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16 UTILITIES, DRAINS AND SEWERS

16.1 General

16.1.1 The Contractor shall coordinate with all relevant parties and identify, divert, support, protect, provide access, reinstate, utilities, drains and sewers, and remove abandoned utilities affected by the Works.

16.1.2 Underground utility services will be encountered during construction. The details of the existing utilities, drains and sewers as shown in the Authorities Drawings are extracted from the records of the Utility Agencies and other relevant authorities and are provided for information only. The Contractor shall note that public lighting cables, overhead cables and minor services are not shown in the Authority's Drawings.

16.1.3 The drawings or details indicated in **Appendix Z** of the Particular Specification are strictly for information and should be considered for reference only. The Contractor shall investigate and verify the accuracy of the information provided and ascertain the presence of all utility services on site by obtaining the latest utilities plans, carrying out trial trenches, cable detection, etc. This includes but not limited to the location, dimension, handling method, treatment etc. The Contractor shall coordinate and obtain approval from the relevant authorities/agencies and the Engineer for the service diversion corridors. The Contractor shall make all necessary cost and time allowances.

16.1.4 The Contractor shall be aware that the Works will be in close proximity to a number of utilities as indicated in **Appendix Z** of the Particular Specification. The Contractor shall coordinate and engage the stakeholders and relevant authorities/agencies prior to commencement of works. The works will be subjected to approval by relevant authorities/agencies and acceptance by the Engineer.

16.1.5 All utilities found on site shall be treated as in-service unless confirmed otherwise by the relevant Utility Agencies. Where abandoned services/manholes are found within the work area, the Contractor shall coordinate with the Utility Agencies for recovery and/or removal including Earth Retaining Stabilising Structures (ERSS) and other necessary works in accordance with the requirements of the Utility Agencies and to the acceptance of the Engineer. All cost and time arising from recovery or removal of abandoned services / manholes shall be deemed included in the Contract Price.

16.1.6 The Contractor shall comply with all Utility Agencies' requirements as set out in **Appendix AQ** or any subsequent amendments specified by the Utility Agencies. There shall be no interruption of services arising from the diversion works throughout the duration of the Contract. The Contractor shall note that not all Utility Agency requirements are provided in the Authority's Documents and shall comply with all requirements of the Utility Agencies whether or not they are within the Authority's Documents.

16.1.7 Utility gaps in ERSS should be minimized as practically as possible and the Contractor shall carry out localized utility diversions as necessary to achieve this at his own cost and time. The Contractor shall refer to **Clause 12.7** of Particular Specification on the treatment of utility gaps if any.

16.1.8 The fire hydrants and dry risers shall not be affected by the Contractor's works. In the event any relocation is required, the Contractor shall notify and obtain approval from PUB, Singapore Civil Defence Force (SCDF), and all other relevant authorities. The Contractor shall be responsible for ensuring that such relocations do not affect the provision and operation of fire hydrants and dry risers.

16.1.9 The Contractor shall consult and obtain approval from stakeholders, and all other relevant authorities / agencies for the diversion of utilities within private land. The Contractor shall provide 24 hours access for regular maintenance by Utility Agencies to all diverted utilities within private land. The access arrangements shall be developed with the Utility Agencies to suit their requirements.

16.1.10 Prior to any work activity, the Contractor shall identify all utilities which are in close proximity to the proposed work activity and propose mitigation measures to protect these utilities; and submit this in a report to the Engineer for acceptance. Upon acceptance, the Contractor shall monitor these utilities and submit a daily report indicating the status of these utilities to the Engineer for record. The Contractor shall comply with the relevant agencies' requirements on the notice for commencement of earthworks near to existing services. All time and cost associated with these works shall be borne by the Contractor.

16.1.11 The Contractor shall note that some utility diversion works shall be carried out by the Utility Agencies' contractors / sub-contractors. The Contractor shall cooperate fully and render assistance to the Utility Agencies and their contractors / sub-contractors in carrying out the aforesaid works. The Contractor shall adequately prepare the service diversion corridors before the proposed diversion and provide attendance and assistance to all contractors undertaking utility diversion works on behalf of the Authority. Any costs involved shall be deemed included in the Contract Price.

16.1.12 Where utility services conflict with the Works and are not feasible to be diverted or not to be diverted, they must be supported and protected during the construction of the Works. All necessary support and protection measures shall be endorsed by a Professional Engineer (PE) and accepted by the relevant Utility Agencies and the Engineer prior to construction, including access to maintain and inspect the supported utilities. All time and cost associated with the associated works shall be borne by the Contractor.

16.1.13 The Contractor shall design and coordinate all utility diversions and utility reinstatement works such that it does not obstruct his Works, including future drainage works, street furniture, landscaping works, etc. Should any services be found encumbering the Works, all time and cost associated with the additional diversion works shall be borne by the Contractor.

16.1.14 After the permanent reinstatement and commissioning of utility services affected by the Works, the Contractor shall liaise with Utility Agencies for decommissioning all utility services that were temporarily diverted either by the Contractor or by the Authority, including but not limited to those as identified in **Appendix Z** of the Particular Specification. The Contractor shall ensure the abandoned services, pipelines and manholes are removed, backfilled, reinstated and made good the areas to the satisfaction of the landowners and to the acceptance of the Engineer. Abandoned pipelines which are within road reserves are to be removed or grouted subject to Utility Agencies' requirements.

16.1.15 The Contractor shall coordinate with Utility Agencies and allow in the overall Programme the duration of utility services diversion work carried out by the Utility Agencies within the vicinity of **CR206 worksite**. The Contractor shall also take into consideration in his programme that diversion works may be carried out sequentially by different Utility Agencies due to the tight corridor along the alignment.

16.1.16 The Contractor shall be responsible for all utility services diversion whether identified as to be borne by the Authority or by the Contractor. The Contractor shall comply with any requirements that may be imposed by the Utility Agencies for diversion of all utilities and deemed to be included in the Contract Price. The Authority's service diversion corridors are for reference only, and the Contractor shall review, coordinate and deconflict any clashes and deemed to be included in the Contract Price and programme.

16.1.17 The Contractor shall be liable for and shall indemnify the Authority against all costs, charges, expenses, and the like sustained by the Authority. No claim for extension of time and/or additional costs by the Contractor will be accepted by the Authority arising out of or in association with the Contractor's failure to discharge his obligations as specified in **Clause 16** of the Particular Specification.

16.2 Identification and Protection of Utility Services

16.2.1 The Contractor is solely responsible for determining accurately the exact locations of all utilities on the Site, and for coordinating with the Utility Agencies on their diversion, support and protection where and when required.

16.2.2 The Contractor shall obtain the latest utilities plan from all agencies as required and carry out his own trial trenches work to confirm the locations of utilities affected by the Works.

16.2.3 Prior to commencement of any part of the Works, the Contractor shall locate (by carrying out trial trenches, cable detections, etc.) the exact positions of all existing sewer mains, gas mains, water mains, electrical cables, telecommunication cables and other utility services. After the initial trial trenches have been excavated to the required depth, the Contractor shall carry out further detection to confirm there are no utilities beneath. If there is a known utility that still cannot be found despite this second detection, the Contractor shall contact the respective Utility Agencies to identify on site the location of the said utility. The costs of all trial trenches and associated works in locating the utilities shall be deemed included in the Contract Price.

16.2.4 The Contractor shall take all precautionary measures to prevent damage to the services during the trial trenching works and throughout the duration of his works. The Contractor shall refer to the Guidelines for Services Identification and Protection and shall conform to the latest requirements which can be obtained from the relevant authorities/ agencies.

16.2.5 The Contractor shall engage a Licensed Cable Detection Worker (LCDW) to carry out detection work as and when necessary, throughout the construction duration. The Contractor shall engage a Registered Earthworks Supervisor (RES) and Registered Excavator Operator (REO) for works to supervise works in the vicinity of SPPG services and gas pipelines in accordance with **Clause 12** of Particular Specification.

16.2.6 The Contractor shall engage a Licensed Telecommunication Cable Detection Worker (TCDW) to carry out detection work prior to commencing any earthworks within the vicinity of any telecommunication cables. The Contractor shall refer to the documents “Guidelines for Telecommunications Cable Detection Works” and “Requirements to be Complied with by Earthworks Contractors for the Prevention of Damage to Telecommunications Cables” posted on IMDA’s website for compliance.

16.2.7 The Contractor shall conduct additional trial trenches to locate and verify the actual position of all electrical cable joints. Joints in cables shall be monitored for movement across joints. The Contractor shall confirm the diversion corridors and ensure that the proposed diversions fit with their planned sequence of works on site.

16.2.8 The Contractor shall produce and submit updated services drawings to the Engineer within three (3) months from award of Contract. These services drawings shall be updated regularly to reflect the latest details/changes on the route, location, position, and depth, etc., of the services based on the results of the trial trenches, cable detection, as-built details of diverted services, etc. The Contractor shall ensure the correctness and accuracy of the updated services drawings.

16.2.9 The Contractor shall indemnify the Authority for any costs, time and/or penalties arising from damage to existing services.

16.2.10 The Contractor shall make allowance for all necessary changes to the planned sequence / method of construction for his Works if the actual alignments / locations of the utilities deviate from the Authority's Drawings and/or any changes to the Utility Agencies schedule and requirement. All time and cost associated shall be borne by the Contractor.

16.2.11 The Contractor shall monitor existing utilities that are within the influence zone of the Contractor's Works.

16.2.12 The Contractor shall provide pegged alignment of diverted or proposed routes and locations of agreed service diversions within the proposed utility diversion corridors to facilitate the laying of utilities as and when required by the Utility Agencies.

16.2.13 It is the intention of the Authority to monitor the settlement of the utilities (diverted or otherwise) throughout the Works. The Contractor is deemed to have included in his Contract Price, the cost of any coordination works and provide safe access to Instrumentation and Monitoring Contractor (IMC) for the monitoring works of all utilities including, but not limited to, power, water, sewer, telecommunications, and gas lines or instructed by the Engineer during the course of the Works.

16.2.14 The Contractor shall take necessary precautionary measures to ensure that no damage occurs to any existing or new canals, sewers, water or gas mains, electrical or telecoms cables, culverts, drains and any other utilities. The Contractor is liable for any damage to the existing and new utilities, drains and culverts as a result of his works such as, but not limited to, earth movement, faulty timbering, excessive weight of machinery and/or excavated material being deposited too close to open trench, leaving the excavation open for an unduly long period, or to any form of settlement following backfilling or tunnelling works. The Contractor shall carry out all repairs or replacement works to the acceptance of the Engineer and the approval of the Utility Agencies.

16.2.15 The Contractor shall note the proximity of existing utilities including, but not limited to, power cables, telecommunication cables, gas, sewers and water pipes to the proposed works. The Contractor shall coordinate, design and install all protective works if required for the diversion/protection of the utilities at his cost.

16.2.16 Any damage arising from the Contractor's works shall be made good to the acceptance of the Engineer and the Utility Agencies by the Contractor at his own expense.

16.3 Advance Utilities Diversion and Schedule

16.3.1 The Authority has appointed CR2016 to coordinate with the utilities agencies to carry out advanced utilities diversion of existing utility services as listed in **Appendix Z** of the Particular Specification and Drawings. Where the advanced utilities diversion works have not been completed upon the award of the Contract, the Contractor shall incorporate the remaining advanced diversion works into CR206's baseline programme and shall liaise and coordinate with CR2016 and utilities agencies to ensure that CR206's works programme is achieved. No extension of time and additional costs due to incorporation of outstanding utilities works will be accepted.

16.3.2 The Contractor shall note that the alignment of the Advanced Utilities Diversion Works as shown in the Drawings are only indicative and for reference. The Contractor shall coordinate with CR2016 to verify the accuracy of the as-built drawings and location of the diverted utilities within vicinity of his worksites. The Contractor shall provide protection of the diverted utilities to suit his proposed construction methods.

16.3.3 The Contractor shall note that any ongoing Advanced Utilities Diversion Works that continues beyond **30 December 2024**, the Contractor shall take over from CR2016 to liaise and coordinate with the utilities agencies to complete the remaining advanced diversion works. The cost for attendance, coordination and liaison works is deemed to be included in the Contract Price.

16.3.4 The Contractor shall coordinate with CR2016 Advanced Utilities contractor for the as-built information of the utilities corridor, slope design, work areas topography, drainage diversion, temporary traffic diversion, etc and incorporate the information to suit his works.

16.4 Utilities within Works Areas

16.4.1 The Contractor shall submit to the Utilities Agencies, relevant agencies, landowner and the Engineer for acceptance, details of the measures he proposes to take to protect, maintain, upgrade and realign if necessary, existing utilities, manholes, drains and sewers affected by the operations in the Works Area. All time and cost associated with these works shall be borne by the Contractor.

16.4.2 Some of these utilities may require to be locally diverted and/or supported and adequately protected over the Works area due to space constraints. The Contractor shall liaise with the respective Utility Agencies for the diversion and/or support of these utilities during the course of the Works to the acceptance of the Engineer and the approval of Utility Agencies. All costs and time associated with the works shall be borne by the Contractor.

16.4.3 The Contractor shall comply with the relevant agencies' requirements on the notice for commencement of earth works near to existing services.

16.4.4 Prior to any work activity, the Contractor shall identify any utilities which are in close proximity to the proposed work activity and propose mitigation measures to protect these utilities; and submit this in a report to the Engineer for acceptance. Upon acceptance, the Contractor shall monitor these utilities and submit a daily report indicating the status of these utilities to the Engineer for record.

16.5 Utility Diversions and Schedule

16.5.1 Utilities that are affected and to be supported/protected or diverted are identified in **Appendix Z** of the Particular Specification. The utilities diversion scheme shown on the Authority's Drawings and those included but not limited to those stipulated in **Table 1** of **Appendix Z** of the Particular Specification are as pre-consulted with Utility Agencies. The utilities diversion routes and support schemes are for reference only. The Contractor shall determine the final alignment of the utilities based on his design and obtain the relevant agencies approval. The Contactor shall have included the coordination time required, with the Utility Agencies, for their approval of the utility diversion. The Authority will not accept any claim from the Contractor for additional cost and time due to any delay in the approval of the Contractor's design submissions by the respective Utility Agencies.

16.5.2 For utilities to be undertaken by the Contractor, including but not limited to those stipulated in **Table 2** of **Appendix Z** of the Particular Specification, the Contractor shall allow and incorporate into his overall construction programme, the following minimum diversion period required by the Utility Agencies to carry out diversion / laying of the Utility Services as identified in Table **16.1**. The Contractor shall note that the minimum diversion period provided below is for reference only. The Contractor shall coordinate and agree with the relevant Utility Agencies / Authorities prior to commencement of his works. The minimum diversion period shall commence from the confirmation of diversion corridor with the relevant Utility Agencies / Authorities or the availability of diversion corridor whichever is later, till the completion of the diversion works. The whole line of the utility may be diverted in single or multiple stages depending on the site availability and the Contractor's planned construction sequence.

Table 16.1 - **Minimum Diversion Period Required by Utility Agencies**

S/N	Type of Services	Minimum Diversion Period (1) Required
(a)	Electrical cables, 22kV & 6.6kV	18 Months
(b)	Telecommunication Cables < 7 ways	18 Months
(c)	Telecommunication Cables ≥ 7 ways	24 Months
(d)	Gas mains & distribution pipes	15 Months
(e)	Other minor services (2)	6 to 15 Months

1) Minimum Diversion Period refers to commencement from Works Service Order (WSO) issuance date, or from handing over of the utility corridor to the respective Utility Agencies; whichever is later, until the completion of the diversion works, subjected to the availability of site to the utility agencies.

2) Minor services shall include electrical cables of less than 6.6kV, gas distribution pipes of less than 300mm diameter.

3) The Contractor shall coordinate with the Utilities Agencies and provide site access for the above utilities/ services.

16.5.3 For utilities to be undertaken by the Contractor, including but not limited to those stipulated in **Table 2** of **Appendix Z** of the Particular Specification, the Contractor shall design and carry out the excavation / digging of trenches, compact the trenches, coordinate, supply and install pipes / conduits, manholes, joint pits / draw pits and other ancillary works to meet the requirements of the respective Utility Agencies, and reinstate the ground after the Agencies' work to the satisfaction of the Engineer and/or relevant Agencies' requirements. The standard shall be as according to the Material and Workmanship Specifications and SDRE. The Contractor shall be responsible for liaising with the Utility Agencies for the diversion of all utilities as shown on the Drawings. The Contractor shall accommodate the Utility Agencies timing and requirements for the diversion of the affected utilities. The Contractor shall allow in his overall construction programme the time duration for all utilities diversion such that the whole of the Works is to be completed within the Contract duration.

16.5.4 The Contractor shall cooperate fully and render assistance to the Utility Agencies and their contractors / sub-contractors. The Contractor shall work closely and coordinate with the Utility Agencies and their contractors / sub-contractors to ensure that the area which the utilities are to be diverted are adequately prepared before the proposed diversion. The Contractor shall provide attendance to such contractor's works and any costs involved shall be deemed to have been included in the Contract Price.

16.5.5 Within three (3) months after the award of Contract, subject to the acceptance of the Engineer, the Contractor shall propose to the Utility Agencies and relevant authorities any necessary diversion, support and protection of utilities, drains and sewers. The Contractor shall provide safe access with platform for regular maintenance by Utility Agencies to all supported utilities. The Contractor shall also be fully responsible to plan and obtain approval from all required agencies, for the necessary support, protection and/or diversion of affected utilities to suit his construction sequences and works. The Contractor shall appoint a PE to design and supervise all temporary support and protection of utilities, drains and sewers. The Contractor shall liaise with the Utility Agencies on the sequence of the diversions and shall design and construct any necessary temporary or permanent support structure at his cost to suit the construction sequence and method for both the Temporary and Permanent works.

16.5.6 Through pre-consultation with Starhub Cable Vision Ltd, Starhub Cable Vision (CATV) cables are currently not in use. The Contractor shall verify with Starhub Cable Vision Ltd and ensure that CATV cables are no longer in use before carrying out their Works. Where CATV cables are found to be live, the Contractor shall liaise and coordinate with Starhub Cable Vision Ltd for the diversion / protection of affected cables. All Starhub-owned CATV pipelines, including those serving existing buildings from Singtel manholes, are to be maintained or diverted for future Starhub uses. The Contractor shall liaise and coordinate with Starhub Cable Vision Ltd for the treatment of CATV cables and Starhub pipelines.

16.5.7 The Contractor shall reconstruct manholes, ducting and piping to match the final road / ground level to the acceptance of the relevant agencies. The Contractor shall deem to have included in his Contract Price the cost of utilities undercrossing other utilities, drains or other structures. The Contractor shall also bear the cost for the utilities level adjustment due to changes resulted from drain invert level.

16.5.8 The Contractor shall note that manholes shall not be buried under any circumstances. Where there is a need to raise or lower any existing manholes, Contractor shall coordinate and obtain approvals from relevant authorities/agencies on such proposals. The final manhole top level shall be surveyed using the affected existing manhole's invert level as the Temporary Benchmark and validated against existing or future road reinstatement surveys. The as-built drawings showing the raised or lowered top levels of the manholes shall be submitted to relevant authorities/agencies.

16.5.9 The Contractor shall coordinate and obtain approval from the relevant authorities/agencies and ensure that his own requirements are properly taken into account in the detailed planning of the diversions, in particular where utility services have to be supported above his excavation. The relevant authorities/agencies shall be informed of any subsequent changes that may become necessary.

16.5.10 The Contractor shall obtain approval from all relevant authorities, agencies and landowners for the temporary or permanent diversion of any utilities, drains and sewers onto State Land or agencies' land. All requirements of relevant authorities, agencies and landowners shall be strictly adhered to.

16.5.11 The Contractor shall note that temporary or permanent utility diversions beyond the road reserve are not permitted. In the event the Contractor proposes to temporarily divert utilities beyond the road reserve, he shall obtain approvals from the relevant authorities / agencies, private landowner and the Engineer complying with all requirements.

16.5.12 The Contractor shall provide a method statement for the utility diversion work, utility support, combined utility diversion plan and the contingency plan. The method statement and contingency plan are subject to the Engineer and relevant agencies' approval.

16.5.13 All utilities serving adjacent properties / stakeholders shall be protected. In the event that diversion of such utilities is required to facilitate his Works, the Contractor shall ensure that there is no disruption of services. The diversion and reinstatement of the affected utilities shall be undertaken by the Contractor and costs are deemed to be included in the Contract Price. The Contractor shall obtain the relevant authorities / agencies and the Engineer's approval prior to commencement of the diversion, relocation and connection of such utility services.

16.6 Works Associated with Sewers

16.6.1 The Contractor shall note that sewer diversions required for the Works are to be undertaken by Contractor unless they are under the scope of CR2016. The Contractor shall review and coordinate with PUB and other relevant stakeholders and shall undertake the necessary diversions if required as part of their scope of works. The Contractor shall also carry out any required relocation of modification to any sewer manholes / pipes that are affected by the Works.

16.6.2 The Authority has developed a reference diversion scheme for the diversion of affected sewer pipes as indicated on the Authority's Drawings. Where required, the Contractor shall develop the diversion scheme and obtain all necessary approval from the relevant agencies. Contractor shall allow for time and cost for these works.

16.6.3 The Contractor shall note that the existing 600mm diameter pumping main run across the proposed underpass structures. The pumping main will be decommissioned by PUB DTSS Contractor upon completion of the DTSS 2.1m diameter link sewer. The Contractor shall liaise with and co-ordinate with PUB DTSS Contractor on the decommissioning works.

16.6.4 Prior to the underpass construction works, the Contractor shall coordinate, verify and ensure that the existing 600mm diameter pumping main has been decommissioned and properly sealed off to his satisfaction.

16.6.5 In the event the existing 600mm diameter pumping main has not been decommissioned in time for his Works, the Contractor shall design and divert the existing 600mm diameter pumping main subject to approval from relevant agencies. All cost and time is deemed to be included in the Contract Price.

16.6.6 The Contractor is required to carry out detailed design and diversions throughout the course of the Works at the Contractor's own cost. The method of construction shall be proposed by the Contractor and subjected to acceptance of the Engineer and relevant agencies. The Contractor shall provide all design as necessary to facilitate his proposed method of construction.

16.6.7 Where required the Contractor shall provide method statements to PUB for future maintenance where the sewer works are within the railway reserve.

16.6.8 The Contractor is required to survey and confirm the location of the existing manholes and alignment and levels of the sewer. During the survey, the Contractor shall not assume that the sewers are aligned with the manhole covers. The Contractor shall take all necessary precautionary measures and obtain approval for man entry into the manholes to confirm the position of the existing sewers.

16.6.9 The Contractor shall include the cost of all associated works necessary to complete the proposed sewer pipe laying works such as design and construction of all temporary works and temporary ERSS required, manhole shafts, utility diversions, drain diversions, tree cutting and re-planting, diversions to road furniture etc. in order to complete the Works.

16.6.10 Where sewer lines and manholes are to be supported, the Contractor shall design the temporary supports and protection measures for the sewers. The supports shall be designed by a qualified PE and submitted to PUB for approval and to the Engineer for acceptance. A robust system of supports shall be provided to hold the sewers up and adequately protect and prevent them from being damaged during the construction. The sewer system shall be kept operational at all times during the construction.

16.6.11 The Contractor shall note that over-pumping shall not be proposed as a temporary provision for sewer works other than as a backup mitigation and with the approval of PUB and the Engineer.

16.6.12 The Contractor shall study the existing ground condition where the existing sewers are not diverted to confirm whether ground treatment is required for due to the impact of the Works. Any ground treatment required will be deemed included in the Contract Price.

16.6.13 The Contractor shall submit all the proposed sewer diversion, manhole shaft design, ERSS and permanent works design as well as sewer removal works to the Engineer for acceptance and to PUB, BCA and other relevant authorities for approval. For structural details of the manhole design, the Contractor shall comply with the Sewerage Standard Drawings that can be retrieved from PUB official website: http://www.pub.gov.sg.

16.6.14 PUB and relevant authorities' approval and the Engineer's acceptance shall be obtained before the commencement of any diversion of the existing sewers / pumping mains.

16.6.15 The Contractor shall refer to PUB's requirements for the protection of sewers, sealing and abandoning of sewers and manholes and the Advisory Note on the Prevention of Damage to Public Sewerage System. All consequential costs shall be deemed to be included in the Contract Price. The Contractor shall note that all abandoned sewers that are not removed are to be fully grouted or otherwise treated to the satisfaction of the Engineer and PUB. The Contractor shall provide the Engineer with the theoretical volume and the final grouted volume.

16.6.16 Prior to the excavation works, the Contractor shall carry out pre-CCTV inspections of sewers within the zone of influence of the works to the full satisfaction of the PUB. The results of this survey shall be presented in the report submitted to PUB and shall take into consideration the allowable movement of the sewers. Upon completion of the excavation works, the Contractor shall carry out post-CCTV inspection together with the PUB. The Contractor shall repair any damage to the sewers evident from the difference in condition of the sewers recorded before and after the Works at his own cost.

16.6.17 The Contractor shall take note and comply with PUB's requirement on removal of any abandoned sewer pipes. All costs for the removal of abandoned sewer pipes or infill with grout, reinstatement and coordination shall be borne by the Contractor. The Contractor is to probe the abandoned sewer pipe to check for grout fill, and to infill with grout if void is found before any piling works are carried out.

16.6.18 The Contractor shall provide standby sewer pipes at structure crossings, where required. This is to comply to PUB requirement for contingency purposes. The cost of such standby pipe shall be deemed included in the Contract Price.

16.6.19 The Contractor shall ensure all sewer pipes connections shall comply with PUB's requirements.

16.6.20 At the end of Defects Liability Period (DLP), the Contractor's QP shall submit a CCTV inspection report to PUB for approval and call for a joint inspection with PUB to handover the sewers. In the event that any defects identified at the end of DLP inspection, the Contractor shall rectify the defects in compliance to PUB's requirements and to extend the warranty / DLP, if any, as stipulated in the PUB's Written Directions. All associated costs and time including the DLP shall be deemed included in the Contract Price.

16.7 Works Associated with Water Services

16.7.1 The Contractor shall note that all water services (i.e. bulk water meter, valves, valve chambers, fire hydrants, etc.) that are affected by the Works shall be diverted/supported by the Contractor and at his own cost. Only PUB approved and BCA registered contractors under the appropriate workhead are allowed to carry out water pipe diversion works. The Contractor shall submit the details of the party carrying out water pipe diversion work to the Engineer for acceptance and PUB for approval.

16.7.2 The Contractor shall note that there is a 2200mm diameter PUB water pipe at the Rail Corridor located above the proposed tunnel alignment from CR206 to CR205. The Contractor shall carry out the necessary impact assessment and ensure that his tunnelling works do not have adverse impact on the 2200 mm diameter PUB water pipe.

16.7.3 The Contractor shall confirm the diversion scheme with PUB and seek approval on horizontal and vertical alignment of temporary and permanent water pipe diversion routes. All costs for the water temporary diversions and permanent reinstatements including the provision of trenches, access, lead-ins etc. for the Utility Agencies, temporary support structures for water pipes prior to and after the completion of the realignment works, removal of abandoned utilities, reinstatement of road surface / pavement and removal/reinstatement of affected trees and plants shall be borne by the Contractor. Upon commissioning of the reinstated water pipes, the Contractor shall liaise with PUB to decommission the temporary diverted water pipes and remove the abandoned pipes to meet PUB's and all relevant authorities/agencies' requirements.

16.7.4 The Contractor shall produce detailed design and seek approval from PUB on the proposed water services diversion and reinstatement works and shall comply with PUB's requirements. The design and construction of water services including temporary ERSS shall be in accordance with PUB's standard specifications and endorsed by the Contractor's PE. The Contractor shall ensure that the diverted pipe shall not impede the present/future construction works of the Contractor and the interfacing contractors.

16.7.5 The Contractor shall engage PUB and PUB approved subcontractor to carry out the final inspection, testing, disinfection and commissioning of these water pipes including water sampling and testing and final connection to the existing main. All associated costs and time including the DLP shall be deemed included in the Contract Price.

16.7.6 In the event that the bulk meter chambers and water pipes that serve Maju Camp and SIM/SUSS are to be relocated and diverted due to the Contractor's work, the Contractor shall allow sufficient time in his programme for the relocation, diversion and reinstalment works. The Contractor shall seek relevant stakeholders' and Utility Agencies' approval prior to any of this work. Water supply to the affected stakeholders shall not be interrupted and operation of the bulk meters shall not be affected. All the costs for the said works shall be deemed included in the Contract Price.

16.8 Reinstatement of Diverted Services

16.8.1 The Contractor shall reinstate all temporarily diverted utility services whether undertaken by the Advanced Utilities Contractor as stipulated in **Appendix Z** or by the Contractor, to be within the permanent road reserve unless otherwise approved by the relevant authorities and land owner.

16.8.2 The Authority will issue Works Orders to the utilities agencies to carry out the utility diversion works. The Contractor shall design and construct utility trenches, coordinate, supply and install pipes/conduits, manholes, joint pits / draw pits, backfill/reinstatement and other ancillary works to meet the requirements of the respective Utility Agencies. The Contractor shall co-operate fully and render assistance to the utility agencies and their contractors/subcontractors in carrying out the aforesaid works.

16.8.3 The Contractor shall allow in his programme for the cost and time required for these utilities reinstatement works and shall be responsible for all necessary planning of corridors and co-ordination with the utility agencies and their contractors to ensure that the area which the utilities are to be reinstated are adequately prepared before the proposed diversion.

16.8.4 The Contractor shall coordinate with Utility Agencies for the location and number of the conduit / service ducts to be reinstated. The Contractor shall supply and lay the conduit / service ducts and seek clearance from the respective Utility Agencies prior to backfilling over those reinstated conduit / service ducts. After backfilling, the Contractor shall conduct a pull through test of all the conduit / service ducts to confirm the serviceability. Any damaged conduit / service ducts shall be replaced to the acceptance of the Utility Agencies.

16.8.5 The Contractor shall remove all abandoned services, pipelines and manholes and reinstated the areas to the satisfaction of the landowners and to the acceptance of the Engineer upon the completion of the utilities services reinstatement.

16.8.6 The Contractor shall demolish the common utility trench after reinstatement of all affected utilities, backfill and reinstate the area to the satisfaction of the landowners and to the acceptance of the Engineer.

16.8.7 The Contractor shall seek PUB’s approval and decommission the 2400mm dia pipe culvert constructed by CR2016 after completion of the permanent drainage.

16.9 Building Services Connections

16.9.1 Building service connections shall be maintained and protected during the execution of the Works.

16.9.2 Building service connections shall include teeing-off branch pipes from the main PUB potable/NEWater pipes complete with isolation valves, incoming trench complete with cover, bulk water meter chambers and bulk meters, sewer connection to existing manhole and drainage discharge pipes, telecommunications, and electrical supply cables, etc.

16.9.3 These services shall be identified on site by trial trenches or other methods approved by the Utility Agencies and the Engineer. Where these services interfere with the Works, the Contractor shall propose localized diversion/support and protection for the approval of the Utility Agencies, relevant agencies, landowner, and the Engineer. All necessary cost and time allowances shall be deemed to be included in the Contract Price.

16.10 Service Ducts affected by the Works

16.10.1 Any Service duct routes and empty duct provisions for utilities that are blocked or damaged during the course of the Works shall be cleared or replaced to the acceptance of the relevant Utility Agencies and the Engineer.

16.11 Drainage Works

16.11.1 All temporary diverted drains shall be designed and built by the Contractor to meet PUB's requirements. The Contractor shall design and submit calculations and drawings to PUB for review and approval prior to commencing the temporary diversion works. All temporary diversions shall be subject to the approval and the requirements of PUB and the relevant authorities/agencies and the Engineer.

16.11.2 The Contractor shall assess and propose drainage diversions or new drains as required for effective drainage of the site. The Contractor shall coordinate and obtain approval from PUB on the finalized drainage diversion scheme.

16.11.3 The Contractor shall be responsible to plan, design and construct the temporary and permanent drains such that runoff within the proposed site, upstream of the proposed site and adjacent to the proposed site can be effectively drained away without causing flooding within the site and the vicinity of the site. All temporary drains are to match with the existing drain sizes / discharge capacity unless otherwise required by PUB.

16.11.4 In addition to the temporary drains, there may be other affected drains, roadside drains and box culverts on adjacent landowners' property that may need to be temporarily or permanently diverted, reconstructed or supported to suit the Contractor's Works. Notwithstanding any other requirements of the landowners, all temporary or permanently diverted drains shall be designed and constructed in accordance with PUB's standards and requirements.

16.11.5 The Contractor shall ensure a complete drainage system to cater for surface water runoff from the surrounding areas or adjacent landowners' property. The Contractor shall design the drainage system in accordance with PUB's requirements. The proposed drainage scheme shall be properly linked to external drains, as necessary. The sizes, levels and alignments of the detention tank, drains, sumps, culvert, etc. shall be submitted to PUB for approval and to the Engineer for acceptance.

16.11.6 If required, the Contractor shall make appropriate provision of detention tank in accordance with PUB's requirements.

16.11.7 The Contractor is required to locate and confirm the exact location and depth of all existing and proposed services prior to commencement of his drainage works.

16.11.8 The Contractor shall plan the utilities diversion and ensure utilities undercrossing drains are laid in accordance with PUB's requirements, to avoid clashes with drains.

16.11.9 No works shall commence prior to obtaining PUB's approval. All existing drainage system within and/or in the vicinity of the proposed site shall not be altered, disturbed, filled, diverted, blocked or interfered without the prior approval from PUB.

16.11.10 All existing drains shall not be demolished or interfered with until their replacement of temporary or permanent drains have been constructed and functioning satisfactorily to PUB standards.

16.11.11 All proposed temporary diverted drain and existing drain affected by the proposed construction activities shall be maintained and cleansed regularly by the Contractor to remove all obstructions, silt and rubbish during the construction period.

16.11.12 All proposed temporary or permanently diverted drains shall be maintained in a free-flowing condition at all times.

16.11.13 All proposed roadside drains and box culverts across roads shall be designed in accordance with the relevant codes and practices including the Authority's Civil Design Criteria (CDC), and to comply with the latest Standard Details of Road Elements (SDRE).

16.11.14 Sumps of sufficient sizes shall be provided where the proposed temporary diverted drain converge. The minimum internal width of the sump shall not be less than 1.5 times the width of the drain leading away from the sump. Drains shall enter the sump at angles less than a right angle and at different levels wherever possible. The invert level of the downstream drains shall be lower than the invert level of the sump so that no stagnant water will collect in the sump.

16.11.15 The Contractor shall ensure his design of all the Temporary Works associated with temporary utilities diversion and reinstatement including ERSS is submitted to the relevant authorities (e.g. BCA) for approval prior commencement of Works.

16.11.16 Upon completion of the Works, all the affected drains / box culverts and other existing drains / box culverts are to be fully reconstructed to their original size, or to the revised sizes as approved by PUB, the relevant landowners and acceptance of the Engineer. All costs and time implications arising from revised sizes shall be borne by the Contractor. The Contractor is required to be present during the joint site inspection prior to handing over the completed drains to PUB.

16.12 Street Furniture and Minor Services

16.12.1 Where street furniture, including lamp posts inclusive of footpath lightings, CCTV cameras and its accessories, traffic lights, OG boxes, fire hydrants, signage, Expressway Monitoring Advisory System (EMAS), minor electrical and telecommunication cables, water services, traffic cameras, speed cameras, etc., are required to be dismantled and stored or relocated temporarily or permanently, the Contractor shall approach the relevant Utility Agencies or relevant authorities for their approval to the proposed arrangements. The Contractor shall allow in the Contract Price for all costs and time associated with such removal, disposal, relocation, storage or reinstatement of all street furniture and diversion of minor services.

16.12.2 In the case of street furniture to be dismantled and stored, this shall be for a period not exceeding six (6) months to allow the relevant Utility Agencies or relevant authorities to decide on its disposal. No street furniture shall become the property of the Contractor. The Contractor shall ensure proper storage of such fixtures/furniture under his custody and be liable for any damage/defacement sustained.

16.12.3 In all cases, the Contractor shall be responsible for the coordination of this work and is deemed to have allowed for this work in his programme.

16.13 Utilities Subsidence Report

16.13.1 The Contractor shall submit a preliminary “Utilities Subsidence Report” to document the expected response of utilities to the execution of his works. This report shall be endorsed by his QP(D), and QP(GEO) where required.

16.13.2 All utilities in service located within the monitoring zone (as established by Contractor’s QP(D)) whether supported or not shall be monitored with settlement points. The monitoring instruments shall be placed on or just above the utility at intervals of not more than 25 metres. If the utility is within 4 metres below ground level, it shall be monitored with settlement points on the utility. If the utility is more than 4 metres below ground level, the settlement points shall be placed 2 metres above the utility. All connections and joints of utilities servicing buildings deep foundations shall be monitored within the influence zone of the works. Additionally, manhole located within influence zone of the work shall be monitored.

16.13.3 The Contractor shall establish, based on the advice of the relevant Utility Agencies, tolerable limits for settlement, horizontal movement and angular distortion for each utility. Review levels (alert and work suspension levels) should be set together with contingency plans and actions when review levels are breached.

16.13.4 All preventive measures to minimize settlement of utilities shall be designed and installed by the Contractor. The Contractor shall also propose contingency plans and implement these in the event that the measured settlements/distortions exceed the accepted review levels or indicate that final long-term settlements/distortions will exceed the allowable values established in the Utilities Subsidence Report.

16.13.5 At least two (2) months prior to the applicable works affecting the utility (e.g. excavation, tunnelling etc.), the Contractor shall carry out CCTV inspections of sewers within the zone of influence of the cut and cover and ground improvement works to the full satisfaction of PUB. The results of this survey shall be taken into consideration in establishing the allowable movement of the sewers. Upon completion of excavation works, the Contractor shall carry out another CCTV inspection together with the PUB. The Contractor shall repair any damage to the sewers evident from the difference in condition of the sewers recorded before and after the Works, at his own cost.

16.13.6 The Preliminary Utilities Subsidence Report shall include, amongst others, the following:

a) The result of the CCTV inspections of sewers;

b) The geotechnical characteristics of the soils and the size, type, age, joints, bedding and current condition of each utility that could be affected by the Works;

c) The Contractor shall establish, based on the advice of the relevant Utility Agencies, tolerable limits for settlement, horizontal movement and angular distortion for each utility. Review levels (alert and work suspension levels) should be set together with contingency plans and actions when review levels are breached;

d) Review levels (alert and work suspension levels) with contingency plans and actions when review levels are breached;

e) Services deemed as ‘critical’ to Utility Agencies because of potential interruption from the Works including the specific monitoring requirements;

f) Identify services deemed as ‘critical’ because of potential interruption with the Utility Agencies. These utilities shall be identified in the Report and specific monitoring requirements identified;

g) An assessment of the effect of the predicted short- and long-term movements including subsidence, horizontal movement and angular distortion which could result from excavation, gaps where utilities cross retaining walls and other construction activities, the proposed programme for subsidence monitoring and the proposed means of protecting utilities. Particular attention is drawn to the risk of ground loss and subsidence from any gaps left in the retaining walls. Any such gaps shall be sealed to the acceptance of the Engineer. The requirement for any protective works shall be fully considered and concept designs proposed;

h) The Contractor shall identify the risk of the utilities being damaged in relation to the predicted settlements and propose mitigation measures to reduce these risks. Protective works and contingency proposals, if predicted settlements are exceeded, are to be included in the report; and

i) Protective works and contingency proposals, if predicted settlements are exceeded.

16.13.7 The Contractor shall submit a Pre-final and Final Utilities Subsidence Report, following the format of the “Preliminary Utilities Subsidence Report”, based on any additional soil investigations or other information obtained. The report should highlight any changes with full justification for the modifications. Protective works designs for all utilities must be fully developed. The Final Utilities Subsidence Report must be submitted prior to the commencement of any major excavation on site and no major excavation will be allowed until the Final Utilities Subsidence Report is accepted by the Engineer.

16.14 Incoming Services for Station and MRT

16.14.1 The Contractor shall ensure that all services penetrations through the Civil Defence boundaries are watertight using Multi-cable Transit (MCT) unless otherwise specified.

16.14.2 The Contractor shall coordinate with all relevant Utilities Agencies, Interfacing Consultants, Authority's In-house Designers and SWC to complete the Coordinated Combined Services Model (CCSM) / Structural, Electrical and Mechanical (SEM) shop drawing submission as stipulated in **Clause 7** of Particular Specification. The CCSM / SEM coordination shall include all incoming utility services to the station.

16.14.3 The Contractor shall liaise directly with Utility Agencies to provide the lead-in pipes, cable ducts, MCTs, etc and the actual extent is subjected to the acceptance by the respective agencies and the Engineer. Notwithstanding the foregoing, the Contractor shall provide all openings required up to and including the MDF Room, including subsequent sealing of openings.

16.14.4 The Contractor shall pre-install all lead-in pipes, cable duct, MCTs, etc. which shall be encased in concrete. The Contractor shall allow in the Contract Price for all costs associated with the coordination and installation of the works.