	37505 / DH/45/7	824,973	836,626	76.95
17134 / DP24	833,617	821,137	2.19	37529 / BH14	826,728	833,498	10.44
17499 / DHPA1	834,815	820,131	2.26	37529 / BH15	826,743	833,494	10.84
17499 / DHPA2	834,797	820,114	2.60	38423 / NCPR13	832,034	824,954	31.80
17499 / DHPA3	834,820	820,118	1.54	41466 / DH1	832,019	824,706	39.36
17499 / DHPA4	834,783	820,146	2.57	41466 / DH2	832,009	824,700	32.49
17589 / D1	824,201	838,160	7.98	42157 / D2	832,475	823,016	100.14
17589 / D11	824,166	838,199	6.54	42157 / D3	832,476	823,041	112.83
17589 / D13	824,157	838,146	5.99	42157 / D4	832,460	823,057	106.76
17589 / D17	824,147	838,226	5.99	42157 / D5	832,443	823,072	108.32
17589 / D-2	824,197	838,139	7.70	42157 / D6	832,421	823,082	100.70
17589 / D20	824,134	838,165	4.66	42202 / DH1	832,104	824,428	113.93
17589 / D3	824,197	838,117	7.96	42202 / DH2	832,124	824,410	116.90
17589 / D4	824,197	838,100	7.49	44680 / DH1	831,861	825,790	23.64
17589 / D5	824,193	838,085	7.42	44969 / BH2	831,546	826,605	88.70
17589 / D-7	824,179	838,166	5.76	4682 / D2	832,178	824,824	71.85
17589 / D8	824,175	838,147	6.68	4682 / D3	832,179	824,795	77.08
17632 / DH404	824,297	838,089	6.44	5007B / MT1065	832,785	821,940	2.70

XRL Summary Table of Water Level Records from Drilling Logs

BH	Easting	Northing	Drilling Water Level mPD
17632 / DH405	824,218	838,136	10.07
17632 / DH407	824,283	838,225	17.79
19692 / A459	824,215	838,106	9.50
20897 / DH16	834,955	819,630	3.36
20897 / DH17	834,952	819,647	5.43
20897 / DH21	834,987	819,674	-0.16
20897 / DH22	834,972	819,465	2.27
20897 / DH55	834,946	819,678	4.58
20897 / DH56	834,941	819,709	1.73
20897 / DH60	834,975	819,721	1.50
20897 / DH63	834,993	819,660	1.77
20897 / DH66	835,004	819,702	2.12
20897 / DH69	835,017	819,657	1.50
20897 / DH72	835,026	819,692	2.17
20901 / DH1	834,977	819,535	2.05
20901 / DH11	834,994	819,557	4.70
20901 / DH13	835,011	819,580	0.65
20901 / DH14	835,007	819,598	1.44
20901 / DH15	835,003	819,616	2.93
20901 / DH2	834,973	819,553	3.24
20901 / DH3	834,969	819,571	1.69
20901 / DH4	834,965	819,589	1.48
20901 / DH5	834,961	819,608	3.95
20901 / DH6	834,999	819,539	0.30
20901 / DH8	834,990	819,576	1.37
20901 / DH9	834,896	819,594	2.88
20971 / PH1	834,916	819,570	2.81
20971 / PH2	834,935	819,476	3.04
20971 / PH7	835,042	819,370	2.69
20971 / PH8	835,042	819,370	2.93
20989 / DSK11	832,725	822,302	44.82
21138 / DH61	834,967	819,730	4.62
21138 / DH64	834,985	819,709	1.02
21138 / DH67	834,996	819,735	1.58
21160 / DH18	835,039	819,549	4.35
21160 / DH20	835,039	819,549	4.35
21265 / BH10	826,674	833,373	12.35
21265 / BH11	826,682	833,344	12.98
21265 / BH12	826,720	833,387	12.64
21265 / BH4	826,621	833,462	10.59
21265 / BH7	826,644	833,490	12.36
21394 / DH10	834,577	820,214	2.90
2605 / HE12	832,870	821,953	2.52
2605 / HE13	832,839	821,960	2.58
2605 / HE14	832,920	821,944	2.76
2605 / HE15	832,854	821,939	2.50
2605 / HE2	832,768	821,990	4.75
2605 / HE24	832,796	821,988	4.70
2605 / HE42	832,877	821,994	3.68
2605 / HE43	832,868	821,980	3.58

BH	Easting	Northing	Drilling Water Level mPD
5007E / EF40/1561	833,048	821,911	1.14
5007F / EF40/1619	833,047	821,911	1.99
5007F / EF40/MP5	833,036	821,907	0.73
5207 / DH2	832,022	824,758	20.60
5207 / DH4	832,031	824,728	34.85
5207 / DH5	832,040	824,742	34.20
5207 / DH6	832,043	824,751	32.00
5882 / DH10	831,890	825,753	15.26
5882 / DH3	831,885	825,613	6.74
5882 / DH4B	831,863	825,494	9.52
5882 / DH6	831,833	825,439	1.39
5882 / DH7	831,801	825,357	5.52
5990 / S3	827,938	831,849	76.48
6654 / BH7	833,764	821,122	3.24
7210 / SH1	831,676	826,453	118.98
7210 / SH2	831,657	826,471	125.27
7210 / SH3	831,667	826,488	120.01
7210 / SH6	831,761	826,454	111.29
7255 / 85815/39D	831,653	826,925	145.40
7304 / D16	834,270	820,694	0.11
7563 / K5A	831,826	825,570	13.11
7573 / B10	834,203	820,779	2.60
7573 / B13	834,237	820,769	2.76
7573 / B14	834,190	820,791	2.45
7573 / B9	834,190	820,791	2.45
7586 / WT5	824,274	838,389	15.22
7586 / WT7	824,282	838,326	36.74
7739 / DH1	831,650	826,541	119.29
7739 / DH2	831,656	826,509	106.41
7739 / DH3	831,621	826,523	113.44
7739 / DH5	831,625	826,449	121.21
7739 / DH6	831,593	826,507	103.10
7739 / PP1	831,599	826,454	112.37
8055 / T1	832,115	827,275	194.92
8055 / T2	832,109	827,261	191.35
8055 / T3	832,126	827,267	198.91
8671 / DH2	832,724	822,203	45.58
8681 / D1	832,710	822,147	26.70
8681 / D2	832,722	822,150	23.15
8681 / D7	832,723	822,165	22.94
8701 / B1	831,548	826,526	82.17
B2 / 1	832,980	821,561	1.75
B2 / 2	832,978	821,567	1.58
B3 / 1	832,977	821,703	-2.16
B4 / 1	832,978	821,776	3.03
B4 / 2	832,973	821,778	2.22
B4 / 3	832,973	821,774	2.94
ERL / DH/003A	824,404	838,189	31.87
ERL / DH/006A	823,531	840,218	3.11
NCS / BH10	833,902	820,957	3.48
NCS / BH11	833,923	820,932	1.56

XRL Summary Table of Water Level Records from Drilling Logs

BH	Easting	Northing	Drilling Water Level mPD	BH	Easting	Northing	Drilling Water Level mPD
NCS / BH12	833,937	820,912	3.49				
NCS / BH14	833,970	820,865	1.08				
NCS / BH15	833,990	820,845	0.76				
NCS / BH16	834,089	820,857	4.55				
NCS / BH2	833,750	821,029	1.92				
NCS / BH22	833,779	821,036	1.23				
NCS / BH23	833,762	821,018	1.32				
NCS / BH24	833,748	821,003	0.77				
NCS / BH25	833,797	821,020	2.25				
NCS / BH27	833,766	820,987	1.95				
NCS / BH28	833,812	821,007	1.48				
NCS / BH29	833,797	820,988	2.24				
NCS / BH30	833,783	820,972	3.33				
NCS / BH32	833,812	820,975	3.43				
NCS / BH34	833,872	820,755	-0.58				
NCS / BH35	833,856	820,937	2.01				
NCS / BH37	833,892	820,937	1.57				
NCS / BH38	833,876	820,919	1.68				
NCS / BH40	833,912	820,919	1.53				
NCS / BH41	833,896	820,902	1.57				
NCS / BH42	833,882	820,886	3.37				
NCS / BH43	833,932	820,902	2.99				
NCS / BH46	833,952	820,884	1.49				
NCS / BH50	833,939	820,832	2.47				
NCS / BH52	833,959	820,812	1.37				
NCS / BH53	833,986	820,814	2.30				
NCS / BH55	834,012	820,789	2.80				
NCS / BH56	833,997	820,773	3.45				
NCS / BH6	833,808	821,034	-0.62				
NCS / BH7	833,824	821,022	0.65				
NCS / IH3	833,894	820,965	1.46				
NCS / BH18	834,047	820,788	1.70				
NCS / BH20	834,049	820,751	1.79				
NCS / BH3	833,763	821,049	1.90				
NCS / BH5	833,780	821,049	2.38				
NCS / BH58	834,016	820,754	1.73				
NOL / DH/029	824,540	837,318	7.03				
NOL / DH/031	824,657	837,609	4.06				
NOL / DH/032	824,719	837,764	12.30				
P10 / L1	832,925	822,118	1.74				
P10 / L2	832,923	822,125	1.80				
P4 / L1	832,938	821,704	2.60				
P4 / L2	832,944	821,704	1.16				
P4 / R1	832,955	821,700	1.29				
P5 / L1	832,935	821,774	2.38				
P5 / L2	832,941	821,774	1.00				
P5 / R1	832,949	821,775	2.72				
P5 / R3	832,954	821,776	3.63				
P6 / 1	832,947	821,844	-0.12				
P6 / 2	832,954	821,844	1.93				
P7 / 2	832,852	821,912	1.14				
P8 / L1	832,945	821,976	1.35				
P8 / L2	832,949	821,976	2.82				
P8 / L4	832,945	821,981	0.61				
P8 / R1	832,966	821,974	2.26				
P8 / R2	832,966	821,982	2.09				
P9 / L2	832,946	822,057	2.80				

XRL Summary od 7 days Monitoring Water Level Records in Piezometer or Standpipe from MTR Contract NEX/2108

BH	Easting	Northing	Installation	Datum (mPD)	Installation Tip level (mpD)	Monitored Materials	Groundwater depth (m) in 7 days									Groundwater Level (mPD)		
							Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Max	Min	Highest	Lowest	Average
2108/XRL/D011	835091.23	818375.28	Piezometer	5.75	-34.25	CD Granite (V) -Silty fine to coarse SAND	3.69	3.65	3.67	3.6	3.72	3.77	3.76	3.77	3.6	2.15	1.98	2.06
2108/XRL/D012	834981.53	818382.47	Piezometer	5.33	-23.67	CD Granite (V) -Silty fine to coarse SAND	3.69	3.63	3.66	3.68	3.6	3.68	3.69	3.69	3.6	1.73	1.64	1.67
2108/XRL/D016(P)	834952.12	818516.22	Piezometer	6.48	-14.9	Fill (Clayey/silty fine to coarse SAND)	4.63	4.63	4.62	4.63	4.67	4.65	4.7	4.7	4.62	1.86	1.78	1.83
2108/XRL/D033(P)	834919.40	819659.41	Piezometer	4.81	51.6	CD Granite (V) -Silty fine to coarse SAND	3.31	3.29	3.33	3.32	3.34	3.3	3.31	3.34	3.29	1.52	1.47	1.50
2108/XRL/D035(P)	834923.61	819747.75	Piezometer	5.08	-25.92	CD Granite (V) -Clayey silty fine to coarse SAND	3.57	3.54	3.55	3.58	3.56	3.57	3.58	3.58	3.54	1.54	1.5	1.52
2108/XRL/D037(P)	834933.54	819604.52	Piezometer	4.41	-20.59	CD Granite (V) -Silty fine to coarse SAND	3.34	3.29	3.32	3.3	3.28	3.28	3.3	3.34	3.28	1.13	1.07	1.11
2108/XRL/D038(P)	834939.57	818272.14	Piezometer	4.85	-45.45	-	2.48	2.5	2.47	2.49	2.53	2.52	2.53	2.53	2.47	2.38	2.32	2.35
2108/XRL/D178(P)	828129.85	832792.68	Piezometer	34.23	3.37	-	0.68	0.65	0.67	0.66	0.69	0.65	0.67	0.69	0.65	33.58	33.54	33.56
2108/XRL/D180(P)	828083.84	832808.07	Piezometer	33.84	-9.16	-	1.87	1.85	1.83	1.86	1.84	1.87	1.88	1.88	1.83	32.01	31.96	31.98
2108/XRL/D254(P)	824069.30	838805.75	Piezometer	4.18	-19.82	CD Meta-Siltstone (V) -very stiff SILT	1	1.01	1.01	0.92	0.88	0.87	0.85	1.01	0.85	3.33	3.17	3.25
2108/XRL/D254(S)	824069.30	838805.75	Standpipe	4.18	0.18	-	0.86	0.86	0.72	0.65	0.59	0.55	0.52	0.86	0.52	3.66	3.32	3.50
2108/XRL/D256(P)	824065.95	838876.79	Piezometer	4.68	-20.32	CD Meta-Siltstone (V) -very stiff SILT	1.37	1.35	1.34	1.35	1.34	1.35	1.35	1.37	1.34	3.34	3.31	3.33
2108/XRL/D256(S)	824065.95	838876.79	Standpipe	4.68	-3.32	-	1.44	1.46	1.45	1.46	1.45	1.46	1.5	1.5	1.44	3.24	3.18	3.22
2108/XRL/D257(P)	823989.34	838902.13	Piezometer	4.18	-19.82	CD Meta-Siltstone (V) -very stiff sandy SILT	1.34	1.35	1.32	1.29	1.32	1.3	1.28	1.35	1.28	2.9	2.83	2.87
2108/XRL/D258(P)	823970.80	838938.50	Piezometer	3.97	-30.03	CD Meta-Siltstone (V) -very stiff sandy SILT	0.87	0.86	0.85	0.87	0.88	0.91	0.94	0.94	0.85	3.12	3.03	3.09
2108/XRL/D258(S)	823970.76	838938.50	Standpipe	3.97	-4.53	-	0.99	0.97	0.95	0.96	0.97	0.99	1.04	1.04	0.95	3.02	2.93	2.99
2108/XRL/D267(PA)	823603.96	839997.13	Piezometer	3.98	-5.02	Marine Deposit (CLAY)	2.02	2.02	2.04	2.03	2.03	2.02	2.01	2.04	2.01	1.97	1.94	1.96
2108/XRL/D267(PB)	823603.96	839997.13	Piezometer	3.98	-17.52	Alluvium (Silty fine to coarse SAND)	2.27	2.24	2.25	2.25	2.26	2.27	2.26	2.27	2.24	1.74	1.71	1.72
2108/XRL/D267(PS)	823603.96	839997.13	Standpipe	3.98	-2.02	-	2.01	2.02	2.05	2.04	2.03	2.04	2.04	2.05	2.01	1.97	1.93	1.95
2108/XRL/D268(P)	823599.68	840112.48	Piezometer	3.77	-21.23	CD Meta-Siltstone (V) -very stiff sandy SILT	1.52	1.59	1.66	1.68	1.69	1.7	1.7	1.7	1.52	2.25	2.07	2.12
2108/XRL/D268(S)	823599.68	840112.48	Standpipe	3.77	-18.43	-	1.69	1.78	1.85	1.86	1.87	1.89	1.9	1.9	1.69	2.08	1.87	1.94
2108/XRL/D281(P)	834406.74	820564.75	Piezometer	7.13	-17.37	CD Granite (V) -very silty fine to coarse SAND	4.76	4.75	4.74	4.75	4.78	4.74	4.76	4.78	4.74	2.39	2.35	2.38
2108/XRL/D281(S)	834406.74	820564.75	Standpipe	7.13	1.13	-	4.92	4.68	4.85	4.87	4.82	4.8	4.84	4.92	4.68	2.45	2.21	2.30
2108/XRL/D283	834247.33	820652.79	Piezometer	4.87	-17.13	CD Granite (V) -very stiff sandy SILT	2.83	2.89	2.87	2.91	2.91	2.93	2.95	2.95	2.83	2.04	1.92	1.97
2108/XRL/D291(P)	833606.80	821199.02	Piezometer	5.33	-23.67	CD Granite (V) -Silty fine to coarse SAND	3.5	3.52	3.52	3.53	3.53	3.54	3.54	3.54	3.5	1.83	1.79	1.80
2108/XRL/D291(S)	833606.80	821199.02	Standpipe	5.33	-4.67	-	3.43	3.42	3.42	3.44	3.44	3.45	3.45	3.45	3.42	1.91	1.88	1.89
2108/XRL/D292(P)	833581.20	821167.65	Piezometer	5.31	-64.76	MD Granite (III) -Weak zone	3.25	3.28	3.28	3.28	3.3	3.32	3.32	3.32	3.25	2.06	1.99	2.02
2108/XRL/D292(S)	833581.20	821167.65	Standpipe	5.31	-13.69	-	3.58	3.58	3.62	3.61	3.61	3.6	3.61	3.62	3.58	1.73	1.69	1.71
2108/XRL/D294	833470.67	821306.02	Piezometer	6.07	-17.93	Alluvium (sandy SILT)	2.61	2.59	2.67	2.65	2.68	2.67	2.66	2.68	2.59	3.48	3.39	3.42
2108/XRL/D297(P)	833139.50	821566.36	Piezometer	5.5	-27.5	CD Granite (V) -Silty fine to coarse SAND	3.28	3.28	3.26	3.3	3.32	3.23	3.21	3.32	3.21	2.29	2.18	2.23
2108/XRL/D297(S)	833139.50	821566.36	Standpipe	5.5	-16.5	-	3.34	3.35	3.32	3.38	3.42	3.29	3.31	3.42	3.29	2.21	2.08	2.16
2108/XRL/D348	831826.78	825770.43	Piezometer	21.43	-26.57	CD Granite (V) -Sligthly Silty sandy fine to coarse GRAVEL	1.95	1.96	1.96	1.97	1.97	1.98	1.98	1.98	1.95	19.48	19.45	19.46
2108/XRL/D400(P)	827316.24	832838.15	Piezometer	21.98	8.98	CD Granodiorite (V) -very stiff, slightly sandy SILT	3.39	3.42	3.45	3.48	3.48	3.48	3.48	3.48	3.39	18.59	18.5	18.53
2108/XRL/D400(S)	827316.24	832838.15	Standpipe	21.98	12.98	-	3.61	3.63	3.64	3.67	3.75	3.77	3.78	3.78	3.61	18.37	18.2	18.29
2108/XRL/D403(P)	827256.95	832972.01	Piezometer	20.46	-3.54	CD Granodiorite (V) -silty sandy fine to coarse GRAVEL	1.53	1.49	1.43	1.42	1.4	1.39	1.38	1.53	1.38	19.08	18.93	19.03
2108/XRL/D403(S)	827256.95	832972.01	Standpipe	20.46	10.46	-	2.42	2.41	2.37	2.35	2.34	2.32	2.3	2.42	2.3	18.16	18.04	18.10
2108/XRL/D405(P)	827108.33	833009.13	Piezometer	19.24	-1.26	CD Granodiorite (V) -Very stiff, sligthly sandy SILT	4.32	4.29	4.27	4.25	4.25	4.22	4.21	4.32	4.21	15.03	14.92	14.98
2108/XRL/D405(S)	827108.33	833009.13	Standpipe	19.24	13.74	-	2.5	2.5	2.49	2.48	2.47	2.44	2.44	2.5	2.44	16.8	16.74	16.77
2108/XRL/D406(P)	827160.23	833129.57	Piezometer	18.99	7.99	CD Granodiorite (V) -very stiff, sandy SILT	0.84	0.89	0.95	0.97	0.97	0.98	0.98	0.98	0.84	18.15	18.01	18.05
2108/XRL/D406(S)	827160.23	833129.57	Standpipe	18.99	10.99	-	1.43	1.46	1.48	1.49	1.49	1.49	1.49	1.49	1.43	17.56	17.5	17.51
2108/XRL/D408(P)	827110.18	833119.32	Piezometer	18.07	8.07	CD Granodiorite (V) -very stiff, sandy SILT	1.7	1.73	1.75	1.83	1.85	1.8	1.85	1.85	1.7	16.37	16.22	16.28
2108/XRL/D408(S)	827110.18	833119.32	Standpipe	18.07	12.07	-	1.65	1.72	1.76	1.78	1.78	1.79	1.8	1.8	1.65	16.42	16.27	16.32
2108/XRL/D410(P)	826985.39	833115.04	Piezometer	15.22	6.72	DFD (silty sandy COBBLE)	2.28	2.33	2.34	2.36	2.36	2.36	2.36	2.36	2.28	12.94	12.86	12.88
2108/XRL/D410(S)	826985.39	833115.04	Standpipe	15.22	9.72	-	3.19	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.19	12.03	12.02	12.02
2108/XRL/D411(P)	827157.58	833234.80	Piezometer	17.56	-2.64	CD Granodiorite (V) -Very stiff, sligthly sandy SILT	1.1	1.1	1.1	1.09	1.09	1.09	1.1	1.1	1.09	16.47	16.46	16.46
2108/XRL/D411(S)	827157.58	833234.80	Standpipe	17.56	13.06	-	0.99	0.95	0.94	0.93	0.91	0.91	0.92	0.99	0.91	16.65	16.57	16.62
2108/XRL/D414(P)	827014.86	833252.51	Piezometer	16.35	-3.15	CD Granodiorite (V) -silty fine to coarse SAND	2.16	2.15	2.14	2.14	2.12	2.12	2.13	2.16	2.12	14.23	14.19	14.21
2108/XRL/D414(S)	827014.86	833252.51	Standpipe	16.35	6.35	-	2.17	2.15	2.1	2.03	1.88	1.9	1.93	2.17	1.88	14.47	14.18	14.33
2108/XRL/D427(P)	826597.95	833872.96	Piezometer	10.68	-6.12	CD Granodiorite (V) -stiff sandy SILT	1.95	1	2.72	2.38	2.89	3	3.01	3.01	1	9.68	7.67	8.26
2108/XRL/D427(S)	826597.95	833872.96	Standpipe	10.68	4.38	-	2.53	.	2.64	2.7	2.83	2.84	2.85	2.85	2.53	8.15	7.83	7.95
2108/XRL/D431(P)	826402.75	834212.74	Piezometer	14.29	-2.21	CD Tuff (V) -very stiff, sandy SILT	0.75	2.78	3.35	3.65	3.7	3.71	3.71	3.71	0.75	13.54	10.58	11.20

XRL Summary od 7 days Monitoring Water Level Records in Piezometer or Standpipe from MTR Contract NEX/2108

BH	Easting	Northing	Installation	Datum (mPD)	Installation Tip level (mpD)	Monitored Materials	Groundwater depth (m) in 7 days									Groundwater Level (mPD)		
							Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Max	Min	Highest	Lowest	Average
2108/XRL/D431(S)	826402.75	834212.74	Standpipe	14.29	4.29	-	2.33	2.58	2.9	3.95	4.3	4.58	4.61	4.61	2.33	11.96	9.68	10.68
2108/XRL/D432(P)	826305.00	834280.04	Piezometer	17.33	-2.67	CD Tuff (V) - very stiff, sandy SILT	2.73	2.74	2.76	2.81	2.83	2.84	2.85	2.85	2.73	14.6	14.48	14.54
2108/XRL/D432(S)	826305.00	834280.04	Standpipe	17.33	6.83	-	4.25	4.27	4.28	4.35	4.36	4.38	4.38	4.38	4.25	13.08	12.95	13.01
2108/XRL/D433(P)	826237.35	834362.32	Piezometer	17.18	-3.27	CD Tuff (V) - very stiff, sandy SILT	2.9	2.91	2.95	2.96	2.96	2.96	2.97	2.97	2.9	14.28	14.21	14.24
2108/XRL/D433(S)	826237.35	834362.32	Standpipe	17.18	4.19	-	4.19	4.21	4.27	4.29	4.3	4.3	4.32	4.32	4.19	12.99	12.86	12.91
2108/XRL/D434(PA)	826244.07	834443.04	Piezometer	20.09	4.19	CD Tuff (V) - Silty fine to coarse SAND	5.5	5.52	5.57	5.59	5.61	5.61	5.61	5.61	5.5	14.59	14.48	14.52
2108/XRL/D434(PB)	826244.07	834443.04	Piezometer	20.09	-17.11	MD Tuff (III) -joints	6.25	6.27	6.29	6.29	6.3	6.3	6.3	6.3	6.25	13.84	13.79	13.80
2108/XRL/D435(S)	826270.20	834393.15	Standpipe	18.78	8.78	-	0.73	0.8	0.83	0.87	0.98	0.99	1.02	1.02	0.73	18.05	17.76	17.89
2108/XRL/D435(P)	826270.20	834393.15	Piezometer	18.78	-0.22	-	3.21	3.28	3.32	3.35	3.44	3.48	3.58	3.58	3.21	15.57	15.2	15.40
2108/XRL/D460(P)	824551.98	837559.58	Piezometer	5.95	17.8	CD Tuff (V) - sandy SILT	2.47	2.49	2.5	2.5	2.51	2.51	2.51	2.51	2.47	3.48	3.44	3.45
2108/XRL/D461(P)	824493.01	837653.13	Piezometer	4.92	17	CD Tuff (V) - sandy SILT	1.49	1.49	1.5	1.53	1.55	1.56	1.58	1.58	1.49	3.43	3.34	3.39
2108/XRL/EDH13(P	834960.69	819541.38	Piezometer	4.46	-20.54	Alluvium (fine to coarse SAND)	3.23	3.3	3.27	3.31	3.34	3.29	3.31	3.34	3.23	1.23	1.12	1.17
2108/XRL/EDH17(P	835255.60	818100.10	Piezometer	3.95	-7.4	CD Granite (V) -Silty fine to coarse SAND	2.85	2.87	3.01	2.95	2.88	3.1	2.87	3.1	2.85	1.1	0.85	1.02
2108/XRL/EDH18(P	823973.66	838978.11	Piezometer	4.03	-24.97	CD Meta-Siltstone (V) -very stiff sandy SILT	0.82	0.85	0.86	0.9	0.92	0.95	0.97	0.97	0.82	3.21	3.06	3.13
2108/XRL/EDH18(S	823973.66	838978.11	Standpipe	4.03	-9.37	-	1.15	1.18	1.22	1.25	1.25	1.24	1.25	1.25	1.15	2.88	2.78	2.81

XRL Summary Table of Water Level Records in Drilling Log from MTR Contract NEX/2108

BH	Easting	Northing	Datum(mPD)	GWL (max in morning) (m)	GWL (max in morning) (mPD)
02108/XRL/D027	834917.55	819112.17	5.61	3.8	1.81
02108/XRL/D028	834928.37	819182.01	4.86	9.6	-4.74
02108/XRL/D030	834969.47	819412.43	4.68	3.18	1.5
02108/XRL/D031	834965.45	819456.84	4.57	3.25	1.32
02108/XRL/D036	834908.62	819700.91	5.12	1.02	4.1
02108/XRL/D255	824039.90	838836.97	3.88	0.75	3.13
02108/XRL/D259	824044.06	838932.63	4.66	1.2	3.46
02108/XRL/D263	823867.34	839212.62	3.36	2.16	1.2
02108/XRL/D264	823872.13	839365.02	3.3	1.12	2.18
02108/XRL/D265	839775.37	823705.10	4.24	1.24	3
02108/XRL/D272	823868.34	839213.62	4.36	2.17	2.19
02108/XRL/D278	834543.00	820381.95	4.34	1.72	2.62
02108/XRL/D279	834497.73	820451.22	6.65	4.82	1.83
02108/XRL/D280	834405.61	820520.70	6.82	3.35	3.47
02108/XRL/D284	834175.73	820745.13	6.02	3.62	2.4
02108/XRL/D286	834044.46	820857.82	6.09	3	3.09
02108/XRL/D293	833596.60	821229.14	6.71	3.2	3.51
02108/XRL/D299	833035.44	821716.04	4.64	3.23	1.41
02108/XRL/D300	833000.66	821755.97	4.57	3.16	1.41
02108/XRL/D329	831793.42	824512.35	12.62	2.8	9.82
02108/XRL/D343	831959.35	825357.82	13.57	4.05	9.52
02108/XRL/D353	831969.42	825851.68	21.81	0.72	21.09
02108/XRL/D395	827674.55	832315.71	28.45	1.92	26.53
02108/XRL/D398	827482.34	832639.20	24.45	2.83	21.62
02108/XRL/D399	827438.73	832702.72	23.34	2.07	21.27
02108/XRL/D401	827328.42	832885.59	21.71	3.9	17.81
02108/XRL/D404	827217.76	833060.72	19.46	0.97	18.49
02108/XRL/D409	827083.61	833183.33	16.93	1.02	15.91
02108/XRL/D412	827129.84	833295.99	16.78	1.42	15.36
02108/XRL/D413	827047.48	833273.77	17.78	0.6	17.18
02108/XRL/D415	826952.95	833295.65	15.55	4.8	10.75
02108/XRL/D416	826935.71	833350.14	15.1	2.16	12.94
02108/XRL/D418	826950.63	833396.09	14.78	1	13.78
02108/XRL/D424	826832.61	833565.73	13.28	2.75	10.53
02108/XRL/D425	826763.22	833621.18	11.5	4.15	7.35
02108/XRL/D426	826689.38	833695.95	10.71	3.75	6.96
02108/XRL/D428	826564.91	833974.09	12.63	3.2	9.43
02108/XRL/D430	826447.54	834101.84	12.33	1.31	11.02
02108/XRL/D463	824403.49	837792.19	6.52	0.3	6.22
02108/XRL/EDH10	834964.09	819267.93	5.29	7.5	-2.21
02108/XRL/EDH11	834976.50	819381.03	4.93	3.25	1.68
02108/XRL/EDH14	834941.95	819637.13	4.56	3.35	1.21
02108/XRL/EDH16	834906.38	818100.10	3.95	3.12	0.83
02108/XRL/EDH19	834912.93	818073.49	4.95	3.45	1.5
02108/XRL/EDH20	835159.15	818190.48	4.66	3.15	1.51
02108/XRL/EDH27	831814.58	824493.63	12.83	0.6	12.23

Appendix B

Designated Area Factsheets

No. 10 - Mai Po Marshes

Site

The Mai Po Marshes cover an area of about 393 hectares of which 209 hectares are kei wais (shallow shrimp ponds) and bunds, the remainder being tidal creeks and dwarf mangrove.

Date of Designation

15 September 1976

Special Scientific Interest

The Marshes contain the largest and most important area of dwarf mangrove in Hong Kong. This highly productive seral community and the related man-made kei wais provide a rich food source for both resident and migratory birds, as well as nesting habitats for a number of species. The Marshes are the only area in Hong Kong where large number of duck, shore and marsh birds can regularly be seen and, as such, have a very considerable recreational and educational potential.

Degree of Hazard

A total of some 98 structures with about 200 inhabitants are present in the area.

There is continual illegal netting of birds during spring and autumn migrations and throughout the winter. A certain amount of illegal shooting occurs.

The housing development at Tai Shang Wai will directly affect the area unless controls are placed on access as it is certain that construction workers, and later residents, will visit the area. With continued infilling of the existing fish ponds, some of the people currently living on the development site may move across onto the Marshes.

Graphite mining is being conducted near the Tam Ken Chau Police Post. There appear to be some 40 structures in the area at present covered by the mining licence and the occupants may move out onto the Marshes if mining continues.

An illegal fish pond was found in the cuter mangrove belt in March 1974. Should further such ponds be developed in the mangrove the results could be serious, not only for the wildlife of the area but also in relation to the operation of the kei wais and the productivity of the oysterbeds.

Existing Protection Measures

The area is currently listed under Schedule Four of the Wild Birds and Wild Animals Protection Ordinance Cap. 170.

The land tenure of the most important kei wais has been formalised by the issue of permits carrying special conditions which relate to the manner of working the kei wais for shrimp and fish production vis a vis their value conservation purposes.

Recommended Additional Protection Measures

Suitable measures should be taken to prevent :-

(a) direct access from the Tai Shang Wai housing estate onto the Marshes;

(b) any increase in the number of people living on the Marshes and to prevent the construction of additional temporary structures;

(c) any further development of fishponds in the outer mangrove.

It should be borne in mind that the area is currently under consideration as a Nature Conservation and Nature Education Area.

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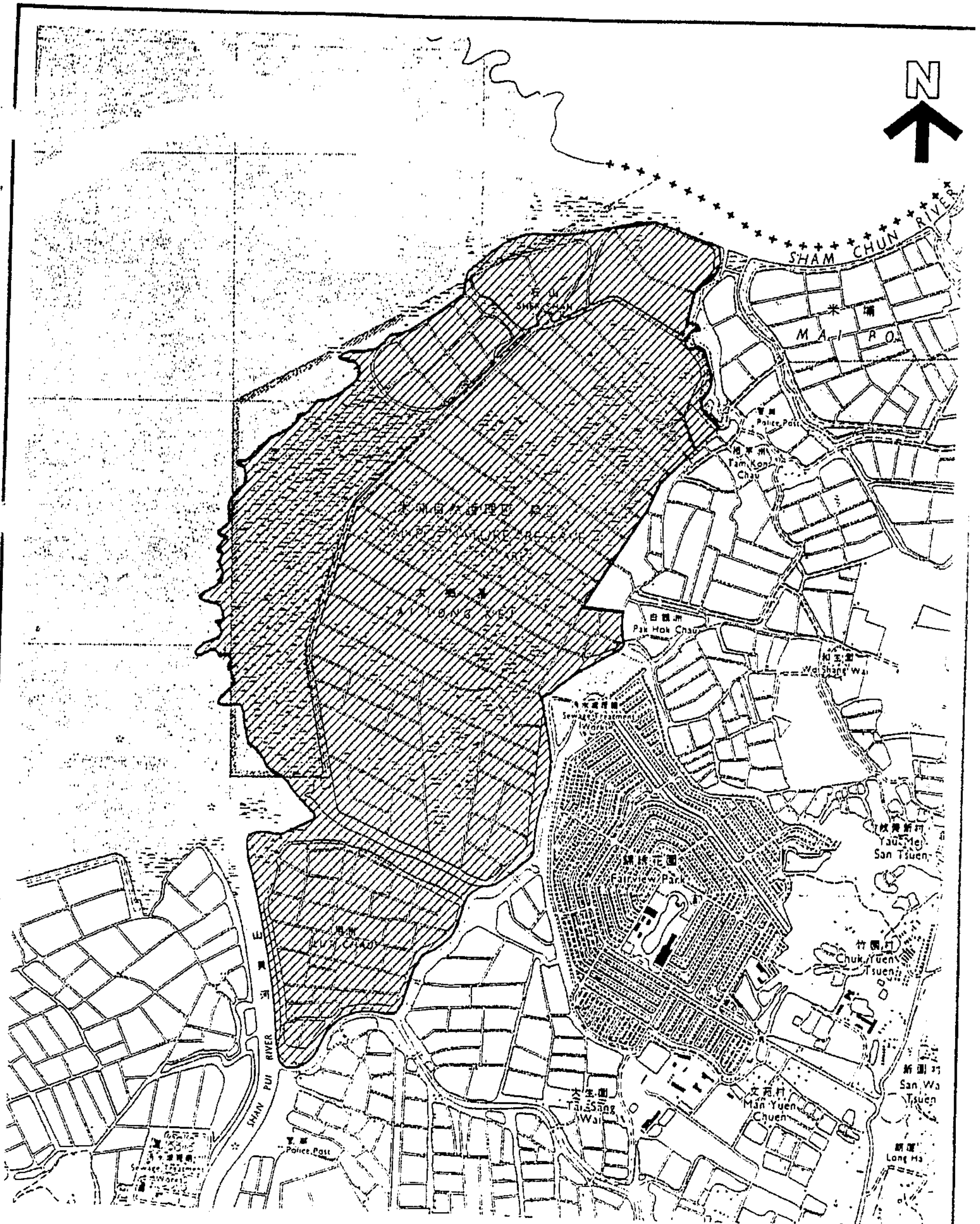
Webster M. 1974. Conservation of the Deep Bay Marshes, Hong Kong. Unpublished paper presented to the XVIth Meeting of the I.C.B.P., Canberra, 1974.



REFERENCE	SITE OF SPECIAL SCIENTIFIC INTEREST — MAI PO MARSHES	PLANNING DEPARTMENT
TE OF DESIGNATION : 15-9-76 BASE PLAN EXTRACTED FROM HM20C SHEET 2 DATE : 30-9-92	SCALE 1 : 20 000 m500 0 500 1000m	PLAN No. TPB/M/92/6 SITE No. 10

No. 41 - Tsim Bei Tsui

Site

The site is a seafront location at Tsim Bei Tsui just below Tsim Bei Tsui Police Post (JV 923897) in the north-western part of the New Territories of Hong Kong. The area is about 2.1 hectares.

Date of Designation

10 January 1985

Special Scientific Interest

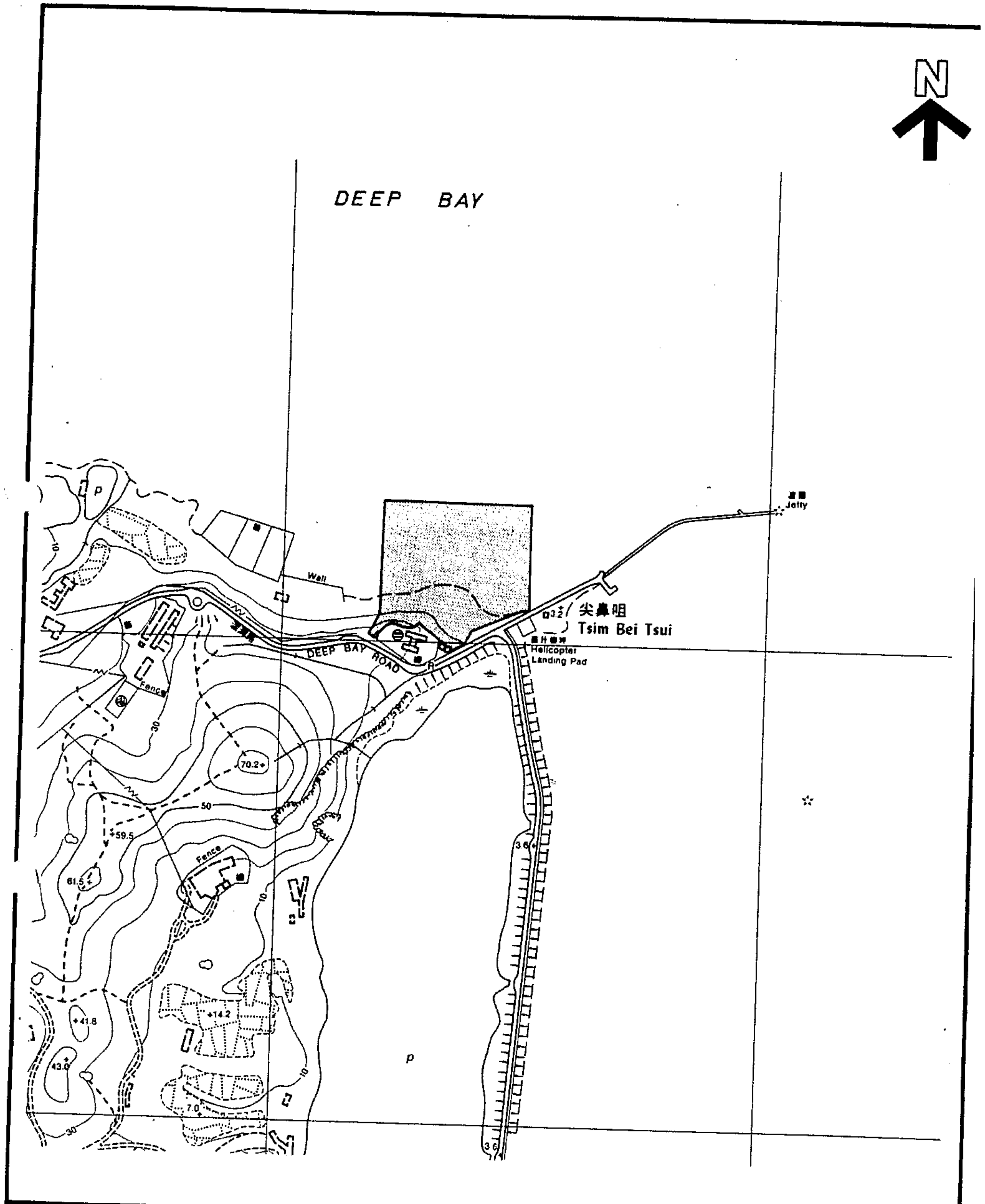
The site contains a mature mangrove community, progressing from the high zoned mangroves of the landward fringe to the pioneer species at the water edge. Amongst them is Bruguiera conjugata which is becoming rare in Hong Kong. Moreover, this mangrove stand provides the only known habitat in Hong Kong for the large mangrove pulmonate snail, Ellobium polita (Ellobiidae).

Degree of Hazard

Although the site appears to be well protected due to its proximity to the Police Station and by the Boarder Fence, any further development of existing or new fish ponds/duck farms or similar foreshore activities could destroy this mangrove community.

Recommended Protection Measures

The Agriculture, Fisheries and Conservation Department should be closely consulted on any development proposals which will affect the site. No other protection or management measures are necessary at the present time.



REFERENCE

DATE OF DESIGNATION : 10-1-85
BASE PLAN EXTRACTED FROM : HP5C SHEET 2-SW-D
DATE : 30.9.92

SITE OF SPECIAL SCIENTIFIC INTEREST— TSIM BEI TSUI

SCALE 1 : 5 000
m 100 0 100 200m

PLANNING DEPARTMENT

PLAN No. TPB/M/92/6

SITE No. 41

No. 46 – Inner Deep Bay

The Site

The Inner Deep Bay area is situated in the North Western part of the New Territories and bordered by the Shenzhen Special Economic Zone to the North. The Bay is dissected by the boundary of Hong Kong Special Administrative Region and the portion of the Bay covered by the Site of Special Scientific Interest (SSSI) is about 1,036 ha. The major habitat types inside the Site include an extensive intertidal mudflat of esturarine nature and a bay with shallow water.

Date of Designation

18 March 1986

Special Scientific Interest

The shallow waters and mudflat provide an abundant food supply and feeding and resting grounds for some 50,000 waterbirds of about 300 species every winter. Over 20 of them are considered globally threatened, including about one fifth of the global population of Black-faced Spoonbill Platalea minor (黑臉琵鷺).

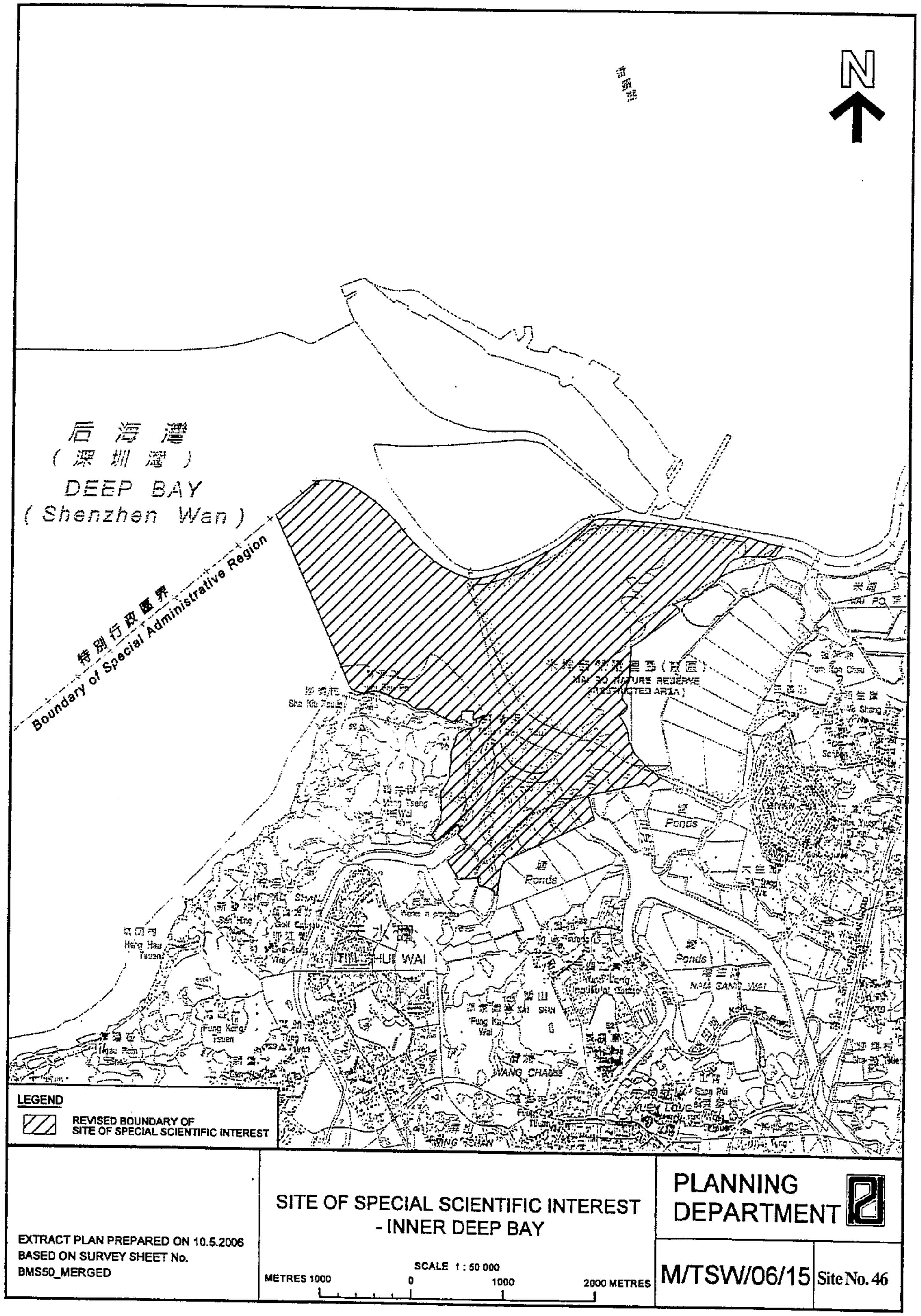
The mudflat and shallow waters also support a wide variety of organisms which are of economic values, e.g. mangrove crabs Scylla paramamosian (鋸緣青蟹) and shrimps Metapenaeus (新對蝦屬) and scientific importance (e.g. it is the type locality of the Sesarmine Crab Perisesarma maipoensis (米埔近相手蟹) which occurs nowhere else in the world).

Degree of Hazard

Development projects in North West New Terrritories may pose threats to the site either directly through dredging; or indirectly by the discharge of pollutants into the Bay.

Protection Measures

Departments concerned with planning and development should be made aware of the importance of the Site so that due consideration of the Site will be given when planning and development in or near the Site is proposed. The Agriculture, Fisheries and Conservation Department should be closely consulted on any development proposals which may affect directly or indirectly the site.



FACT SHEET

RAMSAR CONVENTION AND MAI PO NATURE RESERVE

Factsheet No.25

WHAT IS THE RAMSAR CONVENTION?

There are many types of 'wetlands', e.g. lakes, estuaries, rivers, rice fields, fish ponds, coral reefs etc., which may be natural or man-made. A wetland is where land meets water. Many people think wetlands are of little value or simply a piece of wasteland which should be reclaimed. However, wetlands are amongst the world's most productive places in providing food (e.g. fish), drinking water and other important resources (e.g. fuelwood).

In order to stop and reverse the destruction or degradation of the world's wetlands, an intergovernmental meeting was held at Ramsar, a town in Iran, in 1971, to sign an international convention for conserving the world's important wetlands. This convention was thereafter known as the Ramsar Convention.

As of 13 December 1999, over 118 countries were party to the Ramsar Convention and over 1010 wetlands had been placed on the List of Wetlands of International Importance, covering an area of over 44,000,000 ha, an area about the size of Sweden. China joined the convention in 1992 and the United Kingdom in 1976. The convention was extended to Hong Kong in 1979 which means Hong Kong has an international obligation to protect its valuable wetlands.

WHY IS MAI PO DESIGNATED AS A RAMSAR SITE?

Each of the signatory countries to the Ramsar Convention has to designate at least one internationally important wetland in their country following a set of criteria. Currently, China has 7 Ramsar Sites (Poyang Lake, Jiangxi Province; Dongting Lake, Hunan Province; Dongzaigang Nature Reserve, Hainan Island; Niaodao, Qinghai Province; Xianghai Nature Reserve, Jilin Province; Zhalong Marshes, Heilongjiang Province; Mai Po and Inner Deep Bay, Hong Kong SAR) (see attached map).

Map 1. Locations of the seven Ramsar sites in China

For further information, refer to the page about Ramsar Convention and Mai Po.

Mai Po and Inner Deep Bay were formally designated as a Ramsar Site on September 1995 after years of lobbying by WWF HK. Below is a table showing how Mai Po meets the listing criteria:

Criteria of a Ramsar Site	How Mai Po meets the criteria
It is a particularly good representation of a natural or near-natural wetland, characteristic of one, or common to more than one, biogeographical region.	The stand of mangrove forest around Deep Bay/Mai Po is the sixth largest remaining along the coast of China, and the reedbed is one of the largest in Guangdong Province.
It supports an appreciable assemblage of rare, vulnerable, or endangered species of plants or animals.	15 endangered waterbirds species occur in Mai Po. In addition, over 20 species of invertebrates new to science have been found.
It holds more than 20,000 waterbirds.	Mai Po regularly holds over 20,000 wintering waterbirds. In January, 1996, over 68,000 waterbirds were recorded in the Mai Po/Deep Bay wetlands.
It holds more than 1% of the individuals in the population of a species of waterbird.	Mai Po holds over 1% of the individuals in the population of 12 species of waterbirds. In particular about 25% of the world population of Black-faced Spoonbill (*Platalea minor*) winters at Mai Po.

WHAT SHOULD THE SIGNATORY COUNTRIES DO UNDER THE RAMSAR CONVENTION?

Apart from caring for wetlands which have been designated Ramsar Sites, each signatory country also has to conserve the other wetlands in their country. Under Article 3 of the Convention, Governments are obliged to "...include wetland conservation considerations within their national land-use planning. They are required to formulate and implement this planning so as to promote, as far as possible, the * wise use of wetlands in their territory".

In order to implement the 'wise use' concept, governments are urged to develop National Wetland Policies in consultation with the local people. Governments should also set up a national Wetland Committee to coordinate decisions on wetland use. Under the 'wise use' concept, human activity can be allowed in a Ramsar site, e.g. for fish farming, low intensity recreation etc., as long as the use is sustainable.

HOW WILL RAMSAR DESIGNATION FOR THE DEEP BAY BENEFIT THE LOCAL COMMUNITY?

After designation, Mai Po and Inner Deep Bay wetlands will be managed by the Ramsar Management Authority, chaired by the Agriculture and Fisheries Department (AFD) to ensure the wetlands are managed under the wise use principle. In 1996, AFD commenced a consultancy study to draft a management plan for the Ramsar site.

Designation of the Mai Po and Inner Deep Bay Ramsar Site would, in effect, provide an additional area of countryside in Hong Kong, which can be managed for education and recreation, as is being done at the WWF Hong Kong's Mai Po Marshes Nature Reserve. In addition, the current land-use, e.g. fish pond farming in certain areas can be retained so that local people can continue to benefit from the area.

Ramsar designation for the Mai Po and Inner Deep Bay wetlands provides an exciting opportunity for conserving the largest remaining wetland in Hong Kong, which can be managed for the benefit of the Hong Kong people, as an area where education, recreation, farming and conservation can be integrated.

Footnote:

** Wise use- Wise use of wetlands means their sustainable use so that they may yield the greatest continuous benefit to present generations, while maintaining their potential to meet the needs and aspirations of future generations.*

Further Readings:

1. *An overview of the world's Ramsar Sites.* Wetlands International Publication No. 39., Frazier, s. 1996.

2. *Directory of Wetlands of International Importance - An update.* Frazier, S. (compiler). 1996., Ramsar Convention Bureau, Gland, Switzerland.

3. *The Ramsar Convention Manual.* Davis, T.J. (ed.) 1994, Ramsar Convention Bureau, Gland Switzerland.

4. *Waterlogged Wealth.* Maltby, E. 1986 Earthscan Nottingham.

5. *Wetlands in Danger.* Dugan, P. 1993. Mitchell Beazley, London.

6. *Wetlands.* Finlayson, M. and M. Moser. (eds.) 1991. Facts on File Ltd., Oxford.

FACT SHEET

SITES OF SPECIAL SCIENTIFIC INTEREST IN HONG KONG
Factsheet No.16

WHAT IS A SITE OF SPECIAL SCIENTIFIC INTEREST (SSSI)?

Conserving habitats plays a vital role in nature/wildlife conservation. However, the conservation value of our countryside differs according to the characteristics of a particular site, for example, the fauna and flora found there, and the habitat type. Therefore, it is desirable to recognise and mark those sites of outstanding interest, so as to highlight their conservation needs. To address this need, Hong Kong has since 1975 selected a number of sites to be designated as "Site of Special Scientific Interest" or in short: SSSI.

WHAT ARE PRESENT IN A SSSI?

A SSSI is designated according to the site's special faunal, floral, ecological or geographical features. Therefore, sites where rare plants or animals occur could be considered to be a SSSI as could a site, which is unique or representative in terms of its general ecology. For example, two rare trees *Keteleeria fortunei* are found in the Cape D'Aguilar Peninsula SSSI on Hong Kong Island. The *fung shui* wood egretry at Yim Tso Ha, Sha Tau Kok, where egrets and herons nest each year was one of the first SSSIs to be designated. An area of sedimentary rocks on the shore of Tolo Harbour contains a rich deposit of fossil ammonites and is another SSSI. The most well known SSSI is the Mai Po Marshes, where the unique habitats composed of mangroves, *gei wai,* and reedbeds constitute an internationally important wetland supporting hundreds of species of wildlife.

WHY SHOULD A SSSI BE DESIGNATED?

Unique wildlife and habitats cannot speak up for their survival. Unless the important sites are identified and designated through a conservation measure, Government or private sector developments could destroy these important habitats and their wildlife without us even being aware of it. This is a serious problem especially in Hong Kong where the large population, small land area and fast economic growth results in a great demand for land for development.

Once an area is designated as a SSSI, attention can be drawn to its existence. The aim of a SSSI designation is to ensure that full account is taken when development or change in the land use is proposed.

THE CURRENT SSSI SYSTEM IN HONG KONG

Currently, there are 51 SSSI's in Hong Kong (Fig. 1). However, not all the SSSI's receive legal protection. Control on development in SSSIs is only imposed in those SSSIs, which are covered by the Town Planning Ordinance (See WWF HK Factsheet No. 4). For the rest of the SSSI's, only administrative procedures are available to safeguard their interests.

The register of SSSIs is held by the Agricultural, Fisheries and Conservation Department. Individuals or parties can make proposals, with reasons, to the department to suggest that a site be designated. Each proposal is reviewed according to a set of general guidelines to assess whether a site should be designated. Consultation with different Governmental Departments or even local residents is also carried out. If a SSSI proposal is adopted, a map with the SSSI marked and a brief outlining its justifications will be produced. If the SSSI also falls within an area with planning control, the SSSI would also be zoned on the relevant statutory planning plan.

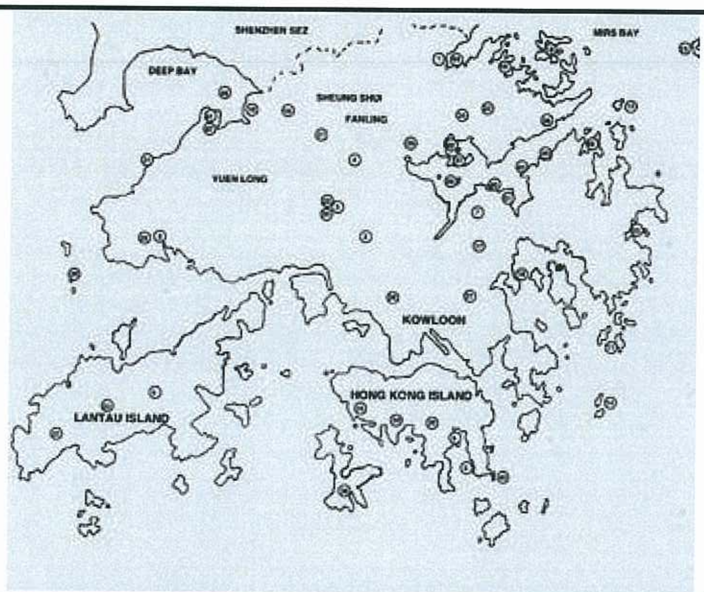
THE INADEQUACIES OF THE SSSI SYSTEM AND THREATS

To date, no comprehensive guidelines are available to assess whether a SSSI merits designation. Also, designated SSSIs are not regularly monitored to detect if there is any change in their characteristics or threat to them. Actions to manage or protect SSSIs are lacking, and there is no indication on the ground of the boundaries of any SSSIs.

Continual urban expansion and development are the most obvious threats to the SSSIs. In many of the cases SSSIs are not threatened from development within them, but by developments around them. There are many examples where unauthorised developments have been completed in the vicinity of a SSSI without any prior notice of the project. Also, economic growth always plays a key factor when a development near a SSSI is planned, thus adequate mitigation measures may not be implemented.

In summary, existing legal protection of SSSIs is inadequate, and our knowledge of the flora and fauna of the Hong Kong SAR is fragmentary, thus making it difficult to identify sites of importance.

Figure 1. Map showing the locations of the Sites of Special Scientific Interest in Hon Kong



Sites of Special Scientific Interest

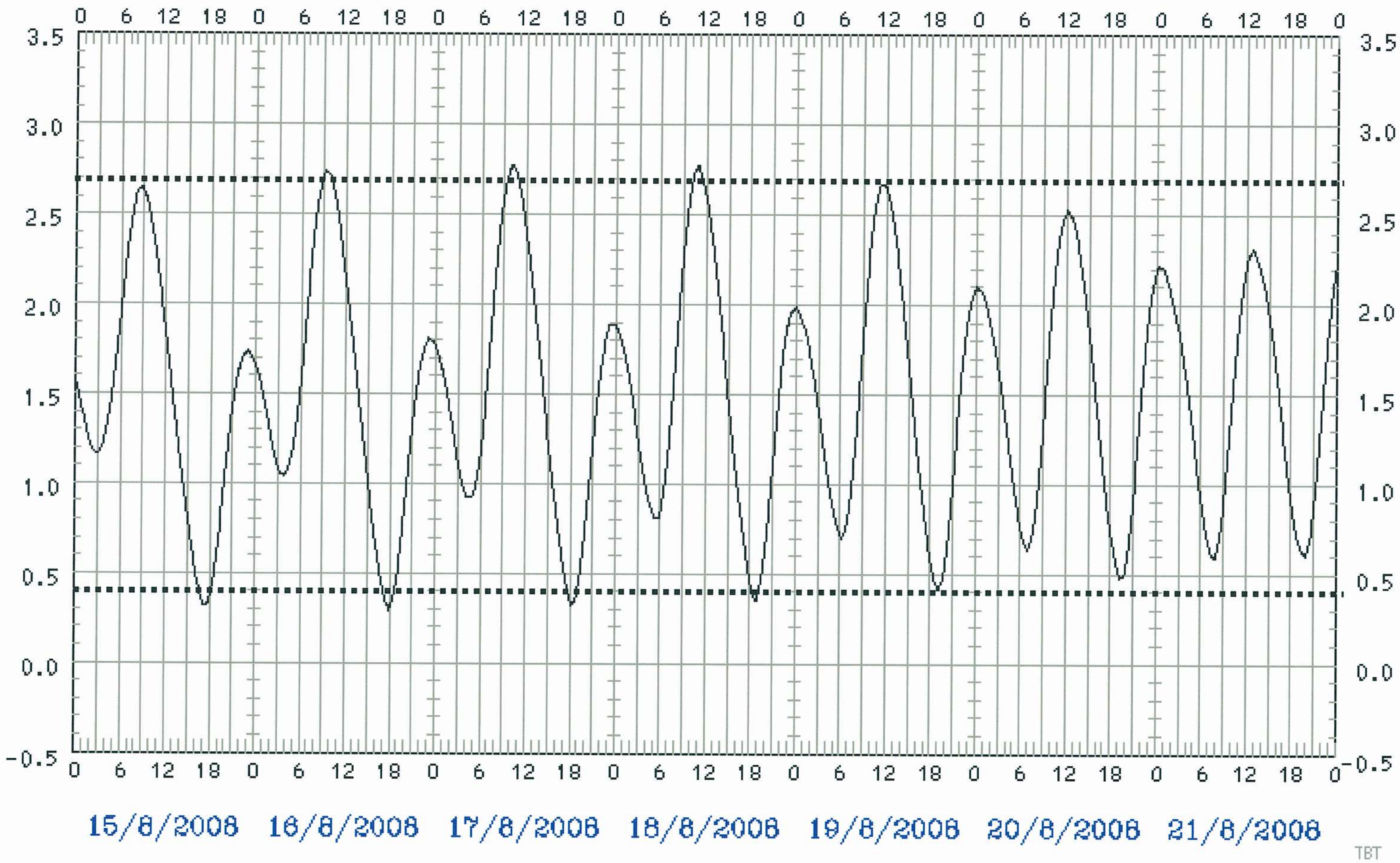
No.	Location	Date of Approval of SSSI
1	YIM TSO HA EGRETRY	25/2/1975
2	SHING MUN FUNG SHUI WOODLAND	25/2/1975
3	TAI MO SHAN MONTANE SCRUB FOREST	15/9/1975
4	SHE SHAN FUNG SHUI WOODLAND	15/9/1975
5	TAI TAM HARBOUR (INNER BAY)	24/10/1975
6	D'AGUILAR PENINSULA	24/10/1975
7	MA ON SHAN	23/6/1976
8	TSING SHAN TSUEN	23/6/1976
9	SUNSET PEAK	23/6/1976
10	MAI PO MARSHES	15/9/1976
11	BLUFF ISLAND & BASALT ISLAND	16/2/1979
12	PORT ISLAND	16/2/1979
13	KAT O CHAU	16/2/1979
14	NINEPIN GROUP	16/2/1979
15	PING CHAU	16/2/1979
16	MAI PO VILLAGE	16/2/1979
17	MAU PING	16/2/1979
18	PAK SHA WAN PENINSULA	16/2/1979
19	LAI CHI WO BEACH	16/2/1979

World Wide Fund For Nature Hong Kong
世界自然(香港)基金會

20	NG TUNG CHAI	16/2/1979
21	PAK TAI TO YAN	20/9/1979
22	CHIU KENG TAM	20/9/1979
23	TAI LONG WAN	20/9/1979
24	POK FU LAM RESERVOIR CATCHMENT AREA	20/9/1979
25	TAI TAM RESERVIOR CATCHMENT AREA	20/9/1979
26	BEACON HILL	20/9/1979
27	HO CHUNG VALLEY	20/9/1979
28	LUNG KWU CHAU, TREE ISLAND & SHA CHAU	20/9/1979
29	CASTLE PEAK	5/2/80
30	TAI MO SHAN	5/2/1980
31	PAK NAI	5/2/1980
32	MAN CHEUNG PO	5/2/1980
33	LANTAU PEAK	5/2/1980
34	PAT SIN RANGE	5/2/1980
35	FUNG YUEN VALLEY	5/2/1980
36	SOUTH LAMMA ISLAND	5/2/1980
37	YIM TIN TSAI & MA SHI CHAU	24/9/1982
38	TOLO CHANNEL (NORTHERN COAST)	24/9/1982
39	CENTRE ISLAND	24/9/1982
40	NAI CHUNG COAST	24/9/1982
41	TSIM BEI TSUI	10/1/1985
42	TING KOK	1/3/1985
43	SHAM CHUNG COAST	25/3/1985
44	A CHAU	9/4/1985
45	LAI CHI CHONG	25/4/1985
46	INNER DEEP BAY	18/3/1986
47	TSIM BEI TSUI EGRETRY	5/1/1989
48	HOI HA WAN (TEMP.)	5/1/1989
49	HOK TSUI (CAPE D'AGUILAR)	19/7/1990
50	NAM FUNG ROAD WOODLAND	22/6/1993
51	KEI LING HA MANGAL	3/6/1994

Appendix C

Tidal Information from HKO and Field Monitoring Data



地鐵公司 MTR Corporation	**Arup Atkins**	**Express Rail Link**	Title: Predicted Tidal level at Tsim Bei Tsui from Hong Kong Observatory

Scale: As Shown	Date: 08/2008	Figure No. Appendix C

Water Monitoring at observation boreholes, 2108/XRL/D254, 2108/XRL/D257 and 2108/XRL/D258 on 19/08/08

Time	2108/XRL/ 0254(P) (+4.18 mPD)	2108/XRL/ 0254(S) (+4.18 mPD)	2108/XRL/ 0257 (+4.18mPD)	2108/XRL/ 0258(P) (+3.97mPD)	2108/XRL/ 0258(S) (+3.97mPD)	2108/XRL/ ERL-18(P) (+4.03mPD)	2108/XRL/ ERL-18(S) (+4.03mPD)	2108/XRL/ E256(P) (+4.68mPD)	2108/XRL/ E256(S) (+4.68mPD)
Instrument	Piezometer	Standpipe	Standpipe	Piezometer	Standpipe	Piezometer	Standpipe	Piezometer	Standpipe
Datum Level mPD	4.18	4.18	4.18	3.97	3.97	4.03	4.03	4.68	4.68
9:20	3.175	3.405	3	3.06	2.88	3.03	2.81	3.25	3.17
10:20	3.175	3.405	2.995	3.06	2.87	-	-	-	-
11:20	3.17	3.4	2.99	3.06	2.85	-	-	-	-
12:20	3.17	3.39	2.988	3.055	2.87	-	-	-	-
13:20	3.175	3.385	2.985	3.055	2.865	-	-	-	-
14:20	3.175	3.387	2.987	3.055	2.855	-	-	-	-
15:20	3.175	3.385	2.98	3.05	2.85	-	-	-	-
16:20	3.175	3.385	2.983	3.055	2.853	-	-	-	-
17:20	3.165	3.375	2.975	3.05	2.848	-	-	-	-
18:20	3.175	3.38	2.975	3.055	2.848	-	-	-	-
Max Difference (m)	0.01	0.03	0.025	0.01	0.032	-	-	-	-

Appendix D

Permeability Test Records from GIU and MTR Contract NEX2108

The Result Records for Falling and Constant Head Permeability Tests

Borehole	Easting	Northing	Type of Tests	Datum	Permeability (m/s)	Test Zone Top Depth (m)		Test Zone Base Depth (m)	Materials	Material Class	Material Type
11997/BH18	832287.00	823544.00	constant head	226.20	7.66E-05	3	to	4	CD Granite	Grade V	Granitic
11997/BH18	832287.00	823544.00	constant head	226.20	3.63E-05	5	to	6	CD Granite	Grade V	Granitic
12565/BH8	832505.46	825909.17	constant head	75.36	9.74E-03	2	to	3	CDG (Sandy SILT)	Grade V	Granitic
13528/BH118	832296.14	823884.47	constant head	216.51	9.94E-07	10.5	to	12	HDG (Silty SAND)	Grade IV	Granitic
13528/BH118	832296.14	823884.47	falling head	216.51	1.41E-07	10.5	to	12	HDG (Silty SAND)	Grade IV	Granitic
13528/BH118	832296.14	823884.47	constant head	216.51	3.79E-07	4.5	to	6	C/HDG (Silty fine SAND)	Grade IV/V	Granitic
13528/BH118	832296.14	823884.47	falling head	216.51	1.09E-07	4.5	to	6	C/HDG (Silty fine SAND)	Grade IV/V	Granitic
13528/BH119	832308.30	823924.99	constant head	230.45	4.72E-07	15.01	to	28.14	HDG (Sandy SILT with gravels)	Grade IV	Granitic
13528/BH119	832308.30	823924.99	falling head	230.45	9.93E-08	15.01	to	28.14	HDG (Sandy SILT with gravels)	Grade IV	Granitic
13528/BH119	832308.30	823924.99	constant head	230.45	5.00E-05	0	to	15	C/HDG (Clayey Silt with gravels)	Grade IV/V	Granitic
13528/BH119	832308.30	823924.99	falling head	230.45	1.24E-05	0	to	15	C/HDG (Clayey Silt with gravels)	Grade IV/V	Granitic
13976/B3A	832826.67	826804.69	falling head	193.42	3.94E-06	9	to	9.5	CDG (Silty SAND)	Grade V	Granitic
16180/UKA9	833057.78	822190.03	falling head	6.89	3.02E-07		to	13.2	CDG (slightly silty gravelly SAND)	Grade V	Granitic
16180/UKE7	834775.95	821605.79	falling head	8.47	1.74E-07		to	32.3	HDG (slightly silty gravelly SAND)	Grade IV	Granitic
16180/UKF16	834981.95	821243.39	falling head	5.26	1.10E-06	19	to	20.5	S/HDG (coarse grained, with narrow stained joint)	Grade II/IV	Granitic
16180/UKF16	834981.95	821243.39	falling head	5.26	2.14E-07		to	16.8	CDG (clayey SAND)	Grade V	Granitic
17454/BH4	834826.02	822187.50	falling head	33.33	1.56E-06	19	to	20.5	CDG (silty coarse SAND)	Grade V	Granitic
19508/DH12-A	834906.13	822830.96	falling head	146.25	2.61E-07	21	to	22.5	H/MDG (with gravelly medium to coarse SAND)	Grade IV/III	Granitic
19508/DH15-A	834853.64	822843.12	falling head	133.47	3.74E-07	0.5	to	21	Residual soil (silty medium SAND), CDG (silty fine to coarse SAND), MDG(medium grained Granite)	Grade VI	Granitic
19508/DH15-B	834853.64	822843.12	falling head	133.47	1.25E-06	22	to	23.5	M/SDG with closely to widely spaced planar joints	Grade III/II	Granitic
19508/DH2	834990.97	822932.47	falling head	170.06	7.81E-07	1.5	to	16.5	M/SDG (medium grained, with stepped joints)	Grade II/III	Granitic
19508/DH24-B	835019.66	822762.53	falling head	167.31	2.72E-06	19.8	to	23.43	M/SD medium-grained Granite with medium spaced kaolin, rough planar joints	Grade III/II	Granitic
19508/DH27-A	834976.78	822765.65	falling head	142.27	3.23E-07	0.5	to	24.5	CDG (silty medirum SAND)	Grade V	Granitic
19508/DH27-B	834976.78	822765.65	falling head	142.27	3.43E-07	25.5	to	27	CDG (silty medirum SAND)	Grade V	Granitic
19508/DH36	834769.76	822756.75	falling head	120.77	4.66E-07	1.5	to	16.07	MDG (locally rock of fractured)	Grade III	Granitic

Borehole	Easting	Northing	Type of Tests	Datum	Permeability (m/s)	Test Zone Top Depth (m)		Test Zone Base Depth (m)	Materials	Material Class	Material Type
19508/DH43-A	834904.42	822695.01	falling head	120.49	1.98E-06	0.5	to	6	Residual Soil / MDG (stained joints / rock of fragments)	Grade VI/ Grade III	Granitic
19508/DH43-B	834904.42	822695.01	falling head	120.49	2.57E-06	7	to	8.5	Residual Soil / MDG (stained joints / rock of fragments)	Grade VI/ Grade III	Granitic
19508/DH71	834874.07	822576.79	falling head	89.56	1.68E-06	6.8	to	8.3	H/MDG with rock fragments, MDG (closely spaced, chlorite, kaolin coated, rough planar)	Grade IV/III	Granitic
19508/DH8-A	834873.79	822908.88	falling head	149.10	2.35E-07	0.5	to	18	Residual Soil (clayey silty medium to coarse SAND), CDG (silty medium to coarse SAND)	Grade VI	Granitic
19508/DH8-B	834873.79	822908.88	falling head	149.10	6.06E-07	19	to	20.5	HCG (gravelly silty medium to coarse SAND)	Grade IV	Granitic
19679/DX5	834770.86	822491.56	falling head	106.80	9.84E-08	2	to	3.5	CDG (sity Sand)	Grade V	Granitic
19679/DX5	834770.86	822491.56	falling head	106.80	7.65E-07	5	to	6.5	CDG (sity Sand)	Grade V	Granitic
21273/BH1	834798.86	820336.26	falling head	5.08	3.41E-06	10.96	to	12.26	SDG	Grade II	Granitic
21273/BH10	834845.37	820329.59	falling head	5.52	4.52E-06	12.75	to	14.5	CDG	Grade V	Granitic
21273/BH12	834840.88	820303.33	falling head	5.29	3.43E-06	16.5	to	17.45	CDG	Grade V	Granitic
21273/BH3	834787.39	820309.98	falling head	5.12	3.01E-06	9.54	to	10.84	SDG	Grade II	Granitic
24770/BH1	834814.70	820472.60	falling head	4.51	9.86E-06	2.2	to	7.9	C/MDG wit silty fine-coarse sand / medium-closely spaced joints	Grade V/III	Granitic
24770/BH5	834820.60	820469.30	falling head	4.46	8.36E-06	2.2	to	7.2	M/SDG with medium to closely spaced inclined joints	Grade II/III	Granitic
24770/BH6	834838.40	820471.60	falling head	4.42	3.26E-06	2.2	to	10.23	CDG (silty fine to coarse SAND), H/MDG (corestone), MDG (coarse grained with closely spaced inclined joints	Grade V	Granitic
30128/DH21	834797.34	821719.26	falling head	18.90	2.63E-07	0.5	to	8	CDG(Silty Sand with gravel)	Grade V	Granitic
40267/DH1	839545.00	830438.80	falling head	42.26	1.63E-06	24.2	to	25.5	CDG (silty fine to coarse SAND)	Grade V	Granitic
40267/DH2	839558.65	830443.33	falling head	33.05	9.11E-07	36.2	to	37.5	CDG (silty fine to coarse SAND)	Grade V	Granitic
40267/DH6	839525.69	830481.77	falling head	36.14	8.68E-07	38.6	to	39.9	CDG (silty fine SAND with fine gravel)	Grade V	Granitic
40267/DH8	839608.15	830473.02	falling head	5.87	4.01E-06	23.2	to	24.5	CDG (silty fine SAND with fine gravel)	Grade V	Granitic
45799/F390/BH1-P	833892.07	825260.64	falling head	266.39	6.94E-05	22.7	to	24	CDG (clayey, silty SAND)	Grade V	Granitic
4929/EF40/1777	833066.52	821673.06	constant head	3.85	6.70E-05	23.54	to	24.54	CDG (clayey, silty SAND)	Grade V	Granitic
4929/EF40/1781	833092.59	821645.00	constant head	3.83	6.90E-05	29.54	to	30.54	CDG (clayey, silty SAND)	Grade V	Granitic
6680/DH32-U	834428.30	824143.70	falling head	164.40	6.41E-09	8.1	to	9.6	CDG (silty,fine SAND)	Grade V	Granitic
6990/EF/1506	834979.24	821107.35	constant head	4.93	2.39E-05	8.13	to	8.84	CDG (Sandy SILT)	Grade V	Granitic
6990/EF/1531	834132.06	821845.21	constant head	4.64	4.98E-05	10	to	11	CDG (Silty Clayey SAND)	Grade V	Granitic

Borehole	Easting	Northing	Type of Tests	Datum	Permeability (m/s)	Test Zone Top Depth (m)		Test Zone Base Depth (m)	Materials	Material Class	Material Type
6990/EF/1532	834106.03	821832.90	constant head	4.69	1.53E-06	24.4	to	25.1	CDG (Sandy Silt with gravels)	Grade V	Granitic
6990/EF40/1506	834979.24	821107.35	constant head	4.93	2.39E-05	8.13	to	8.84	CDG(Sandy Silt with fine gravels)	Grade V	Granitic
6990/EF40/1512	834788.02	821289.57	constant head	4.69	2.35E-05	9.62	to	10.62	CDG (Silty SAND)	Grade V	Granitic
ERL/DH207	834843.68	820596.34	falling head	4.91	3.177E-05	6.5	to	7.8	CDG	Grade V	Granitic
2108/XRL/D021	835025.75	818686.53	constant head	5.23	1.62E-06	24	to	25.5	CD Granite(Silty fine to coarse SAND)	Grade V	Granitic
2108/XRL/D027	834917.55	819112.17	constant head	5.61	3.66E-07	29.5	to	43.52	CD/MD/SD medium grained Granite (V/III/II)	Grade V/III/II	Granitic
2108/XRL/D029	834978.45	819333.25	constant head	5.10	4.16E-07	27.5	to	29	CD Granite (Sandy silt)	Grade V	Granitic
2108/XRL/D031	834965.45	819456.84	constant head	4.57	7.01E-07	35.5	to	37	CD Granite (fine to coarse SAND)	Grade V	Granitic
2108/XRL/D032	834951.88	819592.19	constant head	4.41	3.85E-06	36.00	to	37.50	CD Granite (sandy Silt with gravel)	Grade V	Granitic
2108/XRL/D033	834919.40	819659.41	constant head	4.81	4.40E-07	37.5	to	39	CD Granite (silty fine to coarse SAND)	Grade V	Granitic
2108/XRL/D034	834926.69	819722.59	constant head	5.02	2.24E-07	38.5	to	40	CD Granite (silty fine to coarse SAND)	Grade V	Granitic
2108/XRL/D036	834908.62	819700.91	constant head	5.12	2.31E-06	39	to	40.5	CD Granite (silty fine to coarse Sand)	Grade V	Granitic
2108/XRL/D037	834933.54	819604.52	constant head	4.41	3.64E-06	39.5	to	41	CD Granite (silty fine to coarse Sand)	Grade V	Granitic
2108/XRL/D057	834830.18	820869.79	constant head	4.37	1.13E-05	18	to	19.5	CD Granite (silty fine to coarse Sand with gravel)	Grade V	Granitic
2108/XRL/D067	834829.34	821496.63	falling head	6.06	9.11E-07	12.5	to	14	CD Granite (silty fine to coarse Sand with gravel)	Grade V	Granitic
2108/XRL/D067	834829.34	821496.63	falling head	6.06	9.18E-07	12.5	to	14	CD Granite (silty fine to coarse Sand with gravel)	Grade V	Granitic
2108/XRL/D070	834858.25	821577.73	constant head	10.43	2.40E-06	21.5	to	23	CD Granite (very stiff sandy SILT, silty fine to corase SAND)	Grade V	Granitic
2108/XRL/D178	828129.85	832792.68	constant head	34.23	9.55E-07	19.4	to	20.9	CD Granodiorite (very stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D180	828083.84	832808.07	constant head	33.84	1.02E-06	20.8	to	22.3	CD Granodiorite (very stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D280	834405.61	820520.70	constant head	6.82	1.40E-06	22.5	to	24	CDG (very stiff, sandy SILT; silty fine to coarse SAND)	Grade V	Granitic
2108/XRL/D281	834406.74	820564.75	constant head	7.13	4.02E-07	17.5	to	19	CD Granite (very stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D283	834247.33	820652.79	constant head	4.87	3.66E-07	25.5	to	27	CD Granite (very stiff sandy SILT)	Grade V	Granitic
2108/XRL/D296	833223.62	821496.76	constant head	6.25	1.73E-06	34.5	to	36	CD Granite (silty fine to coarse SAND)	Grade V	Granitic
2108/XRL/D300	833000.66	821755.97	falling head	4.57	6.47E-07	32.3	to	33.8	CD Granite (silty fine to coarse Sand with gravel)	Grade V	Granitic
2108/XRL/D300	833000.66	821755.97	falling head	4.57	6.63E-07	32.3	to	33.8	CD Granite (silty fine to coarse Sand with gravel)	Grade V	Granitic
2108/XRL/D401	827328.42	832885.59	constant head	21.71	1.16E-08	9.5	to	11	CD Granodiorite (very stiff, sandy SILT)	Grade V	Granitic

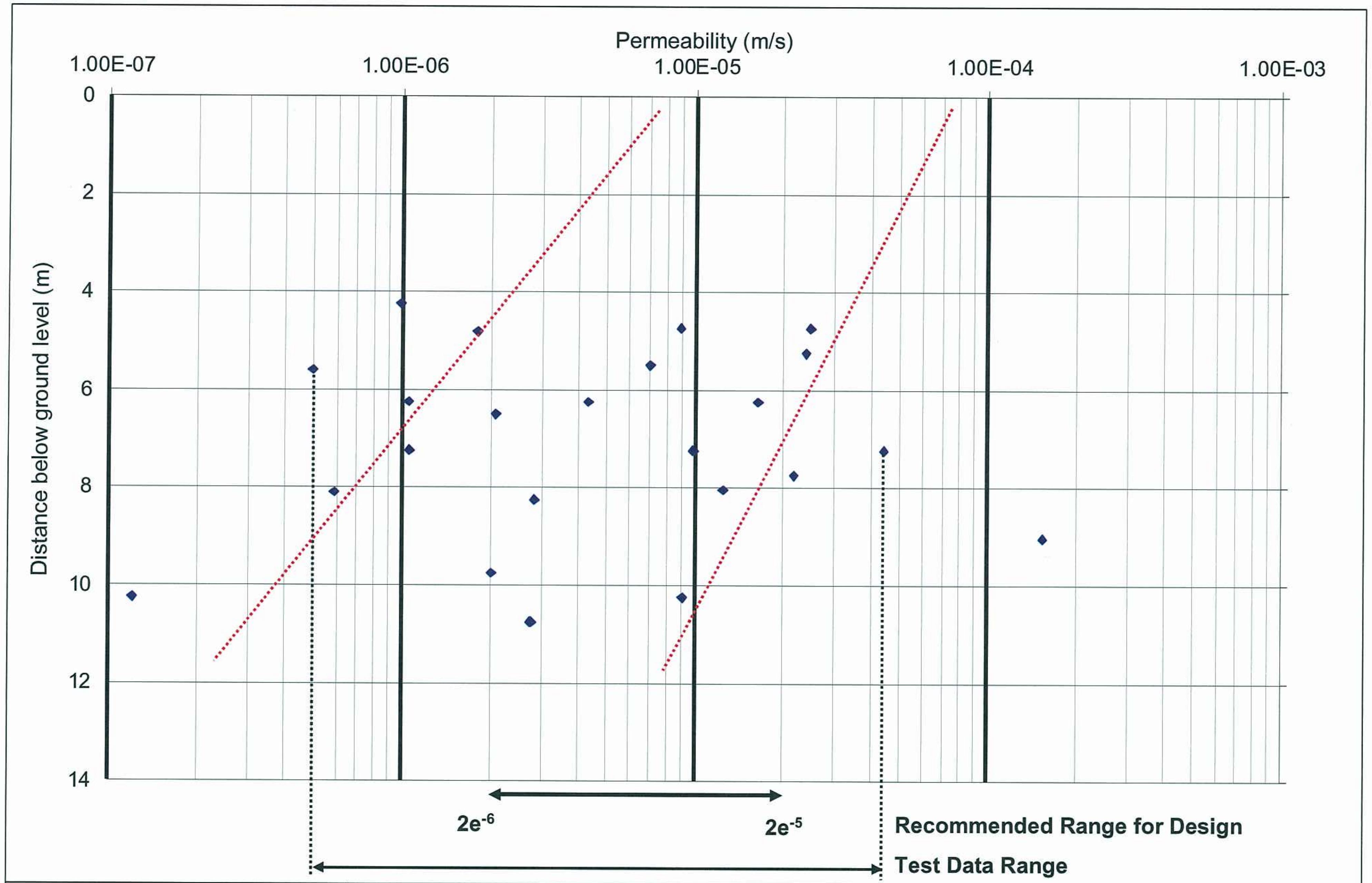
Borehole	Easting	Northing	Type of Tests	Datum	Permeability (m/s)	Test Zone Top Depth (m)		Test Zone Base Depth (m)	Materials	Material Class	Material Type
2108/XRL/D409	827083.61	833183.33	constant head	16.93	2.41E-07	9.5	to	11	CD Granodiorite (very stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D411	827157.58	833234.80	constant head	17.56	7.26E-08	6	to	7.5	CD Granodiorite (very stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D413	827047.48	833273.77	constant head	17.78	1.88E-08	11	to	12.5	CD Granodiorite (stiff, slightly sandy SILT)	Grade V	Granitic
2108/XRL/D414	827014.86	833252.51	constant head	16.35	4.24E-07	14	to	15.5	CD Granodiorite (very stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D426	826689.38	833695.95	constant head	10.71	5.68E-07	8.2	to	9.7	CD Granodiorite (very stiff, slightly sandy SILT)	Grade V	Granitic
2108/XRL/D427	826597.95	833872.96	constant head	10.68	2.90E-05	9	to	10.5	CD Granodiorite (stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D427	826597.95	833872.96	constant head	10.68	1.56E-05	14.5	to	16	CD Granodiorite (stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D428	826564.91	833974.09	constant head	12.63	3.83E-07	12.3	to	13.8	CD Granodiorite (stiff, sandy SILT)	Grade V	Granitic
2108/XRL/D436	826203.63	834470.04	constant head	19.31	7.73E-06	6.5	to	8	HD Granodiorite (quartz vein)	Grade VI	Granitic

The Result Records for Packer Tests

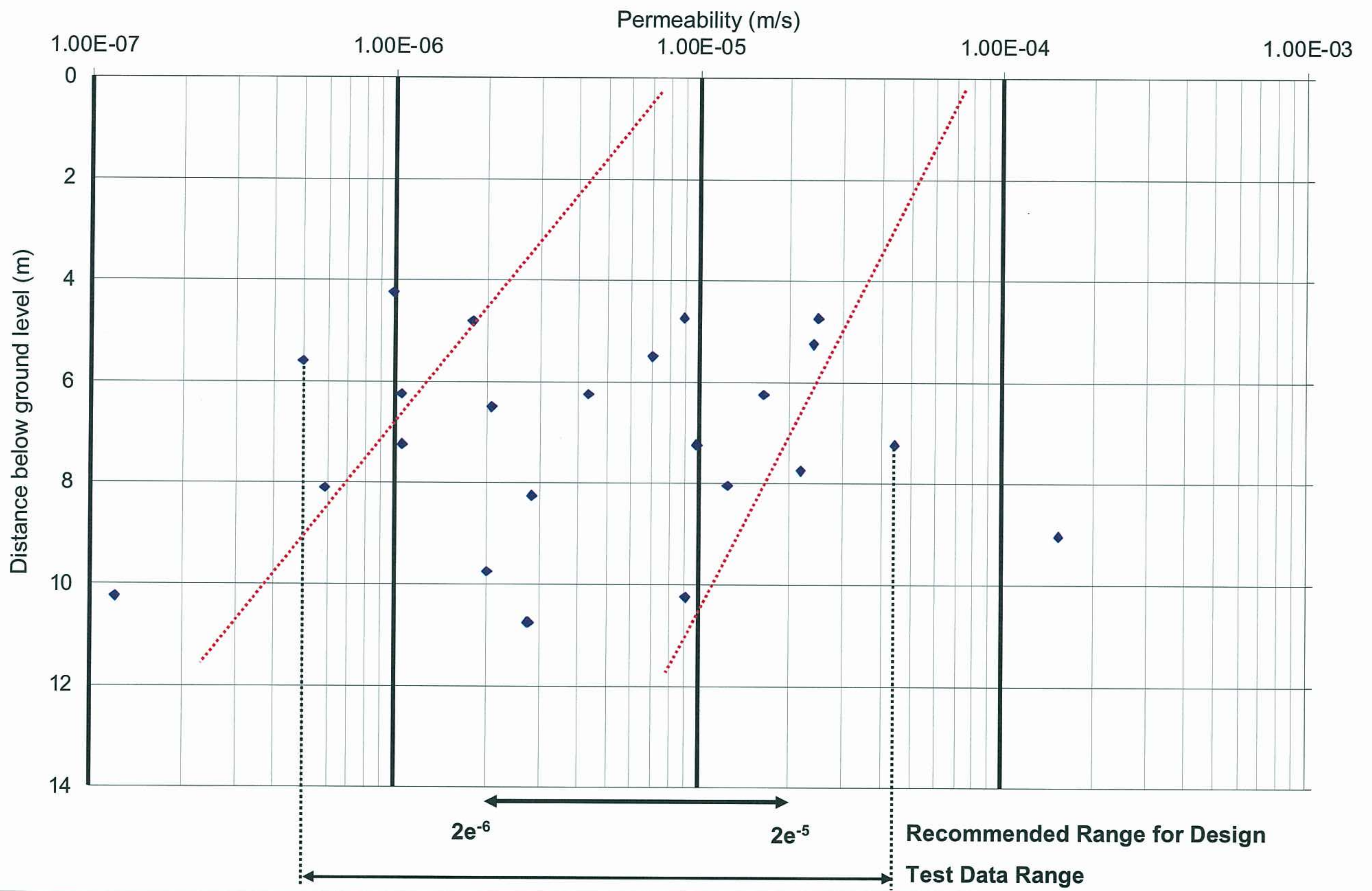
Borehole	Easting	Northing	Rock Type	Permeability (Lugeon)	Permeability K in (m/s)	Datum	Test Zone Top depth(m)		Test Zone Base depth(m)	Rock head mPD
3171/ST6	832738.9	826478.8	Granite (II)	0.42	4.20E-08	158.50	22	to	27	157.1
3171/ST6	832738.9	826478.8	Granite (II)	2.6	2.60E-07	158.50	16	to	21	157.1
3171/ST6	832738.9	826478.8	Granite (II)	3.3	3.30E-07	158.50	10	to	15	157.1
3171/ST7	832807.1	826518.3	Granite (II)	9.1	9.10E-07	174.90	29.7	to	34.8	157.1
3171/ST7	832807.1	826518.3	Granite (II)	3	3.00E-07	174.90	22	to	27	157.1
3183/F1	827570.11	839086.58	Volcanic (III)	1.55	1.55E-07	50.04	30.5	to	34.17	33.84
3183/G1	826977.4	837298.45	Volcanic (III)	2.875	2.88E-07	93.87	43.5	to	47	50.57
5859/101	832746.6	826519.3	SDG (II)	1.5	1.50E-07	174.00	22.3	to	30.46	161.8
5859/101	832746.6	826519.3	SDG (II)	0.03	3.00E-09	174.00	30.3	to	37.06	161.8
5859/101	832746.6	826519.3	SDG (II)	0.066	6.60E-09	174.00	36.5	to	43.16	161.8
5859/101	832746.6	826519.3	SDG (II)	3.63	3.63E-07	174.00	42	to	48.72	161.8
5859/101	832746.6	826519.3	SDG (II)	0.82	8.20E-08	174.00	49	to	51.1	161.8
5859/103	832807.7	826492.6	MDG/SDG (II/III)	2.36	2.36E-07	166.40	20.7	to	26.15	161.85
5859/103	832807.7	826492.6	MDG/SDG (II/III)	2.75	2.75E-07	166.40	27.02	to	32.28	161.85
5859/104	832867.7	826472.6	MDG/SDG (II/III)	1.18	1.18E-07	190.06	42	to	48.16	171.56
5859/104	832867.7	826472.6	S/FDG (II/I)	2.11	2.11E-07	190.06	48	to	54.16	171.56
5859/104	832867.7	826472.6	FDG(I)	5.76	5.76E-07	190.06	54	to	59.25	171.56
5859/104	832867.7	826472.6	S/FDG (II/I)	3.59	3.59E-07	190.06	61.1	to	66.35	171.56
5859/104	832867.7	826472.6	FDG(I)	0.83	8.30E-08	190.06	67.2	to	72.2	171.56
5859/106	832935	826458	SDG (II)	4.43	4.43E-07	205.70	63.85	to	67.6	192
5859/106	832935	826458	SDG (II)	0.97	9.70E-08	205.70	68.6	to	73.94	192
5859/106	832935	826458	SDG (II)	0.32	3.20E-08	205.70	74.85	to	80.7	192
5859/106	832935	826458	SDG (II)	0.2	2.00E-08	205.70	81.4	to	88.2	192
5859/106	832935	826458	SDG (II)	0.15	1.50E-08	205.70	89.2	to	93.05	192
5876/107	833252.6	826346.1	SDG (II)	No data	N/A	188.50	50	to	59.75	184.02
5876/107	833252.6	826346.1	SDG (II)	0.59	5.90E-08	188.50	60	to	80.7	184.02
5876/107	833252.6	826346.1	SDG (II)	1.72	1.72E-07	188.50	70	to	80.7	184.02
5957/BH5	832220	826680	Granodiorite	0.383	3.83E-08	83.14	2.47	to	6.91	82.34
6439/303	832934.76	826458.23	SDG (II)	0.22	2.20E-08	206.25	116	to	132	190.06
6439/303	832934.76	826458.23	MDG/SDG (II/III)	0.34	3.40E-08	206.25	100	to	116	190.06
6981/G1	826977.4	837298.45	MD/SD Pyroclastic (II/III)	2.857	2.86E-07	93.87	43.5	to	47	50.57

Borehole	Easting	Northing	Rock Type	Permeability (Lugeon)	Permeability K in (m/s)	Datum	Test Zone Top depth(m)		Test Zone Base depth(m)	Rock head mPD
6981/M1	826369.96	830818.42	MD/SD Pyroclastic (II/III)	No data	N/A	88.87	33	to	41.93	54.616
9486/H1	855756.4	824507.2	MD Volcanic (III)	25.4	2.54E-06	65.20	9	to	10.5	58.3
9486/H1	855756.4	824507.2	MD/SD Volcanic (III/II)	26.82	2.68E-06	65.20	14.5	to	16	58.3
9486/H1	855756.4	824507.2	SD Volcanic (II)	20.81	2.08E-06	65.20	19.3	to	20.8	58.3
9486/H2	855737.2	824512.3	Volcanic (III/II)	33.33	3.33E-06	65.20	19.5	to	21	52.7
9486/H2	855737.2	824512.3	Volcanic (III/II)	52.6	5.26E-06	65.20	14.5	to	16	52.7
9486/H3	855724.1	824520.7	Volcanic (III/II)	8.33	8.33E-07	65.20	14.37	to	15.87	55.6
9486/H3	855724.1	824520.7	Volcanic (III/II)	39.47	3.95E-06	65.20	19.37	to	20.87	55.6
9486/H4	855709.5	824529.1	Volcanic (III/II)	No data	N/A	65.20	14.1	to	15.6	54.3
12565/BH6	832464.35	825971.03	Granite(II)	No data	N/A	63.65	4.3	to	8.3	60.95
12565/BH8	832505.46	825909.17	Granite(II/III)	19.4	1.94E-06	75.36	6.15	to	11.15	72.05
13976/B1	832837.57	826820.48	Granodiorite (II/III)	13.71	1.37E-06	193.33	16	to	17.92	177.31
13976/B1	832837.57	826820.48	Granodiorite (II/III)	0.91	9.10E-08	193.33	17.8	to	20.01	177.31
13976/B3A	832826.67	826804.69	Altered Granite (III)			193.42	2.35	to	2.95	174.72
13976/B3A	832826.67	826804.69	Altered Granite (III)	0.045	4.50E-09	193.42	15.95	to	16.9	174.72
21591/DH205	833009.26	825636.66	Granite (II)	0.18	1.80E-08	147.73	60	to	70.16	145.13
21591/DH205	833009.26	825636.66	Granite (II/III)	0.23	2.30E-08	147.73	50	to	60	145.13
21591/DH205	833009.26	825636.66	Granite (II/III)	0.27	2.70E-08	147.73	40	to	50	145.13
21591/DH205	833009.26	825636.66	Granite (II/III)	0.08	8.00E-09	147.73	30	to	40	145.13
21591/DH205	833009.26	825636.66	Granite (II)	0.02	2.00E-09	147.73	20	to	30	145.13
21591/DH205	833009.26	825636.66	Granite (II)	0.03	3.00E-09	147.73	10	to	20	145.13
21591/DH206	832766.33	826526.45	Granite (II/III)	0.7	7.00E-08	175.57	88.5	to	100.05	157.84
21591/DH206	832766.33	826526.45	Granite (II/III)	0.94	9.40E-08	175.57	77.5	to	87.5	157.84
21591/DH206	832766.33	826526.45	Granite (II/III)	0.84	8.40E-08	175.57	62.5	to	77.5	157.84
21591/DH206	832766.33	826526.45	Granite (II/III)	0.62	6.20E-08	175.57	55	to	61.5	157.84
21591/DH207	832684.36	826398.96	Granite (II/III)	9.09	9.09E-07	173.35	110	to	120.45	147.7
21591/DH207	832684.36	826398.96	Granite (II/III)	11.79	1.18E-06	173.35	105	to	115	147.7
21591/DH207	832684.36	826398.96	Granite (II/III)	7.25	7.25E-07	173.35	95	to	105	147.7
21591/DH207	832684.36	826398.96	Granite (II/III)	10.01	1.00E-06	173.35	85	to	95	147.7
21591/DH207	832684.36	826398.96	Granite (II/III)	6.98	6.98E-07	173.35	75	to	85	147.7
21591/DH208	832435.97	826970.17	SD Granodiorite	0.07	7.00E-09	137.54	34	to	44	133.44
21591/DH208	832435.97	826970.17	SD Granodiorite	0.05	5.00E-09	137.54	24	to	34	133.44
21591/DH208	832435.97	826970.17	SD Granodiorite	0.1	1.00E-08	137.54	8	to	18	133.44

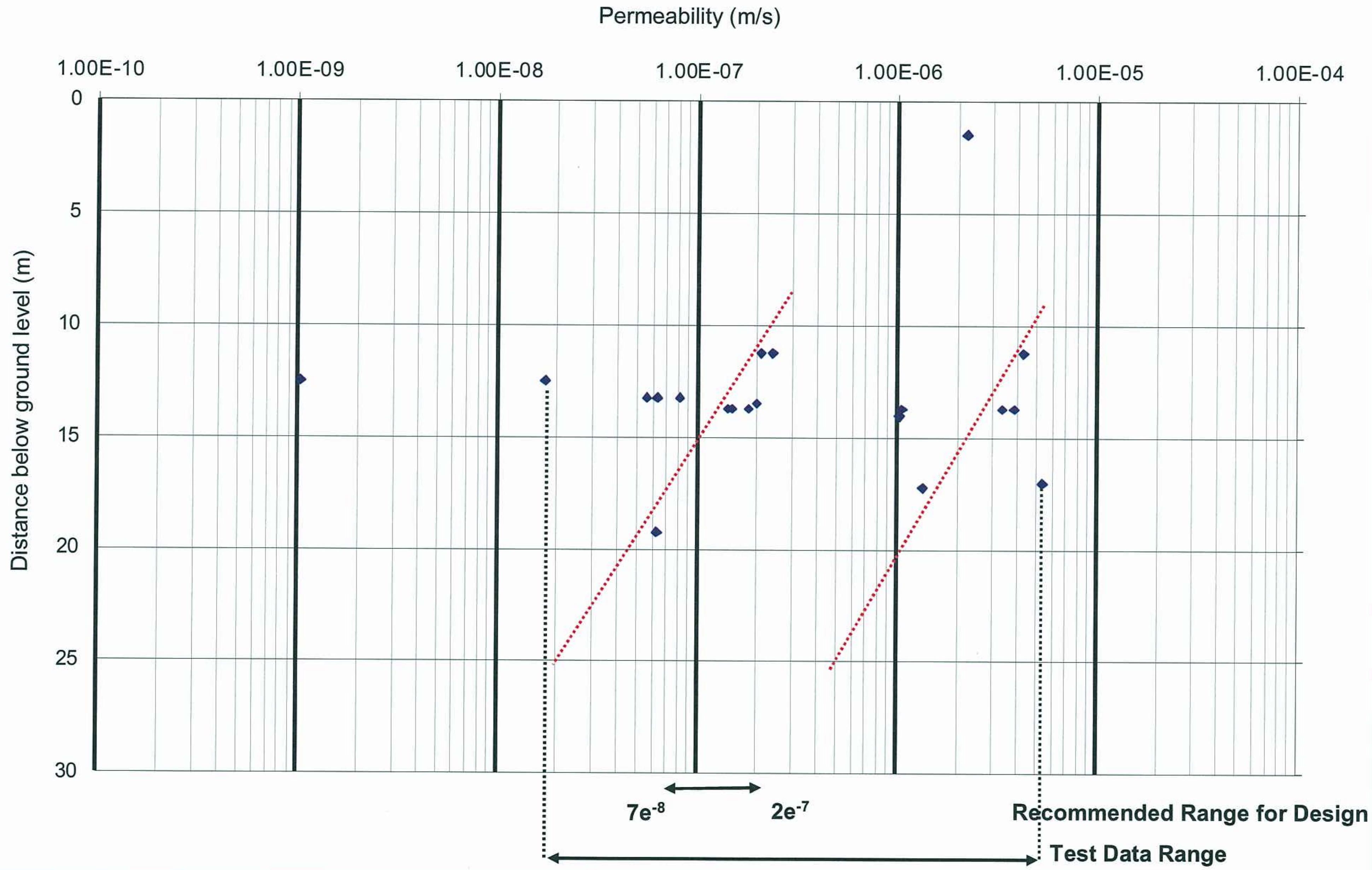
Borehole	Easting	Northing	Rock Type	Permeability (Lugeon)	Permeability K in (m/s)	Datum	Test Zone Top depth(m)		Test Zone Base depth(m)	Rock head mPD
ERL/DH001A	825081.91	837079.43	MD Coarse Ash Tuff Grade III	11.97	1.20E-06	15.15	84	to	85.8	-67.83
ERL/DH211	832208.18	826741.23	SD Granodiorite Grade II	0.28	2.80E-08	88.47	117.5	to	123	88.17
ERL/EDH002A	824120.1	837959.15	SD Coarse Ash Tuff Grade II	Failed	N/A	8.14	70.5	to	73.5	53.48
ERL/IDH214A	824120.1	837959.15	Granite Grade III/IV/V	7.33	7.33E-07	8.14	53	to	62.37	-45.34
NOL/DH035	824888.16	838124.66	M/SD Coarse Ash Tuff Grade III/II	0.94	9.40E-08	65.17	37	to	41	30.43
NOL/DH036	824997.95	838250.67	Coarse Ash Tuff GradeVI/III/II	0.4	4.00E-08	65.97	46	to	51	23.32
NOL/DH037	825089.68	838300.48	Coarse Ash Tuff Grade III/II	6.22	6.22E-07	39.35	33	to	37	21.8
2108/XRL/D039	835041.78	818035.92	M/SD medium grained Granite	0.16	1.60E-08	4.45	45		46.44	-36.35
2108/XRL/D057	834830.18	820869.79	SD medium grained granite	0.39	3.90E-08	4.37	66.37		69.37	-30.29
2108/XRL/D178	828129.85	832792.68	SD Granodiorite	1.97	1.97E-07	34.23	38.5		41.68	2.51
2108/XRL/D178	828129.85	832792.68	SD Granodiorite	0.24	2.40E-08	34.23	33		37	2.51
2108/XRL/D179	828144.85	832745.86	SD Granodiorite	20.57	2.06E-06	34.61	39.05		42.05	9.01
2108/XRL/D179	828144.85	832745.86	SD Granodiorite	13.59	1.36E-06	34.61	35		38	9.01
2108/XRL/D179	828144.85	832745.86	SD Granodiorite	10.14	1.01E-06	34.61	27.5		30.5	9.01
2108/XRL/D434	826244.07	834443.04	SD coarse ash TUFF	15.86	1.59E-06	20.09	37		42	-0.59
2108/XRL/D434	826244.07	834443.04	SD coarse ash TUFF	2.01	2.01E-07	20.09	42		45.06	-0.59
2108/XRL/D434	826244.07	834443.04	SD coarse ash TUFF	0.91	9.10E-08	20.09	33		37	-0.59
2108/XRL/D434	826244.07	834443.04	SD coarse ash TUFF	0.94	9.40E-08	20.09	29		33	-0.59
2108/XRL/D434	826244.07	834443.04	SD coarse ash TUFF	0.84	8.40E-08	20.09	25		29	-0.59



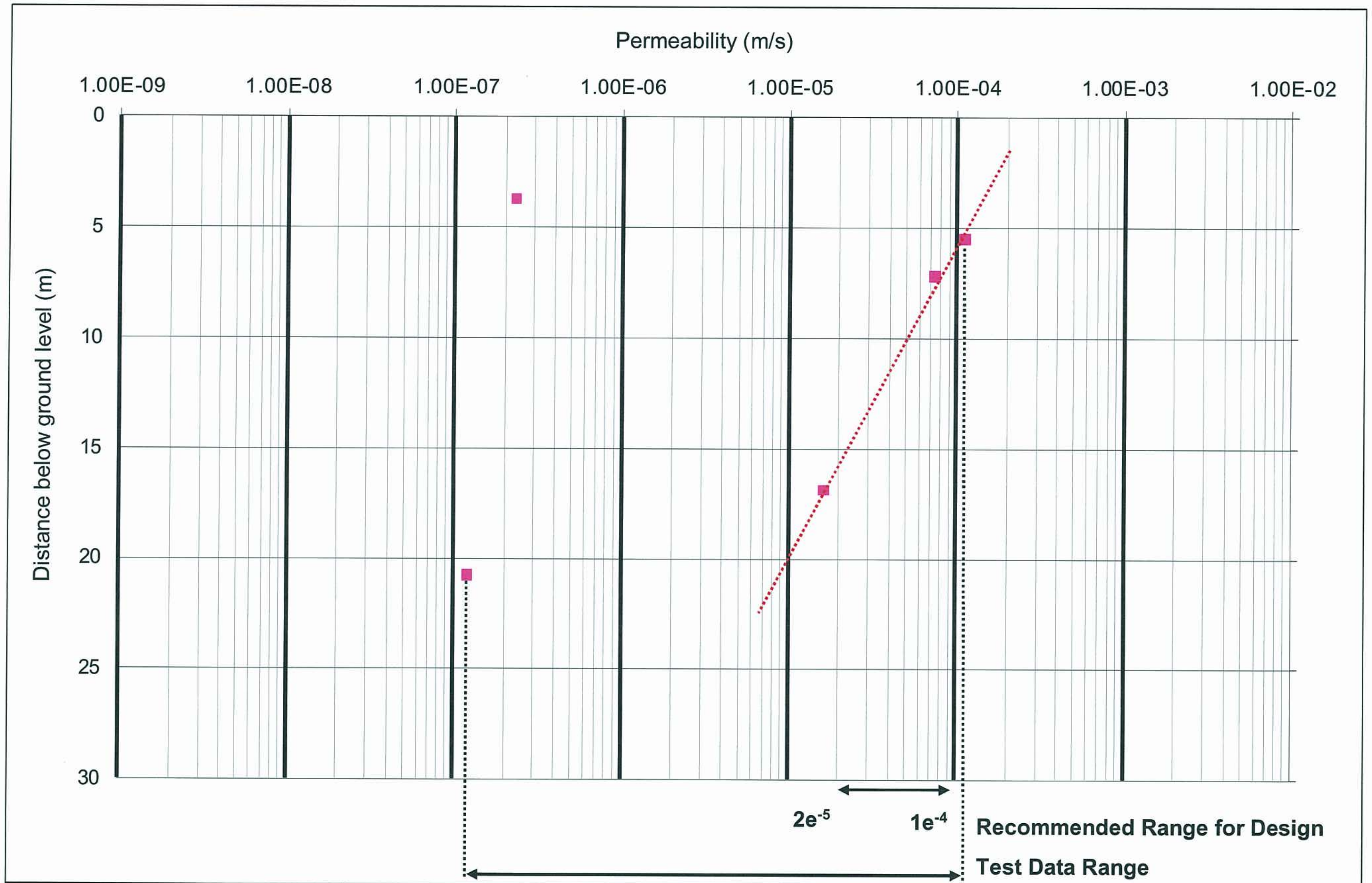
地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Permeability Tests Result - Fill
			Scale: NTS · Date: 11/2008 · Figure No.: 5.3.1



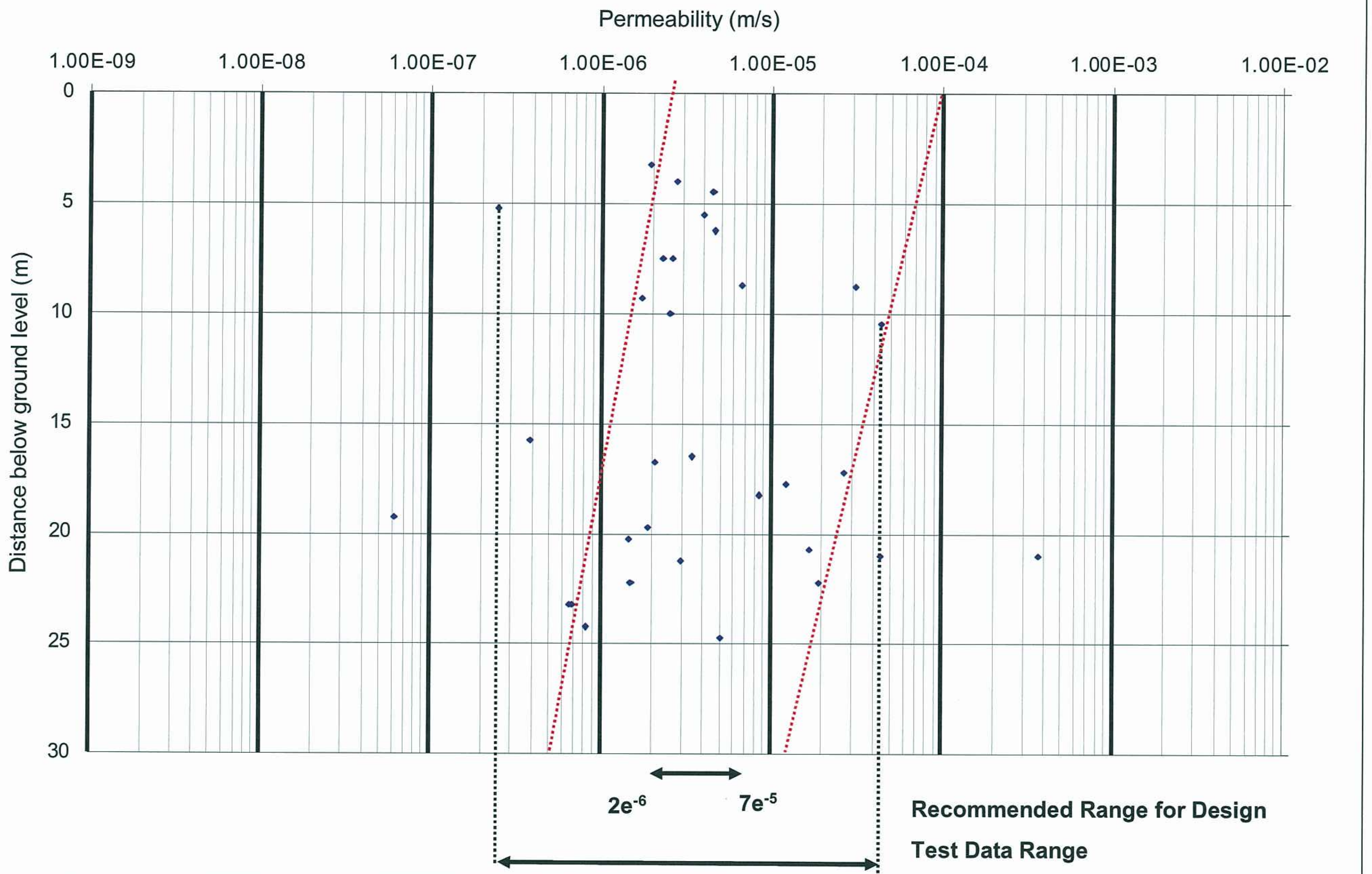
地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Permeability Tests Result - Fill
			Scale: NTS · Date: 11/2008 · Figure No. 5.3.1



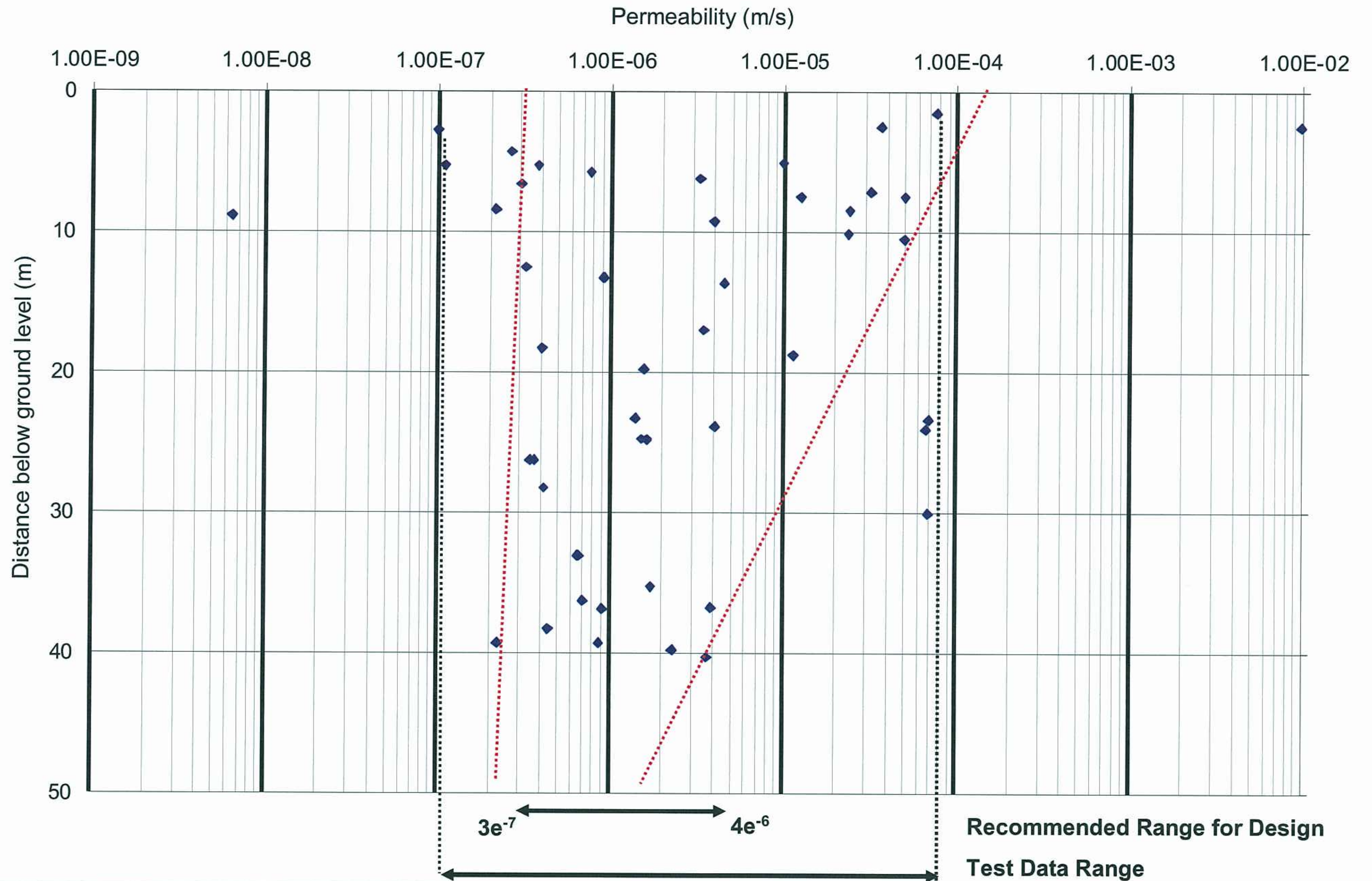
地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Permeability Tests Result – Marine Clay
			Scale: NTS · Date: 11/2008 · Figure No.: 5.3.2



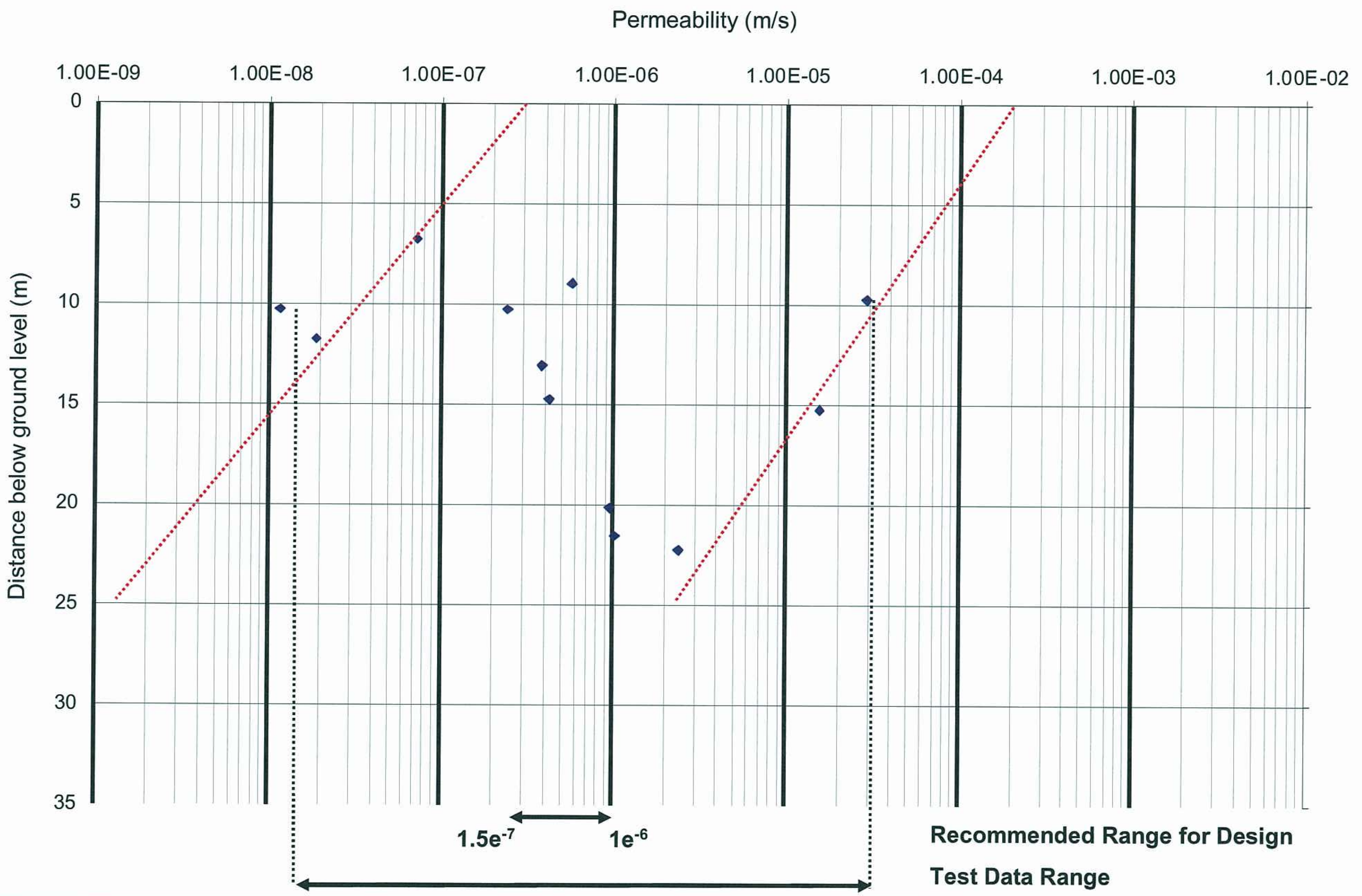
地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Permeability Tests Result – Marine Sand
			Scale: NTS; Date: 11/2008; Figure No. 5.3.3



地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Permeability Tests Result – Alluvium Sand
			Scale: NTS / Date: 11/2008 / Figure No. 5.3.4



地鐵公司 MTR Corporation	**Arup Atkins**	**Express Rail Link**	Title: Permeability Tests Result - CDG
			Scale: NTS · Date: 11/2008 · Figure No. 5.3.5

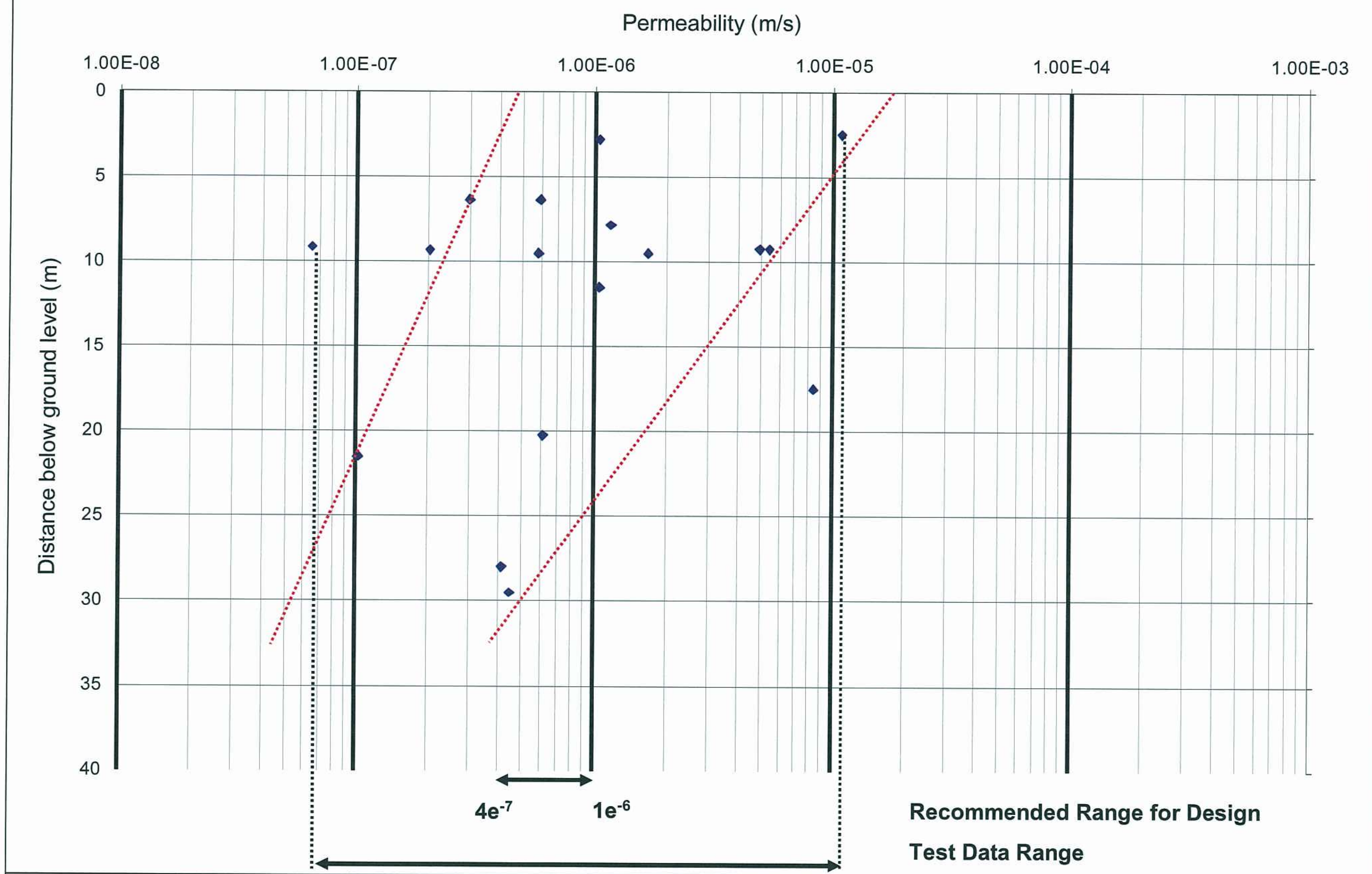


地鐵公司 MTR Corporation

Arup Atkins

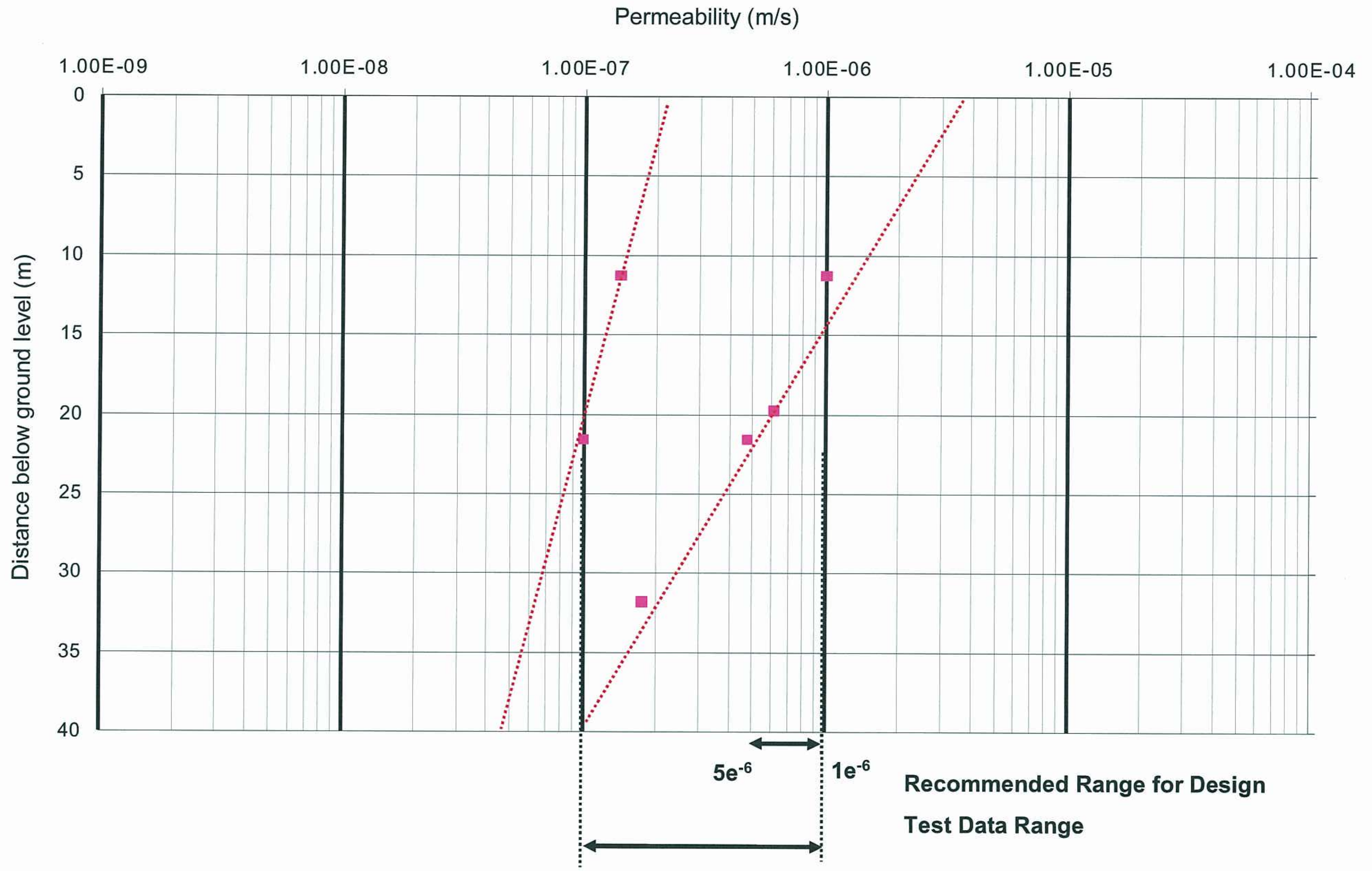
Express Rail Link

Title: Permeability Tests Result - CDGd		
Scale: NTS	Date: 11/2008	Figure No.: 5.3.6

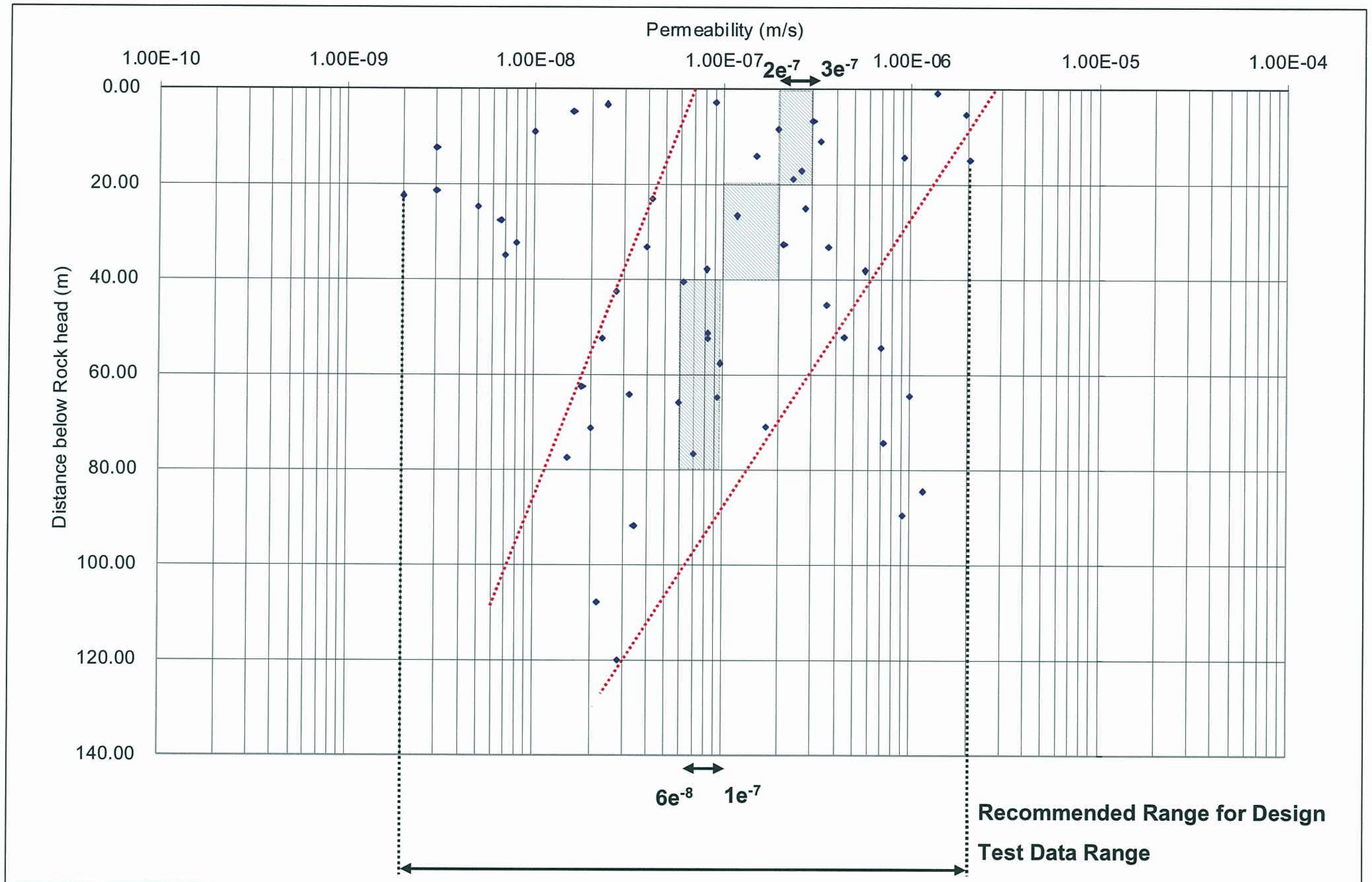


地鐵公司 MTR Corporation | Arup Atkins | Express Rail Link | Title: Permeability Tests Result - CDV

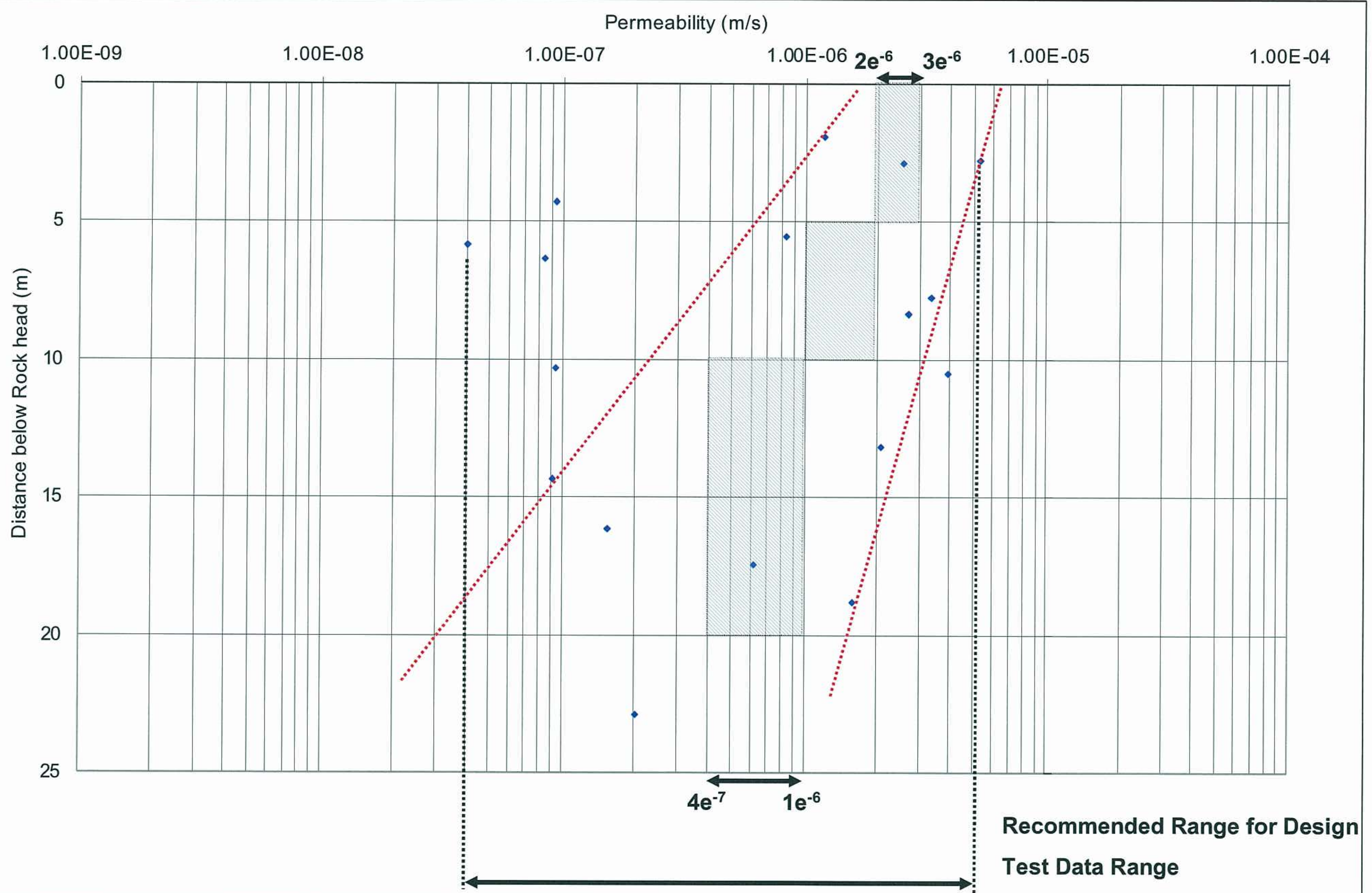
Scale: NTS | Date: 11/2008 | Figure No. 5.3.7



地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Permeability Tests Result - HDG
			Scale: NTS · Date: 11/2008 · Figure No. 5.3.8



地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Packer Tests Result - SDG
			Scale: NTS · Date: 11/2008 · Figure No. 5.3.9



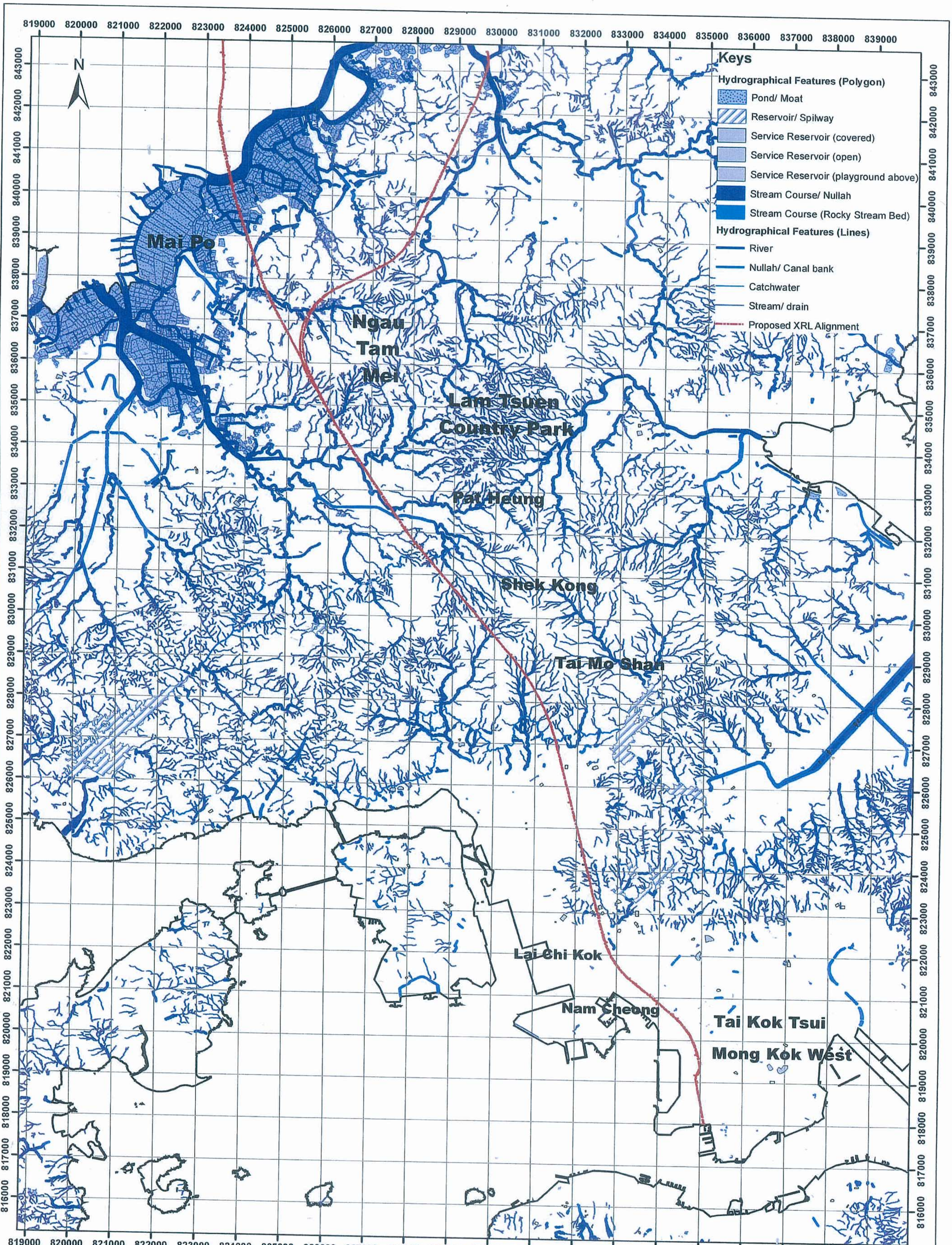
地鐵公司 MTR Corporation

Arup Atkins

Express Rail Link

Title		
Packer Tests Result - SDV		
Scale: NTS	Date: 11/2008	Figure No. 5.3.10

Figures



地鐵公司 MTR Corporation	Arup Atkins	Express Rail Link	Title: Location plan of Hydrogological Features
			Scale: 1:80,000 @ A3 — Date: 08/2008 — Figure No. 4.1

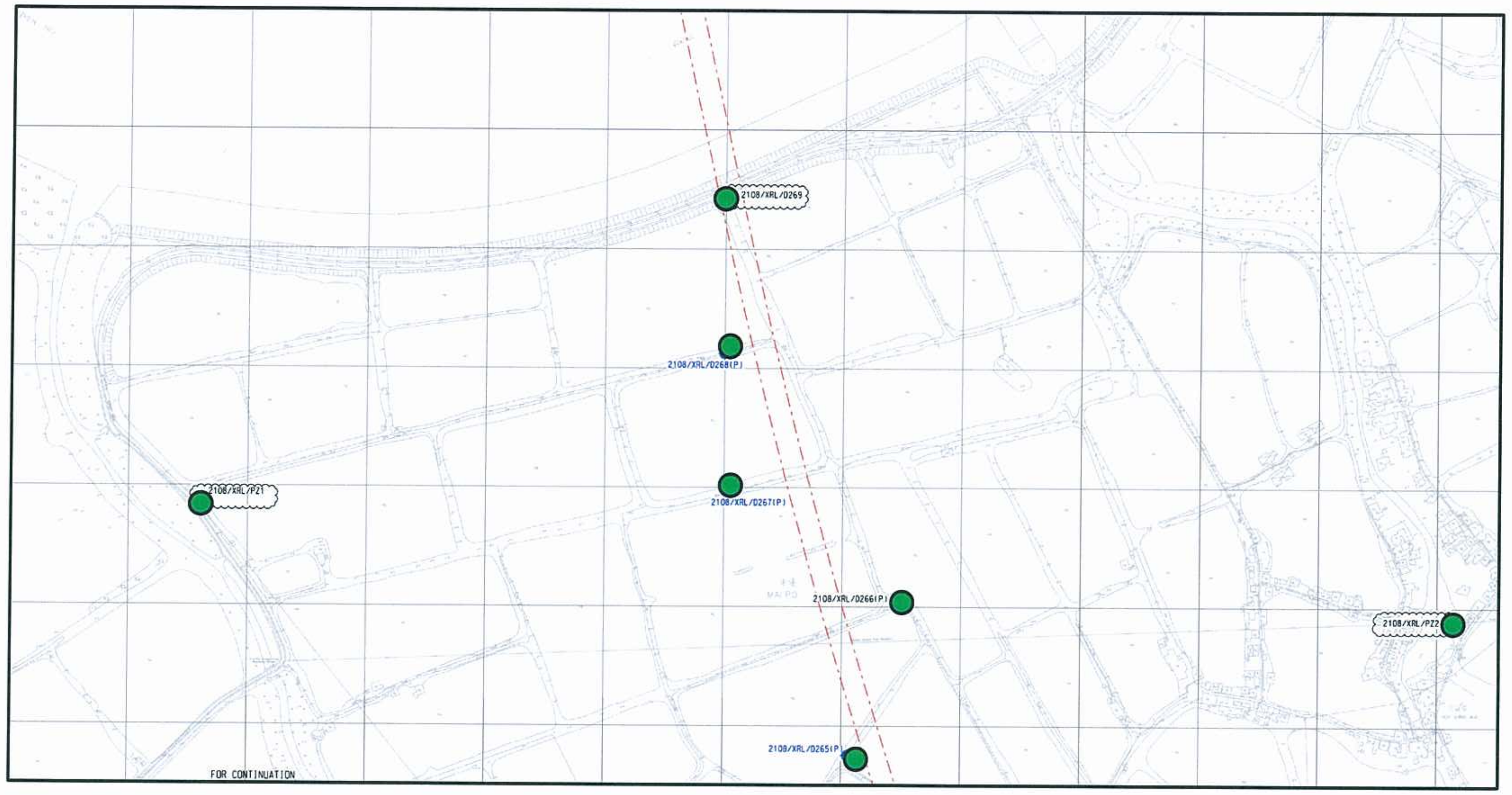
地鐵公司 MTR Corporation

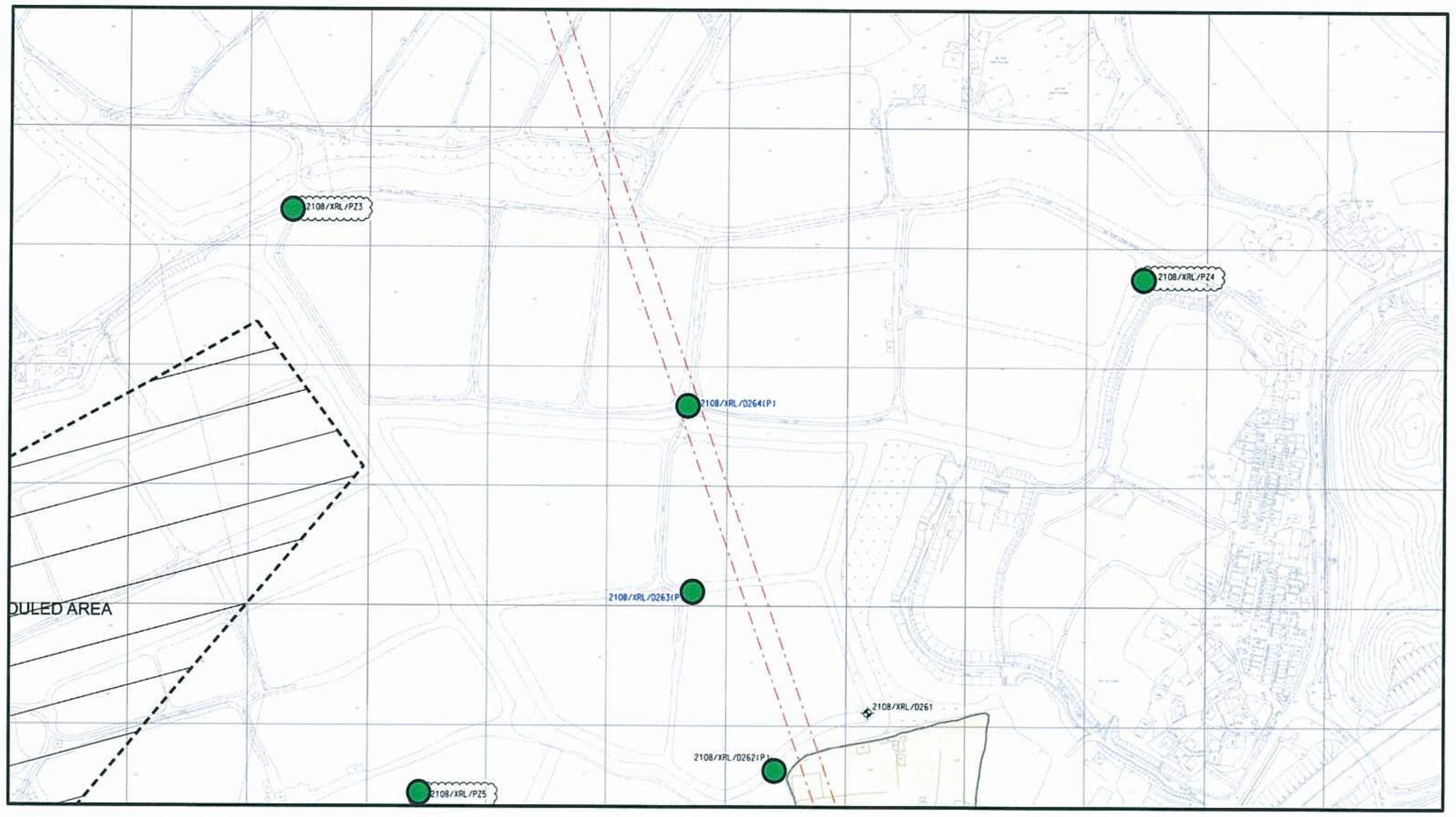
Arup Atkins

Express Rail Link

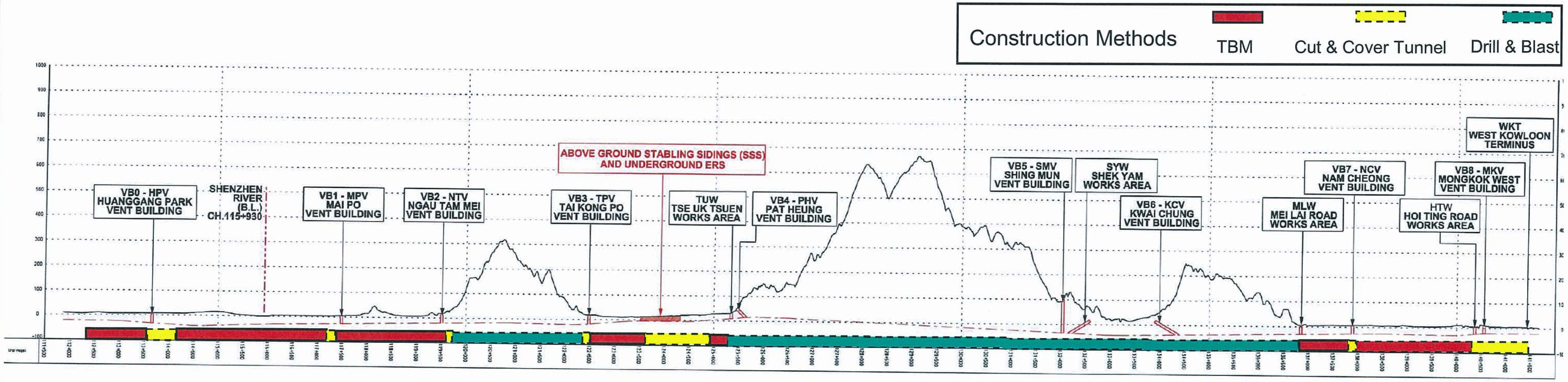
Title: Location Map of GEO Raingauges

Scale	Date	Figure No.
As Shown	08/2008	4.2

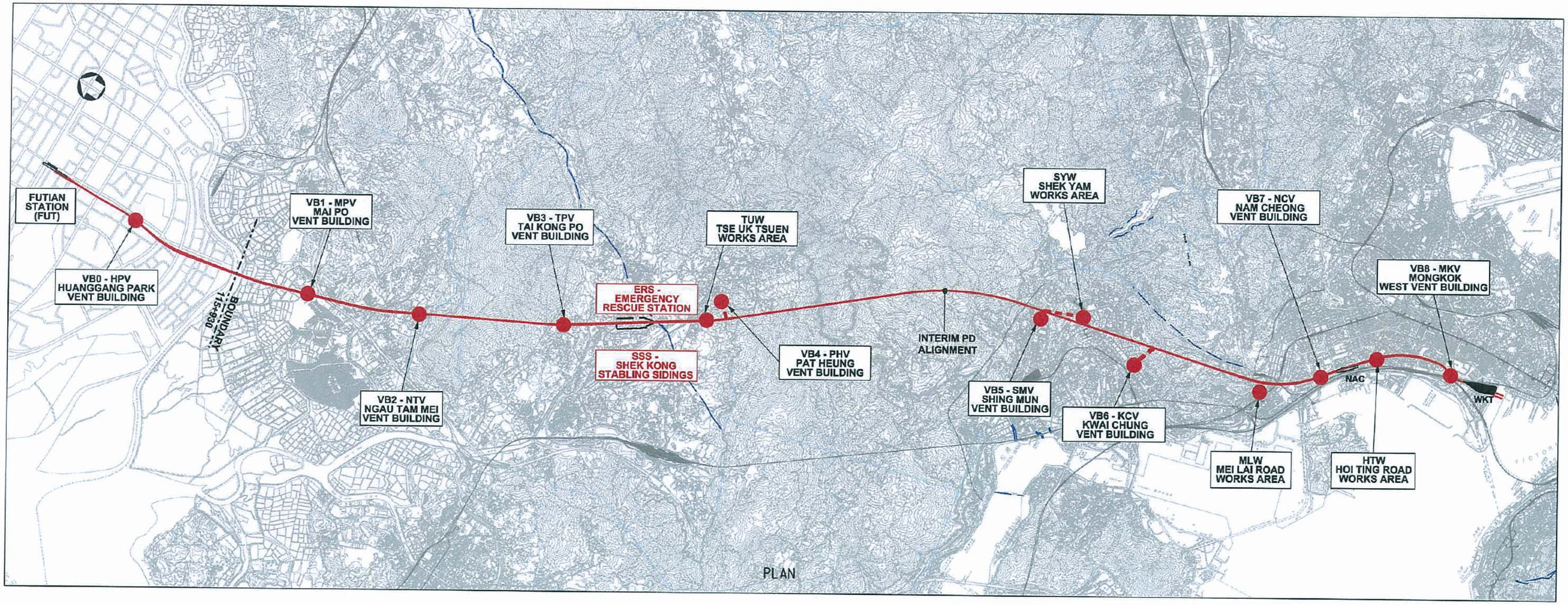




地鐵公司 MTR Corporation	**Arup Atkins**	**Express Rail Link**	Title: THE LOCATION OF PIEZOMETERS ALONG MAI PO AREA
			Scale: As Shown · Date: 11/2008 · Figure No. 5.1

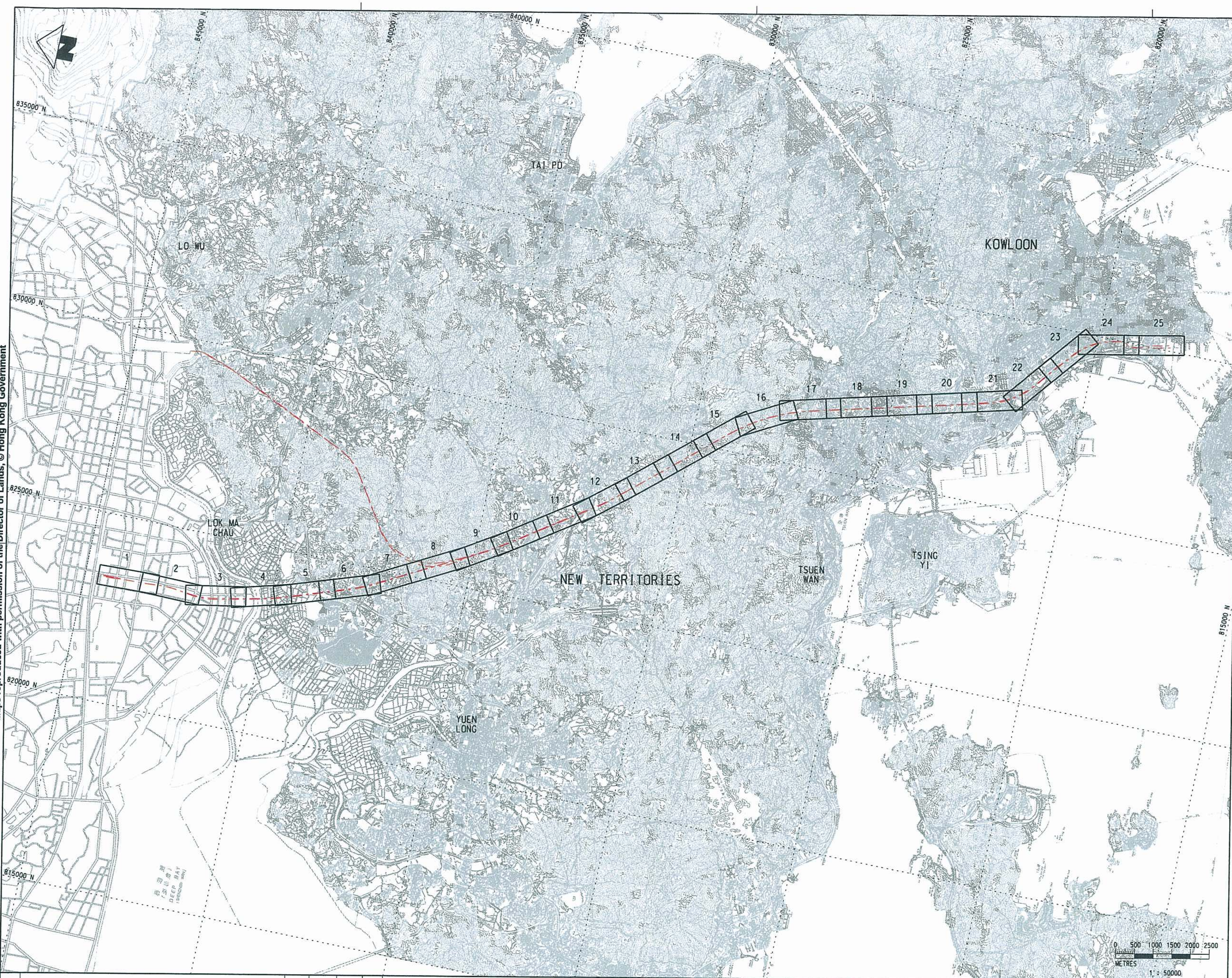


ELEVATION



地鐵公司 MTR Corporation	**Arup Atkins**	**Express Rail Link**	Title: THE CONSTRUCTION METHODS FOR THE PROPOSED XRL TUNNEL
			Scale: As Shown — Date: 11/2008 — Figure No. 6.1

Drawings



NOTES:

1. THE GROUNDWATER CONTOURS ARE GENERATED BASED UPON LIMITED GROUNDWATER DATA.
2. GROUNDWATER DATA POINTS ARE COLLATED FROM EXISTING PIEZOMETERS / STANDPIPES (GENERALLY WITH 7 DAYS GROUNDWATER MONITORING RECORDS) AND DAILY GROUNDWATER MEASUREMENTS DURING BOREHOLE DRILLNIG.
3. GROUNDWATER CONTOURS SHOWN ARE GENERATED FROM COMPUTER PROGRAMME SURFER USING KRIGING DEFAULT GRIDDING METHOD AND SHOULD BE TREATED WITH CAUTION IN AREAS WHERE DATA POINTS ARE LACKING PARTICULARLY IN THE HILLY GROUNDS.
4. ALL THE DATA POINTS USED IN THE CONTOURING ARE SHOWN IN APPENDIX 1. SOME DATA POINTS ARE LOCATED OUTSIDE THE LAYOUT PLAN.
5. THE GROUNDWATER CONTOURS WILL BE UPDATED UPON RECEIVING THE NEW PROJECT SPECIFIC GROUND INVESTIGATION DATA.

LEGEND:

	PROPOSED XRL ALIGNMENT
2108/XRL/XXX	GROUNDWATER DATA POINT-EXISTING PIEZOMETER / STANDPIPE WITH 7 DAYS GROUNDWATER MONITORING RECORDS
2108/XRL/XXX	GROUNDWATER DATA POINT - EXISTING BOREHOLE WITH DAILY WATER LEVEL MEASUREMENT DURING DRILLING
10	INFERRED GROUNDWATER CONTOUR WITH LEVEL IN mPD
?	INFERRED GROUNDWATER TABLE

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	25/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_170B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN

INFERRED GROUNDWATER CONTOUR PLAN & PROFILE
INDEX SHEET

SCALE	DRAWING NO.	REV.
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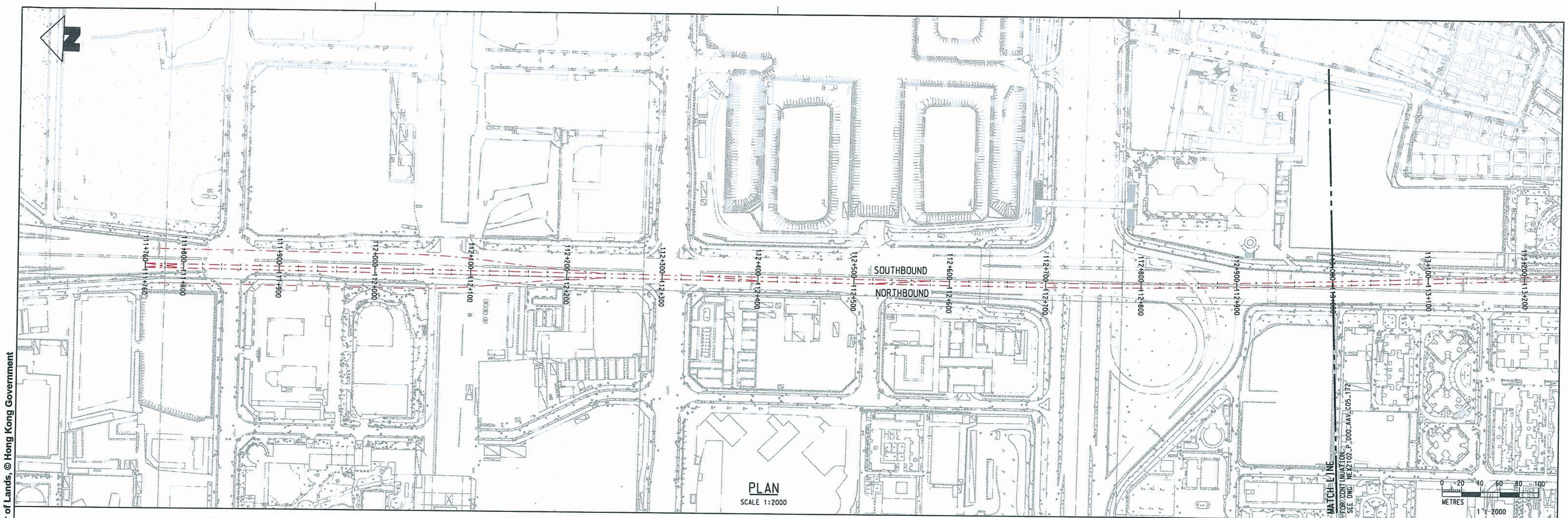

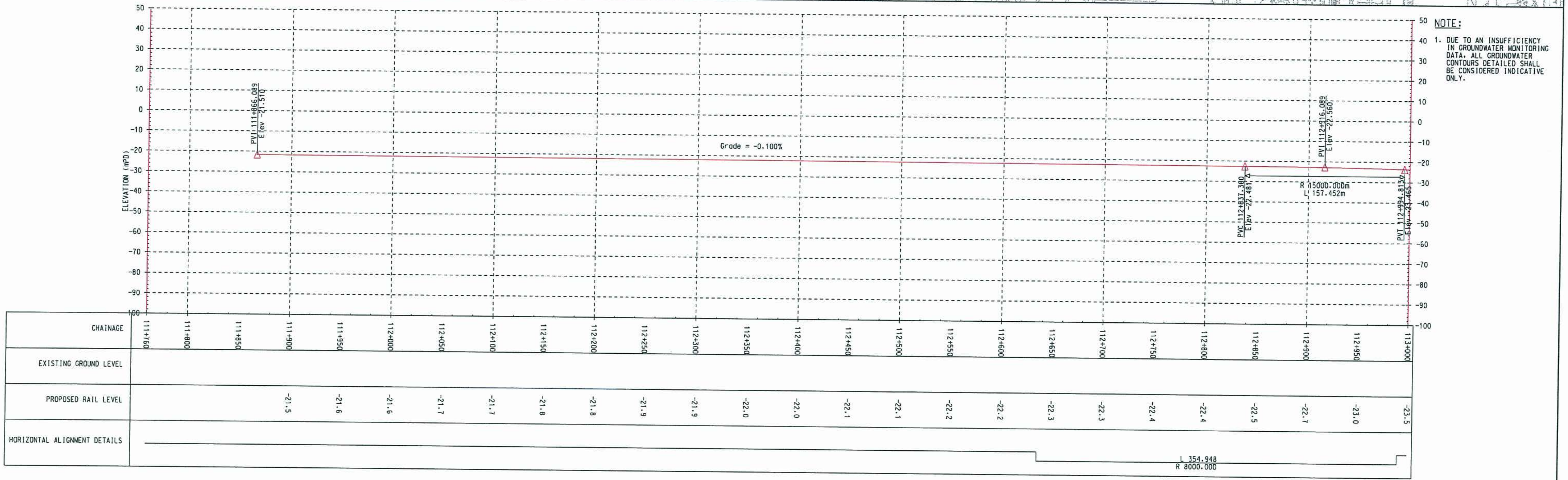

CHAINAGE	PROPOSED RAIL LEVEL
111+760	
111+800	
111+850	
111+900	-21.5
111+950	-21.6
112+000	-21.6
112+050	-21.7
112+100	-21.7
112+150	-21.8
112+200	-21.8
112+250	-21.9
112+300	-21.9
112+350	-22.0
112+400	-22.0
112+450	-22.1
112+500	-22.1
112+550	-22.2
112+600	-22.2
112+650	-22.3
112+700	-22.3
112+750	-22.4
112+800	-22.4
112+850	-22.5
112+900	-22.7
112+950	-23.0
113+000	-23.5

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_171B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 1

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/171

REV. B

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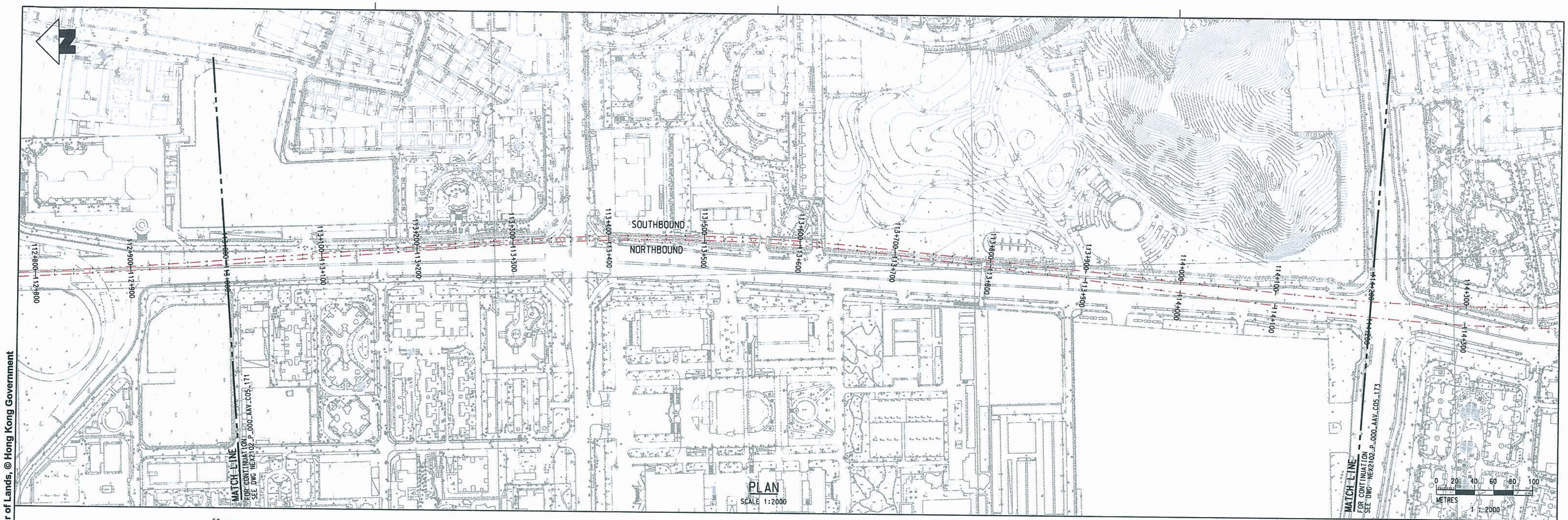
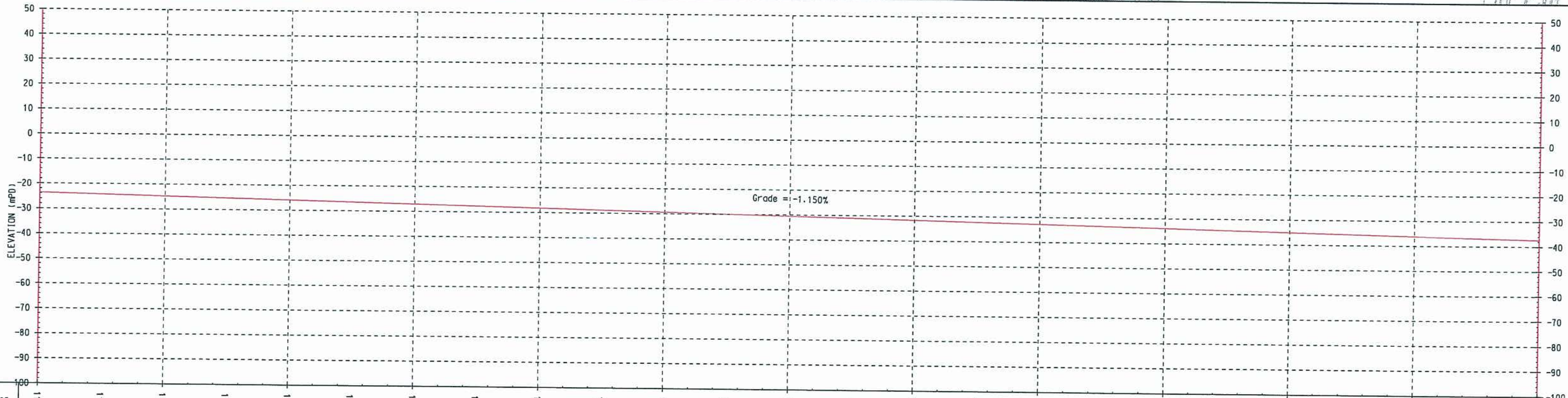


PLAN
SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	113+000	113+050	113+100	113+150	113+200	113+250	113+300	113+350	113+400	113+450	113+500	113+550	113+600	113+650	113+700	113+750	113+800	113+850	113+900	113+950	114+000	114+050	114+100	114+150	114+200
EXISTING GROUND LEVEL																									
PROPOSED RAIL LEVEL	-23.5	-24.1	-24.7	-25.2	-25.8	-26.4	-27.0	-27.5	-28.1	-28.7	-29.3	-29.8	-30.4	-31.0	-31.6	-32.1	-32.7	-33.3	-33.9	-34.4	-35.0	-35.6	-36.2	-36.7	-37.3
HORIZONTAL ALIGNMENT DETAILS	L 200.000 A 632.456							L 166.184 R 2000.000					L 200.000 A 632.456									L 169.622 A 632.456			

PROFILE
SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/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. NEX2102_P_000_AAV_C05_172B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 2

SCALE 1 : 2000 (A1)
DRAWING NO. NEX2102/P/000/AAV/C05/172
REV. B

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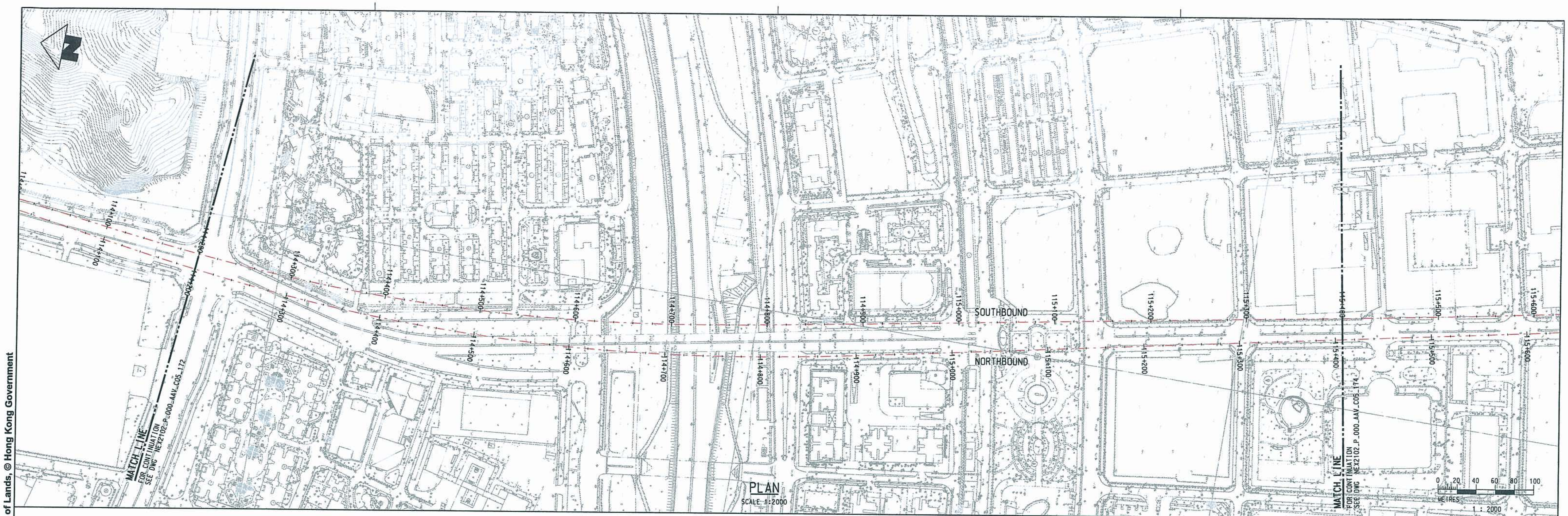
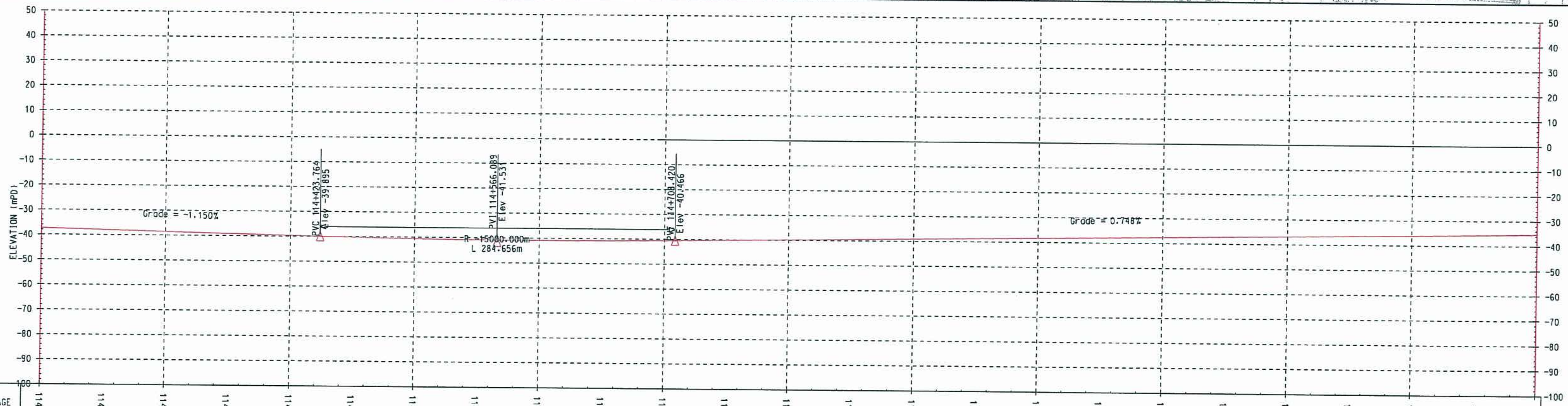


PLAN
SCALE 1:2000



CHAINAGE	114+200	114+250	114+300	114+350	114+400	114+450	114+500	114+550	114+600	114+650	114+700	114+750	114+800	114+850	114+900	114+950	115+000	115+050	115+100	115+150	115+200	115+250	115+300	115+350	115+400
EXISTING GROUND LEVEL											0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PROPOSED RAIL LEVEL	-37.3	-37.9	-38.5	-39.0	-39.6	-40.2	-40.6	-40.8	-40.9	-40.8	-40.5	-40.2	-39.8	-39.4	-39.0	-38.7	-38.3	-37.9	-37.5	-37.2	-36.8	-36.4	-36.0	-35.7	-35.3
HORIZONTAL ALIGNMENT DETAILS	L 30.378 A 632.456					L 432.410 R 2000.000						L 200.000 A 632.456													

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_173B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 3

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/173

REV. B

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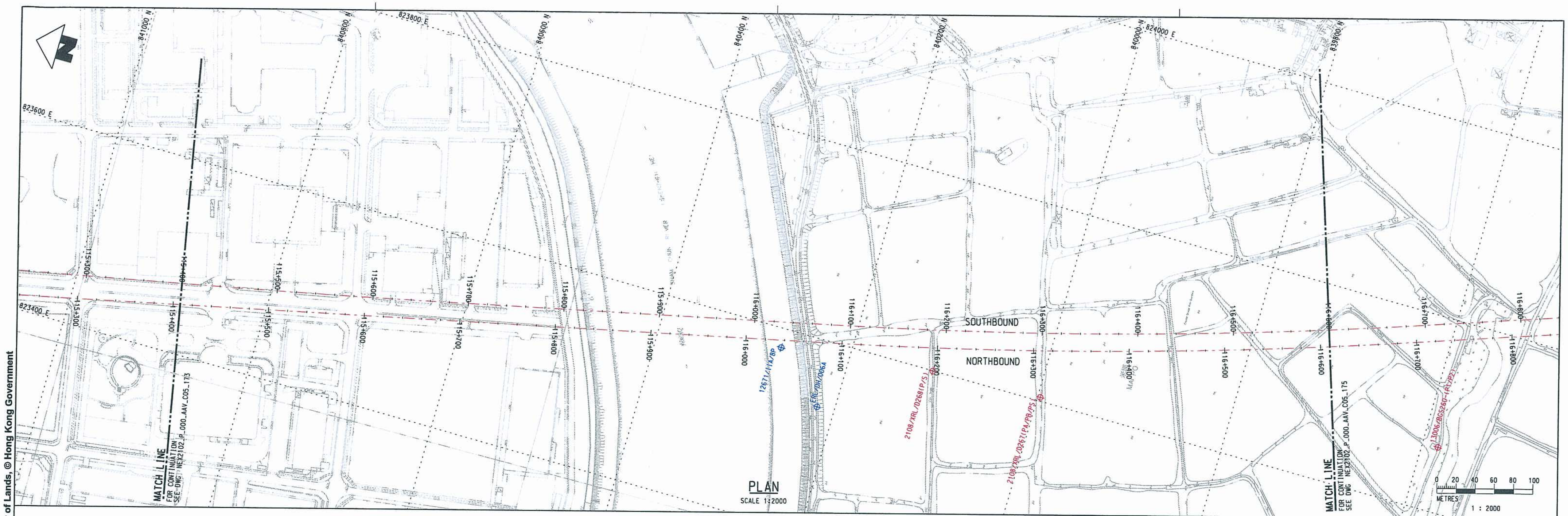
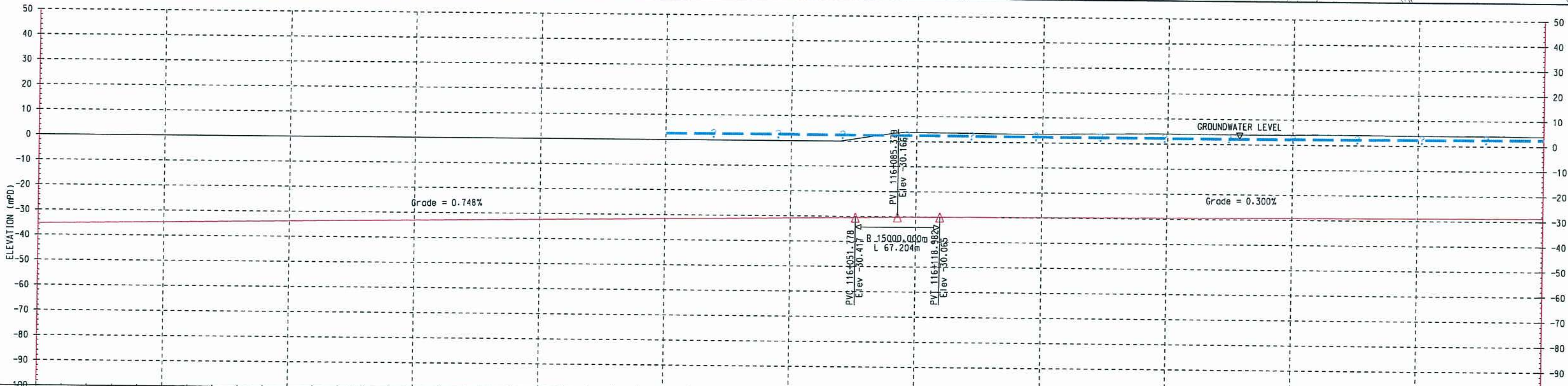


PLAN

SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
115+400	0.0	-35.3
115+450	0.0	-34.9
115+500	0.0	-34.5
115+550	0.0	-34.2
115+600	0.0	-33.8
115+650	0.0	-33.4
115+700	0.0	-33.0
115+750	0.0	-32.7
115+800	0.0	-32.3
115+850	0.0	-31.9
115+900	0.0	-31.6
115+950	0.0	-31.2
116+000	0.0	-30.8
116+050	0.9	-30.4
116+100	3.7	-30.1
116+150	3.5	-30.0
116+200	3.5	-29.8
116+250	3.8	-29.7
116+300	4.0	-29.5
116+350	3.9	-29.4
116+400	4.0	-29.2
116+450	4.1	-29.1
116+500	4.0	-28.9
116+550	4.0	-28.8
116+600	3.9	-28.6

HORIZONTAL ALIGNMENT DETAILS: L 260.306 R 12000.000; L 160.000 A 894.427; L 410.914 R 5000.000; L 3.818 A 894.427

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_174B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 4

SCALE 1 : 2000 (A1) | DRAWING NO. NEX2102/P/000/AAV/C05/174 | REV. B

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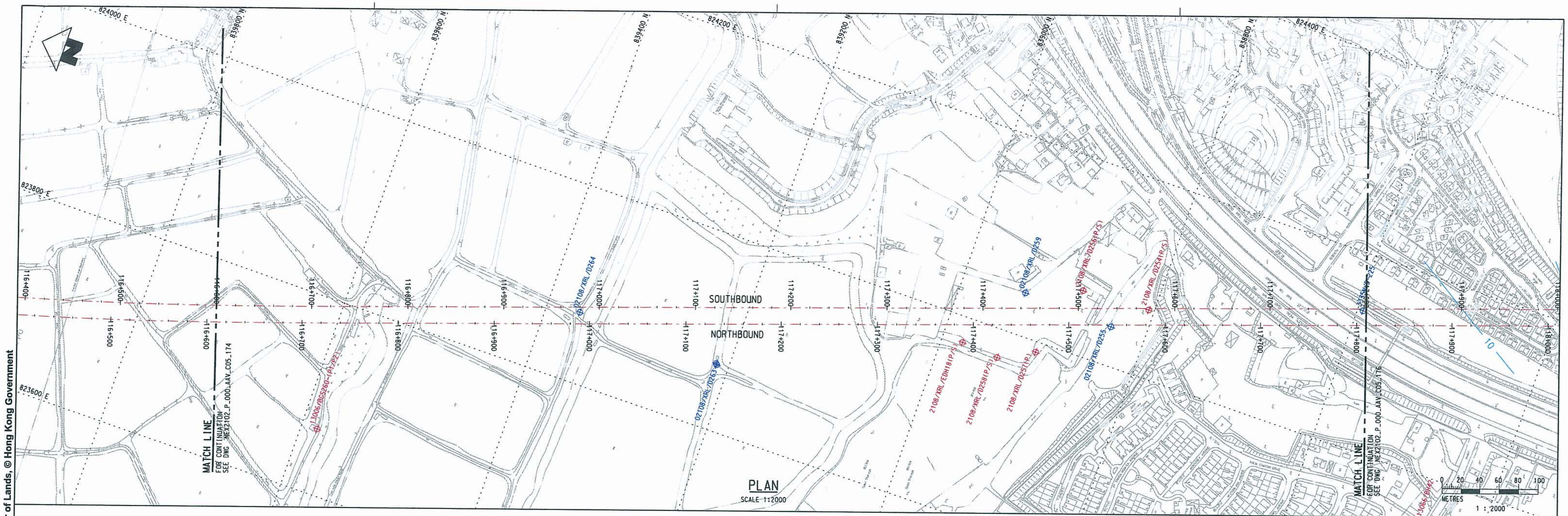
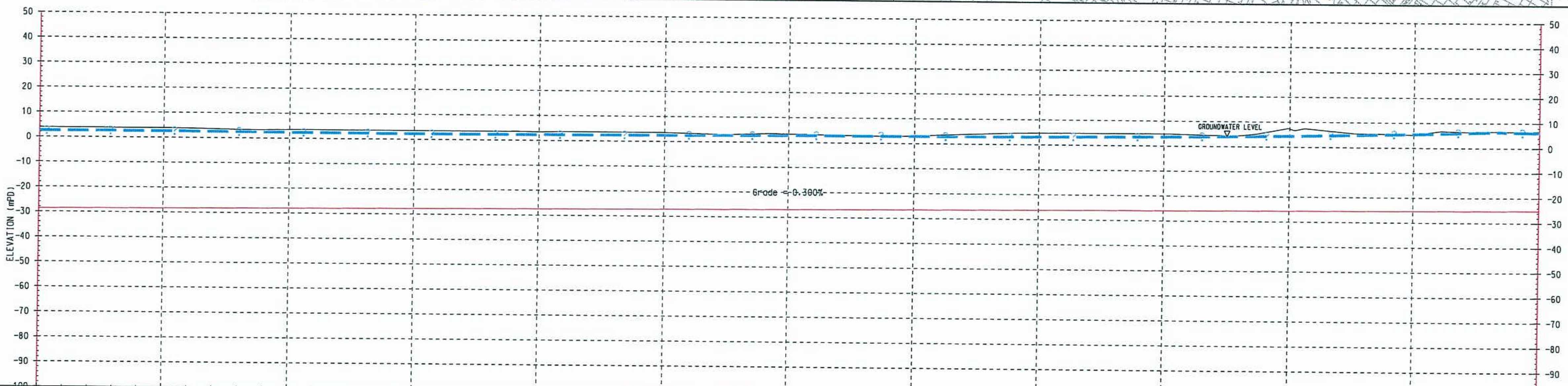




NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA. ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	116+600	116+650	116+700	116+750	116+800	116+850	116+900	116+950	117+000	117+050	117+100	117+150	117+200	117+250	117+300	117+350	117+400	117+450	117+500	117+550	117+600	117+650	117+700	117+750	117+800
EXISTING GROUND LEVEL	3.9	3.8	3.8	3.5	3.4	3.5	3.5	3.5	3.4	3.6	3.5	3.0	3.4	3.0	3.1	4.1	4.7	4.8	4.8	4.3	7.3	5.7	5.2	6.6	6.8
PROPOSED RAIL LEVEL	-28.6	-28.5	-28.3	-28.2	-28.0	-27.9	-27.7	-27.6	-27.4	-27.3	-27.1	-27.0	-26.8	-26.7	-26.5	-26.4	-26.2	-26.1	-25.9	-25.8	-25.6	-25.5	-25.3	-25.2	-25.0
HORIZONTAL ALIGNMENT DETAILS	L 156.182 A 894.427																								

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_175B.dgn

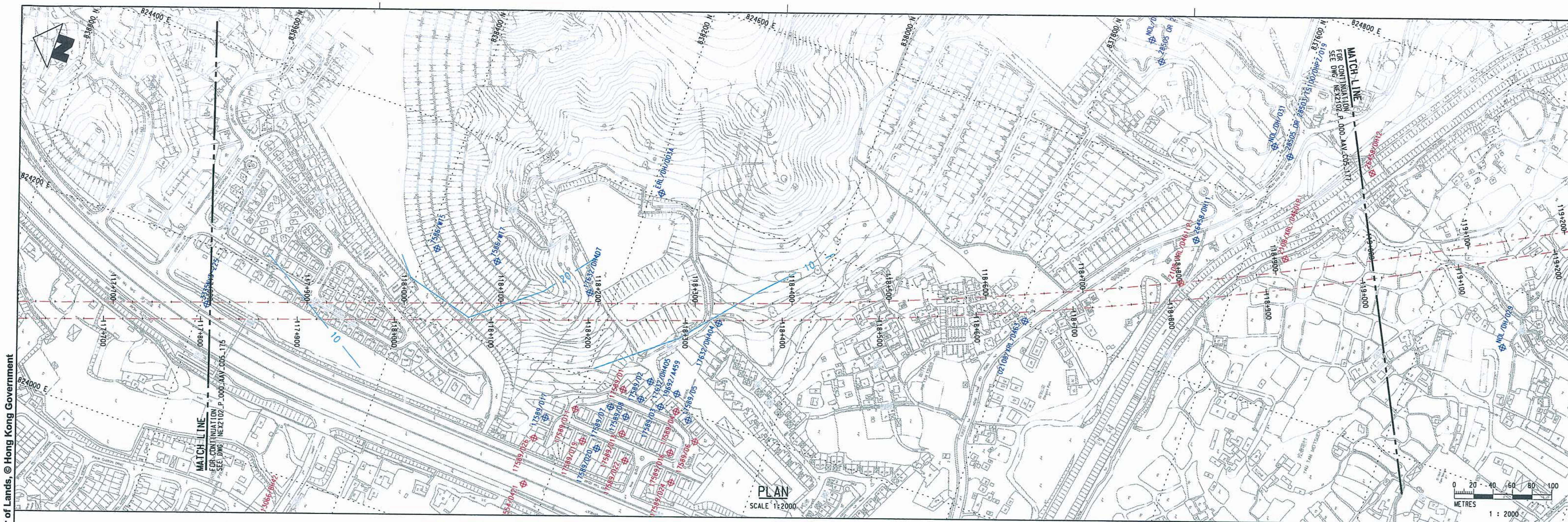
TITLE

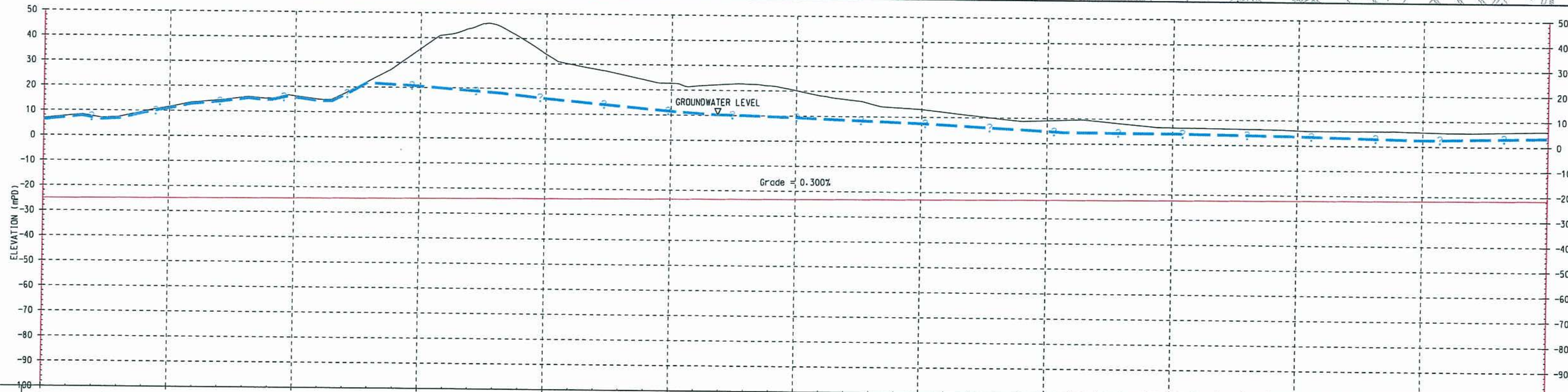
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 5

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/175

REV. B





CHAINAGE	117+800	117+850	117+900	117+950	118+000	118+050	118+100	118+150	118+200	118+250	118+300	118+350	118+400	118+450	118+500	118+550	118+600	118+650	118+700	118+750	118+800	118+850	118+900	118+950	119+000
EXISTING GROUND LEVEL	6.8	7.1	11.6	15.0	16.3	20.2	35.6	45.9	33.8	27.1	22.7	22.7	20.2	16.2	13.1	10.3	9.1	8.6	6.8	6.5	6.0	5.9	5.7	5.6	6.1
PROPOSED RAIL LEVEL	-25.0	-24.9	-24.7	-24.6	-24.4	-24.3	-24.1	-24.0	-23.8	-23.7	-23.5	-23.4	-23.2	-23.1	-22.9	-22.8	-22.6	-22.5	-22.3	-22.2	-22.0	-21.9	-21.7	-21.6	-21.4

HORIZONTAL ALIGNMENT DETAILS
L 160.000
A 894.427
L 597.406
R 5000.000

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_176B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 6

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/176

REV. B

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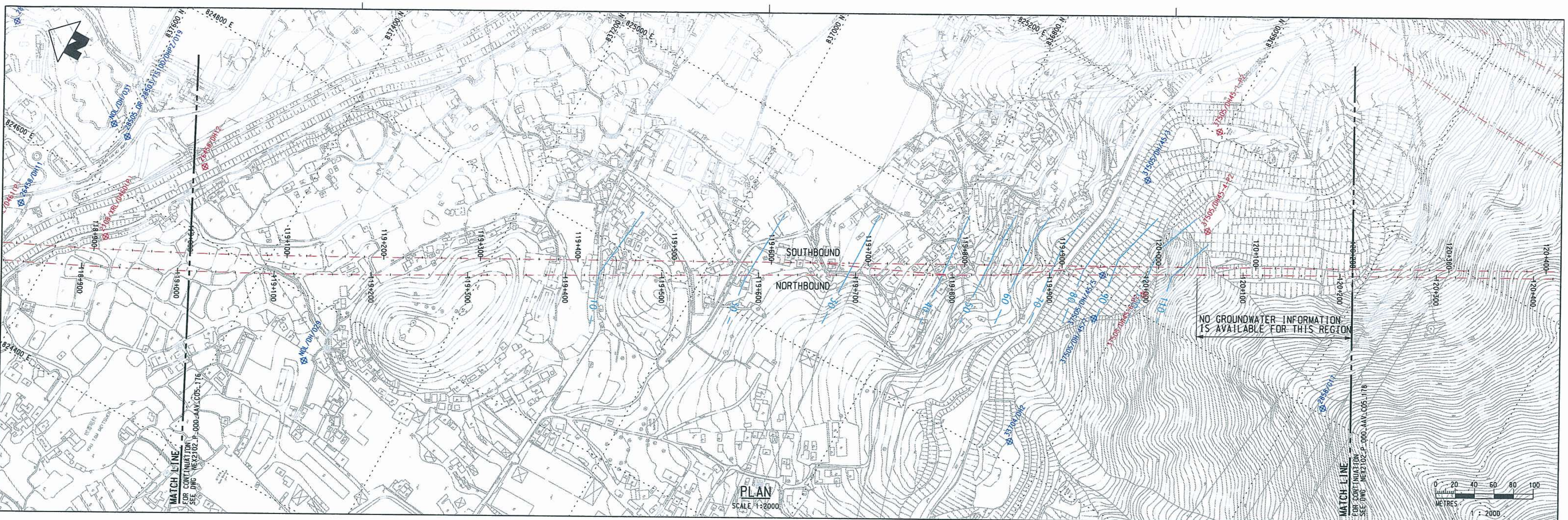

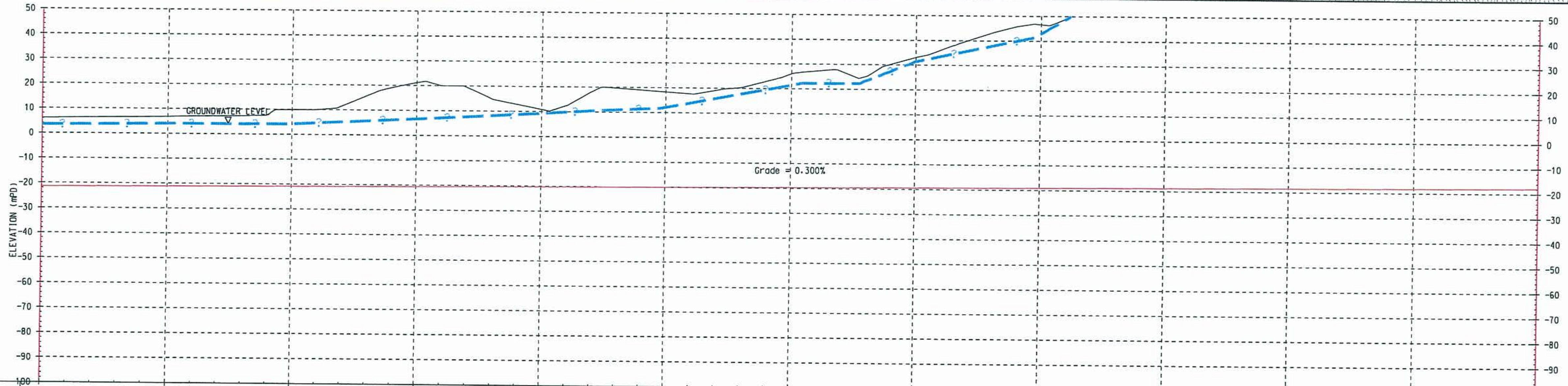

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	119+000	119+050	119+100	119+150	119+200	119+250	119+300	119+350	119+400	119+450	119+500	119+550	119+600
EXISTING GROUND LEVEL	6.1	6.4	6.8	7.2	9.9	13.6	21.2	17.2	10.9	20.0	18.3	19.8	26.1
PROPOSED RAIL LEVEL	-21.4	-21.3	-21.1	-21.0	-20.8	-20.7	-20.5	-20.4	-20.2	-20.1	-19.9	-19.8	-19.6

CHAINAGE	119+650	119+700	119+750	119+800	119+850	119+900	119+950	120+000	120+050	120+100	120+150	120+200
EXISTING GROUND LEVEL	25.2	33.1	41.4	46.6	57.9	70.8	91.7	122.2	154.8	162.8	164.1	160.9
PROPOSED RAIL LEVEL	-19.5	-19.3	-19.2	-19.0	-18.9	-18.7	-18.6	-18.4	-18.3	-18.1	-18.0	-17.8

HORIZONTAL ALIGNMENT DETAILS: L 43.626 R 5000.000; L 160.000 A 894.427

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_177B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 7

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/177

REV. B

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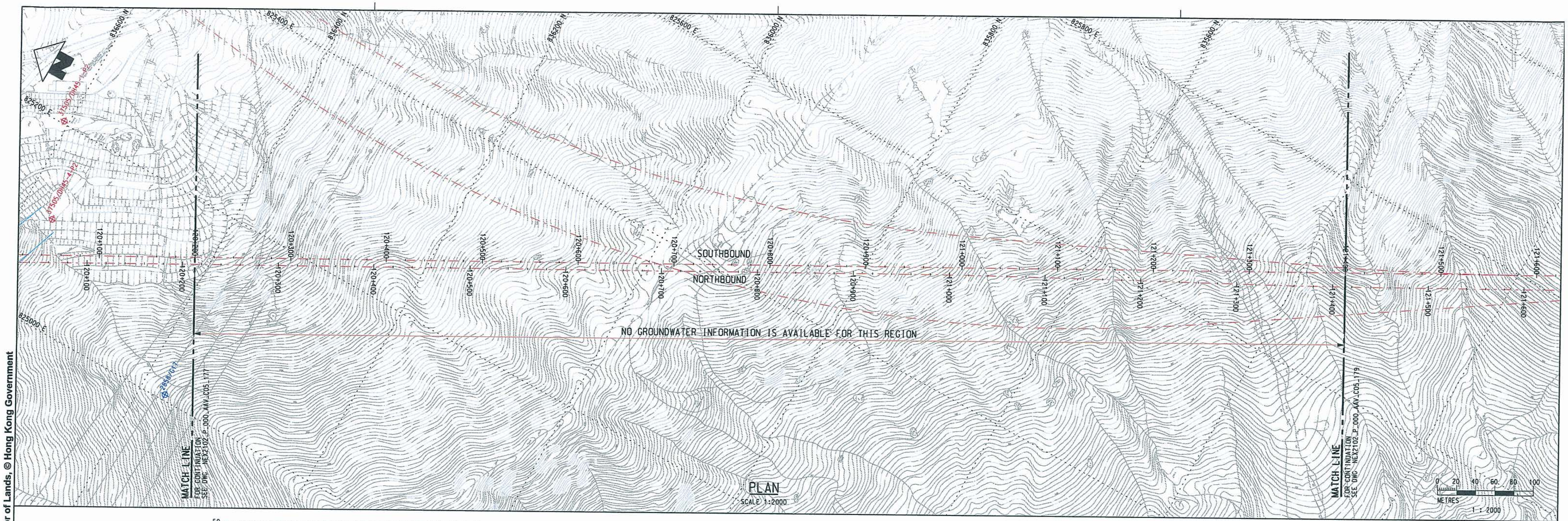
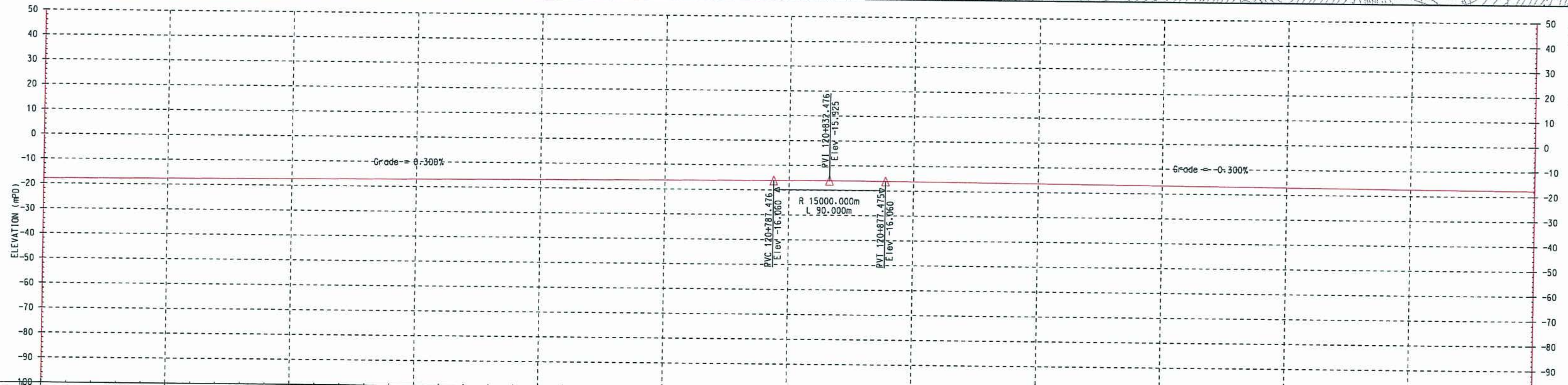


PLAN
SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
120+200	160.9	-17.8
120+250	160.5	-17.7
120+300	177.1	-17.5
120+350	210.1	-17.4
120+400	229.8	-17.2
120+450	234.6	-17.1
120+500	260.0	-16.9
120+550	272.7	-16.8
120+600	287.7	-16.6
120+650	304.5	-16.5
120+700	310.0	-16.3
120+750	318.0	-16.2
120+800	305.2	-16.0
120+850	284.6	-16.0
120+900	280.8	-16.1
120+950	268.5	-16.3
121+000	252.6	-16.4
121+050	234.5	-16.6
121+100	224.9	-16.7
121+150	211.6	-16.9
121+200	215.2	-17.0
121+250	200.2	-17.2
121+300	197.3	-17.3
121+350	173.5	-17.5
121+400	185.6	-17.6

HORIZONTAL ALIGNMENT DETAILS

PROFILE
SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

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

CADD REF. NEX2102_P_000_AAV_C05_178B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 8

SCALE 1 : 2000 (A1)
DRAWING NO. NEX2102/P/000/AAV/C05/178
REV. B

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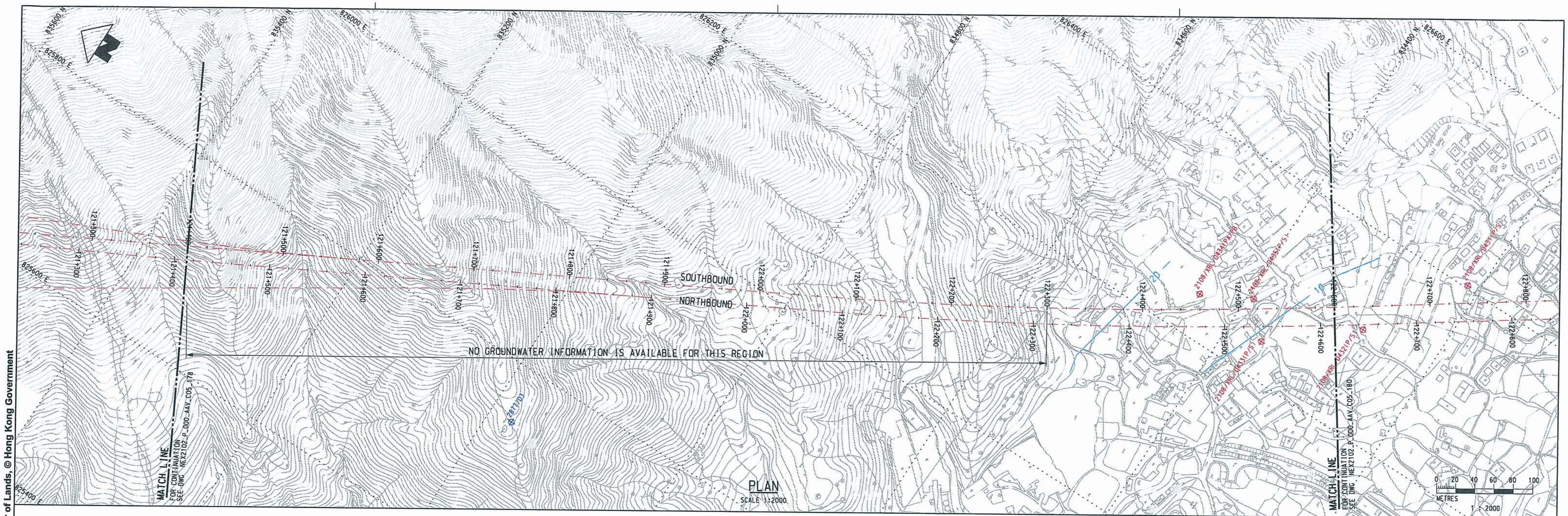
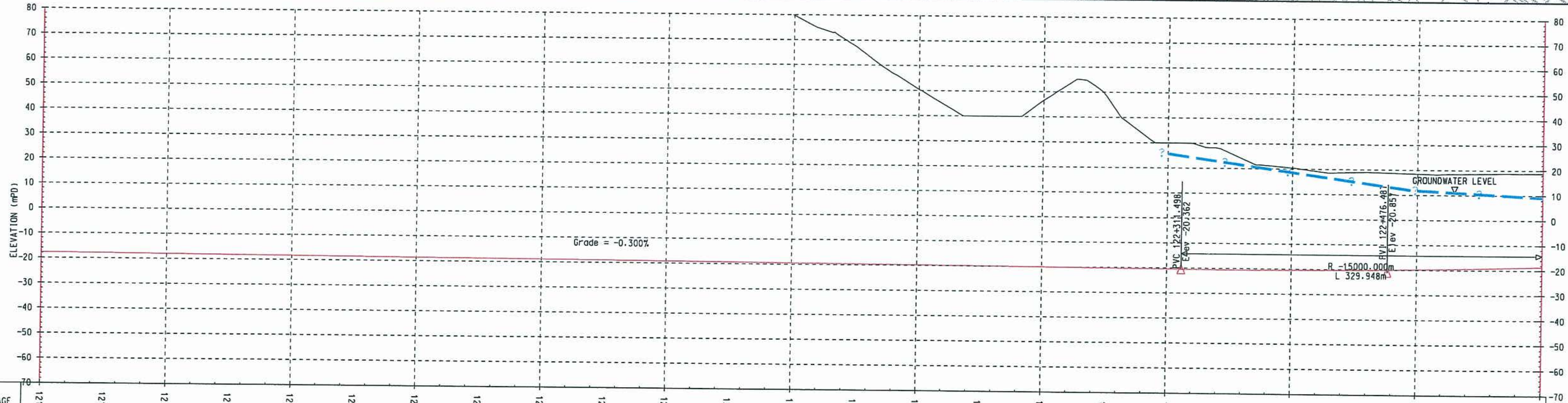


PLAN
SCALE 1:2000



CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
121+400	185.6	-17.6
121+450	176.3	-17.8
121+500	152.3	-17.9
121+550	155.6	-18.1
121+600	179.8	-18.2
121+650	197.7	-18.4
121+700	183.4	-18.5
121+750	150.9	-18.7
121+800	124.2	-18.8
121+850	100.0	-19.0
121+900	92.6	-19.1
121+950	89.3	-19.3
122+000	79.7	-19.4
122+050	67.3	-19.6
122+100	50.4	-19.7
122+150	40.0	-19.9
122+200	46.5	-20.0
122+250	48.6	-20.2
122+300	30.0	-20.3
122+350	26.1	-20.4
122+400	20.4	-20.4
122+450	18.9	-20.1
122+500	18.5	-19.7
122+550	18.6	-19.2
122+600	18.8	-18.5

HORIZONTAL ALIGNMENT DETAILS: L 160.000 A 894.427; L 384.311 R 5000.000; L 93.689 A 894.427

PROFILE
SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:
1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR
EXPRESS RAIL LINK

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

CADD REF. NEX2102_P_000_AAV_C05_179B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 9

SCALE 1 : 2000 (A1)
DRAWING NO. NEX2102/P/000/AAV/C05/179
REV. B

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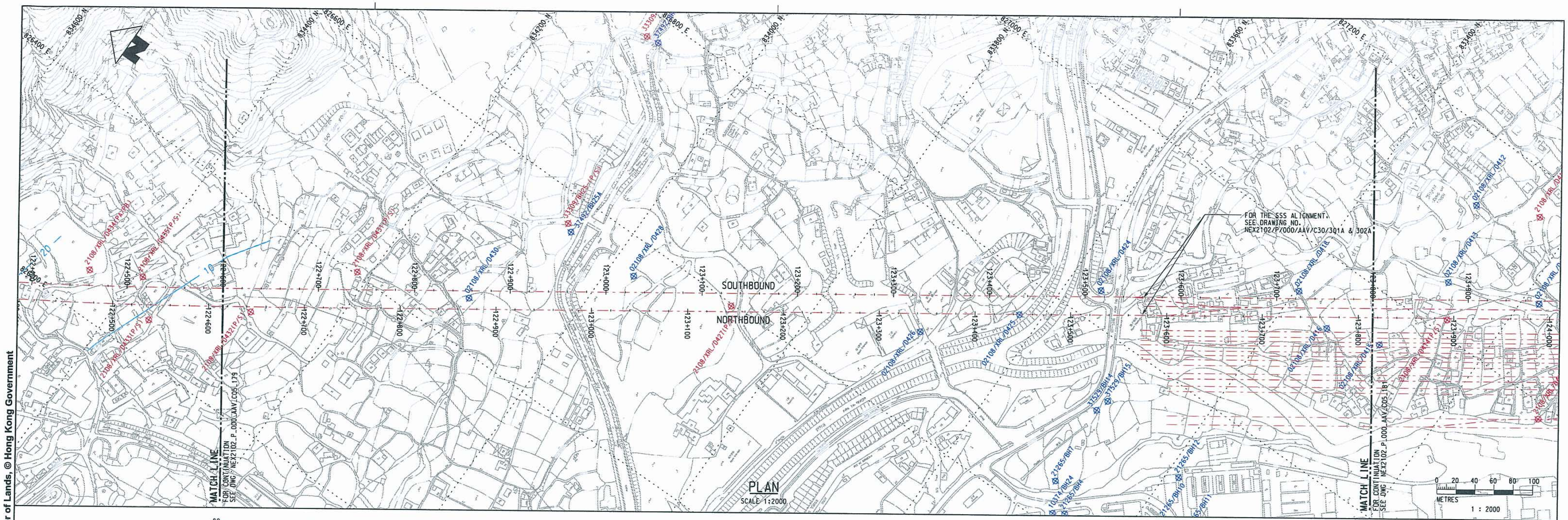
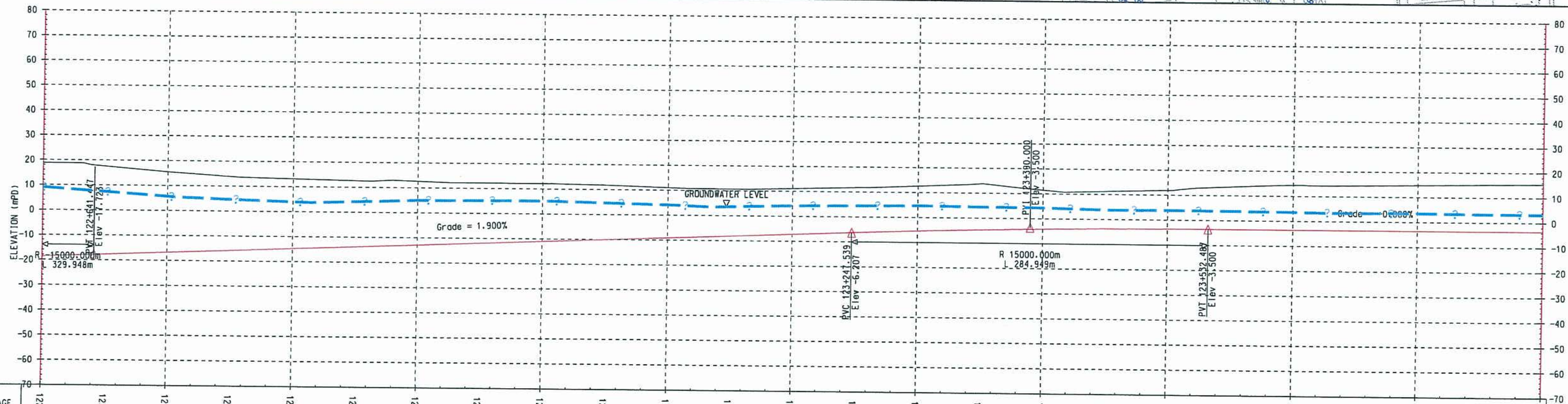


PLAN
SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
122+600	18.8	-18.5
122+650	17.5	-17.6
122+700	15.5	-16.6
122+750	13.9	-15.7
122+800	13.1	-14.7
122+850	12.6	-13.8
122+900	12.6	-12.8
122+950	12.2	-11.9
123+000	12.2	-10.9
123+050	11.8	-10.0
123+100	11.0	-9.0
123+150	10.7	-8.1
123+200	11.1	-7.1
123+250	11.7	-6.2
123+300	12.6	-5.3
123+350	13.7	-4.6
123+400	11.5	-4.1
123+450	11.2	-3.7
123+500	11.9	-3.5
123+550	13.5	-3.5
123+600	14.4	-3.5
123+650	14.5	-3.5
123+700	14.8	-3.5
123+750	15.2	-3.5
123+800	15.4	-3.5

HORIZONTAL ALIGNMENT DETAILS: L 66.311, A 894.427

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_180B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 10

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/180

REV. B

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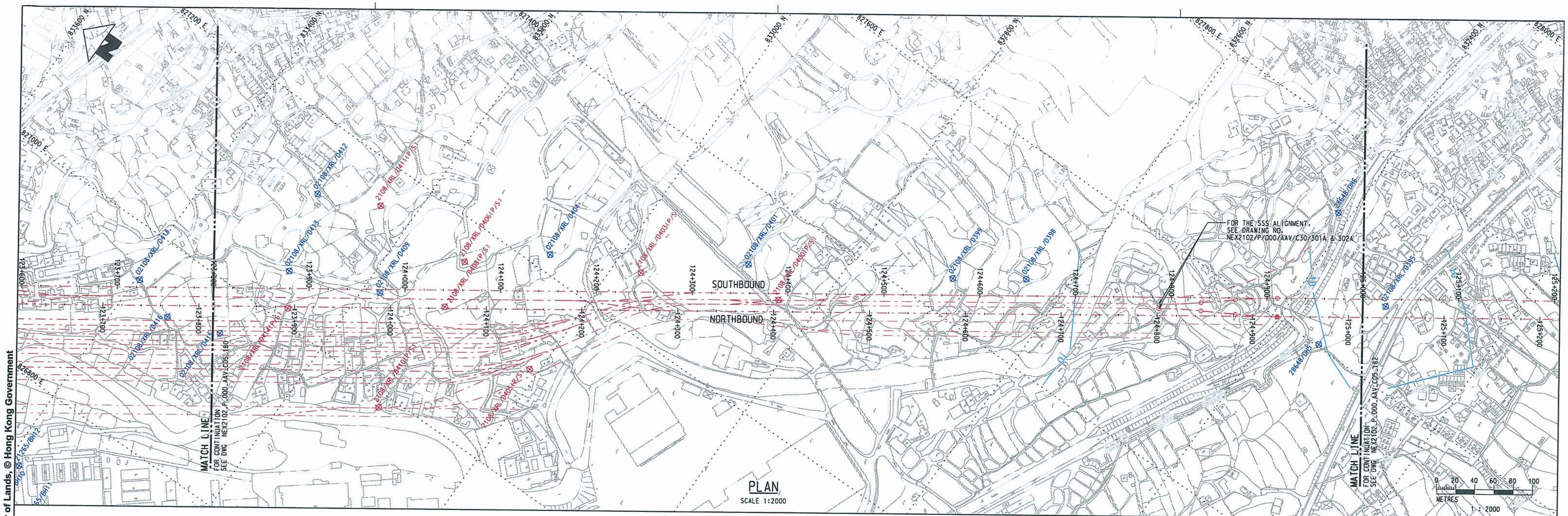
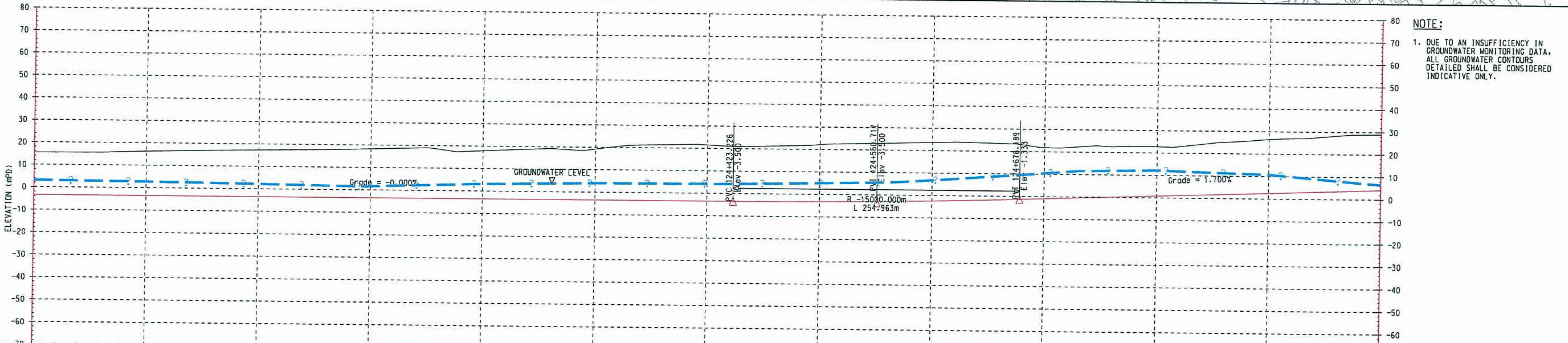


PLAN
SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
123+800	15.4	-3.5
123+850	15.6	-3.5
123+900	16.3	-3.5
123+950	16.8	-3.5
124+000	17.3	-3.5
124+050	17.7	-3.5
124+100	18.3	-3.5
124+150	19.0	-3.5
124+200	17.9	-3.5
124+250	19.0	-3.5
124+300	19.2	-3.5
124+350	21.3	-3.5
124+400	21.5	-3.5
124+450	21.2	-3.5
124+500	22.1	-3.3
124+550	23.0	-3.0
124+600	23.6	-2.5
124+650	23.6	-1.8
124+700	21.8	-1.0
124+750	22.8	-0.1
124+800	22.8	0.7
124+850	24.6	1.6
124+900	26.5	2.4
124+950	27.8	3.3
125+000	29.0	4.1

HORIZONTAL ALIGNMENT DETAILS

PROFILE
SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

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

CADD REF. NEX2102_P_000_AAV_C05_181B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 11

SCALE 1 : 2000 (A1) | DRAWING NO. NEX2102/P/000/AAV/C05/181 | REV. B

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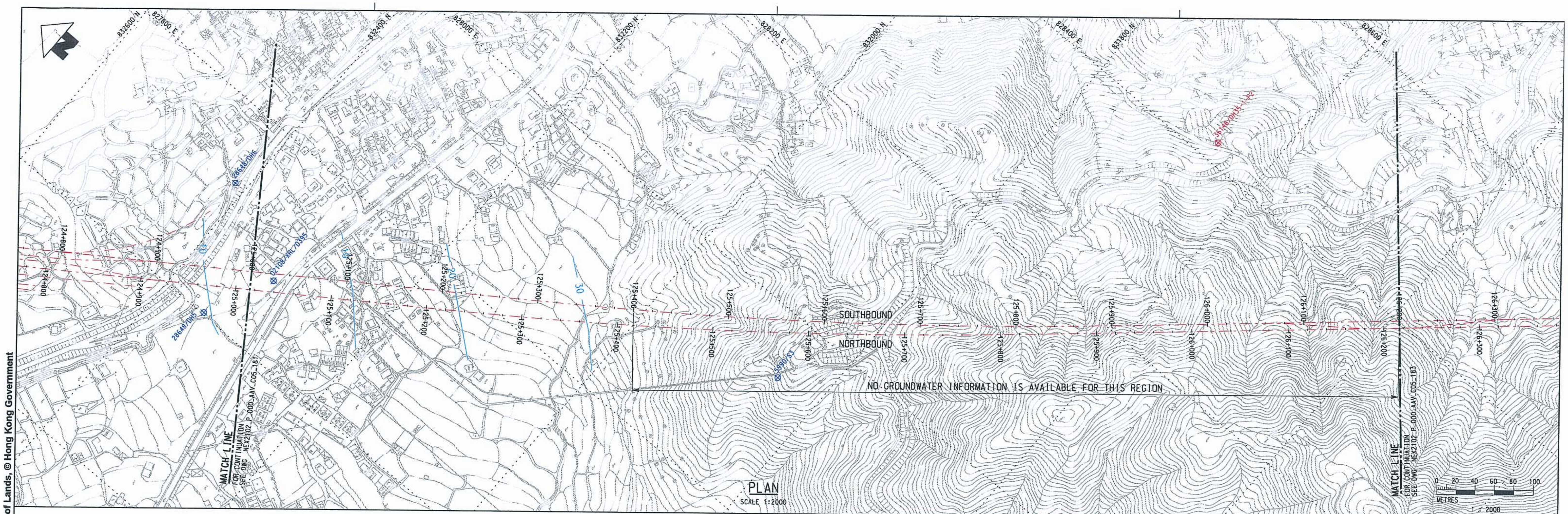
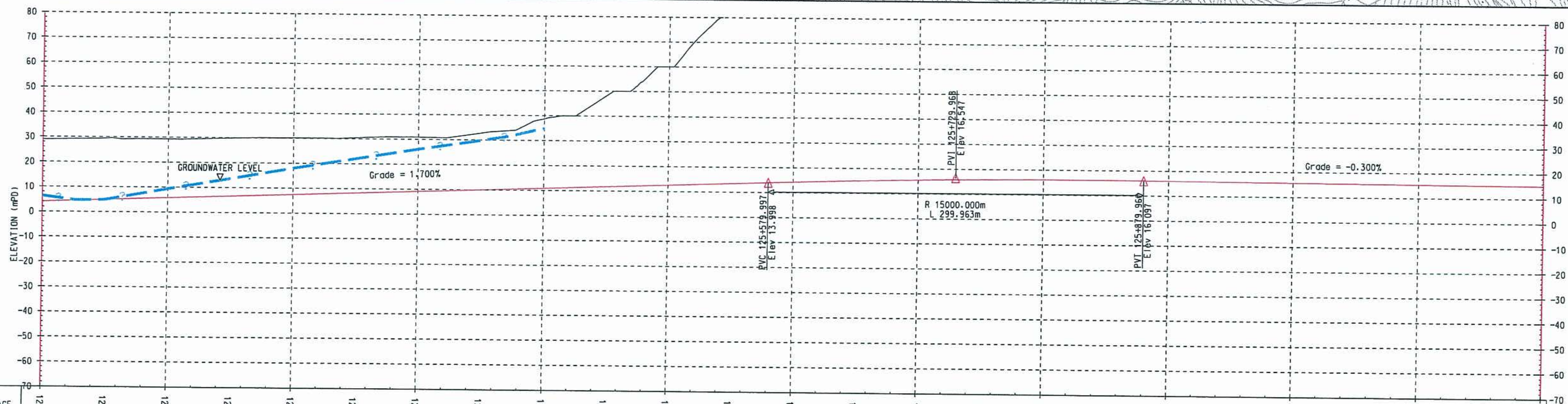


PLAN

SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.

CHAINAGE	125+000	125+050	125+100	125+150	125+200	125+250	125+300	125+350	125+400	125+450	125+500	125+550	125+600
EXISTING GROUND LEVEL	29.0	29.5	29.3	29.8	30.1	30.4	30.9	32.8	38.7	48.2	60.0	81.8	95.3
PROPOSED RAIL LEVEL	4.1	5.0	5.8	6.7	7.5	8.4	9.2	10.1	10.9	11.8	12.6	13.5	14.3

CHAINAGE	125+650	125+700	125+750	125+800	125+850	125+900	125+950	126+000	126+050	126+100	126+150	126+200
EXISTING GROUND LEVEL	96.9	111.7	116.6	134.9	131.2	140.4	144.8	150.7	138.4	132.1	146.1	141.8
PROPOSED RAIL LEVEL	15.0	15.6	15.9	16.1	16.2	16.0	15.9	15.7	15.6	15.4	15.3	15.1

HORIZONTAL ALIGNMENT DETAILS: L 160.000 A 894.427 — L 425.507 R 5000.000 — L 160.000 A 894.427

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_182B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 12

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/182

REV. B

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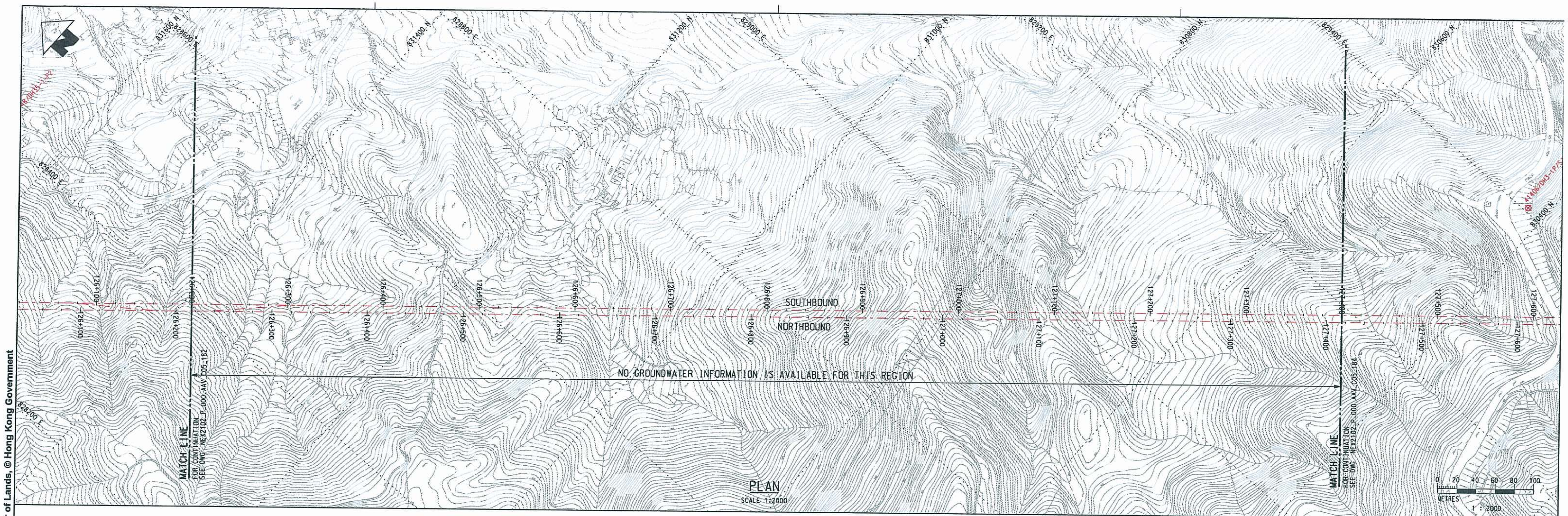

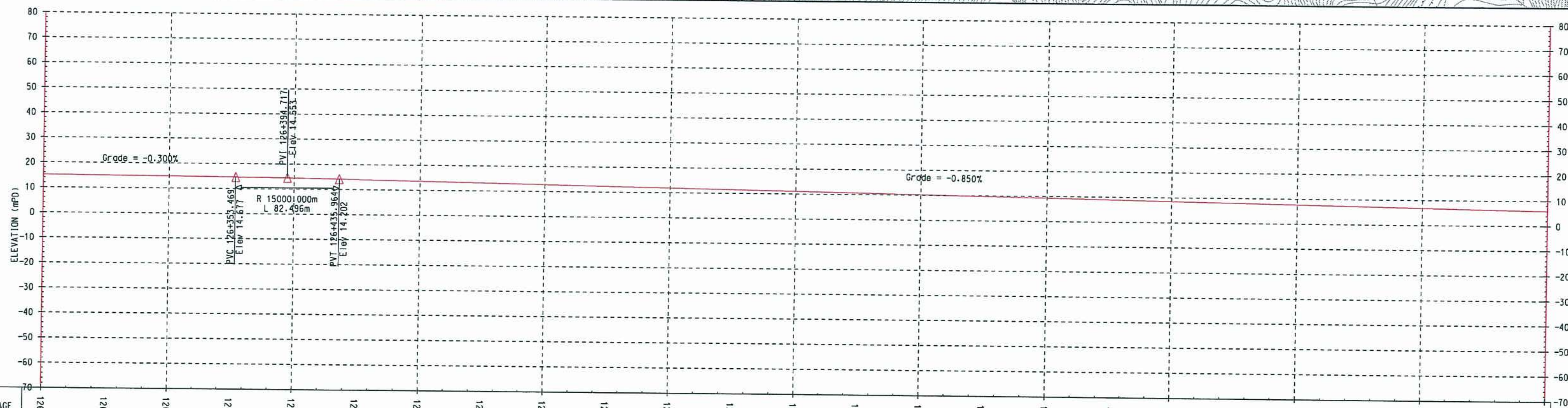

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

CHAINAGE	126+200	126+250	126+300	126+350	126+400	126+450	126+500	126+550	126+600	126+650	126+700	126+750	126+800	126+850	126+900	126+950	127+000	127+050	127+100	127+150	127+200	127+250	127+300	127+350	127+400
EXISTING GROUND LEVEL	141.8	124.0	120.0	123.5	135.1	155.3	150.0	149.7	147.9	147.4	172.1	197.1	216.9	227.6	251.7	277.3	253.3	250.0	269.9	265.1	282.4	295.3	317.8	341.7	354.6
PROPOSED RAIL LEVEL	15.1	15.0	14.8	14.7	14.5	14.1	13.7	13.2	12.8	12.4	12.0	11.5	11.1	10.7	10.3	9.8	9.4	9.0	8.6	8.1	7.7	7.3	6.9	6.4	6.0
HORIZONTAL ALIGNMENT DETAILS																									

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_183B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 13

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/183

REV. B

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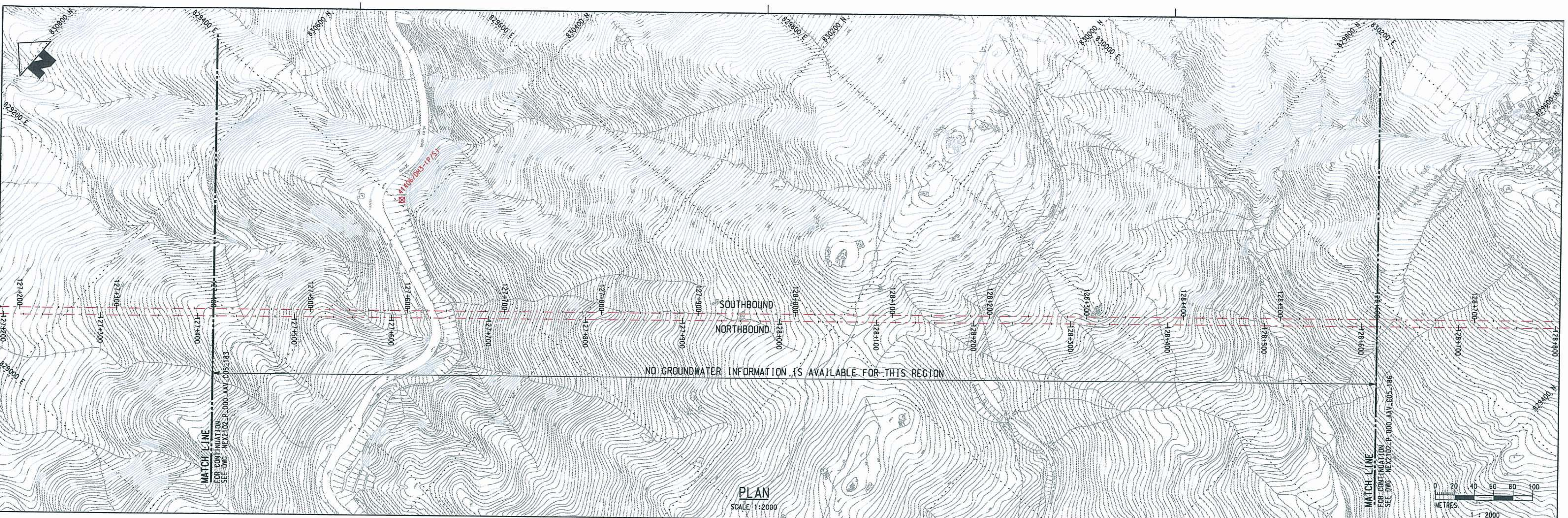
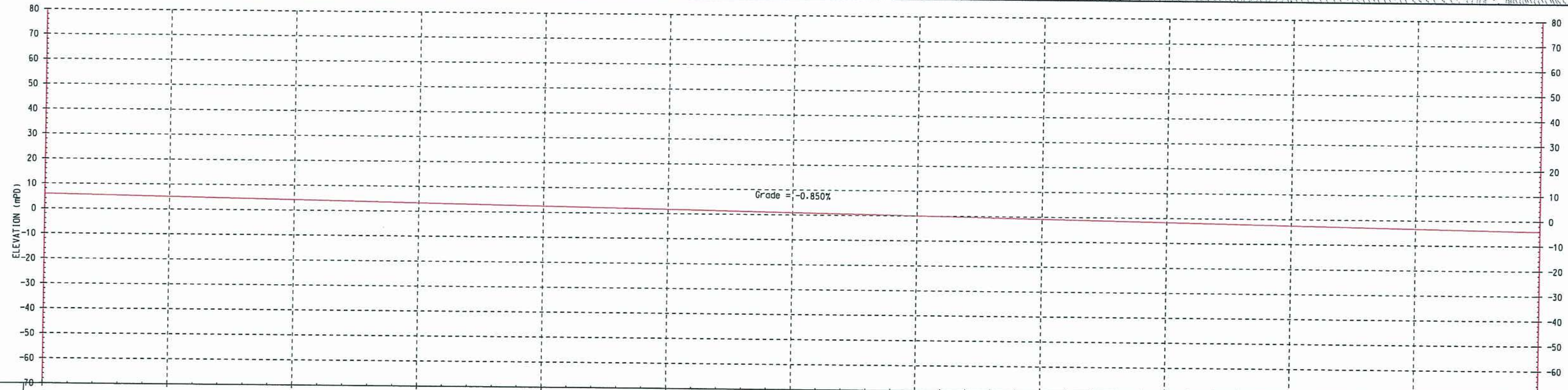


PLAN

SCALE 1:2000



CHAINAGE	127+400	127+450	127+500	127+550	127+600	127+650	127+700	127+750	127+800	127+850	127+900	127+950	128+000
EXISTING GROUND LEVEL	354.6	364.2	392.7	389.3	407.7	432.5	464.7	499.4	528.2	556.1	582.5	600.9	620.8
PROPOSED RAIL LEVEL	6.0	5.6	5.2	4.7	4.3	3.9	3.5	3.0	2.6	2.2	1.8	1.3	0.9
HORIZONTAL ALIGNMENT DETAILS													

CHAINAGE	128+050	128+100	128+150	128+200	128+250	128+300	128+350	128+400	128+450	128+500	128+550	128+600
EXISTING GROUND LEVEL	635.2	628.3	618.8	604.6	592.2	580.6	565.9	548.8	517.1	498.5	523.6	544.0
PROPOSED RAIL LEVEL	0.5	0.1	-0.4	-0.8	-1.2	-1.6	-2.1	-2.5	-2.9	-3.3	-3.8	-4.2
HORIZONTAL ALIGNMENT DETAILS												

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_184B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 14

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/184

REV. B

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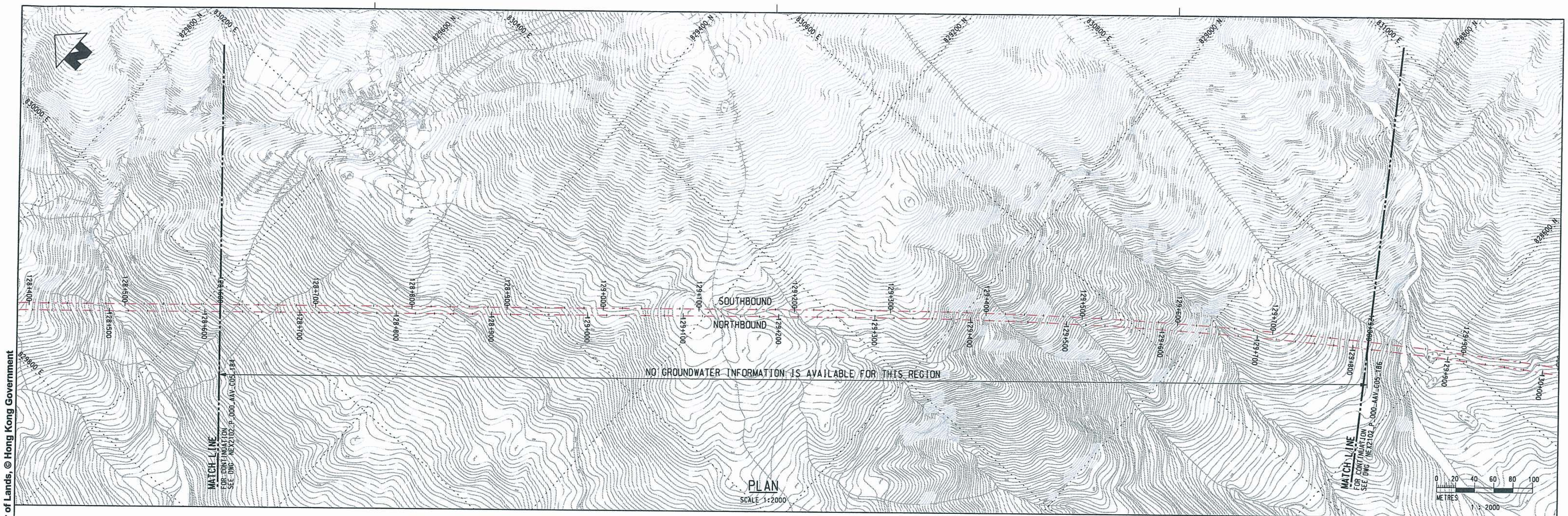

PLAN

SCALE 1:2000

CHAINAGE	128+600	128+650	128+700	128+750	128+800	128+850	128+900	128+950	129+000	129+050	129+100	129+150	129+200
EXISTING GROUND LEVEL	544.0	558.7	579.9	593.6	604.6	607.7	621.2	632.4	647.4	655.5	670.0	660.0	650.0
PROPOSED RAIL LEVEL	-4.2	-4.6	-5.0	-5.5	-5.9	-6.3	-6.7	-7.2	-7.6	-8.0	-8.4	-8.9	-9.3

CHAINAGE	129+250	129+300	129+350	129+400	129+450	129+500	129+550	129+600	129+650	129+700	129+750	129+800
EXISTING GROUND LEVEL	647.1	649.8	642.6	601.6	576.0	541.1	522.0	488.5	453.3	463.0	442.7	413.1
PROPOSED RAIL LEVEL	-9.7	-10.1	-10.6	-11.0	-11.4	-11.8	-12.3	-12.7	-13.1	-13.5	-14.0	-14.4

HORIZONTAL ALIGNMENT DETAILS: L 160.000 A 895.089; L 453.954 R 5007.400

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_185B.dgn

TITLE

NEX-2102

PRELIMINARY DESIGN

INFERRED GROUNDWATER CONTOUR

PLAN & PROFILE

SHEET 15

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/185

REV. B

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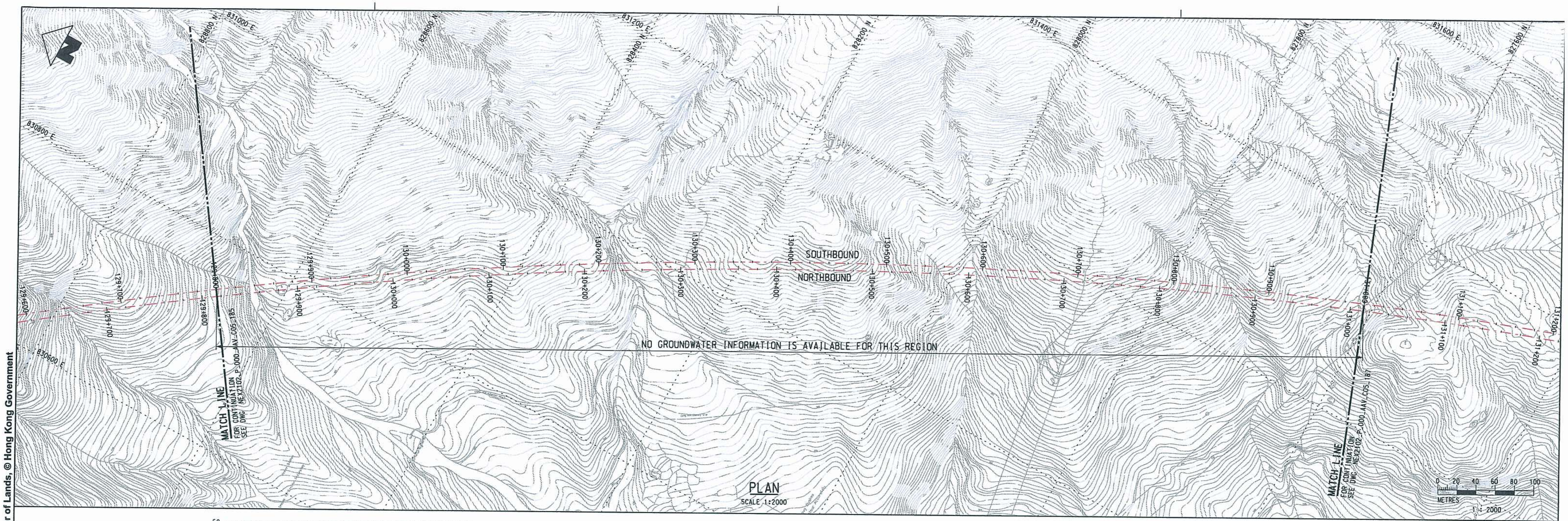
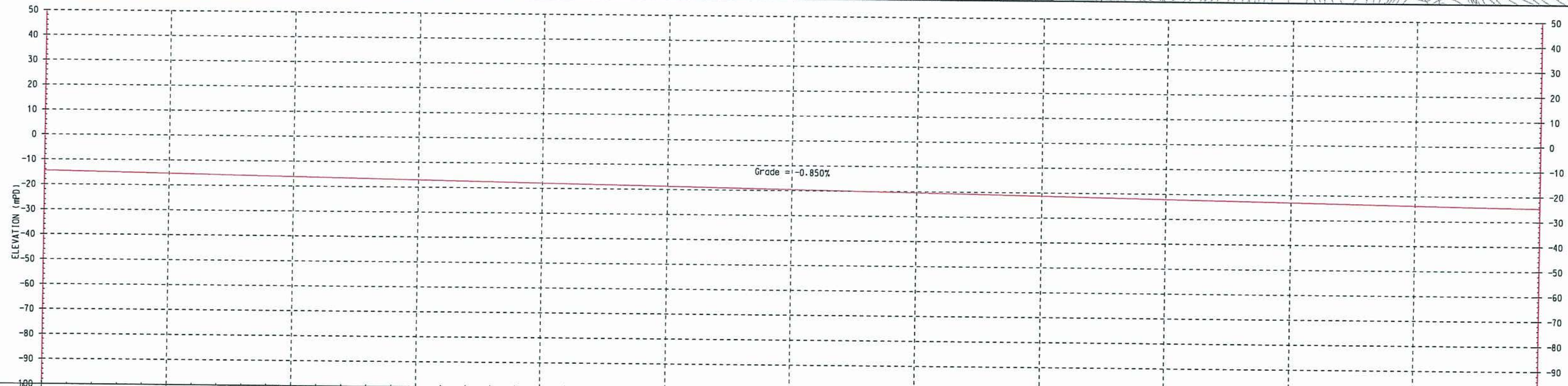


PLAN

SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

CHAINAGE	129+800	129+850	129+900	129+950	130+000	130+050	130+100	130+150	130+200	130+250	130+300	130+350
EXISTING GROUND LEVEL	413.1	394.2	397.2	399.4	388.2	382.1	387.0	379.4	367.5	356.5	368.8	385.9
PROPOSED RAIL LEVEL	-14.4	-14.8	-15.2	-15.7	-16.1	-16.5	-16.9	-17.4	-17.8	-18.2	-18.6	-19.1
HORIZONTAL ALIGNMENT DETAILS												

CHAINAGE	130+400	130+450	130+500	130+550	130+600	130+650	130+700	130+750	130+800	130+850	130+900	130+950	131+000
EXISTING GROUND LEVEL	386.7	393.7	371.6	340.0	332.7	358.8	369.5	363.8	351.0	322.6	328.5	312.1	302.6
PROPOSED RAIL LEVEL	-19.5	-19.9	-20.3	-20.8	-21.2	-21.6	-22.0	-22.5	-22.9	-23.3	-23.7	-24.2	-24.6
HORIZONTAL ALIGNMENT DETAILS													

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_186B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 16

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/186

REV. B

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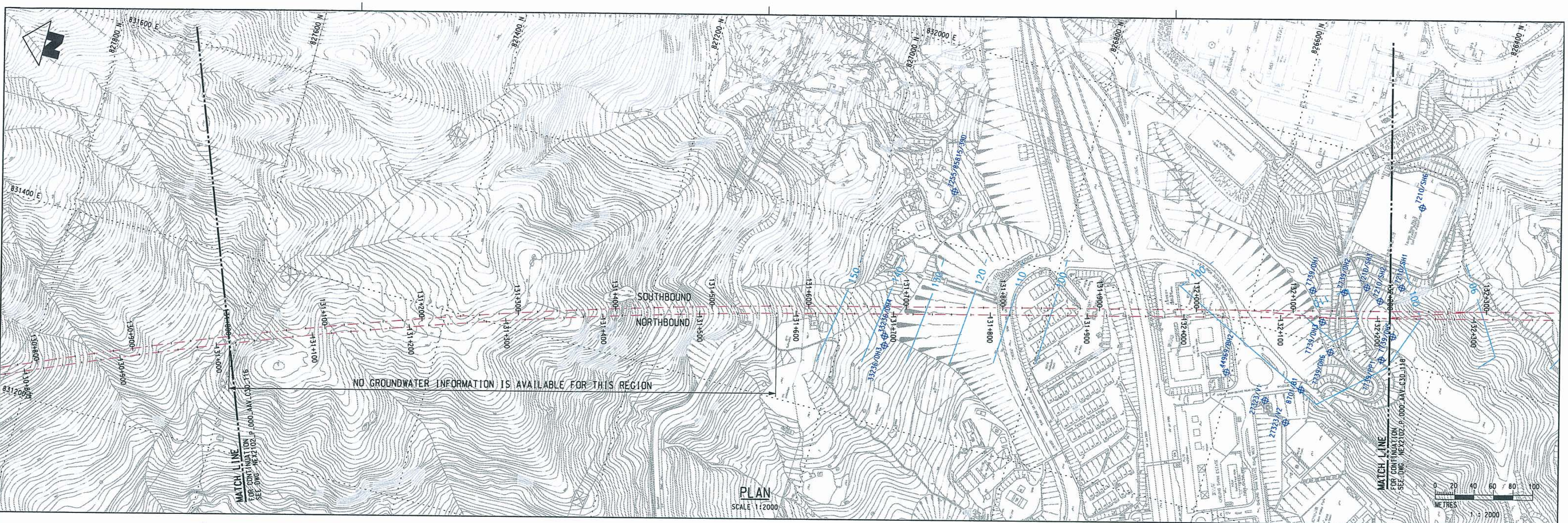
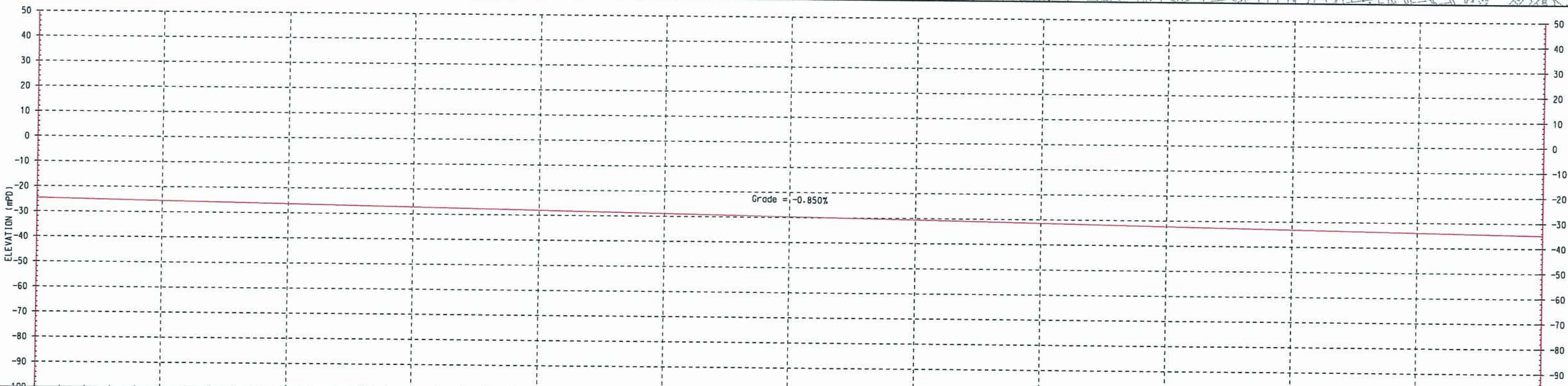


PLAN

SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED INDICATIVE ONLY.
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
131+000	302.6	-24.6
131+050	324.3	-25.0
131+100	320.8	-25.4
131+150	324.8	-25.9
131+200	320.0	-26.3
131+250	310.7	-26.7
131+300	310.0	-27.1
131+350	304.2	-27.6
131+400	279.9	-28.0
131+450	244.1	-28.4
131+500	221.9	-28.8
131+550	201.3	-29.3
131+600	179.2	-29.7
131+650	162.7	-30.1
131+700	149.8	-30.5
131+750	126.0	-31.0
131+800	104.7	-31.4
131+850	106.0	-31.8
131+900	99.9	-32.2
131+950	90.7	-32.7
132+000	91.1	-33.1
132+050	100.4	-33.5
132+100	120.2	-33.9
132+150	113.4	-34.4
132+200	129.1	-34.8

HORIZONTAL ALIGNMENT DETAILS: L 529.872 R 5007.400; L 160.000 A 895.089

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_187B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 17

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/187

REV. B

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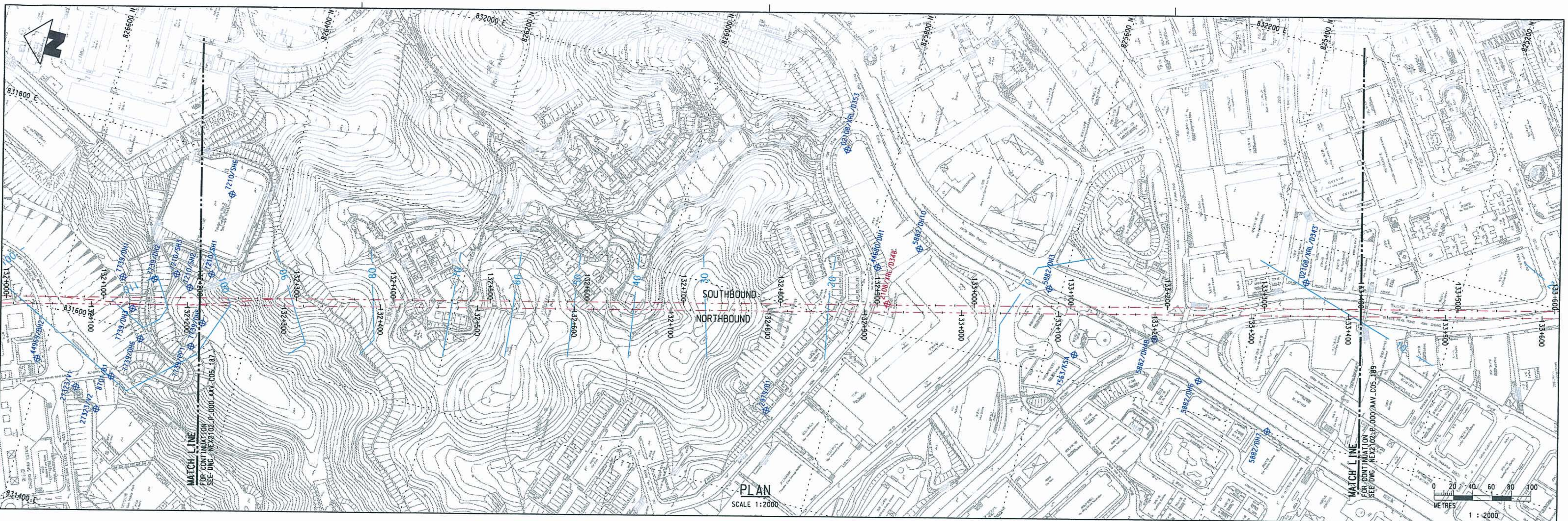
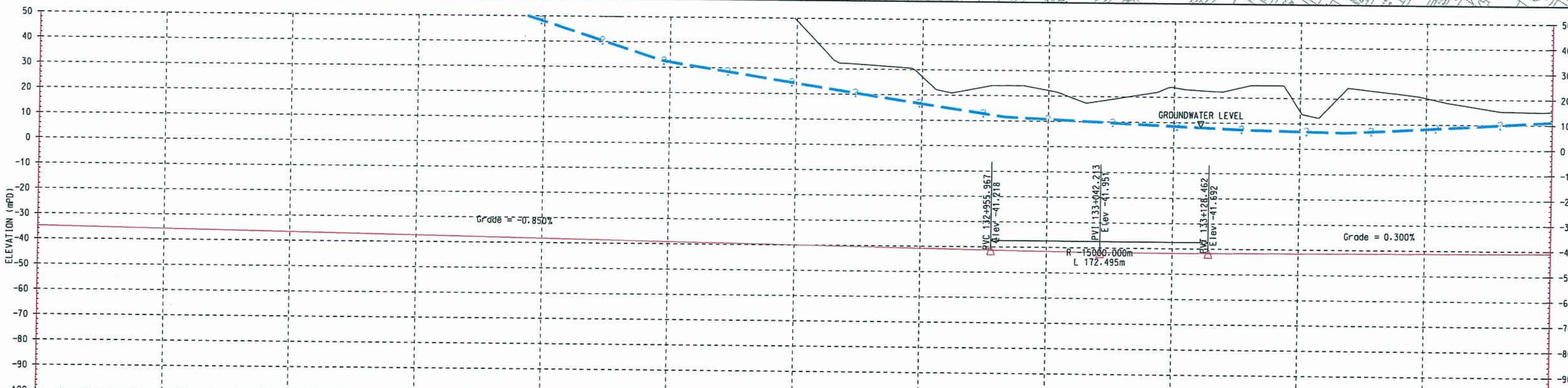


PLAN

SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

CHAINAGE	132+200	132+250	132+300	132+350	132+400	132+450	132+500	132+550	132+600	132+650	132+700	132+750
EXISTING GROUND LEVEL	129.1	109.5	90.0	82.6	72.9	60.3	67.2	73.5	63.0	50.0	69.5	70.2
PROPOSED RAIL LEVEL	-34.8	-35.2	-35.6	-36.1	-36.5	-36.9	-37.3	-37.8	-38.2	-38.6	-39.0	-39.5
HORIZONTAL ALIGNMENT DETAILS												

CHAINAGE	132+800	132+850	132+900	132+950	133+000	133+050	133+100	133+150	133+200	133+250	133+300	133+350	133+400
EXISTING GROUND LEVEL	49.0	32.0	27.2	23.5	22.2	19.0	23.8	23.7	14.8	23.6	20.5	16.1	15.3
PROPOSED RAIL LEVEL	-39.9	-40.3	-40.7	-41.2	-41.5	-41.7	-41.8	-41.6	-41.5	-41.3	-41.2	-41.0	-40.9
HORIZONTAL ALIGNMENT DETAILS													

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_188B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 18

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/188

REV. B

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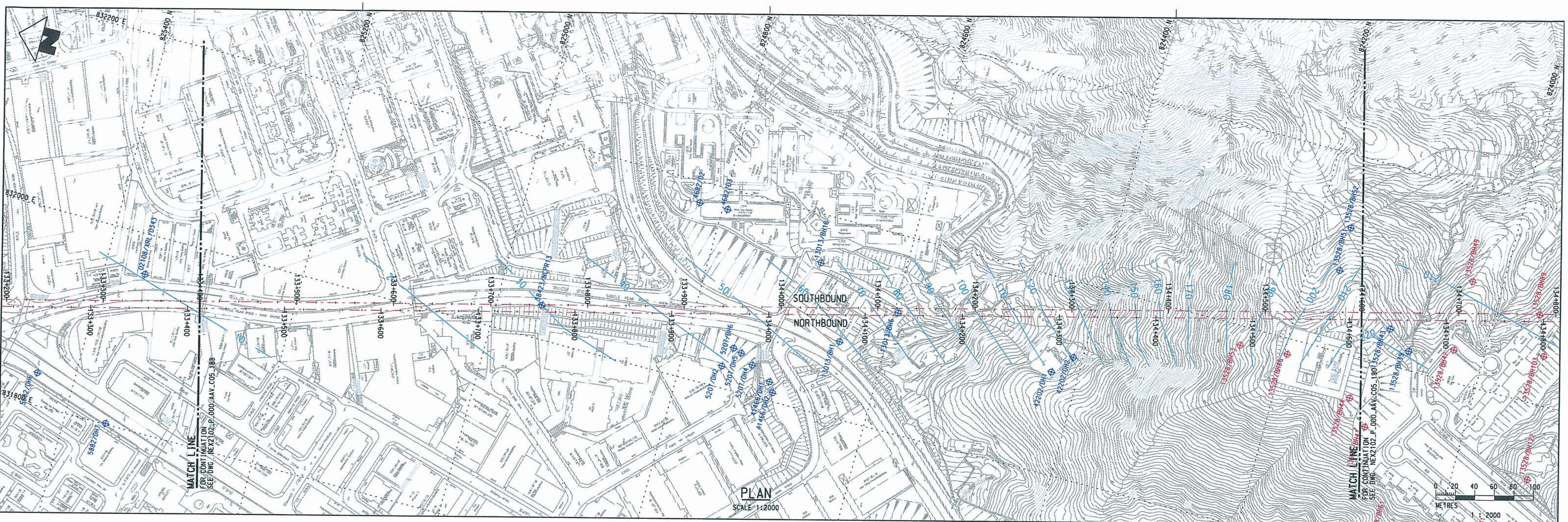

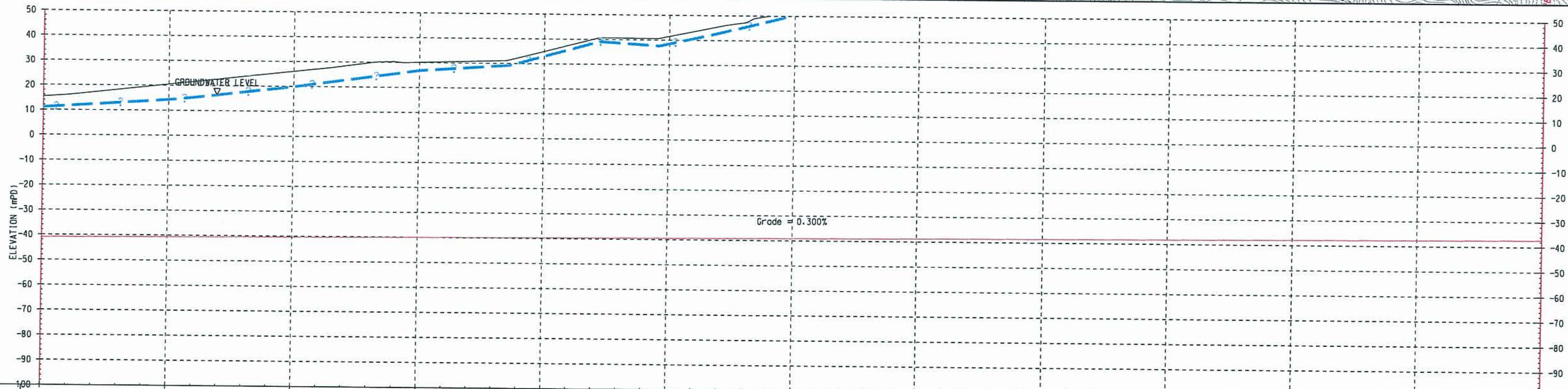

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

CHAINAGE	133+400	133+450	133+500	133+550	133+600	133+650	133+700	133+750	133+800	133+850	133+900	133+950	134+000
EXISTING GROUND LEVEL	15.3	17.7	20.5	23.3	26.1	29.0	30.1	30.8	35.0	40.7	41.5	46.5	54.3
PROPOSED RAIL LEVEL	-40.9	-40.7	-40.6	-40.4	-40.3	-40.1	-40.0	-39.8	-39.7	-39.5	-39.4	-39.2	-39.1
HORIZONTAL ALIGNMENT DETAILS													

CHAINAGE	134+050	134+100	134+150	134+200	134+250	134+300	134+350	134+400	134+450	134+500	134+550	134+600
EXISTING GROUND LEVEL	65.6	64.9	80.8	84.0	99.1	116.3	144.5	175.7	211.8	243.6	242.5	240.5
PROPOSED RAIL LEVEL	-38.9	-38.8	-38.6	-38.5	-38.3	-38.2	-38.0	-37.9	-37.7	-37.6	-37.4	-37.3
HORIZONTAL ALIGNMENT DETAILS												

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_189B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 19

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/189

REV. B

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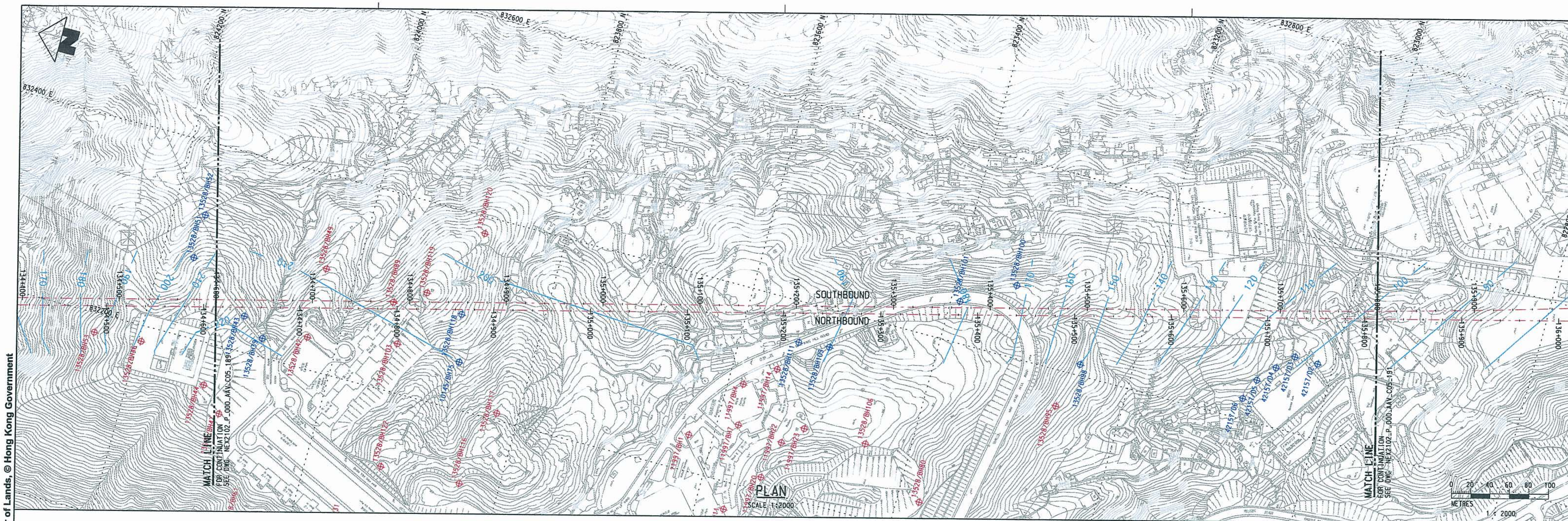

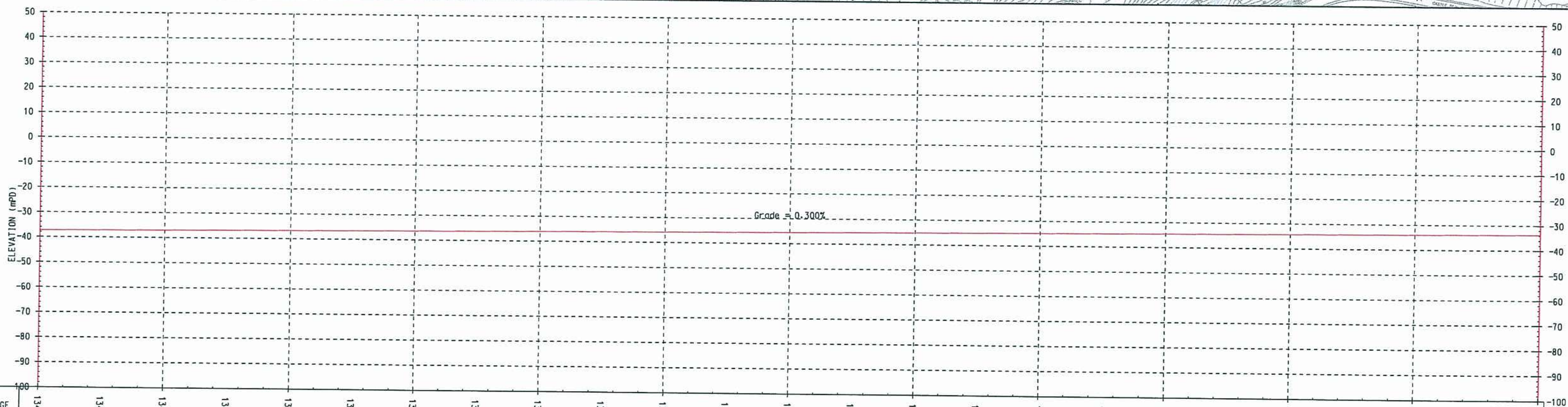

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED
2. INFERRED GROUNDWATER TABLE LIES OUTSIDE THE CROSS SECTION.

CHAINAGE	134+600	134+650	134+700	134+750	134+800	134+850	134+900	134+950	135+000	135+050	135+100	135+150	135+200	135+250	135+300	135+350	135+400	135+450	135+500	135+550	135+600	135+650	135+700	135+750	135+800
EXISTING GROUND LEVEL	240.5	227.1	230.0	216.1	229.8	220.0	200.0	201.7	191.2	185.9	197.8	207.7	200.9	196.5	193.6	194.4	194.9	185.4	170.4	164.1	151.5	136.6	119.7	101.8	111.9
PROPOSED RAIL LEVEL	-37.3	-37.1	-37.0	-36.8	-36.7	-36.5	-36.4	-36.2	-36.1	-35.9	-35.8	-35.6	-35.5	-35.3	-35.2	-35.0	-34.9	-34.7	-34.6	-34.4	-34.3	-34.1	-34.0	-33.8	-33.7
HORIZONTAL ALIGNMENT DETAILS	L 90.000 A 821.584	L 45.635 R 7500.000																							

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_190B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 20

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/190

REV. B

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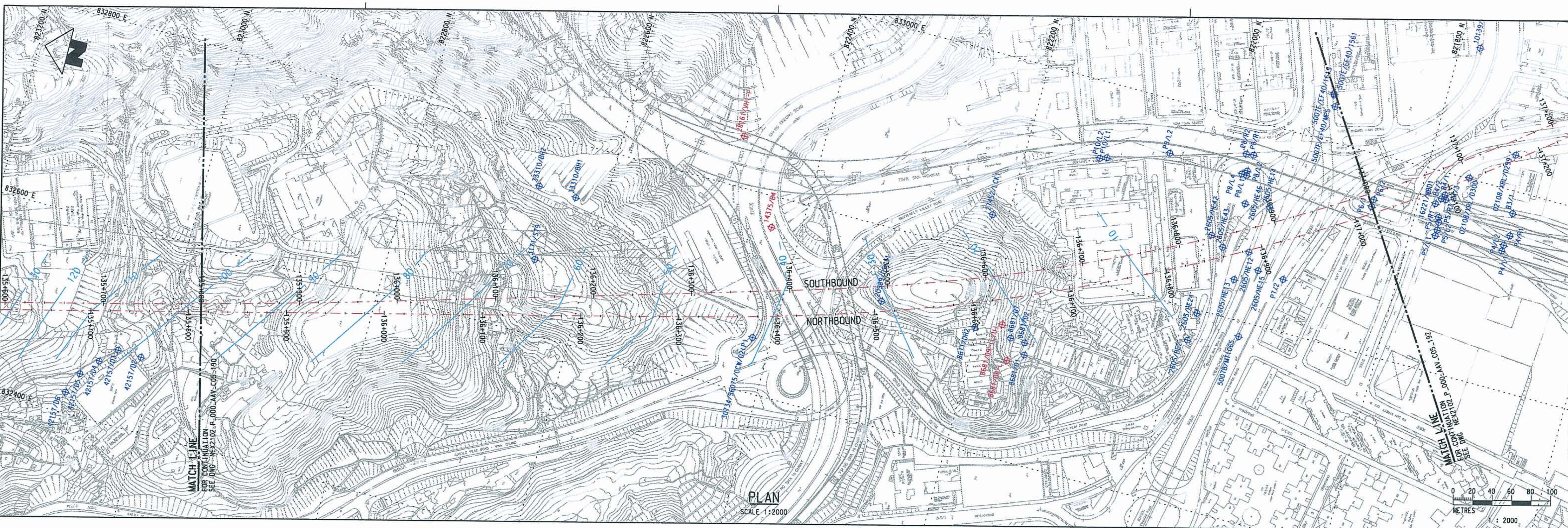

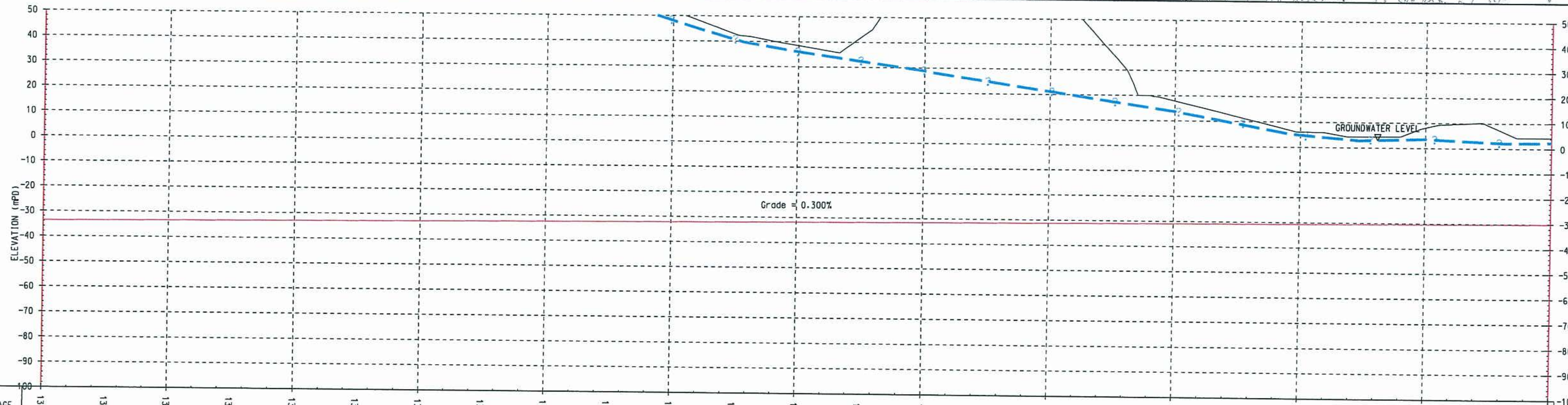

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
135+800	111.9	-33.7
135+850	112.0	-33.5
135+900	123.9	-33.4
135+950	133.5	-33.2
136+000	134.5	-33.1
136+050	115.4	-32.9
136+100	89.0	-32.8
136+150	102.8	-32.6
136+200	99.2	-32.5
136+250	81.9	-32.3
136+300	53.4	-32.2
136+350	42.7	-32.0
136+400	38.5	-31.9
136+450	42.1	-31.7
136+500	70.0	-31.6
136+550	70.0	-31.4
136+600	64.4	-31.3
136+650	36.6	-31.1
136+700	17.9	-31.0
136+750	11.8	-30.8
136+800	6.1	-30.7
136+850	4.4	-30.5
136+900	8.2	-30.4
136+950	9.2	-30.2
137+000	4.3	-30.1

HORIZONTAL ALIGNMENT DETAILS: L 142.214 R 7500.000; L 90.000 A 821.584; L 200.000 A 632.456; L 472.137 R 2000.000

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_191B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 21

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/191

REV. B

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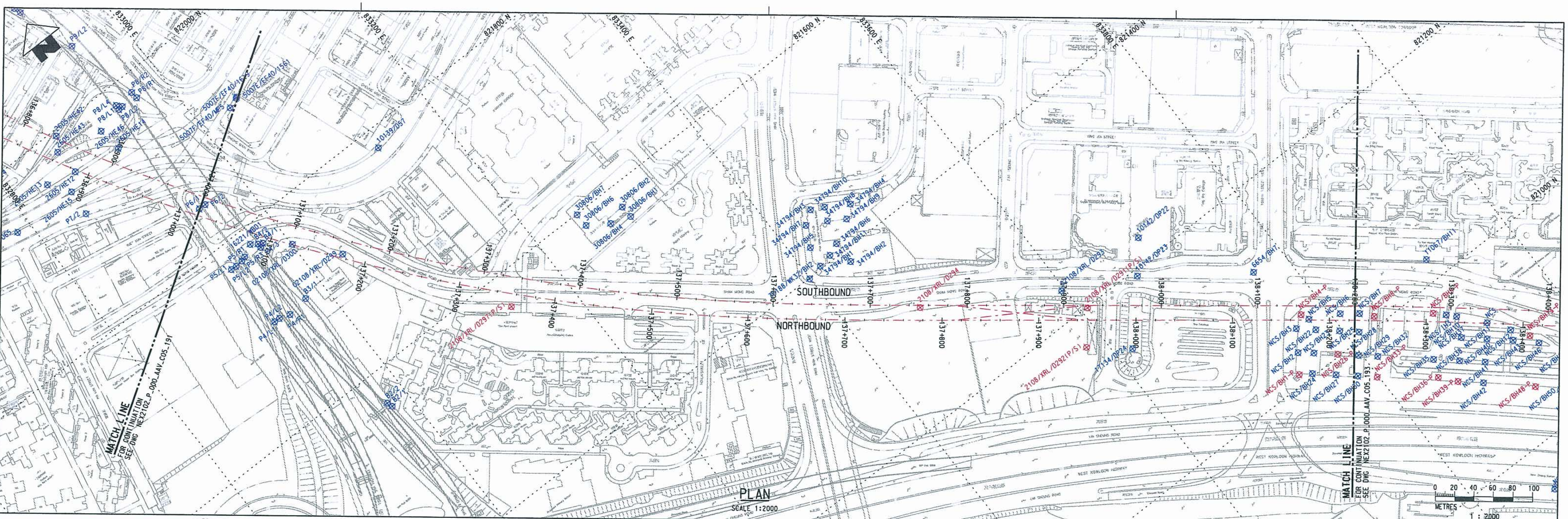
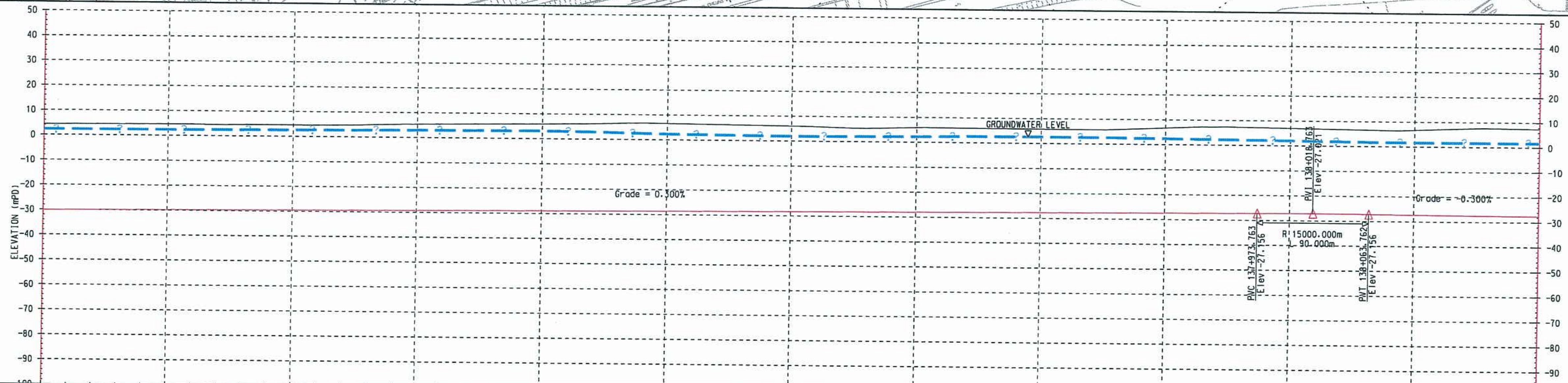


PLAN

SCALE 1:2000



CHAINAGE	137+000	137+050	137+100	137+150	137+200	137+250	137+300	137+350	137+400	137+450	137+500	137+550	137+600	137+650	137+700	137+750	137+800	137+850	137+900	137+950	138+000	138+050	138+100	138+150	138+200
EXISTING GROUND LEVEL	4.3	4.5	4.6	4.5	4.6	4.8	5.4	5.7	5.9	6.3	6.6	6.3	6.0	5.4	5.9	5.9	5.8	5.7	6.7	7.4	7.1	6.7	6.7	7.6	7.4
PROPOSED RAIL LEVEL	-30.1	-29.9	-29.8	-29.6	-29.5	-29.3	-29.2	-29.0	-28.9	-28.7	-28.6	-28.4	-28.3	-28.1	-28.0	-27.8	-27.7	-27.5	-27.4	-27.2	-27.1	-27.1	-27.3	-27.4	-27.6

HORIZONTAL ALIGNMENT DETAILS: L 563.249 R 2000.000 | L 200.000 A 632.456 | L 78.274 A 633.404

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_192B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 22

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/192

REV. B

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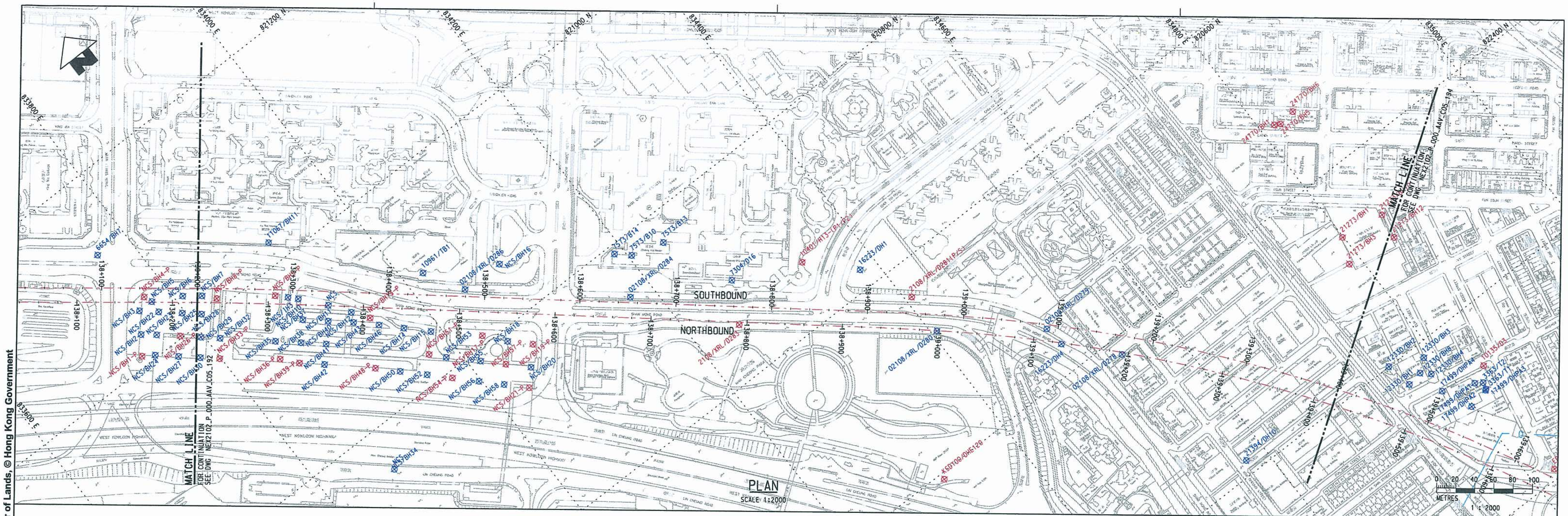
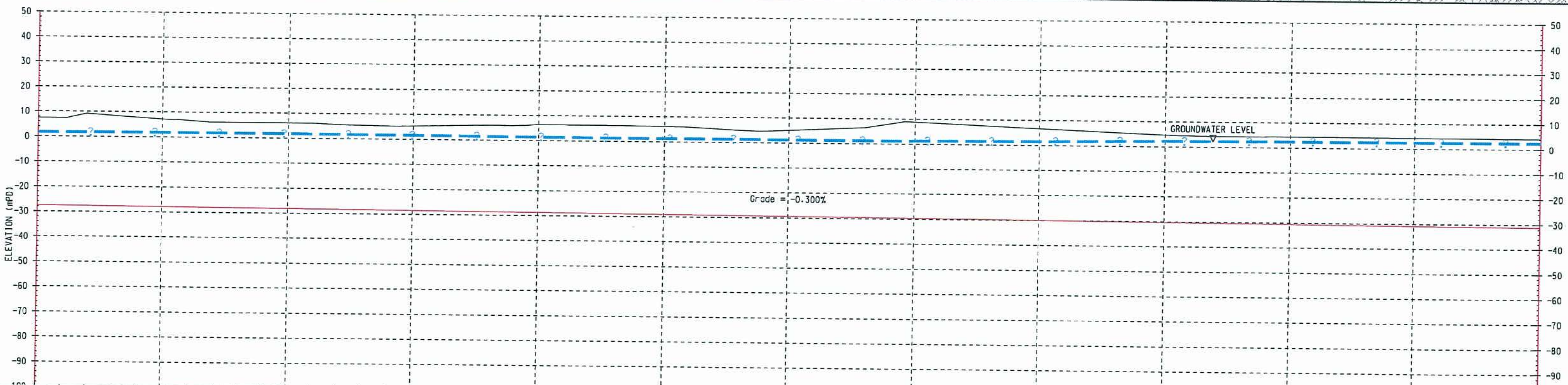


PLAN
SCALE 1:2000



CHAINAGE	138+200	138+250	138+300	138+350	138+400	138+450	138+500	138+550	138+600	138+650	138+700	138+750	138+800
EXISTING GROUND LEVEL	7.4	8.8	7.2	6.1	6.1	5.5	5.3	5.9	6.4	6.3	6.1	5.2	5.1
PROPOSED RAIL LEVEL	-27.6	-27.7	-27.9	-28.0	-28.2	-28.3	-28.5	-28.6	-28.8	-28.9	-29.1	-29.2	-29.4

CHAINAGE	138+850	138+900	138+950	139+000	139+050	139+100	139+150	139+200	139+250	139+300	139+350	139+400
EXISTING GROUND LEVEL	6.2	8.8	7.7	6.7	5.7	4.7	4.3	4.4	4.4	4.4	4.3	4.3
PROPOSED RAIL LEVEL	-29.5	-29.7	-29.8	-30.0	-30.1	-30.3	-30.4	-30.6	-30.7	-30.9	-31.0	-31.2

HORIZONTAL ALIGNMENT DETAILS: L 1.726 A 633.404; L 95.801 R 5015.000; L 80.000 A 633.404; L 150.000 A 497.494; L 383.888 R 1650.000

PROFILE
SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:
1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR
EXPRESS RAIL LINK
ORIGINATOR
Arup Atkins JV
Supported by TFP Farrells, DLS, SIYUAN, Knight Frank, Team 73
CADD REF. NEX2102_P_000_AAV_C05_193B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 23

SCALE 1 : 2000 (A1) | DRAWING NO. NEX2102/P/000/AAV/C05/193 | REV. B

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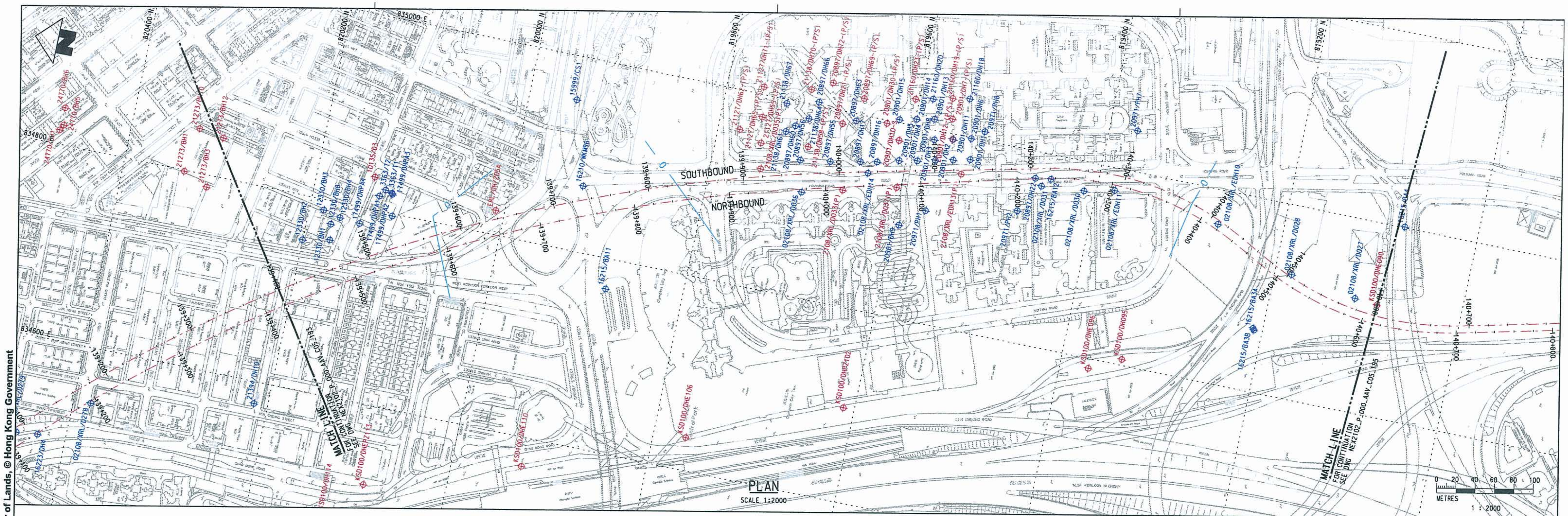

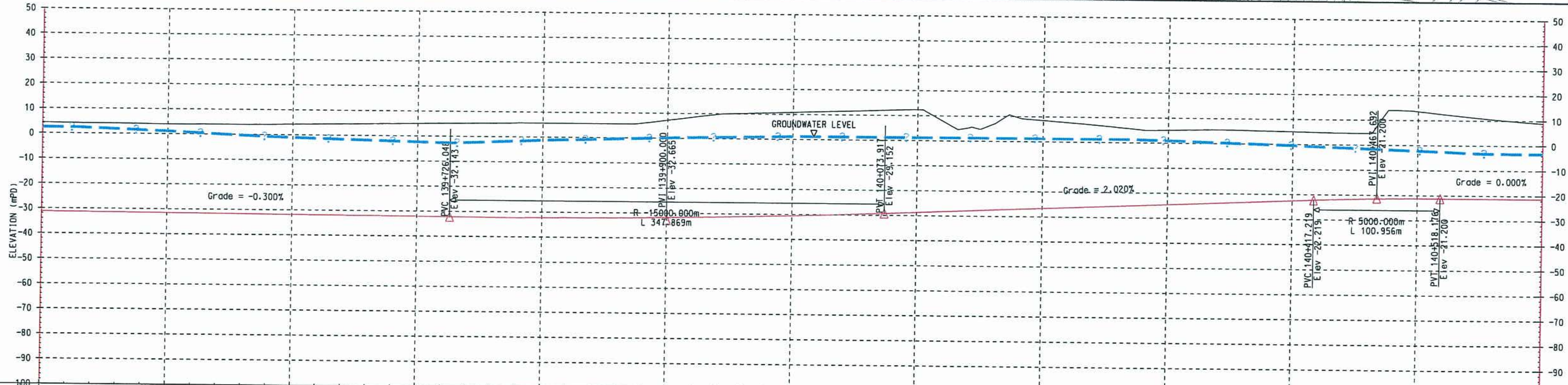

CHAINAGE	139+400	139+450	139+500	139+550	139+600	139+650	139+700	139+750	139+800	139+850	139+900	139+950	140+000	140+050	140+100	140+150	140+200	140+250	140+300	140+350	140+400	140+450	140+500	140+550	140+600
EXISTING GROUND LEVEL	4.3	4.1	3.9	4.0	4.2	4.6	5.0	5.3	5.6	5.6	7.2	10.0	10.8	11.6	12.4	4.7	8.5	6.5	5.1	5.5	5.0	4.7	13.5	11.0	8.9
PROPOSED RAIL LEVEL	-31.2	-31.3	-31.5	-31.6	-31.8	-31.9	-32.1	-32.2	-32.2	-32.0	-31.7	-31.1	-30.5	-29.6	-28.6	-27.6	-26.6	-25.6	-24.6	-23.6	-22.6	-21.7	-21.2	-21.2	-21.2
HORIZONTAL ALIGNMENT DETAILS						L 537.476 R 1650.000							L 150.000 A 497.494				L 36.000 A 103.923		L 178.752 R 300.000		L 36.000 A 103.923	L 36.000 A 103.923		L 110.765 R 300.000	

PROFILE

SCALE 1:2000 HORI. 1:1000 VERT.

NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR

EXPRESS RAIL LINK

ORIGINATOR

Arup Atkins JV

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

CADD REF. NEX2102_P_000_AAV_C05_194B.dgn

TITLE

NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 24

SCALE 1 : 2000 (A1)

DRAWING NO. NEX2102/P/000/AAV/C05/194

REV. B

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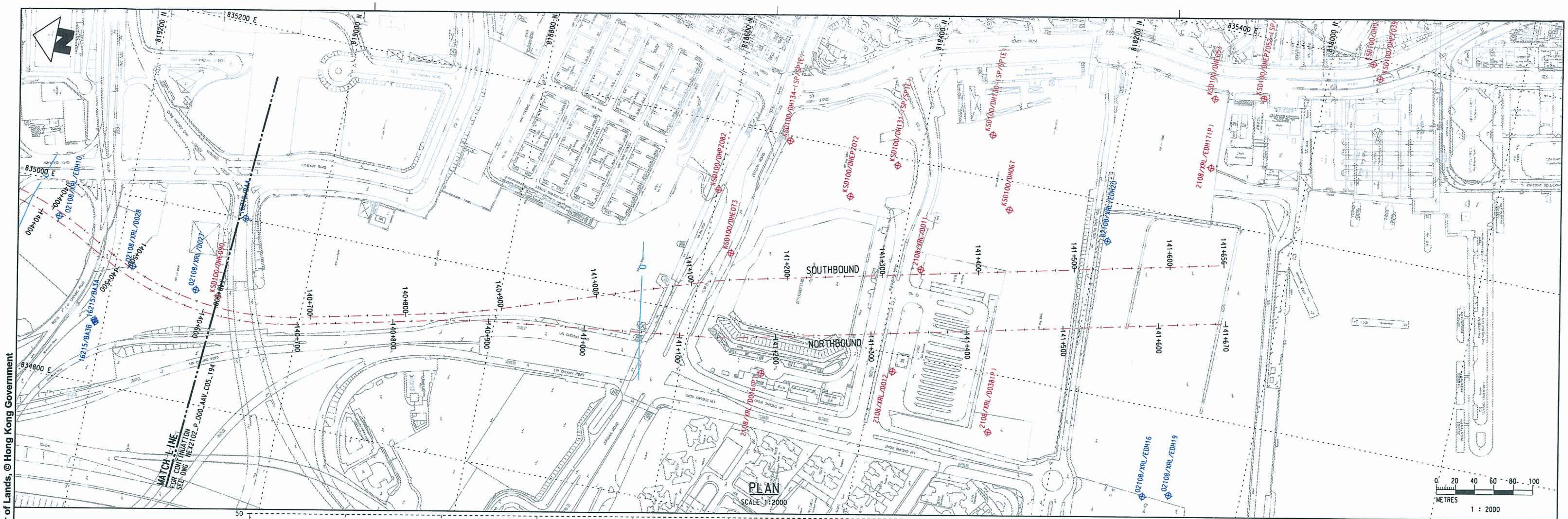
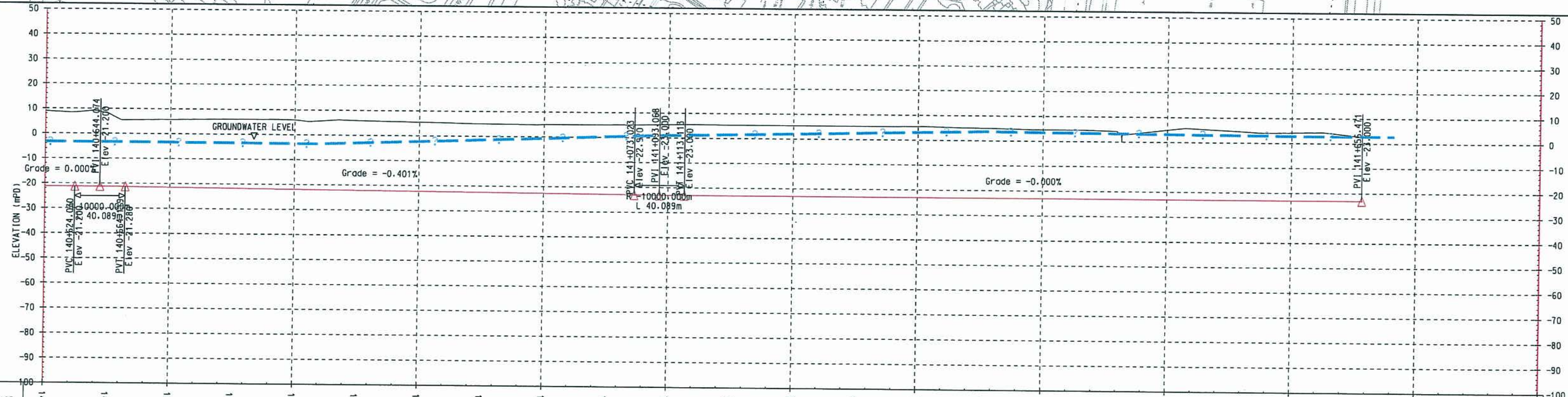


PLAN
SCALE 1:2000



NOTE:

1. DUE TO AN INSUFFICIENCY IN GROUNDWATER MONITORING DATA, ALL GROUNDWATER CONTOURS DETAILED SHALL BE CONSIDERED

CHAINAGE	EXISTING GROUND LEVEL	PROPOSED RAIL LEVEL
140+600	8.9	-21.2
140+650	8.1	-21.2
140+700	5.7	-21.4
140+750	6.0	-21.6
140+800	5.9	-21.8
140+850	5.9	-22.0
140+900	5.4	-22.2
140+950	5.0	-22.4
141+000	4.9	-22.6
141+050	5.0	-22.8
141+100	5.3	-23.0
141+150	5.4	-23.0
141+200	5.4	-23.0
141+250	5.4	-23.0
141+300	5.5	-23.0
141+350	5.0	-23.0
141+400	4.6	-23.0
141+450	4.4	-23.0
141+500	4.9	-23.0
141+550	4.8	-23.0
141+600	4.2	-23.0
141+650	3.0	-23.0
141+700		
141+750		
141+800		

HORIZONTAL ALIGNMENT DETAILS: L 71.076 R 300.000; L 36.000 A 103.923; L 20.000 A 105.357; L 46.202 R 561.344; L 20.000 A 89.443; L 20.048 R 400.000; L 20.000 A 89.443

PROFILE
SCALE 1:2000 HORI. 1:1000 VERT.

REV	DESCRIPTION	BY	DATE	APPROVED
B	PRELIMINARY DESIGN STAGE (FINAL)	LW	24NOV08	JM
A	PRELIMINARY DESIGN STAGE (INTERIM)	JB	25AUG08	JM

DRAWN	LW
DESIGNED	AC
CHECKED	JB
APPROVED	JM
DATE	12/AUG/2008

MTR
EXPRESS RAIL LINK

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

CADD REF. NEX2102_P_000_AAV_C05_195B.dgn

TITLE
NEX-2102
PRELIMINARY DESIGN
INFERRED GROUNDWATER CONTOUR
PLAN & PROFILE
SHEET 25

SCALE 1 : 2000 (A1)
DRAWING NO. NEX2102/P/000/AAV/C05/195
REV. B

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