

13.0 SUMMARY AND CONCLUSIONS

13.1 Scope of the EIA

13.1.1 The scope of the Project includes the extension of the sewer network to encompass villages in the Tai Lam Chung Valley and So Kwun Wat and connection to the existing existing sewerage system. The works include the construction of six pumping stations and associated sewer network.

13.1.2 The EIA has been undertaken in accordance with the EIAO and the Study Brief and has included an assessment of the impacts and benefits of the project on the local environment and sensitive receivers during both the construction and operational phases. The following environmental parameters have been evaluated:

- C air quality;
- C noise;
- C water quality;
- C waste management;
- C ecology;
- C heritage;
- C landscape and visual; and
- C environmental monitoring and audit.

13.1.3 In three cases, additional specialist survey work has been identified as being required to fulfill the environmental assessment. In this regard, baseline odour measurements were carried out at the existing So Kwun Wat pumping station to provide details on sewage odour issues for the proposed pumping stations. Additional ecological surveys were undertaken of habitats identified as being of importance and concern. Further investigation to assess the archaeological baseline of the study area was also undertaken comprising historical and cultural heritage features and archaeological site surveys.

13.2 Summary of Findings and Recommendations

13.2.1 The key findings of the EIA are described in the following sections and summarised in Table 13.1.

Air Quality

13.2.2 In respect of air quality, the main construction phase issue will be dust generation with the key areas for control being during the concrete breaking operations in the villages themselves due to the proximity of the sensitive receivers. In all cases, it has been predicted that any adverse impacts can be controlled to acceptable levels with the implementation of suitable mitigation measures, for which the Contractor will be responsible under the auspices of the Air Pollution Control (Construction Dust) Regulations.

13.2.3 During the operational stage, the potential for air quality are limited to odour nuisance from the pumping stations. Based upon the dispersion rate of the odour over distance determined

from the odour measurements taken at the existing pumping station and the setback of the sensitive receivers, it is predicted that the odour concentrations would be well within the criteria of 5 odour units under normal operating conditions.

- 13.2.4 Odour modelling was also conducted and the findings concurred with the monitored readings, with odour concentrations from all the pumping stations being predicted to be within the acceptable limits at all existing and future pumping stations.

Noise

- 13.2.5 Noise may be generated from different stages of the construction works, namely pumping station, main sewer and village sewer works. Indicative worst case construction equipment and scenarios have been developed for each of these as a basis for the noise impact assessment. In respect of the majority of construction activities, noise levels would be above the acceptable criteria for 13 representative noise sensitive locations during pumping station construction, with all other locations being of sufficient distance away to remain unaffected, and at most locations during main and village sewer construction due to the proximity of the NSRs. Thus, mitigation measures will be required to control noise levels in most cases.
- 13.2.6 Suitable mitigation measures in the form of mufflers on the breakers, silencers on trucks and the use of temporary noise barriers can control the pumping station construction noise to within the 75dB(A) for all the residential NSRs. In Luen On San Tsuen, the school and kindergarten have a different criteria of 70 dB(A) during normal hours and 65 dB(A) during exam periods. The 70dB(A) criteria is predicted to be exceeded at the kindergarten only during the vibratory compaction of concrete and while this activity is of short duration, it is recommended that it be scheduled outside the normal kindergarten hours. The 65 dB(A) is predicted to be exceeded by various activities at both the school and the kindergarten and thus, it is recommended that certain activities are scheduled to be carried out outside the exam periods.
- 13.2.7 The results for the main sewer alignments show that, with the same mitigation applied, NSRs within 10m of the works, comprising 8 representative locations, would still be subject to noise above the criteria. Thus, additional measures, for example the use of acoustic enclosures, manual breaking of the hard standing and excavation, alternative pavement removal methods and scheduling of operating times, have been recommended. It is considered that based upon these measures or a combination of these measures, compliance with the standards should be achievable in most cases. However, in Luen On San Tsuen, it is recommended that works adjacent to the school and kindergarten are scheduled outside normal school hours wherever practicable and not within exam periods.
- 13.2.8 Assuming a noise barrier can be used during the village sewer construction, properties more than 5m away will not experience noise greater than the 75 dB(A) standard. Due to the proximity of many of the residential units to the proposed works, space constraints may mean that barriers would not be practicable. This is particularly the case for properties within 1-2m of the sewer alignment. Additional measures as recommended for the main sewer construction have been specified but it is considered that residual impacts may occur.

- 13.2.9 All construction activities during both main and village sewer works will be of short duration in any one location with individual village units being affected by residual noise levels for a period of no more than a 1-2 hours. The construction of the sewer alignment is an integral element of the project and cannot be avoided. However, based upon the very short duration of the works, any residual impacts during sewer construction would be considered acceptable within the overall benefits of the scheme.
- 13.2.10 During the operational phase, predicted noise levels at NSRs, based upon the sound power level of the pump, would be within the criteria due to the large attenuation afforded by the pumping station building. Thus, it was concluded that the operational noise levels would not create any adverse impacts to local residents.

Water Quality

- 13.2.11 The most significant potential impact on water quality during the construction phase will be due to suspended solids runoff from excavation sites and spoil heaps and from dewatering of trenches and foundations, when water containing high concentration of suspended solids may be discharged to water courses. However, with the implementation of suitable mitigation measures it is concluded that there will be no adverse impacts. A further key issue will be during construction of the sewer across the water courses themselves which is designed to occur on three locations, Tai Lam Chung Tsuen, Luen On San Tsuen and So Kwun Wat San Tsuen. The former location involves the construction of a pipebridge and there is potential for impacts during dredging and foundation laying works. However, impacts are not anticipated to be significant. Works in the other two areas will involve open trench construction and thus it is recommended that works are carried out during low tide and periods of low flow respectively. No residual construction impacts are predicted.
- 13.2.12 Once operational, overall the system will collect the sewage from this area that was previously being chronically discharged, untreated or only partially treated, into the surface water drainage system, with subsequent effects on the water quality of the surrounding water courses. Thus, the scheme offers a significant environmental benefit to the area in terms of improvements in the quality of inland streams and coastal water.
- 13.2.13 The only potential water quality issue during the operational stage will arise from the emergency overflow of sewage into the local receiving waters. To protect against this, all pumping stations have been designed to include a stand-by pump, emergency power supply and a telemetry system. Based upon these mitigation measures, it is extremely unlikely that a failure will occur and due to the telemetry system, any failure would be repaired promptly and the discharge would be short-term.
- 13.2.14 Notwithstanding the negligible risk of a discharge, all overflows in the Tai Lam Valley have been designed to discharge into a large water body, where the sewage will be suitably diluted and any impact would be short-term and localised to the point of discharge only. The emergency overflow at the Castle Peak Villas pumping station is designed to flow into a small existing drainage channel which flows to a non-gazetted beach and will ultimately drain into the sea at high tide. Due to topographical and technical constraints, the pumping station has been located at the lowest point on Lok Chui Street and this dictates the location of the emergency outfall. While all possible measures to avoid a discharge have been made, in the unlikely event of an

overflow occurring, the discharge would be rapidly diluted and flushed out of the bay within no more than 1-2 days and will not cause a significant impact to water quality or marine ecology. In So Kwun Wat, the location of the emergency overflow below So Kwun Wat Tsuen into the channelised stream will avoid damage to the more natural upper stream. Recovery of the streams fauna would be expected to occur relatively quickly from any discharge as species re-colonise from the more diverse and natural upstream areas.

- 13.2.15 Thus, the pumping stations have been designed to minimise the risk of an overflow and limit its duration if such an event did occur and the receiving watercourses have been assessed as being able to receive a short-term discharge without any long term effects. Thus, no unacceptable residual impacts are predicted.

Waste

- 13.2.16 A large proportion of the soil material that will be excavated during the construction phase will be suitable for use as backfill material for the sewer alignment. The remaining earth and the broken surface material will require off-site disposal on the basis that it will be surplus to requirements or unsuitable for backfilling respectively. The total amount of surplus material from the installation of the sewer alignment and excavation for the pumping stations has been determined to be approximately 18,000 m³. This would equate to about 4 truck loads per day over the entire site. In practice, only one lorry trip would be expected in any one location and this will not result in any significant environmental impacts.

- 13.2.17 The waste material generated during the operational phase will be limited to screening materials removed during the maintenance of the pumping station and materials removed from manholes after removal of blockages. Assuming proper handling and disposal methods are adopted, no adverse impacts are predicted.

Ecology

- 13.2.18 The ecology assessment has involved an initial habitat survey to characterise the general ecological structure of the study area. The habitats identified within the study area are shown below:

- C uplands;
- C lowlands;
- C marshland;
- C woodland;
- C fishponds;
- C streams;
- C coastal and intertidal; and
- C estuarine.

- 13.2.19 The data collected from the literature review and both the initial and specialised field studies has been combined to provide an ecological baseline description of the study area and undertake a detailed assessment of ecological impact magnitude and significance was carried out.

- 13.2.20 Adverse impacts identified as a result of the potential loss of woodland habitat north of Tai Lam Chung, east of Wong Uk and east of So Kwun Wat Tsuen from the construction of the originally proposed sewer alignment and site boundary have been avoided by the realignment of the sewer and revision of the site boundary.
- 13.2.21 The loss of a very small area of marshland (5m²) south of Tai Lam Chung Tsuen will be of minor significance given that only 0.2% of the total marsh are will be taken. Nevertheless, the magnitude of this impact can be reduced by minor changes to the site boundary during construction to minimise the loss of marshland habitat. Drainage impacts on the marsh can also be avoided during construction by returning water entering an excavated trench back to the marsh.
- 13.2.22 The stream east of So Kwun Wat Tsuen may experience impacts of minor significance as a result of disturbance of the stream bed and generation of suspended solids during construction. These impacts can be mitigated somewhat by confining laying of the sewer across the stream to periods of low stream water flow.
- 13.2.23 Construction of the Tai Lam Valley pumping station will result in the loss of a brackish water fish pond resulting in an impact of moderate significance. No mitigation is possible but the residual impacts are not unacceptable given the size and quality of the habitat loss, the availability of similar habitats in the area and the overall benefits of the scheme.
- 13.2.24 In conclusion, the majority of all significant ecological impacts predicted can be successfully mitigated and no adverse residual impacts will occur.

Heritage

- 13.2.25 Excavation of the substructures of the proposed pumping stations could affect or destroy any archaeological remains within its footprint. In addition, remains present outside the footprint but within the outline of the building foundations or services, are likely to be severely truncated by construction works. Preliminary assessment work recommended the need to detailed site survey work to be undertaken. The field assessment was divided into the assessment of historical and cultural features and archaeological site surveys based upon areas of high, medium and low archaeological potential identified during the initial assessment phase.
- 13.2.26 The proposed works for the affected villages will not directly impact on any of the historic structures identified. However, there will be indirect impacts, as the works will be carried out in close proximity to many of the structures and as such mitigation in the form of supervision of some structures during the construction period have been recommended.
- 13.2.27 The archaeological site surveys of the pumping stations and sewer alignment did not identify any archaeological artefacts or soil deposits and no further action is recommended. Areas of high archaeological potential and pumping station sites not included in the survey due to coverage of concrete, however, will need to be supervised during construction.

Landscape and Visual

- 13.2.28 The landscape and visual impact assessment has the broad objectives to outline the landscape baseline conditions, identify the visually sensitive receivers and assess the impacts occurring after construction of the proposed sewerage network. However, this assessment has also considered construction phase impact on the local community. Assessment of the potential visual impacts of the proposed works and impacts on the existing landscape has comprised two distinct sections, namely baseline site surveys and assessment of the potential impacts by identification of the impact sources, their magnitude and sensitivity of receivers.
- 13.2.29 Overall, pipe laying will not cause landscape or visual impacts upon completion, with some exceptions as discussed below. The main landscape and visual impacts are, therefore, expected to arise instead from the intrusion of the pumping stations and compounds.
- 13.2.30 The visual intrusion of the pumping stations can be minimised, however, by the integration of the proposed pumping station into its surrounding environment by the use of a suitable colour scheme of the pump station building to match the design of adjacent properties, construction of a boundary wall similar to the adjacent housing, instead of standard chain link and barbed wire fence, and planting of trees to the boundary of the pumping station compound, wherever practicable.
- 13.2.31 Trees which may be affected by the pumping station or the main sewer alignment have been identified at Castle Peak Villas, Tai Lam Chung Tsuen pumping station site, in the lanes of the older villages in So Kwun Wat Tsuen and close to the refuse collection point near the Tai Lam Correctional Institution. With the exception of the latter, all these trees can be avoided either by minor realignment of the sewer or care during construction.
- 13.2.32 With respect to the mature trees adjacent to the refuse collection point on Tai Lam Chung Road, this will have to be cleared for the sewer alignment and future access area. However, due to the proposed planting at the adjacent pumping station, it is judged that these trees will be adequately compensated and the impact is not significant.
- 13.2.33 The location of the Tai Lam Valley pumping station will require the resumption and filling in of a brackish fish pond. While the visual and landscape quality of this pond is medium and its loss is not considered significant, it does add something to the visual and landscape environment. The loss can be compensated by the planting of trees around the boundary of the compound, where practical.
- 13.2.34 The potential landscape and visual impacts of the Tai Lam Chung Tsuen pumping station site is moderate due to the necessary clearance of vegetation and the visibility of the site to road users and nearby village houses but can be mitigated by the planting of trees around the boundary of the compound, where practical.
- 13.2.35 The Luen On San Tsuen pumping station site is located at the junction of Luen Tai Street and Luen Hung Lane on a site currently occupied by properties soon to be demolished. The landscape impacts are not anticipated to be significant so long as the existing mature trees bordering Luen Tai Street close to the pumping station are retained.
- 13.2.36 Where mitigation has been determined as required, recommended measures can mitigate all

landscape and visual impacts to acceptable levels and no unacceptable residual impacts will arise.

Environmental Monitoring and Audit

13.2.37 Based on the findings of the EIA, EM&A requirements for the construction phase of the project have been specified. The construction EM&A requirements relate to dust, noise, water quality and landscape and visual impacts to ensure mitigation measures are being implemented and effective. The landscape and visual EM&A in the form of audit of the compensatory planting establishment works will also extend into the first year of the operation of the pumping stations. In addition, supervision of excavation works in areas of medium and high archaeological potential and some pumping station which were not included in the survey due to being covered by hardstanding, are recommended to be supervised for archaeological artefacts and soil deposits.

13.3 Conclusions

13.3.1 The overall conclusion of the EIA is that the project will be environmentally acceptable with mitigation measures applied and no unacceptable adverse residual impacts are predicted.

Table 13.1 Summary of Findings and Conclusions

Environmental Parameter	Sewer Alignment	Pumping Stations	Mitigation Requirements
Air Quality	<ul style="list-style-type: none"> C control of dust in village environs key due to proximity of sensitive receivers C works of short duration C impacts acceptable with mitigation 	<ul style="list-style-type: none"> C construction impacts affect a limited number of sensitive receivers C impacts acceptable with mitigation C operational odour impacts within the standards 	<ul style="list-style-type: none"> C use of water sprays C cover material during stockpiling and transportation C use of wheel washing facilities at pumping station sites C use of deodoriser for wet well ventilation
Noise	<ul style="list-style-type: none"> C combination of mitigation measures can reduce most construction impacts to acceptable levels C potential for residual impacts at the closest sensitive receivers C residual impacts short-term and not considered unacceptable within benefits of the scheme 	<ul style="list-style-type: none"> C construction phase impacts acceptable with mitigation C limitation of construction some activities in Luen On San Tsuen during normal school and kindergarten hours and exam times C operational pump noise within day and night time standards 	<ul style="list-style-type: none"> C silencers on trucks C mufflers on breakers C temporary noise barriers C acoustic enclosures C hand digging C alternative pavement removal techniques C scheduling of operating times
Water Quality	<ul style="list-style-type: none"> C potential for site runoff to enter water courses during construction C potential for elevated suspended solids during sewer construction across streams C impacts acceptable with mitigation C no residual impacts 	<ul style="list-style-type: none"> C potential for site runoff to enter water courses during construction C overall improvement to water quality after implementation due to collection of sewage C risk of emergency overflow very low C receiving water capable of coping with short-term impact with no long term effects 	<ul style="list-style-type: none"> C construction mitigation includes: <ul style="list-style-type: none"> - control of surface runoff - undertake work over streams in periods of low flow - use sand/silt traps C operation mitigation includes: <ul style="list-style-type: none"> - telemetry system - stand by pumps - emergency power supply

Table 13.1 Cont'd....

Environmental Parameter	Sewer Alignment	Pumping Stations	Mitigation Requirements
Waste	<ul style="list-style-type: none"> C total surplus material for disposal approximately 14,000m³ C no significant impacts predicted from waste handling, transportation or disposal 	<ul style="list-style-type: none"> C total surplus material for disposal approximately 4,000m³ C no significant impacts predicted from waste handling, transportation or disposal C operational screenings in small quantities and no impacts predicted 	<ul style="list-style-type: none"> C sort surplus material into C&D and public fill fractions C avoid vegetated area during stockpiling C cover trucks during transportation
Ecology	<ul style="list-style-type: none"> C dredging across streams may cause short-term impacts on stream fauna C loss of small area of marshland C potential drainage of marsh C impact acceptable with mitigation 	<ul style="list-style-type: none"> C permanent loss of habitat C loss of brackish pond in Tai Lam Valley cause medium impact C overall habitats lost of low ecological value C no adverse residual impacts 	<ul style="list-style-type: none"> C undertake work across stream in periods of low flow C return water drained from marsh
Heritage	<ul style="list-style-type: none"> C surveys revealed no archaeological deposits C no direct impacts on historical structures C impacts acceptable with mitigation 	<ul style="list-style-type: none"> C surveys revealed no archaeological deposits C no direct impacts on historical structures C impacts acceptable with mitigation 	<ul style="list-style-type: none"> C monitor specific historical structures during construction C supervision of excavation in areas of high and medium archaeological potential currently under concrete C supervision of pumping station sites currently under concrete
Landscape and Visual	<ul style="list-style-type: none"> C minimal landscape and visual impacts C loss of trees along Tai Lam Chung Road C impacts acceptable with mitigation 	<ul style="list-style-type: none"> C pumping stations visually intrusive C landscape impacts not significant C impacts acceptable with mitigation 	<ul style="list-style-type: none"> C blend pumping station design with local village properties C amenity planting around compound perimeter where possible C regrassing of disturbed areas C avoid trees and tree roots where possible