A3 WATER QUALITY & HYDROLOGICAL IMPACT ASSESSMENT

A3.1 INTRODUCTION

The water quality assessment has followed the guidelines presented in *Annex 14 of TMEIA*. The assessment has focused on the construction and operational impact associated with implementing the Project.

A3.2 GOVERNMENT LEGISLATION AND STANDARDS

Protection of marine water quality during and following construction is governed by the *Water Pollution Control Ordinance (WPCO)*, which defines the *Water Quality Objectives (WQOs)* and standards for effluent discharges. The criteria adopted in this assessment are laid out in the *TMEIA Annex 6*.

For assessment of the effect to the local hydrology, impacts arise during the construction phase and operational phase will be examined, with an emphasis on the potential effect from the proposed construction method.

A3.3 WATER QUALITY SENSITIVE RECEIVERS & BASELINE WATER QUALITY CONDITIONS

In the HKSAR end of the Project, the proposed works site is surrounded by fishponds, including both active and in-active ones.

The Study Area is bound at the north by the Shenzhen River into which all local streams and nullah flow.

Fishponds

Figure 1.4 shows the general layout of the Study Area and the fishponds therein. A previous study of nearby fishponds by Binnie (1999) suggested that the water quality in both actively managed and unmanaged fishponds had a high concentration of algae, probably due to nutrients present from decomposing fish waste, plants and organic fertilizers deposited on the pond base.

It was further suggested that high turbidity and oxygen levels indicated high algae concentration, which would have absorbed much of the nutrients present, giving low nitrogen and phosphorous levels.

Shenzhen River

The Shenzhen River is the main receiving water body of the streams and watercourses in the vicinity. As such, its water quality would be directly affected by the quality of the effluent discharged into these local watercourses and nullah.

Data reported in the *San Tin EIA* (ERM 1999) indicated poor water quality with low DO and high BOD5 and SS, which had probably been due to discharge of untreated effluent from industry, agriculture, livestock farming and human sewage. Sediment testing from *KCRK Lok Ma Chau Station EIA*

(Binnie 2002) indicated that high levels of copper, zinc and lead were present.

Table A3.1 – Water quality data for Shenzhen River (high and low water levels) in dry season of 1994 (ERM 1999) (all values in mg/L)

Station No.	W2		W3		W4	
Water Levels	High	Low	High	Low	High	Low
Dissolved Oxygen (DO)	1.0	0.8	0.7	0.6	0.8	0.7
SS	250	241	120	87	135	125
BOD_5	74	75	63	62	25	46

Table A3.2 – Sediment quality data for Shenzhen River (Shenzhen River Regulation Project, report in ERM 1999) (All values in mg/kg)

Location		Cr	Cu	Hg	Ni	Pb	Zn	Cd
River	Zhanmatou	106.0	207	0.30	-	102.0	523.0	0.43
	Hekou	65.0	99.0	0.13	-	82.0	308.0	0.24

Table A3.3 – Elutriate test results for sediment from Shenzhen River (ERM 1999) (All values in mg/L)

		TN	TP	COD	Cu	Pb
River	No sediment	26.97	2.82	19.39	0.018	0.048
	1:100	24.50*	0.55*	20.13 (+3.8%)	0.014+	0.048
	1:1000	28.48 (+5.6%)	1.87*	21.06 (+8.6%)	0.014+	0.048

Note: * Decrease due probably to adsorption or degradation.

Ha Wan Nullah

One of the key components of this Project is the (temporary) diversion of the Ha Wan Nullah necessary for the construction of the viaducts.

The Nullah will initially be diverted into a temporary channel running west and approximately parallel to the alignment of the proposed bridge discharging directly into the Shenzhen River. It will eventually be connected to the San Tin Eastern Main Drainage Channel (San Tin Eastern MDC) when works under the said project is substantially completed in 2006. The diversion schemes are shown in *Figure 2.4*.

A3.4 IDENTIFICATION AND EVALUATION OF POTENTIAL IMPACTS

The impact to the water quality and the hydrology of the Shenzhen River due to the construction of the new piers should be examined in two phases – during construction and operation phases.

Construction Phase

Water Quality

The proposed works could give rise to impacts on the quality of the water bodies in the vicinity during the construction phase in various manners:

- Effluent from construction activities discharged into local watercourses would ultimately be discharged into the Shenzhen River causing pollution both to the watercourses themselves and to the River;

- Run-off from construction sites to nearby fishponds causing pollution;
- Concrete washings that is usually of poor quality and has high ammonia content (therefore high pH) may raise the unionized ammonia level, a contaminant that is highly toxic to many aquatic organisms;
- Excavation of trenches for the relocation of an existing nullah may alter the local groundwater regime. This process may alter the existing permeability characteristics of the soil, possibly reducing the infiltration of the topsoil by the introduction of finer material and compaction of the soil structure. During wet seasons, rainwater may accumulate forming surface run-off that may carry with it high suspended-solids loading.

It is proposed that, taking into account the relative merits of various construction methods, the use of cofferdams for construction of piles and caps represents the preferred option for the foundation construction for the following reasons. While it can provide a contained environment to facilitate the dredging operation and effectively, it is also effective in controlling the release of dredged material into the surrounding water, thereby minimising potential impacts to the Shenzhen River.

Although the installation of the cofferdams for the construction of the bridge pier foundation would disturb sediments at the bottom of the River causing the concentration of the SS to rise, it is envisaged that this activity could be done in a relatively short period. The impact on the river hydrology is therefore anticipated to be minimal.

The cofferdam with a size of 12m x 12m will be provided during the bridge pier construction, with a 1m clearance on each side of the pile cap.

During piling and cap construction, the contaminated water may escape from the enclosed cofferdam and de-watering within the cofferdam may release turbid water into the River. This impact would be mitigated by strict compliance with good site practice and control.

To further minimise impacts to the environment, the bridge deck units are likely to be pre-cast units brought down along the Shenzhen River, and no in-situ concrete works are expected. Suitable mitigation measure should be implemented to protect the water quality and ecologically sensitive area downstream.

As no construction works will be carried out in the fishpond area, it is expected that potential impacts to nearby fishponds will be negligible.

As regards the temporary diversion of Ha Wan Nullah, it is envisaged that careful planning could effectively eliminate much of the potential water quality impacts during its construction. During the construction of the new temporary channel, the existing nullah will remain in operation and completely blocked off from the construction works, thus no deterioration to water quality in the nullah. Upon completion of the temporary channel, the dividing wall will then be demolished in stages to enable flow to be diverted into the new channel. It is unlikely that the water quality would be affected.

Hydrology

The main activity that could give rise to hydrological impact of significance is the installation of cofferdams for the construction of bridge foundation in the Shenzhen River.

To minimise this impact, it is proposed that, as shown in the tentative construction programme in *Figure A2.2*, the construction of the bridge foundation in the Shenzhen River will be carried out in the dry season between November and mid March of the following year. During this period the flow of the Shenzhen River would be considerably slower than that during the wet season, and hence alleviating any likely impact on the surface hydrology. A lowered level of disruption to the surface hydrology would, in turn, translate to minimising water quality impact to the downstream.

It is anticipated that all the bridge piers will be constructed at the same time. While this could affect the flow of the Shenzhen River at the location, it is proposed that two separate cofferdams be used to reduce the blocking effect.

The width of each cofferdam is 12m, which represents approximately a 15% reduction in the total cross-sectional area of the River.

As such, it is anticipated that there would be no significant impact to the hydraulics of the Shenzhen River during dry seaons.

Operational Phase

Water Quality

It is envisaged that there will be no permanent impact to the water quality in the River and groundwater.

The additional two columns supporting the bridge in the Shenzhen River will be approximately 3m x 6m in size and located downstream to the existing bridge. There would not be any change in the cross-sectional area of the Shenzhen River and hence no adverse effect on the hydraulics of the River.

The current Project will involve construction of primarily at-grade and elevated roads, and involves no facilities that are foreseen as a likely source of human or other sewerage effluent. As such, consideration for possible water quality impact from these sources is considered not necessary in this assessment. However, the likely cause of increase in people using the Crossing facilities and hence sewerage production is outside the scope of this assessment and will be addressed in the forthcoming further expansion of kiosk project to be undertaken by ASD.

Hydrological Impact

As the new pile caps will be smaller than that of the existing bridge and located along the new pile caps and piers, it is expected that there will be no gross increase in the cross-sectional normal to the flow direction, and hence hydraulics of the River.

A3.5 Mitigation Measures

Much of the potential impacts are likely to occur during the construction phase, and little impacts are expected during the operational phase of the Project.

The main form of pollution would be increase in the level of suspended solids (SS), variation in the pH values and oil/grease from site run-off.

The following is a summary of mitigation measures for various construction activities:

Potential Impact	**Corresponding Mitigation Measures**
Surface run-off from works site	• Implementation of suitable temporary drainage system, including the use of channels, sandbags or bunds to avoid escape of contaminated water. • Provision of de-silting facilities to reduce SS levels in effluent. • Provision of oil interceptor as appropriate.
Marine bored-piling	• The installation of the sheetpiles for the cofferdams shall be controlled to minimize stirring up of sediments. • Recycle of bentonite where appropriate. • Contain run-off from cofferdams. • Waste discharged from the piling activities shall be treated and disposed of offsite.
Elevation of pH in watercourses from concrete washings	• Close monitoring of pH in watercourses. • Construction of temporary working platform underneath the concreting work to collect split cement and concrete washings.
General	• Avoid spillage of wastewater and materials into the River. • Minimize concrete production on site – use pre-cast units where possible. • Wastewater from construction should be collected and treated before being discharged.

A3.6 Conclusion

The proposed Project may have a potential water quality impact on two

aspects, namely the Shenzhen River and nearby fishponds.

The current condition in the Shenzhen River is poor, with low DO and high BOD5 and SS, which have probably been due to discharge of untreated effluent from industry, agriculture, livestock farming and human sewage into nearby streams that discharge into the River.

The potentially adverse impact to the nearby water bodies, including the River and fishponds, through run-off with high SS level and other toxic contaminants could be avoided through implementation of good site practices and adequate treatment before being discharged. Attention should be given to the containment of construction waste (including wastewater), such as concrete washings with a high pH level detrimental to marine organisms.

The main concerns with the installation of the sheetpiles at the cofferdmans will be the stirring up the sediments possibly raising the SS level for a short duration. The Contractor should install the tubular cofferdam at slow rate to minimize stirring of the sediments.

Since the size of the new pile caps, and hence the size of the cofferdams required, will be smaller than that of the existing ones located immediately in front, the use of temporary cofferdam is expected to have negligible effect on the hydraulics of the River during the construction phase

Similarly, the additional piers, which will be of a similar structural form and size to the existing ones, is expected to have no adverse effect on the hydraulics of the River during the operational phase both in dry and wet seasons.

With all these precautionary and mitigation measures in place, it is expected that the impacts to water quality and hydrology as a result of the proposed works will be minimal.