1 GENERAL

1.1 SUMMARY

1.1.1 Scope

1 This Section includes specifications for the construction and rehabilitation of sewerage, surface water drainage and treated sewage effluent pipelines, piping, pipeline appurtenances and sewage treatment plants.

2 If the technology or material or specification are not mentioned in this section, modifications are permitted and shall be subjected to approval as mentioned in the introduction of QCS (00-02).

3 The purpose of QCS is to provide as a general technical guide for acceptable construction work practices in the State of Qatar, considering this; any addition for technology, material, specification, standard that are not mentioned in this section or their modification, shall be subject to approval as stated in the introduction of QCS (00-02)

4 This Part includes general requirements basic to this Section and common to its Parts.

5 Related Parts and Sections are as follows:

This Section
Part 10, Pipeline Cleaning and Inspection Survey
Section 1, General
Section 5, Concrete
Section 6, Roadworks
Section 9, Mechanical and Electrical Equipment
Section 10, Instrumentation, Control and Automation
Section 21, Electrical Works.

1.1.2 References

1 Documents of the following agencies are referred to in this Section:

American National Standards Institute, ANSI
American Society for Testing and Materials, ASTM
American Water Works Association, AWWA
British Standards Institution, BS
Euro Norms, EN
Ministry of Municipal Affairs & Agriculture, Roads Department, Highway Maintenance Section
National Joint Health and Safety Committee for the Water Services, UK
International Organization for Standardization, ISO
Swedish Standards Commission, SS
Water Research Centre, WRC, UK

2 The following standards or revised/updated versions and other documents are referred to in this Part:

BS 6100.....Glossary of building and civil engineering terms

BS 8010.....Pipelines

EN 752 .....Drain and Sewer Systems outside buildings

1.1.3 Definitions

1 The following definitions apply generally to this Section. These and other definitions included in this Section are based, where applicable, on BS 6100, Part 2.

(a) Surface water: Water that flows over, or rests on, the surface of buildings, other structures or the ground; the definition is extended to include groundwater.

(b) Sewage: Contents of a sewer that does not solely convey surface water.

(c) Treated sewage effluent (TSE): Effluent from a sewage treatment works following completion of treatment of sewage and disinfection of the treated sewage effluent to attain a water quality standard suitable for reuse for selected purposes.

1.1.4 System Description

1 Unless otherwise specified herein or elsewhere in the Specification, designated in the Project Specification, or directed by the Engineer, the material, equipment and systems to be provided under this Section shall:

(a) be capable of providing the required level of service

(i) under the climatic conditions in Qatar as stated in Section 1

(ii) in handling the process fluids and materials of the prevailing and indicated

(iii) quality and quantity and variations thereof

(iv) under the prevailing and indicated characteristics and quality of the natural and

(v) process environments and process materials

(b) comply with the provisions of EN 752, BS 8010, and BS 8301.

1.1.5 Submittals

General

1 The Contractor shall submit to the Engineer for approval all drawings and data including samples, calculations, schedules, certificates and other submittals specified in Section 1, this Section, the Project Specification, and required by variations. Submittals shall be in accordance with the procedures specified in Section 1, in this Part and in the other Parts of this Section.

2 The Contractor, shall be responsible for preparing final record drawings relating to the civil, structural and architectural aspects of the Works. Mechanical, Electrical and ICA record drawings shall be provided by the Contractor as required by Section 1 Part 21.

3 During the course of the Works, the Contractor shall maintain a detailed record of all changes in order to facilitate accurate preparation of record drawings and to ensure that these drawings are in all respects a true record of the installation.

4 The Contractor shall provide the Engineer or his nominated representative drawings and a photocopy of each schedule correctly and neatly modified in red ink to truly represent the Works constructed. These shall be submitted to the Engineer or his nominated representative for approval before the contract completion date.

5 If any drawing is not approved, it shall be returned to the Contractor with marked indications of the additional information required.

6 In addition the Contractor shall complete the Drainage Affairs Network Record Sheets in the prescribed format but not necessarily limited to, the following Record Sheets as applicable in both hard copy and electronic copy in a widely used Data Exchange Format (DXF) textual (i.e. .mdb, .xls or similar approved) format. Electronic format record sheets shall be obtained from the Engineer or his nominated representative.

PIPE LINE AND APPURTENANCES

a) Manhole Record (2 pages)
b) Discharge Chamber Record (2 pages)
c) Sewer Record
d) Valve Inventory
e) Valve Chamber Survey (3 pages)
f) TSE Pipeline Record
g) Rising Main Record
h) TSE Tower Record
i) TSE Distribution Chamber
j) Overflow Pipe Record
k) TSE/Rising Main Fittings Record
l) House Connection Record
m) Pumping Station Record
n) Gully Record
o) CCTV record sheet and video tape

PUMPING STATIONS

a) Pumping Station Well Inventory Sheet
b) Pumping Station Hoist Inventory Sheet
c) Pumping Station Motor Inventory Sheet
d) Pumping Station Penstock Inventory Sheet
e) Pumping Station Data Sheet
f) Pumping Station Pump Inventory Sheet
g) Pumping Station Shaft Inventory Sheet
h) Pumping Station Valve Inventory Sheet
i) Pumping Station Ventilation Inventory Sheet
j) Pumping Station Fan Inventory Sheet
k) Pumping Station Generator Sheet
l) Pumping Station Control Panel Inventory Sheet 1
m) Pumping Station Control Panel Inventory Sheet 2
n) Pumping Station Control Panel Inventory Sheet 3
o) Pumping Station Actuator Sheet
p) Pumping Station Air Conditioner Sheet

7 The Contractor shall be deemed to have included all provisions within his Tender should the above list be altered by PWA from time to time.

8 Individual Record Sheets shall be prepared for each length of sewer, TSE pipeline, rising main and overflow pipe, each manhole and house and gully connection, and shall be submitted to the Engineer or his nominated representative for approval after which they shall become the property of the Employer.

9 Record sheets for pipelines (c, f, g, i, j, k, l & n above as appropriate), and record sheets for any other work that is to be covered up, shall be presented for approval prior to covering up the works. Backfilling will not be permitted prior to the record sheets being approved.

10 Record sheets for work of an exposed nature that can be later verified by the Engineer or his nominated representative may be submitted up to 14 days after the work has been carried out.

11 Photocopies of record sheets relating to work carried out since the previous valuation shall be submitted with each interim valuation application.

12 No valuation of sections of work will be considered in the absence of completed record sheets for the work in question.

13 A Certificate of Completion will not be issued until a complete set of Record Sheets endorsed by the Engineer's Site Representative has been presented to the Engineer.

14 Blank hard copy Record Sheets, as detailed in sub-clause 6 above will be supplied by the Engineer.

15 The Contractor shall accurately locate by co-ordinates to the Qatar National Grid, the centre of all covers of manholes and chambers constructed under this project or to which any work whatsoever has been undertaken under this project. The Contractor shall also locate by co-ordinates the position of buried bends and fittings on pressure mains. Where pipelines are not laid to straight lines between chambers or fittings the co-ordinates of every pipe joint shall be recorded prior to covering up the pipeline. Where flexible pipes are used coordinates shall be at 10m intervals.

16 All Survey works shall be undertaken by Survey Company approved by Engineer.

1.1.6 Quality Assurance

1 Materials and products shall be furnished by approved suppliers as designated in the Contract and Project Specifications.

2 Survey work for obtaining record sheet data and the compilation of the data shall be carried out by approved prequalified surveying companies designated in the Contract or Project Specification.

1.1.7 Site in Private Lands

1 The Employer will serve the necessary notices to permit pipelines to be constructed in private land in accordance with the agreed programme of work. The Contractor shall not enter those lands without the Engineer's permission. The Contractor shall temporarily fence the Site in private lands to the satisfaction of the Engineer and the Contractor's operations shall be confined within the fenced area. The Contractor shall use the Site for the purposes of constructing the Works only.

1.1.8 Inspection and Handover Procedure

1 The inspection and handing over of the Works to the Employer shall be in accordance with the procedure specified in Section 1, and, Clauses 1.3.4 and 1.3.5 of this Part.

1.2 TESTING OF MATERIALS

1.2.1 Materials Generally

1 All materials to be used in contact with sewage or its atmosphere must be shown to withstand corrosion. In the absence of satisfactory evidence of equivalent testing results, materials will be required to pass the 100 day acid test as detailed in Clause 1.2.2 of this Part.

1.2.2 100 Day Acid Test

General

1 Based on the results at 100 days, materials shall be deemed to be unsuitable for use in contact with sewage or sewer atmosphere in the opinion of the Engineer the tested samples fail to satisfy any of the following requirements:

2 All materials to be used in contact with sewage or its atmosphere must be shown to withstand corrosion and in the absence of satisfactory evidence of equivalent testing results will be required to pass successfully the 100 day acid test as detailed in this Specification. The test shall be carried out by an approved laboratory, experienced in undertaking the test.

3 All materials to be used in contact with sewage or its atmosphere must be shown to withstand corrosion. Such materials may be divided into two categories:

4 Category 1 Materials - material which serve a purpose other than protection (e.g. pipes and pipe jointing materials)

5 Category 2 Materials – materials which protect other (usually structural) corrodible materials (e.g. coating to step irons, GRP manhole liners, acid resistant mortar).

6 Sample preparation and testing shall, as far as is possible, simulate the conditions to which the materials will ultimately be subjected.

7 Samples shall be taken and prepared in a manner to be approved by the Engineer. Care shall be taken in preparation of samples of non-homogenous materials to ensure that only the face that will be exposed to the corrosive environment in the sewer is exposed to the acid during the testing.

(a) Samples in Category I materials shall be cut from pipe/pipe joint samples selected by the Engineer and cut ends adequately protected by a gel coat.

(b) Samples of Category II materials shall be generally prepared by coating a corrodible material with the protective coating to be tested.

8 For each test two samples shall be prepared and indelibly marked with an identifying number.

9 One sample shall be partially immersed in 10% V/V sulphuric acid maintained at a temperature of 50°C for 100 days. The concentration of acid shall be maintained by preventing evaporation. In addition the strength of the acid shall be regularly checked and the level and strength adjusted as necessary. The second sample shall be kept as a control.

10 The test sample shall be visually inspected at weekly intervals. Interim reports on the condition of the sample shall be submitted to the Engineer by the laboratory following visual inspections of the samples after 25, 50 and 75 days. Such reports shall include reference to any changes in surface condition and colour of the samples, changes in colour of the liquid, and any presence of any particles in the liquid.

11 If the interim report after 75 days is satisfactory the Contractor may request the Engineer's approval to use of the material prior to completion of the 100 day acid test. Such approval shall be solely at the discretion of the Engineer, and the use of the materials shall be entirely at the Contractor's risk. Any costs associated with the replacement of such materials, should they subsequently fail the acid test, shall be borne by the Contractor.

12 On completion of the test period, the sample tested in sulphuric acid shall be split or the coating removed to determine the internal condition of the sample. The final test report shall give full details of:

(a) The test procedure adopted.

(b) The surface condition of the samples before, during and after testing, listing the times at which significant changes in appearance were noted.

(c) The internal condition of the sample.

(d) Any changes in the solution.

13 Materials shall be deemed to be unsuitable for use in acid environments if the acid tested samples fail to satisfy any of the following requirements:

(a) Category 1 Materials - the surface of the samples shall not be significantly different in texture from the non-immersed control sample.

(b) Category 2 Materials -the underlying corrodible material shall not show any sign of corrosion.

14 The surfaces of the samples shall not be significantly different in texture from the non-immersed control sample. No change in surface hardness will be permitted, and no splits, cracks, blisters or delamination will be allowed.

1.3 IMPLEMENTATION

1.3.1 Site Information

1 Notwithstanding any relevant information included or referred to in the Project Specification or furnished by the Engineer, the Contractor shall be responsible for obtaining his own information on ground and subsoil conditions at the Site and the locations of all pipelines and services within or near the Site.

2 The Contractor shall complete a services information sheet for each section of the Works and shall submit the completed sheet for the Engineer's approval at least seven days before work is due to begin on that section. Work shall not begin on that section until the respective services information sheet has been approved by the Engineer.

3 Blank services information sheets will be provided by the Engineer.

1.3.2 Health and Safety

1 The requirements of this Clause are pursuant to or in addition to the health and safety requirements in Section 1 and Section 11. Safety requirements in relation to specific classes of work are specified in other Parts of this Section.

2 The recommendations contained in "Working with Sewage – The Health Hazards" Published by the Health & Safety Executive – http://www.hse.gov.uk/pubns/indg198.htm shall be adhered to in respect of all work to be carried out in operational sewers, pumping stations and sewage treatment works.

3 Arrangements shall be made with Drainage Operation and Maintenance Department, Public Works Authority before entering in or working on existing sewers and associated works. A Permit to Work must be obtained from Asset Affairs Drainage Operations and Maintenance Department prior to any works taking place .

4 The Contractor's attention is drawn to the hazards involved in working in confined spaces including sewers, manholes, inspection chambers, wet wells, pumping stations and ancillary structures. The Contractor shall be responsible for ensuring that adequate precautions are taken to ensure safe working conditions as well as the availability of safe tools and facilities. The Contractor shall issue his risk assessment to the Engineer for his approval prior to applying for a Permit to Work at the site. This risk assessment shall meet but not be limited to the requirements of this Part of this Section.

5 The Contractor shall appoint a Safety Officer who shall be suitably qualified and experienced. The Contractor shall ensure that the Safety Officer is available on Site during the mobilisation period and thereafter to train the Contractor's personnel in safety operations. The work shall not proceed unless such training has been accomplished to the Engineer's approval.

6 The Safety Officer's main responsibilities shall be to

(a) ensure that all the Contractor's employees follow the agreed safety procedures

(b) ensure that all employees are supplied with the appropriate safety/protective equipment and that it is used and maintained as per agreed procedures

(c) assist in carrying out of refresher safety training courses for working in confined spaces

(d) investigate all accidents and dangerous occurrences, and where applicable, submit reports recommending actions to be taken to prevent a recurrence.

7 The Contractor shall provide and erect approved safety barriers around all unattended open manholes and trenches. All manholes shall be covered with suitable temporary steel sheets. Advance warning notice road signs shall be erected at least 50 m either side of areas where work is in progress.

8 The need for adequate protection to the general public in the vicinity of the Works is stressed.

9 Care must be exercised when working in or near live sewers, and tests must be made to verify that no hydrogen sulphide or other toxic gases are present, before anyone enters an existing manhole or confined space.

10 Particular attention is drawn to the dangers of poisoning, asphyxiation or explosion while working in, or near, or inspecting pipelines, manholes, chambers, treatment units, pumping stations, or any confined space. In this connection the Contractor must obtain appropriate safety equipment and acquaint all personnel with the dangers involved, and precautions to be taken, and shall regularly discuss with the Engineer's Representative the sufficiency of safety precautions on site.

11 The following minimum precautions must be taken before entry into a manhole, chamber or other confined space:

(a) Sufficient numbers of covers of manholes or chambers upstream and downstream of the entry point shall be removed to ensure adequate ventilation.

(b) The manhole or confined space must be thoroughly ventilated by mechanical air blower prior to entry.

(c) Before entering the confined space the atmosphere shall be checked for the presence of toxic gases, flammable gases, and oxygen level.

(d) The mechanical air blower must be kept close by the manhole or confined space that has been entered.

(e) No naked lights, matches or lighters shall be used in a sewer or in close proximity to an open manhole or chamber. All equipment shall be intrinsically safe.

(f) The hydrogen sulphide level in the manhole or confined space must be continually monitored. If the level rises the manhole or confined space must be evacuated immediately.

(g) All persons entering a manhole or confined space must wear a safety harness properly rigged to the lifting frame.

(h) At least two top men must be available to operate the air blower and lifting tackle in the event of an emergency. The top men shall keep in touch with the men in the sewer, manhole, chamber or confined space by calling or signalling to them at frequent intervals. No person shall enter the confined space alone.

12 Before entering any confined space, the atmosphere shall be checked for the presence of toxic gases, flammable gases and oxygen level. The Contractor shall have on site in working order, sufficient calibrated gas monitors to continually monitor the atmosphere in all confined spaces and in all areas adjacent to sewage where men are working.

13 The Contractor will not be permitted to work in manholes, pipelines, or pumping stations if such gas monitors are not in use.

14 The following equipment is to be made available throughout the Contract at each and every entry point to a confined space.

Safety Harness (not a safety belt) and ropes	1 No.
Lifting frame and tackle for safety harness	1 No.
Gas monitor	1 No.
Mechanical air blower with compressor and generator	1 No.

15 Gas monitors shall incorporate the following features:

(a) Continuous monitoring of oxygen level, with visual and audible high and low level alarms.

(b) Continuous electrochemical monitoring of Hydrogen Sulphide with indication of the gas concentration, and audible and visual alarms under the following conditions:

(i) Time weighted average providing 8 hours exposure at the threshold limit value.

(ii) Time weighted average providing 10 minutes of exposure at short term exposure limit, or ceiling value.

(iii) Exposures to ten times the threshold limit value.

(c) Continual monitoring for flammable gas at intervals not exceeding 2 minutes.

1.3.3 Setting Out of the Works

1 The following requirements are pursuant to or in addition to the requirements in Section 1. The Contractor shall locate, by co-ordinates to the Qatar National Grid, the locations of the elements of the Works. Pipelines shall be located by the position of the centre of manholes and chamber covers. Pressure pipelines shall be located by the position of bends and fittings.

2 The execution of surveys, recording of data and preparation of record sheets shall comply with the following requirements:

(a) surveys shall be based on Qatar National Grid survey control points

(b) co-ordinates shall be located to within ±0.1 m

(c) co-ordinates shall be determined by radial (polar) observations using theodolite and electronic distance measuring (EDM) equipment. The co-ordinates shall be checked by independent methods and the error shown to be within acceptable limits

(d) if required, additional temporary control points may be established as follows:

(i) observations for additional temporary control points shall consist of at least two

(ii) rounds of angles (on two faces) with a different zero setting for each round.

(iii) where applicable, distances shall be determined by trigonometric methods and

(iv) at least two rounds of vertical angles (on two faces) shall be observed.

(v) positions of additional temporary control points shall be determined by

(vi) reference to not less than three Qatar National Grid survey control points and shall be proven to have standard errors of not more than ± 0.08 m.

3 On completion of work, all observations, computations, sketches and any other documentation used in determining the co-ordinates shall be submitted to the Engineer. A daily log giving the number of additional control stations and manholes surveyed shall be maintained and submitted. A comprehensive report on the work carried out including methods used, problems encountered, solutions used and a full summary of the results shall be submitted.

4 The Engineers approval of the setting out shall be obtained before work on each element commences.

5 The Contractor shall be deemed to have included all provisions within his tender for the 'topographical survey information which should include: - features (fittings), manhole chamber co-ordinates/levels in a widely used Data Exchange Format (DXF), accurate positional survey drawings (i.e. either.DWG or.DXF) layout files together with equally widely used DXF textural (i.e. xls, .txt or similar approved).

1.3.4 Inspection of Works

1 The Contractor shall provide a safe and convenient means of access to the Works to enable the Engineer's inspections to be carried out.

2 The Contractor shall submit to the Engineer notice of work requiring inspection on a completed Notice of Inspection Required form not less than 24 hours before requiring inspection of those works. Blank forms will be provided by the Engineer.

3 Requests for inspection by the Engineer shall be submitted for the following:

(a) setting out
(b) formation level of excavation
(c) pipelaying, bedding and testing
(d) base slabs
(e) manhole precast chamber rings in place before internal linings and external coatings are applied
(f) manhole concrete surround
(g) formwork and reinforcing steel before concreting
(h) before backfilling of permanent Works
(i) before reinstatement
(j) any other constructional operation that the Engineer may require.

4 Works covered up or in any way made unavailable for inspection before the submission of the Notice of Inspection Required form or the Engineer's approval to proceed shall be uncovered at the Contractor's expense.

5 Prior to inspection, the Contractor shall submit his Quality Control plan (QC plan) / Inspection and Test Plan (ITP) in accordance with Section 1 Clause 7.6.3.

1.3.5 CCTV Survey

1 The Contractor shall on written instruction of the Engineer undertake a CCTV survey on designated lengths of pipelines laid during the execution of the Works, including pipeline cleaning where necessary and submission of a Survey Report, as part of the final inspection of the Works.

2 The Certificate of Completion for the Works or part thereof shall not be issued until the CCTV Survey, including provision of the Survey Report, and any subsequent sewer remedial works have been completed to the satisfaction of the Engineer.

3 Should any length of the surveyed between adjacent manholes, or the manholes indicate failure to comply with the requirements of the Contract, the whole cost of any pipeline cleaning, the CCTV Survey, Survey Report and any subsequent remedial works carried out to the satisfaction of the Engineer shall be borne by the Contractor.

4 The CCTV Survey shall be carried out by an approved specialist subcontractor designated in the Project Specification. The subcontractor shall provide suitable documentation to verify previous experience in undertaking CCTV Surveys to the satisfaction of the Engineer.

5 Pipeline cleaning and CCTV surveys and reporting shall be carried out as specified in Part 10 of this Section.

1.3.6 Compensation for Damage to Property

1 Before commencing any work on site, the Contractor shall undertake an extensive condition survey of all properties adjacent to the proposed works. A detailed report including sketch plans, schedules of defects and photographs shall be submitted to the Engineer for agreement.

2 The Contractor shall not mark boundary walls to properties in any way whether deliberately for identification purposes or accidentally. All markings, howsoever caused, shall be repaired and repainted. Sufficient area of wall shall be repainted to avoid a patchy appearance.

END OF PART