



## **10. CULTURAL HERITAGE**

### **10.1 Introduction**

- 10.1.1 This section presents the assessment on the cultural heritage impacts during the construction and operation phases of the expansion and upgrading of the Tai O STW, construction of Hang Mei and Fan Kwai Tong SPS and the sewers works of the Project. Cultural heritage resources were identified and the potential direct and indirect impacts from proposed works on these resources were assessed. Appropriate mitigation measures were identified, where necessary, to mitigate the potential impacts.
- 10.1.2 This assessment has based on the criteria and guidelines for evaluation and assessment of cultural heritage impacts as stated in Annexes 10 and 19 of the EIAO-TM and has covered the scope outlined in Section 3.4.9 of the EIA Study Brief.

### **10.2 Relevant Legislations, Standards & Guidelines**

- 10.2.1 Legislation, Standards, Guidelines and Criteria relevant to the consideration of Cultural Heritage impacts under this study include the following:
- Antiquities and Monuments Ordinance (Cap.53);
  - Environmental Impact Assessment Ordinance (Cap.499); including Technical Memorandum on Environmental Impact Assessment Process and the Guidelines for Cultural Heritage Impact Assessment;
  - Hong Kong Planning Standards and Guidelines; and
  - Guidelines for Marine Archaeological Investigation

#### **Antiquities and Monuments Ordinance**

- 10.2.2 The Antiquities and Monuments Ordinance (the Ordinance) provides the statutory framework to provide for the preservation of objects of historical, archaeological and paleontological interest. The Ordinance contains the statutory procedures for the Declaration of Monuments. The proposed monument can be any place, building, site or structure, which is considered to be of public interest by reason of its historical, archaeological or paleontological significance.
- 10.2.3 Under Section 6 and subject to sub-section (4) of the Ordinance, the following acts are prohibited in relation to certain monuments, except under permit:
- To excavate, carry on building works, plant or fell trees or deposit earth or refuse on or in a proposed monument or monument;
  - To demolish, remove, obstruct, deface or interfere with a proposed monument or monument.
- 10.2.4 The discovery of an Antiquity, as defined in the Ordinance must be reported to the Antiquities Authority (the Authority), or a designated person. The Ordinance also provides that, the ownership of every relic discovered in Hong Kong after the commencement of this Ordinance shall vest in the Government from the moment of discovery. The Authority on behalf of the Government may disclaim ownership of the relic.
- 10.2.5 No archaeological excavation may be carried out by any person, other than the Authority and the designated person, without a licence issued by the Authority. A licence will only be issued if the Authority is satisfied that (1) the applicant has sufficient scientific training or experience to enable him to carry out the excavation



and search satisfactorily, (2) is able to conduct, or arrange for, a proper scientific study of any antiquities discovered as a result of the excavation and search and (3) has sufficient staff and financial support.

- 10.2.6 It should also be noted that the discovery of an antiquity under any circumstances must be reported to the authority, i.e. the Secretary for Development or designated person. The authority may require that the antiquity or supposed antiquity is identified to the authority and that any person who has discovered an antiquity or supposed antiquity should take all reasonable measures to protect it.

*Environmental Impact Assessment Ordinance*

- 10.2.7 The EIAO was implemented on 1 April 1998. Its purpose is to avoid, minimise and control any adverse impact on the environment arising from designated projects, through the application of the EIA process and the Environmental Permit (EP) system. The relevant document pertaining to cultural heritage under the legislation is the “Technical Memorandum on Environmental Impact Assessment Process”.
- 10.2.8 The general criteria and guidelines for evaluating and assessing impacts to Sites of Cultural Heritage are listed in Annexes 10 and 19 of the Technical Memorandum on Environmental Impact Assessment Process TM-EIAO. It is stated in Annex 10 that all adverse impacts to Sites of Cultural Heritage should be kept to an absolute minimum and that the general presumption of impact assessment should be in favour of the protection and conservation of all Sites of Cultural Heritage. Annex 19 provides the details of scope and methodology for undertaking Cultural Heritage Impact Assessment, including baseline study, impact assessment and mitigation measures.

*Guidelines for Cultural Heritage Impact Assessment*

- 10.2.9 The document, as issued by the Antiquities and Monuments Office (AMO), outlines the specific technical requirement for conducting archaeological and built heritage impact assessments and is based upon the requirements of the TM-EIAO. It includes the parameters and scope for the Baseline Study, specifically desk-based research and field evaluation. Besides, it also includes guidelines encompassing reporting requirements and archive preparation and submission in the form of Guidelines for Archaeological Reports and Guidelines for the Handling of Archaeological Finds and Archives.
- 10.2.10 The prerequisite conditions for conducting impact assessment and mitigation measures are presented in detail, including the prediction and evaluation of impacts based upon five levels of significance (Beneficial, Acceptable, Acceptable with Mitigation Measures, Unacceptable and Undetermined). The guidelines also state that preservation in totality must be taken as the first priority and if this is not feasible due to site constraints or other factors, full justification must be provided.
- 10.2.11 Mitigation measures will be proposed in cases with identified impacts and shall have the aim of minimising the degree of adverse impact and also where applicable providing enhancement to a heritage site through means such as enhancement of the existing environment or improvement to accessibility of heritage sites. The responsibility for the implementation of any proposed mitigation measures must be clearly stated with details of when and where the measures will be implemented and by whom.

**Hong Kong Planning Standards and Guidelines**

- 10.2.12 Chapter 10 of the HKPSG details the planning principles for the conservation of natural landscape and habitats, historical buildings and archaeological sites. The



document states that the retention of significant heritage features should be adopted through the creation of conservation zones within which uses should be restricted to ensure the sustainability of the heritage features. The guidelines state that the concept of conservation of heritage features, should not be restricted to individual structures, but should endeavour to embrace the setting of the feature or features in both urban and rural settings.

- 10.2.13 The guidelines also address the issue of the preparation of plans for the conservation of historical buildings, archaeological sites and other antiquities. It is noted that the existing Declared Monuments and proposed Monuments be listed in the explanatory notes of Statutory Town Plans and that it be stated that prior consultation with AMO is necessary for any redevelopment or rezoning proposals affecting the Monuments and their surrounding environments.
- 10.2.14 It is also noted that planning intention for non-statutory town plans at the sub-regional level should include the protection of monuments, historical buildings, archaeological sites and other antiquities through the identification of such features on sub-regional layout plans. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong, and Government departments involved in conservation.

#### **Guidelines for Marine Archaeological Investigation**

- 10.2.15 The AMO has issued Guidelines for Marine Archaeological Investigation (MAI) which detail the standard practice, procedures and methodology which must be followed for all projects.
- 10.2.16 In accordance with the Guidelines, the MAI comprised 4 tasks:
- Task 1 : Baseline Review to assess the archaeological potential of the study area from desk based research and establish the extent and value of existing information.
  - Task 2 : Marine Geophysical Survey to obtain detailed data about the seabed and sub surface sediments.
  - Task 3 : Establish archaeological potential.
  - Task 4 : Diver/ROV inspection of seabed features to establish their archaeological value.

### **10.3 Study Area and Sensitive Receivers**

#### **Terrestrial Archaeology**

- 10.3.1 There are two known sites of archaeological interest at Tai O which intersect with the proposed works. **Figures 10.1 to 10.3** show the locations of the sites of archaeological interest in relation to the proposed impact areas. The below descriptions are indicative of the potential for further archaeological materials and deposits in the identified areas:

#### ***Tai O Site of Archaeological Interest (AM96-0736) (Figures 10.1 and 10.2)***

- 10.3.2 Three possibly Tang Dynasty kiln structures spanned over an 18m stretch of coastline colluvium near Po Chue Tam, were first recorded in 1971 by Y.K. Chan (Peacock 1986). Several subsequent site visits were conducted by the AMO between 1982 and 1984. According to the Hong Kong Archaeological Survey between 1982-1985, these kiln structures were almost entirely destroyed by erosion

of cliff face in which the kiln structures were exposed. None of the structures remained and no further action was recommended (Peacock 1986).

- 10.3.3 In 2001 prior to the construction work at No. 19-25 Market Street, six test pit excavations were conducted, which resulted in the recovery of recent and modern materials. It was concluded that the site is located on former sea-side rocky beach before reclamation taken place in early 20<sup>th</sup> century. No ancient remains were found on site (AMO 2001).
- 10.3.4 Two Qing Dynasty cannons were discovered at Tai O Market Street in the course of laying public utilities in 1999 and 2002 (AMO's website Geographical Information System on Hong Kong Heritage page). One of the cannons was recovered during works near the Tai O Hotel and Fuk Moon Mun Restaurant at Market Street which is the site of former Qing Yamen. It was reported by a local informant that in front of the Yamen used to be 6 big cannons pointing to the sea.
- 10.3.5 An Archaeological Watching Brief programme was undertaken in 2008 for rehabilitation and replacement of water mains within Tai O Site of Archaeological Interest. A total of four small pits were monitored to a maximum depth of 1.3 m. While the excavators conclude no significant finds were recovered, materials dating to the Song, Ming and Qing Dynasty were uncovered (ERM 2008). Tai O had an important salt pan industry of which little remains. Archaeological deposits and materials, while not necessary in situ or easy recognisable, may contribute to this once thriving industry and its population.
- 10.3.6 An historical obelisk (formerly known as the Tai O Inscription – Peacock 1986) located on Cheung Shan lies in close proximity to this Site of Archaeological Interest.

#### ***Tai O Fu Shan Site of Archaeological Interest (AM02-1674) (Figure 10.3)***

- 10.3.7 The site was identified during an archaeological investigation conducted in 2002. Archaeological deposits dated to the Song Dynasty were mainly located in the gently sloped foothill area to the west of Po Chue Tam and valley area in the middle part of the island. Some of these areas have already been disturbed by modern burials. A single cultural layer with thickness of 0.2-0.5 m was identified. The finds included high quality porcelain finds and a small number of Ming blue-and-white sherds were collected from the surface. It was suggested by the investigators that such high quality finds could be related to the fallen kingdom of Southern Song (HKIA 2002b).
- 10.3.8 In addition to the above two mentioned sites of archaeological interest, some surface finds of Qing to recent period were found in a small plot of agricultural land behind village houses near Fan Kwai Tong Tsuen, Leung Uk Nam Chung during the 1997-98 Territory-wide Survey (North Lantau). No ancient materials were found in the marshy land outside Yeung Hau Temple or in the burial ground on the hill behind (AMO 1998).

#### **Marine Archaeology**

- 10.3.9 The location of the study area is presented in **Figure 10.4**. The study area is approximately 29,500 m<sup>2</sup> which is greater than the impact area of the outfall.
- 10.3.10 The Marine Archaeological Review and the Baseline Review indicated high archaeological potential based on historical evidence. No record for a specific archaeological site was located.



- 10.3.11 A licence (no. 340) was granted to Ms Sarah Heaver to conduct the Marine Archaeological Investigation (MAI) on 29 October 2012. The MAI started on 7 November 2012 and took four days to complete the site diving. The geophysical survey covered an area of 400m x 180m to allow space for changes to the alignment. After the proposed works area was defined, the no. of magnetic contacts and side scan sonar contacts requiring diver inspection were reduced from 46 to 30 and reduced from 3 (SC001, SC002 and SC003) to 0 respectively. In summary, the marine geophysical survey located thirty buried magnetic anomalies within the study area which did not have an identifiable source and could be associated with buried archaeological remains. A diver survey has been completed on the buried magnetic anomalies identified in the marine geophysical survey within the study area. Every magnetic contact was located and identified as modern construction waste. There was no evidence for marine archaeological resources on the seabed.
- 10.3.12 **Figure 10.5** is a summary drawing showing the location of each magnetic anomalies in relation to the proposed outfall. The detailed methodologies and results of the marine archaeological review and the visual diver survey report are presented in **Appendix 10.1** and **10.2** respectively.

### **Built Heritage**

- 10.3.13 The Study Area for the built heritage survey will include all resources within 50 metres of the proposed works. There are no Proposed or Declared Monuments or Government Historic Sites in Tai O. Twelve Graded Historic Buildings have been identified and one Proposed Grade 2 Historic Building, as well as the stilt houses of Tai O (proposed for Grading) have been identified in the project Study Area. A brief background is provided below and detailed description and photographs can be found in the built heritage catalogue in **Appendix 10.3**.

#### ***No.1 Tai O Market Street, Tai O (T-39) (Grade 2)***

- 10.3.14 Tai O Market Street was built on reclaimed land in 1930. It is believed that No. 1 was built in the 1930's based on its style and information on the original land lease. A photograph from the 1950's shows that the building was used as a timber yard at that time. The building is a Balcony Shophouse in style with open first floor balcony with concrete balustrades. The ground floor is currently in use as a restaurant and the upper floor appears vacant.

#### ***Nos. 7, 9, 11, 13 Tai O Market Street (T-40) (Grade 2)***

- 10.3.15 Tai O Market Street was built on reclaimed land in 1930. It is believed that Nos. 7, 9, 11 and 13 were built in the 1930's based on their style. The buildings are Balcony Shophouse style with open first floor balconies with grille work balustrades. There do not appear to have been any major exterior renovations since the 1950's, apart from some window replacements. The ground floor sections are in use as small shops and it would appear that the upper floors are vacant.

#### ***No. 14 Tai O market Street (T-43) (Grade 2)***

- 10.3.16 The original land lease for this site dates to 1898, but it is believed that No. 14 was built in the 1930's based on its style. The balcony has iron grille work balustrades and shaped balcony brackets. The ground floor contains a shop area and the upper floor appears vacant.





***No.17 Tai O Market Street (T-41) (Grade 2)***

- 10.3.17 The original land lease for this site dates to 1898, but it is believed that No. 14 was built in the 1930's based on its style. It is a Balcony Style Shophouse with first floor balcony with ornamental canopy with flattened arches and keystone patterns supported on columns. The ground floor contains a closed up shop area and the upper floor appears vacant.

***No. 60 Kat Hing Street (T-49) (Grade 2)***

- 10.3.18 The house belonging to the Chan family dates back to 1933. The ground floor was originally used as a clothing shop and then later leased out. The upper floor was used as a residence for the builder and his wife up until the time of their deaths. The family is now owned by their grandchildren. It is a Balcony style shophouse with Chinese Eclectic elements. It has two floors, the upper floor has a concrete balcony. The roof is pitched and tiled and the walls rendered and painted.

***Kwan Tai Temple (T-44) Kat Hing Back Street (Grade 2)***

- 10.3.19 The temple dates to the 6<sup>th</sup> year of the Qianlong Reign of the Qing Dynasty (1741). It is a Qing vernacular style building with a two hall one courtyard plan of a three bay layout. The central courtyard originally open has now been covered. It is constructed of grey brick walls with a pitched roof of clay tiles with wooden support structures. The main roof ridge contains Shiwan ceramics, which are some of the best preserved in Hong Kong.

***Shrine with Stone Dog, Kat Hing Back Street, Tai O (T-54) (Grade 3)***

- 10.3.20 The shrine consists of a concrete base and incense holder with a rounded metal sheet for the walls and roof. It is believed to have been at its current site since before 1898. The granite dog statue in the shrine is an interesting feature that may relate to an earlier dog worshiping function of the shrine. The inscribed tablet also refers to Buddhism. The shrine is currently used as an Earth God Shrine by the local villagers.

***Tin Hau Temple (T-45) Kat Hing Back Street (Grade 3)***

- 10.3.21 The Tin Hau temple which is connected to the Kwan Tai temple was built in the 37<sup>th</sup> year of the Qianlong Reign of the Qing Dynasty (1772). It is a Qing Vernacular building of two hall and one courtyard plan with the courtyard being covered with a tiled roof. It is constructed of grey bricks with the door frame and lower courses of the building being made of granite. The temple has undergone renovations in 1835, 1852, 1903, 1959, 1975, 1987 and 1997.

***Nos. 46 Kat Hing Street (T-48A) (Grade 3)***

- 10.3.22 The building is a typical pre-war shop house that serves both commercial-cum-residential purposes. Possessed by the Ip family, the ground floor is rented out for business, while the upper floor is held by the owner for living accommodation. The most significant feature of the tenement is the colonial veranda with segmental arch at the end.

***No. 48 Kat Hing Street (T-48B) (Grade 3)***

- 10.3.23 The building is a typical pre-war shop house that serves both commercial-cum-residential purposes. Possessed by the Ip family, the ground floor is rented out for business, while the upper floor is held by the owner for living accommodation. The



most significant feature of the tenement is the colonial veranda with segmental arch at the end.

***Shek Lun Kok (T-50), 33 Kat Hing Back Street (Grade 3)***

10.3.24 The residence was built in 1934 by Tsang Yung, probably as a holiday home for himself and his family. His family was traditionally associated with the Salt Industry and he ran a successful taxicab business. He contributed to the local community through funding of a street lighting scheme and school scholarships. The building was taken over as the headquarters of the Japanese occupying force during WWII, but handed back to Tsang Yung after one year. The house was bought by the Wong Family during the 1980's and the current name reflects the business of paper recycling that was carried out there. The building is Modern Eclectic in style with a long veranda along the north and east facades on the first floor.

***Wing Hing Petrol Station (T-59), No. 99C Kat Hing Back Street (Grade 3)***

10.3.25 The building was built before 1941 for the storage of kerosene and has also been referred to as Fo Shui Chong by the local population. The first owner was Chan lu and he sold the building to Lau U-ming in 1948, but the ownership was transferred back to Chan lu in the same year. After the 1960's the building was mainly used for the storage of LPG instead of kerosene. The building remains to be owned by members of Chan lu's family. It is a small one storey structure with a flat roof, there is a concrete ramp leading up to the front entrance and the compound is enclosed by a thick concrete wall. The architectural style of the building is Utilitarian.

10.3.26 The following buildings are proposed Graded Historic Buildings:

***Nos. 2 and 4 Tai O Market Street, Tai O (T-38) (Proposed Grade 2)***

10.3.27 Tai O Market Street was built on reclaimed land in 1930. It is believed that No. 2 and 4 were built in the 1930's based on their style. A photograph from 1956 shows that the buildings were historically used as a mix of residential (upper floor) and commercial (ground floor) purposes. The buildings are Neo-Classical Colonial style with open first floor verandas and grille work balustrades. There do not appear to have been any major exterior renovations since the 1950's. The buildings are currently used as an HSBC ATM centre and a dried seafood shop.

***Stilt Houses in Tai O Lantau (T-66 & T-67) (Proposed to be Graded)***

10.3.28 These houses were built by the local fisherman and began in the 19<sup>th</sup> Century. The buildings were built along side of the waterways and often had extended balconies over the water. The buildings were constructed of wood, but in recent years many structures have a metal sheeting for the exterior walls and rounded roof. A fire that broke out in 2000 destroyed approximately 90 of these structures.

10.3.29 In addition to the above cited historical buildings, 105 other historical structures (including buildings, shrines and gates) have been confirmed and are presented in **Appendix 10.3**. All built heritage resources have been highlighted on the maps showing their relationship to the proposed works in **Figures 10.6 to 10.20**.

## **10.4 Evaluation of Potential Impacts**

### ***Terrestrial Archaeology***

10.4.1 Sites of archaeological interest were identified and the methodologies as well as scope of archaeological works were proposed. A summary for the assessment of



archaeological potential and proposed scope for each area is summarised in **Table 10-1**.

**Table 10-1 : Summary for the Assessment of Archaeological Potential within Project**

Areas of Impact	Assessment of Archaeological Potential	Scope
<b>Proposed Sewers Works</b>		
Shek Tsai Po (West and East) (Figures 10.22, 10.23 and 10.25)	There is some archaeological potential in the form of deposits associated with the historical village. The extent of the fill marked on the geology maps however, covers the area of the historical village and thus the proposed sewer alignments.	No further action
Kat Hing Back Street (Figure 10.24)	The proposed alignments on Figure 10.24 are situated inside the boundary of Tai O Site of Archaeological Interest (SAI). There are however, some known impacts from watermains and CLP cables which may have affected potential archaeological deposits and materials.  The results indicate to a moderate archaeological potential for this area.	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest) marked on Figure 10.24
Kat Hing Street (Figure 10.24)	The proposed sewer alignments are located within the boundary of Tai O Site of Archaeological Interest. There are however, some known impacts from watermains and CLP cables which would have affected potential deposits.  The results indicate to a moderate archaeological potential for this area.	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest) marked on Figure 10.24
Tai O Market Street (Figure 10.26)	The proposed sewer alignments are located within the boundary of Tai O Site of Archaeological Interest. There is some known disturbance of utilities (both in 1999 and 2001) . The archaeological findings of 2 cannons and the knowledge that originally there were 6 may suggest further cannons may be present.  The results indicate to a moderate archaeological potential for this area.	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest) marked on Figure 10.26
Wang Hang Tsuen (Figures 10.28, 10.30)	All of the alignments are located on existing footpaths with extensive disturbance from previous utility groundworks. The alignment located at Tai O Creek has no implications on terrestrial archaeology. In addition, previous archaeological testing (auger hole tests and test pitting) carried out in nearby area revealed no significant finds or cultural layers (HKIA 2002).	No further action.
Wing On Street (Figures 10.26, 10.27)	Although the area is located within the boundary of Tai O Site of Archaeological Interest and with known Qing Dynasty settlement along Wing On Street, there is disturbance from previous utility groundworks. The potential for in situ archaeological deposits associated with the historical village is limited. The area is deemed to have moderate archaeological potential due to the fact that, while the area has known disturbance from utilities, the alignments are proposed within a known SAI.	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest) marked on Figures 10.26, 10.27





Areas of Impact	Assessment of Archaeological Potential	Scope
Tai Ping Street (Figure 10.27)	<p>Although part of the area is located within the boundary of Tai O Site of Archaeological Interest and with known Qing Dynasty settlement along Tai Ping Street, there is disturbance from previous utility groundworks. The potential for in situ archaeological deposits associated with the historical village is limited. The area is deemed to have moderate archaeological potential due to the fact that, while the area has known disturbance from utilities, the alignments are proposed within a known SAL.</p> <p>The other proposed alignments are located on extensive artificial fill deposits.</p>	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest) marked on Figure 10.27
Leung Uk Tsuen (Figure 10.33)	<p>Leung Uk Tsuen is a historical village (approximately 200 years of existence); the proposed alignments are located on existing footpaths, with some disturbance from utilities. The far east of the village has not yet been extensively rebuilt, archaeological deposits associated with the early settlement and potentially the salt industries are possible.</p>	No further action.
Nam Chung Tsuen (Figures 10.32, 10.33, 10.34)	<p>Nam Chung Tsuen is a historical village (around 60 years old); all of the proposed sewer alignments are located on existing footpaths with disturbance from previous utility groundworks. In addition, some of the alignments are located on fill of former salt fields.</p>	No further action.



Areas of Impact	Assessment of Archaeological Potential	Scope
<b>Proposed SPS</b>		
Hang Mei SPS (Figure 10.30)	The proposed pumping station is located in a low-lying area and is far away from the major salt production areas. In addition, previous archaeological testing (auger hole tests and test pitting) carried out in nearby area revealed no significant finds or cultural layers (HKIA 2002).  The pumping station foot print is deemed to have no archaeological potential.	No further action.
Fan Kwai Tong SPS (Figure 10.32)	The proposed site is in an unoccupied dry land location beside the former coastline. According to the 2000 <i>Tai O Sheltered Boat Anchorage CHIA Report</i> , the current proposed site is located in very close proximity to the current coastline.	No further action.

### Marine Archaeology

- 10.4.2 The survey established that there are no marine archaeological resources that will be impacted by the construction work and therefore no further action is required.

### Built Heritage (Construction and Operational Phases)

#### *Sewers Works*

- 10.4.3 The proposed works will consist of the laying of pipes between 150 mm – 225 mm in diameter in Tai O Wing On Street and Tai O Tai Ping Street (with expected depths of 0.9 to 2.2 m). In Tai O Market Street the diameter of pipes will be 150 mm and the depth will range from 0.6 to 1.4 m. The proposed sewer works in Kat Hing Back Street will range from 0.6 to 1.1 m in depth. The proposed pipe diameter in Shek Tsai Po East and Shek Tsai Po West is 150 mm with depths ranging between 0.9 to 3.2 metres. The proposed pipe diameter in Hang Mei and Wang Hang Tsuen is also 150 mm and the depth range from 0.6 to 3.4 metres. Finally the proposed pipe widths in Leung Uk Tsuen, Fan Kwai Tong and Nam Chung Tsuen are 150 mm and 225 mm. The proposed excavation depth in these villages will range from 0.6 to 4.4 m.
- 10.4.4 This project does not include connection of the sewerage system to any structures and no direct impacts to structures will occur as a result of the construction activities. A tapping sewer (a short pipe for future sewerage connection) will be designed and constructed within government lands as practicable as possible up to the lot boundary/front gate of the village houses.
- 10.4.5 The construction works for the sewerage alignments have the potential to directly impact wells and associated shrines. If any such impacts are identified, the alignment should be altered to avoid damage to the well and shrine. As well, direct impacts may occur to any historical ground surface coverings, such as granite paving stones, slabs and steps that are located along the proposed alignment. No such surfaces were identified during the field survey; however, if any surfaces (not visible at the ground surface level) are encountered during the construction works, the material should be removed during the excavation process and reinstated upon completion of the works.
- 10.4.6 Indirect impacts from construction related activities, such as concrete breaking and excavation works may occur if conducted in the vicinity of built heritage structures.



In addition, excavation works in close proximity to any built heritage, has the potential to disturb associated sub-structure. The distance that will require attention will be defined as 20 m from the proposed works area.

- 10.4.7 It should be noted that a study area for the built heritage survey has been set at 50 m. The purpose for this is to ensure that if there are any minor alterations to sewerage alignments at a later stage, heritage resources will already have been identified and impacts assessment and mitigation if required can be undertaken on an individual basis.
- 10.4.8 Heritage resources in close proximity (i.e. less than 5 m from the proposed works areas) may also be damaged by contact with machinery and equipment during the works and buffer zones should be provided. As there may be insufficient room for provision of adequate buffer zones, protective covering on a movable fence for the exterior surfaces of these structures should also be provided.
- 10.4.9 The proposed construction works areas are in close proximity to a number of shrines and temples and safe public access to these structures may be restricted by the presence of works areas.
- 10.4.10 As the alignments are to be situated on existing footpaths there is no predicted impact to cultural landscape features such as fung shui woods and ponds.
- 10.4.11 The sewers alignments will be located underground and will not cause any adverse impacts during the operational phase.

#### ***Proposed SPS***

- 10.4.12 The works during the construction phase will include excavation for the pumping station with large excavators, the installation and removal of shoring and support by vibratory piling and construction activities associated with the building of the pumping stations. Adverse impacts arising from vibration associated with the piling works for insertion and removal of support and shoring may occur.
- 10.4.13 During the operational phase, pumping stations have the potential to impact the environmental setting of any surrounding villages. The assessment for such impacts will include all heritage structures in the village both public and private.

#### ***Expansion and Upgrading of Tai O STW***

- 10.4.14 It is proposed to expand and upgrade the existing Tai O STW to improve the standard of treatment and processing capacity. The proposed works will occur within and in close vicinity of the existing facilities and impacts during the construction works, if applicable will be indirect and will arise from ground borne vibration. The expansion works outside of the existing facility, may cause visual impacts to the existing environment.

### **10.5 Mitigation Measures**

#### **Terrestrial Archaeology**

##### ***Archaeological Works during Construction Phase***

- 10.5.1 An Archaeological Watching Brief during construction phase was recommended for areas with archaeological potential within the villages.
- 10.5.2 In order to create a specification tailored to this Project, it was necessary to devise a means of calculating the numbers of Archaeological Watching Brief visits per section of alignment, where 'section' can nominally be taken to mean a length of sewer



alignment between two manholes. Past experience has shown that engineering work of this kind tends to be conducted on the basis of short sections of alignment between two manholes. Although the lengths of alignment between manholes vary somewhat, this is nevertheless a meaningful basis upon which to decide the monitoring schedule. With this in mind, four levels of Archaeological Watching Brief frequency were matched to four different levels of archaeological potential associated with undisturbed areas of archaeological potential and areas of high to low archaeological potential but disturbed by utilities. The suggested visit frequencies for the four categories are provided in **Table 10-2**.

**Table 10-2 : Suggested Archaeological Watching Brief Visit Frequency**

Categories of Archaeological Potential	Approximate Archaeological Watching Brief Frequency
Undisturbed sites of archaeological potential	One visit per two sections of alignment
Areas of high archaeological potential but disturbed by utilities	One visit per three sections of alignment
Areas of moderate archaeological potential but disturbed by utilities	One visit per four sections of alignment
Areas of low archaeological potential but disturbed by utilities	One visit per six sections of alignment

Note:

1) Wherever practicable, the archaeologist conducting such Archaeological Watching Briefs should ensure that site visits provide adequate coverage of the works area in question (i.e. they are reasonably evenly distributed along the alignment).

10.5.3 Each monitoring visit should nominally be of a day's duration and would typically involve observation, finds collection and recording as specified in **Appendix 10.4**.

10.5.4 Should significant findings be made, additional archaeological resources will be provided in the form of additional/extended visits to ensure that appropriate recording and retrieval is accomplished prior to the continuation of engineering groundworks.

#### ***Archaeological Watching Brief Scope***

10.5.5 The methodology for conducting an Archaeological Watching Brief programme is appended in **Appendix 10.4**. **Table 10-3** presents in summary form the proposal for further archaeological works to be conducted during the construction phase:



**Table 10-3 : Proposed Further Archaeological Works during Construction Phase**

Areas of Impact	Archaeological Potential	Type of Archaeological Investigation/ Protection	Scope (for frequency of monitoring, see Section 10.5.2)
<b>Proposed Sewers Works</b>			
Kat Hing Street (Figure 10.24)	Moderate archaeological potential potentially disturbed by utilities	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest)	Archaeological Watching Brief area is marked on Figure 10.24.  Due to the moderate archaeological potential which is based on previous findings and level of existing impacts, one visit per four sections monitoring frequency is proposed.
Kat Hing Back Street (Figure 10.24)	Moderate archaeological potential potentially disturbed by utilities	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest)	Archaeological Watching Brief area is marked on Figures 10.24.  Due to the moderate archaeological potential which is based on previous findings and level of existing impacts, one visit per four sections monitoring frequency is proposed.
Tai O Market Street (Figure 10.26)	Moderate archaeological potential potentially disturbed by utilities.	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest)	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest) is marked on Figure 10.26.  Due to the nature of the findings and the limited works (three sections only) full time monitoring of the works is recommended.
Wing On Street (Figures 10.26, 10.27)	Moderate archaeological potential potentially disturbed by utilities	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest)	Archaeological Watching Brief area is marked on Figures 10.26, 10.27.  Due to the moderate archaeological potential which is based on previous findings and level of existing impacts, one visit per four sections monitoring frequency is proposed.
Tai Ping Street (Figure 10.27)	Moderate archaeological potential potentially disturbed by utilities	Archaeological Watching Brief (area located within the boundary of Tai O Site of Archaeological Interest)	Archaeological Watching Brief area is marked on Figure 10.27.  Due to the moderate archaeological potential which is based on previous findings and level of existing impacts, one visit per four sections monitoring frequency is proposed.

### Marine Archaeology

- 10.5.6 The survey established that there are no marine archaeological resources that will be impacted by the construction work and therefore no mitigation action is required.

### Built Heritage (Construction Phase Impacts and Mitigation)

#### *Proposed sewers works (Impacts)*

- 10.5.7 The impacts arising from the construction works for sewer alignments and the recommended mitigation are presented in **Table 10-4** and **Table 10-5**. It should be





noted that the alignments in the vicinity of all Graded/ Proposed Graded Historic Buildings have been designed to provide the maximum feasible distance between the resource and the proposed works.

- 10.5.8 Although no historical ground surface covering, such as granite paving slabs were identified as being directly impacted during the survey, there is potential for such surfaces to exist under modern covering. If any such surfaces are encountered during the construction works there is potential that they may be damaged or destroyed. If such materials are encountered the material should be removed during the excavation process and reinstated upon completion of the works.

***Proposed SPS and Expansion and Upgrading of the Tai O STW (Impacts)***

- 10.5.9 The proposed works include the construction of two SPS, one at Hang Mei and the other at Fan Kwai Tong, as well as expansion and upgrading of the existing STW at Tai O. The impacts arising from the construction works and recommended mitigation is presented in **Section 10.5.18 to 10.5.20**.

***Mitigation Recommendations***

- 10.5.10 The following mitigation recommendations will be presented for resources as required from the findings of the impact assessment are also presented in **Table 10-4, Table 10-5** and **Section 10.5.18 to 10.5.20**. The description below will provide the detailed requirements for each of the mitigation actions and will be abbreviated in the tables by the letters shown in brackets.

***Condition Survey (CS)***

- 10.5.11 A condition survey must be carried out by qualified building surveyor or engineer in advance of works for Graded Historic Buildings and structures and Nil Graded heritage structures that may be affected by ground borne vibration. The Condition Survey Report should contain descriptions of the structure, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended.
- 10.5.12 The condition survey report for Graded Historic Buildings must be submitted to AMO for comment before construction activities commence. The location of proposed monitoring point in the building should avoid damaging the historic fabric and approved by the owner. The contractor must implement the approved monitoring and precautionary measures.

***Vibration and Settlement Monitoring (VM)***

- 10.5.13 Indirect impacts from construction related activities, such as concrete breaking and excavation works may occur if conducted in the vicinity of built heritage structures. This distance that required attention will be defined as 20 m from the proposed works area.



10.5.14 Vibration and settlement monitoring should be undertaken during the construction works to ensure that safe levels of vibration and settlement are not exceeded. A maximum level of 5 mm/s for Grade 1, 7.5 mm/s for Grades 2 and 3 Historic Buildings and 15 mm/s for Nil Graded heritage structures should be adopted. The Alert/Alarm/Action limits for settlement shall be 6mm, 8mm and 10mm respectively. It should be noted that the condition survey report should highlight if the limit should be lowered after the detailed study of the condition of the building. A monitoring schedule should be included in the condition survey report. The location of any monitoring equipment in the building must be approved by the owner before installation and should avoid damaging the historic fabric.

***Provision of Buffer Zones (BZ)***

10.5.15 A buffer zone should be provided to separate the building from the construction works. The buffer zone should be clearly marked out by temporary fencing. The buffer zone should be made at least 1 m from the proposed works or if this is not possible as large as the site restrictions allow.

***Provision of Protective Covering (PC)***

10.5.16 Protective covering in the form of plastic sheeting on a movable fence should be provided for external walls and surfaces of historical buildings and structures in close proximity to works areas, i.e. areas where a buffer zone alone cannot provide protection from equipment and works activities.

***Safe Public Access (SPA)***

10.5.17 Any proposed works in close proximity to buildings or structures used by the public for religious, ritual or funerary purposes, such as shrines, ancestral halls, temples and graves have the potential to create an unsafe environment for members of the public. The contractor must ensure that safe public access is maintained, through provision of clearly marked paths separated from the construction works.

***Proposed SPS***

10.5.18 No built heritage resources were recorded in the vicinity of the Hang Mei SPS. No impacts to built heritage resources will occur and no mitigation will be required.

10.5.19 Two built heritage resources were identified in the vicinity of the proposed Fan Kwai Tong SPS, a shrine (T-105) and a grave (T-106). The shrine is situated 8 m from the proposed works and may be damaged by ground borne vibration during the construction works. Mitigation in the form of a condition survey and vibration monitoring will be required. The grave is 35 m from the proposed SPS and no impacts are expected and no mitigation will be required during the construction phase.

***Expansion and Upgrading of Tai O STW***

10.5.20 No built heritage resources were recorded in the vicinity of the Tai O STW and no impacts to built heritage resources will occur during the construction works and no mitigation will be required.



**Table 10-4 : Assessment of Impacts and Mitigation Recommendations for Graded and Proposed Graded Historic Buildings in Tai O (sewers works)**

Recorded Resource	Grade	Cat Ref	Description of Constructi on Works	Minimum Distance to Works	Impact Assessment	Mitigation
Kwan Tai Temple	Grade 2	T-44	Sewer and manhole	30 m	Based on distance to the proposed works no adverse impacts are expected.	No mitigation required
No. 1 Tai O Market Street, Tai O	Grade 2	T-39	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Nos. 7, 9, 11 &13 Tai O Market Street, Tai O	Grade 2	T-40	Sewer and manhole	10 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
No. 14 Tai O market Street	Grade 2	T-43	Sewer and manhole	11 m	Indirect impacts may arise from ground borne vibration.	CS/VM
No. 17 Tai O Market Street, Tai O	Grade 2	T-41	Sewer and manhole	30 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
No. 60 Kat Hing Street	Grade 2	T-49	Sewer and manhole	50 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
Tin Hau Temple	Grade 3	T-45	Sewer and manhole	35 m	Based on distance to the proposed works no adverse impacts are expected.	No mitigation required
Nos. 46 Kat Hing Street	Grade 3	T-48A	Sewer and manhole	30 m	Based on distance to the proposed works no adverse impacts are expected.	No mitigation required
Nos. 48 Kat Hing Street	Grade 3	T-48B	Sewer and manhole	30 m	Based on distance to the proposed works no adverse impacts are expected.	No mitigation required
Shek Lun Kok	Grade 3	T-50	Sewer and manhole	6 m	Indirect impacts may arise from ground borne vibration.	CS, VM
Wing Hing Petrol Station	Grade 3	T-59	Manhole	20 m	Indirect impacts may arise from ground borne vibration.	CS, VM



Recorded Resource	Grade	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation
Shrine with stone dog at Kat Hing Back Street	Grade 3	T-54	Sewer and manhole	3 m	Damage to the shrine may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.  Safe public access may be restricted.	CS/ VM, BZ, PC, SPA
Nos. 2 & 4 Tai O Market Street, Tai O	Proposed Grade 2	T-38	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Stilt Houses of Tai O	Proposed to be Graded	T-66 & T-67	Tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.	CS/VM, BZ, PC



**Table 10-5 : Assessment of Impacts to Nil- Graded Historic Structures in Tai O (sewers works)**

Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
Shrine in front of No.23 Tai O Wing On Street	Earth Shrine	T-01	Sewer, manhole and tapping pipe	Close proximity	Damage to the shrine may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Shrine between No.24 & 26 Tai O Wing On Street	Earth Shrine	T-02	Sewer, manhole and tapping pipe	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
No.30 Tai O Wing On Street	Village House	T-03	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Nos.44 & 46 Tai O Wing On Street	Village House	T-04	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No.48 Tai O Wing On Street	Yik Cheung Salt Fish Store	T-05	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine across from No. 103 Shek Tsai Po Street	Shrine	T-06	Manhole	15 m	Indirect impacts may arise from ground borne vibration.	CS/ VM





Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 54 Tai O Wing On Street	Tai O Culture Shop	T-07	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery.	CS/ VM, BZ, PC
No. 64 Tai O Wing On Street	Village House	T-08	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 72 Tai O Wing On Street	Fat Kee Hardware Shop	T-09	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 92 Tai O Wing On Street	Village House	T-10	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 96 Tai O Wing On Street	Village House	T-11	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 104 Tai O Wing On Street	Dou Fok Tong	T-12	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 101 Tai O Wing On Street	Village House	T-13	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 107 Tai O Wing On Street	Village House	T-14	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 105 Tai O Wing On Street	Village House	T-15	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM BZ, PC
No. 112 Tai O Tai Ping Street	Wing Chor School and Tai O Catholic Church	T-16	Sewer, manhole and tapping pipe	8 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
No. 121 Tai O Tai Ping Street	Village House	T-17	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine next to No. 120 Tai O Tai Ping Street	Shrine	T-18	Sewer, manhole and tapping pipe	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC/ SPA
No. 124 Tai O Tai Ping Street	Civil Aid Association of Tai O	T-19	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 145 Tai O Tai Ping Street	Village House	T-20	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 147 Tai O Tai Ping Street	Village House	T-21	Sewer and manhole	6 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
No. 140 Tai O Tai Ping Street	Village House	T-22	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 144 Tai O Tai Ping Street	Village House	T-23	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 155 Tai O Tai Ping Street	Village House	T-24	Sewer and manhole	12 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
No. 152 Tai O Tai Ping Street	Village House	T-25	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 156 Tai O Tai Ping Street	Shop/ factory	T-26	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 158 and No. 160 Tai O Tai Ping Street	Shop house	T-27	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 168 Tai O Tai Ping Street	Village House	T-28	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 170 Tai O Tai Ping Street	Shop/ factory Village House	T-29	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 172 Tai O Tai Ping Street	Tong Yi Zan	T-30	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Ruin beside No. 181 Tai O Tai Ping Street	Village House	T-31	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No 181 Tai O Tai Ping Street	Village House	T-32	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 182 Tai O Tai Ping Street	Shop house	T-33	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 184 Tai O Tai Ping Street	Village House	T-34	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 200 Tai O Tai Ping Street	Village House	T-35	Sewer, manhole and tapping pipe	10 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Nos. 205 & 207 Tai O Tai Ping Street	Village House	T-36	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine east of No. 207 Tai O Tai Ping Street	Fuk Tak Gong	T-37	Sewer and manhole	15 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Behind No. 20 Tai O Market Street, Tai o	Shop/ factory	T-42	Tapping pipe	25 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
Earth Shrine on east of Rural committee Building (Kat Hing Back Street)	Shrine	T-46	Tapping pipe	25 m	The shrine is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
No. 42 Kat Hing Street	Restaurant	T-47	Sewer and manhole	40 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
Ruin beside No. 39 Kat Hing Back Street	Village House	T-51	Sewer and manhole	10 m	Indirect impacts may arise from ground borne vibration.	CS/VM





Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 43 Kat Hing Back Street	Village House	T-52	Sewer and manhole	10 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Shrine behind No. 56 Kat Hing Street	Earth Shrine	T-53	Sewer and tapping pipe	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Shrine between Nos. 77 & 79 Kat Hing Back Street	Chong Long She	T-55	Sewer and manhole	10 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
No. 77 Kat Hing Back Street	Village House	T-56	Sewer and manhole	6 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Building between nos. 81 & 86 Kat Hing Back Street	Fuel Storage Building	T-57	Tapping pipe	18 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Gate near Nos. 86 & 87 Kat Hing Back Street	Entrance gate to former garden	T-58	Tapping pipe	Close proximity	Damage to the gate structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration	CS/ VM, BZ, PC
Shrine near BBQ Area on path to Yeung Hau Temple	Earth Shrine	T-60	Tapping pipe	15 m	Indirect impacts may arise from ground borne vibration.	CS/ VM



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 95 Kat Hing Back Street	Village House	T-61	Manhole and Tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine to the north of No. 95 Kat Hing Back Street	Earth Shrine	T-62	Tapping pipe	8 m	Indirect impacts may arise from ground borne vibration.	CS/VM
No. 98 Kat Hing Back Street	Village House	T-63	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/VM, BZ, PC
Gate foundation next to the gate of Tai O No.4 Flood Pumping Station	Gate Foundation	T-64	Sewer and manhole	20 m	The works are at sufficient distance that no direct or indirect impacts will occur.	No mitigation required
No. 83 Kat Hing Back Street	Shop/ village house	T-65	Sewer and manhole	10 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Shrine to the east of No. 111 Shek Tsai Po Street	Earth Shrine	T-68	Tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/VM, BZ, PC, SPA



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
Nos. 109, 110 & 111 Shek Tsai Po Street	Shop/ Residential	T-69	Tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 97A Shek Tsai Po Street	Village House	T-70	Tapping pipe	25 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
Shrine in front of No. 91A Shek Tsai Po Street	Earth Shrine	T-71	Manhole	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.  Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Shrine in front of No. 52 Shek Tsai Po Street	Earth Shrine	T-72	Manhole	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery.  Indirect impacts may arise from ground borne vibration.  Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Well behind No. 6 Shek Tsai Po	Well	T-73	Sewer and manhole	15 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Well behind No. 19 Shek Tsai Po	Well	T-74	Sewer and manhole	15 m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Shrine next to No. 34 Shek Tsai Po	Earth Shrine	T-75	Tapping pipe	7 m	Indirect impacts may arise from ground borne vibration.	CS/ VM



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 44 Shek Tsai Po	Village House	T-76	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine next to No. 21 Shek Tsai Po	Earth Shrine	T-77	Sewer and manhole	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works	CS/ VM, BZ, PC, SPA
Well and shrine next to No. 72 Shek Tsai Po	Well and shrine	T-78	Sewer and manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
No. 21 Shek Tsai Po	Village House	T-79	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shop at No. 19 Shek Tsai Po	Cheng Cheung Hing's Shrimp Store	T-80	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
Nos. 15, 16 & 17 Shek Tsai Po	Village House	T-81	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Nos. 66, 67 & 68 Shek Tsai Po	Village House	T-82	Sewer and manhole	8m	Indirect impacts may arise from ground borne vibration.	CS/ VM
No. 62 Shek Tsai Po	Village House	T-83	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Well south of No. 59 Shek Tsai Po	Well	T-84	Sewer and manhole	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine in front of No. 8 Shek Tsai Po	Earth Shrine	T-85	Tapping pipe	3 m	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine to the northwest of 21B Leung Uk Tsuen	Earth Shrine	T-86	Sewer, manhole and tapping pipe	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Nos. 16 17 Leung Uk Tsuen	Village House	T-87	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC





Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 15 Leung Uk Tsuen	Village House	T-88	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 14 Leung Uk Tsuen	Village House	T-89	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 13 Leung Uk Tsuen	Village House	T-90	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Nos. 9 – 11 Leung Uk Tsuen	Village House	T-91	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 12 Leung Uk Tsuen	Village House	T-92	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 8 Leung Uk Tsuen	Village House	T-93	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 4 - 6 Leung Uk Tsuen (and unit beside No. 6)	Village House	T-94	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
Leung Ancestral Hall in Leung Uk Tsuen	Ancestral Hall	T-95	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 2 Leung Uk Tsuen	Village House	T-96	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
No. 1 Leung Uk Tsuen	Village House	T-97	Sewer, manhole and tapping pipe	Close Proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Well east of No. 1 Leung Uk Tsuen	Well	T-98	Sewer, manhole and tapping pipe	12m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Hung Shing Temple and shrine on Shek Tsai Po Street	Temple Shrine	T-99A T99B	Sewer, manhole and tapping pipe	22m 15 m	Based on distance to the proposed works no adverse impacts are expected. Indirect impacts may arise from ground borne vibration.	No mitigation required CS/VM
Ruin behind Leung Uk Playground	Village House	T-100	Sewer and Manhole	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine behind No 1B Nam Chung Tsuen	Earth Shrine	T-101	Sewer and manhole	12m	Indirect impacts may arise from ground borne vibration.	CS/ VM



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
Building beside No. 6 Nam Chung Tsuen	Village House	T-102	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine next to gate of No. 8 Nam Chung Tsuen	Earth Shrine	T-103	Sewer, manhole and connection pipe to nearby property	Close Proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Well next to gate of No. 8 Nam Chung Tsuen	Well	T-104	Sewer, manhole and tapping pipe	Close Proximity	Damage to the well and shrine may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Shrine north of No. 10 Nam Chung Tsuen	Earth Shrine	T-105	Sewer and manhole	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Grave south of No. 11 Nam Chung Tsuen	Grave	T-106	Sewer and manhole	15m	Indirect impacts may arise from ground borne vibration.	CS/ VM
Seawall north of Nam Chung Tsuen	Seawall	T-107	Sewer and manhole	Close proximity	The seawall dates back to the 18th Century and was renovated in the 1990's. The seawall is situated in close enough proximity to the proposed works that the historical elements may be damaged from vibration impacts.	CS/ VM



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
No. 8 Fan Kwai Tsuen	Village House	T-108	Sewer and manhole	35 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
Nos. 6 – 7 Fan Kwai Tsuen	Village House	T-109	Sewer and manhole	45 m	The structure is situated at a sufficient distance from the proposed works/ no impacts are expected.	No mitigation required
Building north of No. 6 Fan Kwai Tsuen	Village House	T-110	Sewer and manhole	30 m	The works are at sufficient distance that no direct or indirect impacts will occur.	No mitigation required
Salt Pan north of Wang Hang Village	Salt Pan	T-111	Sewer and manhole	20 m	Based on the distance to the works and the non-structural nature of the salt pans, no adverse impacts are expected to arise during the construction works for the project.	No mitigation required
Shrine east of the bridge north of Wang Hang Village	Earth Shrine	T-112	Sewer and manhole	Close proximity	Damage to the shrine structure may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Well and Shrine near 21B Leung Uk Tsuen	Well and Shrine	T-113	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the shrine may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Nos. 2 & 4 Wang Hang Village and nearby ruins	Village House	T-114	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC,



Recorded Resource	Type/ Title	Cat Ref	Description of Construction Works	Minimum Distance to Works	Impact Assessment	Mitigation Recommendations
Nos. 8 – 10 Wang Hang Village	Village House	T-115	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Temple south of Nos. 11 – 13 Wang Hang Village	Wah Kwong Temple	T-116	Sewer, manhole and tapping pipe	Close proximity	Damage to the exterior walls may occur during the construction works through contact with digging equipment and machinery. Indirect impacts may arise from ground borne vibration. Safe public access to the temple may be restricted by the construction works.	CS/ VM, BZ, PC, SPA
Building to the north of Nos. 19 & 20 Wang Hang Village	Village House	T-117	Sewer, manhole and tapping pipe	11 m	Indirect impacts may arise from ground borne vibration.	CS/ VM, BZ, PC
Salt Pan north of Nam Chung Tsuen	Salt Pan	T-118	Sewer and manhole	20 m	Based on the distance to the works and the non-structural nature of the salt pans, no adverse impacts are expected to arise during the construction works for the project.	No mitigation required



## **Built Heritage (Operation)**

### ***Sewers Works***

- 10.5.21 The sewer alignments will be underground and no impacts are expected during the operation of the sewer system.

### ***Proposed SPS***

- 10.5.22 No built heritage resources were recorded in the vicinity of the Hang Mei SPS. No impacts to built heritage will occur and mitigation measures will be required.
- 10.5.23 For the proposed Fan Kwai Tong SPS, the shrine and grave are situated in a village with modern structures and visual impacts will not change the current environmental setting of these resources. No mitigation is required.

### ***Expansion and Upgrading of Tai O STW***

- 10.5.24 No built heritage resources were recorded in the vicinity of the Tai O STW and there will be no impacts to built heritage resources.

## **10.6 Residual Environmental Impacts**

- 10.6.1 There will be no residual impacts from the operation of the sewerage works on sites of terrestrial and marine archaeological interest, built heritage resources in Tai O.

## **10.7 Environmental Monitoring and Audit**

### **Terrestrial Archaeology**

- 10.7.1 During the construction phase of the sewers works, an Archaeological Watching Brief programme should be undertaken at Kat Hing and Kat Hing Back Streets, Wing O Street, Tai O Market Street and Tai Ping Street. Watching Brief should be undertaken by a qualified archaeologist, who must apply for a licence under the Antiquities and Monuments Ordinance (Cap. 53) from the Antiquity Authority before the commencement of archaeological watching brief.
- 10.7.2 The alignment of village sewers may be subject to refinement prior to the construction works, and potential findings of archaeological works in future under other projects may provide additional field data for a more precise planning of the proposed AWB in respect of extent and frequency. Thus, a review on the scope of AWB should be carried out and agreed with the AMO before the licence application.

### **Marine Archaeology**

- 10.7.3 No mitigation or environmental audit will be required.

### **Built Heritage**

- 10.7.4 No specific mitigation measures are required for the works of expansion and upgrading of Tai O STW under this Project. Monitoring and preventive measures for the sewers works and SPS construction will be recommended as part of the environmental monitoring and audit requirements. The recommended measures are described as follow:



### ***Condition Survey***

- 10.7.5 The requirements for the condition survey have been highlighted in **Sections 10.5.11** and **10.5.12**. Condition survey will be required for all highlighted Graded Historic Buildings and Nil-Graded Historic Structures as shown in **Section 10.5.19**, **Table 10-4** and **Table 10-5** respectively.

### ***Vibration and Settlement Monitoring***

- 10.7.6 The requirements for vibration and settlement monitoring have been identified in this report. The condition survey report will confirm the Graded Historic Buildings and Nil-Graded Historic Structures that will require vibration and settlement monitoring during the construction works.

### ***Provision of Buffer Zone***

- 10.7.7 The requirements for provision of buffer zone have been highlighted in **Section 10.5.15**. Resources requiring buffer zone are shown in **Table 10-4** and **Table 10-5**.

### ***Protective Covering***

- 10.7.8 The requirements for protective covering have been highlighted in **Section 10.5.16**. Resources requiring protective covering are shown in **Table 10-4** and **Table 10-5**.

### ***Safe Public Access***

- 10.7.9 The requirements for safe public access have been highlighted in **Section 10.5.17**. Resources requiring measures for safe public access are shown in **Table 10-4** and **Table 10-5**.

### **Operational Phase**

- 10.7.10 No adverse impacts on any cultural heritage resources would be expected as a result of the implementation of the Project during operational phase. Thus, no specific EM&A programme with respect to cultural heritage during the operational phase is required.

## **10.8 Conclusion**

- 10.8.1 The construction and operation of the sewerage works will not cause any insurmountable impacts. Monitoring and preventative measures have been recommended. Adverse impact is not anticipated if the measures are being implemented properly.

## **10.9 References**

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