AECOM

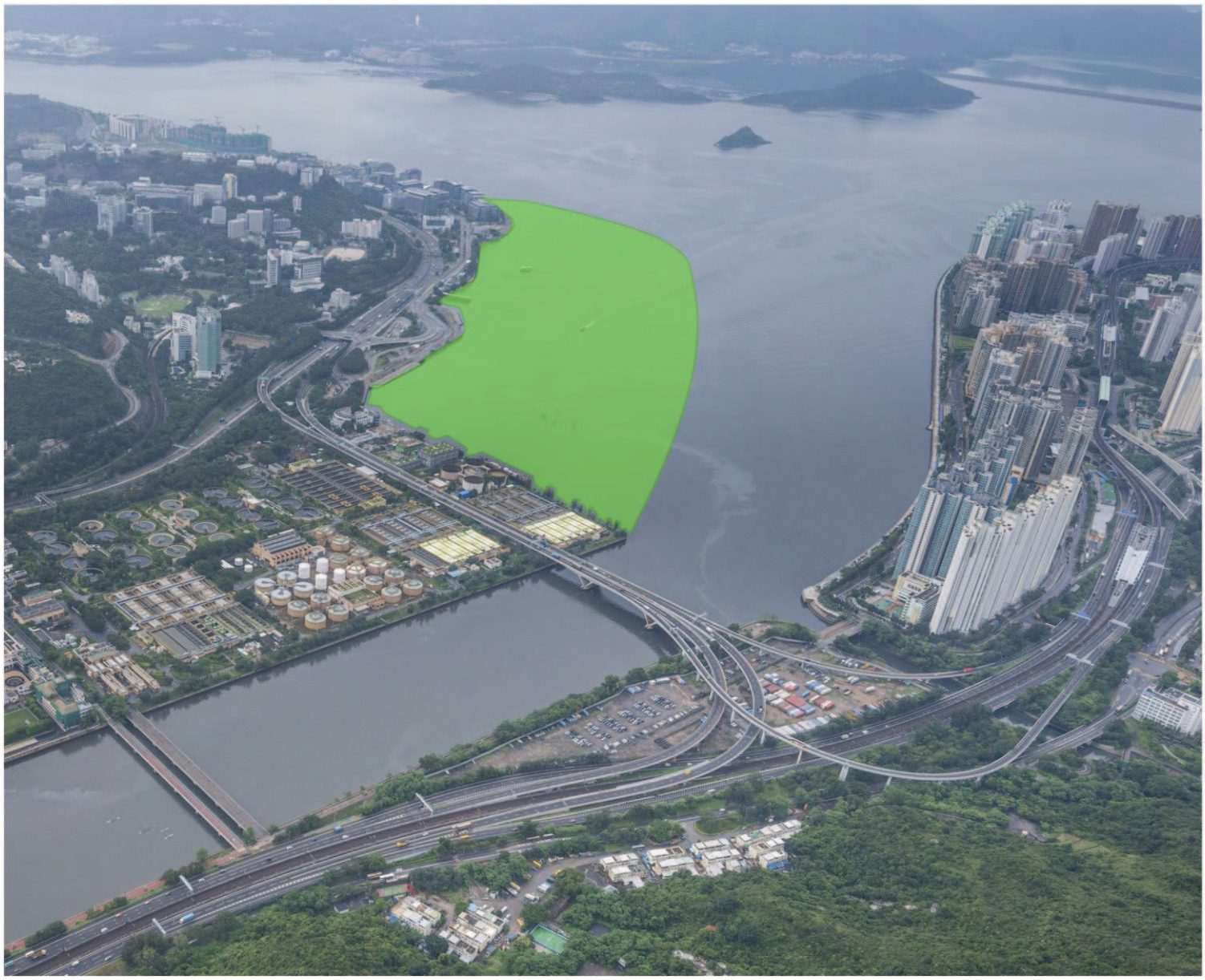
Executive Summary
for the Study (Final)

November 2017

土木工程拓展署
CEDD Civil Engineering and Development Department

Agreement No. CE 66/2014 (CE)

Study on Technical Issues Related to Potential Reclamation Site at Ma Liu Shui – Feasibility Study



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24 November 2017

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AECOM ASIA COMPANY LIMITED

1. INTRODUCTION

1.1. Background

1.1.1. On 30 June 2011, the Civil Engineering and Development Department (CEDD) commenced the Increasing Land Supply by Reclamation and Rock Cavern Development cum Public Engagement – Feasibility Study (the Land Supply Study) to identify suitable locations for reclamation outside Victoria Harbour and rock cavern development in Hong Kong.

1.1.2. Apart from broad technical assessment, the Land Supply Study comprised a 2-stage Public Engagement (PE) Exercise. Stage 1 PE was conducted from November 2011 to March 2012 and views collected showed a broad support for a "six-pronged approach" to enhance land supply, which included reclamation outside Victoria Harbour. Moreover, the potential impacts on environmental and local communities were considered the most important site selection criteria when selecting reclamation.

1.1.3. Under Stage 2 PE conducted between March and June 2013, the public was consulted on the possible land uses for the potential reclamation sites including Ma Liu Shui, as well as particular aspects which needed attention in further studies. During Stage 2 PE, different technical concerns on the potential reclamation site at Ma Liu Shui were raised. The major concerns include the potential impact on environmental, ecology, landscape and visual, drainage, hydraulic performance of Shing Mun River, traffic and transport infrastructure, etc.

1.1.4. In February 2015, AECOM Asia Company Ltd. was commissioned by the CEDD to undertake Agreement No. CE 66/2014 (CE) – Study on Technical Issues Related to Potential Reclamation Site at Ma Liu Shui – Feasibility Study (herein referred as "the Study") in order to examine the technical issues raised by the stakeholders related to the potential reclamation site at Ma Liu Shui.

2. KEY ASSUMPTIONS

2.1. Existing Site Condition

2.1.1. The potential reclamation site at Ma Liu Shui (hereinafter referred to as "PRS") is located at the opening of the Shing Mun River Channel, bounded by the Sha Tin Hoi water body at the east, the Tolo Harbour water body at the north, the Sha Tin Sewage Treatment Works (STSTW), Marine Police Outer Waters District Headquarters and Marine North Division at the south, and the Tolo Highway as well as the Hong Kong Science Park to its west. The major land uses surrounding the PRS include residential development of medium to high density, village type development, government, institution or community facilities, Hong Kong Science Park, open space, commercial, industrial and business uses. The PRS also surrounded with a robust railway network which is served by East Rail Line and the future Shatin to Central Link with the closest MTR stations at University and Tai Shui Hang. The potential reclamation site and its surrounding areas are shown in ***Figure 2.1***.

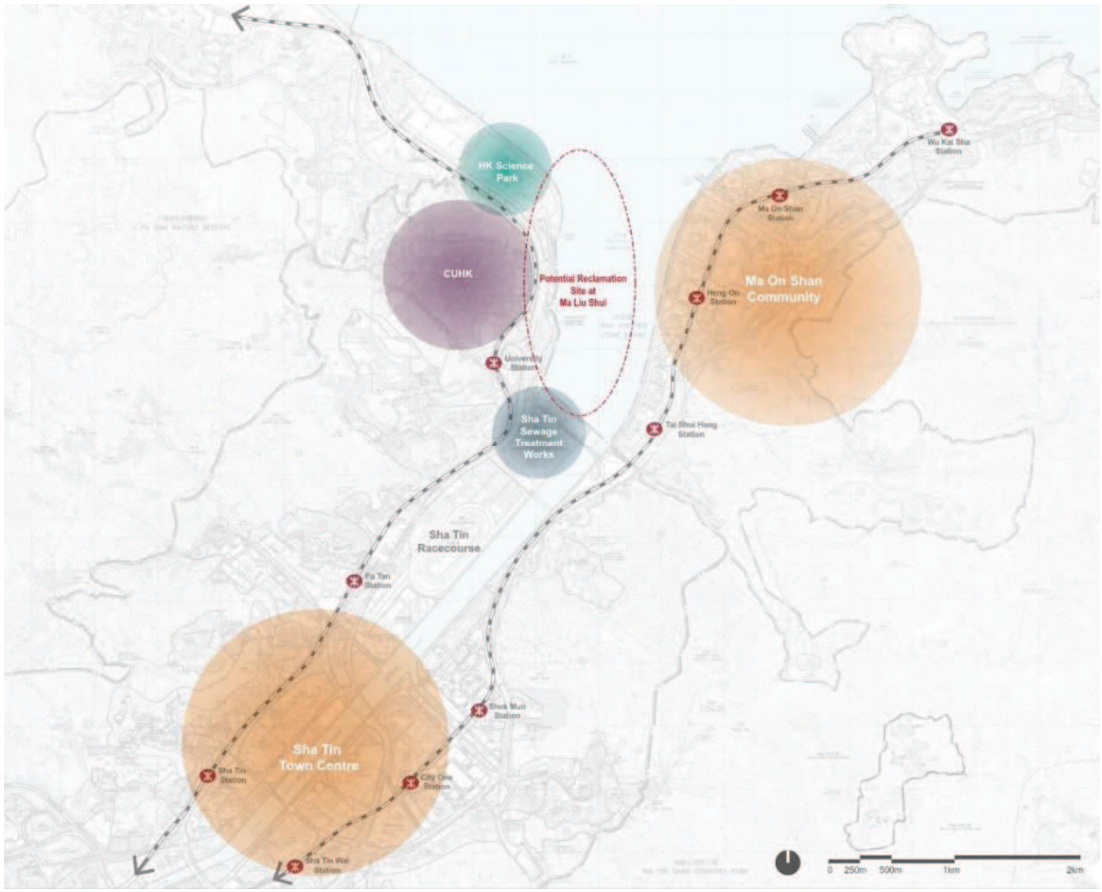

Figure 2.1 *– Potential Reclamation Site and its Surrounding Areas*

2.2. Summary of Key Assumptions

2.2.1. The PRS has been featured in the conceptual spatial framework of Hong Kong 2030+. Given that the PRS located at one of the primary development axes, i.e. the "Eastern Knowledge and Technology Corridor", there are opportunities to develop high technology and knowledge-based industries, housing and other uses at this location. It could create synergy with other developments such as the Chinese University of Hong Kong (CUHK) and the Hong Kong Science Park, which will in turn strengthen the corridor by additional knowledge and technology developments. It could also generate employment opportunities and help redress the home job imbalance.

2.2.2. In addition to this Study, the CEDD has engaged The Institute of Future Cities of the CUHK to conduct a district aspiration study including questionnaire survey and design charrette on the potential development in Sha Tin District. According to the study's findings, the public longs for leisure and cultural

activities together with human-water interaction in the area. It is majorly proposed to have ecological mix-land use development which combines business, residential and recreational land uses with consideration to potential environmental, visual and traffic impacts, along with individual members' aspirations on minimal disturbances to the existing water body.

2.2.3. Taking into account the opportunities, the following crude assumptions were made under the Study in order to facilitate the preliminary technical assessments on the PRS. The reclamation extent, land uses and scale of development are to be further explored and ascertained in the future planning and engineering study.

(a) Reclamation Extent: About 60ha

(b) Scale and Type of Development (including the potential development at the vacated site of STSTW):

- Population: about 34,100
- Total no. of flats: about 11,000
- Employment opportunities: about 41,500
- Development Type: research and development (R&D), higher education, housing and/ or other uses

(c) Public and Private Housing:

- Ratio of 60:40

(d) Additional Greenery Area:

- Around 30% of the site including about 20% of the site for open space plus roadside amenity

(e) Building Height:

- A stepped height profile increasing from north to south and increasing from seaside to inland

(f) Air Paths:

- Provision of suitable air paths and building separations

2.2.4. The assumed reclamation extent of the PRS for preliminary technical assessment purpose is shown in ***Figure 2.2***.

Figure 2.2 *– Assumed Reclamation Extent of the PRS*

3. TECHNICAL ASSESSMENTS

3.1. Preliminary Water Quality Impact Assessment

3.1.1. The Preliminary Water Quality Impact Assessment mainly covers the concerns of the stakeholders on water quality due to the reclamation works and the change of hydraulic condition.

3.1.2. The preliminary assessment covers the marine waters in Tolo Harbour as well as the inland waters near the PRS including the Shing Mun River designated under the Water Pollution Control Ordinance (WPCO) and other relevant areas in the vicinity being impacted. Numerical model and sediment plume model have been built up to assess the water quality parameters including suspended solid (SS), dissolved oxygen, 5 days Biochemical Oxygen Demands, E. Coli, etc.

3.1.3. The preliminary assessment shows that the major water quality impact associated with marine-based construction is the elevation of SS within the marine water column. Potential water quality impacts were identified and strategic mitigation measures (e.g. installation of silt curtain) are recommended under this preliminary water quality impact assessment. For land-based construction works, the potential water quality impacts from the land-based construction works are associated with the general construction activities, construction site run-off, accidental spillage, and sewage effluent from construction workforce. It is concluded that with the implementation of the recommended mitigation measures (e.g. provision of catchpit and perimeter channels), no adverse water quality impacts due to the construction works of the PRS would be expected.

3.1.4. The preliminary assessment also indicates that:

(a) no significant change in current velocities at Tolo Harbour and Shing Mun River were predicted with presence of the PRS, and hence no significant change in flow discharge in absolute terms is anticipated;

(b) slight SS and E-coli impact to WSD flushing water intakes were predicted but no significant effect on the health and environment is anticipated as WSD's practice is to treat flushing water to reduce the SS and E-coli to safe levels before supplying to the end-users;

(c) no other significant deviations of water quality modelling results predicted between this Study and that in the EIA study brief no. ESB-273/2014 for Sha Tin Cavern Sewage Treatment Works (STCSTW). Hence no change/ update in the findings of the EIA study of STCSTW; and

(d) no direct discharge of sewage effluent to marine environment and hence no adverse water quality impact is anticipated from sewage generated from the developments of the PRS. Hence, no adverse water quality impact in Tolo Harbour is anticipated. With proper implementation of the recommended mitigation measures, it is anticipated that the water quality impacts associated with the non-point source discharge from road surfaces and developed areas of the PRS would be minimized. Moreover, the water quality impacts of the diversion of the submarine rising main of Tolo Harbour Effluent Export Scheme (THEES) and twin 2,500mm dia. submarine outfall pipes will be assessed in the future EIA study if diversion is preferred after the review.

3.2. Preliminary Air Quality Impact Assessment

3.2.1. The Preliminary Air Quality Impact Assessment mainly covers the concerns of the stakeholders on air quality due to the reclamation works and the potential odour issue.

3.2.2. The preliminary assessment covers the area within 500m from the PRS. PATH and AERMOD models have been built up to assess the air quality parameters including total suspended particulates (PM_{10}), fine suspended particulates ($PM_{2.5}$), odour, etc.

3.2.3. The preliminary assessment shows that the air quality impacts from the construction works of the PRS would mainly be related to fugitive dust emissions generated by various construction activities, including excavation, sand filling above water, site formation, spoil/material handling, transportation and removal, stockpiling, wind erosion etc., at all potential works areas. With the implementation of mitigation measures specified in the Air Pollution Control (Construction Dust) Regulation, proposed dust suppression measures and good site practices regularly checked by regular site environmental audits, no significant impact of dust at the air sensitive receivers in the vicinity of the construction site is anticipated.

3.2.4. Odour patrol was conducted to provide information on the existing condition around the PRS and Shing Mun River. The odour patrol results show that there is no odour impact arising from the existing Shing Mun River. According to the water quality modelling results, the dissolved oxygen concentration at Shing Mun River would comply with the criteria of water quality objections with the presence of the PRS which would deter the anaerobic condition and avoid hydrogen sulphur generation from the sediment at the riverbed. Hence, no adverse odour impact from the PRS is expected.

3.2.5. In addition to the air quality, the CEDD also engaged Institute of Future Cities of CUHK to conduct Expert Evaluation on Site Wind Availability and Air Ventilation Assessment. Assuming a stepped height profile, provision of appropriate breezeway, vegetated airpaths and greenery area, no adverse air ventilation issue is anticipated.

3.3. Preliminary Noise Impact Assessment

3.3.1. The Preliminary Noise Impact Assessment mainly covers the concerns of the stakeholders on noise pollution due to the reclamation works.

3.3.2. The preliminary assessment covers the area within 300m from the PRS. Some noise sensitive receivers (e.g. Kam Fung Court, Vista Paradiso, Ocean View and Tak Sun Secondary School) at Ma On Shan which are located outside the

300m assessment boundary from the PRS have also been assessed in this study since (1) they are particularly concerned by the stakeholders, (2) they are the first layer noise sensitive receivers to the east which could demonstrate construction noise compliance at these noise sensitive receivers, and (3) they are located within 300m from helicopter flight path.

3.3.3. The assessment illustrates that the predicted construction noise impact at existing representative noise sensitive receivers would comply with relevant noise criteria. No adverse construction noise impact is anticipated under unmitigated scenario.

3.4. Preliminary Ecological Impact Assessment

3.4.1. The Preliminary Ecological Impact Assessment mainly covers the concerns of the stakeholders on ecological impact due to the reclamation works.

3.4.2. The preliminary assessment examines the flora, fauna and other components of the ecological habitats within the assessment areas. It also identifies the potential ecological impacts to the natural environment and the associated wildlife groups and habitats/species arising from the PRS.

3.4.3. The preliminary assessment shows that the direct ecological impact due to the loss of marine habitats within the PRS (subtidal artificial vertical seawall, soft bottom seabed, and intertidal shoreline) is anticipated to be minor. All three habitats are assessed to be of low ecological values with low diversity and abundance of wildlife recorded. According to the dive surveys conducted, no spotted seahorse (*Hippocampus kuda*) was recorded. In addition, direct loss of a locally common hard coral species *Oulastrea crispata* (***Figure 3.1***) within the PRS is anticipated to be of minor impact. It also shows that direct ecological impact due to habitat loss of intertidal artificial shoreline habitat (***Figure 3.2***) within the PRS is anticipated to be of minor impact to the ardeid species. Furthermore, given the low ecological values of the marine habitats, the direct ecological impact due to fragmentation of subtidal seawall (***Figure 3.3***) and intertidal shoreline would be of minor impact. Eco-shoreline is a kind

of shoreline which provides beneficial functions to the local ecosystem through a range of active or passive solutions, whilst coastal protection. It represents a paradigm shift in the fundamental approach to sustainable and environmentally friendly construction, from "minimizing impact" to "creating ecological benefit". Eco-shorelines could also provide beautiful and natural open space for the enjoyment by public. Hence, eco-shoreline (***Figure 3.4***) could be considered to enhance the ecological value and biodiversity after reclamation.

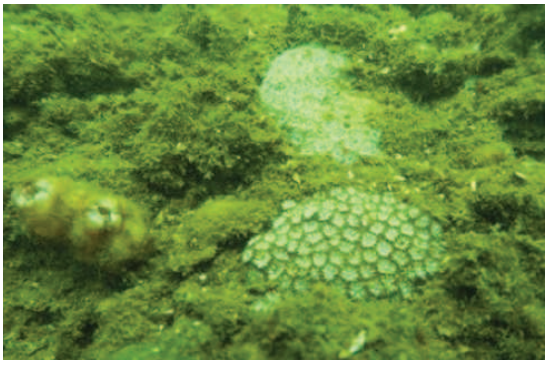

Figure 3.1 *– Hard Coral (Oulastrea crispata)*

Figure 3.2 *– Intertidal Organisms*

Figure 3.3 *– Existing Artificial Seawall*

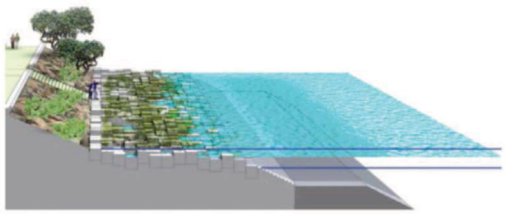

Figure 3.4 *– Example of Eco-shoreline*

3.4.4. Indirect impacts from construction disturbance are anticipated to be very minor on terrestrial habitats (plantation habitat and developed area) in the vicinity of the PRS and the indirect impact from the reclamation on the flight lines of breeding ardeids is anticipated to be minor, given the low percentage of ardeids and the short distance of flight path impacted and the presence of alternative flight paths in the vicinity. Only minor ecological impacts are anticipated from the PRS.

3.5. Preliminary Landscape and Visual Impact Assessment (LVIA)

3.5.1. The Preliminary LVIA investigates the potential landscape and visual impacts due to the PRS. A baseline study on the existing key landscape and visual resources within the Landscape Impact Assessment study boundary of 500m from the PRS and key visual resources within the visual envelope are identified and their sensitivity is evaluated. Potential landscape and visual impact, and appropriate mitigation measures are also identified.

3.5.2. The preliminary assessment reveals that the PRS will have landscape impact to the existing manmade shoreline along Sha Tin Hoi. Visual impacts, especially on a part of the residential developments and promenade on the opposite bank in Ma On Shan as well as some buildings of CUHK's campus adjacent to the PRS, will be resulted during both construction and operation phases of the PRS. However, there are no significant vegetation types or rare species identified in the Landscape Resources, and implementation of a series of appropriate mitigation measures, the new eco-shoreline aims to recreate and restore the disturbed marine habitat to Sha Tin Hoi. In addition, 30% of greenery coverage will be provided for the new development and provision of view corridors. Despite the loss of water area to Sha Tin Hoi being irreversible, the residual landscape impact to Sha Tin Hoi may be reduced from 'significant' to 'moderate' after the implementation of appropriate mitigation measures in the long run and no unacceptable landscape impact is anticipated.

3.5.3. Overall, the residual landscape and visual impacts of the PRS would be ranging from 'moderate' to 'insubstantial' in long run. To conclude, the PRS is considered preliminarily acceptable with mitigation measures. The extent of the adverse effects to be offset by the mitigation measures requires further study through a detailed Landscape and Visual Impact Assessment based on a detailed proposal in the next stage.

3.6. Preliminary Drainage Impact Assessment (DIA)

3.6.1. The Preliminary DIA mainly covers the concerns of the stakeholders on the drainage impact to Sha Tin Hoi and Shing Mun River due to the reclamation works.

3.6.2. The preliminary assessment reveals that the five outfalls at the existing shoreline of Ma Liu Shui would be required to extend to the reclamation boundary of the PRS. The overall cross section of each box culvert (B.C.) extension is enlarged and having larger capacities to cater for the immediate upstream peak flow under 200-year return period. The results indicated that the freeboard at those sensitive locations with low ground level still has more than 300mm, while branch drainage system at upstream of these box culverts need further investigation at next stage. In conclusion, the additional head loss caused by the outfall extension is insignificant to the existing drainage condition.

3.6.3. The PRS is divided into five catchments mainly by the proposed extension B.C. of existing outfalls and five B.C. are proposed to cater for these catchments respectively. All the proposed B.C. have enough capacity to cater for the surface runoff from the PRS and no adverse impact was found. Due to the back water effects, the maximum water level at the most upstream of the proposed B.C. within the PRS is estimated as about +5mPD under 200-year return period. The site formation level of the PRS will take into account the required freeboard and climate change effect in the next stage.

3.6.4. A Mike 11 model has been built up to assess the impact to Shing Mun River due to the PRS. It is found that the additional water level increase due to the PRS is in an approximate range from 3cm to 6cm along the Shing Mun River. The additional increase in water level is considered to be localized and manageable. The hydraulic performance of Shing Mun River and its upstream channels especially at some low laying areas in the vicinity of Shing Mun River shall be reviewed in details in further study. Taking into account the concerns on the current of Shing Mun River and the effects of spring tidal and extreme

storm surge raised by the stakeholders, further hydraulic study was conducted and the key findings were presented in **Section 3.8**.

3.7. Preliminary Sewerage Impact Assessment Study (SIA)

3.7.1. The Preliminary SIA mainly covers the concerns of the stakeholders on the sewerage impact due to the reclamation works.

3.7.2. The preliminary assessment shows that a 1,000mm dia. THEES submarine rising main and twin 2,500mm dia. submarine outfall pipes at Sha Tin Hoi are identified to have conflicts with the PRS. The MLS North Pumping Station with designed peak flow of 0.1 m^3/s and MLS South Pumping Station with designed peak flow of 0.21 m^3/s are proposed to pump the sewage flow from the PRS to the planned Intermediate Sewage Pumping Station under Agreement No. CE 30/2014 (DS). In addition, twin 250mm dia. rising mains are proposed to connect MLS North Pumping Station with MLS South Pumping Station and twin 300mm dia. rising mains are proposed to connect MLS South Pumping Station with the planned Intermediate Sewage Pumping Station under Agreement No. CE 30/2014 (DS). Since the estimated total sewage ADWF from the PRS together with the potential development at the vacated site of STSTW is about 12,600 m^3/d, which is smaller than the planned value under Agreement No. CE 30/2014 (DS), as such no adverse impact is found on both existing and planned sewerage and sewage facilities due to the subject development in this Preliminary SIA.

3.7.3. The diversion of the above-mentioned 1,000mm dia. THEES submarine rising main and twin 2,500mm dia. submarine outfall pipes will be assessed and with necessary mitigation measures proposed in the future EIA study if diversion is preferred after the review.

3.8. Hydraulic Study on Sha Tin Hoi and Shing Mun River

3.8.1. The hydraulic study mainly covers the concerns of the stakeholders on the effect of spring tidal and extreme storm surge at Shing Mun River and Sha Tin Hoi due to the reclamation works.

3.8.2. The Delft3D model has been adopted and the changes resulting from the PRS, with respect to flooding due to tides combined with storm surge, have been evaluated. Key findings from the study are summarized as below:-

(a) Under normal spring tidal conditions:

- There is no detectable changes in peak water levels; and
- There are minor local increases and decreases in peak current speeds, typically within the range ±0.02m/s.

(b) Under combined normal spring tidal and extreme storm surge conditions:

- Peak water levels are increased by about 5 cm near the reclamation;
- Peak water levels are increased by between 1 – 3cm within the Shing Mun River channel;
- Current patterns downstream and seaward of the reclamation are modified leading to local increases and decreases in current speed in the range ±0.15m/s; and
- Peak current speeds within the Shing Mun River channel upstream of the reclamation are unaffected.

3.8.3. The predicted changes in hydraulic conditions have been assessed for an extreme storm surge condition representative of a Super Typhoon. Typical flow pattern in Tolo Harbour near the PRS is indicated in ***Figure 3.5***. The changes during a less severe event can be expected to be of a reduced magnitude. In addition, under normal spring tidal conditions, there is no detectable change in peak water levels and only a minor change in peak current speeds as a result of the reclamation. In these circumstances there

will therefore be no discernible influence on the flood risk within areas upstream of the section of the Shing Mun River that is represented in the model.

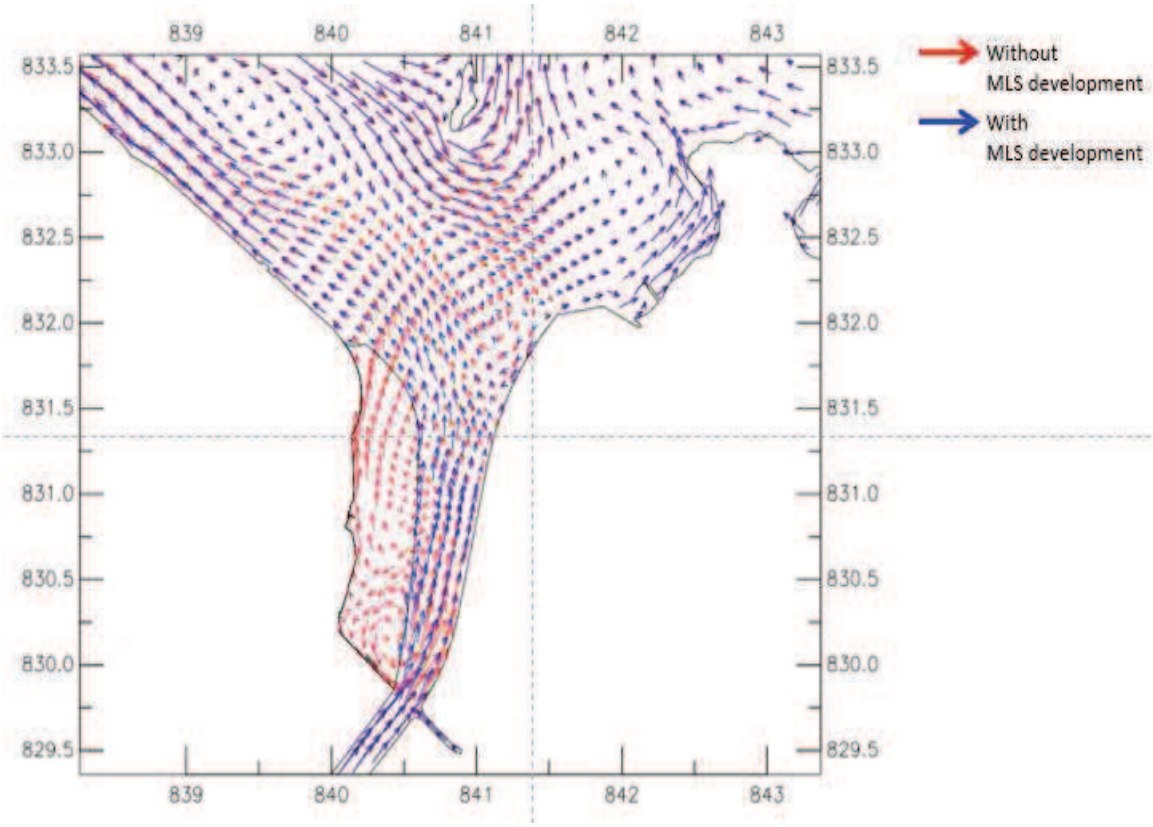

Figure 3.5 *– Typical Flow Pattern in Tolo Harbour (Ebb Tide)*

3.9. Preliminary Traffic and Transport Impact Assessment (TTIA)

3.9.1. The Preliminary TTIA mainly covers the concerns of the stakeholders due to the reclamation works on the following aspects:

(a) To forecast traffic flow and pattern generated and attracted within the area of influence;
(b) To estimate the traffic demand generated by the assumed developments at the PRS and assesses its traffic impact on the adjacent road system;
(c) To assess the likely traffic and transport impacts on both the road network capacity, traffic circulation and develop traffic and transport improvement schemes, where appropriate, to mitigate any traffic and transport impacts; and
(d) To recommend traffic and transport arrangements/measures including the proposed infrastructure.

3.9.2. With the employment node in-placed in the PRS, the traffic pattern of the district would be changed where those people heading to urban bound would be diverted to the employment node, i.e. towards MLS or remain within the Sha Tin district. Hence, the background traffic flow heading to urban bound would be reduced thus allowing some buffer for the development traffic from the PRS. As a result, the traffic impact due to the PRS on the concerned road links would be minimized. With the changing of traffic pattern, the self-containment of the district would be increased accordingly.

3.9.3. The road link capacity assessment for Year 2036 is based on some assumed major road networks such as Road T4, Widening of Tai Po Road and road connections with the PRS. The assessment result indicates that the vehicle/capacity (V/C) ratio of L1 (Tolo Highway (between Tai Po and Pak Shek Kok)) southbound, L12 (Tate's Cairn Tunnel) southbound, and L13 (Lion Rock Tunnel) southbound will be similar during the AM peak hour in Year 2036 with or without the developments of the PRS. The V/C ratio of road link L1 AM peak southbound will be slightly increased by about 0.01 only. The impact is manageable and can be addressed in the future planning and engineering

study. With the developments of the PRS, the V/C ratio of L12 (Tate's Cairn Tunnel) AM peak southbound, L13 (Lion Road Tunnel) AM Peak southbound and PM peak northbound are slightly reduced in Year 2036 when comparing with the Reference Case.

3.9.4. According to the junction analysis results with the PRS, all key junctions will operate within capacity during the AM and PM peak hours in Year 2036.

3.9.5. In conclusion, no insurmountable traffic impact is anticipated due to the PRS.

3.10. Preliminary Transport Infrastructure Study

3.10.1. In connection with the findings of the Preliminary TTIA, this Transport Infrastructure Study investigates the supporting transport infrastructures required due to the reclamation works.

3.10.2. Internal roads within the PRS and connections to the PRS with a new road/bridge and 3 new junctions at Science Park Road, Tolo Highway and the vacated site of STSTW are proposed to serve the development. In general, the design of the road hierarchy within the PRS emphasizes strong integration of road network with land use. The road network is more site specific to prevent unnecessary through traffic traveling across the PRS.

3.10.3. 6.5m wide footpath associated with 3.5m wide amenity strip is proposed to provide within the PRS. 4m wide 2-way cycle track is also proposed to connect to the existing cycle track network connecting Shatin, MLS and Hong Kong Science Park.

3.10.4. There are also opportunities to enhance the connectivity, especially for pedestrians/cyclists, (i) along the shoreline; (ii) between the PRS and Ma On Shan; and (iii) between the PRS and the University Station.

4. CONCLUSION

4.1.1. Based on the above technical assessments, it is concluded that the PRS will unlikely lead to insurmountable technical issues and it can provide opportunities to meet the overall development needs at both territory and community levels.

5. FURTHER STUDIES

5.1.1. Further to the crude assumptions made in the preliminary technical assessments, further studies on planning and engineering would be conducted. More detailed investigation and assessments should be carried out to firm up the development proposal and land use planning, covering aspects such as marine traffic, land traffic and transport, drainage, sewage, etc. Statutory EIA should be carried out to ascertain the environmental acceptability of the development proposal and to explore further mitigation/ enhancement measures.

5.1.2. The locals and relevant stakeholders on the proposed development should be consulted on the proposed development and their views should be sought to formulate the land use proposals. Public engagement shall be allowed in the next stage to seek community's views prior to the finalization of land use them of the development of Ma Liu Shui reclamation.