GENERAL

1. ALL STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH DRAWINGS OF OTHER TRADES WHICH FORM PART OF THE CONTRACT. ALL DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR DECISION BEFORE PROCEEDING WITH THE WORK.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE. ALL LEVELS ARE EXPRESSED IN METRES.
3. ALL DIMENSIONS RELEVANT TO SETTING OUT SHALL BE VERIFIED BY THE CONTRACTOR BEFORE CONSTRUCTION AND FABRICATION IS COMMENCED. THE STRUCTURAL DRAWINGS SHALL NOT BE SCALED.
4. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DIMENSIONS OF ALL SLEEVES, PIPES DUCTS OPENINGS AND EMBEDDED OR ATTACHED ITEMS, SHOWN ON THE CIVIL, ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS.
5. ALL WORKMANSHIP AND MATERIALS SHALL CONFORM TO SPECIFICATIONS.
6. ALL THE STRUCTURES SHALL BE DESIGNED IN ACCORDANCE WITH THE FOLLOWING STANDARDS:
   a. ASHGHAL DESIGN CRITERIA FOR DRAINAGE STRUCTURES: PWA IAN 048.
   b. EURO CODES: BS EN 1990, 1991, 1992, 1993, 1994, 1997 & 1998 AND UK NATIONAL ANNEXES.
   c. QCS 2014 AND QATAR SEWERAGE AND DRAINAGE DESIGN MANUAL.
7. DESIGN REQUIREMENTS OF CIRCULAR MANHOLES:
   a. FOR MANHOLES OF UNIFORM DIAMETER ONLY, UP TO 6 M DEPTH AND NOT SUBJECT TO THRUST FORCE, WALLS AND BASE SLABS SHALL BE DESIGNED AS PLAIN CONCRETE MEMBERS (UNREINFORCED). DESIGN SHALL BE CARRIED OUT FOLLOWING SECTION 12 OF BS EN 1992-1-1:2004+A1:2014.TOP SLABS SHALL BE DESIGNED AS REINFORCED CONCRETE MEMBERS.
   b. FOR ALL OTHER CASES, MANHOLES SHALL BE DESIGNED AS REINFORCED CONCRETE MEMBERS.
8. ALL JOINTS IN WATER RETAINING/EXCLUDING STRUCTURES SHALL INCLUDE A WATERBAR, WHETHER INDICATED ON THE DRAWINGS OR NOT, IN ACCORDANCE WITH QCS 2014.
9. ALL EXPOSED CONCRETE EDGES SHALL HAVE A 25mm CHAMFER.
10. THE USE OF CONSTRUCTION JOINTS NOT SHOWN ON THE DRAWINGS SHALL BE APPROVED BY THE ENGINEER.

CONCRETE AND REINFORCEMENT

1. REINFORCEMENT SHALL BE TYPE 2 DEFORMED WITH A MINIMUM YIELD STRENGTH OF 500 N/mm², CONFORMING TO BS4449 AND BS8666.
2. ALL REINFORCEMENT SHALL BE UNCOATED AND SHALL BE STORED AT SITE UNDERCOVER, AND BE FREE OF RUST, GREASE AND LOOSE MILL SCALE BEFORE CONCRETING.
3. SITE WELDING OF REINFORCEMENT WILL NOT BE PERMITTED.

COVER TO REINFORCEMENT

CLEAR CONCRETE COVER TO REINFORCEMENT IN ALL FACES SHALL BE IN ACCORDANCE WITH QCS 2014 AS FOLLOWS:-

FOUNDATIONS SIDES AND TOP = 75 mm BOTTOM = 75 mm

BURIED STRUCTURES SOIL FACE = 75 mm

BURIED STRUCTURES LIQUID RETAINING FACE = 75 mm

BURIED STRUCTURES NON SOIL/LIQUID RETAINING FACE = 50 mm

UNDERSIDE ROOF SLAB TO LIQUID RETAINING STRUCTURES = 75 mm

ABOVE GROUND STRUCTURES = 50 mm

REINFORCEMENT LAP LENGTHS

ANCHORAGE AND LAP LENGTHS SHALL BE CALCULATED IN ACCORDANCE WITH SECTION 8 OF BS EN 1992-1-1:2004+A1:2014.

CONCRETE GRADES (MIN. CYLINDER/CUBE COMPRESSIVE STRENGTH)

LIQUID RETAINING, BURIED STRUCTURES AND BASE SLABS:

REINFORCED CONCRETE - IN-SITU	C32/40
REINFORCED CONCRETE - PRECAST	C40/50

OTHER STRUCTURES:

UNREINFORCED STRUCTURAL	C32/40
UNREINFORCED MASS (BENCHING)	C32/40
BLINDING FOR MANHOLES	C20/25
MEMBRANE PROTECTION	C20/25
GENERAL FILL BELOW STRUCTURES	C16/20
PROTECTION TO PIPELINES	C16/20

CONCRETE GRADE SHALL SATISFY THE DURABILITY REQUIREMENTS AS SPECIFIED IN GEOTECHNICAL INTERPRETATIVE REPORT.

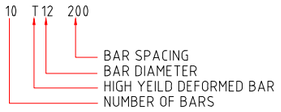
REINFORCEMENT LEGEND

REINFORCEMENT IS REPRESENTED BY THE FOLLOWING SYMBOLS:

T DEFORMED HIGH YEILD BARS - GRADE 500

THE NUMBER FOLLOWING THE BAR SYMBOLS IS THE NOMNAL BAR DIAMETER IN MILLIMETERS.

eg.



× BAR LOCATIONS

T	TOP	FF	FAR FACE
B	BOTTOM	EF	EACH FACE
NF	NEAR FACE	EW	EACH WAY

ABR ALTERNATIVE BARS REVERSED (ONLY SHOW WHERE REQUIRED)

STRUCTURAL DESIGN CRITERIA

1. LOADS (ACTIONS) AND COMBINATION OF ACTIONS SHALL BE IN ACCORDANCE WITH ASHGHAL DESIGN CRITERIA FOR DRAINAGE STRUCTURES: PWA IAN 048.
2. PROVISION FOR THRUST RESTRAINT TO BE PROVIDED FOR STABILITY AND IN STRUCTURAL DESIGN TO ACCOMMODATE MAXIMUM DESIGN PRESSURE (MDP) AND SYSTEM TEST PRESSURE (STP) AS DEFINED IN QATAR SEWERAGE AND DRAINAGE DESIGN MANUAL, VOLUME 4: TSE SYSTEM DESIGN (JUNE 2005), CLAUSE 2.7.3. APPROVAL FOR THE PRESSURE VALUES FROM PWA-DD DRAINAGE TEAM SHALL BE OBTAINED PRIOR TO THE INITIATION OF THE STRUCTURAL DESIGN. FOR FURTHER REQUIREMENTS ON STRUCTURAL DESIGN AND STABILITY, REFER TO ASHGHAL DESIGN CRITERIA FOR DRAINAGE STRUCTURES: PWA IAN 048.

GEOTECHNICAL DATA

1. STRUCTURAL DESIGN OF MANHOLES AND CHAMBER TO BE CARRIED OUT BASED ON LEVEL AND GROUND CONDITION SPECIFIC TO EACH LOCATION, WITH GROUNDWATER ASSUMED TO BE AT FGL, UNLESS MAXIMUM GROUNDWATER LEVEL HAS BEEN RELIABLY ESTABLISHED BY SITE INVESTIGATION.
2. STABILITY AGAINST FLOTATION TO BE PROVIDED ASSUMING GROUNDWATER AT FGL. FOR LAGOONS AND LARGE TANKS, THE DESIGN GROUNDWATER MAYBE ASSUMED AT A LEVEL RELIABLY ESTABLISHED AND SUPPORTED BY AN APPROVED GEOTECHNICAL INTERPRETATIVE REPORT.
3. PASSIVE RESTRAINT AGAINST SLIDING TO BE PROVIDED BY DIRECT CONTACT OF THE STRUCTURE WITH UNDISTURBED NATURAL GROUND ONLY, IN ACCORDANCE WITH THE QCS (THRUST BLOCKS).
4. DESIGN FOR LATERAL EARTH PRESSURE TO INCLUDE A LIVE LOAD SURCHARGE OF 20 kN/m² FOR STRUCTURES SUBJECT TO HIGHWAY LOADING AND 10 kN/m² OTHERWISE.
5. DESIGN OF GEOCELLULAR TANK SHALL BE IN ACCORDANCE WITH CIRIA C737 (STRUCTURAL AND GEOTECHNICAL DESIGN OF MODULAR GEOCELLULAR DRAINAGE SYSTEMS) AND PROJECT PARTICULAR SPECIFICATION.
6. DESIGN OF VERTICAL EMBEDDED RETAINING WALLS (EX. PILE-WALL AND DIAPHRAGM WALL) SHALL BE IN ACCORDANCE WITH CIRIA C760 (GUIDANCE ON EMBEDDED RETAINING WALL DESIGN), EUROCODES AND PROJECT SPECIFICATION.
7. DESIGN OF MICROTUNNELING SHALL FOLLOW THE REQUIREMENTS OF QCS 2014, SECTION 08, PART 09.

BLINDING CONCRETE

1. A LAYER OF BLINDING CONCRETE, 75mm THICK MINIMUM OR AS SHOWN ON DRAWINGS, SHALL BE PLACED ON THE UNDERSIDE OF ALL STRUCTURES AND GROUND SLABS.
2. BLINDING SHALL BE PREPARED TO A U2 FINISH AND COVERED WITH AN IMPERVIOUS MEMBRANE THAT WILL LAP EFFECTIVELY WITH THE TANKING ON THE SUPPORTED STRUCTURE.
3. A 50mm THICK SAND/CEMENT PROTECTIVE SCREED SHALL BE PLACED OVER WATERPROOFING MEMBRANE.

FOUNDATION CONSTRUCTION

1. FOUNDATION DESIGNS ARE BASED ON AN ALLOWABLE NET SOIL BEARING PRESSURE OF 150kN/m² (UNLESS NOTED OTHERWISE) AT MINIMUM DEPTH OF 1.5m BELOW NATURAL SURFACE LEVEL. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ASCERTAIN THAT THE FOUNDATION LAYER HAS A BEARING CAPACITY AT LEAST EQUAL TO THE ABOVE AND TO CONSULT WITH THE ENGINEER IF OTHERWISE.
2. PERCENT COMPACTION SHALL BE DEFINED AS THE RATIO OF THE FIELD DRY DENSITY AS DETERMINED BY "ASTM" TO THE MAXIMUM DRY DENSITY DETERMINED BY ASTM.
3. ALL BACKFILL SHALL BE COMPACTED TO 95% PROCTOR DENSITY UNLESS OTHERWISE STATED ON THE DRAWINGS.
4. THE CONTRACTOR SHALL NOT BACKFILL AGAINST WALL TO BE LATERALLY SUPPORTED BY A FLOOR SLAB UNLESS SUPPORT IS PROVIDED OR SLABS HAVE BEEN PLACED. BACKFILL AGAINST CANTILEVER WALLS SHALL NOT BE PLACED UNTIL THE CONCRETE HAS GAINED ITS 28 DAYS STRENGTH.
5. IF THE SOIL AT THE BOTTOM OF EXCAVATIONS ARE UNSUITABLE TO SUPPORT THE STRUCTURE, IT SHALL BE REMOVED TO AN ADEQUATE STRATUM AS DIRECTED BY THE ENGINEER AND REPLACED WITH MATERIAL IN ACCORDANCE WITH QCS.

PROTECTIVE COATINGS AND LINERS

1. ALL CONCRETE SURFACES SHALL RECEIVE A PROTECTIVE TANKING/COATING SYSTEM IN ACCORDANCE WITH THE QCS.
2. ALL EXTERNAL CONCRETE SURFACES IN CONTACT WITH THE GROUND WILL BE COVERED WITH AN IMPERVIOUS TANKING MEMBRANE SYSTEM.
3. ALL CONCRETE STRUCTURES FOR SEWAGE APPLICATIONS WILL BE FULLY PROTECTED INTERNALLY WITH A GRP LINER.
4. ALL CONCRETE STRUCTURES FOR SURFACE WATER APPLICATIONS SHALL BE COATED INTERNALLY WITH A SOLVENT FREE EPOXY SYSTEM AND GRP LINER TO 300 ABOVE THE CROWN OF THE OUTLET PIPE.
5. ALL CONCRETE STRUCTURES FOR IRRIGATION APPLICATION SHALL BE COATED INTERNALLY WITH A SOLVENT FREE EPOXY SYSTEM.
6. ALL OTHER EXPOSED CONCRETE WILL BE COATED WITH TWO COATS OF SOLVENT FREE EPOXY PAINT AND UV RESISTANT TOP COAT UNLESS STATED OTHERWISE ON THE DRAWINGS.

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ASHGHAL DESIGN CRITERIA FOR DRAINAGE STRUCTURES: PWA IAN 048.

Rev.	Date	Revision Details	Appd.
4	AUG 23	ISSUED FOR USE	
3	APR 19	ISSUED FOR USE	
2	01 MAR 19	UPDATED ISSUE	
1	23 NOV 15	ISSUED FOR USE	
0	15 SEP 13	ISSUED FOR USE	

هيئة الأشغال العامة
Public Works Authority
P.O.Box: 22188
Tel.: 00974 44950000
Fax: 00974 44950999
PA
PROJECTS AFFAIRS
قطر تستحق الأفضل
Qatar Deserves The Best
www.ashghal.gov.qa

QCS Section:
Section 8 - Drainage Works
Part 4 - Pipeline Installation

Drawing Title:

STRUCTURAL NOTES

Approved:	Sheet No: 1 OF 1
Date: AUGUST 2023	Scale: NTS
Drawing Number: SD 8-4-106	Revision: 4