

Supplemental Agreement No. 1
to
Agreement No. CE 54/2001 (CE)

Wan Chai Development Phase II Planning and Engineering Review



Compliance with the Overriding Public Need Test Minimum Reclamation Report

February 2007

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MAUNSELL CONSULTANTS ASIA LTD

**SA1 to Agreement No. CE54/2001 (CE)
WAN CHAI DEVELOPMENT PHASE II
PLANNING AND ENGINEERING REVIEW**

**COMPLIANCE WITH THE OVERRIDING PUBLIC NEED TEST
MINIMUM RECLAMATION REPORT**

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1 INTRODUCTION

1.1 Background

- 1.1.1 The planning and engineering review of the development and reclamation proposals for the Wan Chai Development Phase II project (the “WDII Review”) is being undertaken in response to the Court of Final Appeal (CFA) judgment handed down on 9 January 2004 in respect of the judicial review on the Draft Wan Chai North Outline Zoning Plan No. S/H25/1 (the draft OZP).
- 1.1.2 The CFA ruled that the presumption against reclamation in the Protection of the Harbour Ordinance (PHO) can only be rebutted by establishing an overriding public need for reclamation (the “Overriding Public Need Test”), and that there must be cogent and convincing materials available to enable the decision-maker to be satisfied that the test is fulfilled for rebutting the presumption against reclamation.
- 1.1.3 The main purpose of the WDII project is to provide land within the WDII project area for the construction of the Trunk Road (comprising the Central Wan-Chai Bypass (CWB) which runs from Central Interchange in Central Reclamation Phase I through the Central Reclamation Phase III (CRIII) and WDII project areas, and the Island Eastern Corridor Link (IECL), which provides connection from the eastern portal of the CWB to the Island Eastern Corridor (IEC)), as well as other key transport infrastructure including the necessary ground level roads for connection to the Trunk Road and to cater for through traffic from Central to Wan Chai and Causeway Bay. The objective of the WDII Review is to assess individually the purpose and extent of each proposed reclamation by reference to the Overriding Public Need Test.
- 1.1.4 As it is the Trunk Road which forms the basis of the WDII project proposals and which ultimately determines the form of the waterfront along this part of the north shore of Hong Kong Island, the Trunk Road must, itself, pass the Overriding Public Need Test, such that it satisfies the CFA’s ruling on compliance with the PHO. Once the need for the Trunk Road is established, any reasonable alternative to reclamation for the Trunk Road (ie “no-reclamation” options) need to be identified. If there is no reasonable alternative to reclamation, the Trunk Road scheme must ensure that reclamation is restricted to only the minimum amount necessary to meet the overriding public need.

1.2 Review of Trunk Road Alignments

- 1.2.1 In compliance with the CFA judgment, an overriding public need for the Trunk Road has been established. A district traffic study has confirmed that a dual 3-lane Trunk Road, together with intermediate slip roads, is required to divert traffic away from the existing east-west corridor and to provide adequate relief to the corridor and the local road network. The need for the Trunk Road has also been confirmed by the Expert Panel on Sustainable Transport Planning and Central-Wan Chai Bypass (‘Expert Panel’), which supports the construction of the CWB and the provision of two sets of planned slip roads at Wan Chai and Causeway Bay, and recognises the need for the ground level Road P2. Among the package of measures recommended, the Expert Panel recommends the

construction of a bypass as a medium-term solution to tackle the problem of deteriorating traffic congestion in the Central and Wan Chai area. The Expert Panel considers that the Trunk Road is essential to improve the reliability of the road network. Reference can be made to the “Report of the Expert Panel on Sustainable Transport Planning and Central-Wan Chai Bypass”.

- 1.2.2 Having established the need for the Trunk Road, “no reclamation” scenarios must be considered when considering Trunk Road proposals. Only if the need for reclamation can be demonstrated to be necessary will scenarios involving minimum reclamation be contemplated.
- 1.2.3 During the first phase of the WDII Review, various Trunk Road alignments and forms of construction were examined, together with ideas for harbour-front enhancement, taking on board traffic demand and road network functionality, engineering feasibility and public views and opinions. These studies were undertaken under the guidance of the Harbour-front Enhancement Committee (HEC) Sub-committee on WDII Review. The only feasible Trunk Road routeing was found to be along the foreshore of Wan Chai and Causeway Bay. Alternative alignments including offshore and inland routeings were also examined but found not feasible as they are constrained by existing developments and essential public service infrastructure. Reclamation was found to be required, for all feasible Trunk Road alignments, at the western end of the WDII project area due to the need to cross over the existing MTR Tsuen Wan line, which causes the Trunk Road tunnel structure to lie above the seabed through this area, and, in the east where a Trunk Road tunnel would rise above seabed level to a ground level tunnel portal, for connection to the existing Island Eastern Corridor (IEC) flyover. The studies concluded that all schemes for the Trunk Road alignment through the WDII project area will require reclamation, and that there is no “no-reclamation” alignment for the Trunk Road within the WDII project area.
- 1.2.4 Subsequently, a preferred Trunk Road scheme has been endorsed by the Sub-committee on WDII Review as the basis of the development of the Concept Plan, which in turn will form the basis for the preparation of the draft Recommended Outline Development Plan (RODP) in the following stage of the Project. This Trunk Road scheme, “Trunk Road Tunnel Variation 1”, has been found to affect the least area of the Harbour, in compliance with the requirement of the PHO to preserve and protect the Harbour. Nevertheless, the scheme does involve reclamation and, in accordance with the CFA judgment, it is necessary that each area of reclamation be justified by reference to the overriding need; and each area of reclamation must be demonstrated to be the minimum required by the overriding need.

1.3 Purpose of this Report

- 1.3.1 The purpose of this report is to address the last part of the CFA judgment on overriding public need, that the extent of the proposed reclamation should not go beyond the minimum of that which is required by the overriding need. This Report briefly describes the preferred Trunk Road scheme together with associated infrastructure and reprovisioning requirements for affected waterfront facilities, and the reclamation associated with these, and demonstrates that this area of reclamation is the minimum.

2 RECLAMATION REQUIREMENTS

2.1 The Preferred Trunk Road Scheme

- 2.1.1 The preferred scheme, Trunk Road Tunnel Variation 1, provides for the necessary functional requirements of the road network, in meeting the overriding public need for the Trunk Road, as well as resulting in the least affected area of the Harbour, in conformance with the PHO.
- 2.1.2 A detailed examination of Trunk Road needs and constraints, including an exhaustive investigation into the need for reclamation for the Trunk Road construction and of alternative schemes that might do away with reclamation or, at least, minimise reclamation, as well as review of harbour-front enhancement suggestions put forward by the public and the consolidation of these with the Trunk Road ideas, has been carried out. Reference can be made to the “Report to the HEC Sub-committee on WDII Review on Trunk Road Alignments & Harbour-front Enhancement”. After due consideration of these investigations, the HEC Sub-committee on WDII Review agreed at their meeting on 13 June 2006 to endorse Trunk Road Tunnel Variation 1 as the basis for proceeding to the next stage of the “Harbour-front Enhancement Review – Wan Chai, Causeway Bay and Adjoining Areas” under the steer of the HEC Sub-committee on WDII Review, the preparation of the Concept Plan.
- 2.1.3 The layout of the Trunk Road Tunnel Variation 1 is shown in **Figure 1**. The alignment of the Trunk Road in this scheme has been determined as the optimal alignment having the least intrusion into the Harbour and consequentially affecting the least area of the Harbour. The Trunk Road scheme is described briefly below.

Trunk Road Tunnel Variation 1 Layout

- 2.1.4 At the western end of the WDII project area, connection is required to the Trunk Road tunnel which will be constructed under CRIII. Then, the Trunk Road tunnel must cross over the top of the MTR Tsuen Wan Line tunnel; a piled Trunk Road tunnel structure spanning across the MTR tunnel provides a feasible solution.¹ In this case, the Trunk

¹ **Crossing the MTR Tsuen Wan line**

The Trunk Road must not impose any loads on, or cause any movement of, the existing MTR Tsuen Wan Line tunnel. Tunnelling under the MTR tunnel at sufficient depth to avoid disturbance to the existing ground and movement of the MTR tunnel would result in exceedance of permissible tunnel gradients from the connection to the existing road network at the Central Interchange (conversely, if the maximum permissible tunnel gradients were to be maintained, the Trunk Road connection to the Central Interchange and the existing Rumsey Street Flyover could not be achieved). See Report on Trunk Road Alignments & Harbour-front Enhancement.

A piled Trunk Road tunnel structure spanning across the MTR tunnel has been developed to meet statutory limitations on allowable surcharge, lateral pressure and movement. For this scheme, the Trunk Road will cross over the MTR tunnel at a road level of around -7mPD. The Trunk Road tunnel structure will therefore lie completely above seabed level; indeed, the top part of the tunnel structure, at a level of around +2.5mPD, will lie completely above sea level. As such, even if not contained in reclamation, the tunnel structure would itself be considered reclamation under the PHO.

Road tunnel structure will lie completely above the seabed level, and needs to be contained within reclamation.

- 2.1.5 The Trunk Road tunnel continues through the Hong Kong Convention and Exhibition Centre (HKCEC) water channel and along the Wan Chai shoreline, with the tunnel structure still above seabed level. Again, reclamation is required for the cut-and-cover tunnel construction and to contain and protect the tunnel structure.²
- 2.1.6 The tunnel then passes beneath the Cross Harbour Tunnel (CHT) portal and approach ramp at a level of around -30mPD; this depth is required in order to avoid conflict with the existing rock anchors of the CHT portal structure.³
- 2.1.7 The low level of the Trunk Road tunnel under the CHT means that the tunnel structure lies entirely below the seabed level of the adjacent ex-Public Cargo Working Area (PCWA) basin and the Causeway Bay Typhoon Shelter (CBTS), only rising up above seabed level to a ground level tunnel portal east of the CBTS. Permanent reclamation in the ex-PCWA basin and in the CBTS is not essential. While temporary works will be

² Reclamation for cut-and-cover tunnel

Cut-and-cover tunnel construction involves first installing the tunnel walls by using diaphragm walls (these are reinforced concrete wall panels constructed in existing ground from ground level down to the required depth, usually to the underlying rock layer) on both sides of the tunnel, then excavating the soil from between the diaphragm walls, constructing reinforced concrete top and bottom slabs between the diaphragm walls to form the tunnel box and, finally, backfilling over the tunnel. This form of construction is carried out in existing or formed land to provide the necessary construction access from the surface – should the tunnel alignment cross over seabed, reclamation will be required to first form the land through which the diaphragm walls need to be constructed.

Where the tunnel lies above seabed level, the reclamation also provides protection to the tunnel structure. If the tunnel structure were to be left exposed above the seabed level, it would be at risk of damage from ship impact from ferries and local craft in the inshore water area and from ocean going vessels in the adjacent navigation fairways. The consequences of structural damage to the road tunnel would be severe and not tolerable.

³ Crossing beneath the CHT

The CHT is an immersed tube tunnel constructed in 1970, comprising a thin steel external shell lined internally with reinforced concrete. The immersed tube section of the CHT is considered to be particularly fragile and susceptible to damage due to movement, particularly when the age of the CHT is taken into account. Repair work would be extremely difficult. Given the susceptibility of the old CHT to damage, a near zero movement tolerance would need to be imposed for any Trunk Road tunnel crossing, which will be extremely difficult to ensure. As a result, the risk of damage due to any Trunk Road tunnel scheme crossing the immersed tube section of the CHT will be unacceptably high. Any Trunk Road crossing under the CHT must therefore be confined to the zone beneath the portal and approach ramp of the CHT, where risk of damage can be kept within manageable bounds. In this case, though, the Trunk Road tunnel would need to avoid the rock anchors that tie down the approach ramp structure to the underlying rock; these anchors are there to prevent uplift caused by hydrostatic forces (flotation). The rock anchors, based on available as-built information, are installed to a depth of around -17mPD, therefore, allowing for minimum clearance beneath the anchors, the Trunk Road must pass beneath the CHT at a road level of around -30mPD.

required (which may include temporary land formation for tunnel construction purposes) these can be removed afterwards and the existing seabed and water area reinstated.⁴

2.1.8 To the east of the CBTS, along the North Point shoreline, the Trunk Road rises up above seabed level to the ground level portal, where once again, reclamation is required for the cut-and-cover tunnel construction and to contain and protect the tunnel structure. The Trunk Road then rises on flyover structure to connect with the existing elevated IEC. Connection to the existing IEC elevated road structure is made to the northern side of the IEC, which is the least disruptive form of connection. The existing IEC connections back into Causeway Bay (to Victoria Park Road and Hing Fat Street) are retained.

Slip Roads

2.1.9 The following slip road connections (shown in Figure 1) have been identified as essential in meeting traffic demand and enabling the Trunk Road to adequately perform its function of relieving traffic from the overloaded east-west Connaught Road Central / Harcourt Road / Gloucester Road corridor:

- slip road from the eastbound Trunk Road to Wan Chai North ('Slip Road 1');
- slip road from Wan Chai North to the eastbound Trunk Road ('Slip Road 2');
- slip road from the westbound Trunk Road to Wan Chai North, ('Slip Road 3');
- slip road from Victoria Park Road to the westbound Trunk Road, ('Slip Road 8').

2.1.10 If the slip roads are not available, the Trunk Road cannot be properly utilised. The demand for a bypass comes not just from traffic from the western side of Hong Kong Island to the eastern side of the Island, and vice versa; traffic to/from intermediate areas such as Admiralty, Wan Chai and Causeway Bay also contribute to the congestion in the east-west corridor. Restricting access to the Trunk Road for this traffic will undermine its purpose in relieving traffic congestion on the overloaded east-west corridor.

⁴ Temporary reclamation for tunnel below seabed

The Trunk Road tunnel beneath the ex-PCWA basin and the CBTS will be constructed by cut-and-cover method for this Trunk Road scheme, for which reclamation is required (as explained above). Through these areas, though, the Trunk Road tunnel structure lies at sufficient depth below the seabed that, albeit an unusual construction procedure and having additional cost implications, consideration can be given to removing the reclamation after the tunnel has been constructed. The criteria for deciding where the reclamation can be removed are: that the top of tunnel should be deep enough to allow for adequate structural protection in the absence of the protective reclamation (a 2.2m thick rock armour layer is allowed), and where the tunnel passes through anchorage areas, an additional seabed layer for ships's anchor embedment; and that the removal of reclamation should not have the effect of creating new embayments, in order to avoid water quality impacts.

Note that these temporary reclamation areas are not considered as areas affecting the Harbour under the PHO, insofar as they are short term (for the duration of the construction period) and solely for the purpose of achieving the end product (ie in order to ultimately achieve minimum reclamation). The temporary works won't cause permanent damage to the Harbour. Only the residual areas of permanent reclamation are considered as areas affecting the Harbour.

- 2.1.11 The Wan Chai slip roads (Slip Roads 1, 2 and 3) will rise up from the Trunk Road tunnel, which is above seabed level in reclamation, to their ground level tunnel portals. The slip roads will also be constructed as cut-and-cover tunnel and, as the slip roads also lie above seabed level (and above sea level), they need to be contained within reclamation.
- 2.1.12 The Causeway Bay slip road (Slip Road 8) would ordinarily require reclamation if aligned from the connection with Victoria Park Road directly through the Causeway Bay Typhoon Shelter, due to its shallow level (above seabed). Under the Trunk Road Tunnel Variation 1 scheme, however, an alternative alignment for Slip Road 8 has been proposed, where the slip road connects to the southern side of Victoria Park Road, running along the northern boundary of Victoria Park before dropping into tunnel to cross under Victoria Park Road to connect with the Trunk Road tunnel at a deep enough level below the seabed of the Causeway Bay Typhoon Shelter, such that, similar to the mainline Trunk Road tunnel, permanent reclamation for the slip road is not required.

Refinement of Horizontal Alignment

- 2.1.13 The horizontal alignment of the Trunk Road through the WDII project area is governed by a number of constraints, including highway design standards that dictate the geometry of the road and physical obstructions or restrictions that result in “fixed alignment points”. Together, these determine the road curvature and the extent of intrusion of the Trunk Road tunnel into the harbour. The following fixed alignment points largely determine the horizontal alignment.
- 2.1.14 At the western end of WDII, connection is required to the Trunk Road tunnel under CRIII. Then the tunnel must pass through the HKCEC water channel, between the HKCEC foundations (alignment options both to the north and south of the water channel have been examined but found not feasible due to conflict with existing development). The HKCEC foundations limit the possible movement, both northward and southward, of the Trunk Road alignment through the water channel.
- 2.1.15 Through the centre of the WDII project area, along the Wan Chai shoreline, the existing electricity substation and the Wan Chai East Sewage Screening Plant obstruct the Trunk Road from turning southwards. The northern boundary of the existing Wan Chai East Sewage Screening Plant defines the southern limit of the Trunk Road tunnel alignment: immediately inside this boundary are existing sewage outfall facilities and the planned dropshafts of the Harbour Area Treatment scheme, which restrict any further southward shifting of the Trunk Road alignment. The crossing under the CHT is restricted southwards by the foundations of the Police Officers’ Club and northwards by the extent of the CHT portal structure (as noted above, crossing any further north, beyond the zone of the CHT portal and approach structure, would result in unacceptably high risk of damage to the CHT).
- 2.1.16 At the eastern end of WDII, the Trunk Road tunnel structure is located adjacent to the existing IEC foundation piles, which constrain the extent to which the Trunk Road alignment can be moved any further southwards; this therefore fixes the horizontal alignment of the Trunk Road at this location.

- 2.1.17 The Trunk Road horizontal alignment from the connection with CRIII in the west to the connection to the IEC in the east is then determined by fitting a smooth curve between all these fixed points. Road curvature is in accordance with highway design standards with regard to geometric values for radii and sight distances requirements. Reference can be made to the Transport Planning and Design Manual (TPDM) for details.
- 2.1.18 The resulting horizontal alignment for the Trunk Road, as shown in Figure 1, is found to be the optimal alignment in meeting the necessary highway design standards within physical alignment constraints. The alignment ensures the least intrusion into the harbour, and therefore the minimum extent of reclamation.

Ancillary Trunk Road Tunnel Infrastructure

- 2.1.19 Tunnel ventilation buildings are required at around the centre of the Trunk Road tunnel, near the HKCEC, and near the eastern tunnel portal. A tunnel administration building, for the tunnel operator, is required near the eastern tunnel portal, and operator's roads need to be provided at the eastern portal to facilitate emergency and breakdown vehicle access to and from both the eastbound and westbound tunnels.
- 2.1.20 All of these facilities will be located on existing land or on reclaimed land already formed for the Trunk Road tunnel, and therefore no additional reclamation for this ancillary infrastructure is required.

Summary

- 2.1.21 In summary, permanent reclamation (as shown indicatively in Figure 1) will be required to the west of the HKCEC, through the HKCEC water channel and along the Wan Chai shoreline, to accommodate the cut-and-cover tunnel of the Trunk Road and the Wan Chai slip roads, where the tunnel structures lie above the seabed level. To the east of the CBTS, along the North Point shoreline, permanent reclamation will also be required to accommodate the cut-and-cover tunnel of the Trunk Road and the tunnel portal.

2.2 Ground Level Roads

- 2.2.1 The existing local road network has been modified to accommodate an extension of Road P2 from the eastern limit of CRIII through to local road network connections in Wan Chai North, and to connect the local road network in Wan Chai North and Causeway Bay with the slip roads of the Trunk Road.
- 2.2.2 The modification of the local road network is accomplished within the existing land areas or (in the case of Road P2) over the top of the Trunk Road tunnel, hence no additional reclamation is required over and above that already required for the Trunk Road construction.

2.3 Re provisioning of Affected Facilities

- 2.3.1 The construction of the Trunk Road will affect a number of existing facilities and services along the HKCEC / Wan Chai / Causeway Bay / North Point shoreline, which will need to be re provisioned.

Wan Chai Ferry Pier

- 2.3.2 The Wan Chai ferry pier is a single storey finger pier with double deck of exit ramps, which at present is used by three ferry services, including two cross harbour ferry services (one between Wan Chai and Tsim Sha Tsui and the other between Wan Chai and Hung Hom) and one Harbour Tour service. The former two are regular services and are well patronised, carrying, respectively, an average of 21,000 and 2,600 passengers daily (as at December 2006). The Harbour Tour service shares the pier facilities and carries 260 passengers per day on average (as at December 2006). There is a present and compelling need to maintain these services, in particular the two cross harbour ferry services. There are no available alternative ferry piers in the vicinity that are suitable for maintaining the operation of these ferry services. The existing Expo Drive East pier is a single berth facility, which is insufficient to handle the two cross harbour ferry services. The existing ferry operator has pointed out that the pontoon-type berthing facilities located along Expo Drive East would not be acceptable from an operations point of view. As the existing ferry pier will need to be demolished for the Trunk Road construction, it must be re provided at the new seawall to the north of the existing location, so that it can continue to serve the cross harbour ferry services from Wan Chai North.
- 2.3.3 The new pier will take up an area of the harbour which is not already designated as Trunk Road reclamation. Although the ferry pier will be constructed on piled deck, and not on reclaimed land, its construction could nevertheless be viewed as, in effect, forming 'land' to accommodate a permanent building structure. Under the PHO, the area occupied by the ferry pier would be regarded as affected water area, or 'reclamation', over and above that already required for the Trunk Road construction.

Services and Utilities

- 2.3.4 Affected services such as water mains, stormwater drains, sewers, utility cables, etc, will be relocated within the existing formed land, and no additional reclamation will be required. Drainage outfalls will need to be extended through the new reclamation formed for the Trunk Road construction, but will not themselves require additional reclamation. The existing Wan Chai East sewage outfall will need to be re provisioned, however this is a submarine pipeline that will be constructed below the seabed and therefore does not constitute reclamation. Likewise, the re provisioning of the existing cross harbour water mains, which will be cut off by the Trunk Road tunnel construction, will lie beneath the seabed.
- 2.3.5 Existing cooling water intakes and pumping chambers along the HKCEC seawall, that will be subsumed by the Trunk Road reclamation, will be relocated at existing pumping chambers that have already been provided for this purpose at the north side of the HKCEC Extension, under the earlier Wan Chai Reclamation Phase I project. The

existing cooling water intake and pumping chamber for the Sun Hung Kai building, which is located on the Wan Chai seawall, will need to be reprovisioned at a similar location behind the new seawall of the Trunk Road reclamation; the smaller scale of pumping chamber requirements and lesser operational access requirements for this single cooling water facility means that the new pumping chamber can be designed to be located within the available area of land formed for the Trunk Road, therefore no additional reclamation will be required.

- 2.3.6 The salt water pumping station, located at the seawall next to the Wan Chai ferry pier, will also be subsumed by the Trunk Road reclamation. The reprovisioned facility is proposed to be relocated to the existing vacant site at Wan Shing Street, next to the Wan Chai East Sewage Screening Plant. The reprovisioned salt water pumping station therefore does not require reclamation.
- 2.3.7 In summary, with the exception of the Wan Chai ferry pier, all affected facilities along the existing shoreline can be reprovisioned without the need for additional reclamation over and above the reclamation required for the Trunk Road construction.

2.4 Resultant Reclamation Requirements

- 2.4.1 A Trunk Road scheme has been proposed with the minimum reclamation necessary to meet the overriding need for the Trunk Road, in conformance with the PHO.
- 2.4.2 Reclaimed land will need to be formed along the existing HKCEC, Wan Chai and North Point shorelines, for the construction of the Trunk Road. Modification of the local road network (ground level roads) and reprovisioning of existing affected facilities (other than the Wan Chai ferry pier) can be implemented without the need for additional reclamation over and above that required for the Trunk Road.
- 2.4.3 The new reclamation will form a narrow strip of land along the Wan Chai shoreline from the interface with the CRIII project west of the HKCEC Extension to the ex-PCWA basin, and along the North Point shoreline immediately to the east of the CBTS. In total, an indicative area of around 15 ha of permanent reclamation was found in preliminary studies to be required for the Trunk Road construction. This reclamation area included allowance for the reprovisioning of the Wan Chai ferry pier, which is considered to be reclamation under the PHO. The earlier indicative estimate of reclamation area also made provisional allowance for reprovisioning of affected facilities, most of which have now been determined as not requiring additional reclamation, and allowed for some flexibility in defining the reclamation edge in order to cater for uncertainties of the seawall design.
- 2.4.4 The extent of reclamation has now been refined and is examined in more detail in the following section to ensure that it is the minimum necessary for the implementation of the Trunk Road scheme with reclamation requirements that have now been more clearly defined, including seawall construction details determined from more detailed engineering design. The resulting reclamation will then be the minimum required by the overriding public need for the Trunk Road, in compliance with the CFA ruling on the PHO.

3 MINIMUM RECLAMATION

3.1 General

- 3.1.1 In Section 2 above, Trunk Road Tunnel Variation 1 is presented as the Trunk Road scheme resulting in the least affected area of the Harbour. Nevertheless, reclamation is shown to be required in the area to the west of the HKCEC Extension, in the HKCEC water channel, along the Wan Chai shoreline and along the North Point shoreline. Permanent reclamation is not required in the ex-PCWA basin and in the CBTS.
- 3.1.2 In this section, the engineering requirements in respect of the construction of the Trunk Road tunnel, reclamation and seawalls are examined in more detail to determine the minimum extent of reclamation, within each of these areas.

3.2 HKCEC West and Water Channel

Trunk Road & Infrastructure Layout

- 3.2.1 **Figure 2** shows the Trunk Road Tunnel Variation 1 layout, including the Wan Chai slip roads, as presented above in Section 2 and in Figure 1, in more detail through the HKCEC West area and the HKCEC water channel. The Trunk Road crosses the existing seabed to the west of the HKCEC, and occupies the HKCEC water channel. **Figure 3** shows the vertical profile of the Trunk Road tunnel through the HKCEC West area and the HKCEC water channel.
- 3.2.2 At the western end, connection to the Trunk Road tunnel under CRIII is made at a road level of around -10 mPD. Then, the Trunk Road tunnel must cross over the top of the MTR Tsuen Wan Line tunnel. A piled Trunk Road tunnel structure spanning across the MTR tunnel provides a feasible solution. In this case, the Trunk Road tunnel structure will lie above the seabed level, with the road level high point at around -7.2 mPD (noting that the MTR tunnel is an immersed tube tunnel that lies just below the seabed). Taking into account the height of the Trunk Road tunnel, including ventilation ducts, the top part of the tunnel structure would be above sea level, at a level of around +2.5 mPD. The tunnel structure remains above seabed level through the whole of the HKCEC water channel. As can be observed, and as discussed in Section 2, the Trunk Road tunnel structure therefore requires reclamation for cut-and-cover tunnel construction.
- 3.2.3 The extent of reclamation at the area to the west of the HKCEC is set by the extent of seawall protection in front of the tunnel structure, while the HKCEC water channel will need to be filled in for the construction of the Trunk Road tunnel.

Changes to Marine Basin at HKCEC West and CRIII Interface

- 3.2.4 Previous WDII and CRIII proposals included a marine basin between the HKCEC Extension and the CRIII project area, with the seawall at the HKCEC West area curved outwards to tie in with the shoreline as gazetted under the CRIII project. A causeway was proposed across the front of the marine basin.

- 3.2.5 Although the causeway was proposed as a piled structure, it nevertheless affects that area of the Harbour over which it passes. In line with the need under the PHO to reduce the affected harbour area, the causeway has been deleted from the current proposal.
- 3.2.6 With the deletion of the causeway from the current proposal, there is now scope for reducing the extent of reclamation at the northeast corner of CRIII, where there are no cooling water pumping stations.
- 3.2.7 In the part of CRIII that has been constructed, the separation between the seawall copeline and the diaphragm wall of the Trunk Road tunnel is determined by the re-provisioned cooling water pumping stations for, amongst others, Pacific Place and Admiralty Centre. These result in a minimum distance between the outer edge of the Trunk Road tunnel and the seawall copeline of approximately 60m. Under the original CRIII harbour-front planning, the seawall was extended eastwards to WDII to tie in with the causeway that was proposed across the front of the marine basin to the west of the HKCEC. Now that the causeway has been deleted, this seawall layout can be revised.
- 3.2.8 Furthermore, as there are no cooling water pumping stations at the northeast corner of CRIII, the separation between the seawall copeline and the outer edge of the Trunk Road tunnel can be reduced from around 60m to around 37m (the rationale for this reduced separation is explained in the following sections on seawall structures and the associated extent of reclamation).
- 3.2.9 Figure 2 indicates how the shoreline at the northeast corner of CRIII could be revised, by extending the seawall from the pumping chambers and seawall caisson units that have already been constructed under CRIII, in a smooth curve (avoiding embayment effects) to the minimum separation from the Trunk Road tunnel at the eastern end of CRIII.
- 3.2.10 The reduction in the area of reclamation from that which is currently proposed in the CRIII project area, arising from this revised shoreline at the eastern end of CRIII, is around 0.4 ha.

Seawall Structures

- 3.2.11 Works Branch Technical Circular (WBTC) No. 3/95 specifies the requirements for Control of Wave Reflection in Victoria Harbour: reflection coefficients of seawalls within the Harbour are required to be less than 0.5 from waves with periods less than 5 seconds.
- 3.2.12 A “Study of Inner Harbour Waves and their Reduction”, conducted by the University of Hong Kong and completed in March 1998, concluded that waves in the inner Harbour were mainly caused by marine traffic that generates waves, and conventional blockwork seawalls that reflect waves back into the Harbour. These reflected waves result in a build-up of wave energy in front of the seawalls.
- 3.2.13 To prevent the deterioration of wave conditions in Victoria Harbour, it is Government policy that new marine structures in the Harbour area must be designed to be low wave-energy reflection (wave absorbing) structures. This is also in response to requests to

minimise waves in the Harbour from LegCo members (this issue was discussed in LegCo meetings in 1999 and 2001) as well as the public, who have expressed growing concerns over wave impacts on the navigation stability and safety of vessels sailing in the Harbour.

3.2.14 The use of wave attenuating seawalls is therefore considered a must. Precast seawall units, similar to those already being used in CRIII, are proposed for WDII. The design of these seawalls has been optimised through physical hydraulic modelling studies undertaken by specialist consultants to meet the limiting requirements for wave reflection. Reference can be made to the report by Hydraulics and Water Research (Asia) Ltd titled “2-Dimensional Physical Model Testing of Wave Absorbing Seawalls (Report HWR 158, April 1996). These precast caisson seawall units are therefore used for all seawalls that are exposed to waves. The 15m wide caisson seawall units comprise a wave energy absorbing chamber, the size of which has been optimised through the wave studies, and a ballast chamber and base heel which, together, provide sufficient gravity and soil loading to achieve the adequate factors of safety required against flotation, sliding and overturning. The size of these seawalls is therefore essential in order to comply with necessary engineering design and safety criteria. The seawall units, together with their integrated rockfill foundation and backing layers, have been designed to provide the necessary stability under all anticipated loading and environmental conditions, in accordance with Hong Kong and international design standards.

The Extent of Reclamation

3.2.15 **Figure 4** shows the typical seawall section in the HKCEC West area. The separation between the edge of Trunk Road tunnel structure and the seawall copeline is determined by the seawall and foundation width and the clearance between the seawall foundation and the diaphragm wall of the Trunk Road tunnel. The rockfill foundation of the seawall will have to be set at a distance of about 2m from the Trunk Road tunnel diaphragm wall. If the rockfill foundation mound is in contact with the diaphragm wall, the following problems will likely occur:

- overbreak in the diaphragm wall construction;
- leaking of bentonite slurry through the rubble layer of the foundation (as the particle size of the rockfill is large) and consequential contamination of the underground water and the harbour;
- collapse of the diaphragm wall trench due to undermining or reduction of stability;
- increase in construction cost; and
- increase in construction time.

3.2.16 Appropriate allowance must be made for dredging of soft marine sediments. The typical dredged level is -15 mPD in this area, as determined from ground investigation. For this dredged level, and maintaining the necessary clearance between the seawall foundation and the diaphragm wall of the Trunk Road tunnel, a distance of 32.5m needs to be provided between the outer edge of the Trunk Road tunnel and its slip roads, and the seawall copeline, in general. Dredged levels are lower towards the CRIII interface (dredged levels at the eastern end of CRIII are around -18 mPD), which means that, moving westwards towards the CRIII interface, the separation between the seawall

copeline and the diaphragm wall of the Trunk Road tunnel will increase, to around 37m at the eastern end of CRIII.

- 3.2.17 Referring back to Figure 2, at the MTR Tsuen Wan Line crossing, the caisson seawall cannot be constructed over the MTR tunnel; instead, a wave absorbing and tunnel protection structure will be incorporated in the piled deck over the MTR tunnel, which will serve both to protect the Trunk Road tunnel structure from ship impact and for wave energy absorption. This wave wall structure, of minimum width around 7m, means that the seawall copeline can be pulled back closer to the Trunk Road tunnel structure, and hence reduce the extent of reclamation at the MTR tunnel crossing point. Special MTR tunnel interface wave walls on piles will be constructed for the seawall adjacent to the MTR tunnel protection zone, to avoid disturbance to the MTR tunnel during construction. These are tied back into the caisson seawalls on either side, with blockwork landing steps providing a transition between the piled wave walls and the gravity caisson seawall units.
- 3.2.18 The area of new WDII reclamation in the HKCEC West area, as defined by this seawall copeline shown in Figure 2, is 3.7 ha. Note, though, that this extent of reclamation and the associated shoreline configuration in the HKCEC West area are based on the revised shoreline at the eastern end of CRIII (as discussed in paras 3.2.4 to 3.2.10 above).
- 3.2.19 In the HKCEC water channel, the typical section in Figure 4 illustrates that the Trunk Road tunnel structure, together with the proposed MTR North Island Line (NIL) tunnel, occupies the entire area of the channel. The whole of the water channel will need to be filled in for the Trunk Road construction. Whilst the NIL will occupy part of the reclaimed water channel, this reclamation is required for Trunk Road construction and additional reclamation is not required for the NIL tunnel.
- 3.2.20 The area of new WDII reclamation in the HKCEC water channel is 1.6 ha.

3.3 Wan Chai Shoreline

Trunk Road & Infrastructure Layout

- 3.3.1 **Figure 5** shows the Trunk Road Tunnel Variation 1 layout along the Wan Chai shoreline, as presented in Section 2 above, in more detail. The Trunk Road crosses the existing seabed along the Wan Chai shoreline, and the existing Wan Chai ferry pier structure, before passing beneath the existing land of the ex-PCWA.
- 3.3.2 **Figure 6** shows the vertical profile of the Trunk Road tunnel along the Wan Chai shoreline. The vertical alignment is determined by the crossing over the MTR Tsuen Wan Line to the west (which results in a road level high point around -7.2 mPD at the western side of the HKCEC) and the deep crossing (at road level around -30 mPD) further to the east, under the CHT portal. The Trunk Road tunnel structure lies above the seabed along this shoreline and therefore requires reclamation for cut-and-cover tunnel construction.

- 3.3.3 Existing ferry pier facilities at the Wan Chai shoreline include the Wan Chai (East) ferry pier (which has a plan area of 1,970m²) and the Wan Chai (West) ferry pier (which has a plan area of 450m²).
- 3.3.4 The reprovisioned Wan Chai ferry pier, shown in Figure 5, will provide for the continuation of the three ferry services currently operating at the affected site. The new pier, of plan area 2,270m², represents a reduction in size when compared with the aggregate area of around 2,420m² occupied by the two existing piers.
- 3.3.5 There have been rising expectations among passengers for better facilities at ferry piers. Central Piers No. 7 and 8, which came into service in November 2006, provide facilities for people with disabilities, in accordance with the Disability Discrimination Ordinance, and facilities for different operators to have shared use of the pier (eg separate ticketing offices and pier offices). Each ferry pier occupies a plan area of around 2,270m². Passengers will expect the newly reprovisioned pier in Wan Chai be of similar standard, with facilities comparable to those available at the Central Piers No. 7 and 8.
- 3.3.6 The reprovisioned ferry pier is the minimum size required to meet the above-mentioned needs.
- 3.3.7 The extent of reclamation along the Wan Chai shoreline is, then, determined primarily by the extent of seawall protection in front of the Trunk Road tunnel structure as well the water area occupied by the new ferry pier.

Seawall Structures

- 3.3.8 As noted in para 3.2.14 above, the use of wave attenuating seawalls is considered a must, and precast caisson seawall units, similar to those currently designed for CRIII, will be used for the Wan Chai seawall.

The Extent of Reclamation

- 3.3.9 **Figure 7** shows the typical seawall section in the Wan Chai shoreline area. Allowing for dredging of soft marine sediments (the typical dredge level is -14 mPD in this area, as determined from ground investigation undertaken in this area), and keeping the diaphragm walls of the Trunk Road tunnel clear of the rockfill foundations of the seawall caisson units (similar explanation as given in para 3.2.15, for the HKCEC West seawall, applies here too), a distance of 31m needs to be maintained between the outer edge of the Trunk Road tunnel and the seawall copeline (the lesser dimension than for the HKCEC West area due to the less deep dredging requirement along the Wan Chai shoreline).
- 3.3.10 Referring back to Figure 5, this minimum 31m separation between Trunk Road tunnel and seawall copeline is maintained along most of the Wan Chai shoreline. The seawall copeline follows the curvature of the Trunk Road tunnel edge.
- 3.3.11 A splay in the seawall is incorporated at the corner with Expo Drive East to accommodate the outfall of the drainage Culvert M, which must be extended from Fleming Road through the reclamation to the new seawall. The splay is curved to

enhance flows through this corner and prevent accumulation of pollutants at the culvert discharge area.

- 3.3.12 At the eastern end of the Wan Chai shoreline, the Trunk Road tunnel and its protection layer dips below the seabed just before reaching the existing seawall of the ex-PCWA. Practical and sensible engineering design suggests that the new seawall along the Wan Chai shoreline nevertheless be continued the short distance eastwards until joining the ex-PCWA seawall (ie maintaining generally the width of reclamation along the whole of the Wan Chai shoreline). However, the PHO's minimum reclamation criterion dictates that the seawall be cut back in the area where it is deemed not to meet the overriding need (for the Trunk Road). For water quality reasons, the drainage culvert N must discharge outside the embayment that is created by this cutting back of the seawall (outfalls should not discharge into embayed areas to avoid entrapment of pollutants and consequent deterioration of water quality and odour problems), therefore the seawall is extended eastwards to accommodate the box culvert outfall structure, before the return seawall is introduced. The return seawall is curved to provide a smooth shoreline, also for water quality reasons; this is in order to avoid sharp corners and to enhance tidal flows through the small embayed area that is created, so that pollutants and flotsam are not trapped, which would otherwise give rise to adverse water quality, odour and unsightliness.
- 3.3.13 The area of new reclamation along the Wan Chai shoreline, as defined by this seawall copeline, is 3.9 ha. The area of the reprovisioned ferry pier structure is around 0.2 ha. Therefore, altogether, the area of new reclamation at Wan Chai is 4.1 ha.

3.4 North Point Shoreline

Trunk Road & Infrastructure Layout

- 3.4.1 The Trunk Road layout along the North Point shoreline is determined by the connection with the existing IEC. **Figure 8** shows the Trunk Road Tunnel Variation 1 layout through this area, including the tunnel portal and the mainline and slip road connections to the IEC. Although the existing formed land area is occupied as much as possible, by keeping the Trunk Road alignment as close as possible to the existing IEC structure foundations, the tunnel structure will nevertheless extend beyond the existing seawall and the existing area of land will therefore need to be widened.
- 3.4.2 **Figure 9** shows the vertical profile of the Trunk Road tunnel as it rises up along the North Point shoreline. The vertical alignment is determined by ensuring that the tunnel is at a low enough level through the adjacent typhoon shelter to avoid the need for reclamation there, but then rising as quickly as possible (at a maximum tunnel gradient of 3% – the use of any steeper tunnel gradient would result in excessive ventilation requirements and would adversely affect road capacity, or otherwise a climbing lane would result in additional reclamation) to ground level at North Point. From the tunnel portal, the Trunk Road rises to connect with the existing IEC, at a level of +15 mPD, near City Garden.

- 3.4.3 As with the horizontal layout (para 3.4.1 above), this vertical profile maximises the use of the existing land formation in this area, but the existing extent of land outside the IEC is not sufficient to fully accommodate the Trunk Road tunnel structures. The existing area of land will need to be lengthened to accommodate the tunnel portal and flyover abutment, as shown in Figure 9.

Seawall Structures

- 3.4.4 Similar to above, the use of wave attenuating seawalls is considered a must, and precast caisson seawall units, similar to those currently designed for CRIII, will be used for the North Point seawall.

The Extent of Reclamation

- 3.4.5 **Figure 10** shows the typical seawall sections at the North Point shoreline area. Allowing for dredging of soft marine sediments (the typical dredge level is -14 mPD in this area), and keeping the diaphragm walls of the Trunk Road tunnel clear of the rockfill foundations of the seawall caisson units, a distance of 31m needs to be maintained between the outer edge of the Trunk Road tunnel and the seawall copeline.
- 3.4.6 Referring back to Figure 8, this minimum 31m separation between Trunk Road tunnel and the seawall copeline is maintained along the entire length of North Point shoreline. The eastern limit of the reclamation is determined by the provision of a 1.5m headroom clearance beneath the bridge abutment as the Trunk Road rises onto elevated bridge structure, for maintenance purposes, as shown in section in Figure 10. The resulting 15m separation between the abutment and the seawall copeline is occupied by the caisson seawall structure, which must be set in front of the piled foundations of the abutment.
- 3.4.7 The area of new reclamation along the North Point shoreline, as defined by this seawall copeline, is 3.3 ha.
- 3.4.8 It is also noted that new flyover structures over water are considered to result in affected water area which may be equated to “reclamation” under the PHO. At the eastern end of the North Point shoreline, Trunk Road flyover structures will tie into the existing IEC. The area of new flyover structures over water is 0.4 ha.
- 3.4.9 Together with the area of land formation, the total affected area of the harbour in respect of the PHO along the North Point shoreline is 3.7 ha.

3.5 Summary of Minimum Reclamation Requirements

3.5.1 The minimum reclamation required in the area to the west of the HKCEC Extension, in the HKCEC water channel, along the Wan Chai shoreline and along the North Point shoreline is summarised as follows:

- (i) HKCEC West : 3.7 ha
- (ii) HKCEC Water Channel : 1.6 ha
- (iii) Wan Chai Shoreline: 4.1 ha
- (iv) North Point Shoreline : 3.3 ha⁵

3.5.2 In total, an area of 12.7 ha of reclamation⁶ is needed to meet essential engineering requirements for construction of the Trunk Road. This is considered to be the minimum extent of reclamation required for implementation of the Trunk Road and associated reprovisioning requirements.

3.5.3 The reduction from the previous indicative estimate of 15 ha of reclamation under the earlier preliminary studies arises mainly from a smaller reclamation area at HKCEC West due to the modification of the interface with CR111, a smaller reclamation area at the Wan Chai shoreline by cutting back the seawall at the eastern end of this shoreline, a smaller reclamation area at the North Point shoreline which is now calculated based on more precise dredge levels determined using recently available site investigation data (not available previously), and as it has now been confirmed that additional reclamation is not required for reprovisioning of facilities such as cooling water pumping chambers, salt water pumping station, etc.

⁵ Affected area of the harbour at North Point shoreline is 3.7 ha

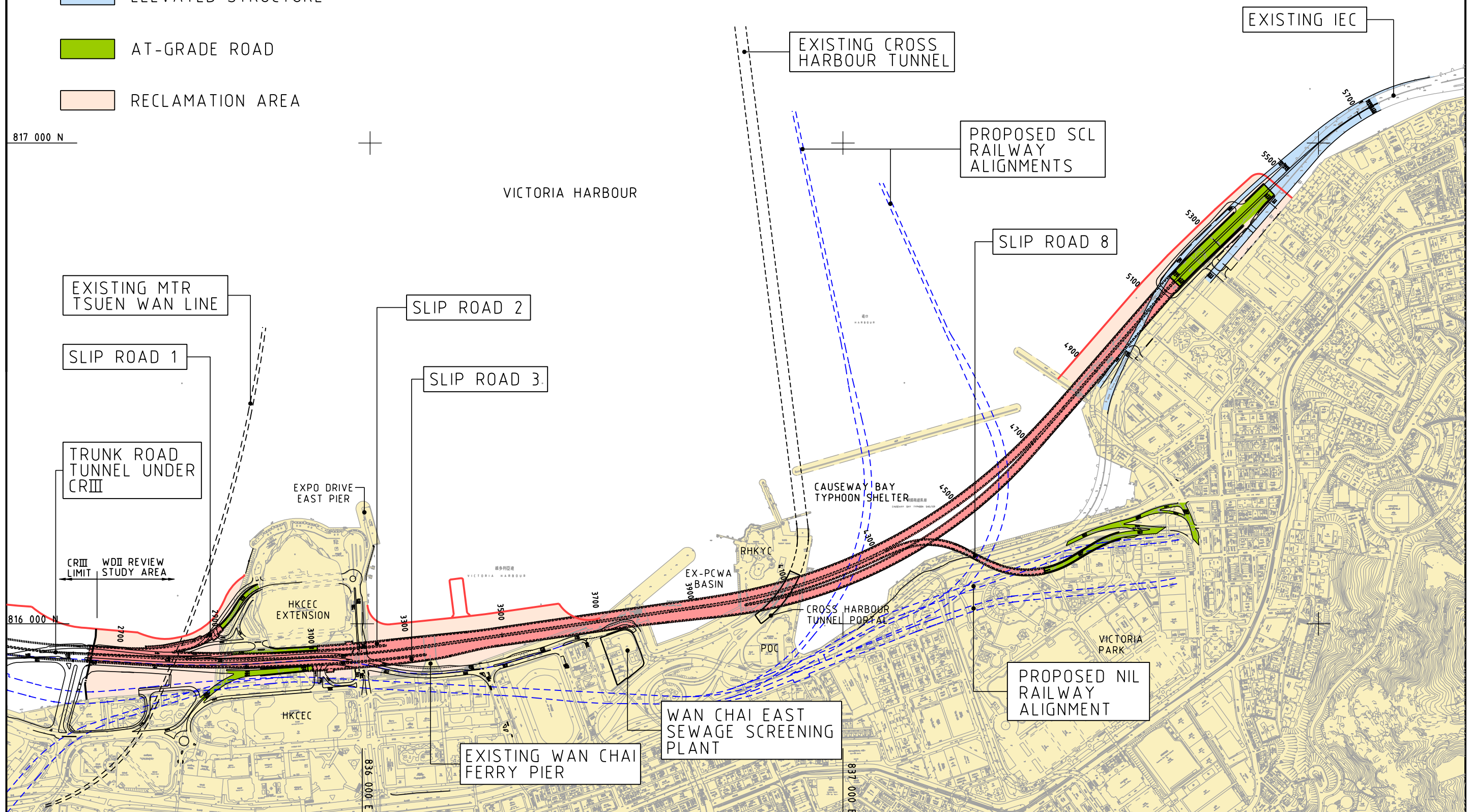
⁶ Total affected area of the harbour is 13.1 ha

4 CONCLUSION

- 4.1.1 Trunk Road Tunnel Variation 1 is presented as the Trunk Road scheme that will have the minimum effect on the Harbour, under the PHO. This Trunk Road scheme meets the overriding public need for the Trunk Road that has been established through traffic studies and confirmed by the Expert Panel. Construction of this Trunk Road scheme will, though, require reclamation in the areas to the west of the HKCEC, through the HKCEC water channel, along the Wan Chai shoreline and along the North Point shoreline. Permanent reclamation is not required in the ex-PCWA basin or in the CBTS.
- 4.1.2 Detailed examination of the engineering requirements in respect of the construction of the Trunk Road tunnel, reclamation and seawalls, and reprovisioning requirements, has been carried out to accurately determine the minimum extent of reclamation, within each of these areas.
- 4.1.3 In total, an area of 12.7 ha of reclamation is needed to meet essential engineering requirements for construction of the Trunk Road (including 0.2 ha for reprovisioning of the piled Wan Chai ferry pier, but excluding the 0.4 ha of affected water area by new flyover structures over water at the connection with the IEC). This is considered to be the minimum reclamation required to meet the overriding need for the Trunk Road.

LEGEND :

- CUT & COVER TUNNEL
- ELEVATED STRUCTURE
- AT-GRADE ROAD
- RECLAMATION AREA



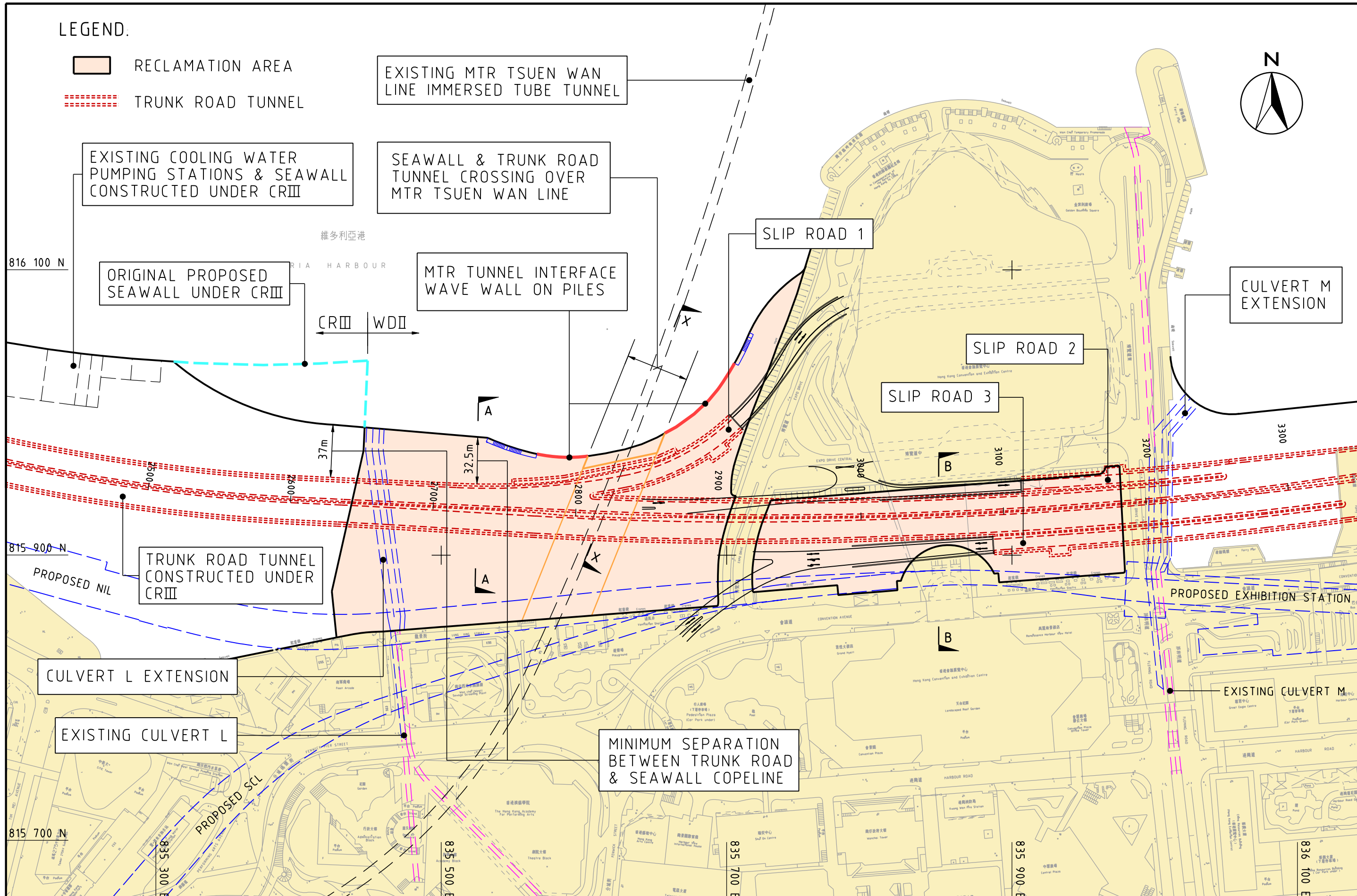
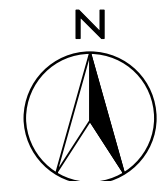
WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

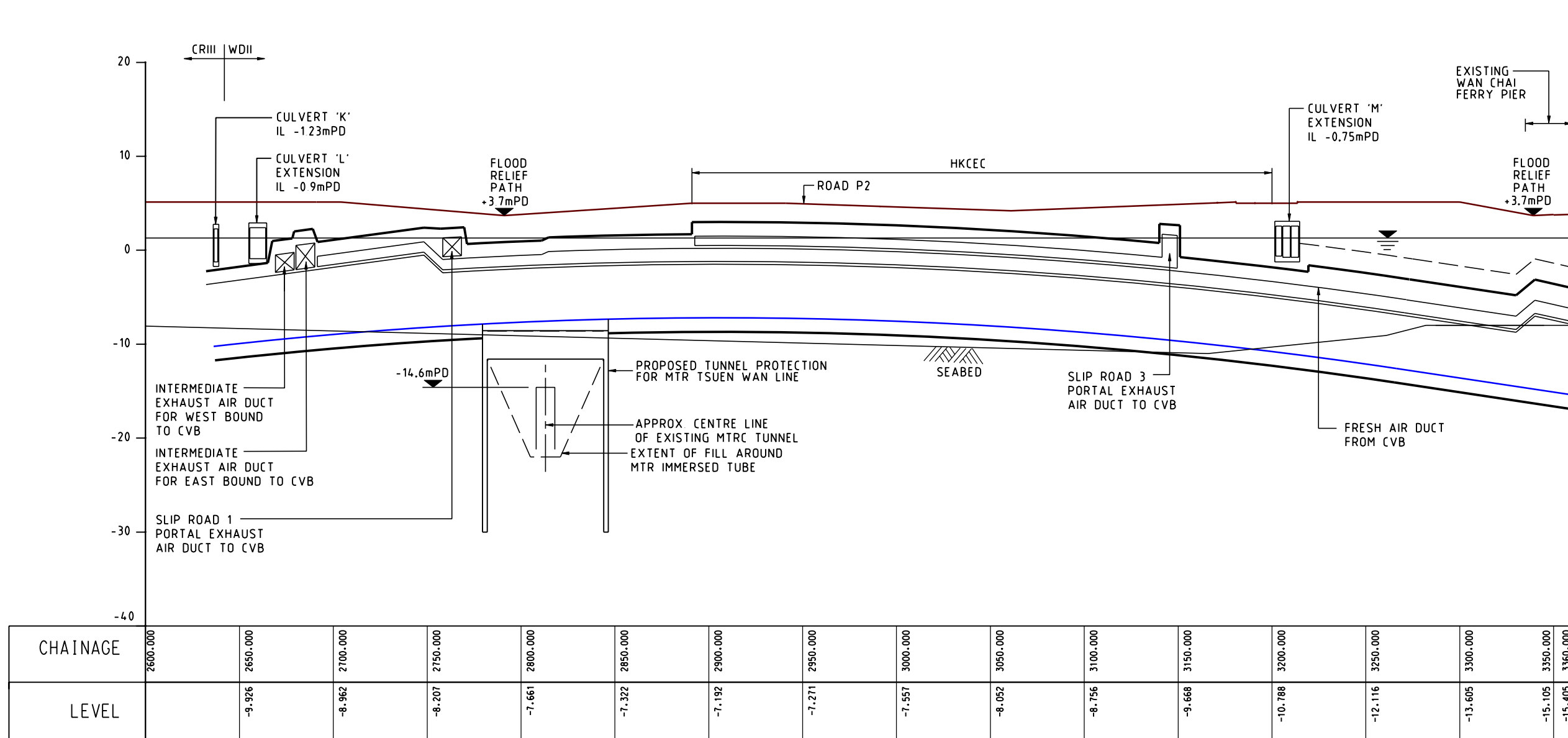
TRUNK ROAD TUNNEL VARIATION 1 LAYOUT

FIGURE 1

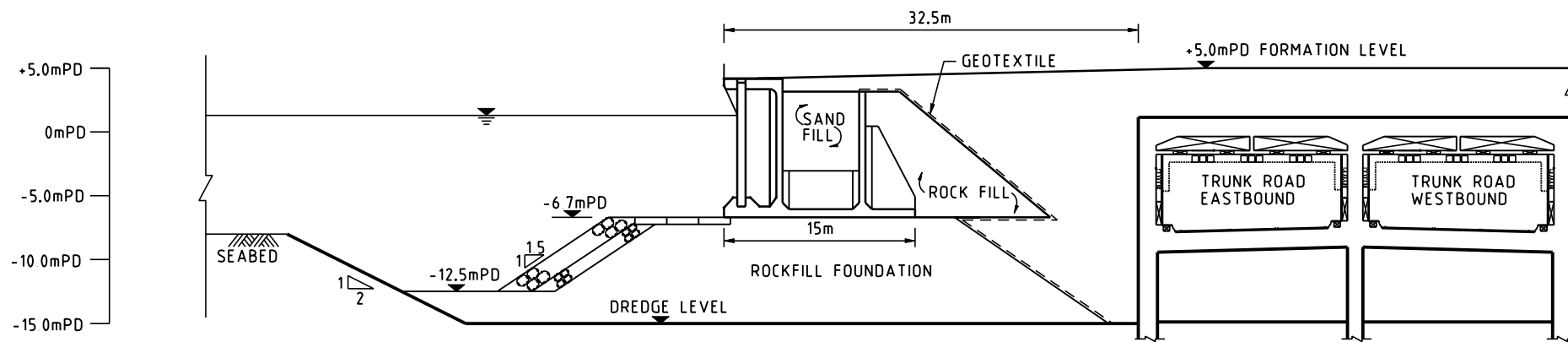
LEGEND:

- RECLAMATION AREA
- TRUNK ROAD TUNNEL

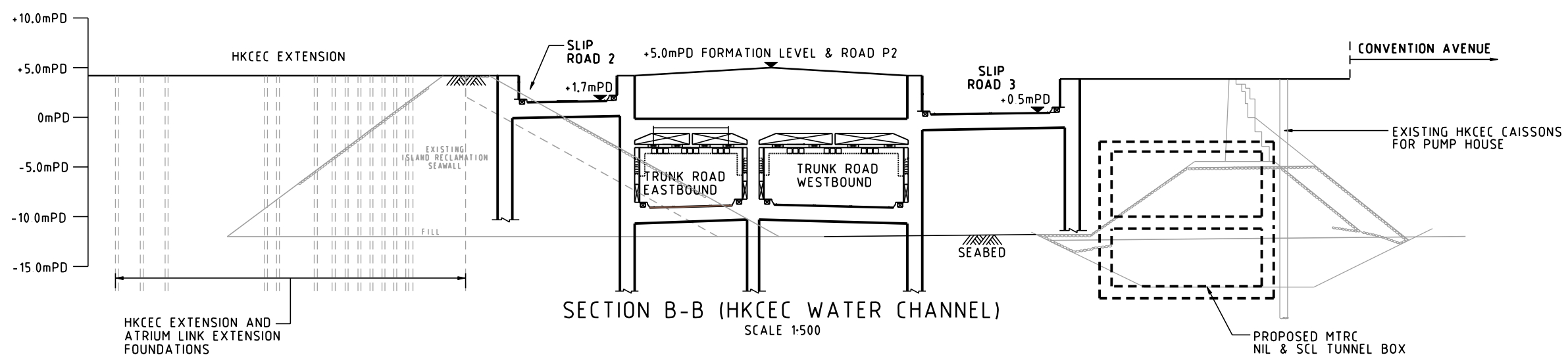




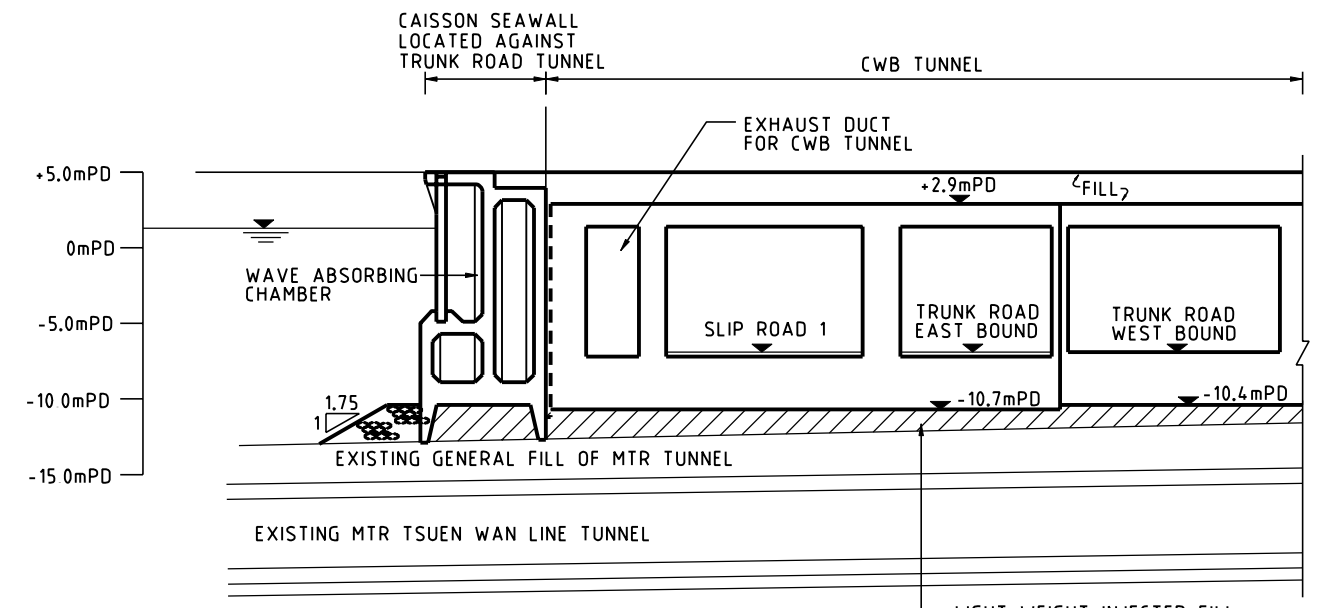
HOR. SCALE 1:2500
VERT. SCALE 1:500



SECTION A-A (HKCEC WEST AREA)
SCALE 1:500



SECTION B-B (HKCEC WATER CHANNEL)
SCALE 1:500



SECTION X - X
SCALE 1 : 500

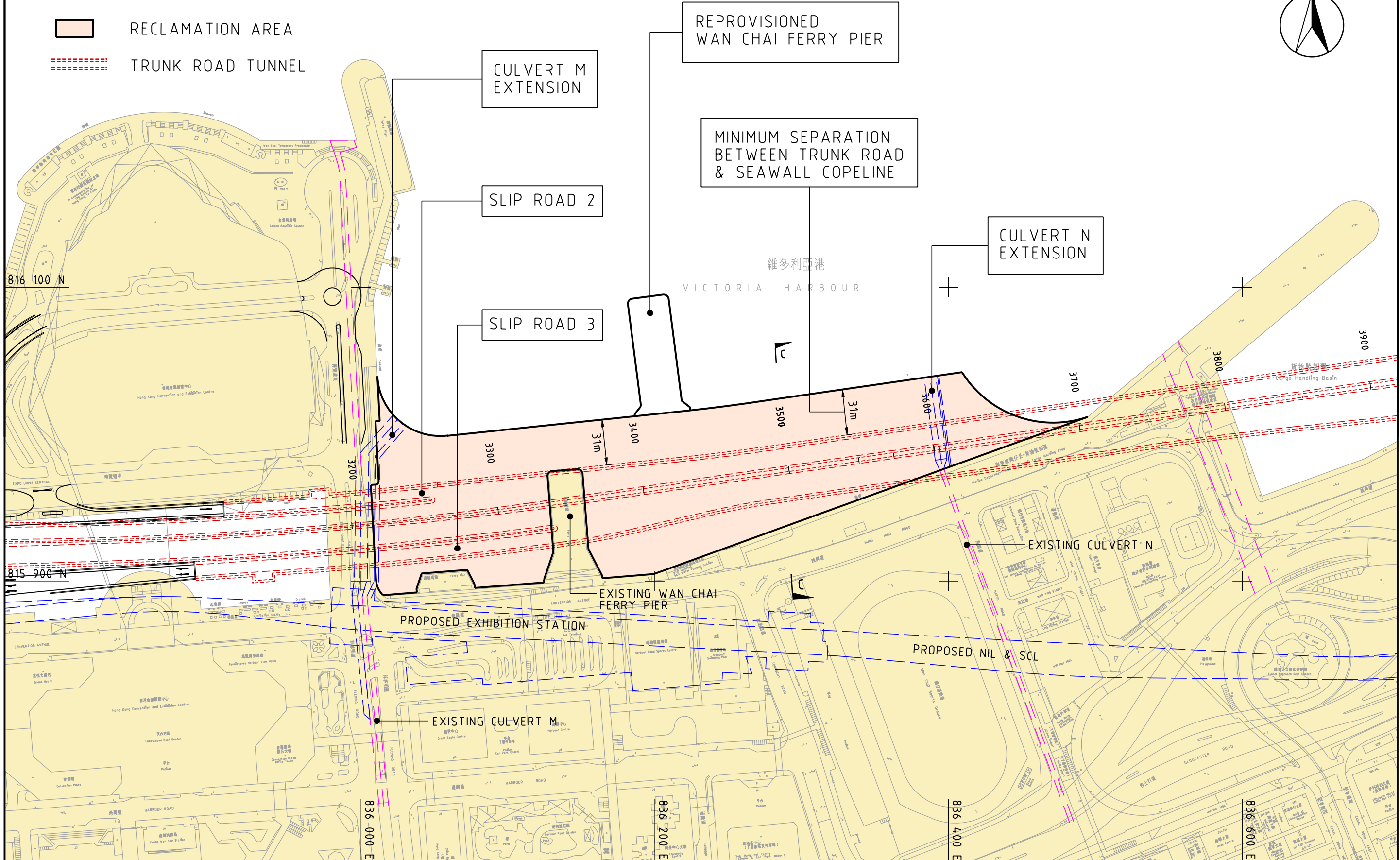
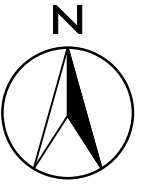
WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

RECLAMATION EXTENT-TYPICAL SECTIONS AT HKCEC

FIGURE 4

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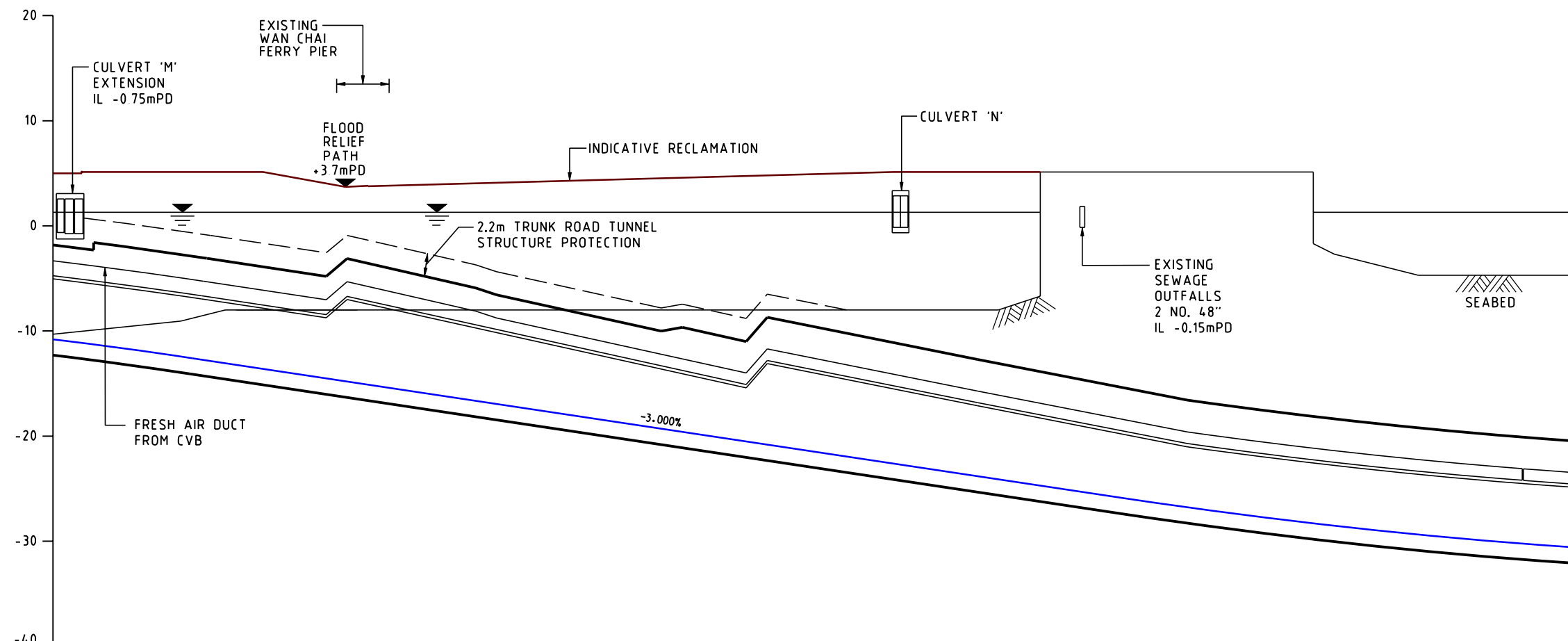
- RECLAMATION AREA
- TRUNK ROAD TUNNEL



WAN CHAI DEVELOPMENT PHASE II - PLANNING AND ENGINEERING REVIEW

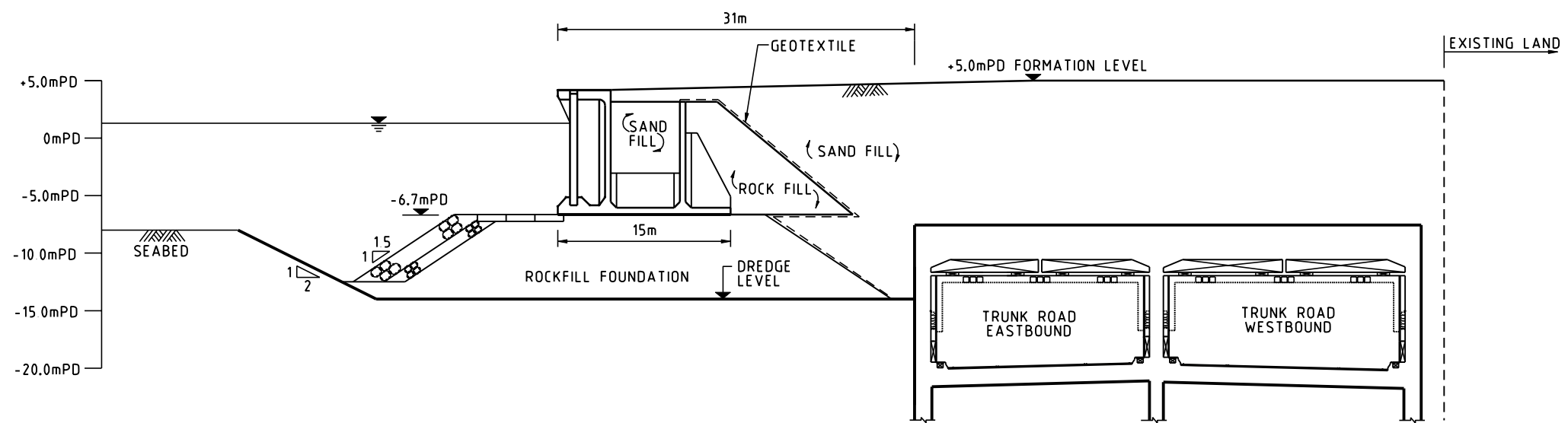
RECLAMATION EXTENT - WAN CHAI LAYOUT

FIGURE 5

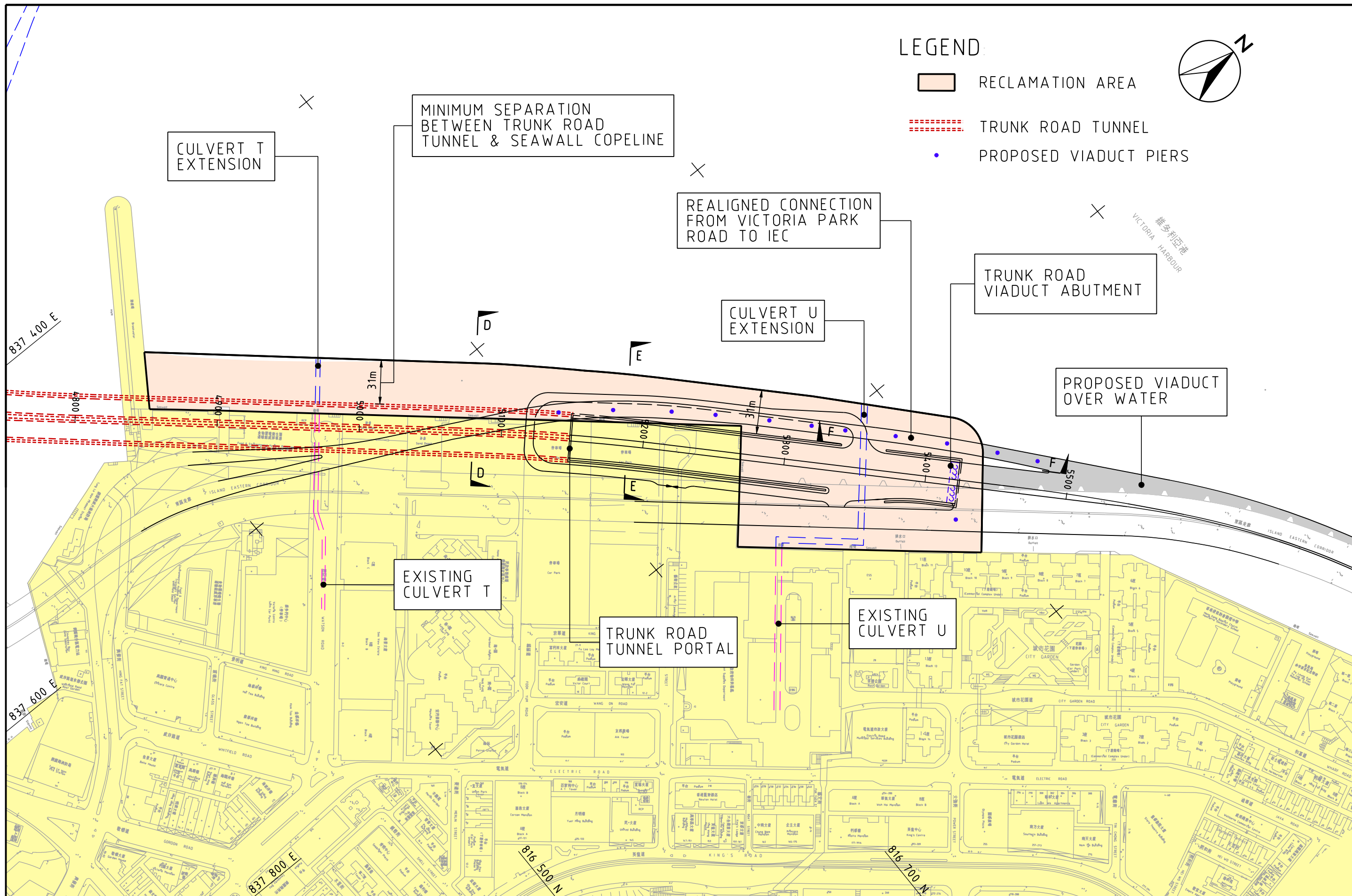


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LEVEL	-10.788	-12.116	-13.605	-15.105	-16.605	-18.105	-19.605	-21.105	-22.605	-24.105	-25.605	-27.048	-28.304	-29.367	-30.238	-30.555

HOR. SCALE 1:2500
 VERT. SCALE 1:500

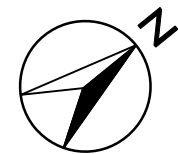


SECTION C-C (WAN CHAI)
SCALE 1:500

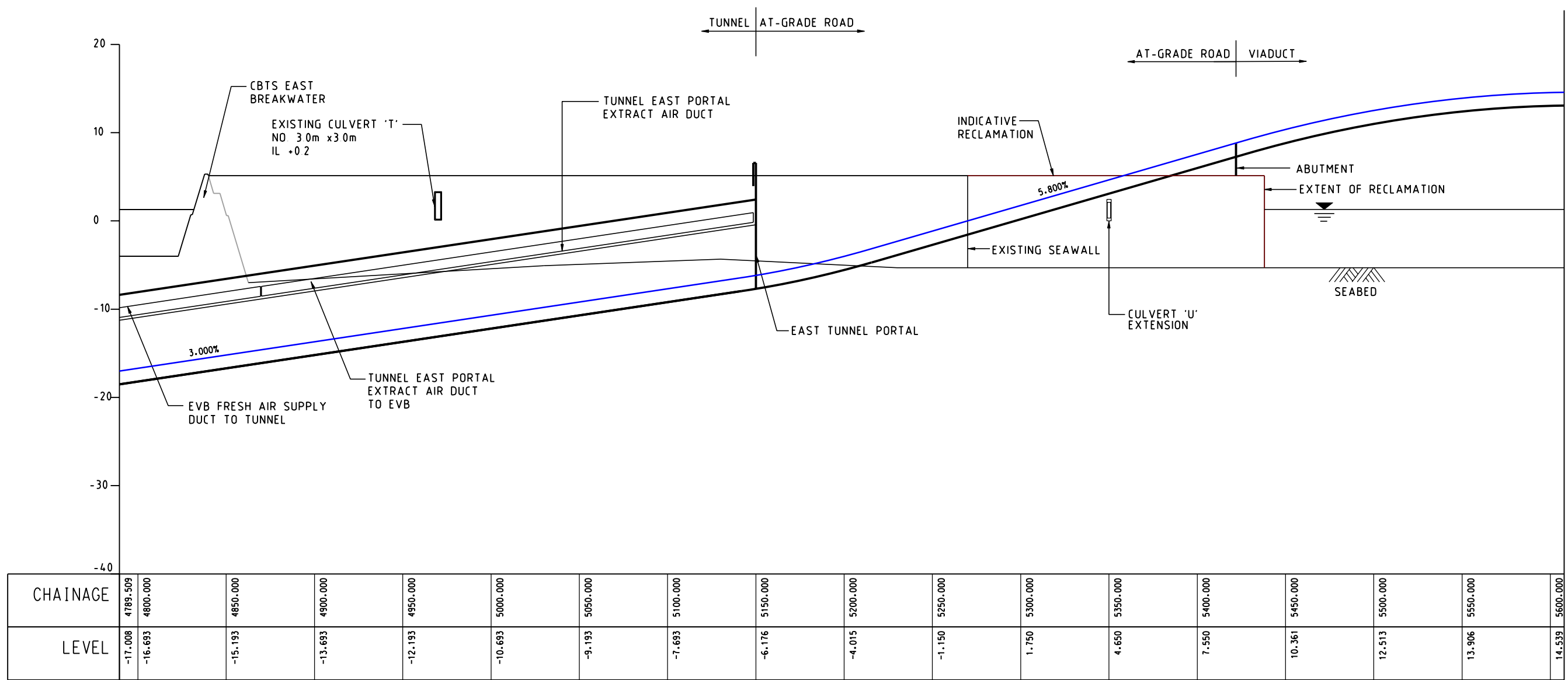


LEGEND

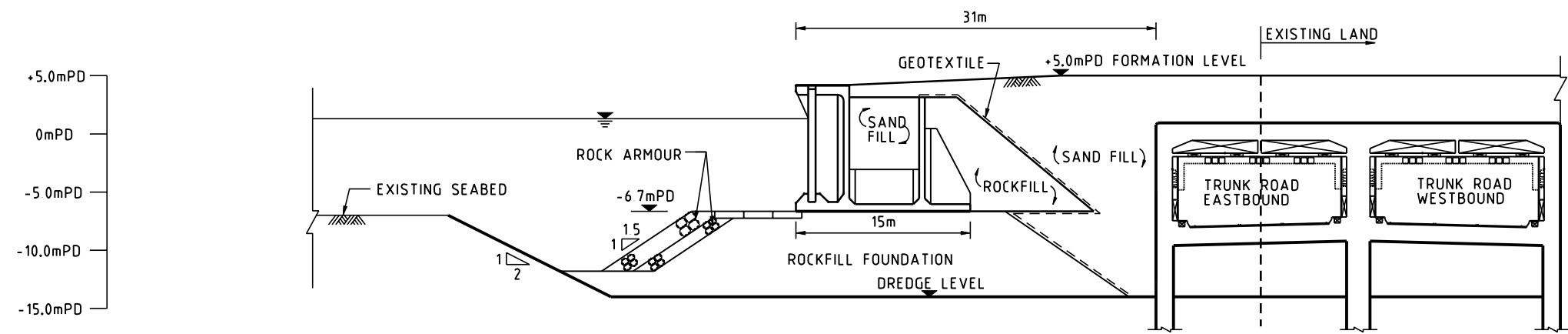
- RECLAMATION AREA
- TRUNK ROAD TUNNEL
- PROPOSED VIADUCT PIERS



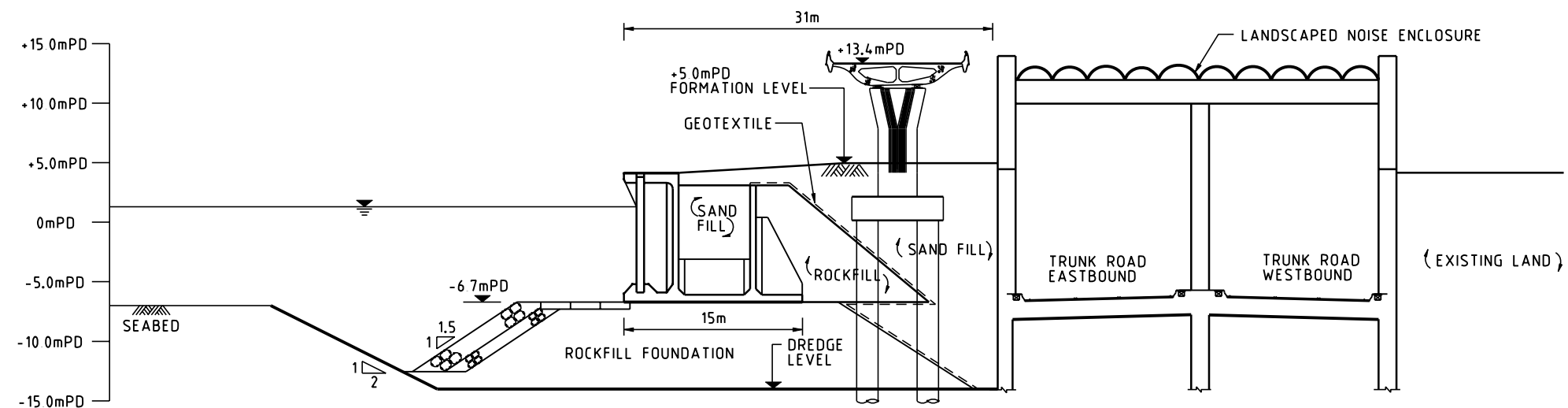
Q:\97103\drawing\report\mini_reclamation\HKCEC WEST\FIG8.dgn SCALE 1:2000 (A3)



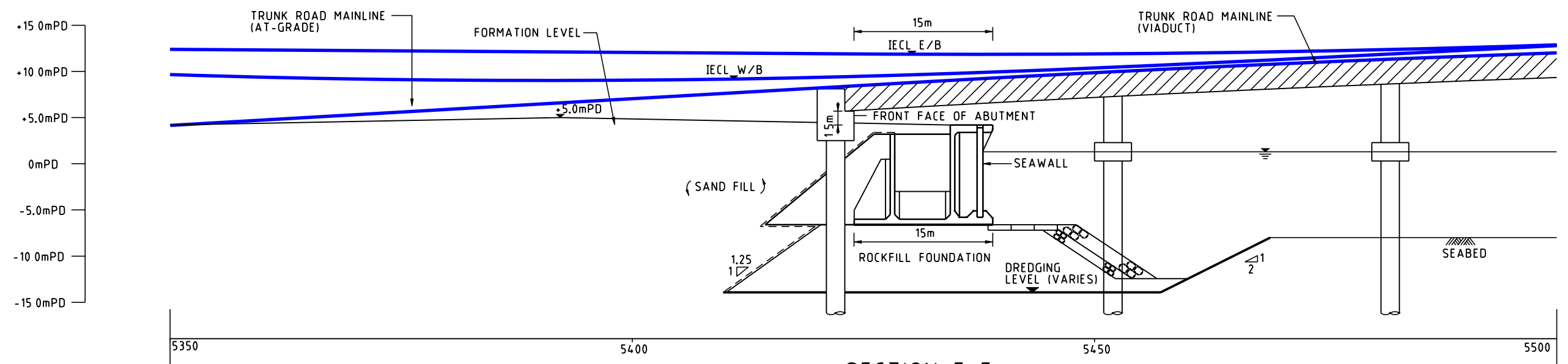
HOR. SCALE 1:2500
VERT. SCALE 1:500



SECTION D-D
SCALE 1:500



SECTION E - E
SCALE 1:500



SECTION F-F
SCALE 1:500