

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

PROJECT No

CONTRACT No

**CONSTRUCTION OF WATER WORKS IN OUADI ED
DELEM – QABB ELIAS AND MRAIJAT**

VOLUME 6

DRAWINGS

**DECEMBER
2023**

**BUREAU TECHNIQUE POUR
LE DEVELOPPEMENT
(B.T.D.) P.O.Box : 70-492
Antélias
Tel : 04/712157-712158
Fax: 04/712159
Email: btd@btd-lb.com**

**MINISTRY OF ENERGY
AND WATER**

**COUNCIL FOR
DEVELOPMENT AND
RECONSTRUCTION**

TITLE 1	TITLE 2	FILE	DRAWING Nb.	SHEET Nb.
MREIJAT BOREHOLE AND PUMPING STATION	TOPOGRAPHICAL SURVEY SITE LAYOUT	509W-PS01-C01-05	509W-PS01-C01	1/5
MREIJAT BOREHOLE AND PUMPING STATION	SITE PLAN-SECTION AA RETAINNING WALL SECTION	509W-PS01-C01-05	509W-PS01-C02	2/5
MREIJAT BOREHOLE AND PUMPING STATION	PLANS-SECTIONS-ELEVATIONS-REINFORCEMENT	509W-PS01-C01-05	509W-PS01-C03	3/5
MREIJAT BOREHOLE AND PUMPING STATION	PLANS-SECTIONS	509W-PS01-C01-05	509W-PS01-C04	4/5
MREIJAT BOREHOLE AND PUMPING STATION	HEAD WORK STRUCTURAL DETAILS	509W-PS01-C01-05	509W-PS01-C05	5/5
FENCE AND TYPICAL GATE 4M AND 1.2M	ELEVATIONS SECTIONS AND DETAILS	509W-PS01-SF01-02	509W-PS01-SF01	1/2
FENCE AND TYPICAL GATE 4M AND 1.2M	ELEVATIONS SECTIONS AND DETAILS	509W-PS01-SF01-02	509W-PS01-SF02	2/2
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	TOPOGRAPHICAL SURVEY SITE LAYOUT	509W-RS02-C01-07	509W-RS02-C01	1/7
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	SITE PLAN SECTION A-A	509W-RS02-C01-07	509W-RS02-C02	2/7
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	ELEVATIONS AND SECTIONS FORMWORK	509W-RS02-C01-07	509W-RS02-C03	3/7
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	DETAILS FORMWORK	509W-RS02-C01-07	509W-RS02-C04	4/7
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	DETAILS FORMWORK	509W-RS02-C01-07	509W-RS02-C05	5/7
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	VERTICAL HALF-SECTION AND PLANS REINFORCEMENT	509W-RS02-C01-07	509W-RS02-C06	6/7
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	SECTIONS AND DETAILS REINFORCEMENT	509W-RS02-C01-07	509W-RS02-C07	7/7
QABB ELIAS VALVE CHAMBER INSIDE DIAMETER 300 CM INSIDE HEIGHT VARIABLE BETWEEN 300 & 600 CM DEPENDING ON THE GROUND LEVEL	FORMWORK REINFORCEMENT	509W-RS02-C08-09	509W-RS02-C08	1/2
QABB ELIAS VALVE CHAMBER INSIDE DIAMETER 300 CM INSIDE HEIGHT VARIABLE BETWEEN 300 & 600 CM DEPENDING ON THE GROUND LEVEL	FORMWORK REINFORCEMENT	509W-RS02-C08-09	509W-RS02-C09	2/2
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	FENCE ELEVATIONS-SECTIONS AND DETAILS RETAINING WALL DETAILS	509W-RS02-SF01-02	509W-RS02-SF01	1/2
QABB ELIAS RESERVOIRS (CAPACITY 2'400 M ³)	FENCE ELEVATIONS-SECTIONS AND DETAILS	509W-RS02-SF01-02	509W-RS02-SF02	2/2
QABB ELIAS RESERVOIRS VALVE CHAMBER	HYDRAULIC ACCESSORIES	509W-RS02-VC01	509W-RS02-VC01	1/1
MAKSE RESERVOIR (CAPACITY 500 M ³)	TOPOGRAPHICAL SURVEY SITE LAYOUT	509W-RS03-C01-09	509W-RS03-C01	1/9
MAKSE RESERVOIR (CAPACITY 500 M ³)	SITE PLAN SECTION A-A	509W-RS03-C01-09	509W-RS03-C02	2/9
MAKSE RESERVOIR (CAPACITY 500 M ³)	ELEVATION AND SECTIONS FORMWORK	509W-RS03-C01-09	509W-RS03-C03	3/9
MAKSE RESERVOIR (CAPACITY 500 M ³)	DETAILS FORMWORK	509W-RS03-C01-09	509W-RS03-C04	4/9
MAKSE RESERVOIR (CAPACITY 500 M ³)	DETAILS FORMWORK	509W-RS03-C01-09	509W-RS03-C05	5/9

TITLE 1	TITLE 2	FILE	DRAWING Nb.	SHEET Nb.
MAKSE RESERVOIR (CAPACITY 500 M ³)	VERTICAL HALF-SECTION AND PLANS REINFORCEMENT	509W-RS03-C01-09	509W-RS03-C06	6/9
MAKSE RESERVOIR (CAPACITY 500 M ³)	SECTIONS AND DETAILS REINFORCEMENT	509W-RS03-C01-09	509W-RS03-C07	7/9
VALVE CHAMBER INSIDE DIAMETER 400 CM INSIDE HEIGHT VARIABLE BETWEEN 300& 600 CM DEPENDING ON THE GROUND LEVEL	FORMWORK REINFORCEMENT	509W-RS03-C01-09	509W-RS03-C08	8/9
VALVE CHAMBER INSIDE DIAMETER 400 CM INSIDE HEIGHT VARIABLE BETWEEN 300& 600 CM DEPENDING ON THE GROUND LEVEL	FORMWORK REINFORCEMENT	509W-RS03-C01-09	509W-RS03-C09	9/9
FENCE AND TYPICAL GATE 4M AND 1.2M	ELEVATIONS SECTIONS AND DETAILS	509W-RS03-SF01-02	509W-RS03-SF01	1/2
FENCE AND TYPICAL GATE 4M AND 1.2M	ELEVATIONS SECTIONS AND DETAILS	509W-RS03-SF01-02	509W-RS03-SF02	2/2
MAKSE RESERVOIR VALVE CHAMBER	HYDRAULIC ACCESSORIES	509W-RS03-VC01	509W-RS03-VC01	1/1
REHABILITATION WORKS OF QABB ELIAS WATER TANK	GENERAL VIEW	509W-RS04	509W-RS04-P01	00
REHABILITATION WORKS OF QABB ELIAS WATER TANK	METALLIC FRAME AND FLOWMETER CHAMBER	509W-RS04	509W-RS04-P02	01
REHABILITATION WORKS OF QABB ELIAS WATER TANK	WATER TANK FORMWORK AND REINFORCEMENT	509W-RS04	509W-RS04-P03	03
REHABILITATION WORKS OF QABB ELIAS WATER TANK	BEAMS REINFORCEMENT	509W-RS04	509W-RS04-P04	04
EL MRAIJAT PUMPING STATION	WELL HEAD SCHEMATIC	509W-PS01-M01	509W-PS01-M01	1/7
EL MRAIJAT PUMPING STATION	CHLORINATION SCHEMATIC	509W-PS01-M02	509W-PS01-M02	2/7
EL MRAIJAT PUMPING STATION	MECHANIC DRAWING FOR WELL HEAD	509W-PS01-M03	509W-PS01-M03	3/7
EL MRAIJAT PUMPING STATION	ELECTRICAL SCHEMATIC	509W-PS01-E01	509W-PS01-E01	4/7
EL MRAIJAT PUMPING STATION	DOMESTIC ELECTRICAL INSTALLATION SCHEMATIC	509W-PS01-E02	509W-PS01-E02	5/7
EL MRAIJAT PUMPING STATION	ELECTRICAL SCHEMATIC	509W-PS01-E03	509W-PS01-E03	6/7
EL MRAIJAT PUMPING STATION	CONTROL SCHEMATIC	509W-PS01-I01	509W-PS01-I01	7/7
QABB ELIAS PUMPING STATION	HYDRAULIC SCHEMATICS	509W-PS02-M01	509W-PS02-M01	1/4
QABB ELIAS PUMPING STATION	CHLORINATION SCHEMATIC	509W-PS02-M02	509W-PS02-M02	2/4
QABB ELIAS PUMPING STATION	ELECTRICAL SCHEMATIC	509W-PS02-E01	509W-PS02-E01	3/4
QABB ELIAS PUMPING STATION	CONTROL SCHEMATIC	509W-PS02-E02	509W-PS02-E02	4/4
GRAVITY LINE FROM OUADI EL DELEM SPRING TO QABB ELIAS EXISTING RESERVOIRS	PLAN+PROFILES	509W-TR-01P01-03	509W-TR-01P01	1/3

TITLE 1	TITLE 2	FILE	DRAWING Nb.	SHEET Nb.
GRAVITY LINE FROM OUADI EL DELEM SPRING TO QABB ELIAS EXISTING RESERVOIRS	PLAN+PROFILES	509W-TR-01P01-03	509W-TR-01P02	2/3
GRAVITY LINE FROM OUADI EL DELEM SPRING TO QABB ELIAS EXISTING RESERVOIRS	PLAN+PROFILES	509W-TR-01P01-03	509W-TR-01P03	3/3
GRAVITY LINE FROM OUADI EL DELEM SPRING TO MRAIJAT MIDDLE RESERVOIR PART 1	PLAN+PROFILES	509W-TR-02P01-02	509W-TR-02P01	1/2
GRAVITY LINE FROM OUADI EL DELEM SPRING TO MRAIJAT MIDDLE RESERVOIR PART 1	PLAN+PROFILES	509W-TR-02P01-02	509W-TR-02P02	2/2
GRAVITY LINE FROM OUADI EL DELEM SPRING TO MRAIJAT MIDDLE RESERVOIR PART 2	PLAN+PROFILES	509W-TR-02P03-03	509W-TR-02P03	3/3
RAS EL AIN GRAVITY LINE	PLAN+PROFILES	509W-TR-03P	509W-TR-03P01	1/1
LIFT LINE FROM QABB ELIAS FRENCH RESERVOIR TO PROPOSED QABB ELIAS RESERVOIRS	PLAN+PROFILES	509W-TR-04P	509W-TR-04P01	1/1
LIFT LINE FROM PROPOSED MRAIJAT WELL TO EXISTING DOUMANI RESERVOIR	PLAN+PROFILES	509W-TR-05P	509W-TR-05P01	1/1
TRANSMISSION AND DISTRIBUTION SYSTEMS	WASHOUT AND AIR VALVE CHAMBER DETAILS	509W-STD001-16	509W-STD001	1/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	WASHOUT AND AIR VALVE CHAMBER DETAILS	509W-STD001-16	509W-STD002	2/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL TRENCH DETAILS AND TELEMETRY CABLE DRAW PIT	509W-STD001-16	509W-STD003	3/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL TRENCH DETAILS AND TELEMETRY CABLE DRAW PIT	509W-STD001-16	509W-STD004	4/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL CONNECTIONS OF NEW PIPES TO EXISTING PIPES	509W-STD001-16	509W-STD005	5/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL CONNECTIONS OF NEW PIPES TO EXISTING PIPES	509W-STD001-16	509W-STD006	6/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	PIPELINE THRUST BLOCKS	509W-STD001-16	509W-STD007	7/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	PIPELINE THRUST BLOCKS	509W-STD001-16	509W-STD008	8/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	PIPELINE THRUST BLOCKS	509W-STD001-16	509W-STD009	9/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	PIPELINE ANCHOR BLOCKS	509W-STD001-16	509W-STD010	10/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL VALVE CHAMBER DETAILS	509W-STD001-16	509W-STD011	11/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL VALVE CHAMBER DETAILS	509W-STD001-16	509W-STD012	12/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	PRESSURE REGULATING AND PRESSURE SUSTAINING VALVE DETAILS OF INSTALLATION AND PROTECTION CHAMBER	509W-STD001-16	509W-STD013	13/16

TITLE 1	TITLE 2	FILE	DRAWING Nb.	SHEET Nb.
TRANSMISSION AND DISTRIBUTION SYSTEMS	PRESSURE SUSTAINING AND PRESSURE REGULATING VALVES DETAILS OF INSTALLATION AND PROTECTION CHAMBER	509W-STD001-16	509W-STD014	14/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	PRESSURE REGULATING VALVES,PRESSURE SUSTAINING VALVES AND WATERMETERS DETAILS OF INSTALLATION AND PROTECTION CHAMBER	509W-STD001-16	509W-STD015	15/16
TRANSMISSION AND DISTRIBUTION SYSTEMS	WATERMETERS DETAILS OF INSTALLATION AND PROTECTION CHAMBER	509W-STD001-16	509W-STD016	16/16

	Date	Dsgn	Drwn	Chk'd	Appr'd

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BUREAU TECHNIQUE POUR LE DEVELOPEMENT

JALL ED DIB – HAJAL Bldg
P.O.BOX:70492 – ANTELIAS

TEL:(04) 712157 / 712158
FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

LIST OF DRAWINGS - 1 OF 1

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-01LS	J. ZALZAL	J. ZALZAL	Z.SABA

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	-	1/1	509W-01LS01

TOPOGRAPHICAL SURVEY
SITE LAYOUT
SCALE 1:200
MREIJAT CADASTRAL AREA



- NOTES:**
- GROUND LEVEL OF PUMPING STATION BUILDING = +1218.00M
 - DO NOT SCALE FROM THIS DRAWING
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 - ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND

	CULVERT/BRIDGE		RETAINING WALL
	SPRING		RAILWAY
	WELL		CHANNEL
	DECIDUOUS/PINE TREE		TERRACE
	ROCKS		FENCE
	BUSHES		STREAM/RIVER
	MANHOLE SEWER		PYLON
	MANHOLE WATER		ELECTRIC SUB STATION
	MANHOLE TELEPHONE		ELECTRIC POLE/TELEGRAPH POLE
	MANHOLE NOT IDENTIFIED		OVERGROUND WATER PIPE
	LIGHTING POLE		UNDERGROUND WATER PIPE
	BUILDING		SPOT HEIGHT
	FOUNDATION/BUILDING UNDER CONSTRUCTION		TRAVERSING STATION
	ROAD		TRIANGULATION POINT
	TRACK		BENCH MARK
	REFERENCE LINE		ML
	SLOPE		LOT No
			BOUNDARY
			CIRCUMSCRIPTION BOUNDARY
			PRIVATIZATION LIMIT

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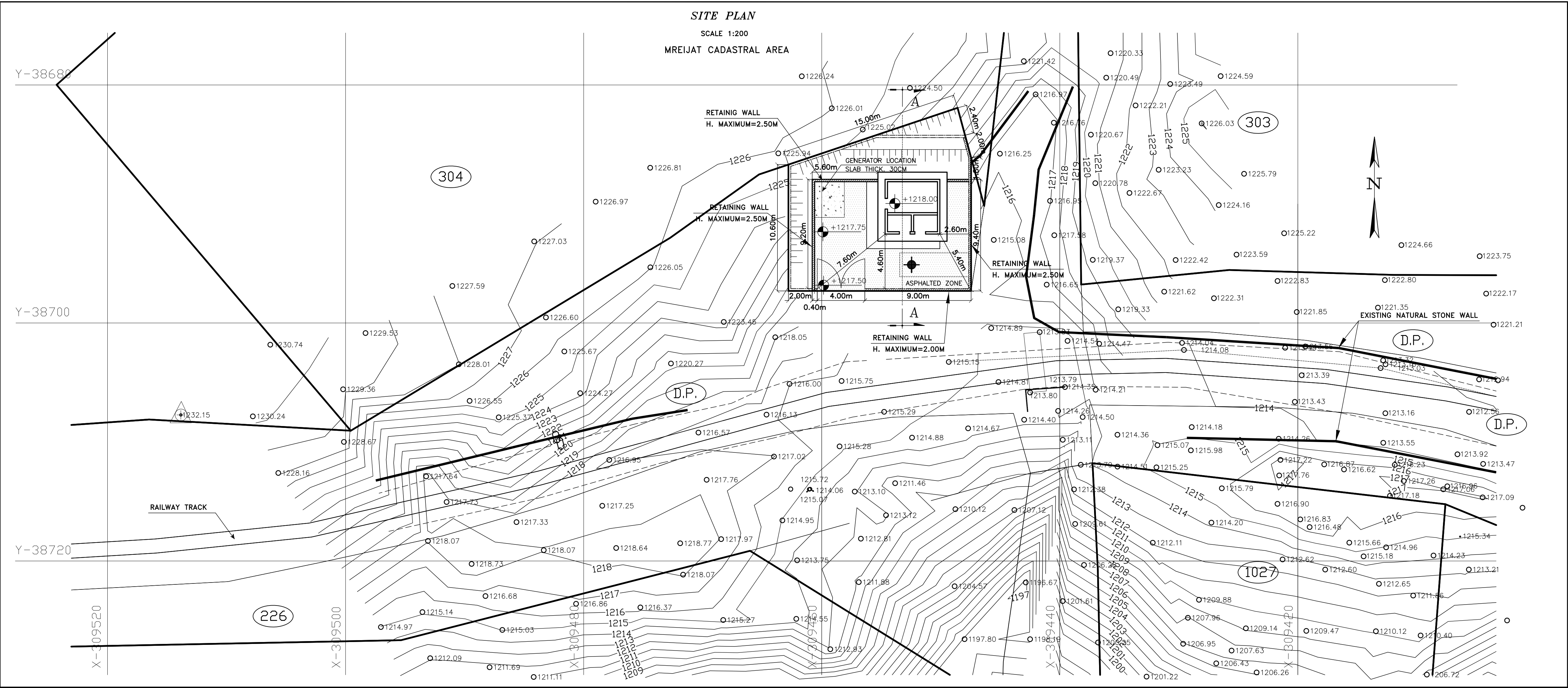
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MREIJAT BOREHOLE
AND PUMPING STATION

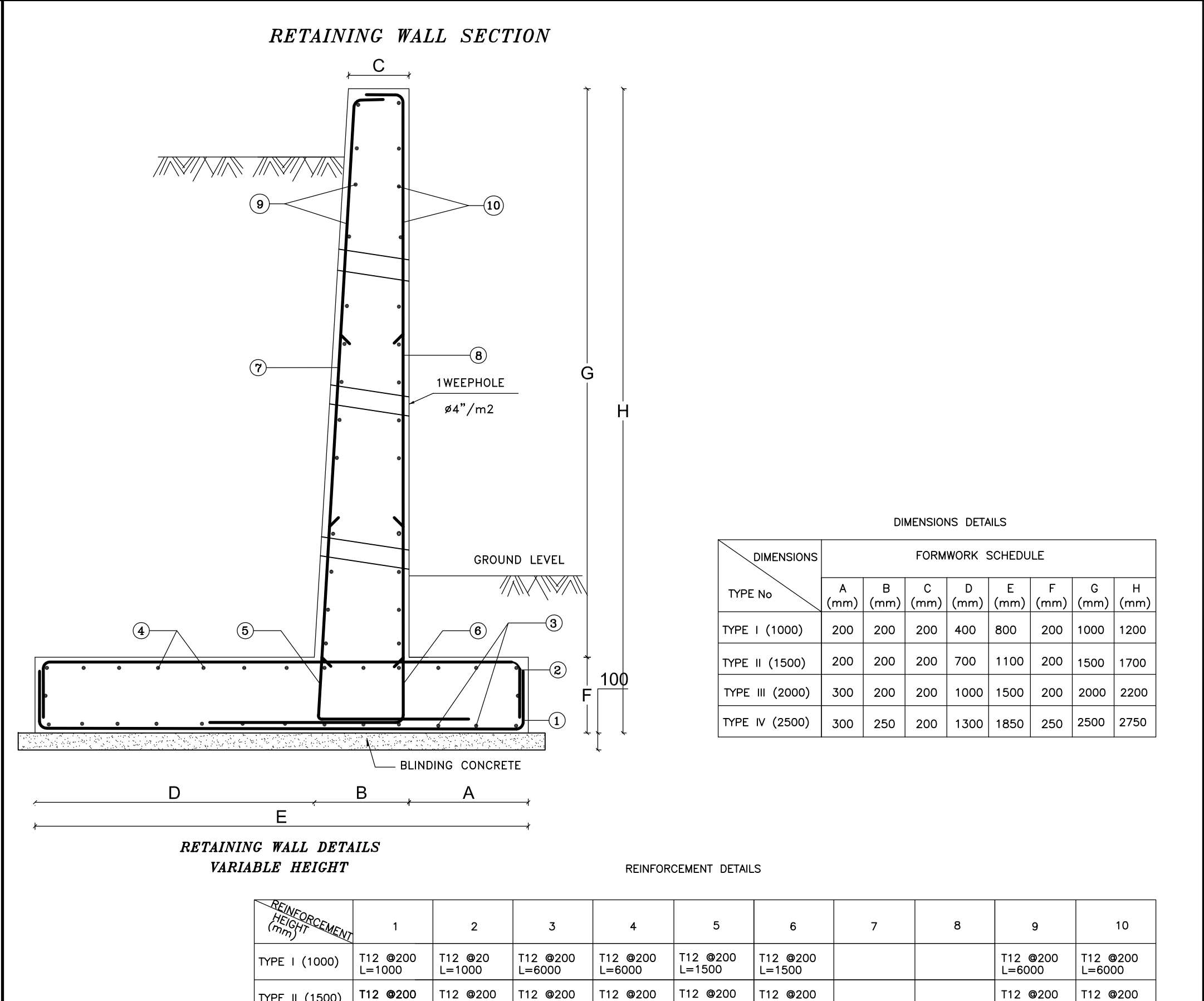
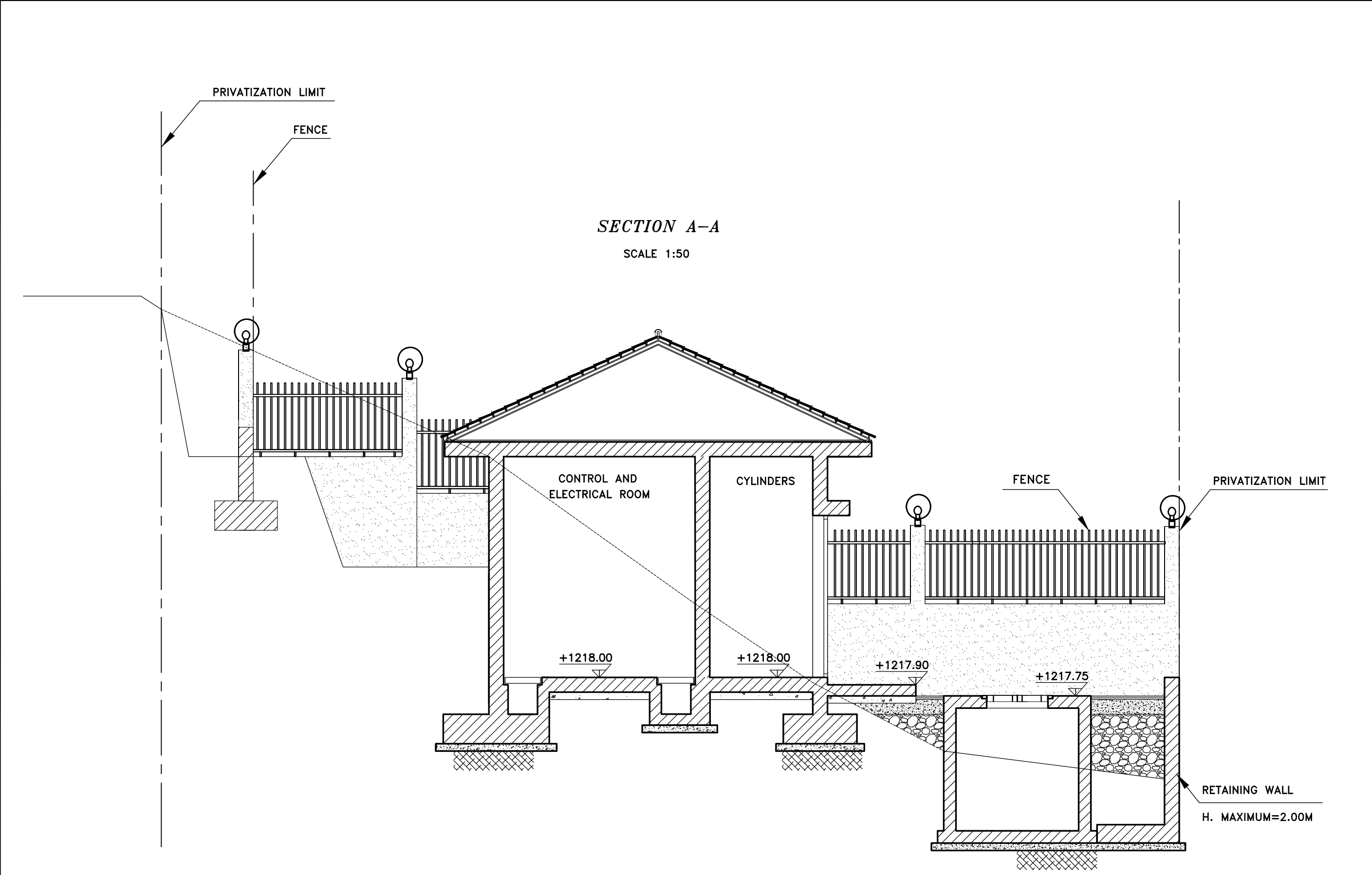
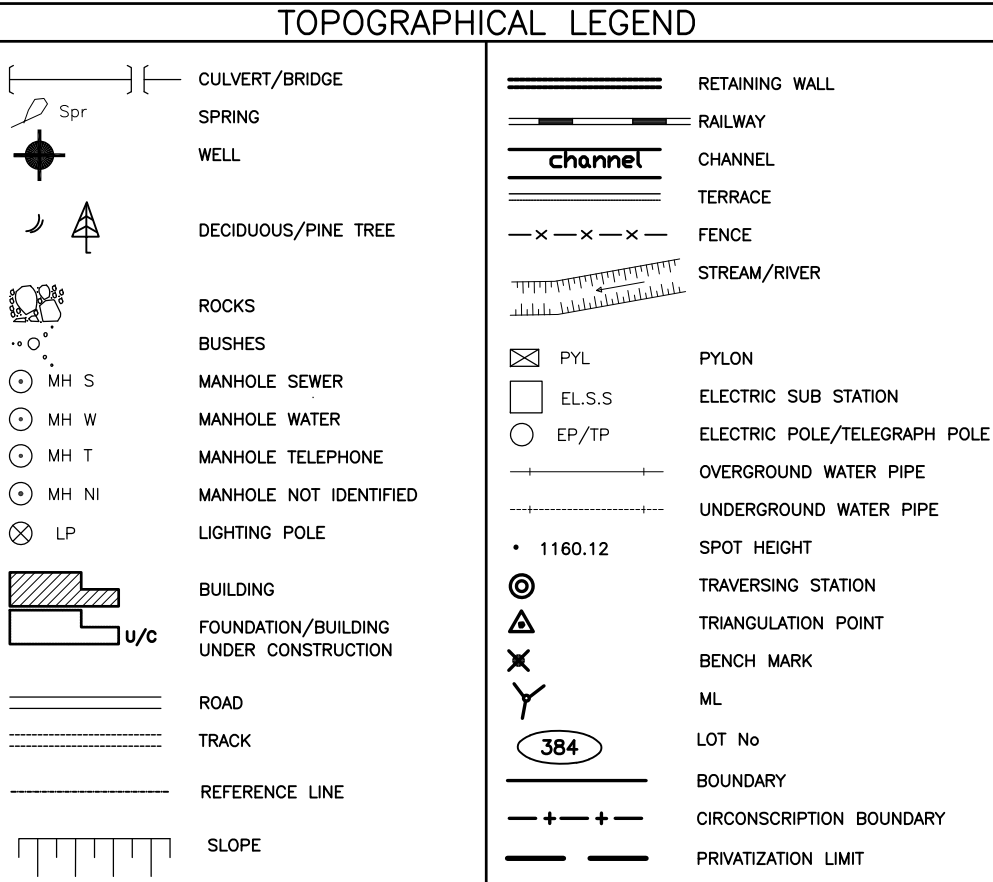
TOPOGRAPHICAL SURVEY
SITE LAYOUT

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-C01-05	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1/200	1/5	509W-PS01-C01



- NOTES:**
- GROUND LEVEL OF PUMPING STATION BUILDING = +1218.00M
 - DO NOT SCALE FROM THIS DRAWING
 - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED
 - ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED



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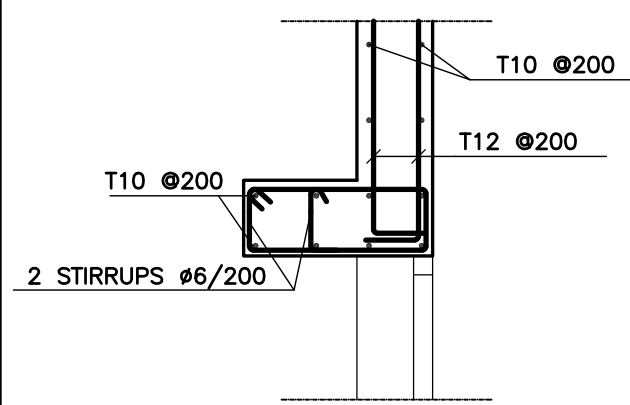
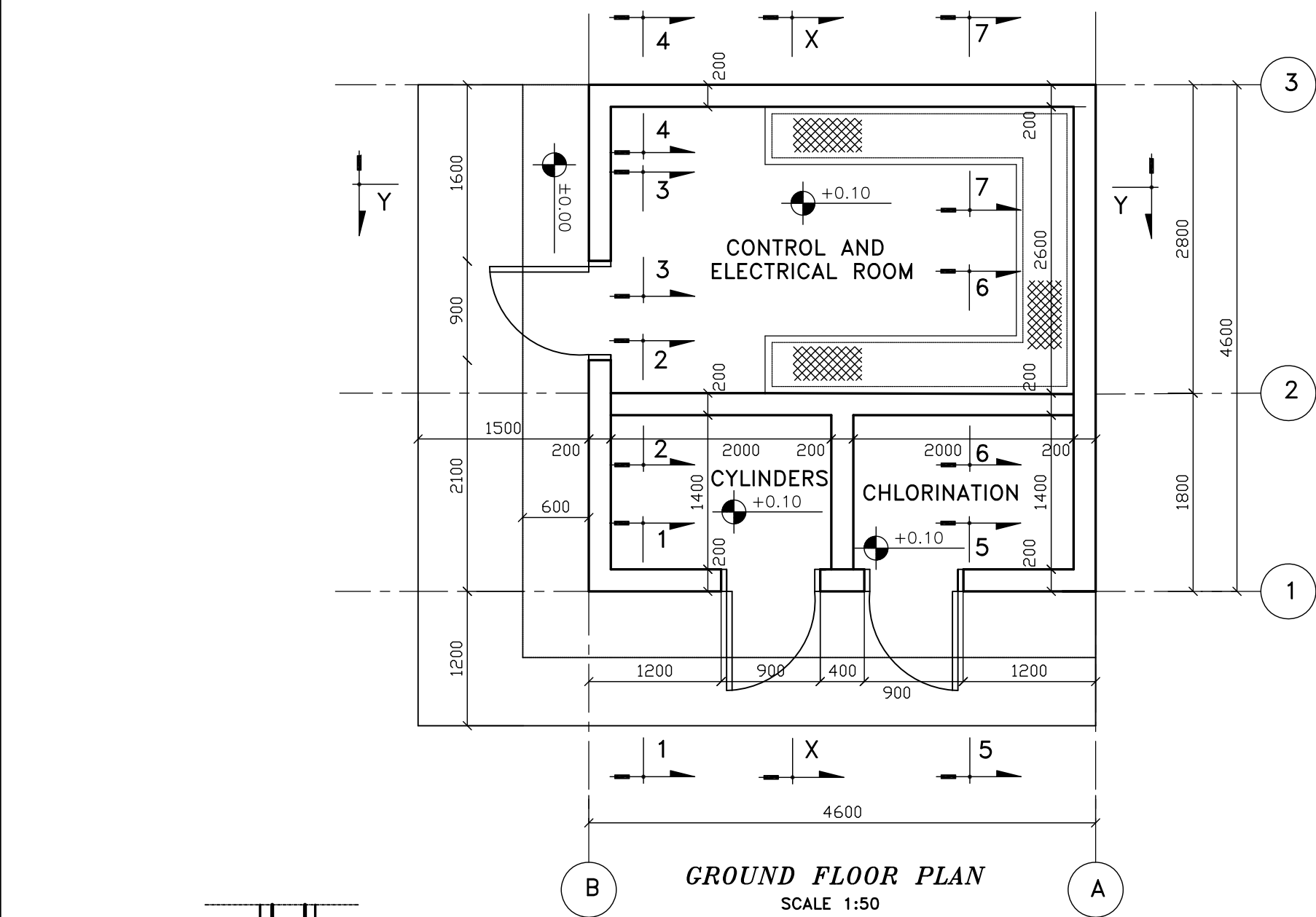
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MREIJAT BOREHOLE
AND PUMPING STATION

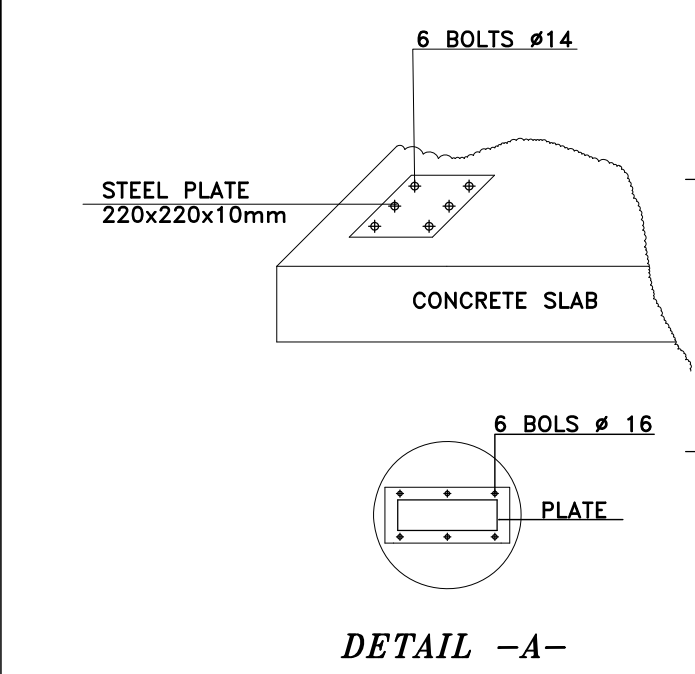
SITE PLAN
SECTION A-A
RETAINING WALL SECTION

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-C01-05	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

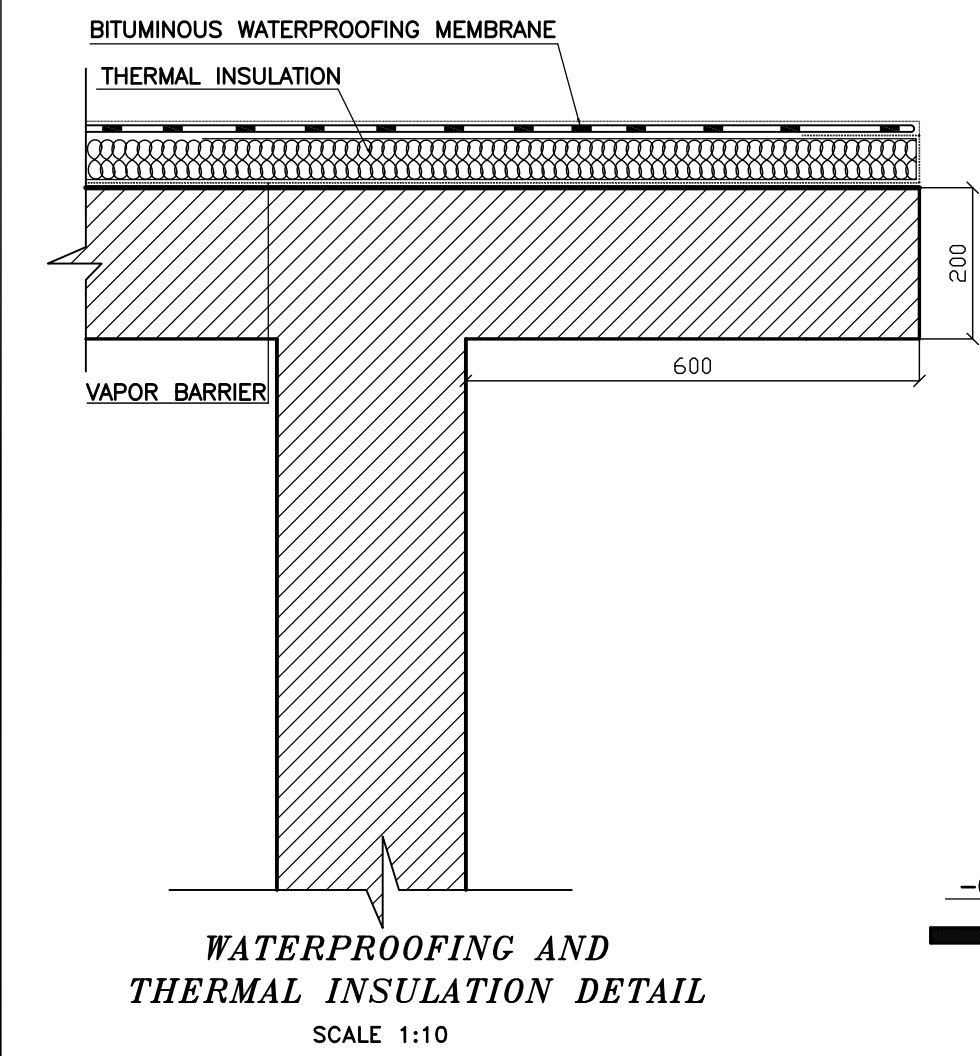
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JULY 2019	1/200-1/50	2/5	509W-PS01-C02



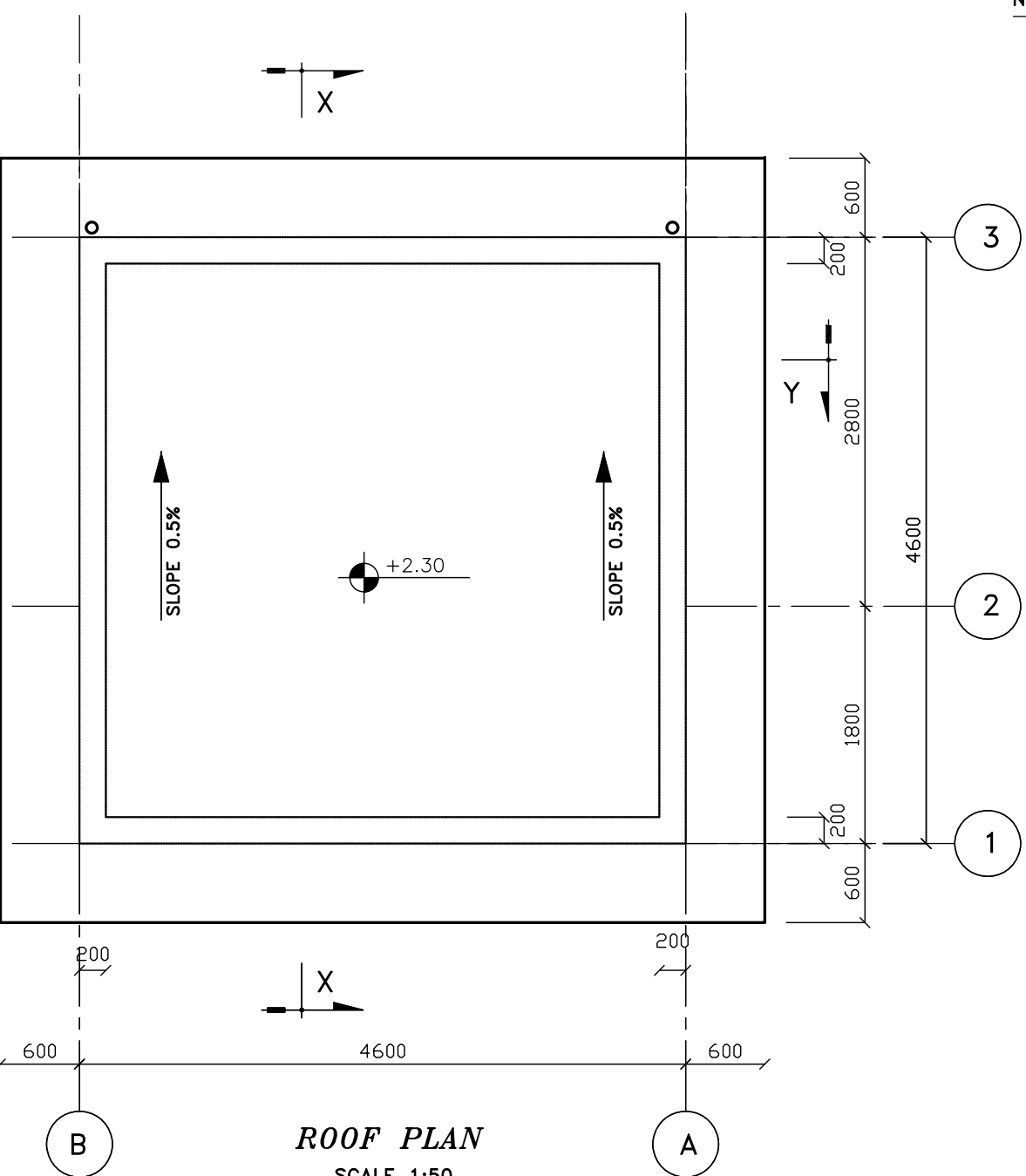
LINTEL DETAILS
SCALE 1:20



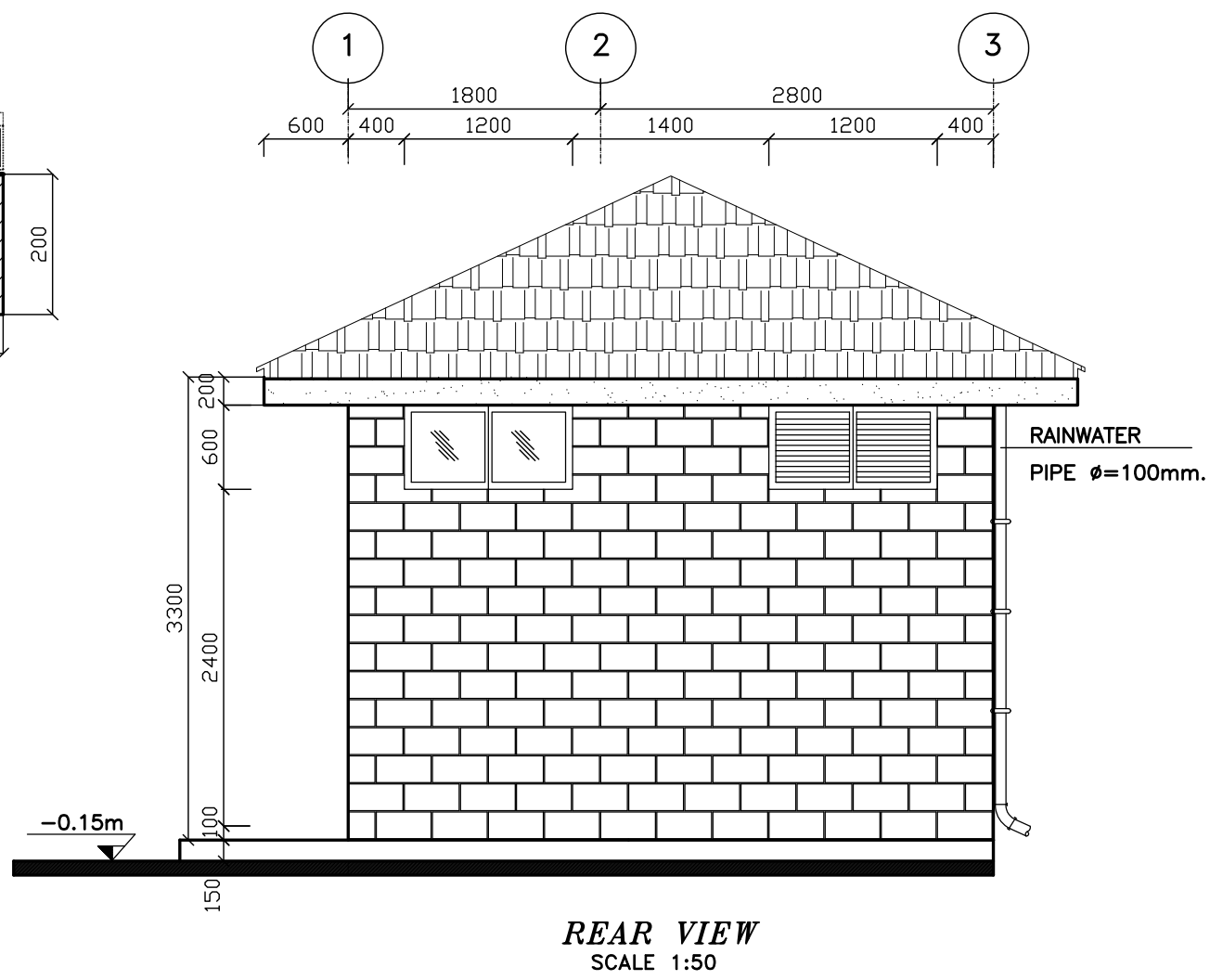
DETAIL -A-



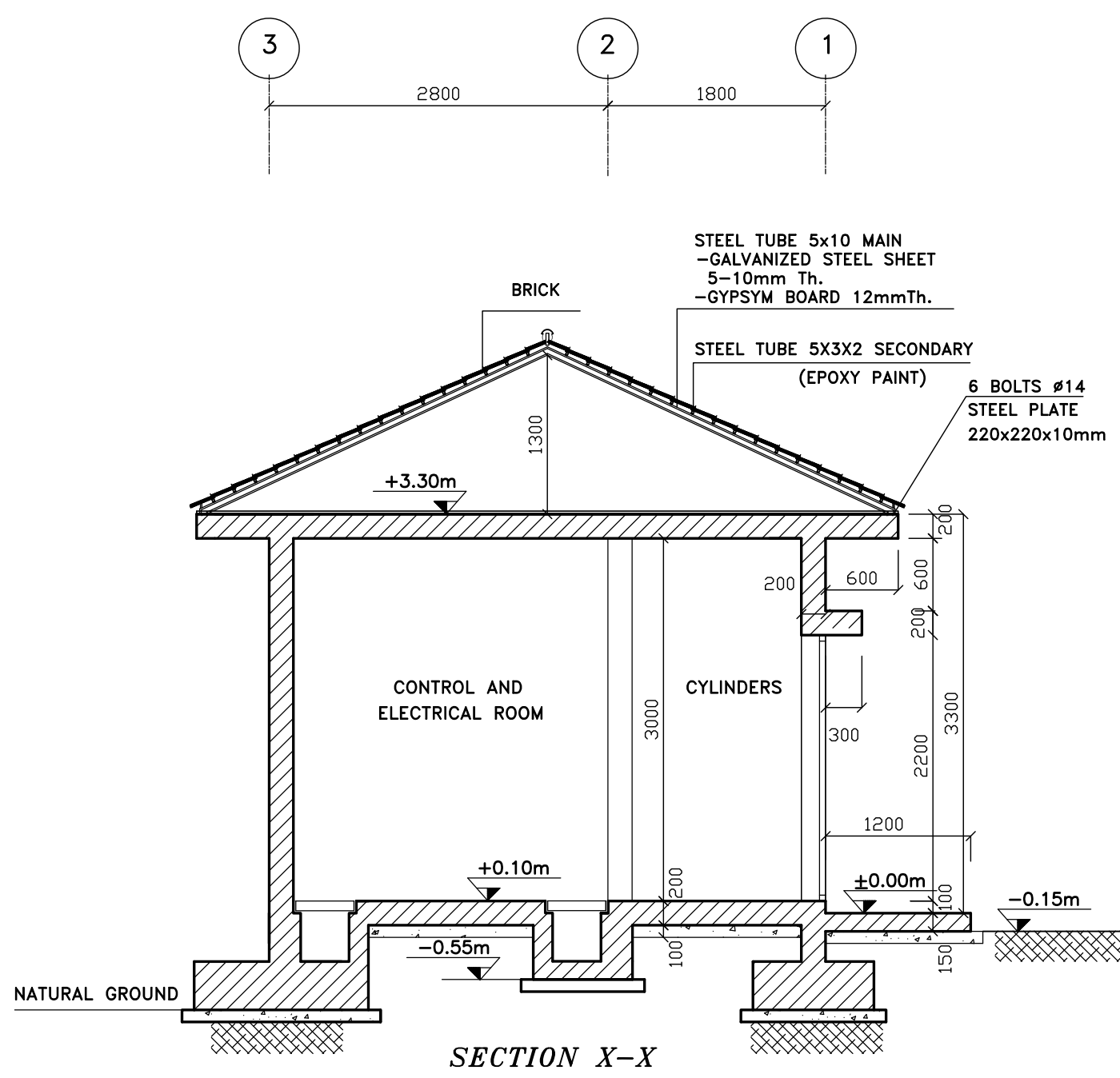
WATERPROOFING AND
THERMAL INSULATION DETAIL
SCALE 1:10



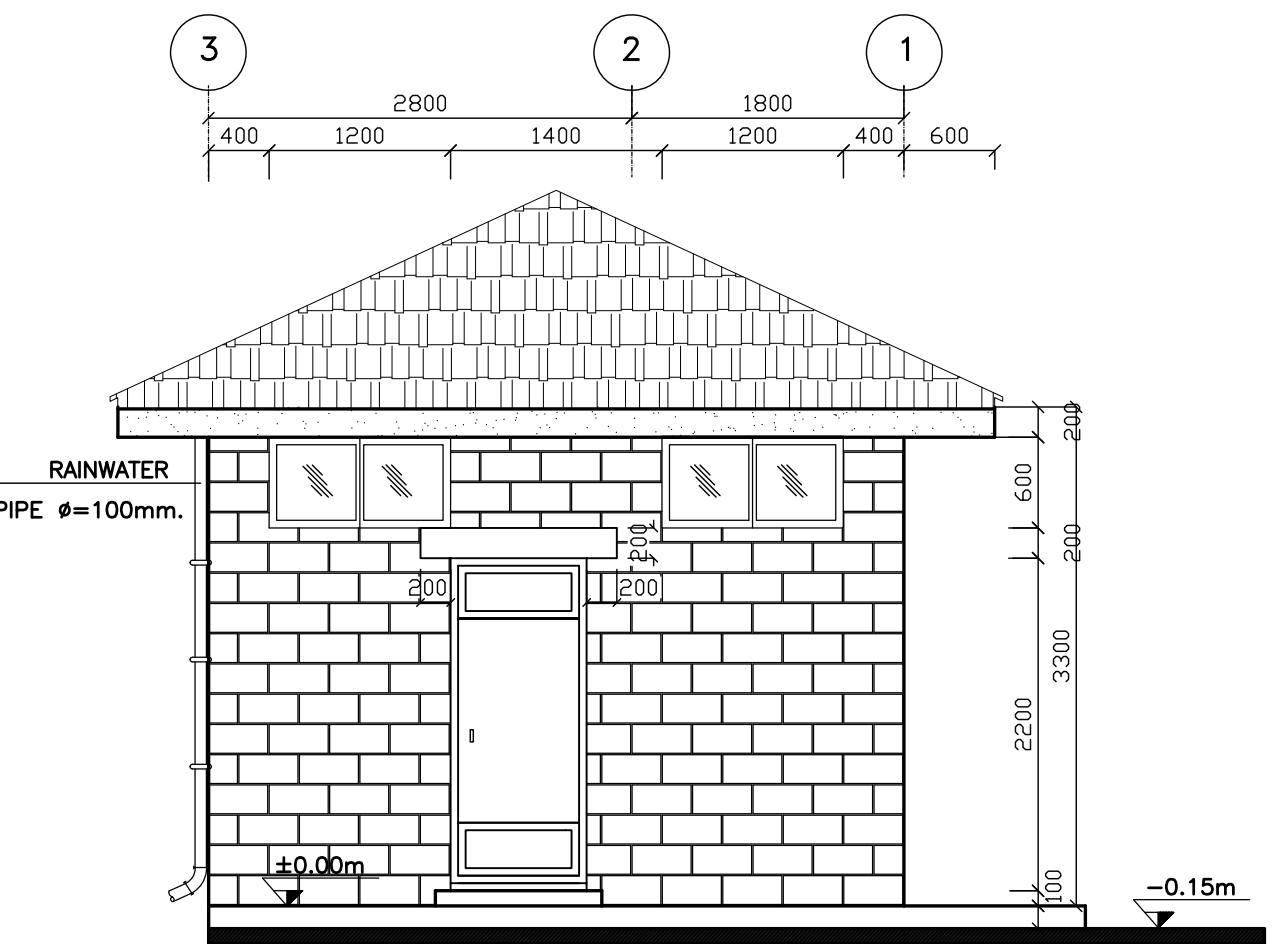
ROOF PLAN
SCALE 1:50



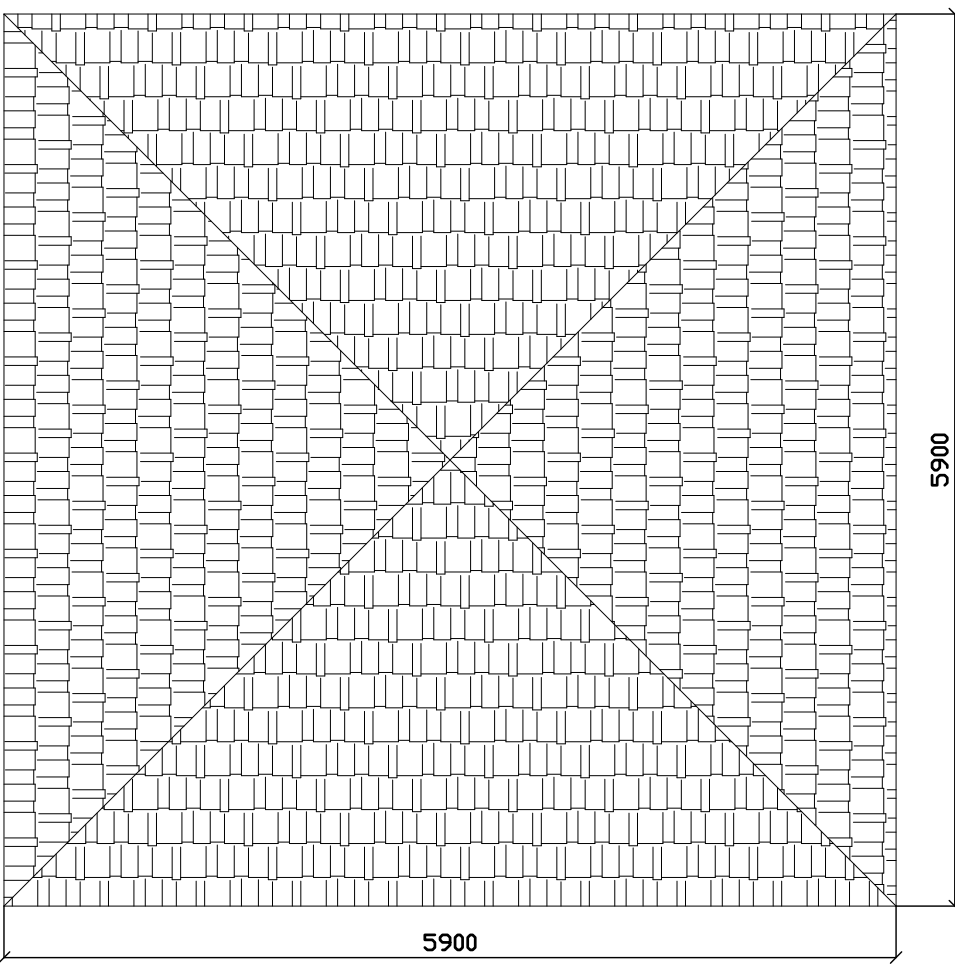
REAR VIEW
SCALE 1:50



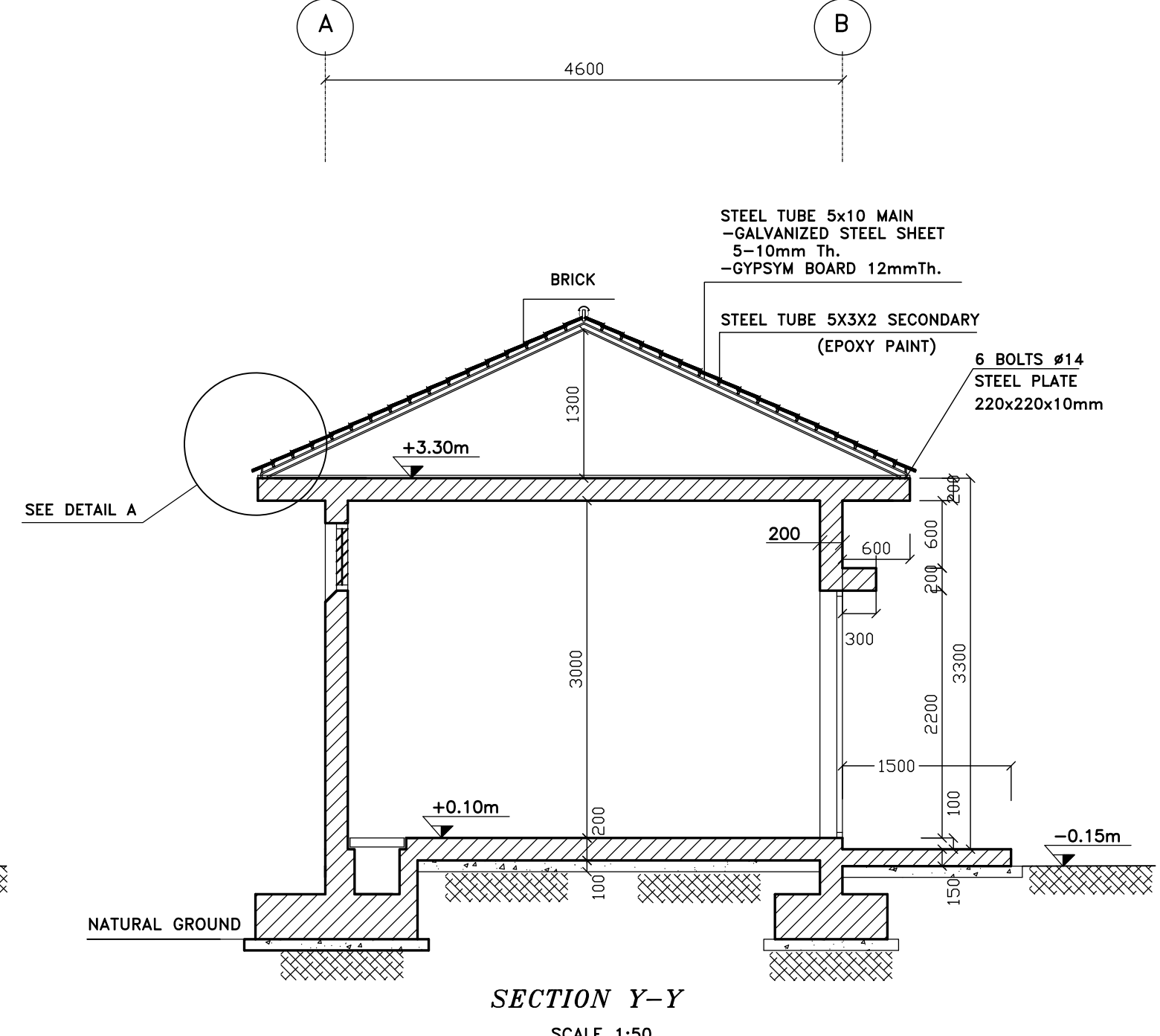
SECTION X-X
SCALE 1:50



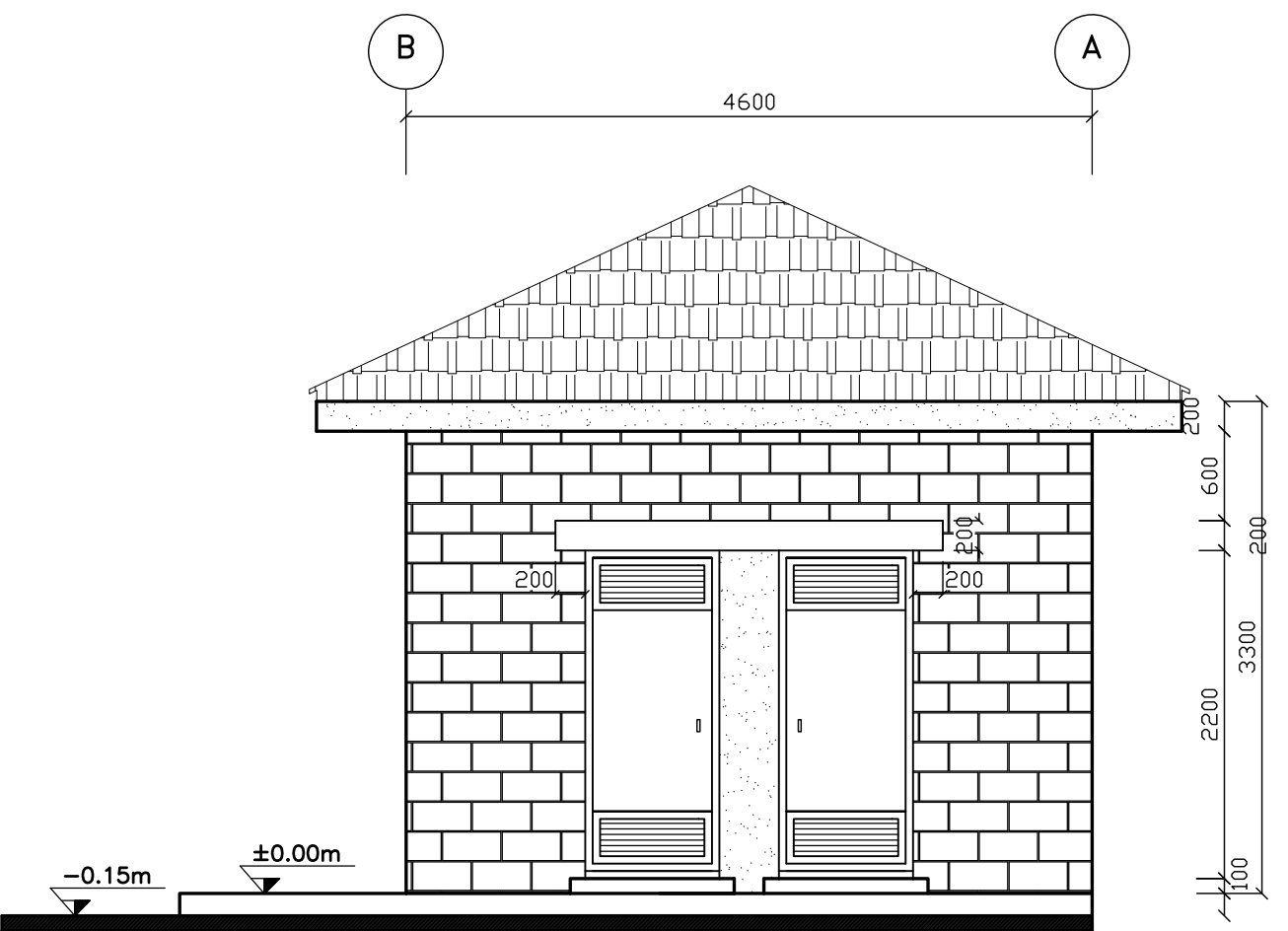
SIDE VIEW
SCALE 1:50



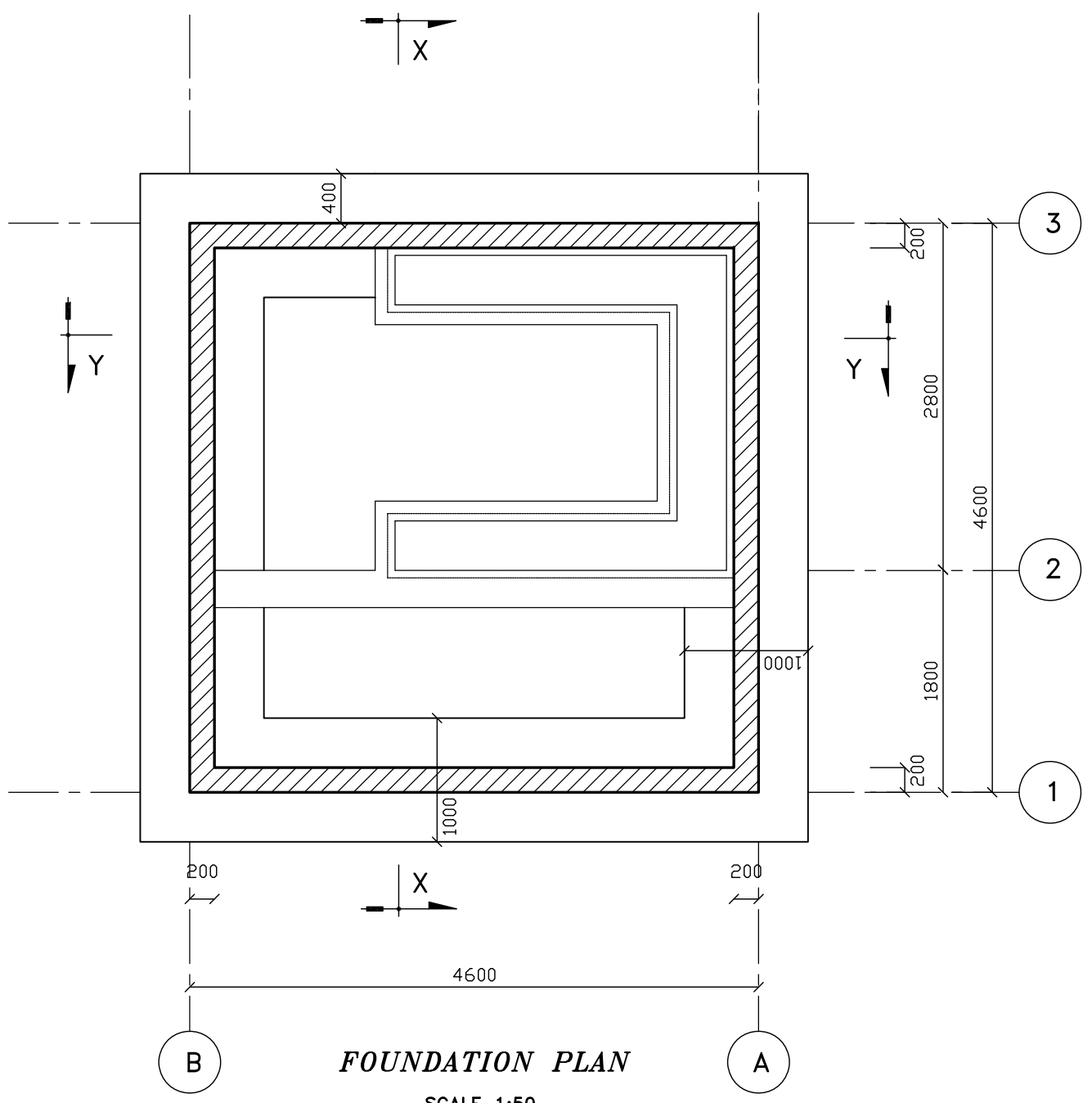
PUMPING STATION BRICK PLAN
SCALE 1:50



SECTION Y-Y
SCALE 1:50



MAIN VIEW
SCALE 1:50



FOUNDATION PLAN
SCALE 1:50

NOTES:

- REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES
- MIX ELEMENTS:
ORDINARY PORTLAND CEMENT, 350kg/m³.
- STRESSES:
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, a = 150mm : 30N/mm²
- ON A CYLINDER #150mm, h=300mm : 25N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS: 2.1N/mm²
MAXIMUM POURING HEIGHT :1500mm.
- CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 30mm FOR STRUCTURES FLOOR SLAB, WALLS AND COVER.
- LEAN CONCRETE/ CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, 250kg/m³.
- REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS : SYMBOL : T YIELD STRESS : F_y= 420N/mm²
MILD STEEL BARS : SYMBOL : # YIELD STRESS : F_y= 250N/mm²
- OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2d_{50#}
(#= NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN A SECTION. PINS #8 SHALL BE USED ON EACH LAP.
- BENDING:
#> 12mm MECHANICALLY COMPULSIONLY
#≤ 12mm MANUALLY EVENTUALLY
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.
- DRAWINGS CONSIDERATION:
--- TOP BARS
--- BOTTOM BARS
- CONSTRUCTION JOINTS:
REDUCED TO THE STRICT MINIMUM IN ALL ELEMENTS PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN: SETTING RETARDERS, BONDING MATERIALS.
- SETTING RETARDERS (CONSTRUCTION JOINTS), PLASTISIZERS, ...
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
- ALL EXECUTED INTERIOR CONCRETE SHALL BE FAIR FACE CONCRETE.
THE ROOF HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
ALL MATERIALS AND EXECUTION PROCESSES SHOULD BE SUBMITTED FOR APPROVAL. THE USE OF #6mm BARS AS TIE-RODS IS NOT ALLOWED.
- METALWORKS:
DOORS ARE MADE OF 3mm MINIMUM SHEET PLATE AND SHALL BE EPOXY PAINTED (PRIMER AND A MINIMUM OF TWO COATS). OPENINGS AND VENTILATIONS SHALL BE TAKEN INTO CONSIDERATION ACCORDING TO THE EQUIPMENT TO BE INSTALLED.

FINISHING SCHEDULE			
ROOM	FLOOR	WALLS	CEILING
CHLORINATION	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
CYLINDERS	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
CONTROL + ELECTRICAL ROOM	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
EXTERNAL FACE OF EXTERIOR WALLS	NATURAL STONE		

EXTERIOR DOORS	WINDOWS	PROTECTION BARS FOR EXTERIOR WINDOWS
STEEL PANELS 3mm THICK (ACCORDING TO DRAWINGS)	ALUMINUM (ACCORDING TO DRAWINGS)	STEEL SQUARE BARS 10x10 (ACCORDING TO DRAWINGS)

- N.B.
- * SCALING FROM THIS DRAWING IS NOT ALLOWED.
 - ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED.
 - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
 - * THIS DESIGN HAS BEEN FOUNDED ON AN HYPOTHESIS STATING THAT THE SOIL IN THE PROJECT AREA IS CONSTITUTED COMPLETELY OF A HARD AND CONTINUOUS LIMESTONE FORMATION. IF DURING EXECUTION A CONTRADICTORY REALITY APPEARS, THE DESIGN SHALL BE REVISED TO COMPLY WITH THE EVENTUAL NEW DATA REVEALED.
 - * THE TRENCH LOCATION COULD BE MODIFIED ACCORDING TO THE EQUIPMENT TO BE INSTALLED.
 - * THE LEVEL ±0.00 IS EQUIVALENT TO +1217.90m.

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COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD BUREAU TECHNIQUE POUR LE DEVELOPEMENT

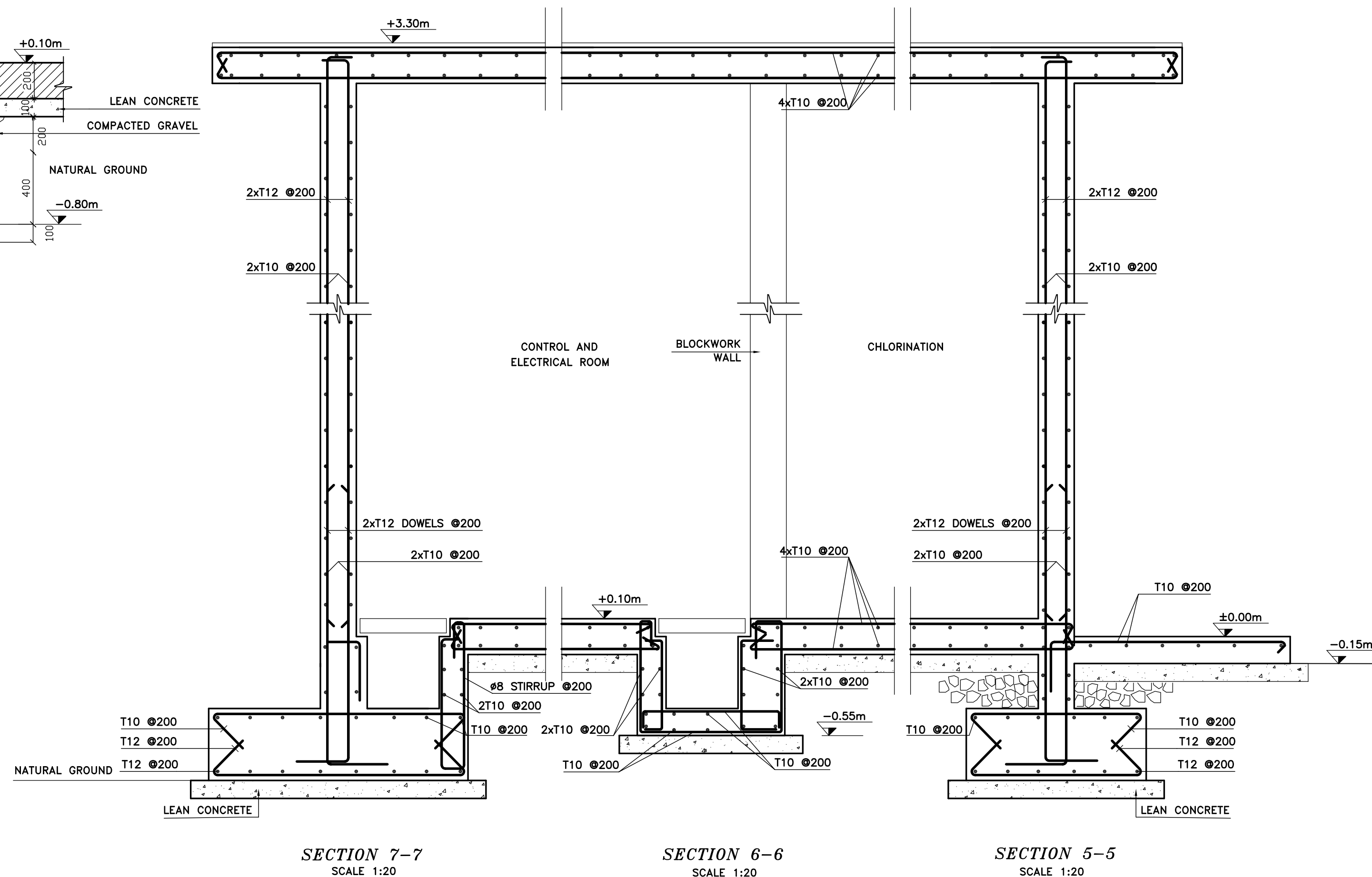
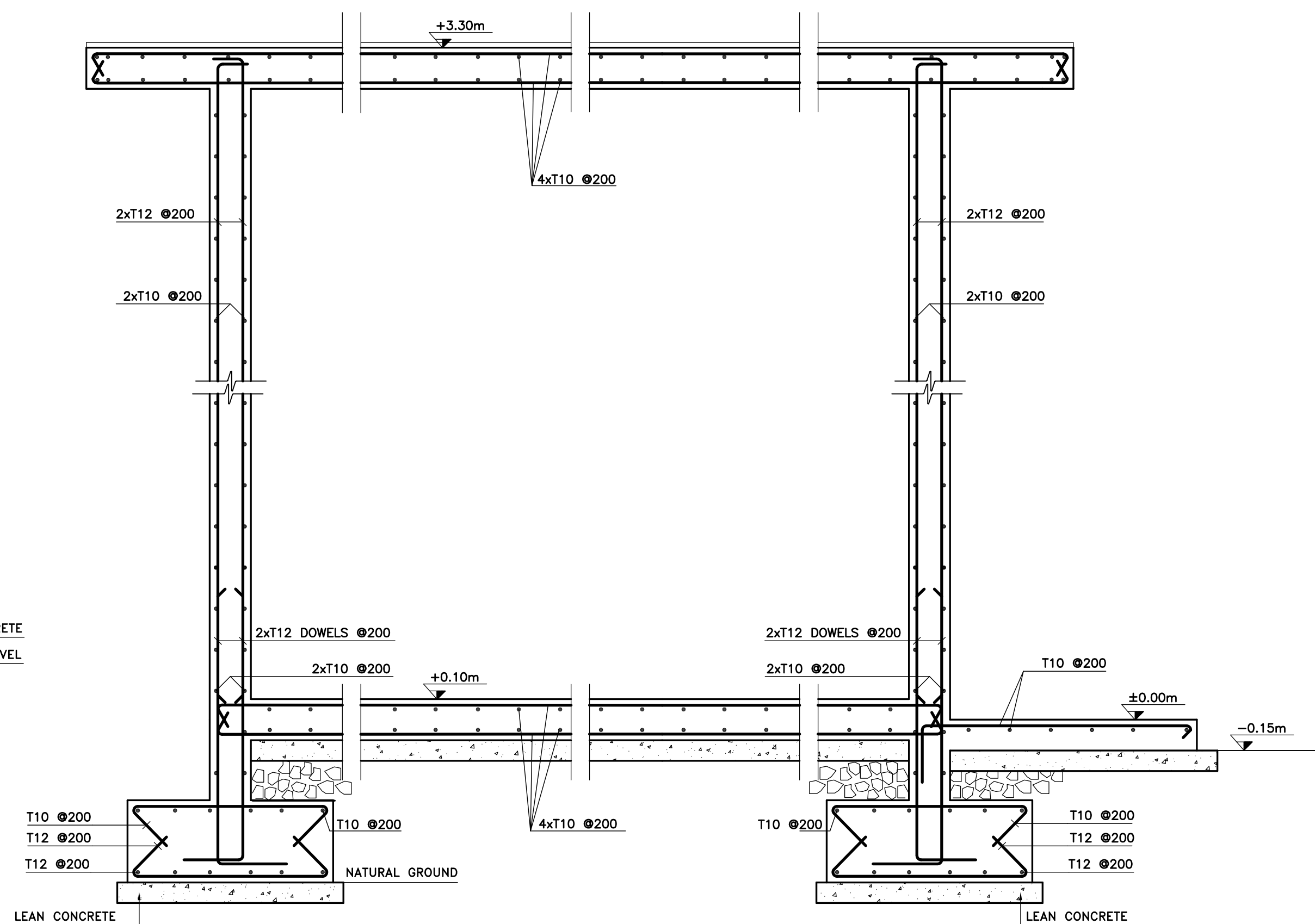
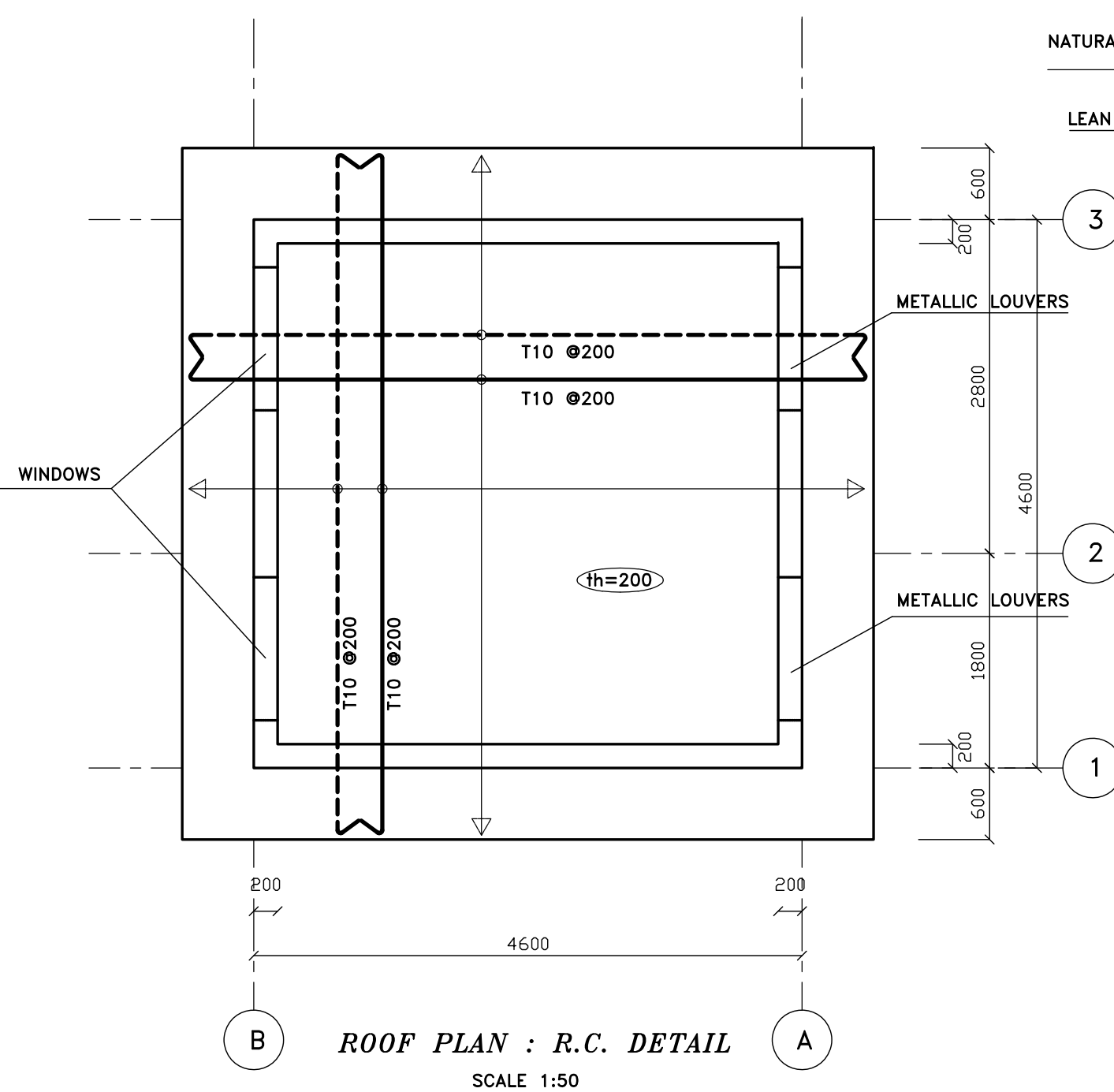
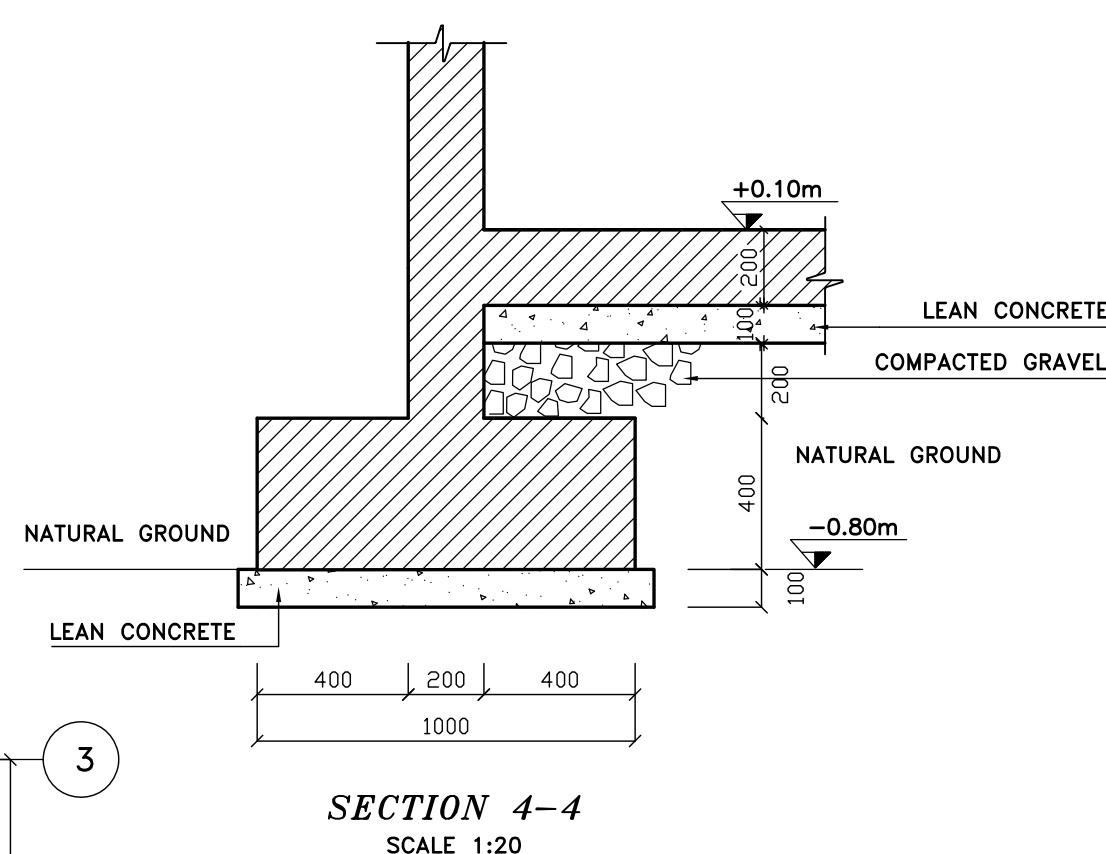
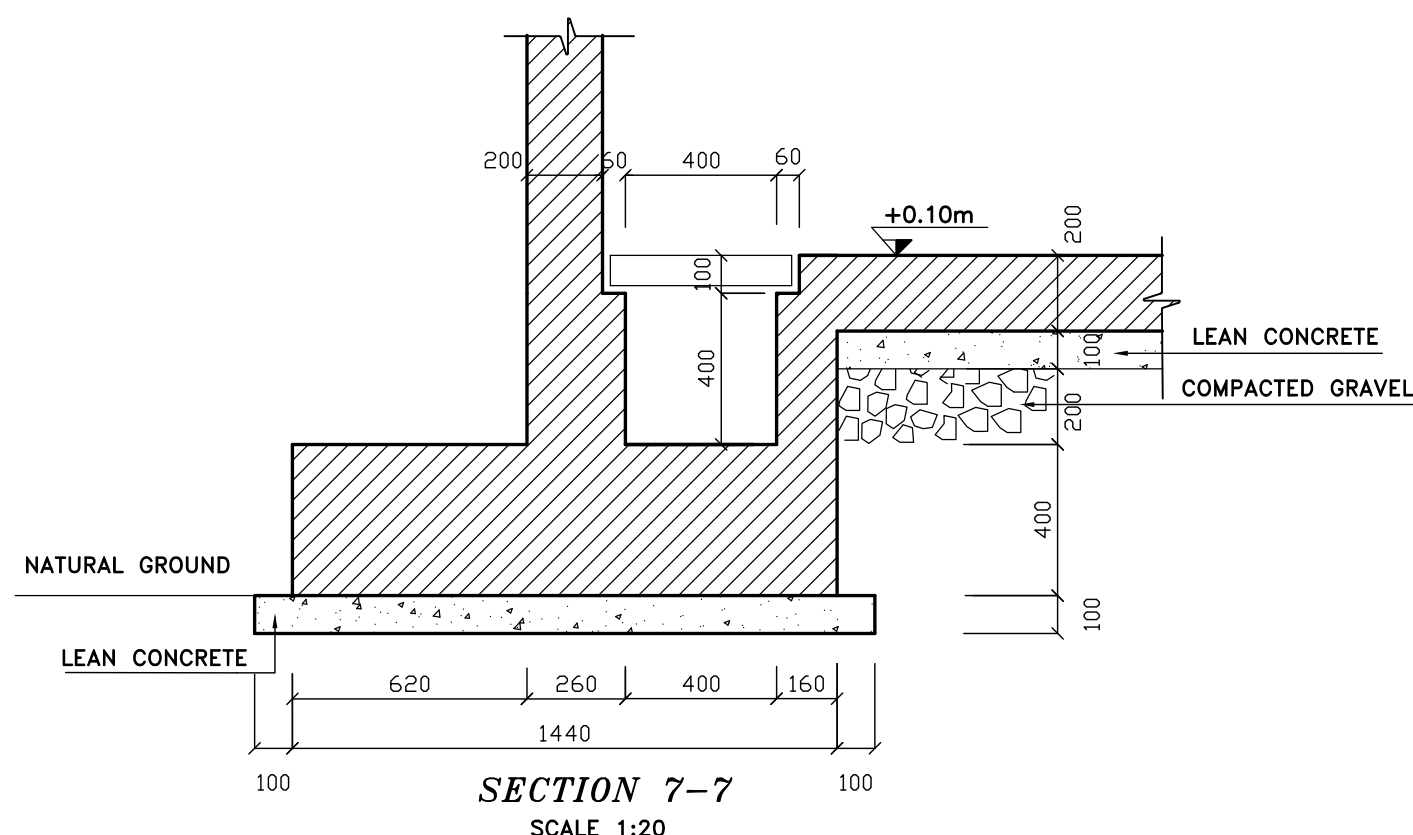
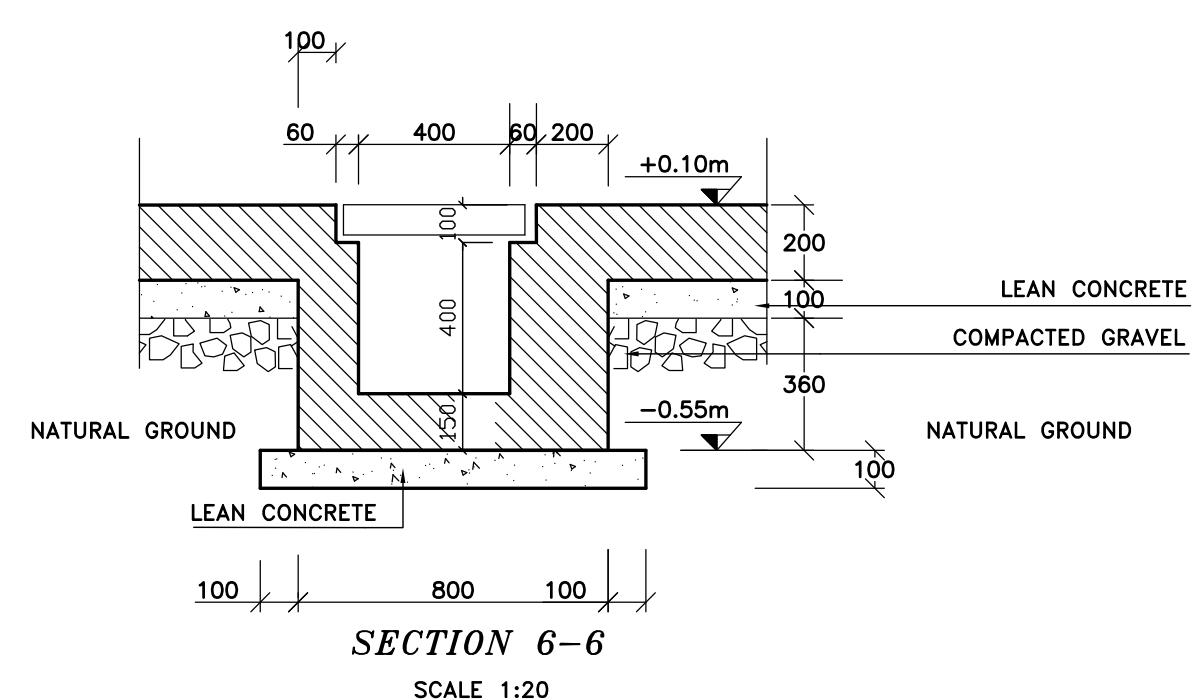
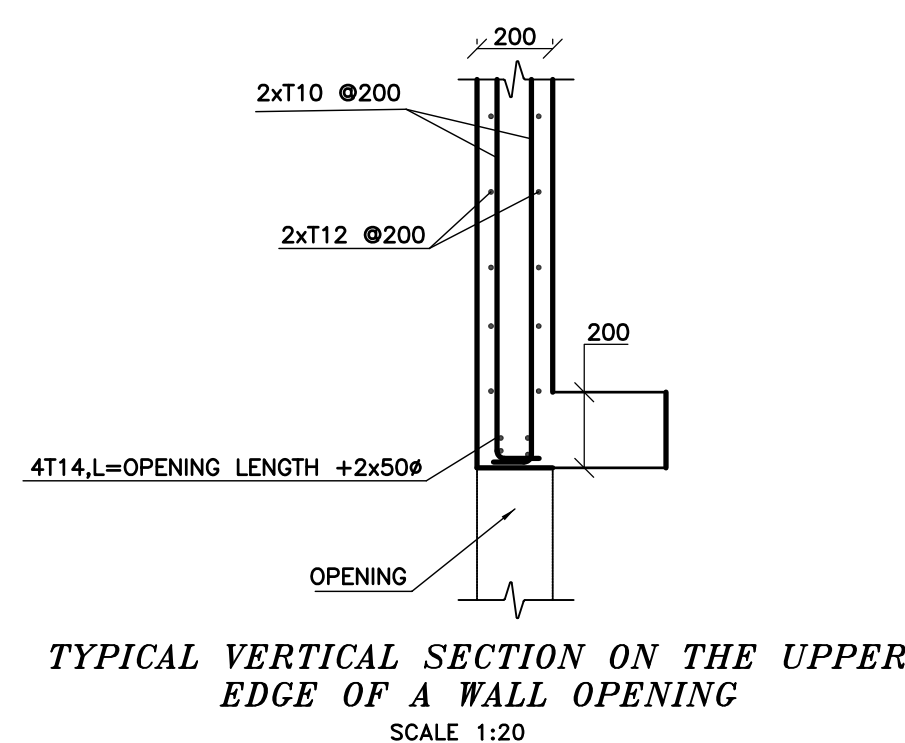
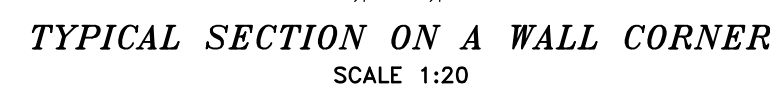
JALL ED DIB - HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 - ANTELIAS FAX:(04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MREIJAT BOREHOLE AND PUMPING STATION	PLANS-SECTIONS-ELEVATIONS REINFORCEMENT
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-C01-05	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20 - 1:10	3/5	509W-PS01-C03



REINFORCED CONCRETE: CONCRETE GRADE C30 FOR ALL STRUCTURES

MIX ELEMENTS: ORDINARY PORTLAND CEMENT, 350kg/m³.

STRESSES: CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
— ON A CUBE, $\phi = 150\text{mm}$: 30N/mm²
— ON A CYLINDER $\phi 150\text{mm}$, $h=300\text{mm}$: 25N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS: 2.1N/mm²
MAXIMUM POURING HEIGHT : 1500mm.

CONCRETE COVER: CLEARANCE BETWEEN THE EXTERNAL GENERATION OF BARS AND THE FACINGS SHALL BE 30mm FOR STRUCTURES FLOOR SLAB, WALLS AND COVER.

LEAN CONCRETE/ CYCLOPEAN CONCRETE: MIX MADE WITH ORDINARY PORTLAND CEMENT, 250kg/m³.

REINFORCEMENT: DEFORMED HIGH STRENGTH STEEL BARS : SYMBOL : T YIELD STRESS : $F_y = 420\text{N/mm}^2$
MILD STEEL BARS : SYMBOL : Φ YIELD STRESS : $F_y = 250\text{N/mm}^2$

OVERLAPPING: LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN $2\phi_{50}$
($\phi =$ NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN A SECTION. PINS #8 SHALL BE USED ON EACH LAP.

BENDING: $\phi \geq 12\text{mm}$ MECHANICALLY COMPULSIONLY
 $\phi \leq 12\text{mm}$ MANUALLY EVENTUALLY
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION: ——— TOP BARS
————— BOTTOM BARS

CONSTRUCTION JOINTS: REDUCED TO THE STRICT MINIMUM IN ALL ELEMENTS PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN: SETTING RETARDERS, BONDING MATERIALS.

SETTING RETARDERS (CONSTRUCTION JOINTS), PLASTISIZERS, ...
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.

ALL EXECUTED INTERIOR CONCRETE SHALL BE FAIR FACE CONCRETE.
THE ROOFS HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
ALL MATERIALS AND EXECUTION PROCESSES SHOULD BE SUBMITTED FOR APPROVAL.
THE USE OF $\phi 6\text{mm}$ BARS AS TIE-RODS IS NOT ALLOWED.

METALWORKS: DOORS ARE MADE OF 3mm MINIMUM SHEET PLATE AND SHALL BE EPOXY PAINTED (PRIMER AND A MINIMUM OF TWO COATS). OPENINGS AND VENTILATIONS SHALL BE TAKEN INTO CONSIDERATION ACCORDING TO THE EQUIPMENT TO BE INSTALLED.

FINISHING SCHEDULE			
ROOM	FLOOR	WALLS	CEILING
CHLORINATION	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
CYLINDERS	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
CONTROL + ELECTRICAL ROOM	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
EXTERNAL FACE OF EXTERIOR WALLS	NATURAL STONE		

EXTERIOR DOORS	WINDOWS	PROTECTION BARS FOR EXTERIOR WINDOWS
STEEL PANELS 3mm THICK (ACCORDING TO DRAWINGS)	ALUMINUM (ACCORDING TO DRAWINGS)	STEEL SQUARE BARS 10x10 (ACCORDING TO DRAWINGS)

- N.B.
- SCALING FROM THIS DRAWING IS NOT ALLOWED.
ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED.
ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- THIS DESIGN HAS BEEN FOUNDED ON AN HYPOTHESIS STATING THAT THE SOIL IN THE PROJECT AREA IS CONSTITUTED COMPLETELY OF A HARD AND CONTINUOUS LIMESTONE FORMATION; IF DURING EXCAVATION A CONTRADICTORY REALITY APPEARS, THE DESIGN SHALL BE REVISED TO COMPLY WITH THE EVENTUAL NEW DATA REVEALED.
- THE TRENCH LOCATION COULD BE MODIFIED ACCORDING TO THE EQUIPMENT TO BE INSTALLED.
- THE LEVEL ± 0.00 IS EQUIVALENT TO $+1217.00m$.

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

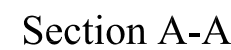
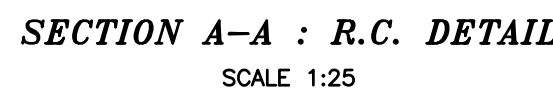
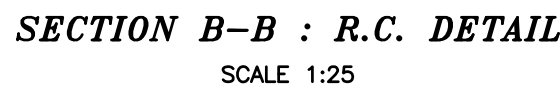


CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

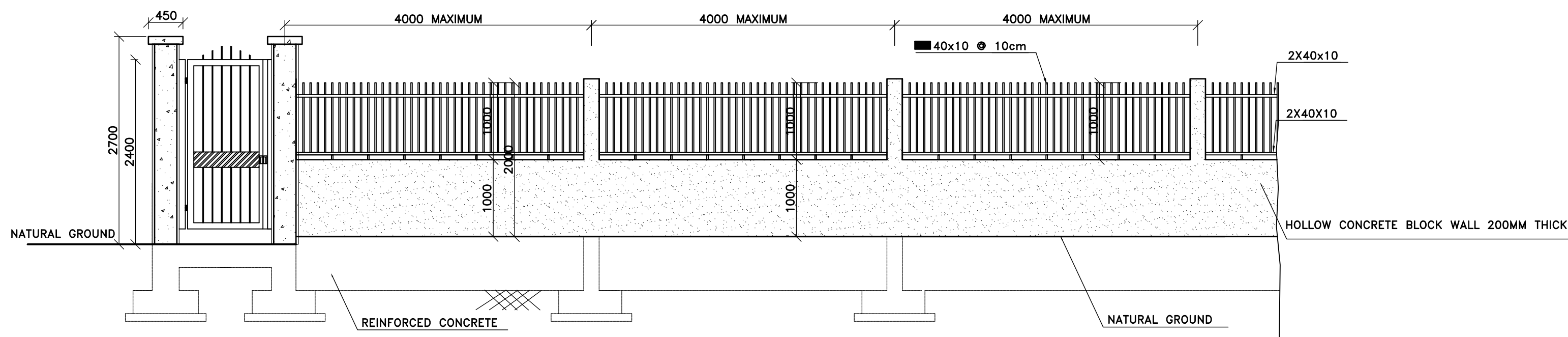
<p>MREIJAT BOREHOLE AND PUMPING STATION</p>	<p>PLAN - SECTIONS</p>
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FILE NAME			
509W-PS01-C01-05	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

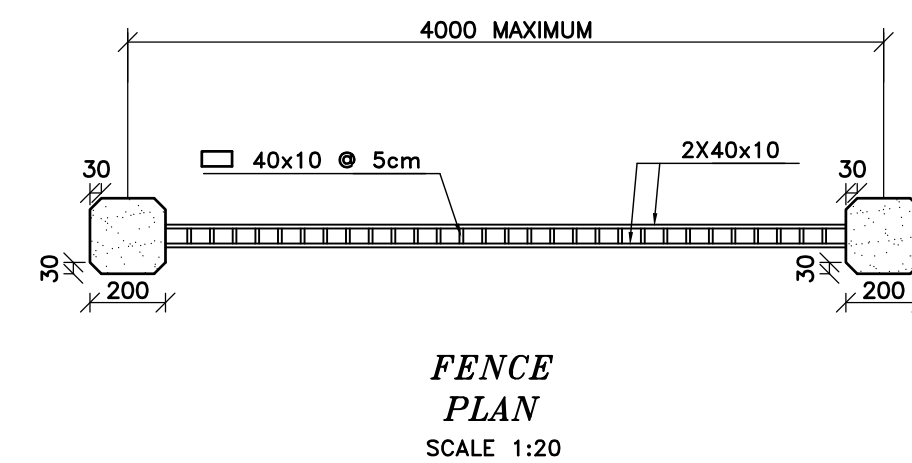
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JULY 2019	1:20-1:50	4/5	509W-PS01-C04



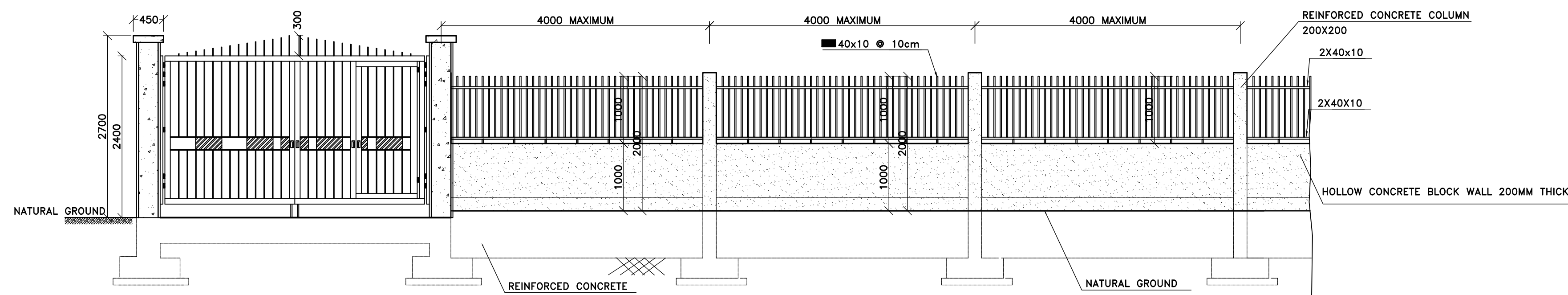
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JULY 2019	1:25	5/5	509W-PS01-C05



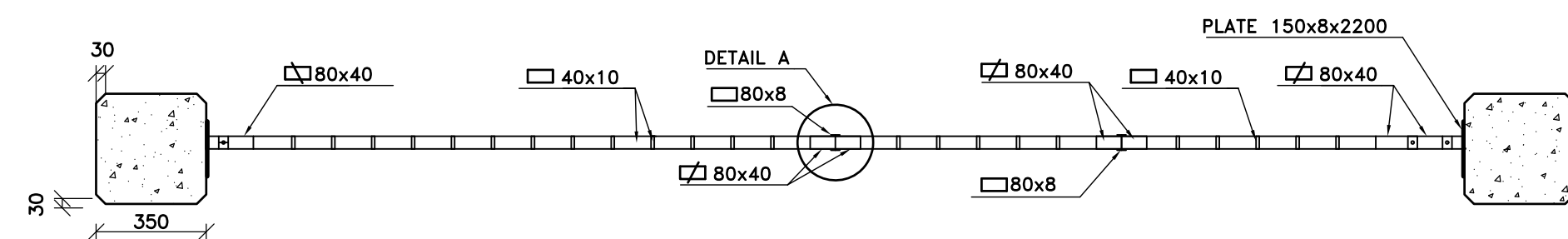
GATE 1.2 m (ELEVATION)
SCALE 1:50



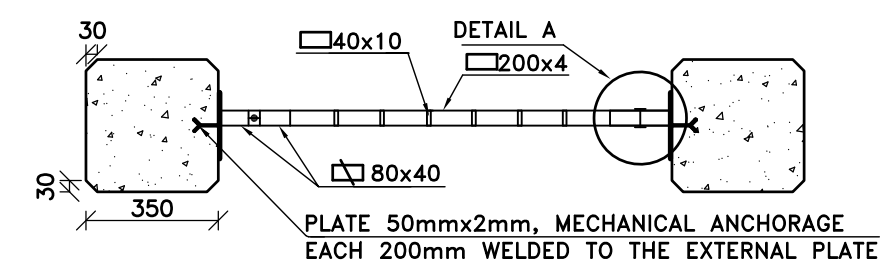
FENCE
PLAN
SCALE 1:20



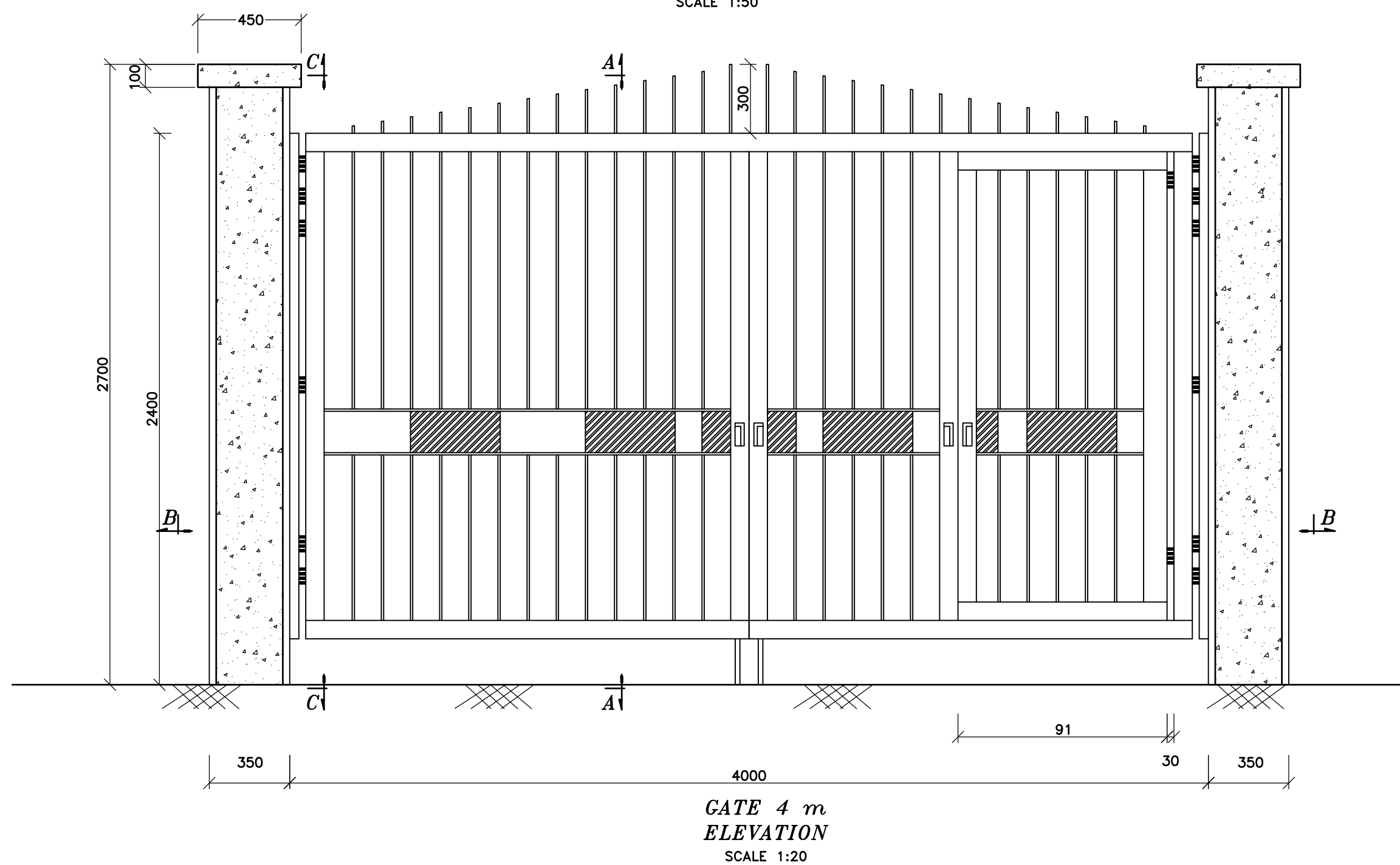
GATE 4 m (ELEVATION)
SCALE 1:50



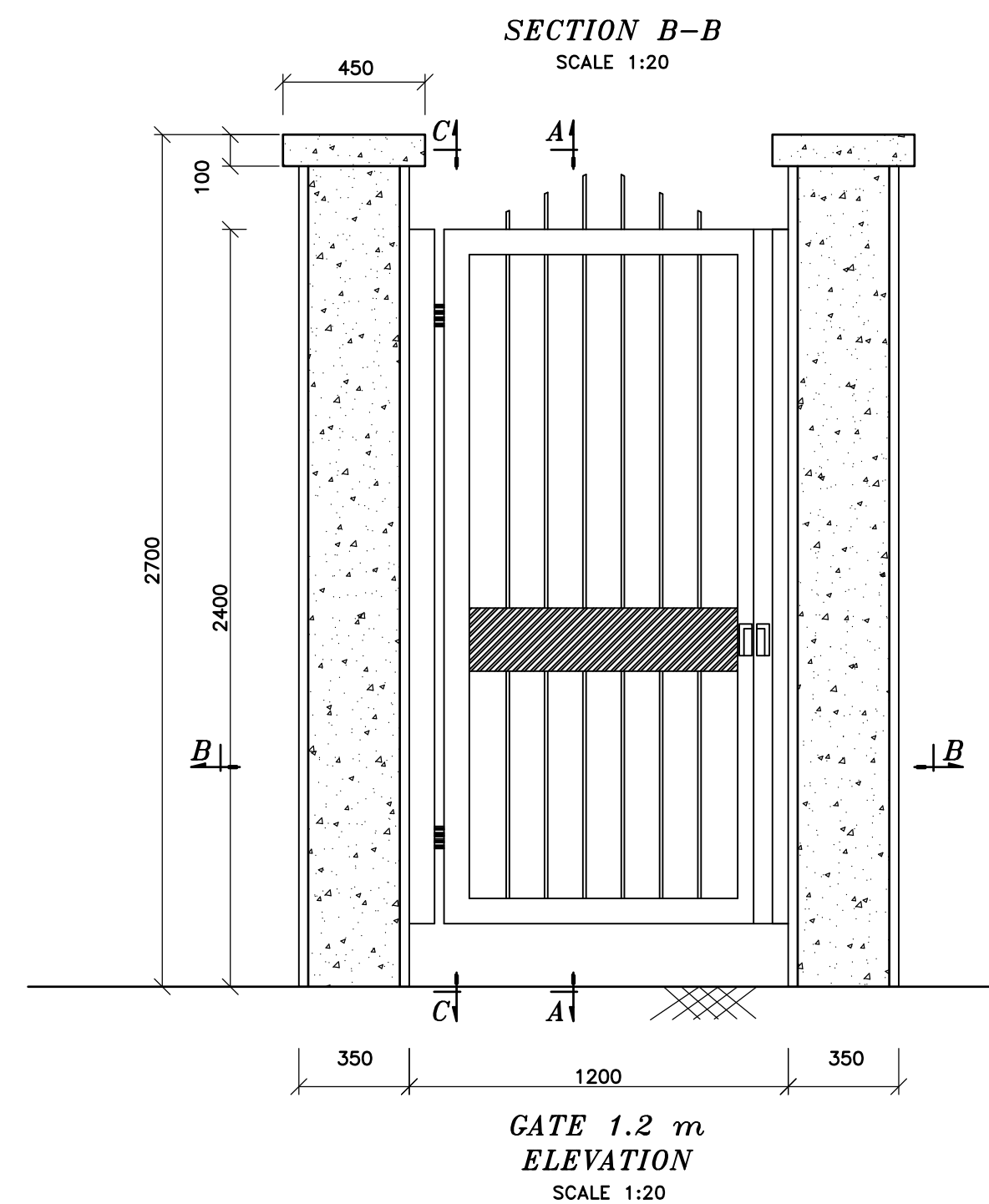
SECTION B-B
SCALE 1:50



SECTION B-B
SCALE 1:20



GATE 4 m
ELEVATION
SCALE 1:20



GATE 1.2 m
ELEVATION
SCALE 1:20

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 - ANTELJAS FAX:(04) 712159

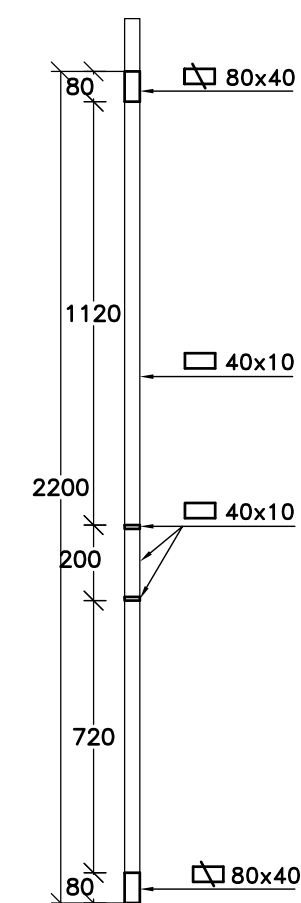
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

FENCE AND
TYPICAL GATE 4m AND 1.2m

ELEVATIONS
SECTIONS AND DETAILS

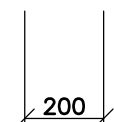
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509W-PS01-SF01-02	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20	1/2	509W-PS01-SF01

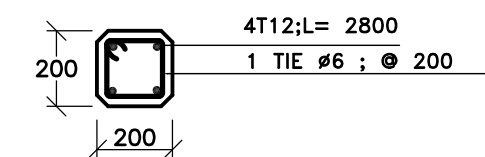


SECTION C-C
SCALE 1:20

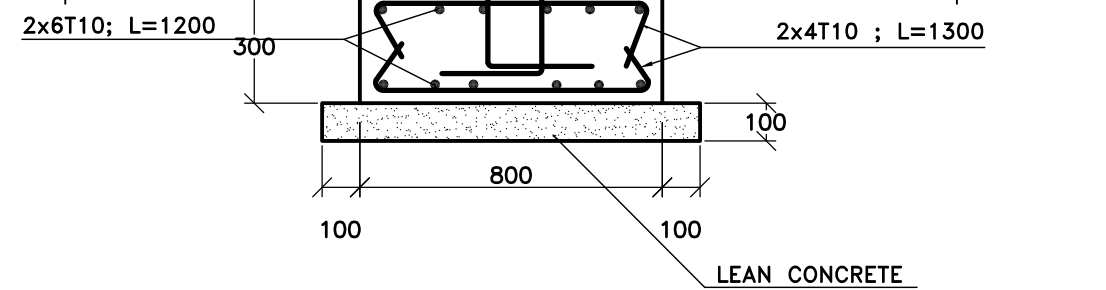
SECTION A-A
SCALE 1:20



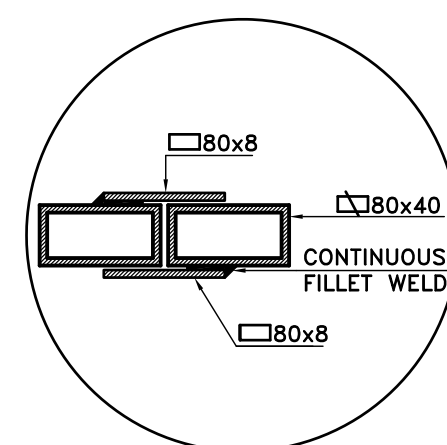
TYPICAL FENCE COLUMN
SCALE 1:20



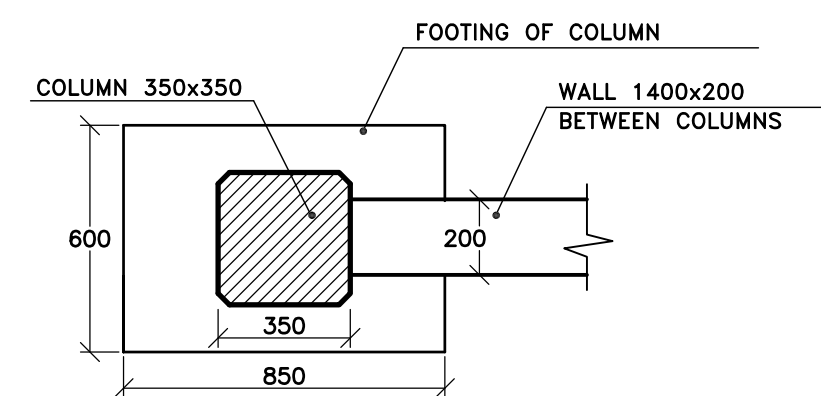
**HORIZONTAL SECTION
OF COLUMN**
SCALE 1:20



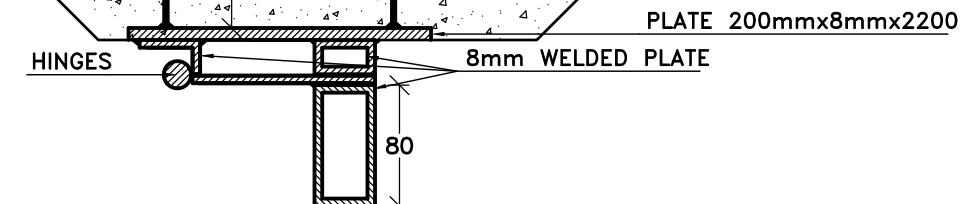
REINFORCEMENT OF TYPICAL COLUMN AND FOOTING
SCALE 1:20



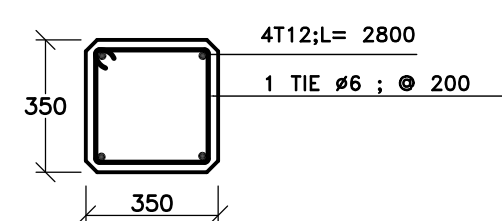
DETAIL A
SCALE 1:5



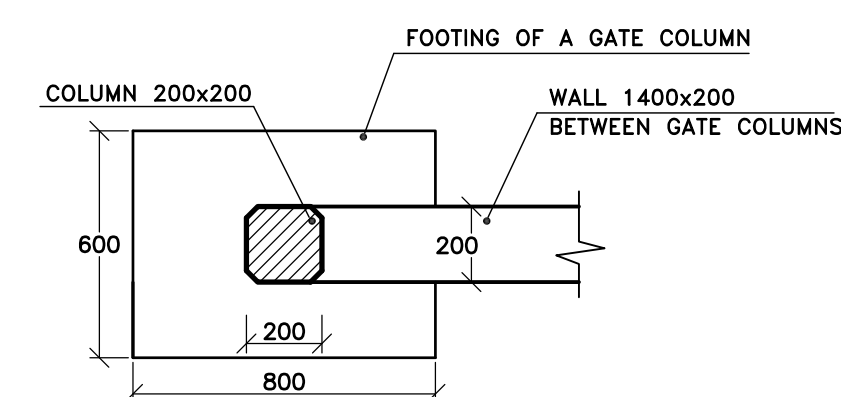
FOOTING
SCALE 1:20



SECTION D-D
SCALE 1:5



*HORIZONTAL SECTION
OF GATE COLUMN*
SCALE 1:20



FOOTING
SCALE 1:20

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 - ANTELIAS FAX:(04) 712159

CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM-QABB ELIAS AND MRAIJAT

<p>FENCE AND TYPICAL GATE 4m AND 1.2m</p>		<p>ELEVATIONS SECTIONS AND DETAILS</p>	
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<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-PS01-SF01-02	BTD	BTD	BTD

















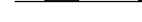




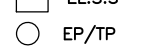














<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
JULY 2019	1:5 - 1:20	2/2	509W-PS01-SF02




NOTES:

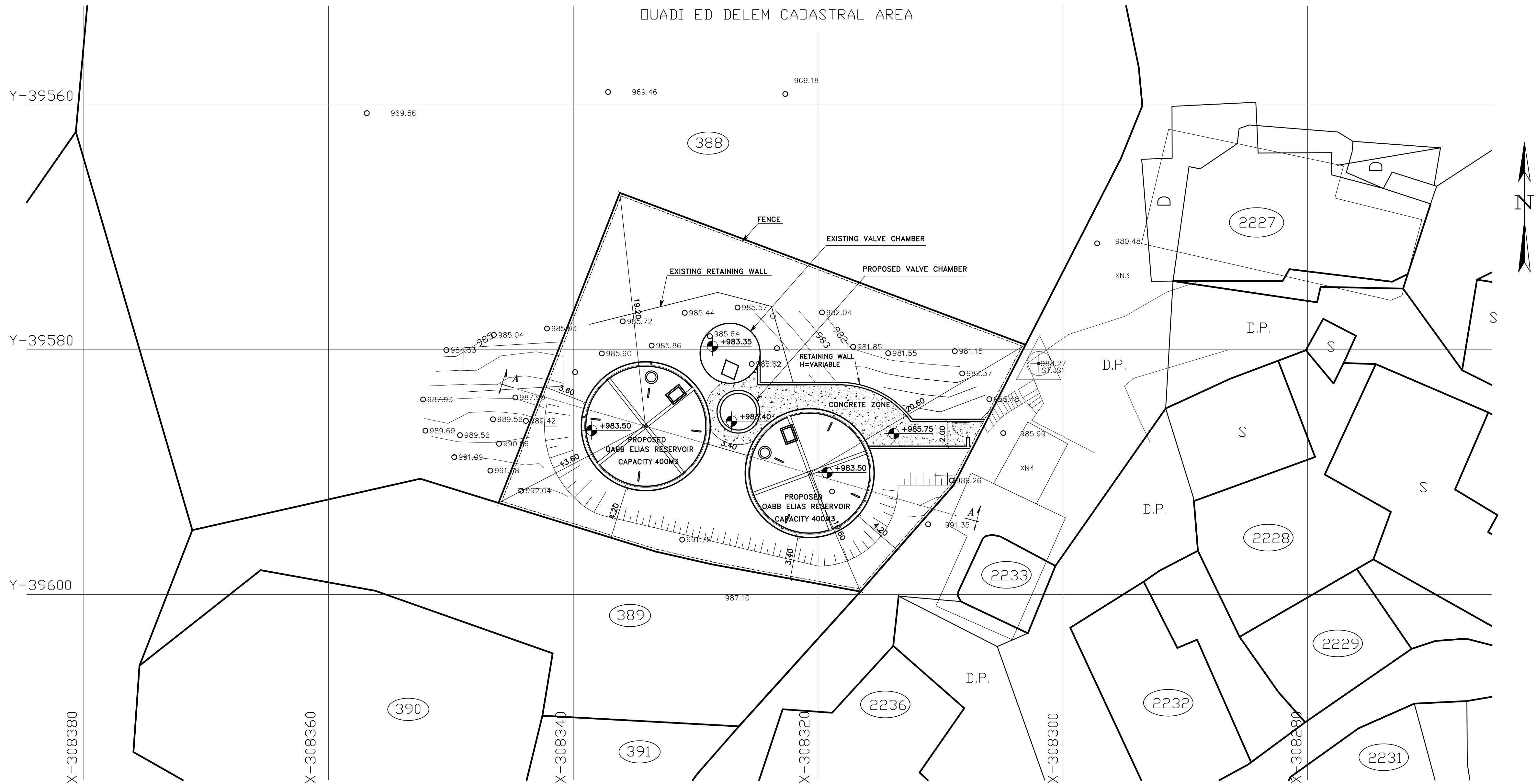
- GROUND LEVEL OF RESERVOIR = +983.50m
- GROUND LEVEL OF EXISTING VALVE CHAMBER = +983.35m
- GROUND LEVEL OF PROPOSED VALVE CHAMBER = +983.40m
- DO NOT SCALE FROM THIS DRAWING
- ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND

 Spr  WELL  DECIDUOUS/PINE TREE  ROCKS  BUSHES  MANHOLE SEWER  MANHOLE WATER  MANHOLE TELEPHONE  MANHOLE NOT IDENTIFIED  LIGHTING POLE  BUILDING  FOUNDATION/BUILDING UNDER CONSTRUCTION  ROAD  TRACK  REFERENCE LINE  SLOPE	 RETAINING WALL  RAILWAY  CHANNEL  TERRACE  FENCE  STREAM/RIVER  PYL  EL.S.S  EP/TP  OVERGROUND WATER PIPE  UNDERGROUND WATER PIPE  • 1160.12  39.4  TRIANGULATION POINT  BENCH MARK  ML  LOT NO  LOT LIMIT  CIRCUMSCRIPTION BOUNDARY  EXPROPRIATION LIMIT
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<h1 style="margin: 0;">REPUBLIC OF LEBANON</h1> <h2 style="margin: 5px 0 0 0;">COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION</h2>			
<div style="display: flex; align-items: center; justify-content: center; gap: 10px;">  <div> <h3 style="margin: 0;">BUREAU TECHNIQUE POUR LE DEVELOPEMENT</h3> <p style="margin: 5px 0 0 0;">JALL ED DIB - HAJAL Bldg P.O.BOX:70492 - ANTELIAS</p> <p style="margin: 5px 0 0 0;">PHONE:(04) 712157/712158 (03) 291016 FAX: (04) 712159</p> </div> </div>			
<h2 style="margin: 0;">CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT</h2>			
QABB ELIAS RESERVOIRS (CAPACITY 2X400 m³)		TOPOGRAPHICAL SURVEY SITE LAYOUT	
FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-C01-07	W. SEIFFEDDINE	W. SEIFFEDDINE	W. SEIFFEDDINE
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:200	1/9	509W-RS02-C01

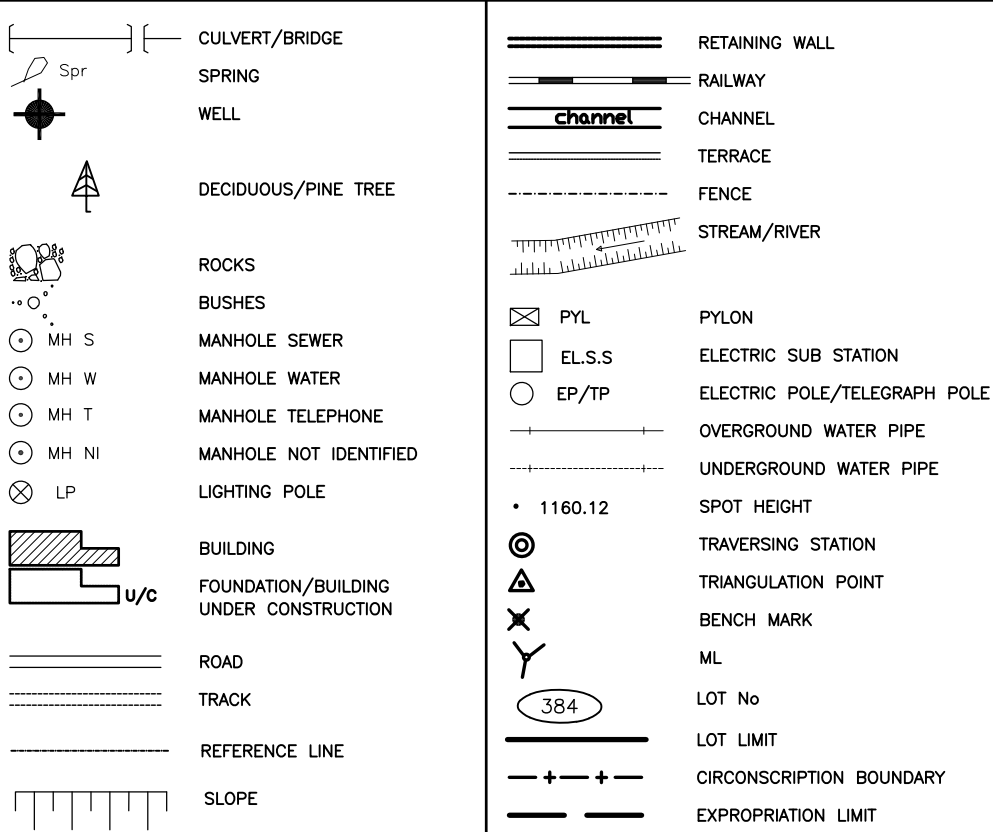
SITE PLAN
SCALE 1:200
QUADI ED DELEM CADASTRAL AREA



NOTES:

- GROUND LEVEL OF RESERVOIR = +983.50m
- GROUND LEVEL OF EXISTING VALVE CHAMBER = +983.35m
- GROUND LEVEL OF PROPOSED VALVE CHAMBER = +983.40m
- DO NOT SCALE FROM THIS DRAWING
- ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION



BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg
P.O.BOX:70492 - ANTELIAS

PHONE:(04) 712157/712158 (03) 291016
FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

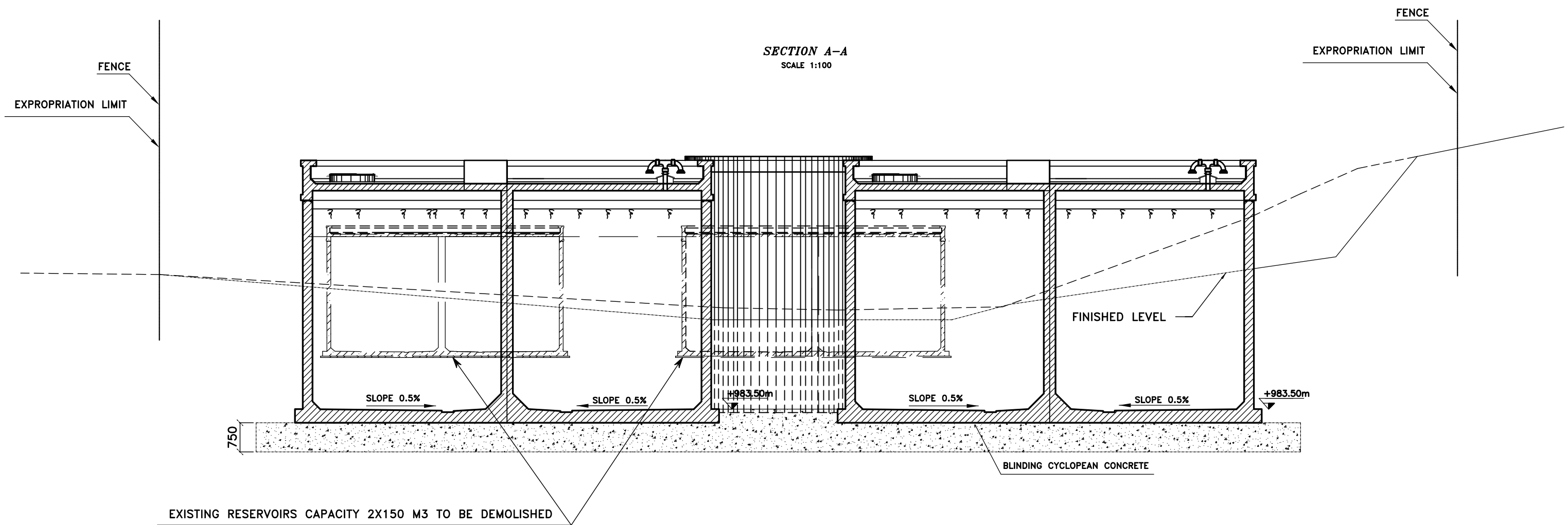
QABB ELIAS RESERVOIRS
(CAPACITY 2X400 m³)

SITE PLAN
SECTION A-A

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-C01-07	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

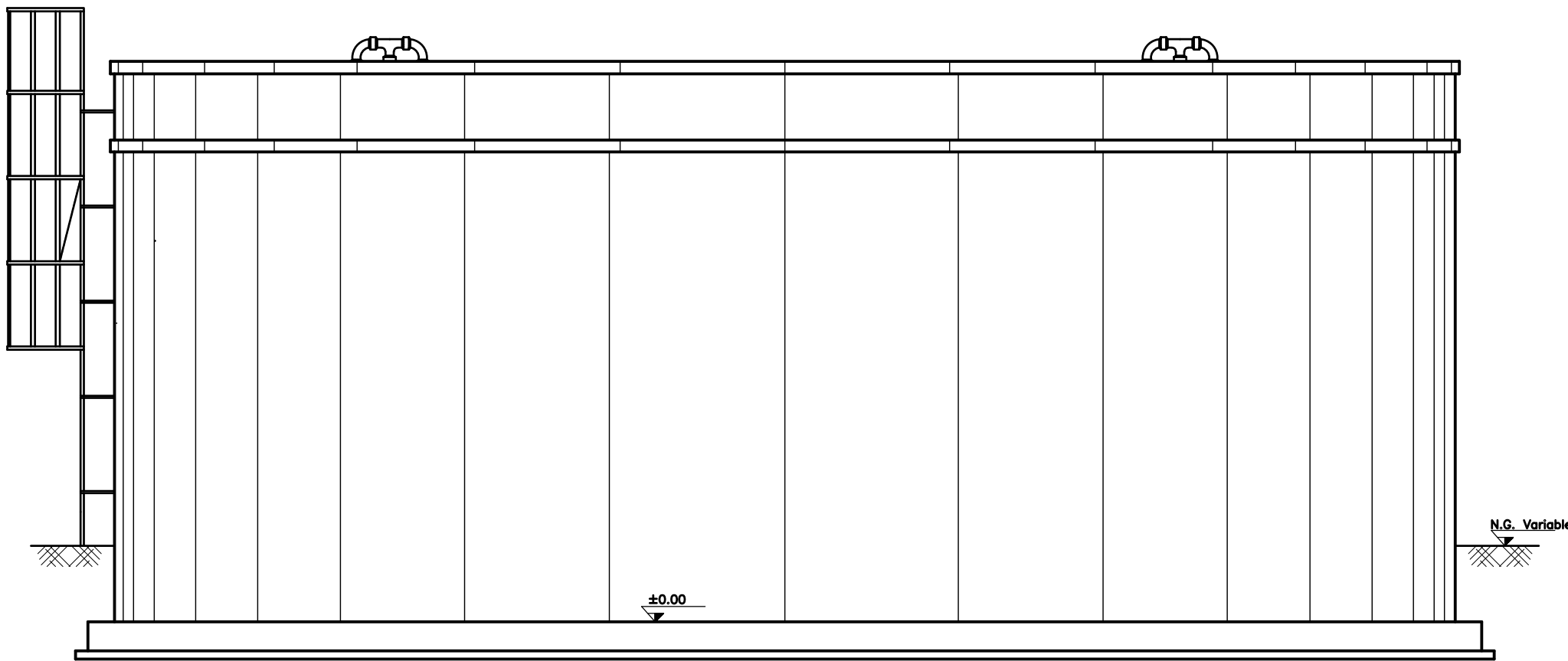
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JULY 2019	1/200-1/100	2/7	509W-RS02-C02

SECTION A-A
SCALE 1:100

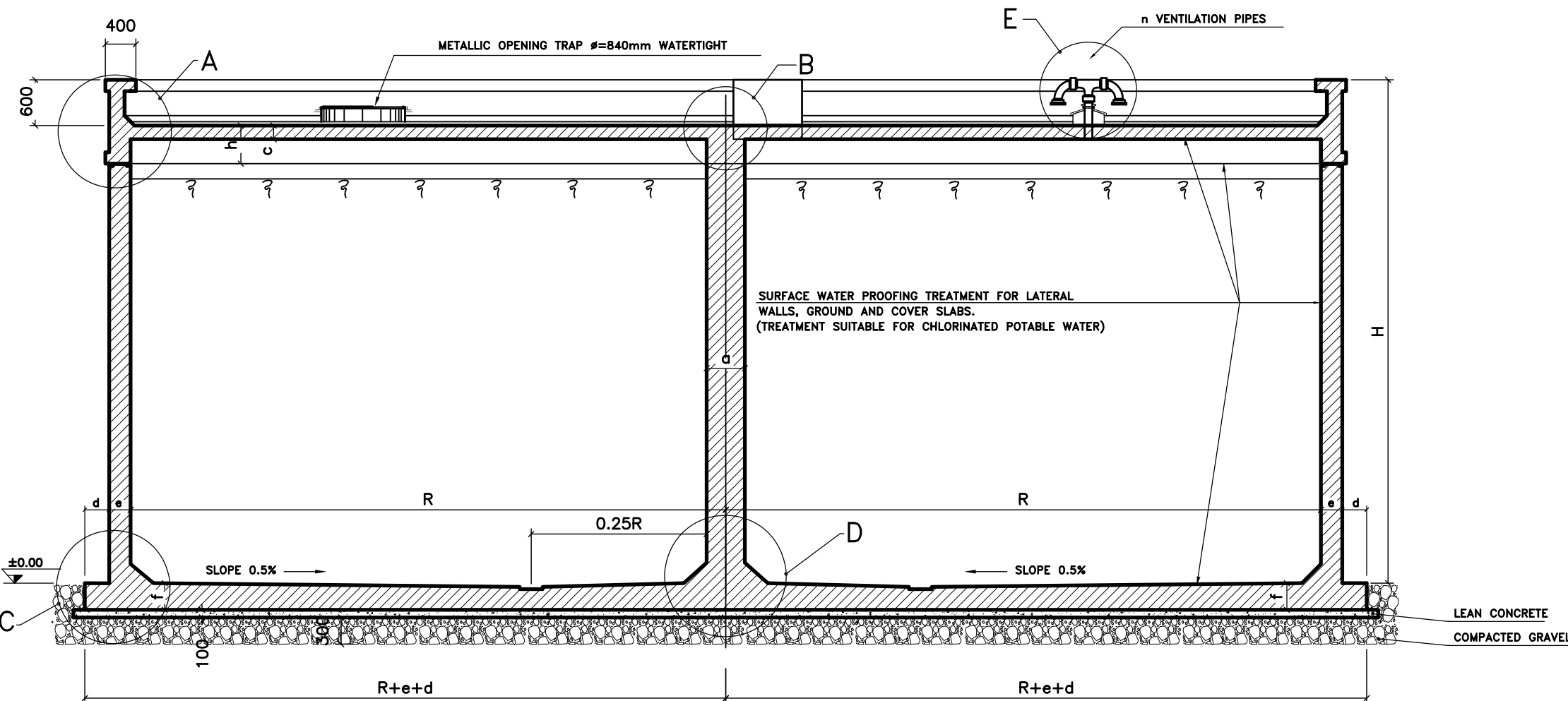


CAPACITY	400M3
R (mm)	5000
0.25R (mm)	1250
t (mm)	250
R+t (mm)	5250
c (mm)	200
f (mm)	300
d (mm)	200
R+t+d (mm)	5450
a (mm)	300
b (mm)	300
h (mm)	350
n (VENTILATION PIPES)	3
n' (DRAIN PIPES)	3
H (mm)	6450
g (mm)	800
j (mm)	1200

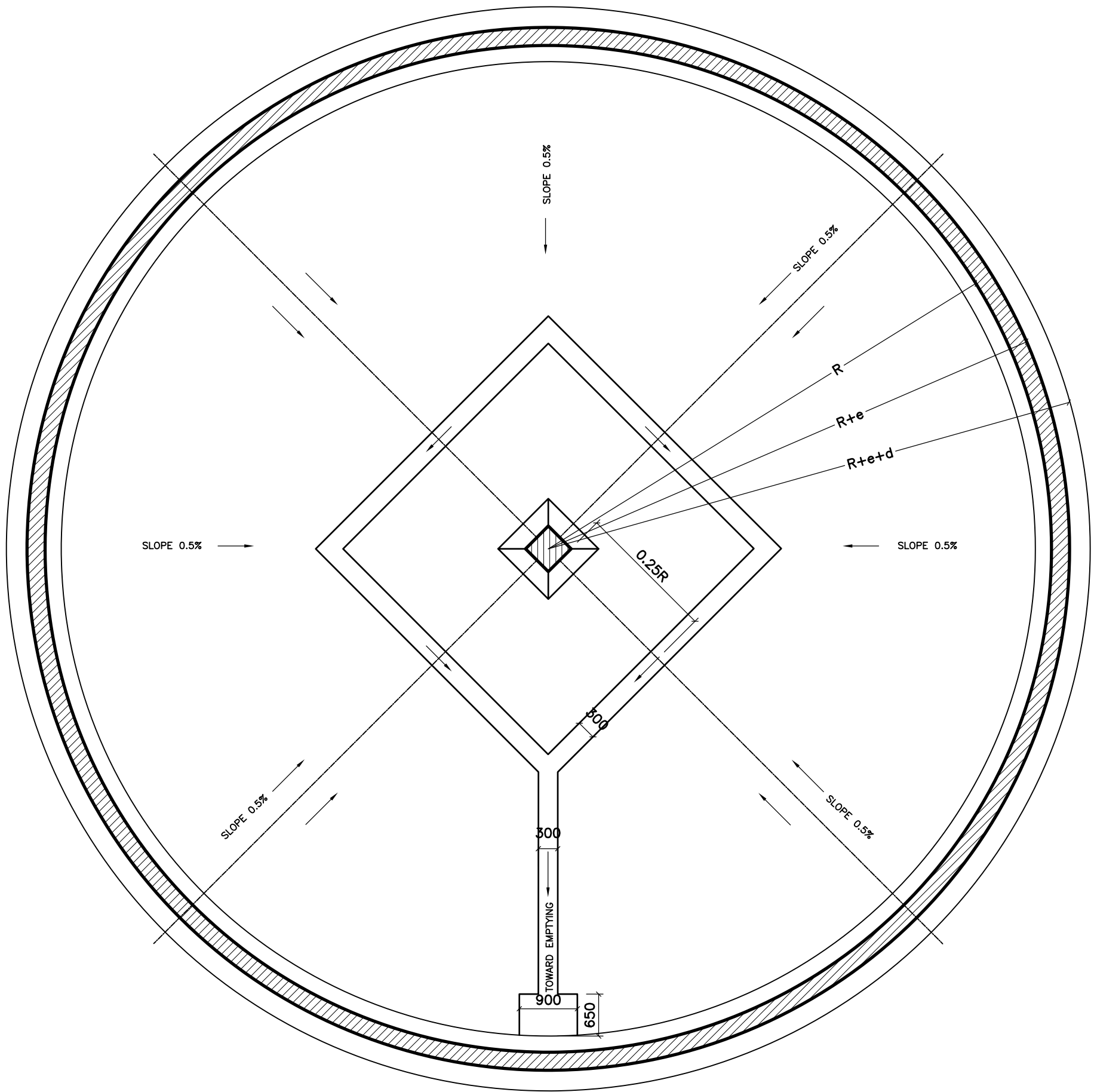
ELEVATION



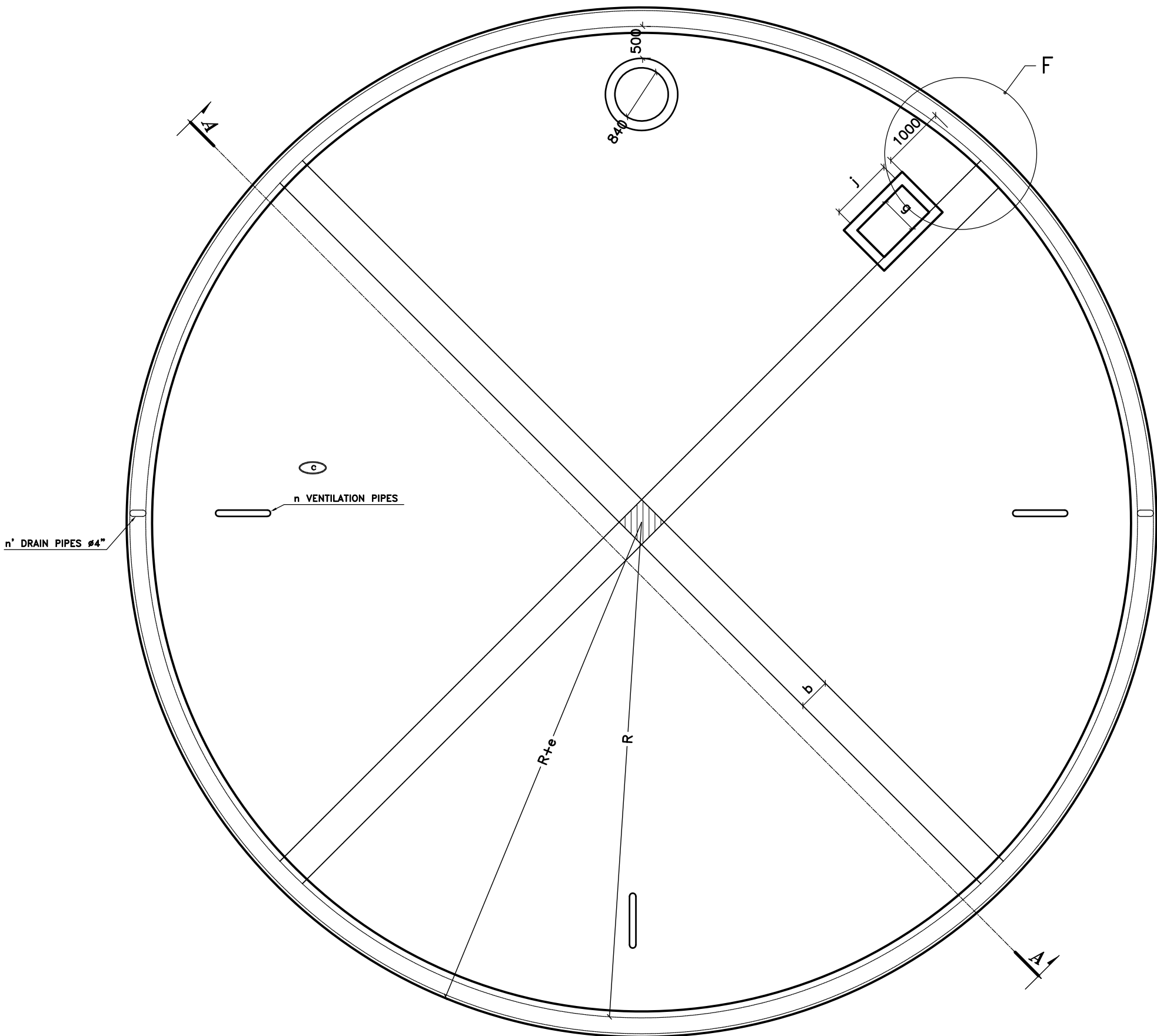
VERTICAL SECTION A-A



MAT FORMWORK



COVER SLAB FORMWORK



NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 400 Kg/m³ FOR LATERAL WALLS AND THE COVER SLAB; 350 kg/m³ ELSEWHERE.

LEAN CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS: SYMBOL # YIELD STRESS: F_y=215 MPa.

STRESSES:
SEVERE CONTROL:
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c =25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t =2.1 MPa.

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS
ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS,
FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.
WATER-STOP JOINTS MUST BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY
(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50#.
(#= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.

BENDING:
> 12mm MECHANICAL
< 12mm MANUEL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION,
A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) D.V. - SBS/OR/APP t_{app} ≥2.5mm
- ADHERENCE OR SEMI-ADHERENCE APPLICATION
(variable min. t=50mm)
(2) INSULATION - EXPANDED POLYSTYRENE λ=0.037kcal/h.m².°C
WITH λ = λ₁ λ₂ = λ₁ λ₂
- SEMI-ADHERENCE OR TOTAL ADHERENCE
APPLICATION ON VAPOUR BARRIER.
(3) WATERPROOFING - SBS/OR/APP t_{total} ≥4mm
WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
(4) PROTECTION - IN FACTORY MINERAL AUTOPROTECTION.
(5) h ≥ 150mm (NILL SLOPE)

REMARKS:
* FLOOR SLAB INVERT LEVEL ±0.00: SEE LAYOUT DAWRINGS.
* DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED
FOR RESERVOIR FORMWORKS TIE-RODS.
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL THE DIMENSIONS ARE IN mm.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* PROVIDE PERFORATED DRAIN PIPES, #4" IN THE GRAVEL PROTECTION LAYER.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

ED BUREAU TECHNIQUE POUR LE DEVELOPEMENT
JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS RESERVOIRS
(CAPACITY 2X400 m³)

ELEVATION AND SECTIONS
FORMWORK

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-C01-07	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S.	3/7	509W-RS02-C03

COVER WATERPROOFING (SEE DETAIL)
(VAPOUR BARRIER, THERMAL INSULATION,
AUTOPROTECTED WATERPROOFING MEMBRANE)

DETAIL F

Diagram of a square with side length a . Inside the square is a shaded octagonal hole. The octagon has parallel sides of length 50. The distance from the top-left corner of the square to the top-left corner of the octagon is 50. The distance from the top-right corner of the octagon to the top-right corner of the square is a .

Diagram illustrating the cross-section of a T-junction manhole structure, showing the concrete structure and the underlying compacted gravel base.

The structure is composed of the following layers and dimensions:

- Lean Concrete:** The upper structure, shown with diagonal hatching. It has a total height of 500 mm (400 mm vertical stem + 100 mm base).
- Compacted Gravel:** The base layer, shown with a pattern of circles, with a thickness of 300 mm.
- Dimensions:**
 - Top width of the stem: a
 - Vertical height of the stem: 400
 - Vertical height of the base: 400
 - Base width: 400
 - Thickness of the lean concrete base: 100
 - Thickness of the compacted gravel: 300

Diagram illustrating the cross-section of a roof penetration detail, showing the assembly of components and materials:

- GALVANIZED STEEL PIPE, #10cm
- GALVANIZED STEEL TEE, ND 100mm
- GALVANIZED STEEL BEND, ND 100mm
- SEALANT
- COLLAR
- CORNER REINFORCING STRIP 10cmx10cm
- SLEEVE
- FIXING PLATE
- CONCRETE MASS
- WATERPROOFING MEMBRANE (3)
- THERMAL INSULATION (2)
- VAPOUR BARRIER V.B. (1)
- STAINLESS STEEL MESH SCREEN 1mm THICK BETWEEN TWO FLANGES
- SLAB

Diagram illustrating the cross-section of a roof corner detail, showing the assembly of waterproofing and insulation layers. The diagram includes the following components and dimensions:

- DRIP**: A small channel or notch at the top of the vertical wall.
- CORNER REINFORCING STRIP**: A strip applied to the corner joint.
- AUTOPROTECTION (4)**: A layer of protection applied to the corner.
- THERMAL INSULATION (2)**: A layer of insulation applied to the horizontal surface.
- WATERPROOFING MEMBRANE (3)**: A layer of waterproofing applied to the horizontal surface.
- VAPOUR BARRIER**: A layer of vapor barrier applied to the horizontal surface.
- Dimensions**:
 - 450**: Vertical dimension of the wall.
 - h**: Horizontal dimension of the wall.
 - e**: Thickness of the wall and the horizontal surface.

CAPACITY	400M3
R (mm)	5000
0.25R (mm)	1250
e (mm)	250
R+e (mm)	5250
c (mm)	200
f (mm)	300
d (mm)	200
R+t+d (mm)	5450
a (mm)	400
b (mm)	400
h (mm)	500
n (VENTILATION PIPES)	3
n' (DRAIN WATER)	3
H (mm)	6600
g (mm)	800
j (mm)	1200

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER
SLAB; 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL ∇ YIELD STRESS: $F_y=420$ MPa.
MILD STEEL BARS : SYMBOL ϕ YIELD STRESS: $F_y=250$ MPa.

SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, $a=150\text{mm}$: 30 N/mm²
- ON A CYLINDER, $\phi=150\text{mm}$, $h=30\text{mm}$: 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.1 N/mm².

PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS
ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS
FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.

CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE

LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50 ϕ .
(ϕ = NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS $\phi 8$ SHALL BE USED ON EACH LAP.

Ø > 12mm MECHANICAL.
Ø < 12mm MANUEL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED

 TOP BARS
 BOTTOM BARS

ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK)

SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION,
A WATERPROOFING MEMBRANE AND ITS PROTECTION.

- (1) SL
 - SBS/OR/APP $\geq 2.5\text{mm}$
 - ADHERENCE OR SEMI-ADHERENCE APPLICATION
- (2) INSULATION
 - $t = \text{variable min. } t = 50\text{mm}$
 - EXPANDED POLYSTYRENE $\lambda = 0.037\text{kcal/h.m}^2\text{.C}$
 - WITH $\frac{1}{\lambda} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$
 - SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION ON VAPOUR BARRIER.
- (3) WATERPROOFING
 - SBS/OR/APP $t_{\text{total}} \geq 4\text{mm}$
 - WITH MINERAL PROTECTION.
 - SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
 - IN FACTORY MINERAL AUTOPROTECTION.
- (4) PROTECTION
 - (5) $n \geq 150\text{mm}$ (NILL SLOPE)

- * FLOOR SLAB INVERT LEVEL ± 0.00 : SEE LAYOUT DRAWINGS.
- * DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
- * HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
- * ALL THE DIMENSIONS ARE IN mm.
- * SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
- * PROVIDE PERFORATED DRAIN PIPES, $\phi 4"$ IN THE GRAVEL PROTECTION LAYER.

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION



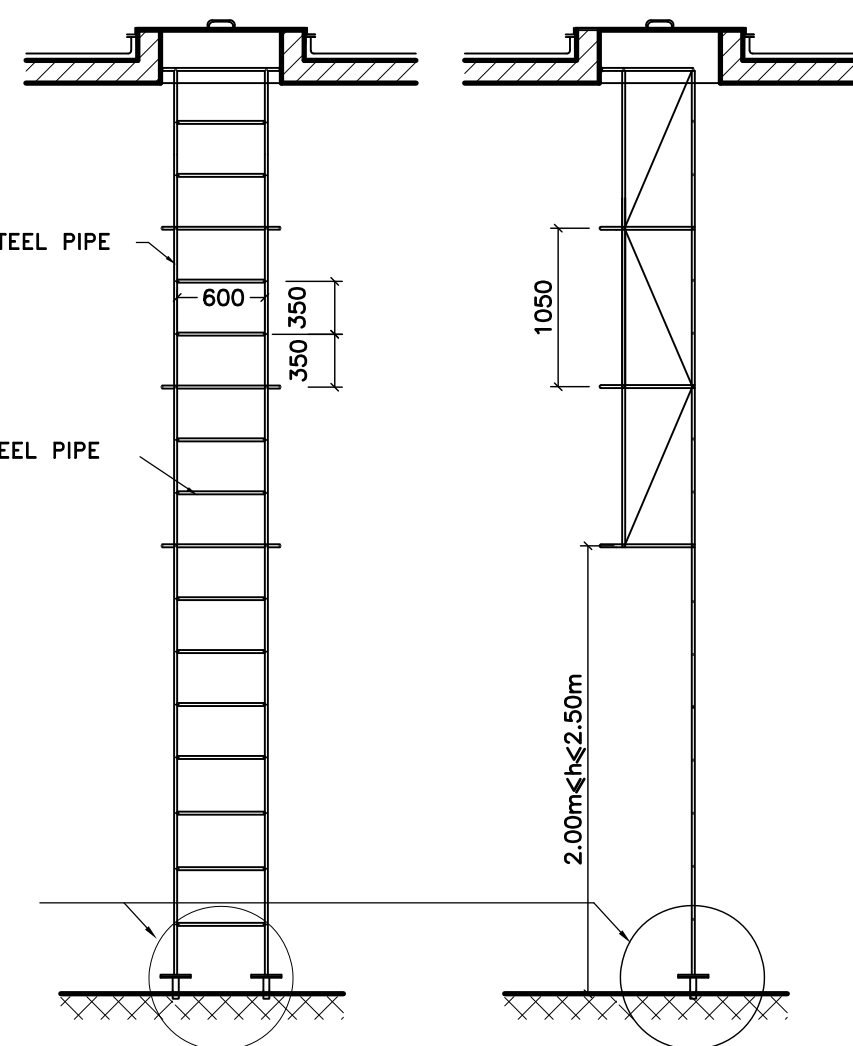
CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS RESERVOIRS (CAPACITY 2X400 m³)	DETAILS FORMWORK
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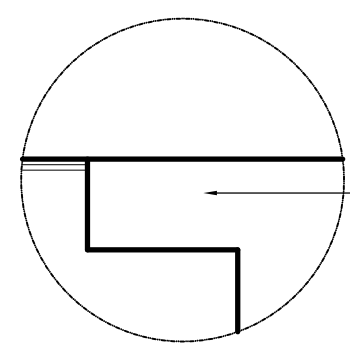
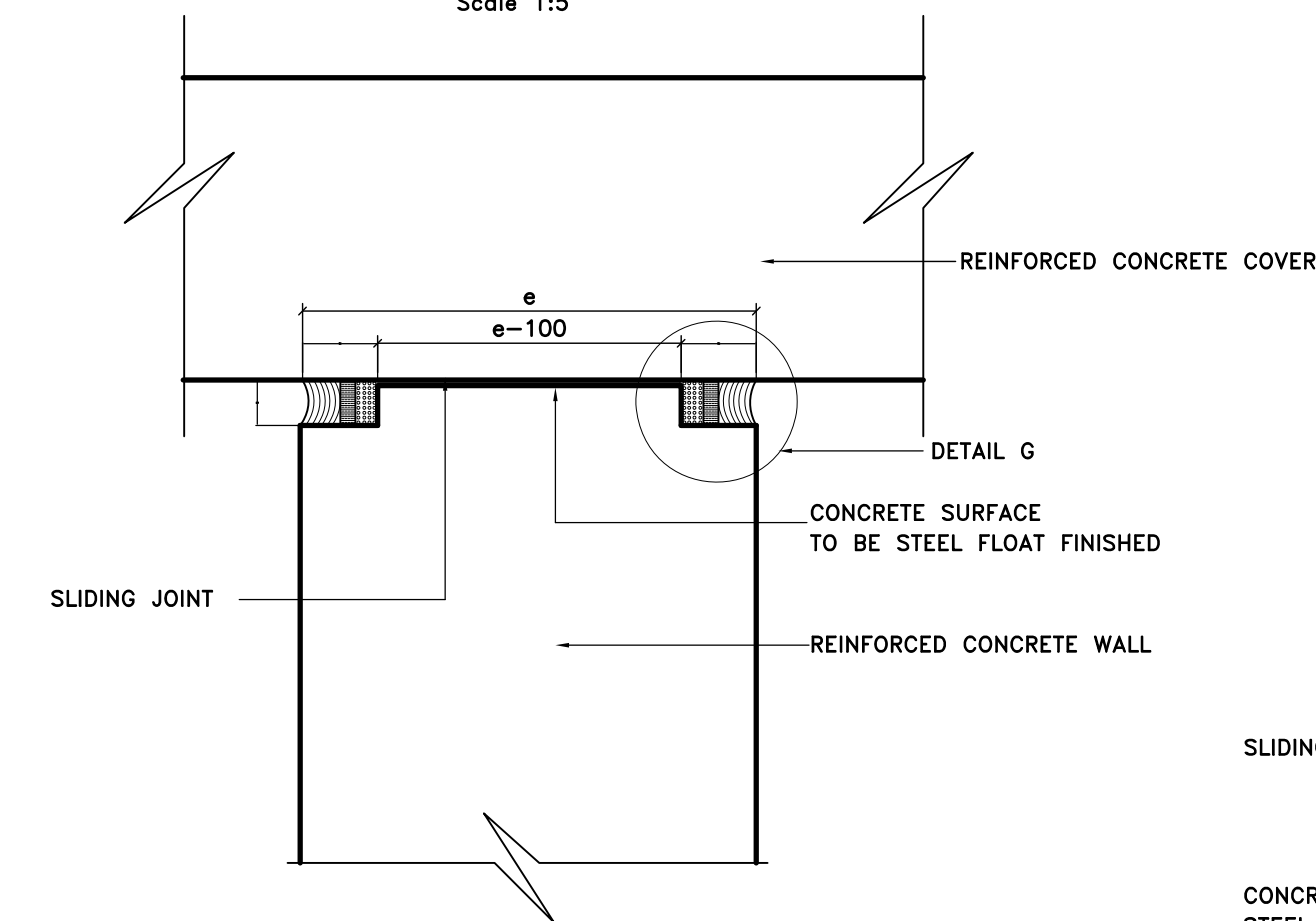
<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS02-C01-07	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
JULY 2019	1:50-1:20-1:10 1:5	4/7	509W-RS02-C04

FRONT VIEW
Scale 1:50

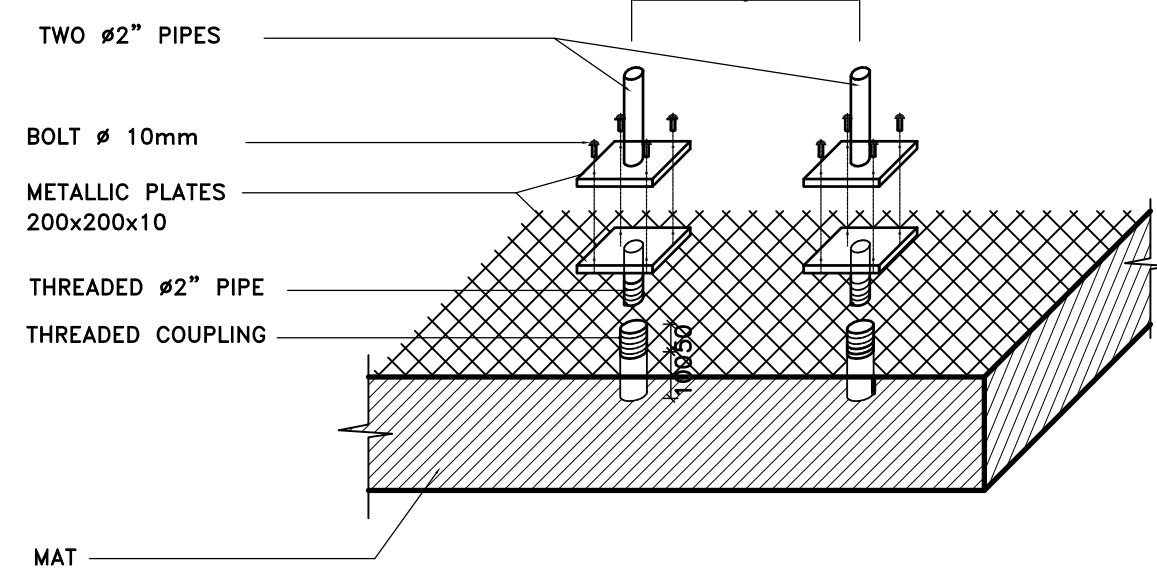


JOINT DETAIL
Scale 1:5



50x30 PERIPHERAL OPENING FILLED WITH RIGID
POLYSTYRENE PLACED PRIOR TO COVER CONCRETING

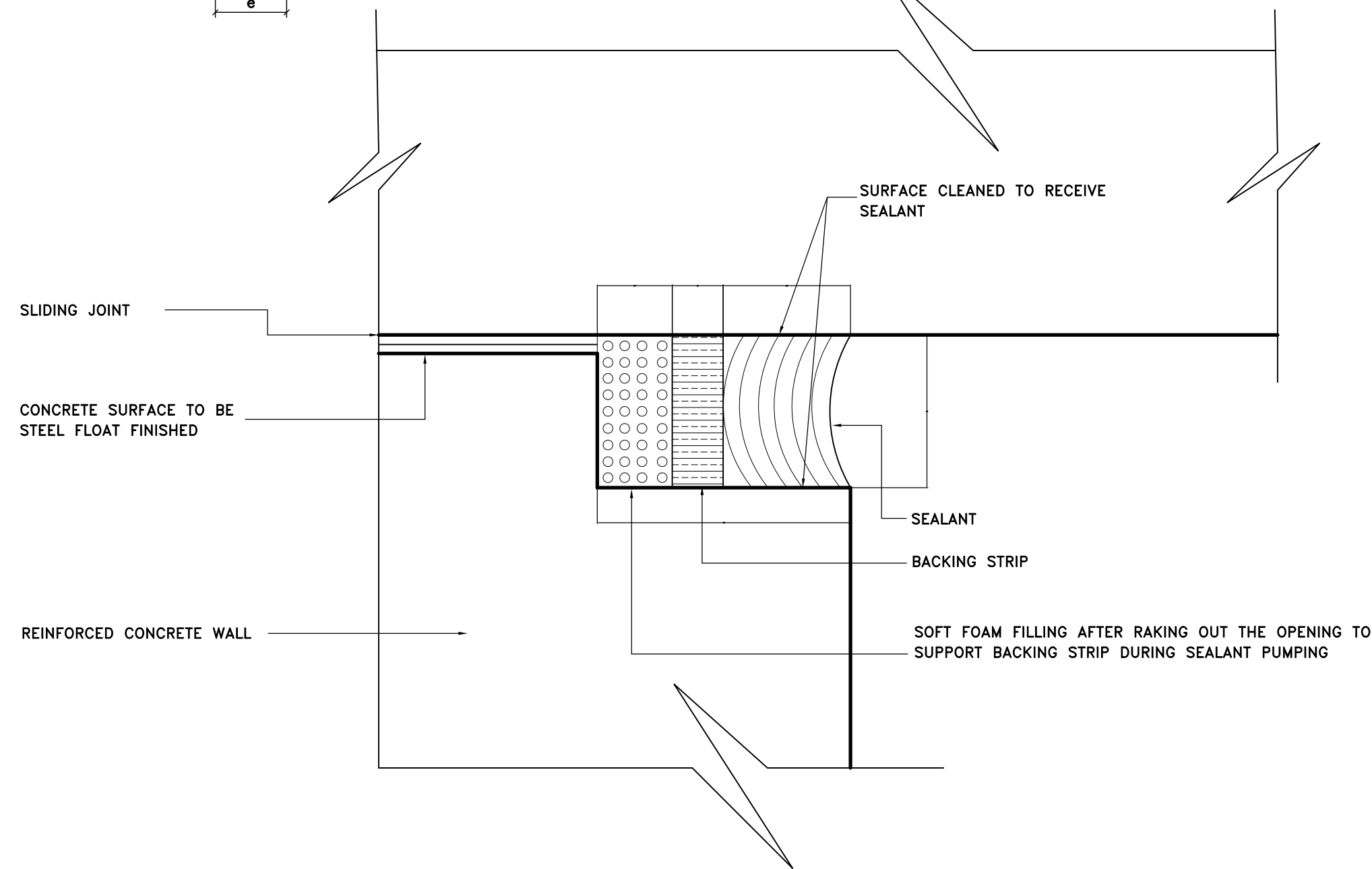
FIXING OF INTERNAL METALLIC LADDER DETAIL
Scale 1:20



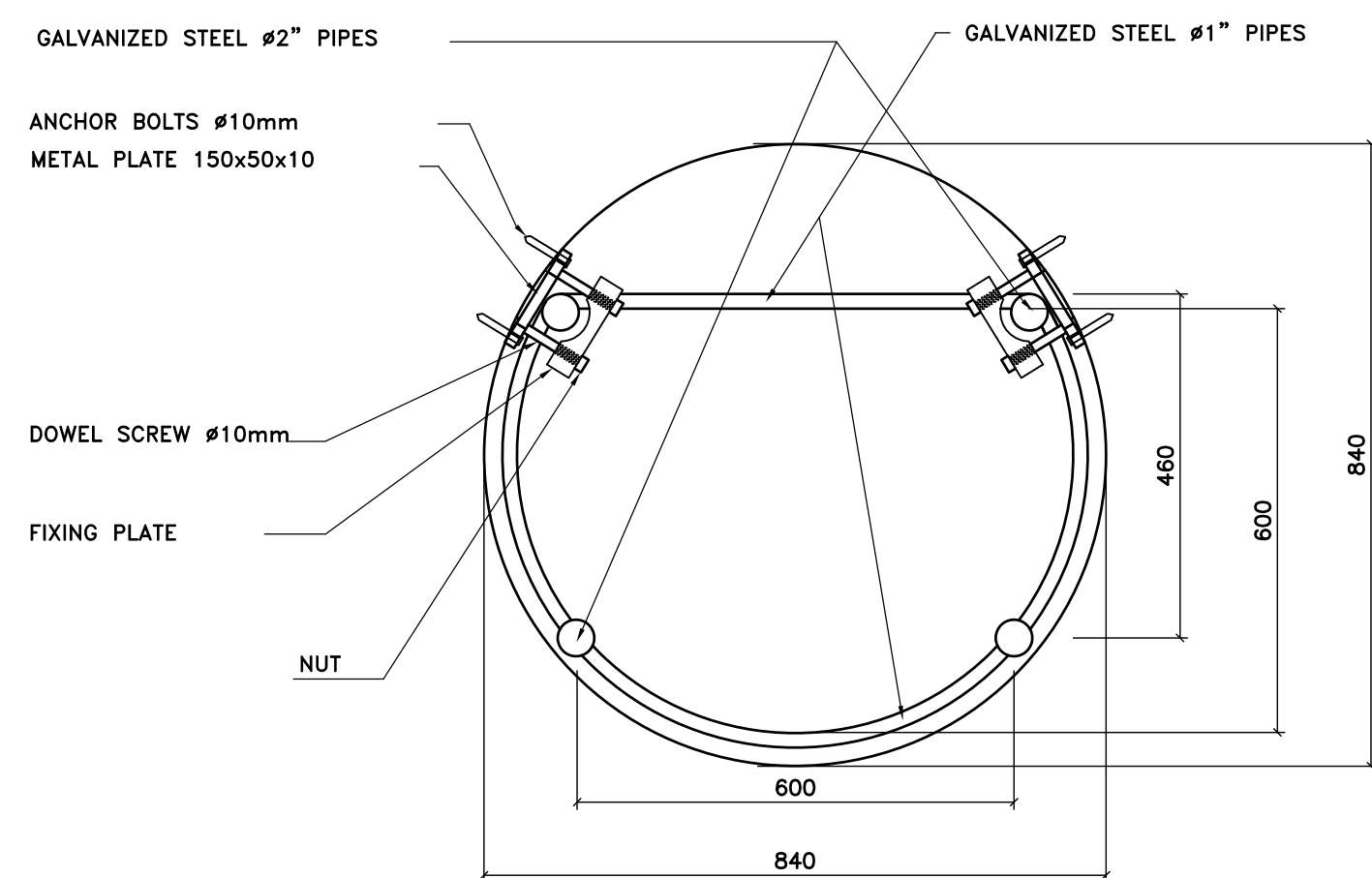
Technical drawing of a cross-section of a roof structure. The drawing shows a central metallic sheet (iron thickness = 3mm) supported by a concrete structure. The concrete structure has a total width of 400mm and a height of 150mm. The metallic sheet has a width of 840mm and a height of 270mm. The concrete structure is covered with waterproofing material. Dimensions are given in mm. Labels include: COVER WATERPROOFING, METALLIC SHEET-IRON THICKNESS= 3mm, and COVER WATER PROOFING.

DETAIL G
Scale 1:1

DETAIL G
Scale 1:1



DETAIL OF INTERNAL LADDER AND UPPER FIXING
PLAN VIEW



Scale 1:50

VARIABLE HEIGHT ACCORDING TO GROUND LEVEL AND RESERVOIR HEIGHT

40 960 40 990 40 990 40 990 40 990

2mshk(2.50m)

400 500

VAR. ACCORDING TO G.L.

ANCHOR BOLT #10 L=100

STEEL PROFILE L 60x40x5 (SEE DETAIL 5)

700 550 1150 1150 1150

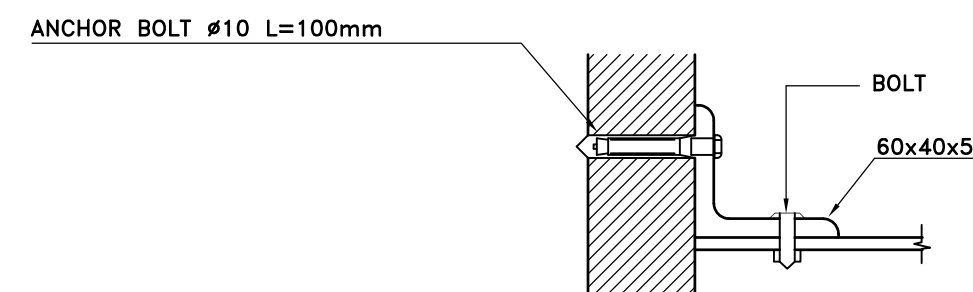
LADDER:
UPRIGHTS: 40x10 FLAT BARS
RUNGS: #26.9 \pm 2.3
MASONRY FIXINGS: 40x6 FLAT BARS

SAFETY HOOP:
UPRIGHTS: 40x4 FLAT BARS
HOOPS: 40x4 FLAT BARS # INTERIOR= 700

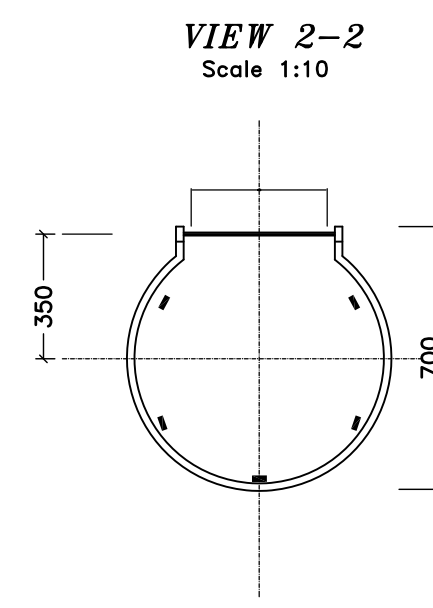
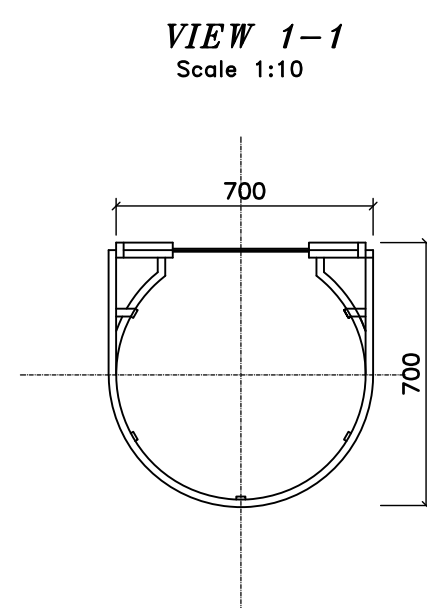
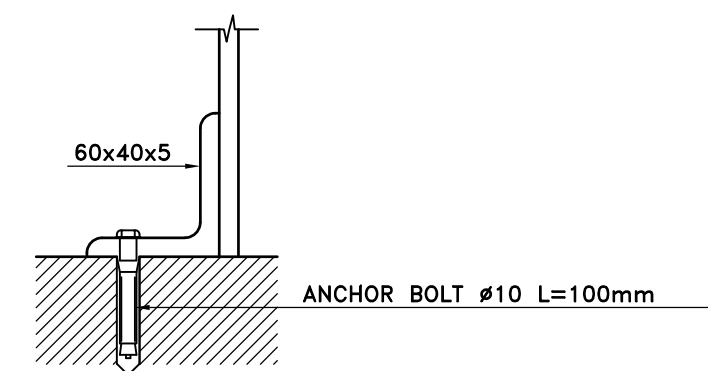
BRACING

N.B.: - IN CASE OF LACK OF STIFFNESS, 50x6 FLAT BARS SHALL BE USED AS BRACINGS TO THE SAFETY HOOP

DETAIL 4: FIXING OF EXTERNAL LADDER TO RESERVOIR WALLS



DETAIL 3: FIXING OF EXTERNAL LADDER TO CONCRETE



REMARKS:

- * FLOOR SLAB INVERT LEVEL ± 0.00 : SEE LAYOUT DAWINGS.
- * DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
- * HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL APPLICATION METHODS.
- * ALL THE DIMENSIONS ARE IN mm.
- * SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
- * PROVIDE PERFORATED DRAIN PIPES, $\phi 4"$ IN THE GRAVEL PROTECTION LAYER.

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>
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REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION



BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg
P.O.BOX:70492 - ANTELIAS

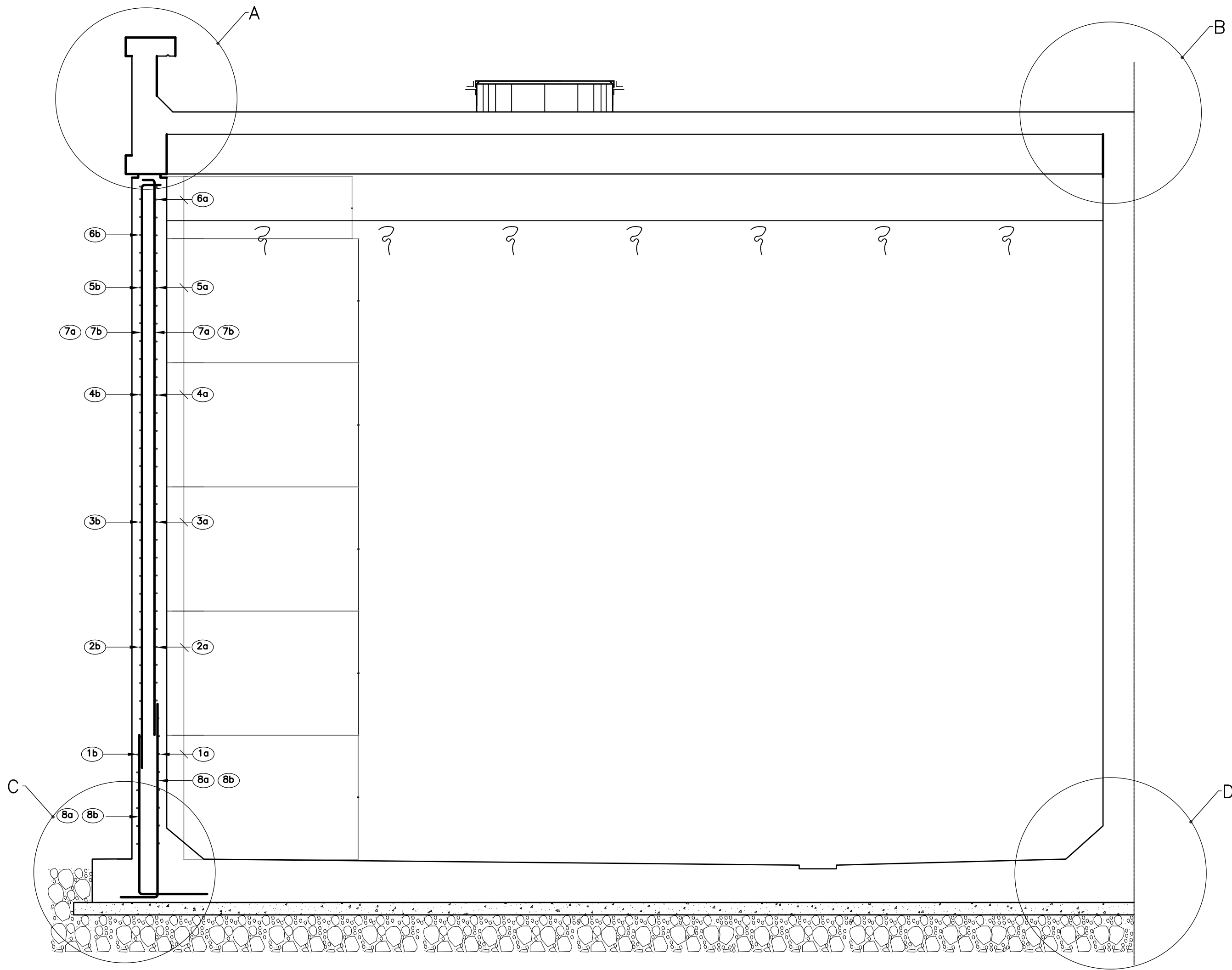
PHONE:(04) 712157/712158 (03) 291016
FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM-QABB ELIAS AND MRAIJAT

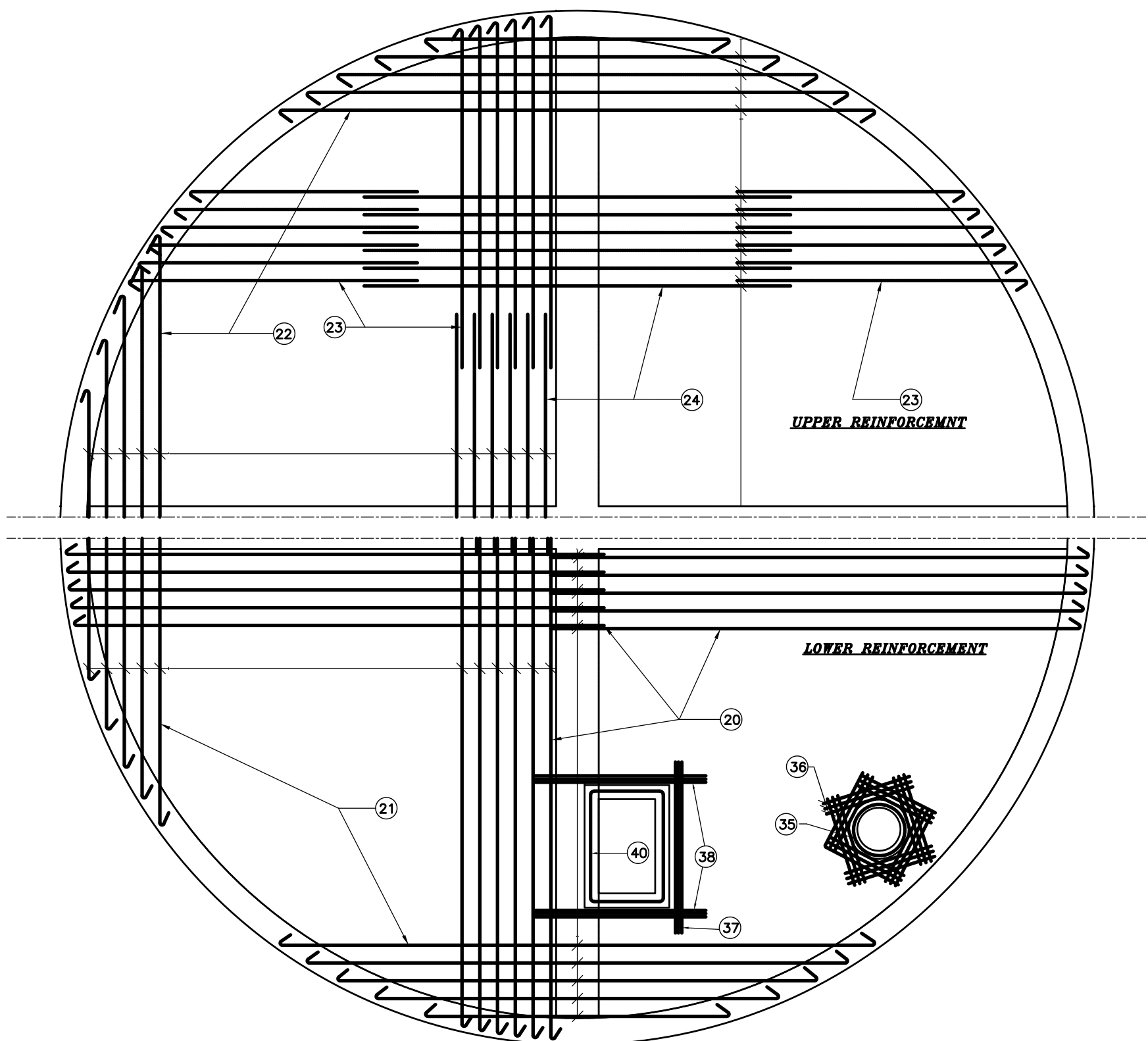
<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS02-C01-07	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
JULY 2019	1:50-1:20-10 1:5-1:1	5/7	509W-RS02-C05

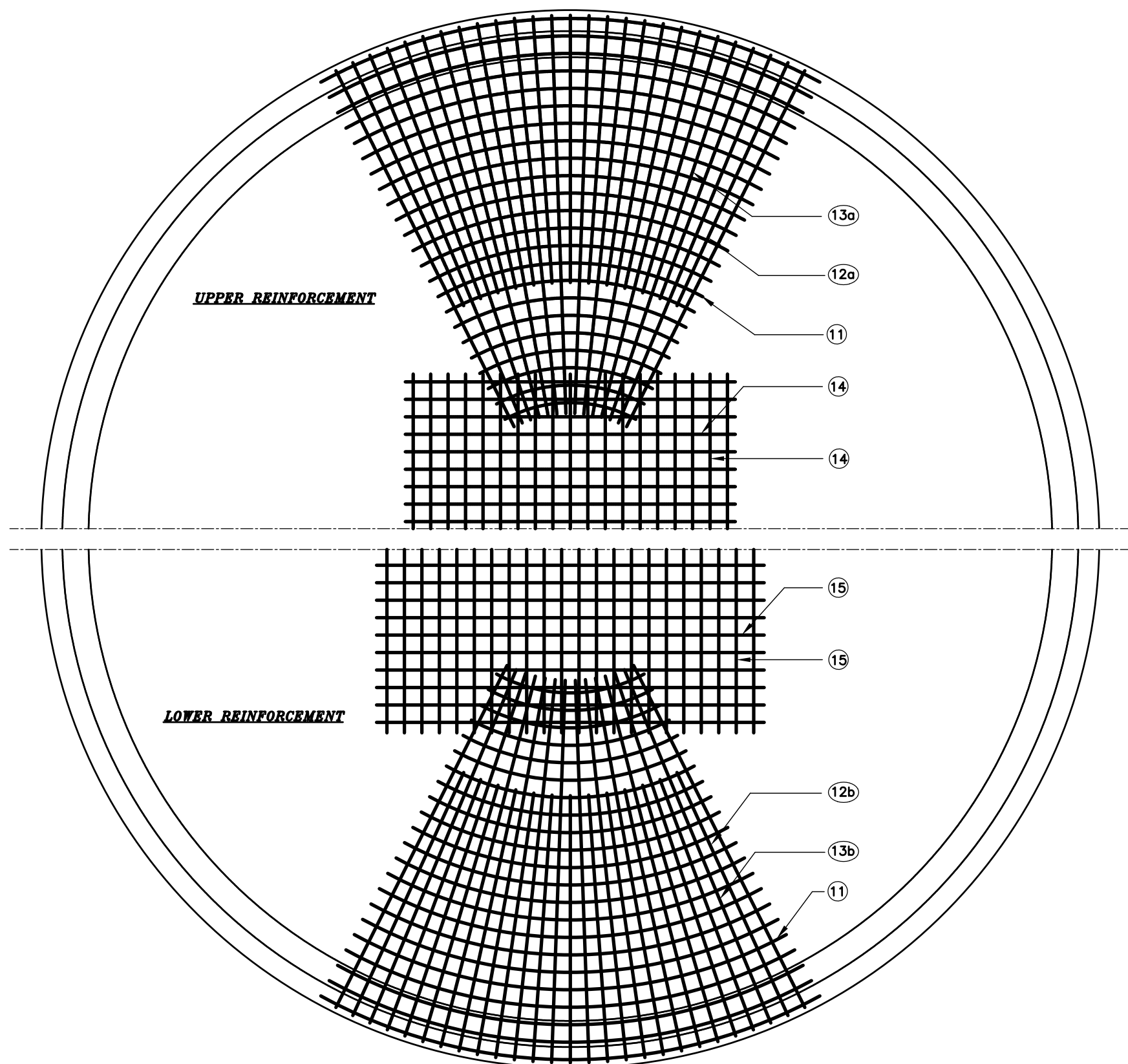
VERTICAL HALF-SECTION REINFORCEMENT



COVER SLAB REINFORCEMENT



MAT REINFORCEMENT



CAPACITY 400

Des	Nbr of layer per ml	Diameter T or Ø	Length (m)	Nbre of bars/layer	Type	Total Nber of bars
1a	6	T14	8.70	4		24
1b	6	T14	8.90	4		24
2a	5	T14	8.70	4		20
2b	5	T14	8.90	4		20
3a	7	T12	8.70	4		28
3b	7	T12	8.90	4		28
4a	6	T12	8.70	4		24
4b	6	T12	8.90	4		24
5a	6	T12	8.70	4		24
5b	6	T12	8.90	4		24
6a	6	T12	8.70	4		12
6b	6	T12	8.90	4		12
7a	3	T12	4.00			198
7b	3	T12	4.50			198
8a	3	T14	2.80			198
8b	3	T14	2.30			198
9a	6	T14	2.00			198
9b	2 (Per section)	T12	8.15	4		8
10a	6	T12	0.50			198
10b	6	T14	1.00			198
11	7	T16	2.70 to 8.20	4		240
12a	3	T16	2.90			99
12b	3	T16	3.00			99
13a	3	HA16	4.20			99
13b	3	HA16	4.40			99
14	7	HA16	3.15			44
15	8	HA16	3.70			64
16	8 (Per section)	HA12	6.00			8
17a	6	Ø8	1.50			35
17b	6	Ø8	1.35			35
18a	8 (Per section)	T12	2.40			8
18b	1 (Per section)	T12	2.75			1
19	8 (Per section)	T12	1.50			8
20	6	T14	3.35 to 5.45	2		212
21	6	T14	2.70 to 6.20	1		24
22	6	T12	2.70 to 6.20	1		24
23	6	T12	1.80 to 3.80	2		212
24	6	T12	4.00	1		106
25a	4 (Per section)	T20	6.00	2		16
25b	4 (Per section)	T20	4.00	2		16
26	4 (Per section)	T16	3.50	2		16
27a	4 (Per section)	T25	6.25	1		8
27b	4 (Per section)	2T25+2T20	3.75	1		8
28	-	-	-	-	-	-
29a	Ø8	1.70	n1=10x12 n2=11x20	0.52		128
29b	Ø8	1.50	n1=10x12 n2=11x20	0.53		128
29c	-	-	-	-	-	-
30	-	-	-	-	-	-
31a	15 (Per section)	T12	8.50 to 8.80	4		60
31b	8 (Per section)	T12	8.50 to 8.80	4		32
31c	5	Ø8	0.80	-		165
32	5	Ø8	1.00			165
33a	5	Ø8	3.00			165
33b	5	Ø8	0.90			165
34	4 (Per section)	T10	3.25 to 4.00	1		4
35	5	Ø8	1.10			15
36		T12	1.50			48
37		T14	3.00			3
38		T12	2.60			6
39		T10	2.60			3
40		T10	2.40			6
41	8 (Per section)	T10	1.30 to 1.70			24
42	5	Ø8	1.50			23

NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:

CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:

ORDINARY PORTLAND CEMENT(400 kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB, 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:

MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS : SYMBOL T YIELD STRESS: Fy=420 MPa
MILD STEEL BARS : SYMBOL Ø YIELD STRESS: Fy=250 MPa

STRESSES:

SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:

- ON A CUBE, a=150mm : 30 N/mm2
- ON A CYLINDER, Ø=150mm, h=30mm : 25 N/mm2
CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.1 N/mm2.

CONSTRUCTION JOINTS:

PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:

SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.

CONCRETE COVER:

CLEARANCE BETWEEN THE EXTERNAL GENERATIVITY OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:

LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x5Øp.
(Øp= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS Ø8 SHALL BE USED ON EACH LAP.

BENDING:

Ø > 12mm MECHANICAL.
Ø ≤ 12mm MANUEL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:

TOP BARS
BOTTOM BARS

FORMWORK:

ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:

- Y.B.
 - SBS/OR/APP t≥2.5mm
 - ADHERENCE OR SEMI-ADHERENCE APPLICATION
- INSULATION
 - t=variable min. t=50mm
 - EXPANDED POLYSTYRENE λ=0.037kcal/h.m.2.°C
 - WITH $\frac{1}{\lambda} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$
 - SEMI-ADHERENCE OR TOTAL ADHERENCE
- WATERPROOFING
 - APPLICATION ON VAPOUR BARRIER.
 - SBS/OR/APP ttotal ≥4mm
 - WITH MINERAL PROTECTION.
 - SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
- PROTECTION
 - IN FACTORY MINERAL AUTOPROTECTION.
- n> 150mm (NULL SLOPE)

REMARKS:

- FLOOR SLAB INVERT LEVEL ±0.00. SEE LAYOUT DAWNING.
- DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
- HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
- ALL THE DIMENSIONS ARE IN mm.
- SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
- PROVIDE PERFORATED DRAIN PIPES, Ø4" IN THE GRAVEL PROTECTION LAYER.

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

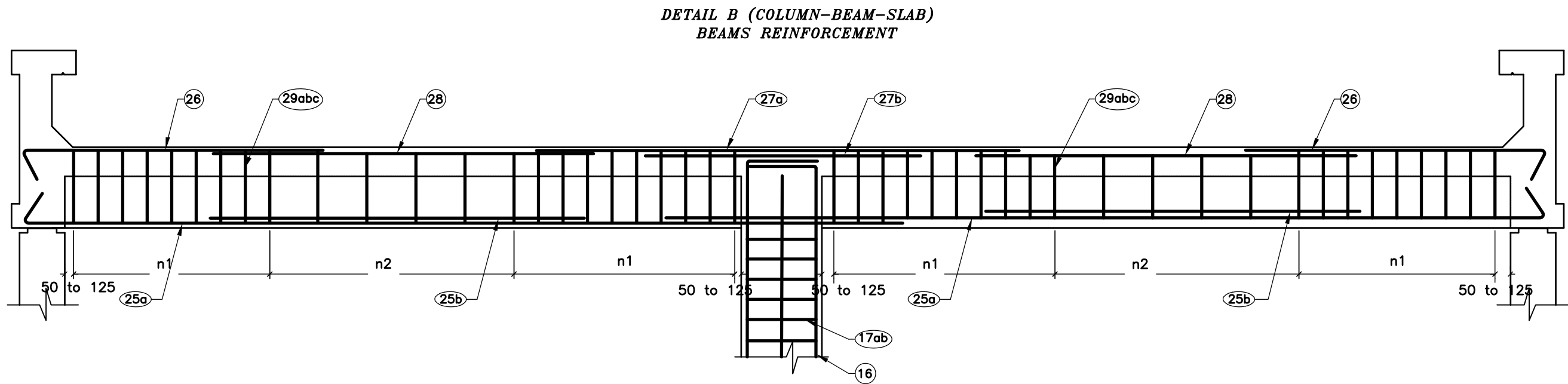
ED BUREAU TECHNIQUE POUR LE DEVELOPPMENT
JALL ED DIB – HAJAL Bldg P.O.BOX:70492 – ANTELAS
PHONE:(04) 712157/712158 (03) 291016
FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS RESERVOIRS
(CAPACITY 2X400 m³)

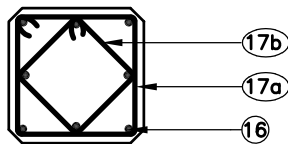
VERTICAL HALF-SECTION AND PLANS
REINFORCEMENT

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-C01-07	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S.	6/7	509W-RS02-C06

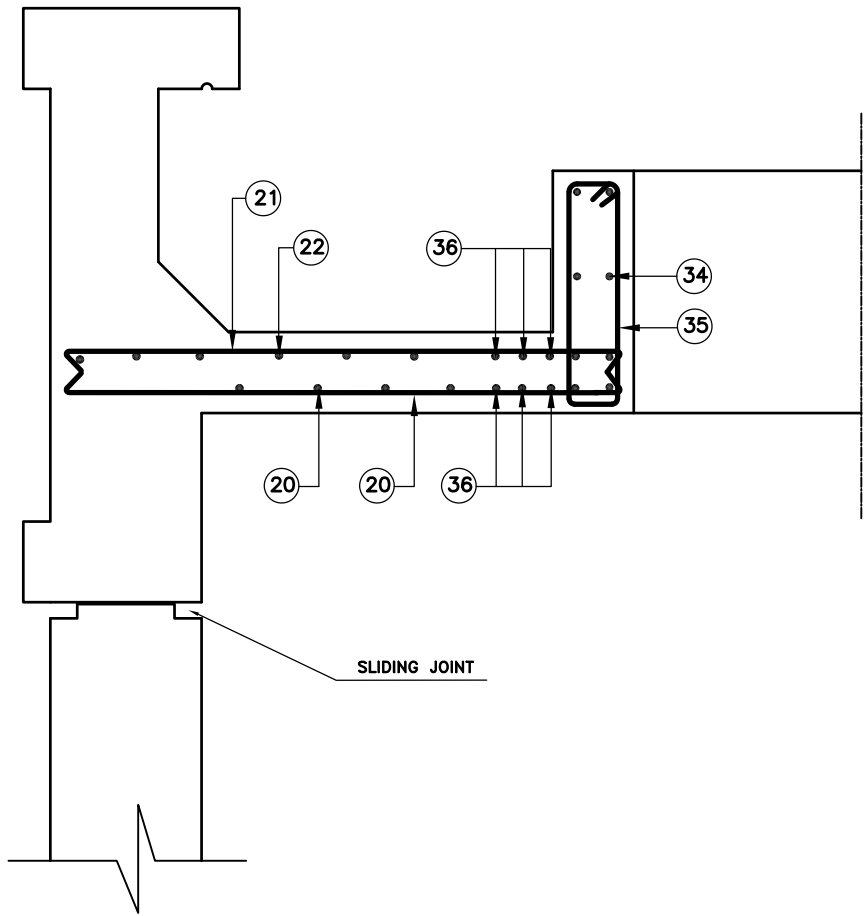


COLUMN REINFORCEMENT

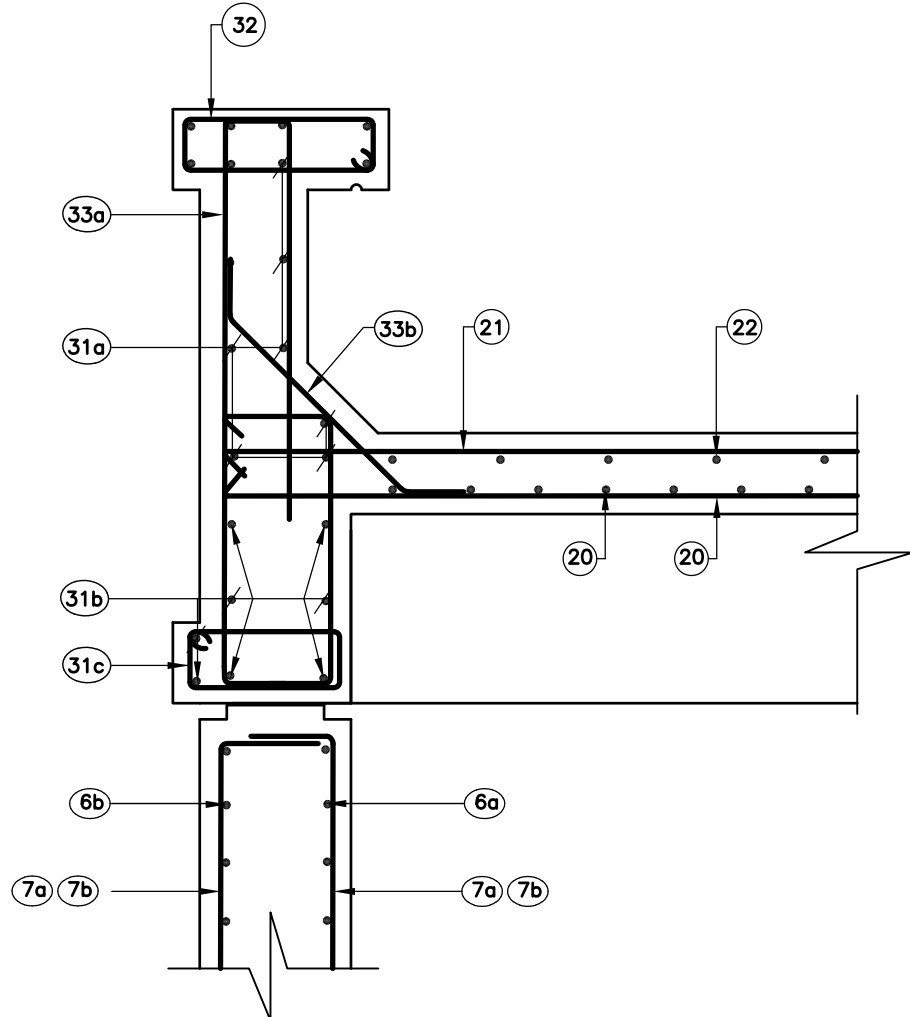
SECTION AT MID SPAN



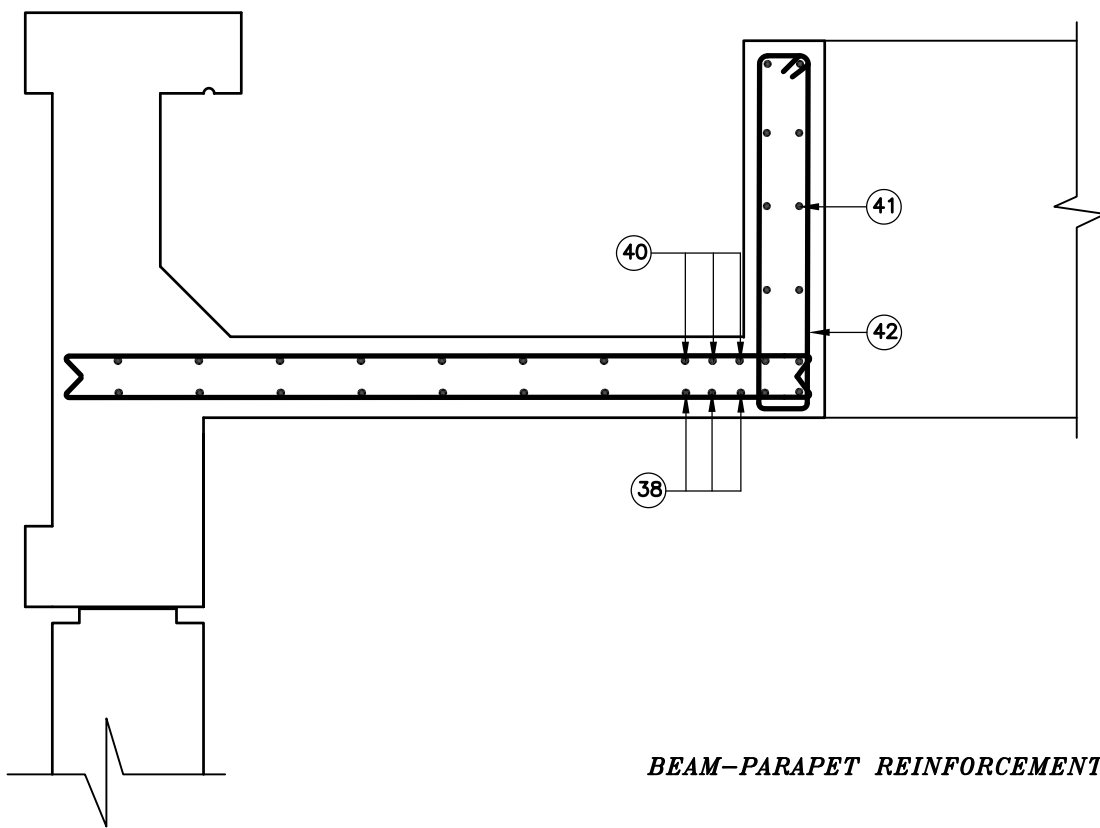
SLAB-TRAP DOOR REINFORCEMENT



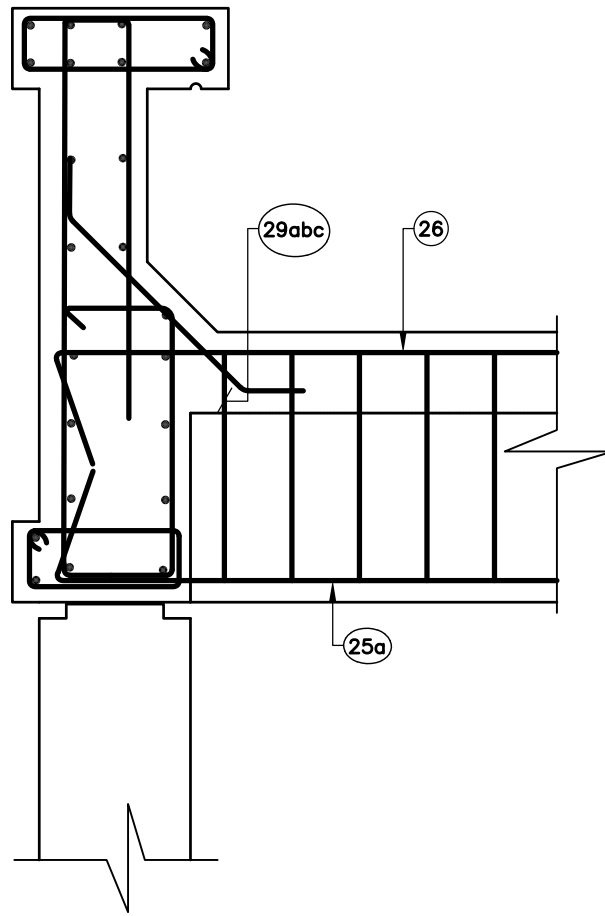
DETAIL A
SLAB-PARAPET REINFORCEMENT



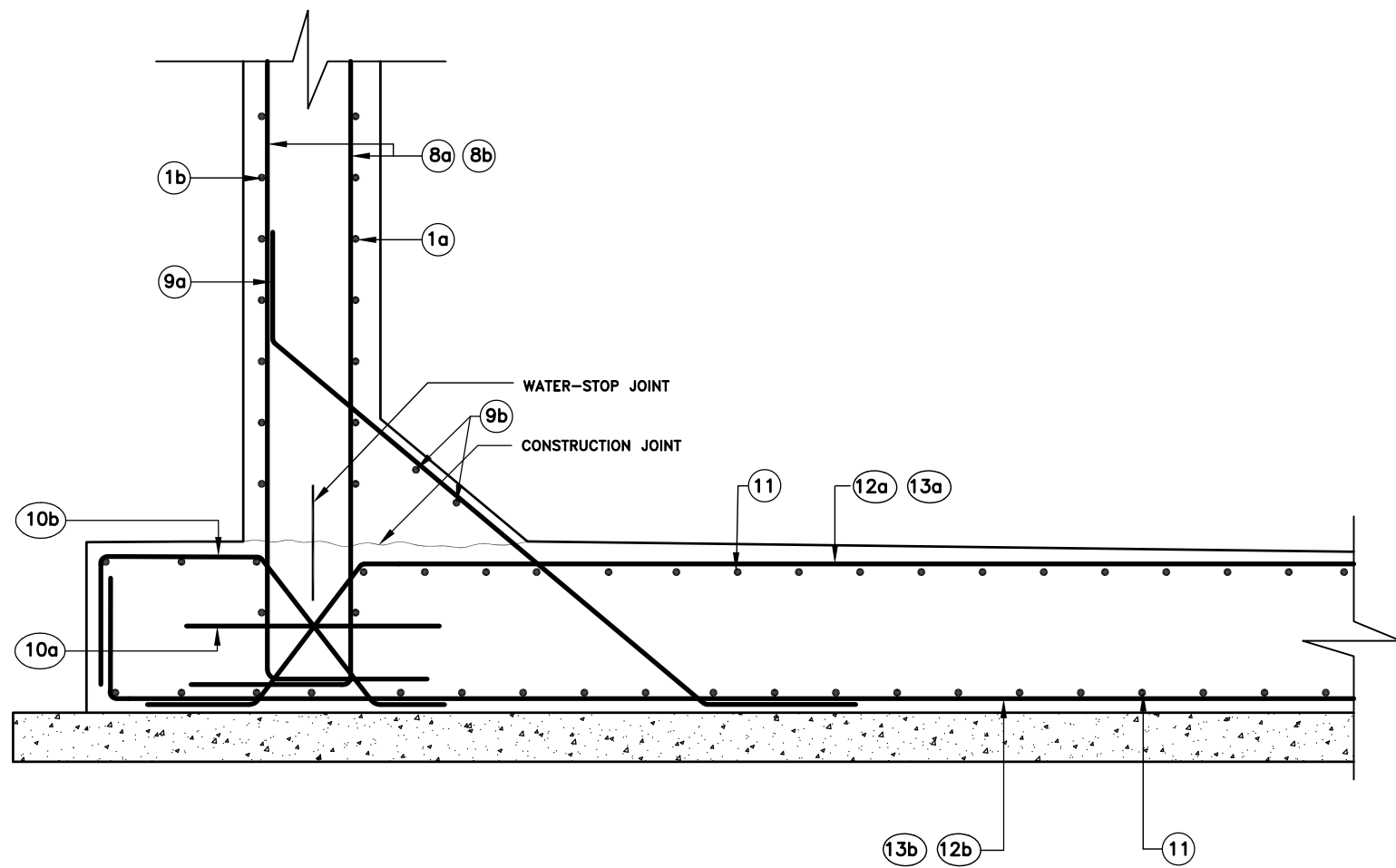
DETAIL F
FLOAT TRAP-DOOR SECTION



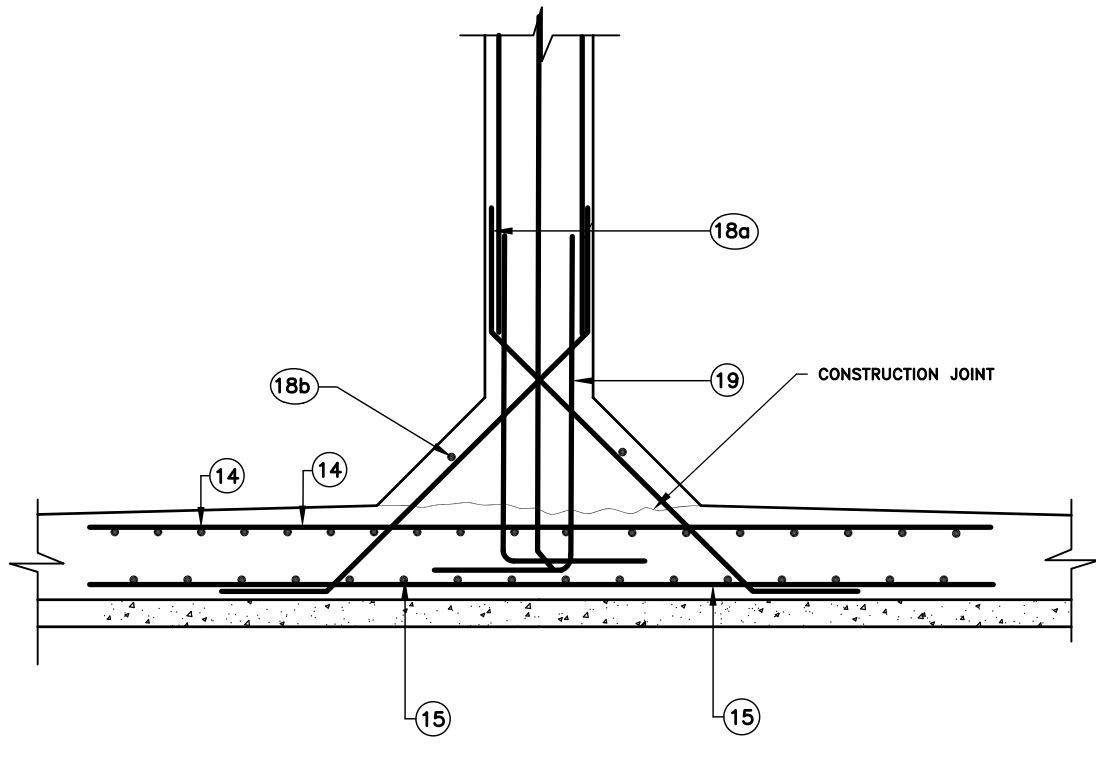
BEAM-PARAPET REINFORCEMENT



DETAIL C
MAT-WALL REINFORCEMENT



DETAIL D
COLUMN-MAT REINFORCEMENT



CAPACITY 400									
Des.	Nbr of layer per ml	Diameter T or Ø	Length (m)	Nbre of bars/layer	Type	total Nber of bars			
1a	6	T14	8.70	4	8.70	24			
1b	6	T14	8.90	4	8.90	24			
2a	5	T14	8.70	4	8.70	20			
2b	5	T14	8.90	4	8.90	20			
3a	7	T12	8.70	4	8.70	28			
3b	7	T12	8.90	4	8.90	28			
4a	6	T12	8.70	4	8.70	24			
4b	6	T12	8.90	4	8.90	24			
5a	6	T12	8.70	4	8.70	24			
5b	6	T12	8.90	4	8.90	24			
6a	6	T12	8.70	4	8.70	12			
6b	6	T12	8.90	4	8.90	12			
7a	3	T12	4.00		3.80	198			
7b	3	T12	4.50		4.30	198			
8a	3	T14	2.80		2.40	198			
8b	3	T14	2.30		1.90	198			
9a	6	T14	2.00		1.10 0.45	198			
9b	2 (Per section)	T12	8.15	4	8.15	8			
10a	6	T12	0.50		0.50	198			
10b	6	T14	1.00		0.25 0.18 0.36 0.40	198			
11	7	T16	2.70 to 3.20	4	2.70 to 3.20 1.35 to 1.40	240			
12a	3	T16	2.90		0.15 0.36 0.45	99			
12b	3	T16	3.00		0.20 2.80	99			
13a	3	HA16	4.20		0.15 0.36 0.75	99			
13b	3	HA16	4.40		0.20 4.30	99			
14	7	HA16	3.15		3.15	44			
15	8	HA16	3.70		3.70	64			
16	8 (Per section)	HA12	6.00		0.35 5.80	8			
17a	6	#8	1.50		0.35 0.35	35			
17b	6	#8	1.35		0.35 0.28	35			
18a	8 (Per section)	T12	2.40		0.45 1.50 0.45	8			
18b	1 (Per section)	T12	2.75		0.65 0.65	1			
19	8 (Per section)	T12	1.50		0.45 1.10	8			
20	6	T14	3.35 to 3.45	2	3.35 to 3.35 0.35 0.40	212			
21	6	T14	2.70 to 3.20	1	2.70 to 3.20 0.35 0.40	24			
22	6	T12	2.70 to 3.20	1	2.70 to 3.20 0.35 0.40	24			
23	6	T12	1.80 to 3.80	2	1.80 to 3.80 1.50 to 3.70	212			
24	6	T12	4.00	1	4.00	106			
25a	4 (Per section)	T20	6.00	2	0.25 5.80	16			
25b	4 (Per section)	T20	4.00	2	0.35 4.00	16			
26	4 (Per section)	T16	3.50	2	3.25 3.25	16			
27a	4 (Per section)	T25	6.25	1	6.25	8			
27b	4 (Per section)	2725+ 2720	3.75	1	3.75	8			
28	-	-	-	-	-	-			
29a	#8	1.70	n1=10x0.12 n2=11x0.20	0.32	0.42	128			
29b	#8	1.50	n1=10x0.12 n2=11x0.20	0.23	0.42	128			
29c	-	-	-	-	-	-			
30	-	-	-	-	-	-			
31a	15 (Per section)	T12	8.50 to 8.80	4	8.50 to 8.80 1.05 to 1.15 0.50 to 0.55	60			
31b	8 (Per section)	T12	8.50 to 8.80	4	8.50 to 8.80 1.05 to 1.15	32			
31c	5	#8	0.80	-	0.09 0.84	165			
32	5	#8	1.00		0.09 0.34	165			
33a	5	#8	3.00		0.13 0.50 1.00 0.14	165			
33b	5	#8	0.90		0.30 0.50 0.20	165			
34	4 (Per section)	T10	3.25 to 4.00	1	3.25 to 4.00 0.45 to 0.55	4			
35	5	#8	1.10		0.08 0.41	15			
36		T12	1.50		1.50	48			
37		T14	3.00		3.00	3			
38		T12	2.60		2.60	6			
39		T10	2.60		2.60	3			
40		T10	2.40		2.40	6			
41	8 (Per section)	T10	1.30 to 1.70		1.30 to 1.70	24			
42	5	#8	1.50		0.08 0.58	23			

NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB; 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 MPa.
MILD STEEL BARS: SYMBOL # YIELD STRESS: Fy=250 MPa.

STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, ø=150mm: 30 N/mm²
- ON A CYLINDER, ø=150mm, h=30mm: 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS: 2.1 N/mm².

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50ø.
(ø= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.

BENDING:
ø > 12mm MECHANICAL.
ø ≤ 12mm MANUEL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:
--- TOP BARS
--- BOTTOM BARS

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) S.B. - SBS/OR/APP (≥2.5mm)
(2) INSULATION - ADHERENCE OR SEMI-ADHERENCE APPLICATION
- t=variable min. t=50mm
- EXPANDED POLYSTYRENE λ=0.037kcal/h.m².°C
- WITH t = L1 + L2
λ λ1 λ2
(3) WATERPROOFING - SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION ON VAPOUR BARRIER.
- SBS/OR/APP ttotal ≥4mm WITH MINERAL PROTECTION.
(4) PROTECTION - SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
- IN FACTORY MINERAL AUTOPROTECTION.
(5) H"> 150mm (NIL SLOPE)

REMARKS:
* FLOOR SLAB INVERT LEVEL ±0.00: SEE LAYOUT DRAWINGS.
* DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL THE DIMENSIONS ARE IN mm.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* PROVIDE PERFORATED DRAIN PIPES, ø4" IN THE GRAVEL PROTECTION LAYER.

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPEMENT
JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN

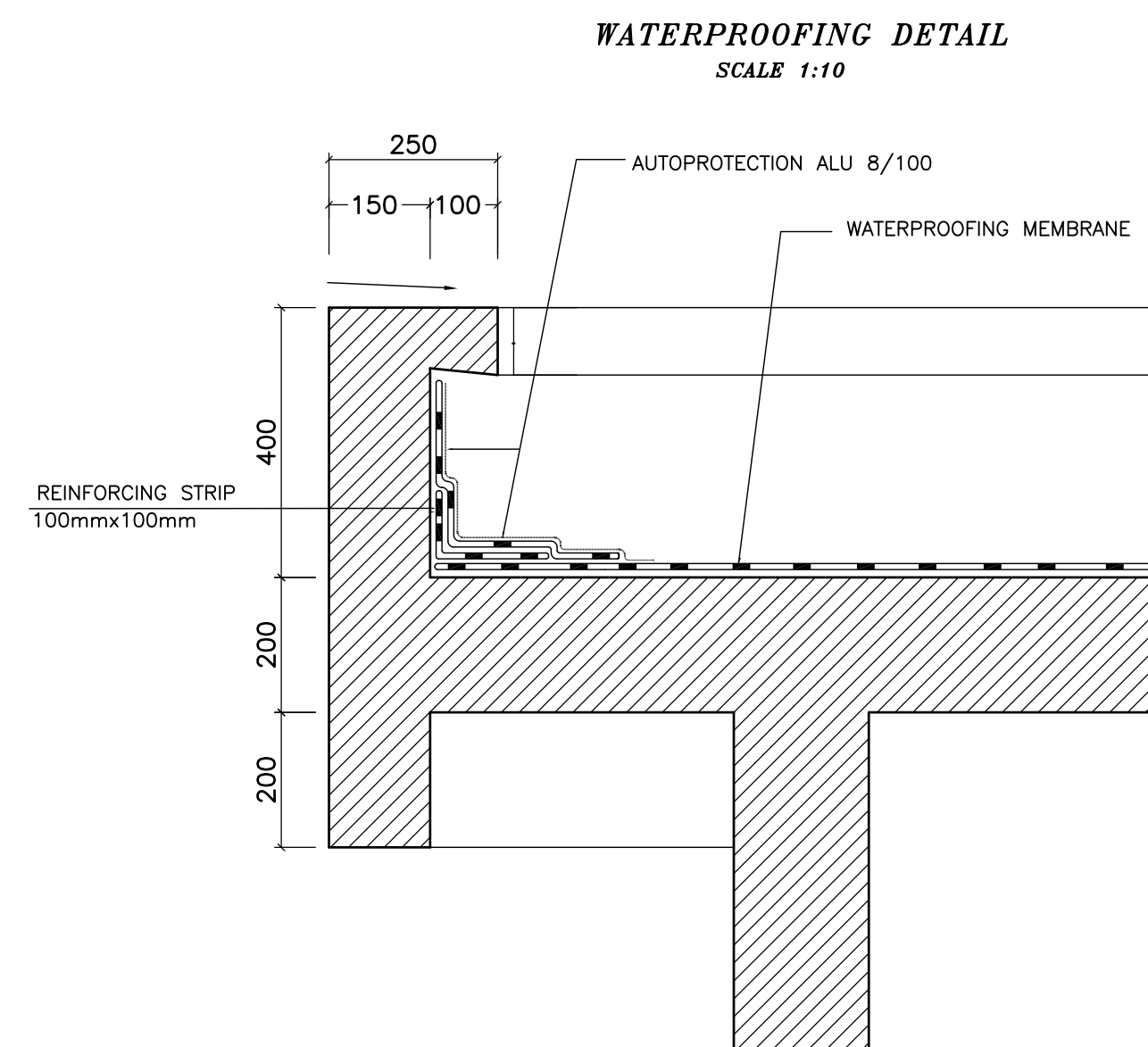
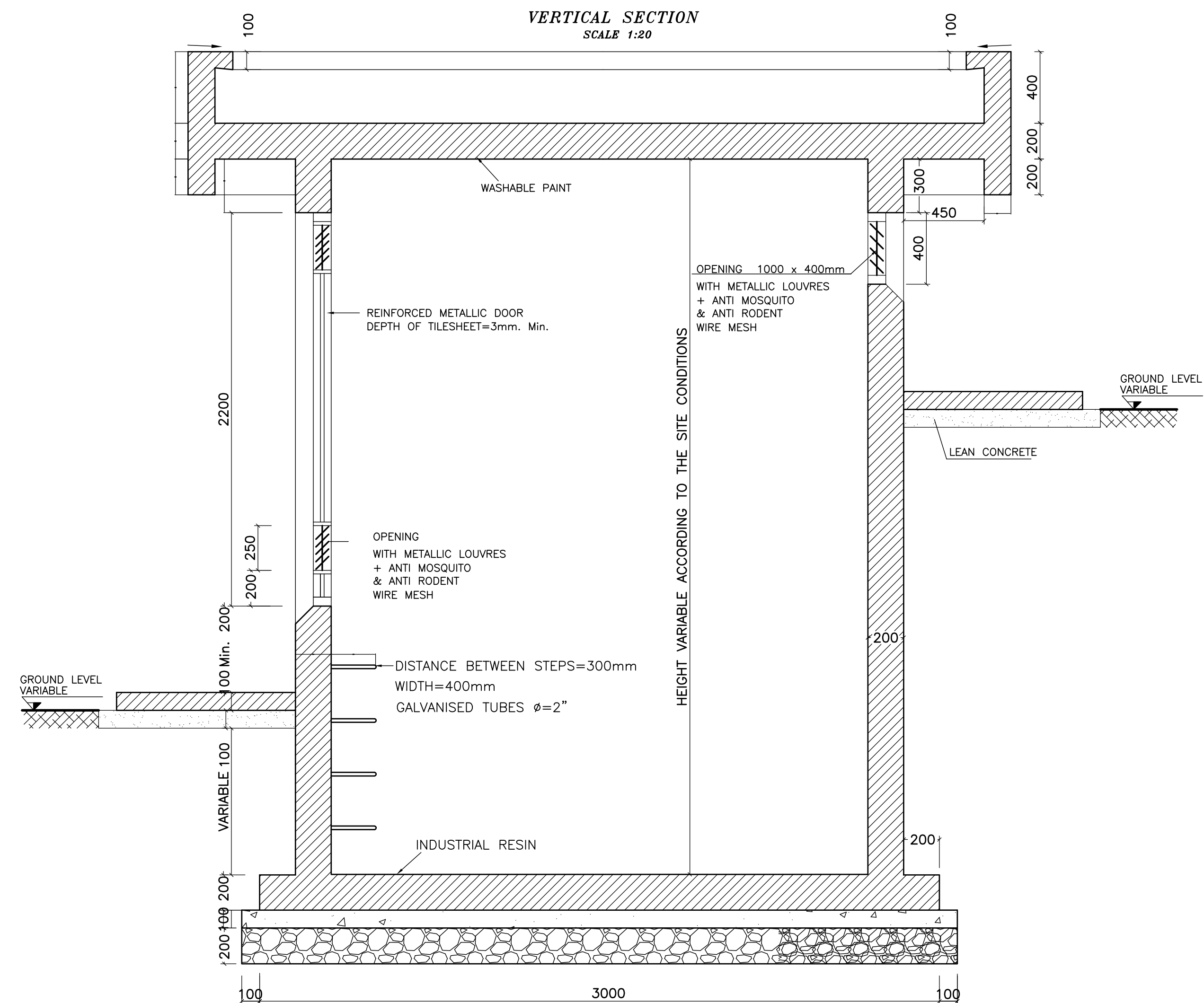
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS RESERVOIRS
(CAPACITY 2X400 m³)

SECTIONS AND DETAILS
REINFORCEMENT

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-C01-07	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S.	7/7	509W-RS02-C07



<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>
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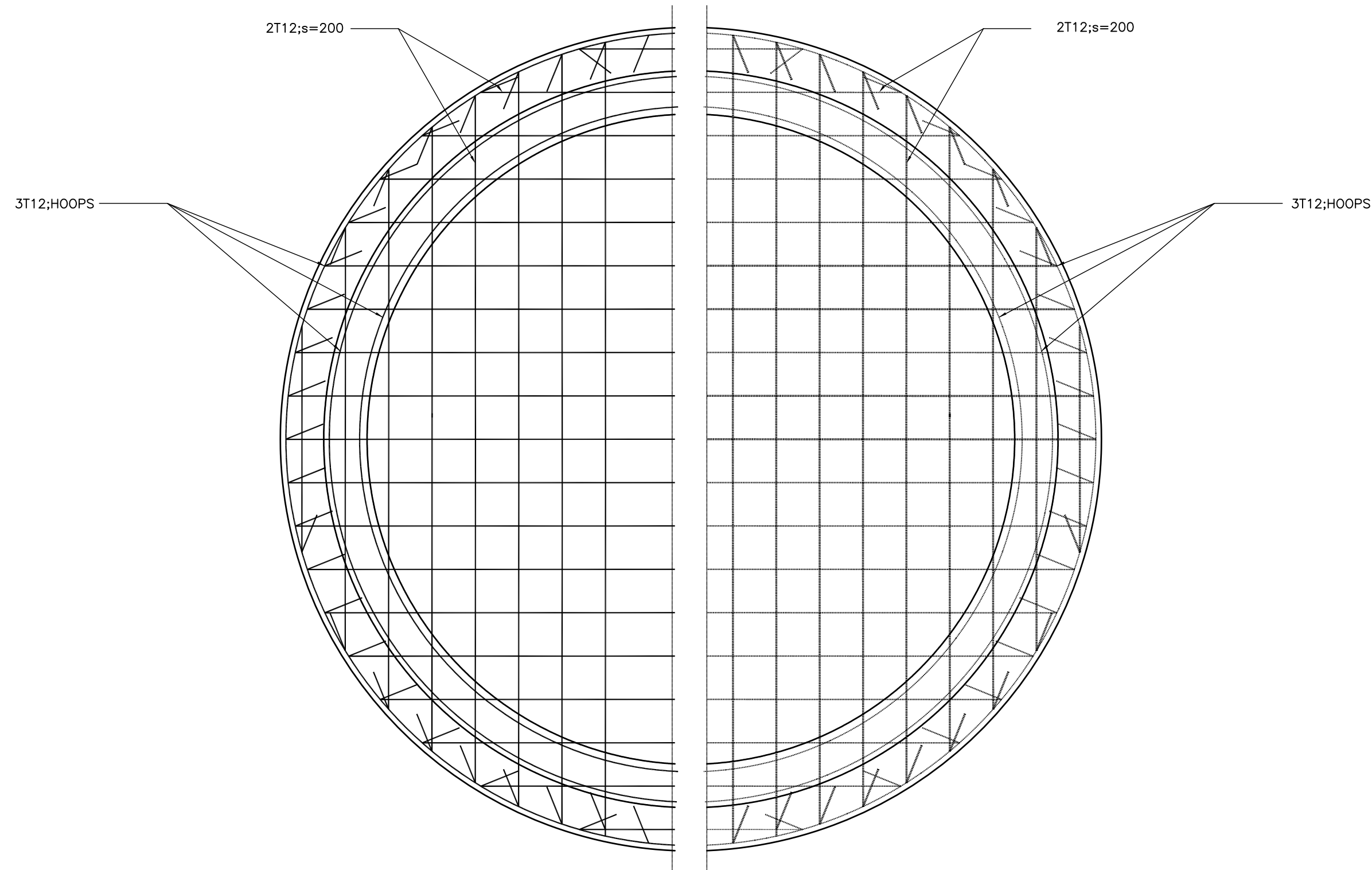
BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg TEL: (04) 712157/712158
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

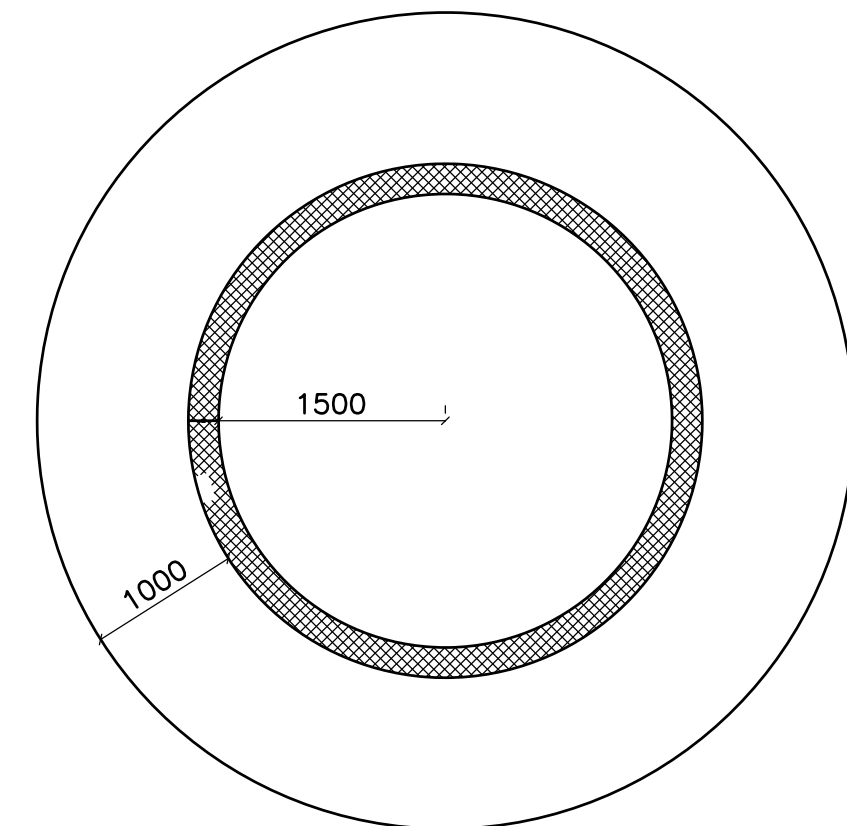
QABB ELIAS VALVE CHAMBER	
INSIDE DIAMETER 300 cm	
INSIDE HEIGHT VARIABLE BETWEEN	FORMWORK
300 & 600cm DEPENDING ON	REINFORCEMENT
THE GROUND LEVEL	

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>SEQ. No.</i>
JULY 2019	1:50-1:20-1:10	1/2	509W-RS02-C08

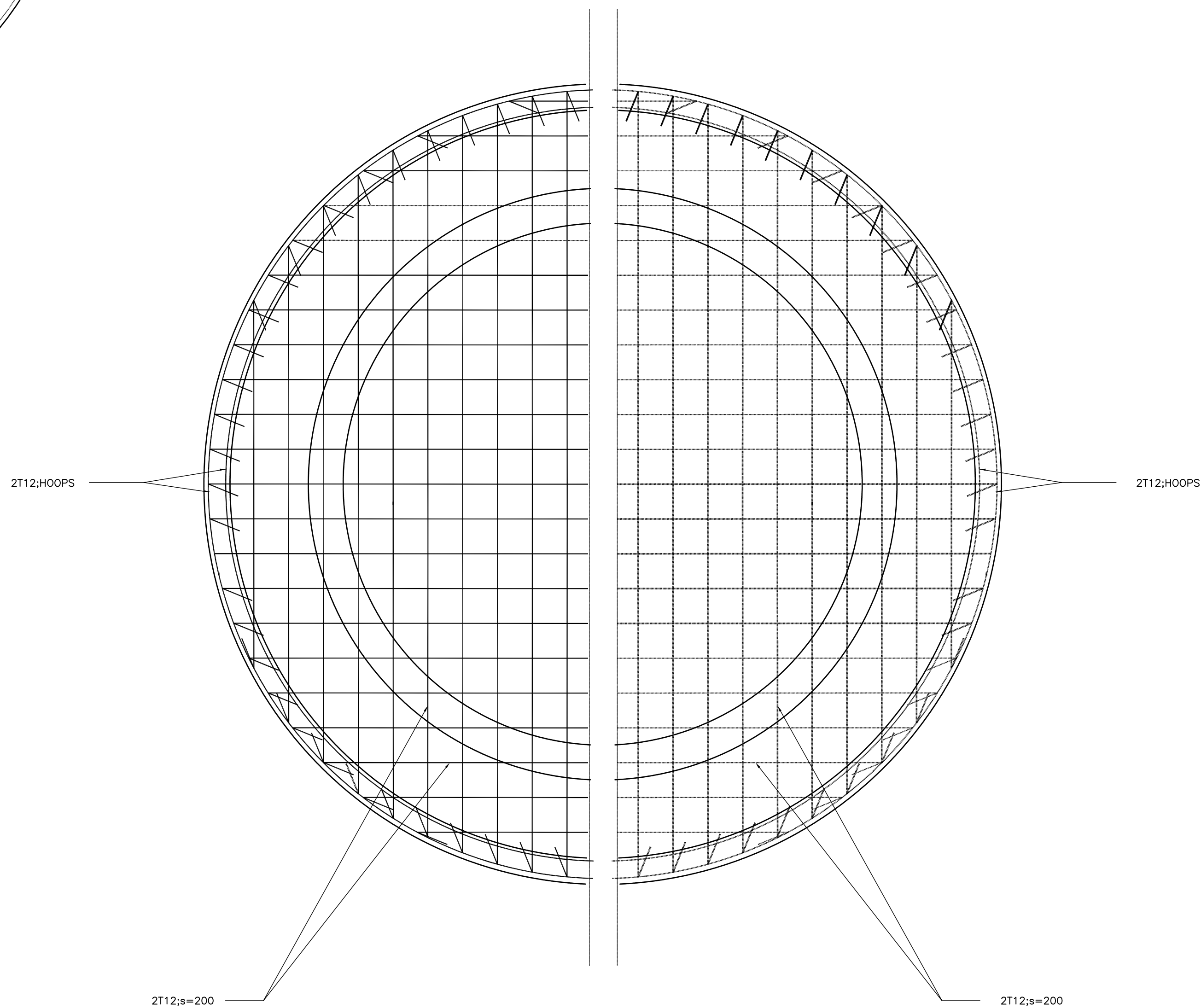
SCALE 1:20



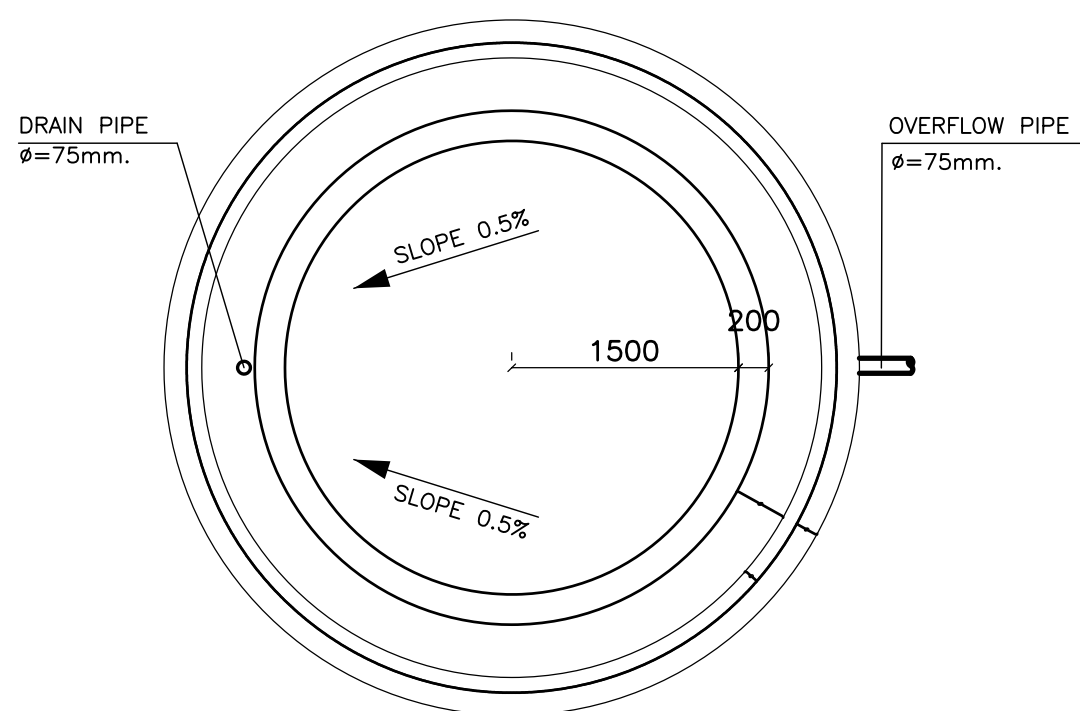
SCALE 1:50



SCALE 1:20



SCALE 1:50



REINFORCED CONCRETE:

REINFORCED CONCRETE SHALL BE MADE OF ORDINARY PORTLAND CEMENT AND SHALL BE OF GRADE C30.
THE MINIMUM CEMENT CONTENT IN CONCRETE FOR WALLS, FLOOR SLABS AND RESERVOIR DOME SHALL BE 350 KG PER 1 M3

LEAN CONCRETE/CYCLOPEAN CONCRETE:

LEAN AND CYCLOPEAN CONCRETES SHALL BE MADE OF ORDINARY PORTLAND CEMENT,
AND SHALL BE OF GRADE C20.
THE MINIMUM CEMENT CONTENT SHALL BE 250 KG PER 1 M3

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: $F_y = 400 \text{ N/mm}^2$.
MILD STEEL BARS : SYMBOL \emptyset YIELD STRESS: $F_y = 215 \text{ N/mm}^2$.

CONCRETE STRENGTH:

SEVERE CONTROL.	
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:	
- ON A CUBE SAMPLES (DIMENSIONS= 150 x 150 x 150 mm):	37.5 N/mm ²
- ON A CYLINDER SAMPLES (DIAMETER= 160mm, HEIGHT= 320mm):	30 N/mm ²
CONCRETE TENSILE STRENGTH AT 28 DAYS :	
MAXIMUM FREE DROP HEIGHT:	2.4 N/mm ² 1500 mm

CONSTRUCTION JOINTS:

CONSTRUCTION JOINTS SHALL BE FORMED ONLY IN THE POSITIONS SHOWN ON THE DRAWINGS OR AS INDICATED BY THE ENGINEER AND CONCRETING SHALL BE CARRIED OUT CONTINUOUSLY BETWEEN AND UP TO JOINTS.

WATER-STOP JOINTS SHALL BE INCORPORATED IN CONSTRUCTION JOINTS FOR RETAINING AQUEOUS LIQUIDS IN PROPERLY CONSTRUCTED JOINTS.

ADMIXTURES:

SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE; TO ACHIEVE WATERTIGHT CONCRETE STRUCTURES
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
ALL ADMIXTURES SHALL BE APPROVED BY THE ENGINEER.

CONCRETE COVER:

40 mm COVER OVER REINFORCEMENT, INCLUDING STIRRUPS AND DISTRIBUTION BARS FOR RESERVOIR FLOOR SLABS AND WALLS, AND 30 mm ELSEWHERE.

BARS OVERLAPPING:

MINIMUM LENGTH OF OVERLAP WILL BE 50 TIMES THE DIAMETER OF THE BARS.
LAPS OF ADJACENT PARALLEL REINFORCEMENT BARS SHALL BE STAGGERED.
FABRIC REINFORCEMENT SHALL BE TIED AT LEAST 40 DIAMETERS OR TWO SQUARES,
WHICHEVER IS THE GREATER.
ALL LAPS OF BARS ARE TO BE TAPPED TIGHTLY WITH SIX LAPS OF 1.5 mm ANNEALED
IRON WIRE AT INTERVALS OF TEN DIAMETERS OF THE BARS.

BENDING:

$\phi > 12\text{mm}$ MECHANICAL.
 $\phi \leq 12\text{mm}$ MANUAL (POSSIBLY).
 STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:

FAIR FACE CONCRETE FORMWORK SHALL BE EMPLOYED FOR ALL EXPOSED CONCRETE
FACES OR AS DIRECTED BY THE ENGINEER.
EMBEDDED WIRE TIES FOR HOLDING FORMS WILL NOT BE PERMITTED IN CONCRETE
WALLS WHICH ARE TO COME INTO CONTACT WITH LIQUIDS.
WIRE TIES MAY BE USED FOR CONCRETE WALLS TO BE PLASTERED AND SHALL BE CUT
BACK AT LEAST 15 mm FROM THE FACE OF THE CONCRETE.
HOLES LEFT IN THE CONCRETE SURFACES AFTER CUTTING BACK OF WIRE TIES AND
REMOVAL OF FASTENERS OR HOLDING RODS OR SLEEVES, AND THE INSIDES OF SLEEVES
WHERE SLEEVES ARE USED, SHALL BE COMPLETELY FILLED WITH AN APPROVED
NON-SHRINKING MORTAR.

COVER WATERPROOFING CONSISTING OF A WATERPROOFING MEMBRANE
AND ITS PROTECTION

WATERPROOFING

- SBS/OR/APP $t_{\text{total}} \geq 4\text{mm}$
WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.

PROTECTION

- IN FACTORY MINERAL AUTOPROTECTION

REMARKS:

- * ALL THE DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
- * DO NOT SCALE FROM THE DRAWINGS; DIMENSIONS SHALL BE INDICATED OR COMPUTED FROM THE DRAWINGS.
- * FLOOR SLAB INVERT LEVEL ± 0.00 : SEE LAYOUT DRAWINGS.
- * DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
- * HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
- * PROVIDE PERFORATED DRAIN PIPES, $\phi 4"$ IN THE GRAVEL PROTECTION LAYER.

BOTTOM STEEL REINFORCEMENT
TOP STEEL REINFORCEMENT

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION



BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg
P.O.BOX:70492 - ANTELIAS

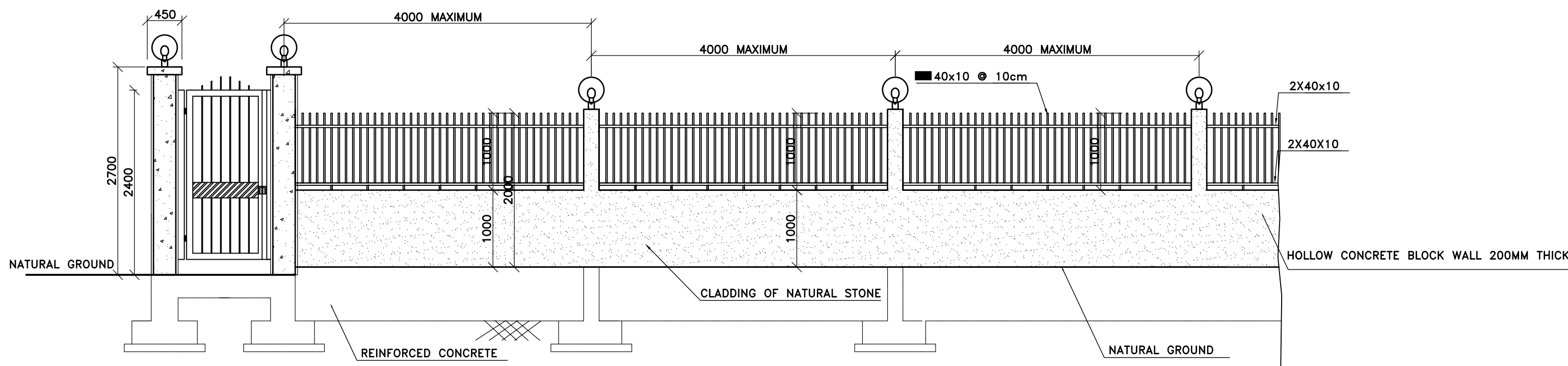
TEL:(04) 712157/712158
FAX:(04) 712159

CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM-QABB ELIAS AND MRAIJAT

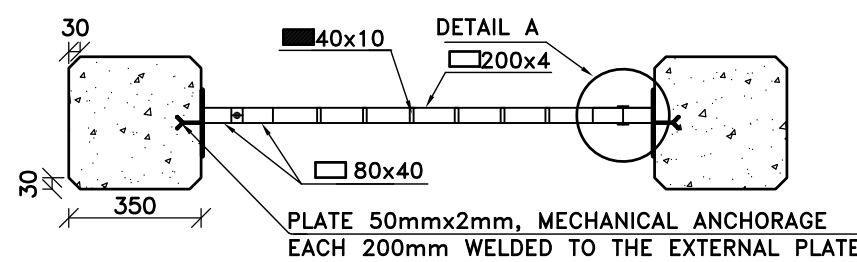
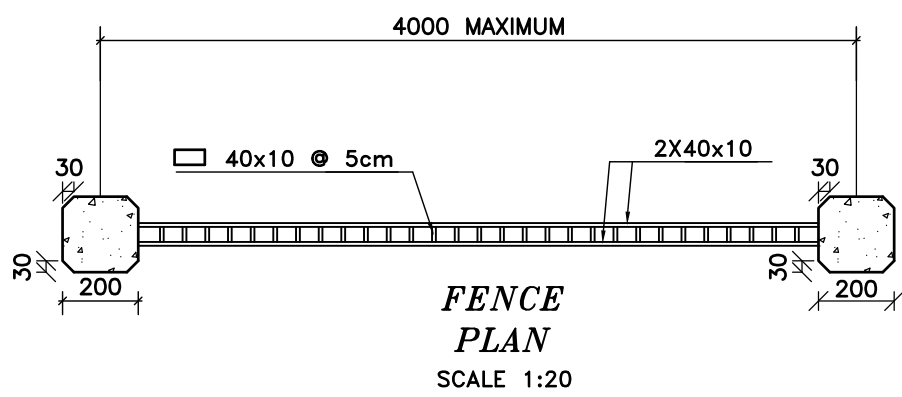
<p>QABB ELIAS VALVE CHAMBER</p> <p>INSIDE DIAMETER 300 cm</p> <p>INSIDE HEIGHT VARIABLE BETWEEN</p> <p>300 & 600cm DEPENDING ON</p> <p>THE GROUND LEVEL</p>	<p>FORMWORK</p> <p>REINFORCEMENT</p>
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<i>DRAWING No.</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS02-C08-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

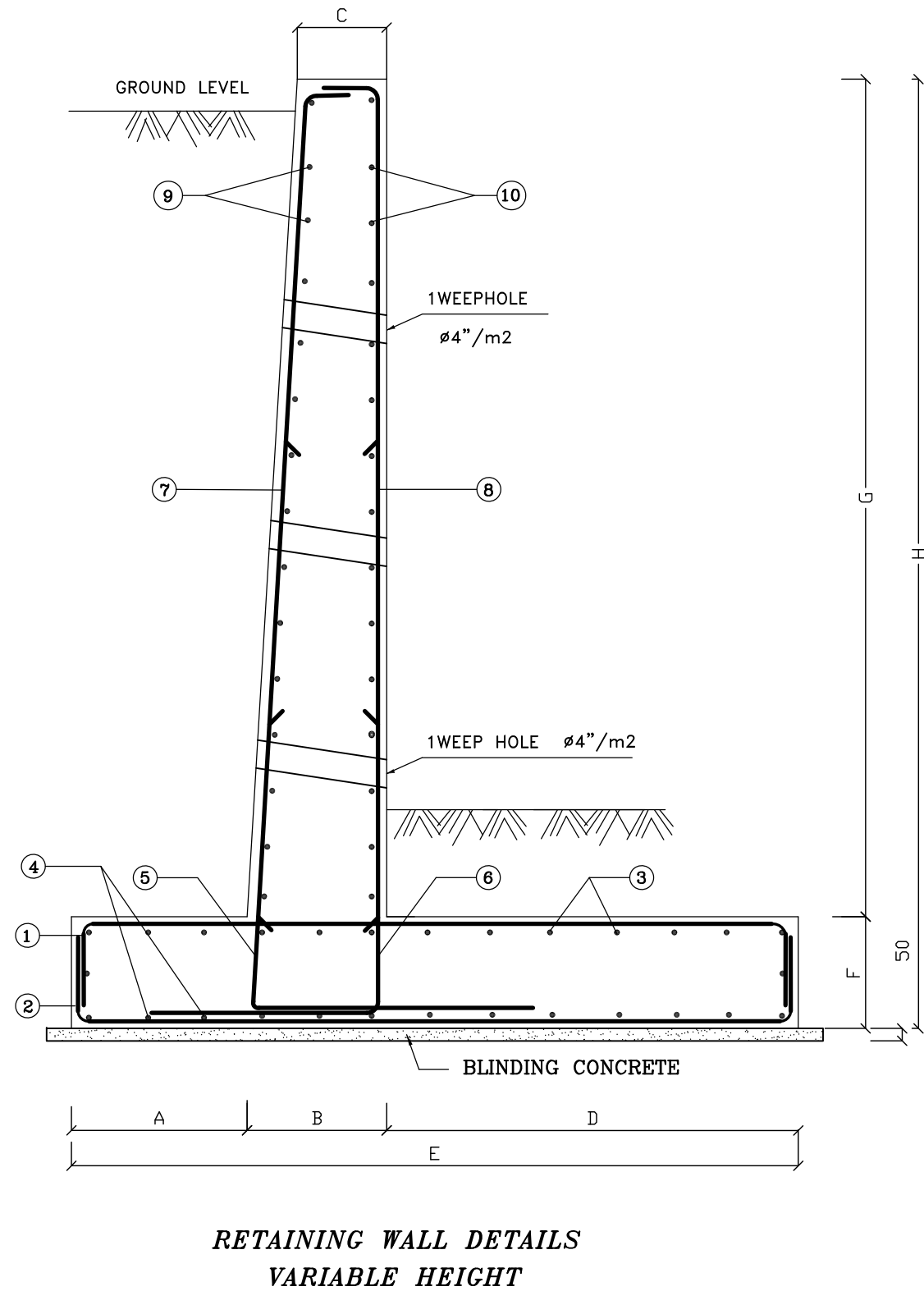
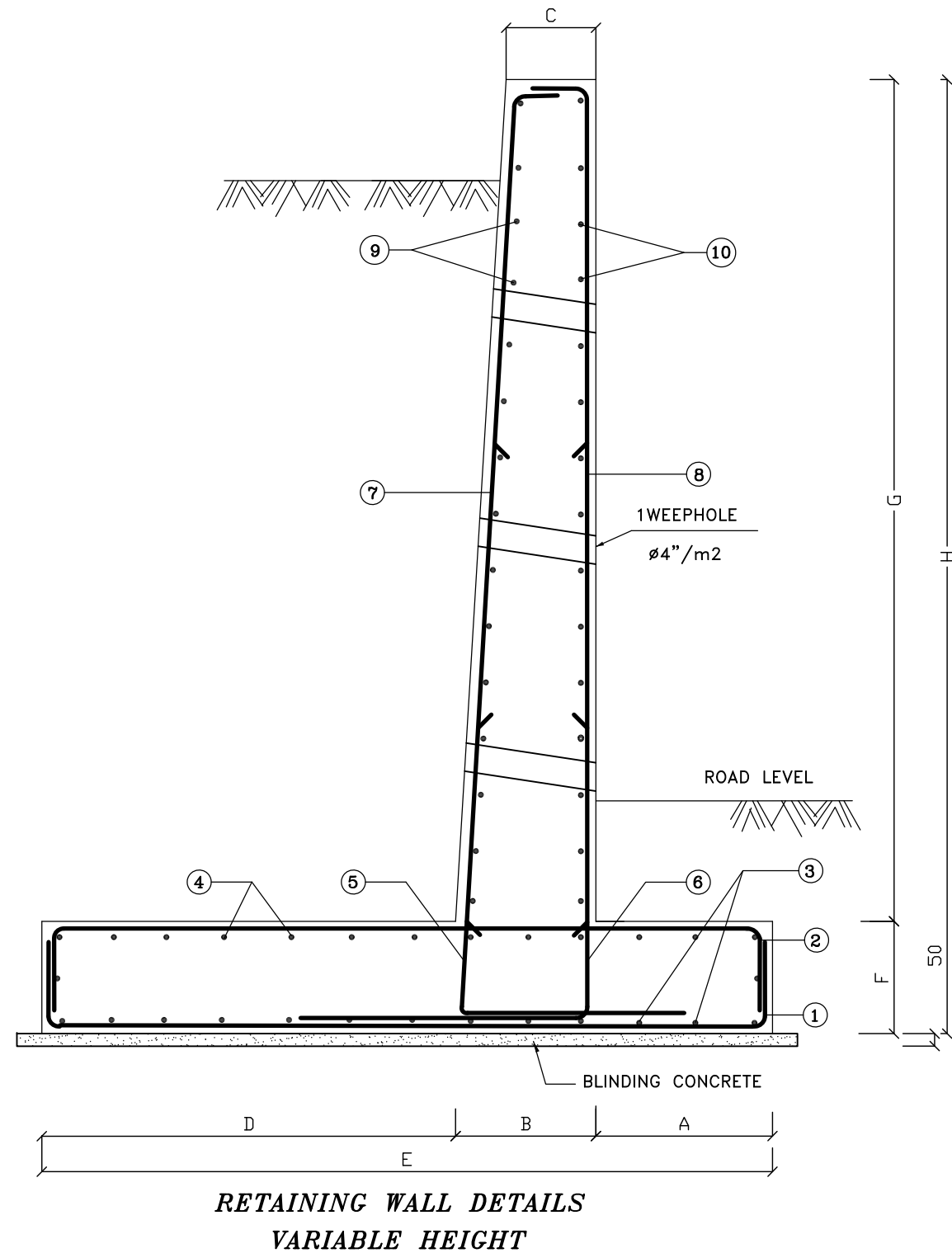
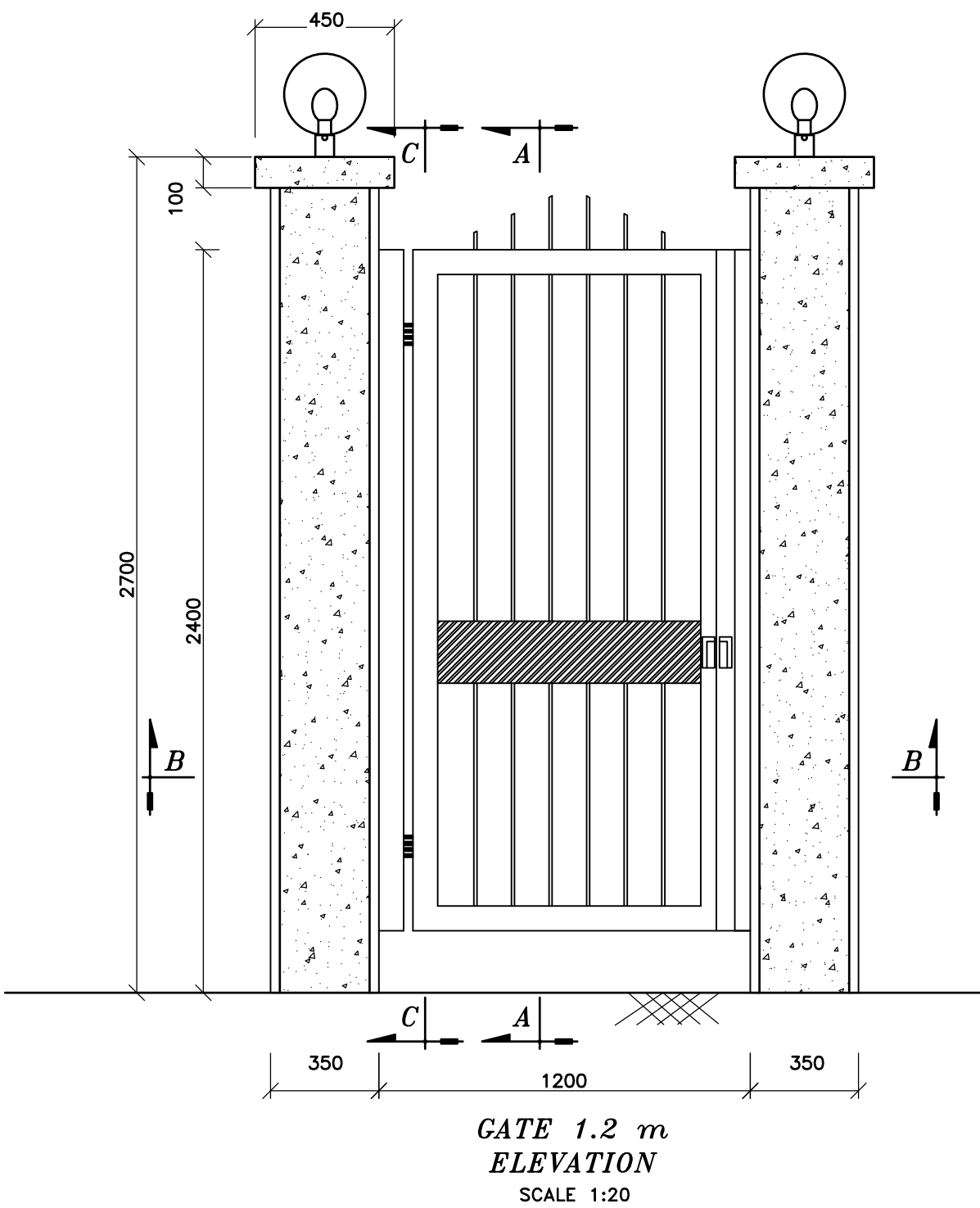
<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>SEQ. No.</i>
JULY 2019	1:50-1:20	2/2	509W-RS02-C09



GATE ELEVATION 1.2 m
SCALE 1:50



SECTION B-B
SCALE 1:20



DIMENSIONS	FORMWORK SCHEDULE							
	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)
TYPE I (1000)	200	200	200	400	800	200	1000	1200
TYPE II (1500)	200	200	200	700	1100	200	1500	1700
TYPE III (2000)	300	200	200	1000	1500	200	2000	2200
TYPE IV (2500)	300	250	200	1300	1850	250	2500	2750
TYPE V (3000)	400	300	200	1500	2200	300	3000	3300
TYPE VI (3500)	400	350	200	1800	2550	350	3500	3850

REINFORCEMENT DETAILS										
REINFORCEMENT (mm)	1	2	3	4	5	6	7	8	9	10
TYPE I (1000)	T12 Ø200 L=1000	T12 Ø20 L=1000	T12 Ø200 L=6000	T12 Ø200 L=6000	T12 Ø200 L=1500	T12 Ø200 L=1500			T12 Ø200 L=6000	T12 Ø200 L=6000
TYPE II (1500)	T12 Ø200 L=1250	T12 Ø200 L=1250	T12 Ø200 L=6000	T12 Ø200 L=6000	T12 Ø200 L=2000	T12 Ø200 L=2000			T12 Ø200 L=6000	T12 Ø200 L=6000
TYPE III (2000)	T12 Ø200 L=1750	T12 Ø200 L=1750	T12 Ø200 L=6000	T12 Ø200 L=6000	T12 Ø200 L=2500	T12 Ø200 L=2500			T12 Ø200 L=6000	T12 Ø200 L=6000
TYPE IV (2500)	T12 Ø200 L=2250	T14 Ø200 L=2250	T12 Ø200 L=6000	T12 Ø200 L=6000	T14 Ø200 L=2000	T12 Ø200 L=2000	T14 Ø200 L=2500	T12 Ø200 L=2500	T12 Ø200 L=6000	T12 Ø200 L=6000
TYPE V (3000)	T12 Ø165 L=2500	T14 Ø165 L=2500	T12 Ø200 L=6000	T12 Ø200 L=6000	T14 Ø165 L=2000	T12 Ø165 L=2000	T14 Ø165 L=3000	T12 Ø165 L=3000	T12 Ø200 L=6000	T12 Ø200 L=6000
TYPE VI (3500)	T14 Ø165 L=3000	T16 Ø165 L=3000	T12 Ø200 L=6000	T12 Ø200 L=6000	T16 Ø165 L=2500	T14 Ø165 L=2500	T16 Ø165 L=3500	T12 Ø165 L=3500	T12 Ø200 L=6000	T12 Ø200 L=6000

NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB; 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 MPa.
MILD STEEL BARS: SYMBOL Ø YIELD STRESS: Fy=250 MPa.

STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, ø=150mm: 30 N/mm²
- ON A CYLINDER, ø=150mm, h=30mm: 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS: 2.1 N/mm².

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50ø.
(ø= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS ø8 SHALL BE USED ON EACH LAP.

BENDING:
ø > 12mm MECHANICAL.
ø ≤ 12mm MANUEL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:
--- TOP BARS
--- BOTTOM BARS

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) S.B. - SBS/OR/APP (≥2.5mm)
(2) INSULATION - ADHERENCE OR SEMI-ADHERENCE APPLICATION
- t=variable min. t=50mm
- EXPANDED POLYSTYRENE λ=0.037kcal/h.m².°C
- WITH t = t₁ + t₂
- SEMI-ADHERENCE OR TOTAL ADHERENCE
APPLICATION ON VAPOUR BARRIER.
(3) WATERPROOFING - SBS/OR/APP t_{total} ≥4mm
WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
- IN FACTORY MINERAL AUTOPROTECTION.
(4) PROTECTION - IN FACTORY MINERAL AUTOPROTECTION.
(5) H> 150mm (NIL SLOPE)

REMARKS:
• FLOOR SLAB INVERT LEVEL ±0.00: SEE LAYOUT DAWINGS.
• DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
• HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
• ALL THE DIMENSIONS ARE IN mm.
• SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
• PROVIDE PERFORATED DRAIN PIPES, ø4" IN THE GRAVEL PROTECTION LAYER.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON

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JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

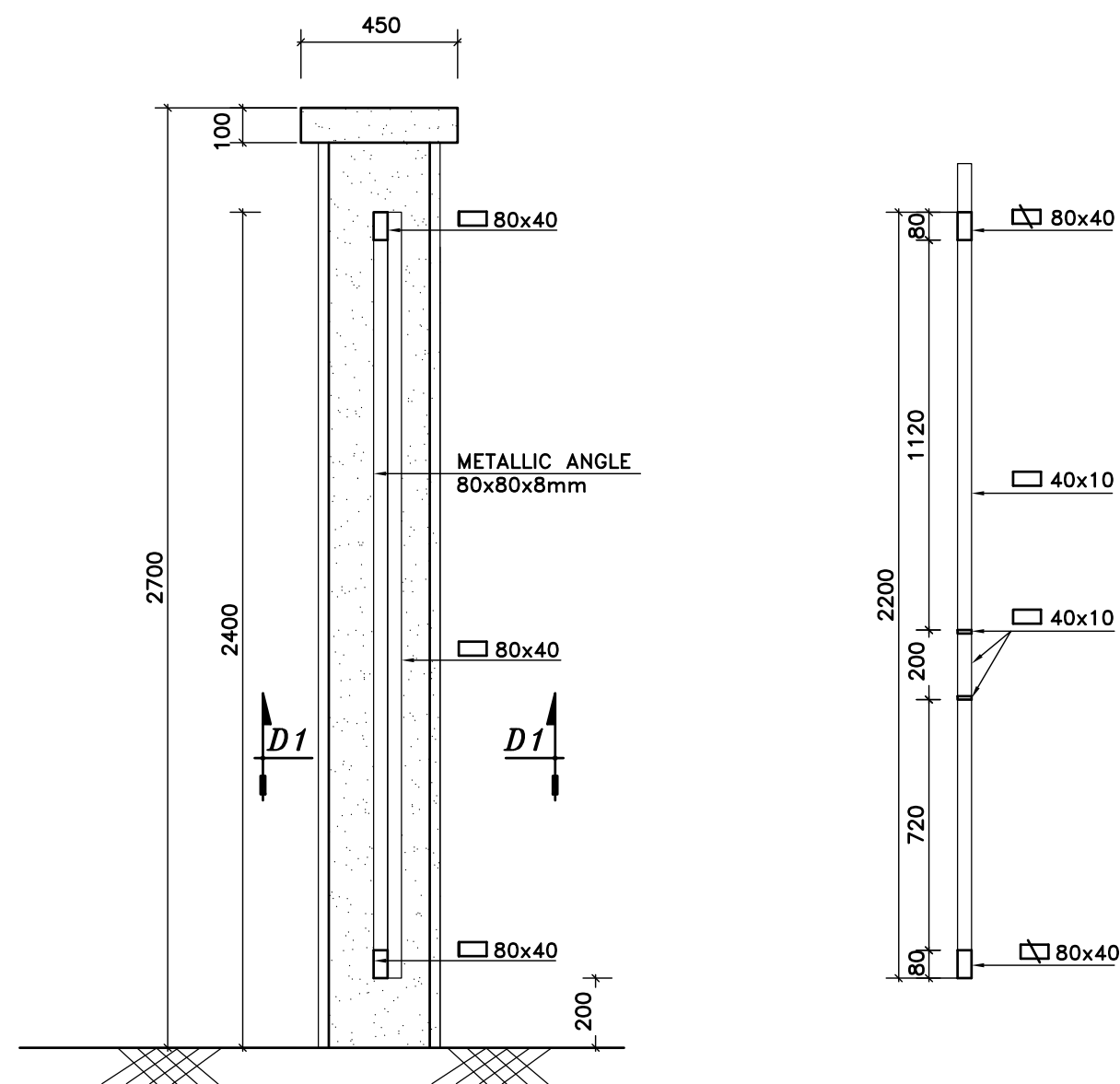
CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS RESERVOIRS
(CAPACITY 2X400 m³)

FENCE ELEVATIONS
SECTIONS AND DETAILS
RETAINING WALL DETAILS

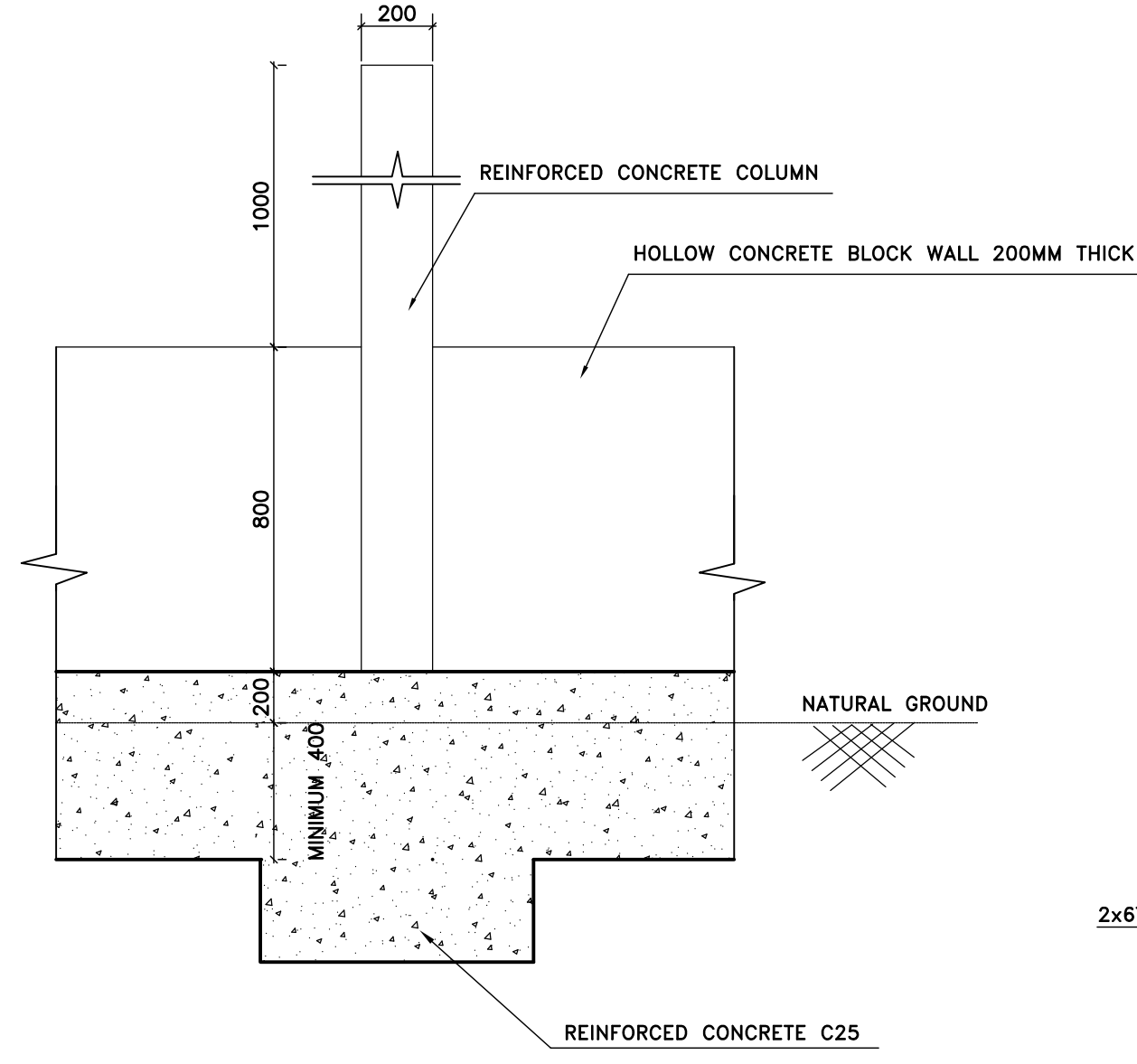
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509W-RS02-SF01-02	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING. No.
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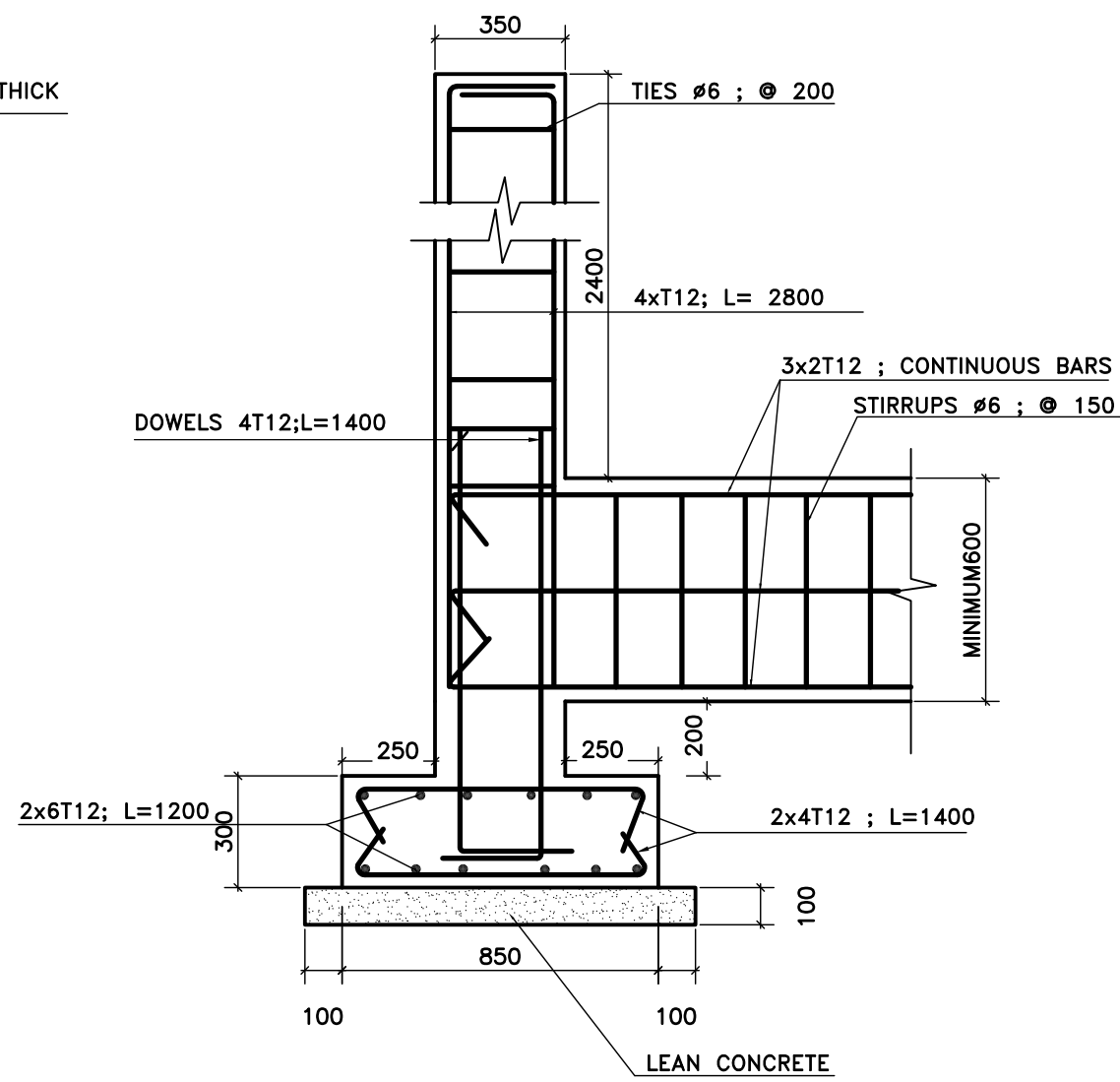


SECTION C-C
SCALE 1:20

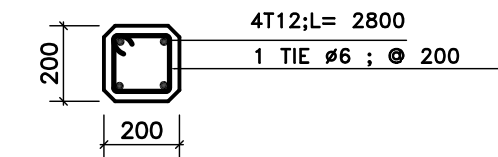
SECTION A-A
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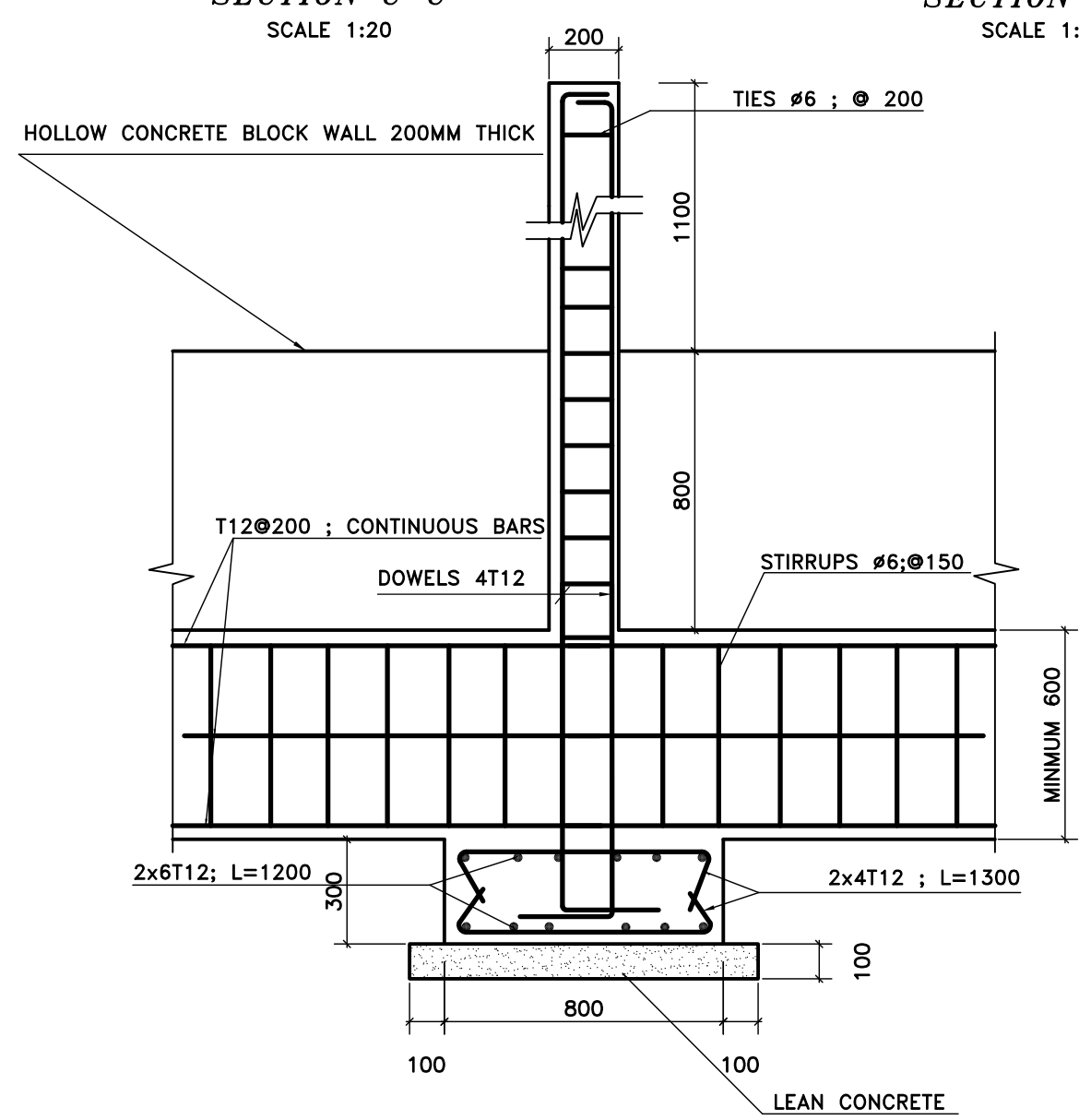
TYPICAL FENCE COLUMN
SCALE 1:20



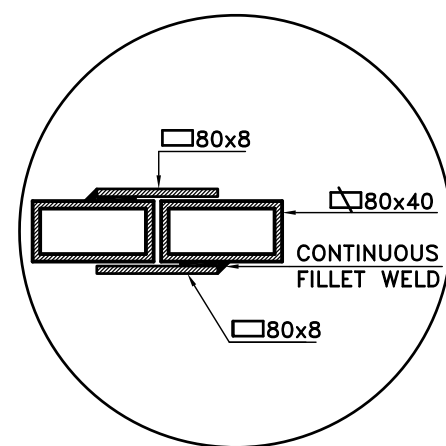
REINFORCEMENT OF TYPICAL ACCESS GATE COLUMN AND FOOTING
SCALE 1:20



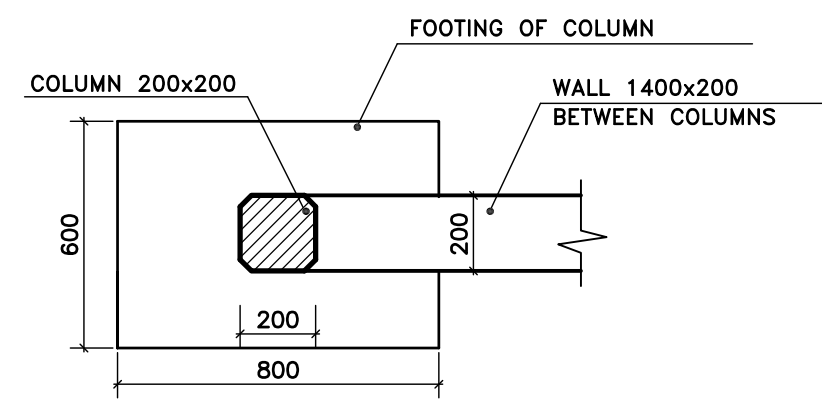
HORIZONTAL SECTION
OF COLUMN
SCALE 1:20



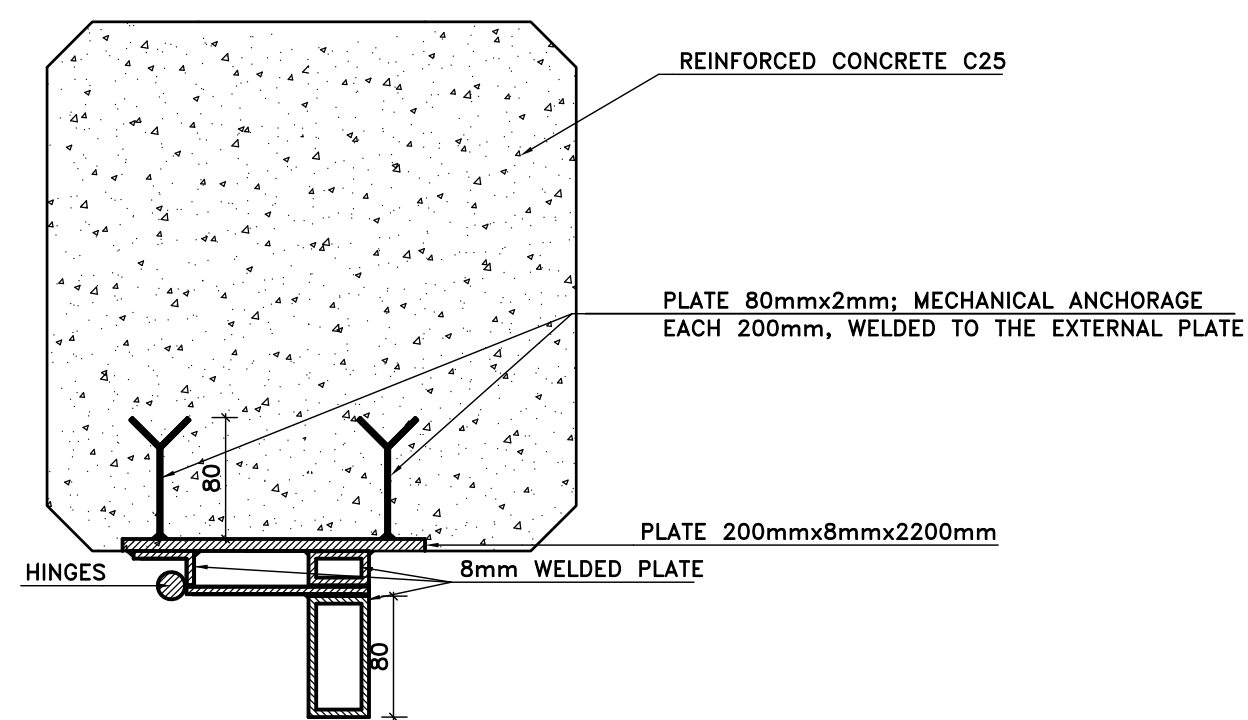
REINFORCEMENT OF TYPICAL COLUMN AND FOOTING
SCALE 1:20



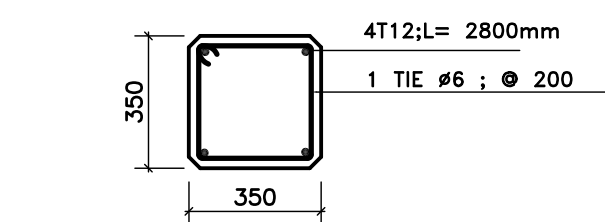
DETAIL A
SCALE 1:5



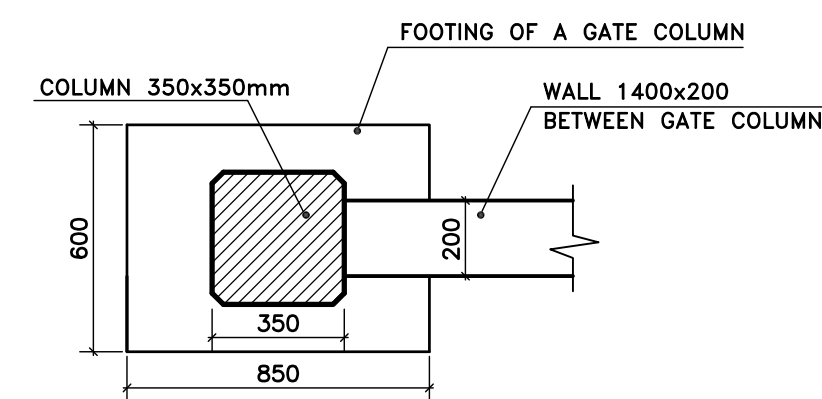
FOOTING
SCALE 1:20



SECTION D-D
SCALE 1:5



HORIZONTAL SECTION
OF GATE COLUMN
SCALE 1:20



FOOTING
SCALE 1:20

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BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIA FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

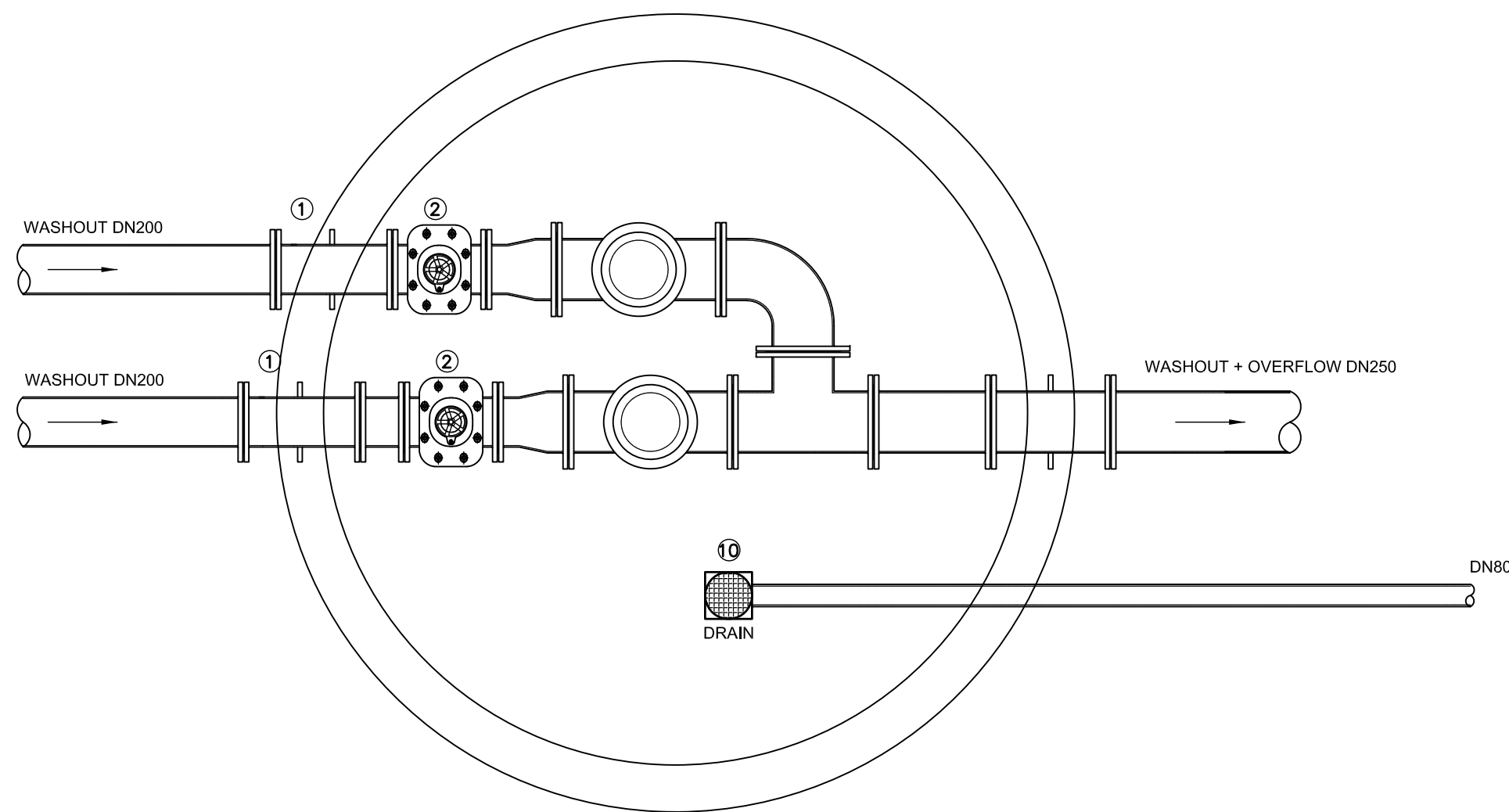
QABB ELIAS RESERVOIRS
(CAPACITY 2X400 m³)

FENCE ELEVATIONS
SECTIONS AND DETAILS

FILE No.	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-SF01-02	BTD	BTD	BTD

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JULY 2019	1:5 - 1:20	2/2	509W-RS02-SF02

QABB ELIAS 2X400m3 RESERVOIRS VALVE CHAMBER
D=3000mm
PLAN 1
INVERT LEVEL OF PIPES = 30cm FROM FLOOR

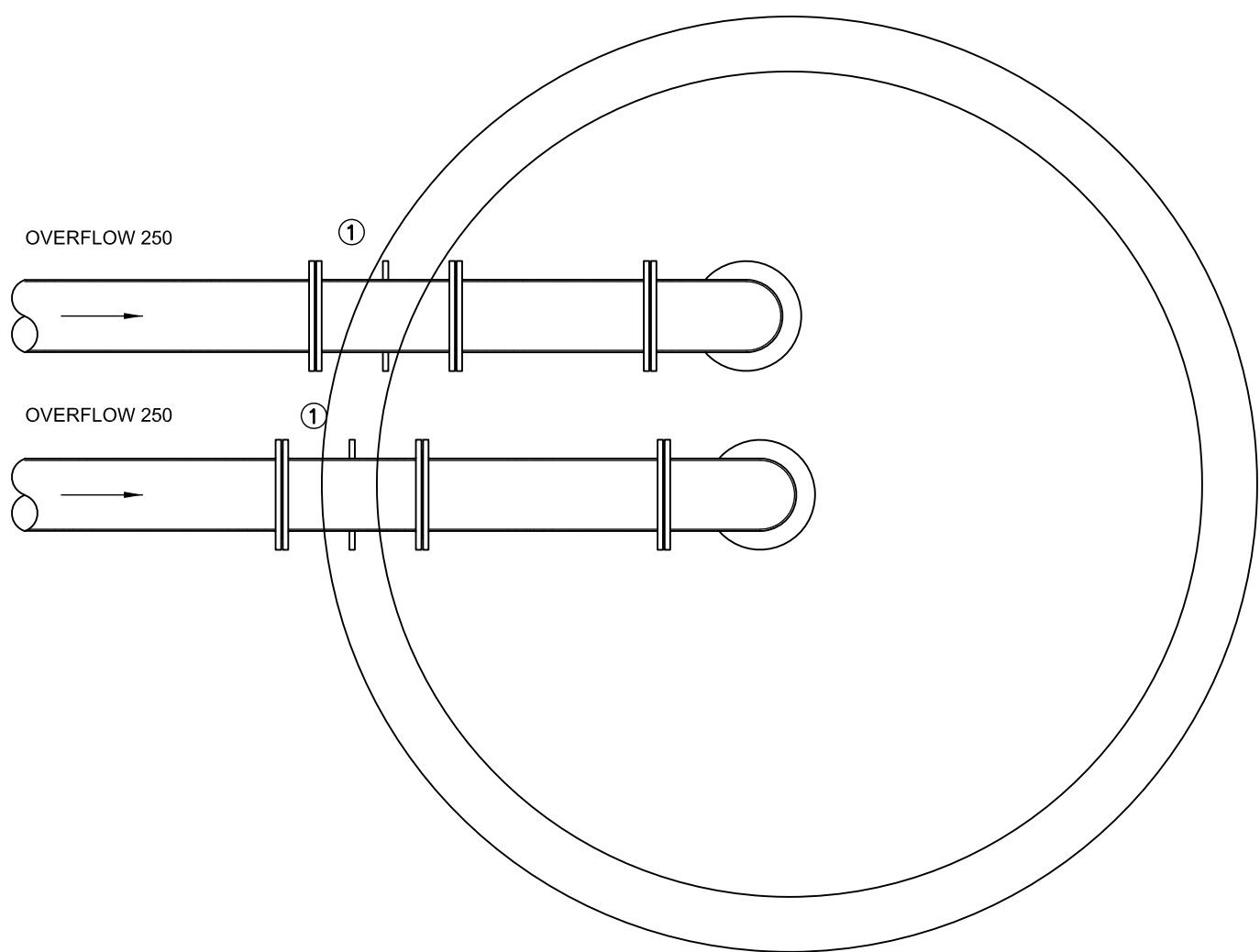


The washout and overflow should discharge
in the nearest watercourse

LEGEND:

- ①: INSERT
- ②: GATE VALVE
- ③: FILTER
- ④: PRESSURE REDUCING AND SUSTAINING VALVE
- ⑤: DISMANTLING JOINT
- ⑥: FLOW STAIGHTENER
- ⑦: WATER METER
- ⑧: BUTTERFLY VALVE
- ⑨: AIR RELEASE VALVE + GATE VALVE
- ⑩: FLOOR DRAIN

QABB ELIAS 2X400m3 RESERVOIRS VALVE CHAMBER
D=3000mm
PLAN 2
INVERT LEVEL OF PIPES = 130cm FROM FLOOR



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FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

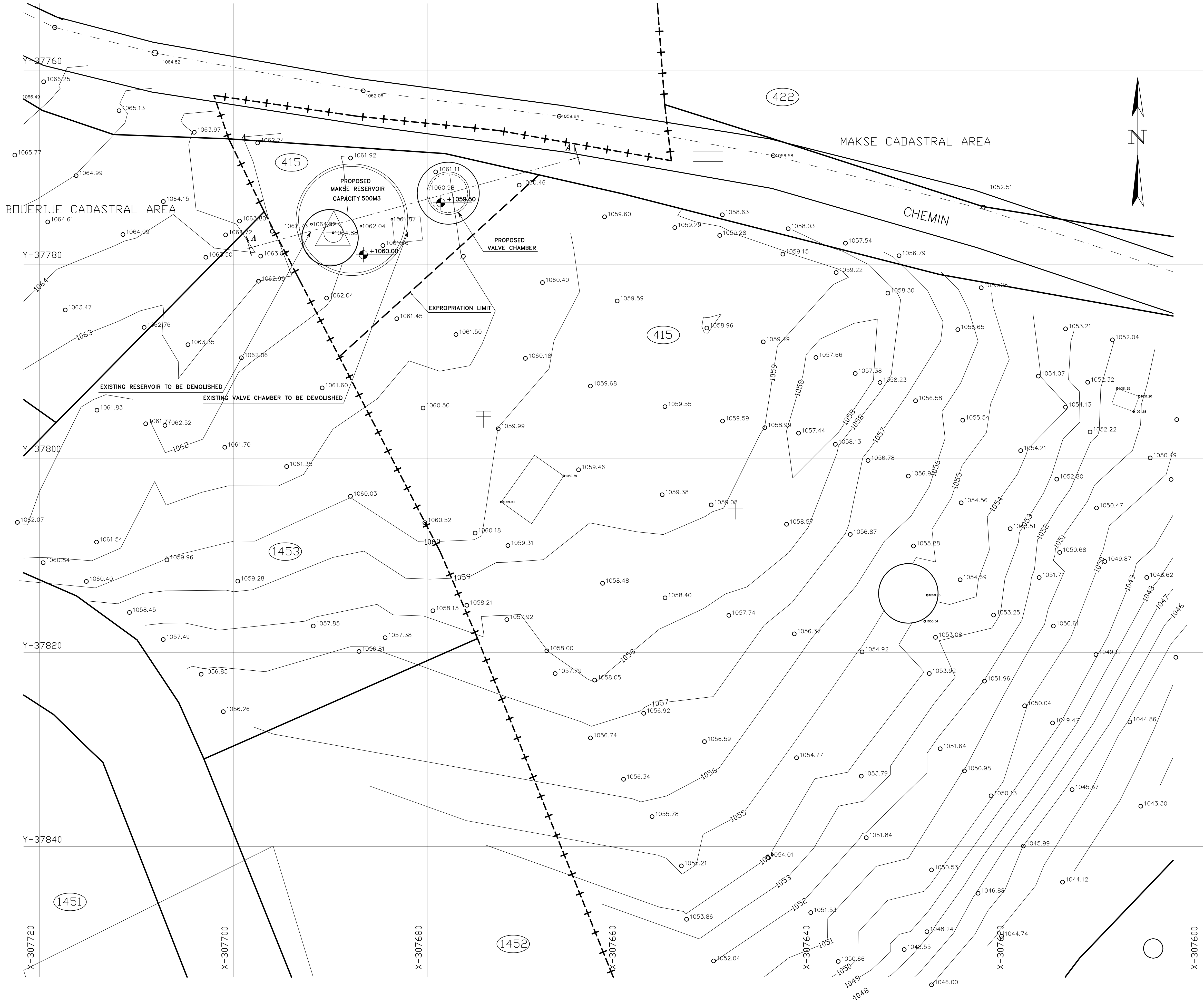
QABBB ELIAS RESERVOIRS VALVE CHAMBER	HYDRAULIC ACCESSORIES
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FILE No.	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-VC01	J. ZALZAL	S. AZAR	Z. SABA

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S	1/1	509W-RS02-VC01

TOPOGRAPHICAL SURVEY
SITE LAYOUT

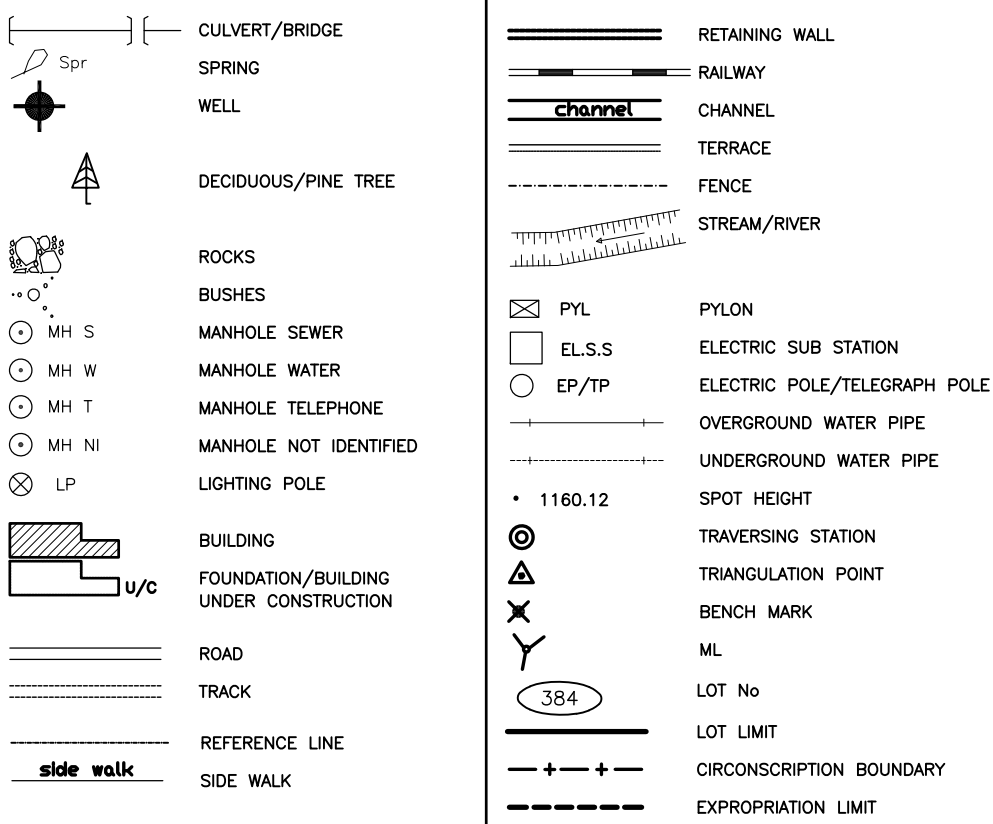
SCALE 1:200



NOTES:

- GROUND LEVEL OF RESERVOIR = +1060.00m
- GROUND LEVEL OF VALVE CHAMBER = +1059.50m
- DO NOT SCALE FROM THIS DRAWING
- ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND



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CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

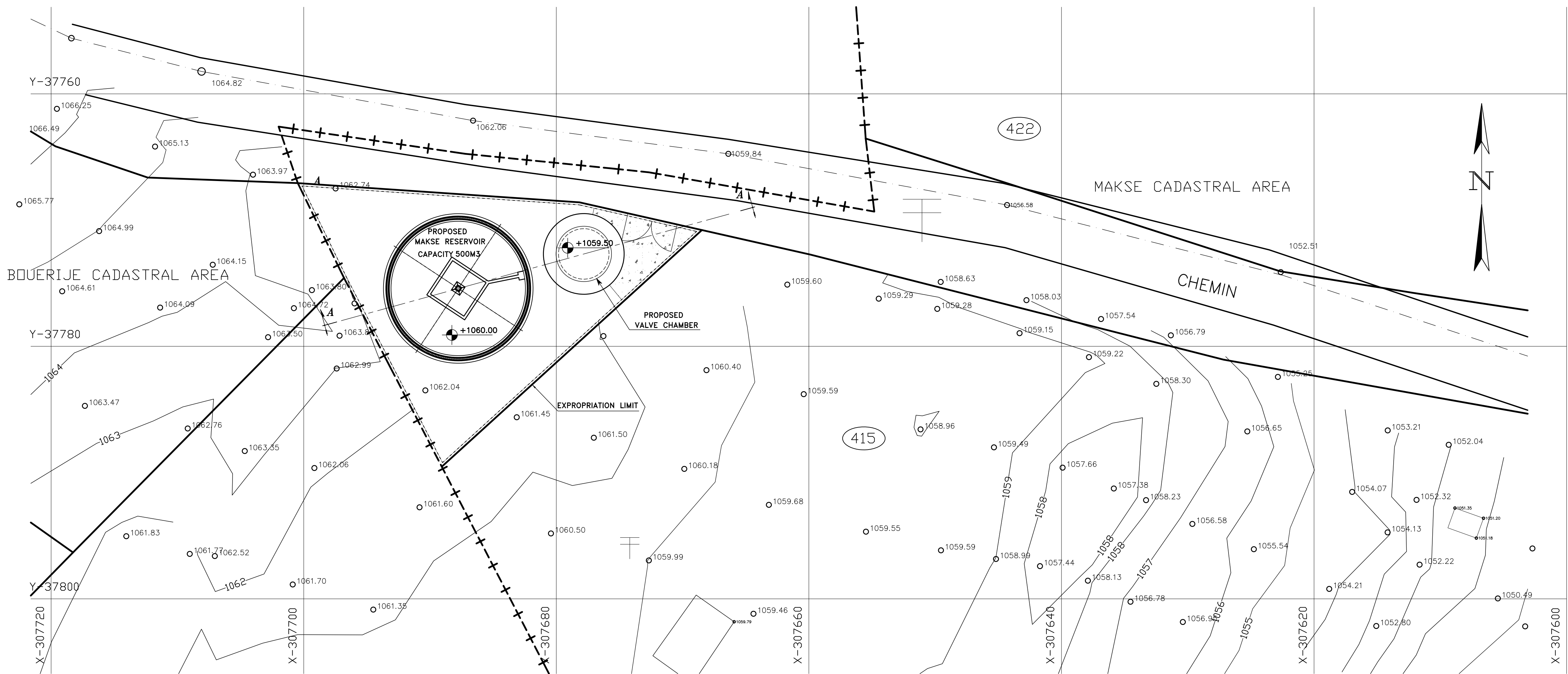
MAKSE RESERVOIR (CAPACITY 500 m³)	TOPOGRAPHICAL SURVEY SITE LAYOUT
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:200	1/9	509W-RS03-C01

SITE PLAN

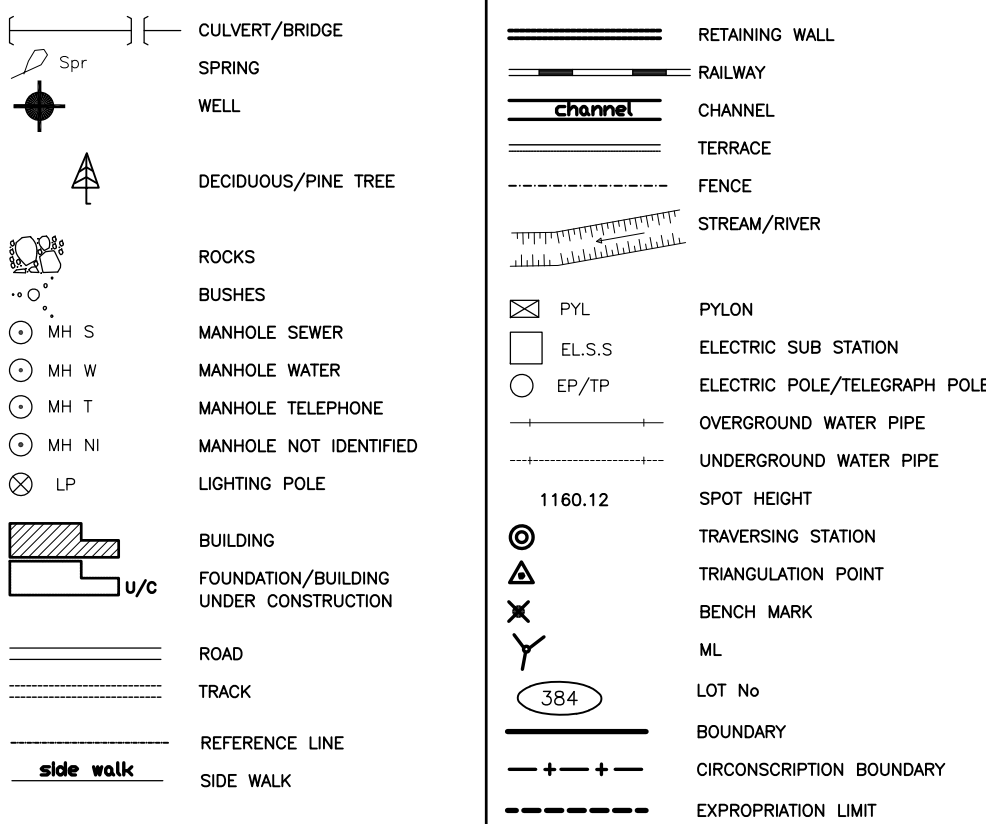
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NOTES:

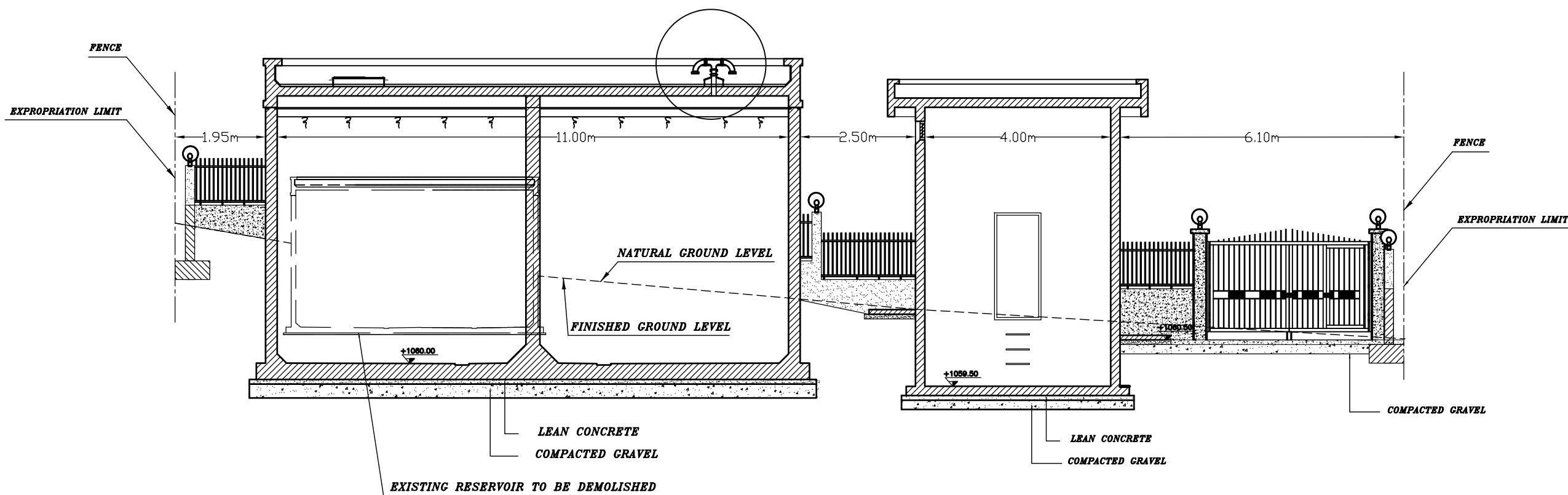
- GROUND LEVEL OF RESERVOIR = +1060.00m
- GROUND LEVEL OF VALVE CHAMBER = +1059.50m
- DO NOT SCALE FROM THIS DRAWING
- ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND



SECTION A-A

SCALE 1:100



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P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR
(CAPACITY 500 m³)

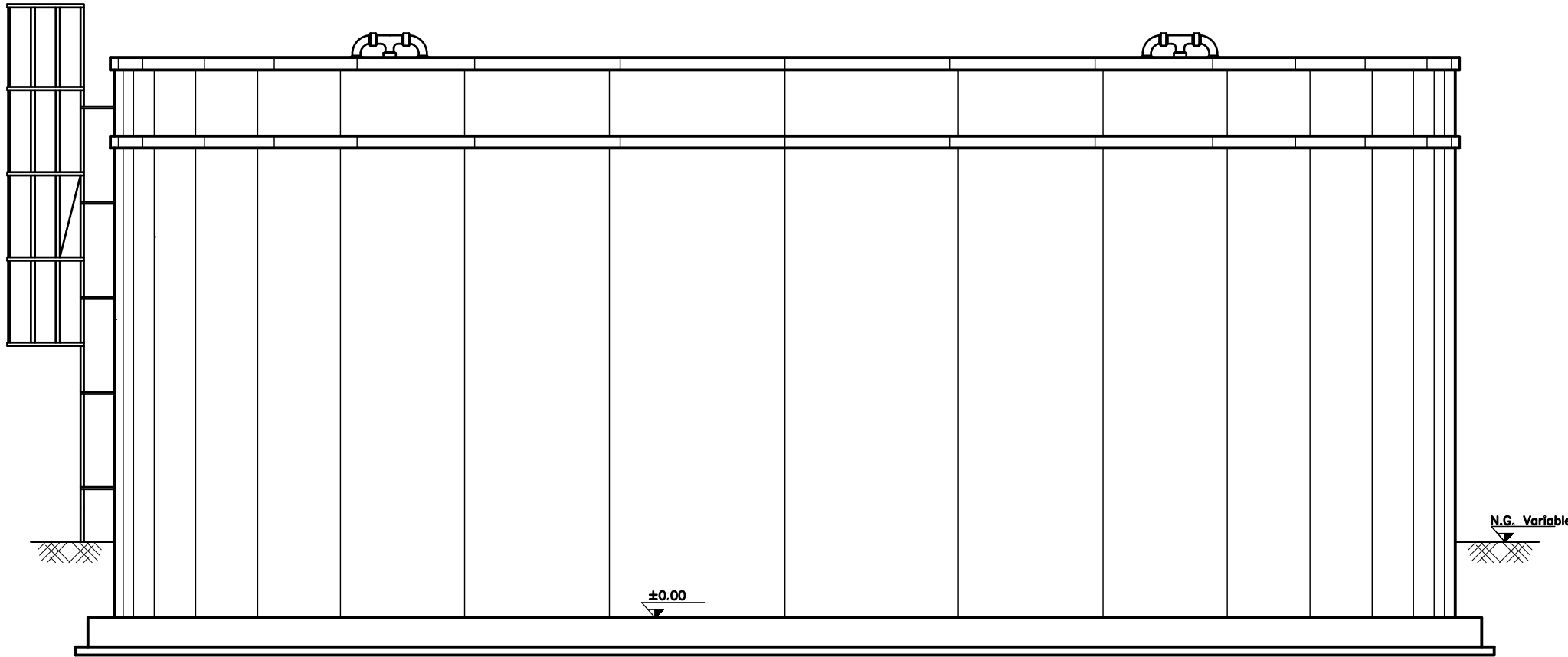
SITE PLAN
SECTION A - A

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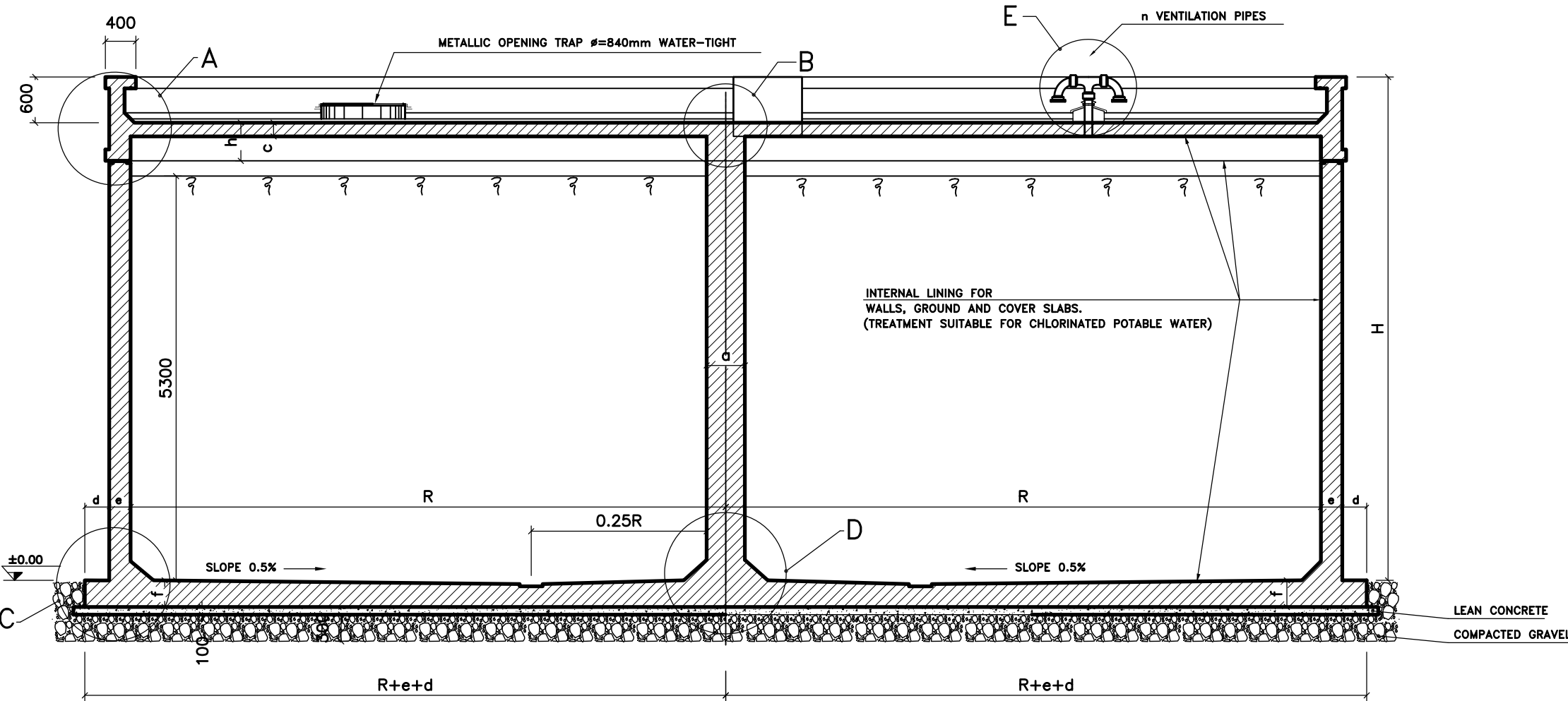
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:200 - 1:100	2/9	509W-RS03-C02

CAPACITY	500M3
R (mm)	5500
0.25R (mm)	1375
e (mm)	250
R+e (mm)	5750
c (mm)	200
f (mm)	350
d (mm)	200
R+e+d (mm)	5950
a (mm)	400
b (mm)	400
h (mm)	600
n	4
(VENTILATION PIPE)	4
n'	4
(RAIN WATER DRAINAGE)	4
H (mm)	6700
g (mm)	800
j (mm)	1200

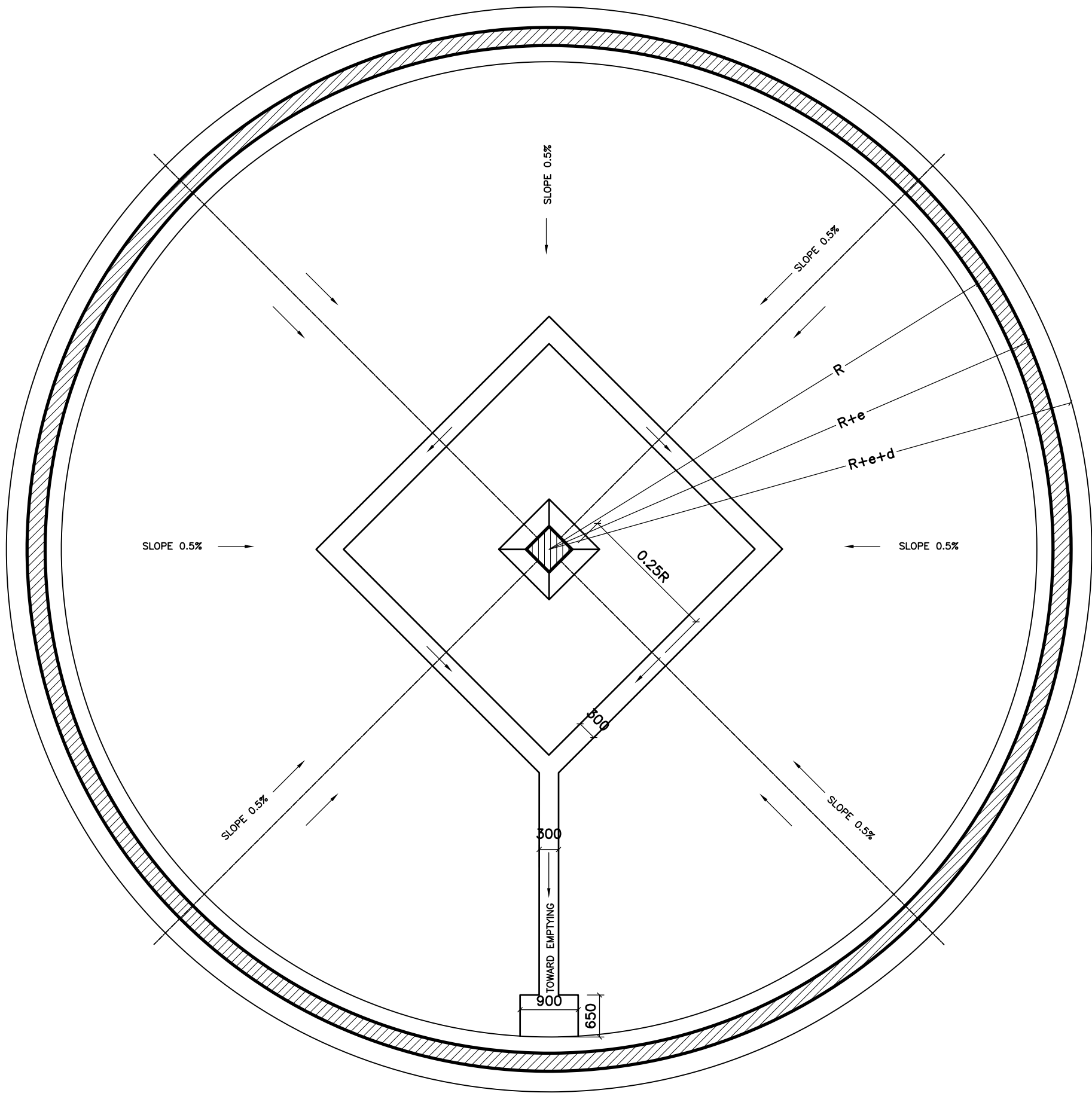
ELEVATION



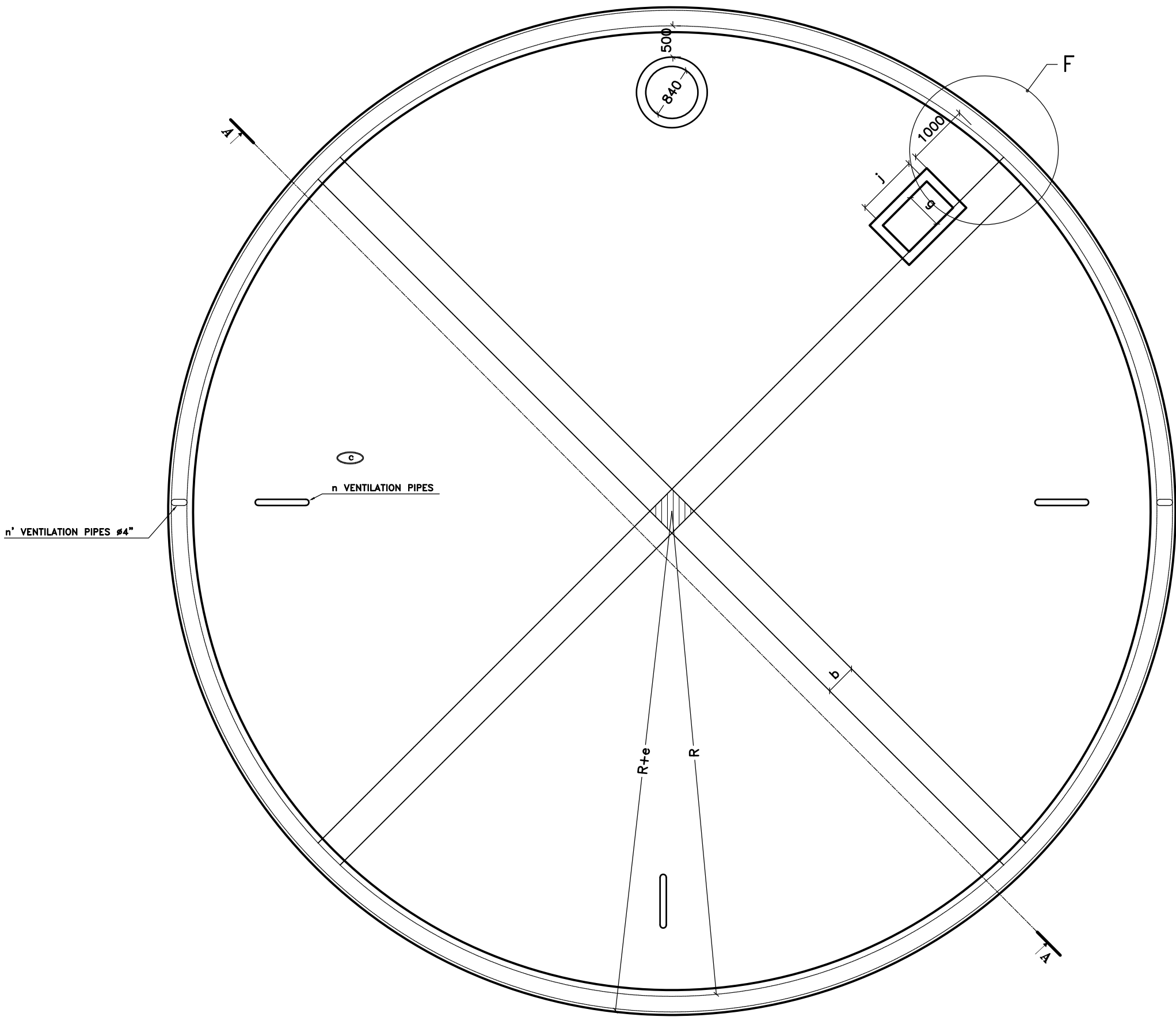
VERTICAL SECTION A-A



MAT FORMWORK



COVER SLAB FORMWORK



NOTES FOR RESERVOIRS:

- REINFORCED CONCRETE:**
CONCRETE GRADE C30 FOR ALL STRUCTURES.
- MIX ELEMENTS:**
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB, 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.
- LEAN CONCRETE / CYCLOPEAN CONCRETE:**
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.
- REINFORCEMENT:**
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 MPa.
MILD STEEL BARS : SYMBOL # YIELD STRESS: Fy=250 MPa.
- STRESSES:**
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, ø=150mm : 30 N/mm²
- ON A CYLINDER, ø=150mm, h=30mm : 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.1 N/mm².
- CONSTRUCTION JOINTS:**
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.
- ADMIXTURES:**
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.
- CONCRETE COVER:**
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.
- OVERLAPPING:**
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50ø.
(ø= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS ø8 SHALL BE USED ON EACH LAP.
- BENDING:**
> 12mm MECHANICAL.
< 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.
- DRAWINGS CONSIDERATION:**
TOP BARS
BOTTOM BARS
- FORMWORK:**
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).
- WATERPROOFING:**
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.
- WATERPROOFING DETAILS:**
(1) V.B. - SBS/OR/APP t≥2.5mm
- ADHERENCE OR SEMI-ADHERENCE APPLICATION
(2) INSULATION - t=variable min. t=50mm
- EXPANDED POLYSTYRENE λ=0.037kcal/h.m.2.°C
- WITH t₁=t₂=t/2
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION ON VAPOUR BARRIER.
(3) WATERPROOFING - SBS/OR/APP t_{total} >4mm
WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
(4) PROTECTION - IN FACTORY MINERAL AUTOPROTECTION.
(5) h> 150mm (NIL SLOPE)
- REMARKS:**
* FLOOR SLAB INVERT LEVEL ±0.00: SEE LAYOUT DRAWINGS.
* DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL THE DIMENSIONS ARE IN mm.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* PROVIDE PERFORATED DRAIN PIPES, ø4" IN THE GRAVEL PROTECTION LAYER.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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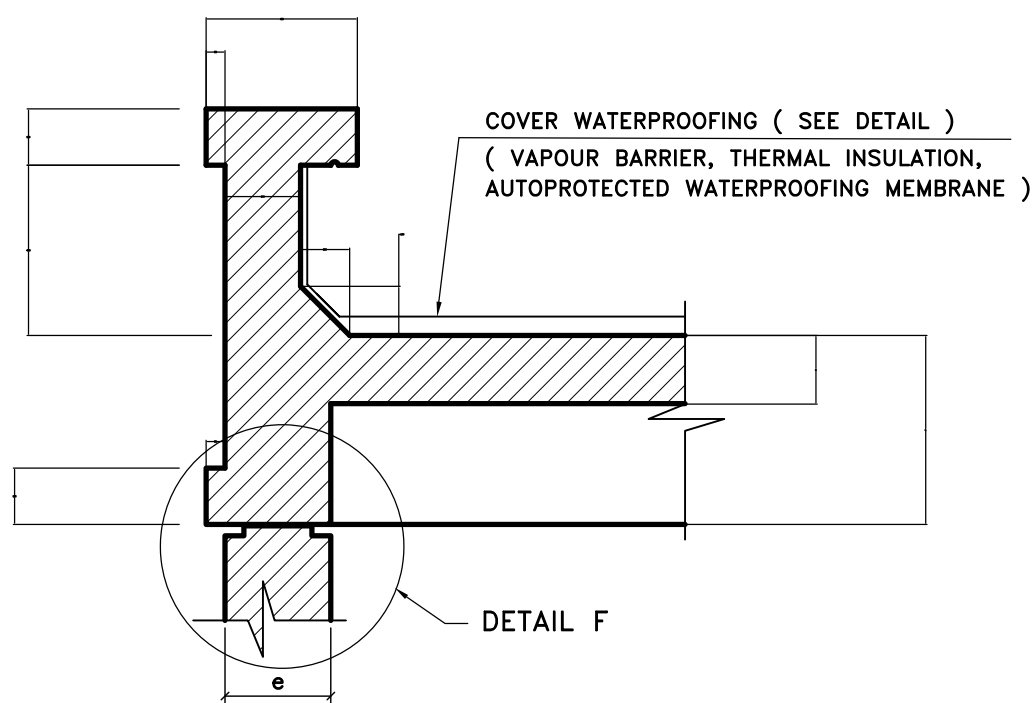
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR (CAPACITY 500 m ³)	ELEVATION AND SECTIONS FORMWORK
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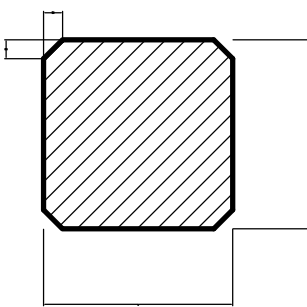
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509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S.	3/9	509W-RS03-C03

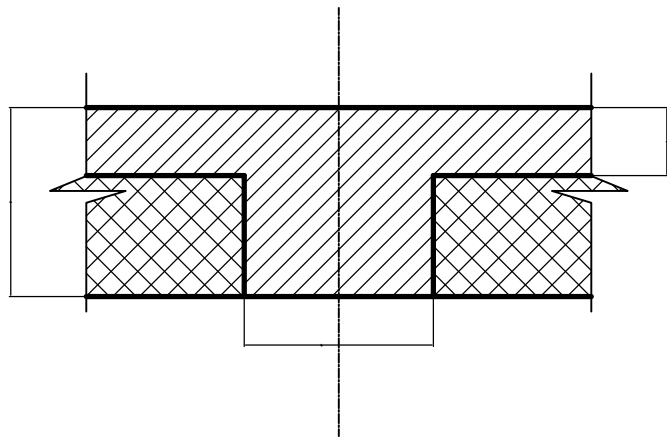
DETAIL A
PARAPET – SLAB SECTION



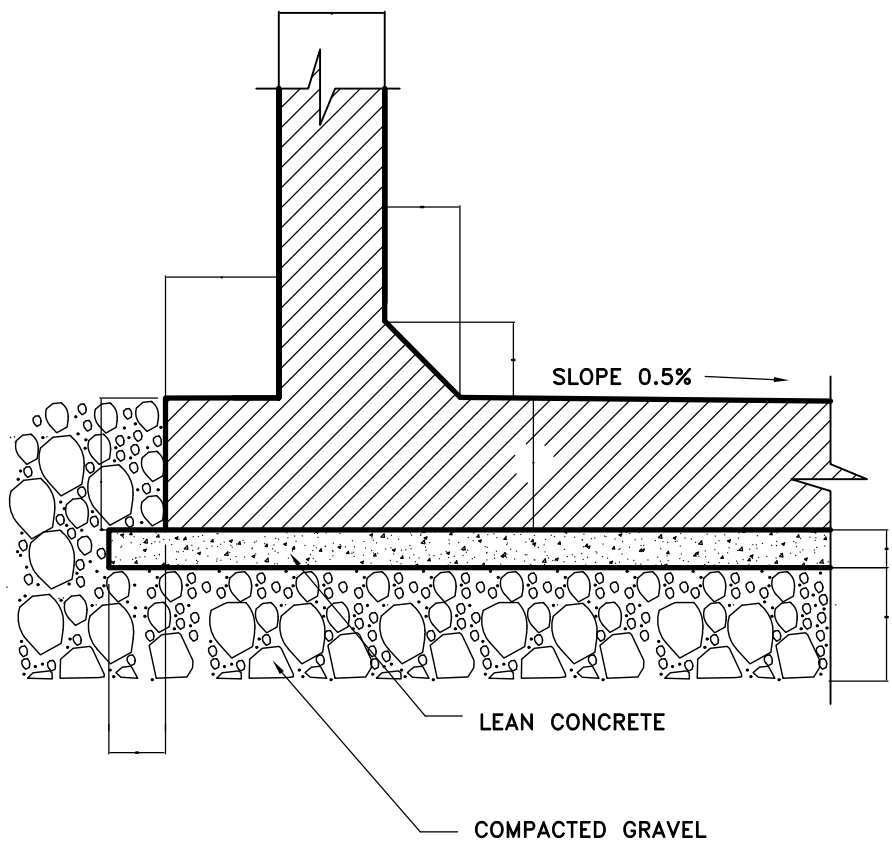
COLUMN DETAIL



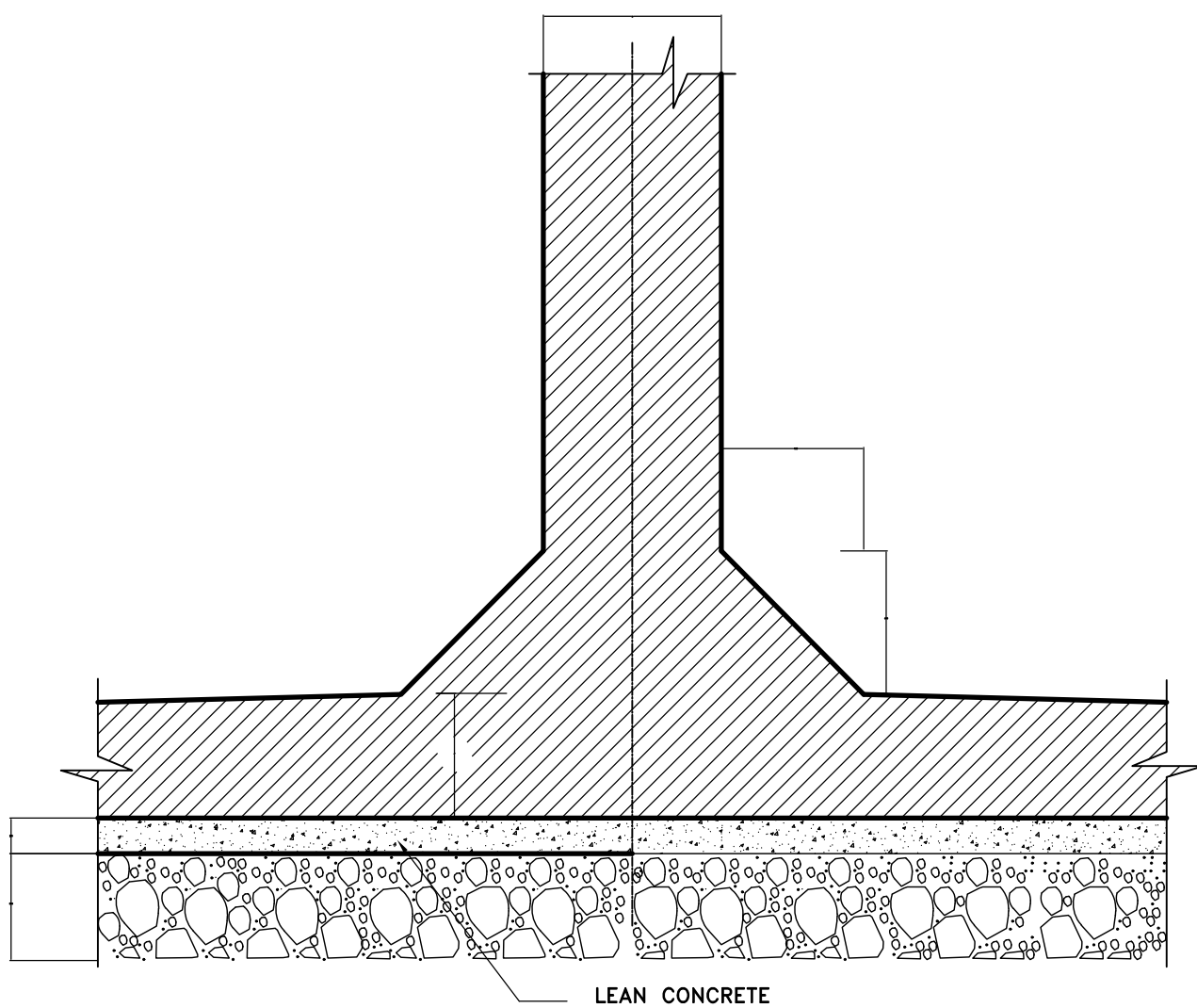
DETAIL B
BEAM–SLAB SECTION



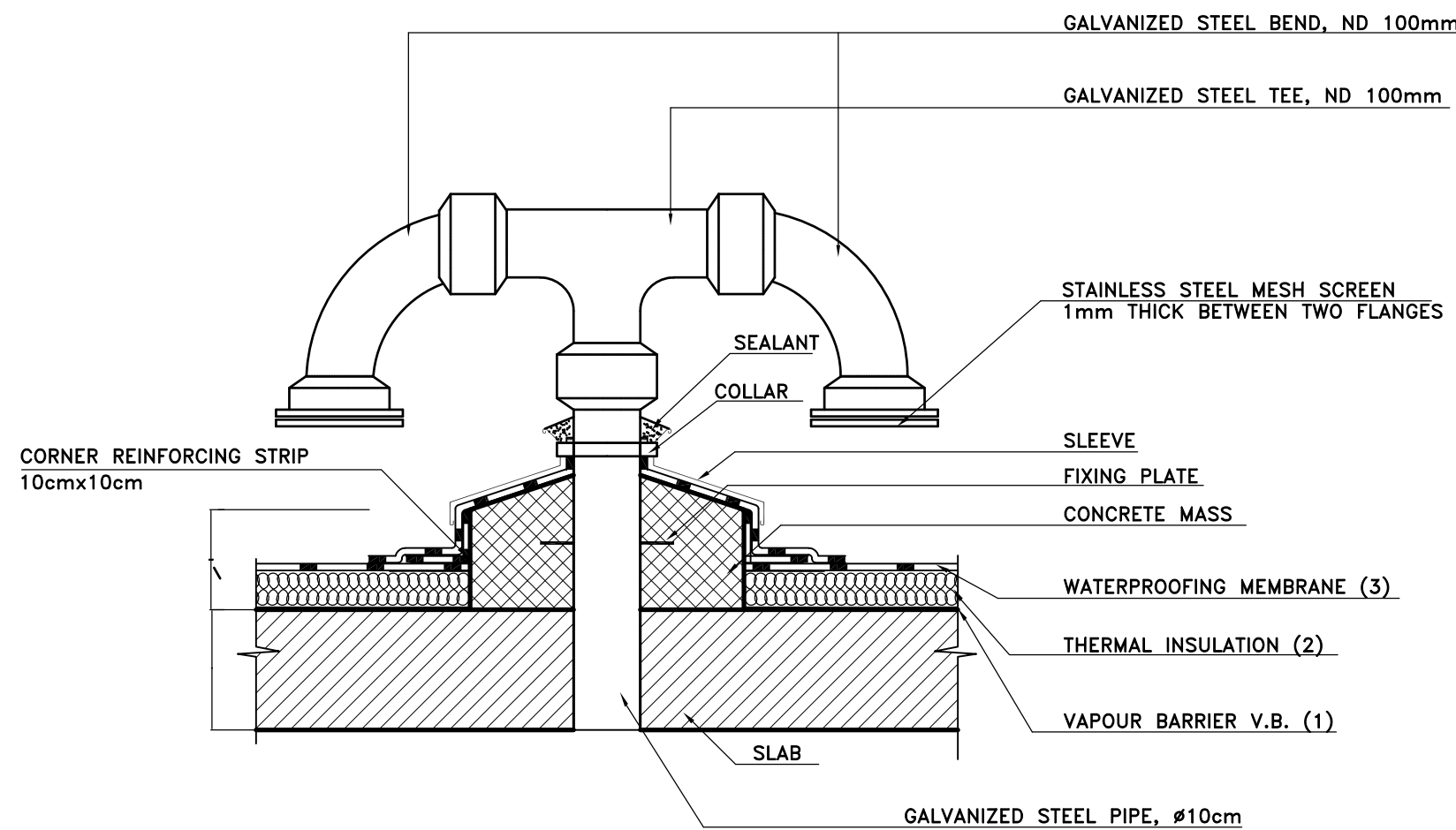
DETAIL C
MAT–WALL SECTION



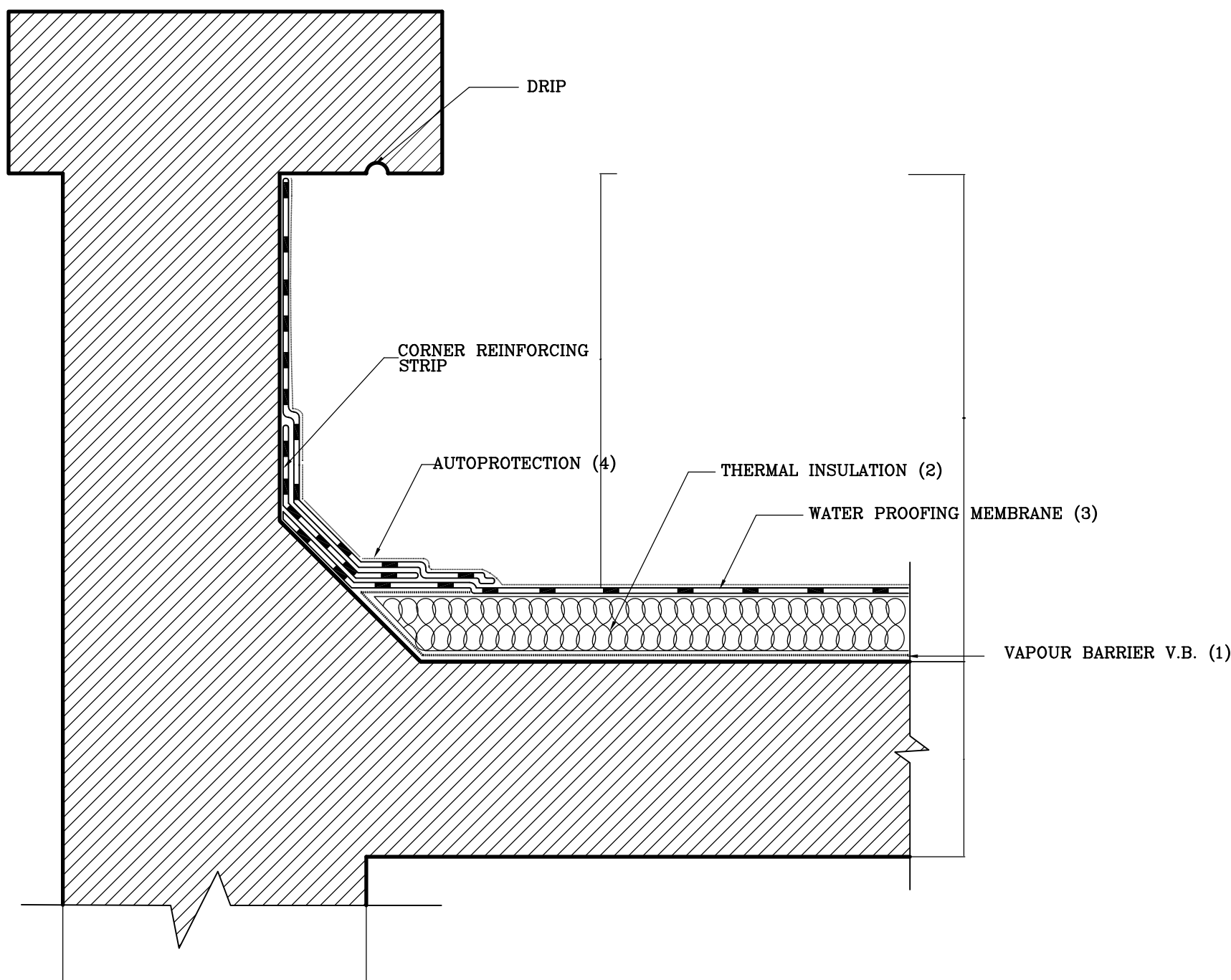
DETAIL D
COLUMN–MAT SECTION



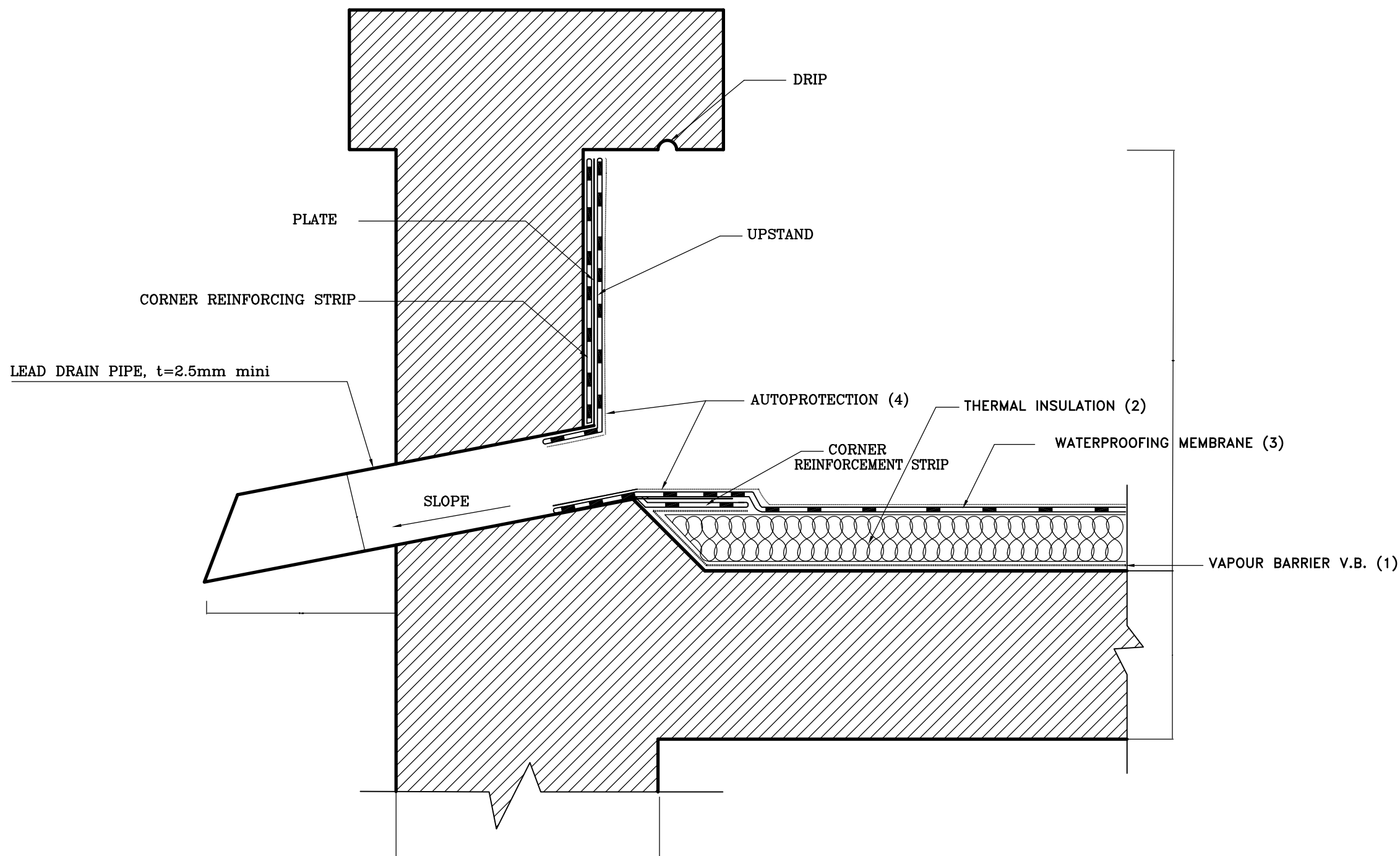
DETAIL E – VENTILATION PIPE
Scale 1:10



WATERPROOFING DETAIL



DETAIL RAIN WATER DRAINAGE



NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB, 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=420 MPa.
MILD STEEL BARS: SYMBOL # YIELD STRESS: F_y=250 MPa.

STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
– ON A CUBE, c=150mm : 30 N/mm²
– ON A CYLINDER, φ=150mm, h=300mm : 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.1 N/mm².

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER–STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50φ.
(φ= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.

BENDING:
φ > 12mm MECHANICAL.
φ < 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:
TOP BARS
BOTTOM BARS

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) V.B. – SBS/OR/APP t≥2.5mm
– ADHERENCE OR SEMI-ADHERENCE APPLICATION
(2) INSULATION – t=variable min. t=50mm
– EXPANDED POLYSTYRENE λ=0.037kcal/h.m.2.°C
– WITH t₁ – t₂ – t₃ – t₄
λ λ λ λ
λ λ λ λ
(3) WATERPROOFING – SBS/OR/APP t_{total} >4mm
– APPLICATION ON VAPOUR BARRIER.
– SBS/OR/APP t_{total} >4mm
– WITH MINERAL PROTECTION.
(4) PROTECTION – SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
– IN FACTORY MINERAL AUTOPROTECTION.
(5) h> 150mm (NILL SLOPE)

REMARKS:
• FLOOR SLAB INVERT LEVEL ±0.00: SEE LAYOUT DRAWINGS.
• DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
• HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
• ALL THE DIMENSIONS ARE IN mm.
• SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
• PROVIDE PERFORATED DRAIN PIPES, #4" IN THE GRAVEL PROTECTION LAYER.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD BUREAU TECHNIQUE POUR LE DEVELOPEMENT
JALL ED DIB – HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 – ANTELIAS FAX:(04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR
(CAPACITY 500 m³)

DETAILS
FORMWORK

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20 - 1:10 1:5	4/9	509W-RS03-C04

NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB, 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=420 MPa.
MILD STEEL BARS : SYMBOL # YIELD STRESS: F_y=250 MPa.

STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, $\phi=150\text{mm}$: 30 N/mm²
- ON A CYLINDER, $\phi=150\text{mm}$, $h=300\text{mm}$: 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.1 N/mm².

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
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CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2 ϕ 0 ϕ .
(ϕ = NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS ϕ 8 SHALL BE USED ON EACH LAP.

BENDING:
 ϕ > 12mm MECHANICAL.
 ϕ < 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:
TOP BARS
BOTTOM BARS

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) V.B. - SBS/OR/APP $t \geq 2.5\text{mm}$
- ADHERENCE OR SEMI-ADHERENCE APPLICATION
 t =variable min. $t=50\text{mm}$
(2) INSULATION - EXPANDED POLYSTYRENE $\lambda=0.037\text{wcd/h.m}^2\text{.}^\circ\text{C}$
- WITH $t_1=t_2=t$
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION ON VAPOUR BARRIER.
(3) WATERPROOFING - SBS/OR/APP $t_{\text{total}} > 4\text{mm}$
- WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
(4) PROTECTION - IN FACTORY MINERAL AUTOPROTECTION.
(5) $h > 150\text{mm}$ (NILL SLOPE)

REMARKS:
* FLOOR SLAB INVERT LEVEL ± 0.00 : SEE LAYOUT DRAWINGS.
* DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL THE DIMENSIONS ARE IN mm.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* PROVIDE PERFORATED DRAIN PIPES, $\phi 4"$ IN THE GRAVEL PROTECTION LAYER.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

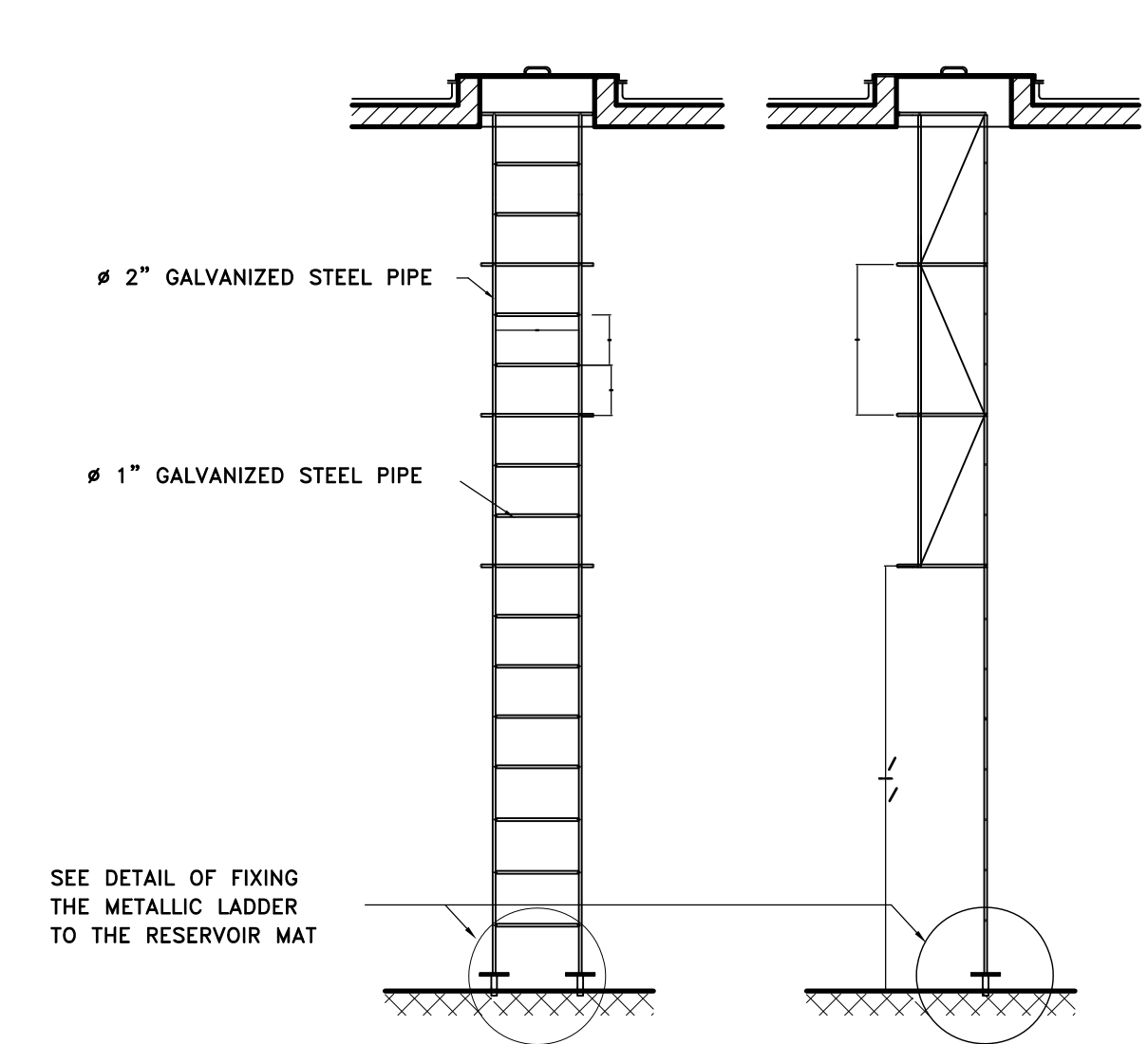
MAKSE RESERVOIR (CAPACITY 500 m ³)	DETAILS FORMWORK
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

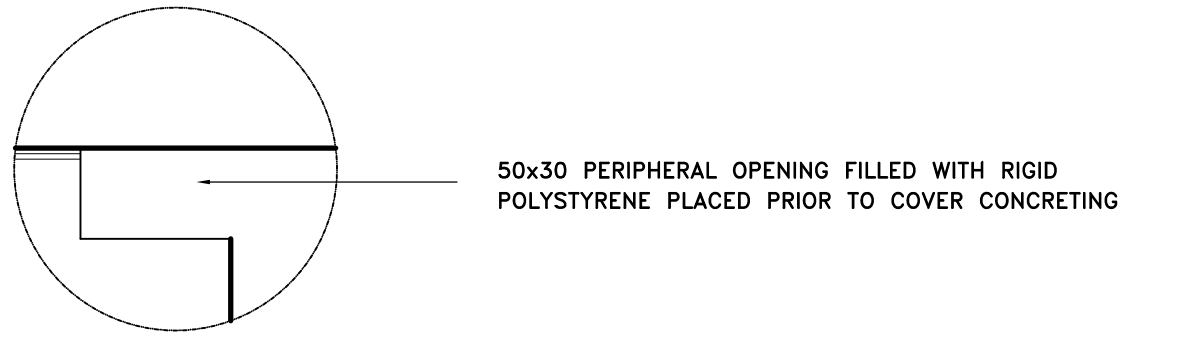
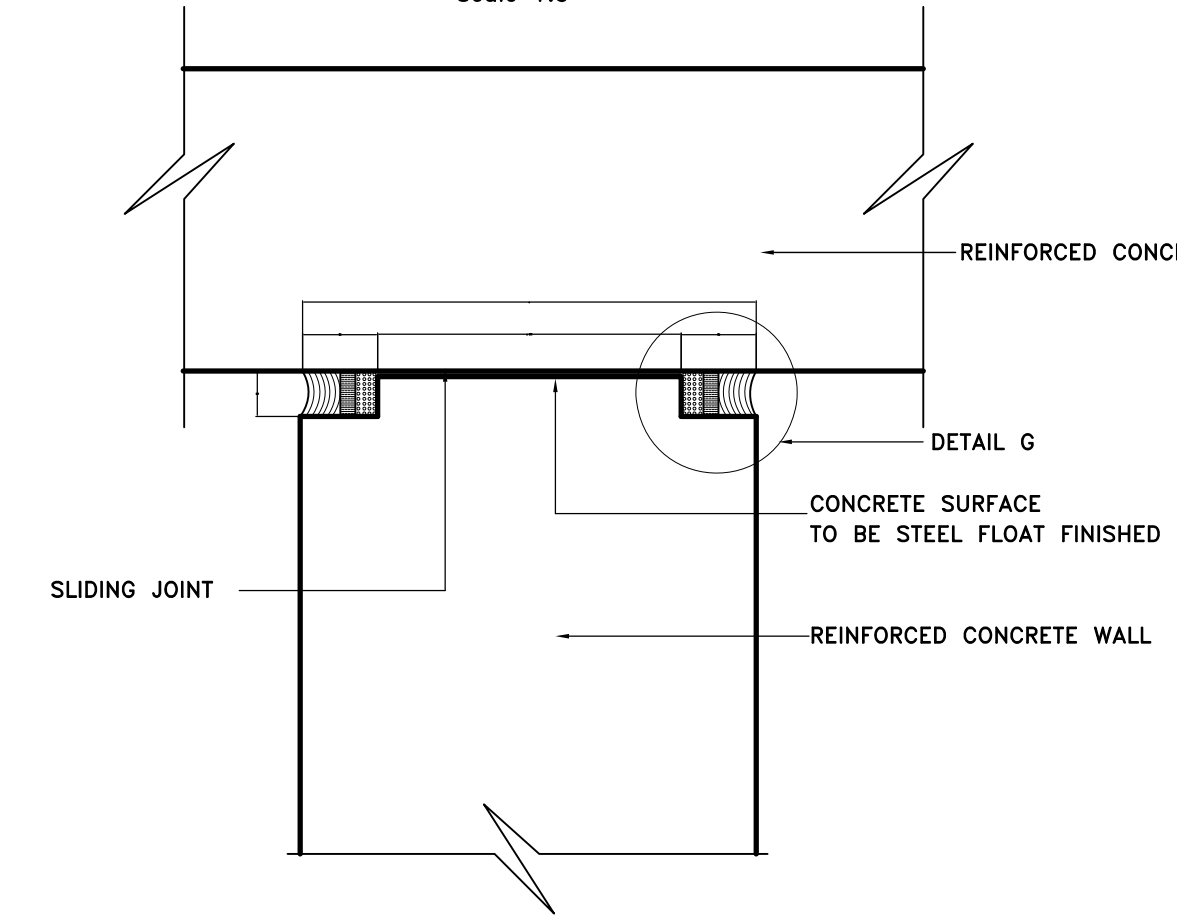
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20 - 1:10 1:5 - 1:1	5/9	509W-RS03-C05

INTERNAL METALLIC LADDER DETAIL

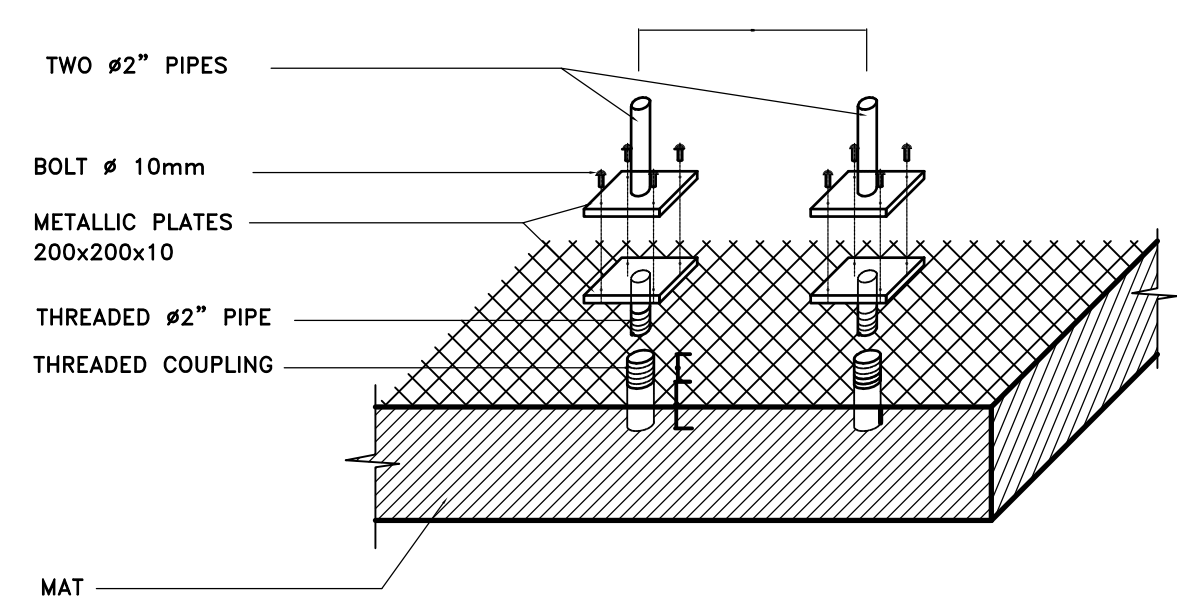
FRONT VIEW Scale 1:50
SIDE VIEW Scale 1:50



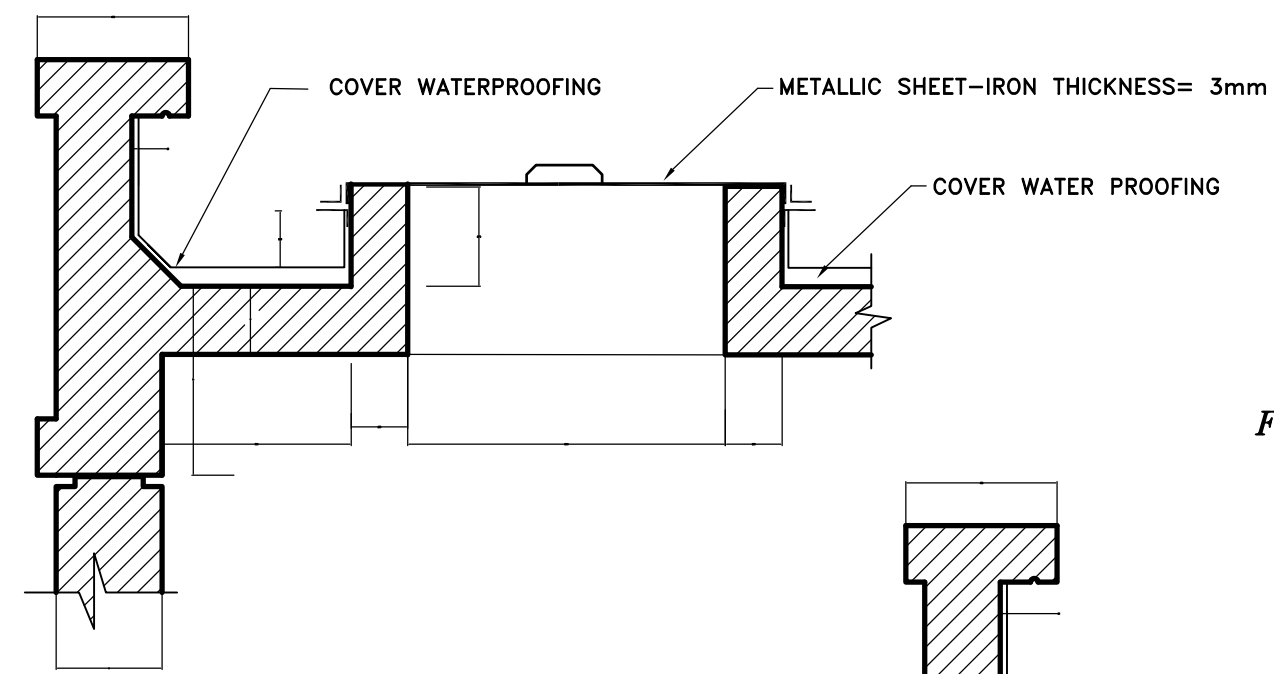
DETAIL F DU JOINT GLISSANT
Scale 1:5



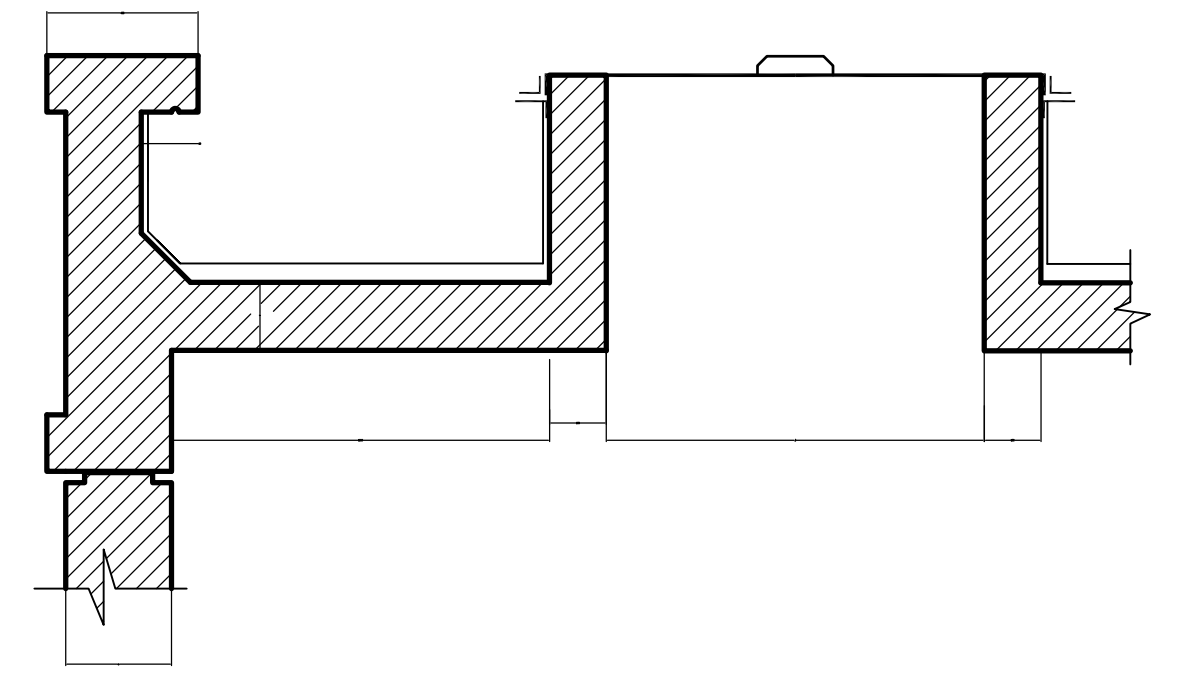
FIXING OF INTERNAL METALLIC LADDER DETAIL
Scale 1:20



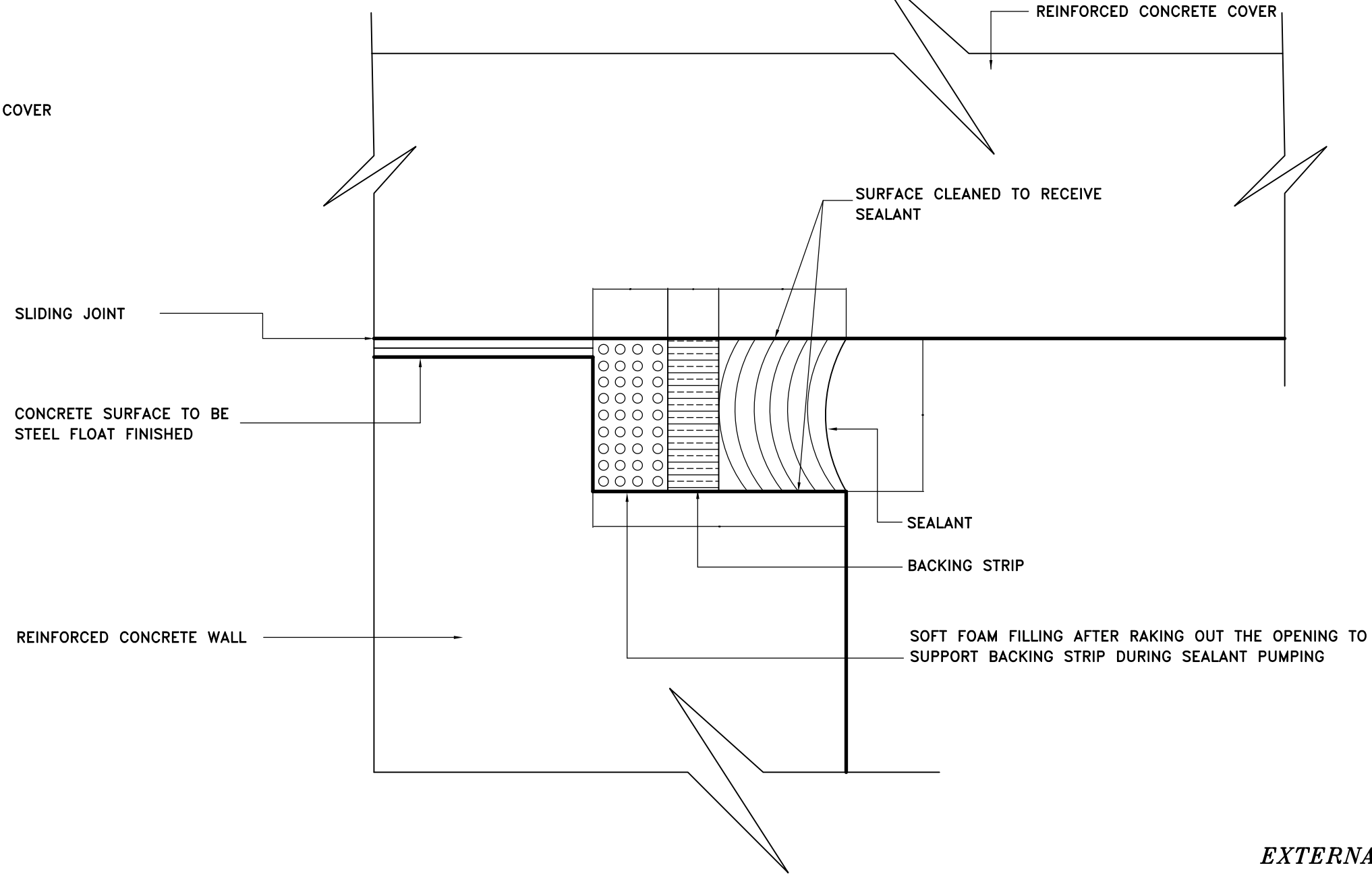
PARAPET-SLAB-TRAP DOOR SECTION



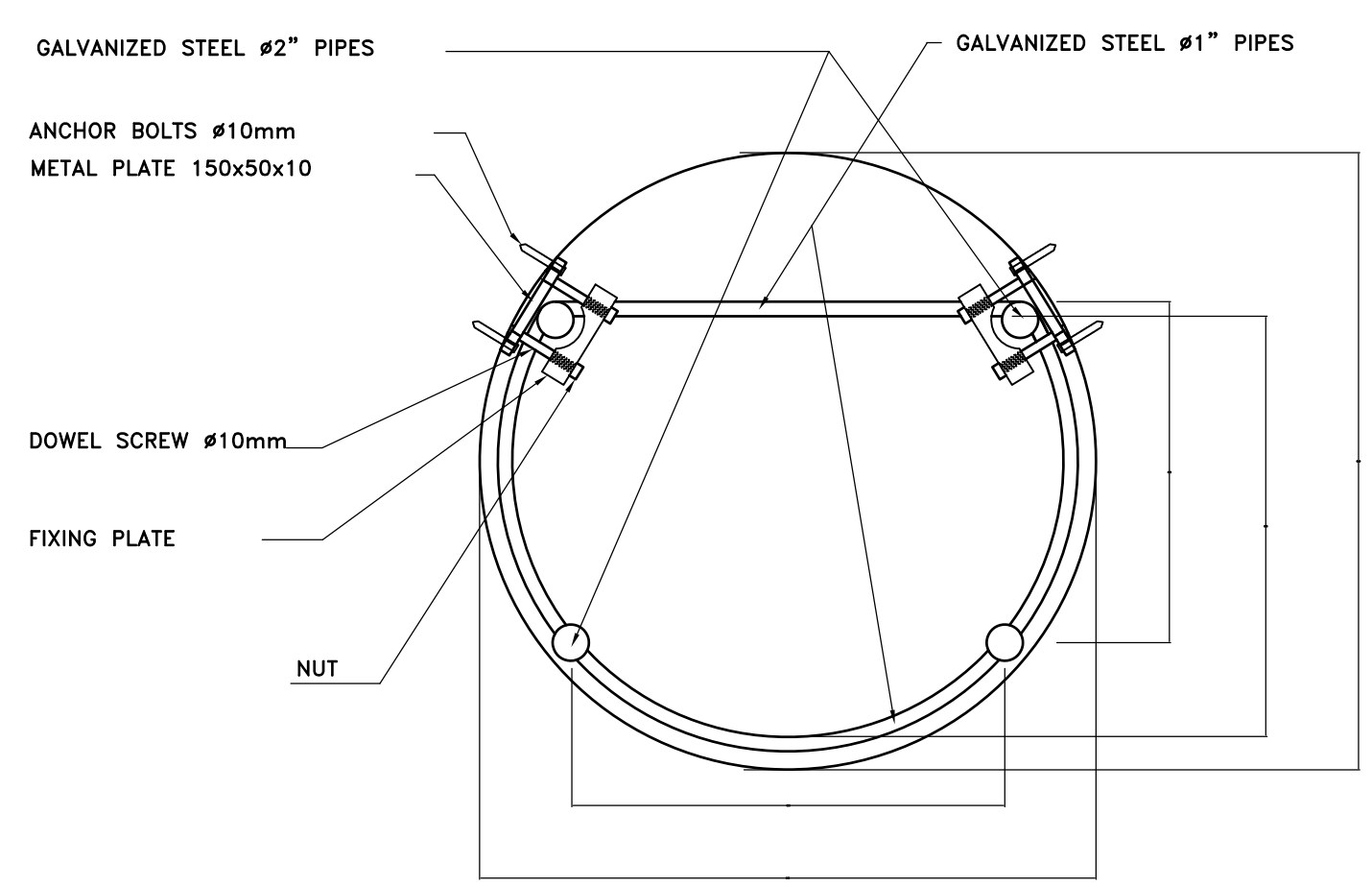
FLOAT TRAP-DOOR SECTION



DETAIL G
Scale 1:1

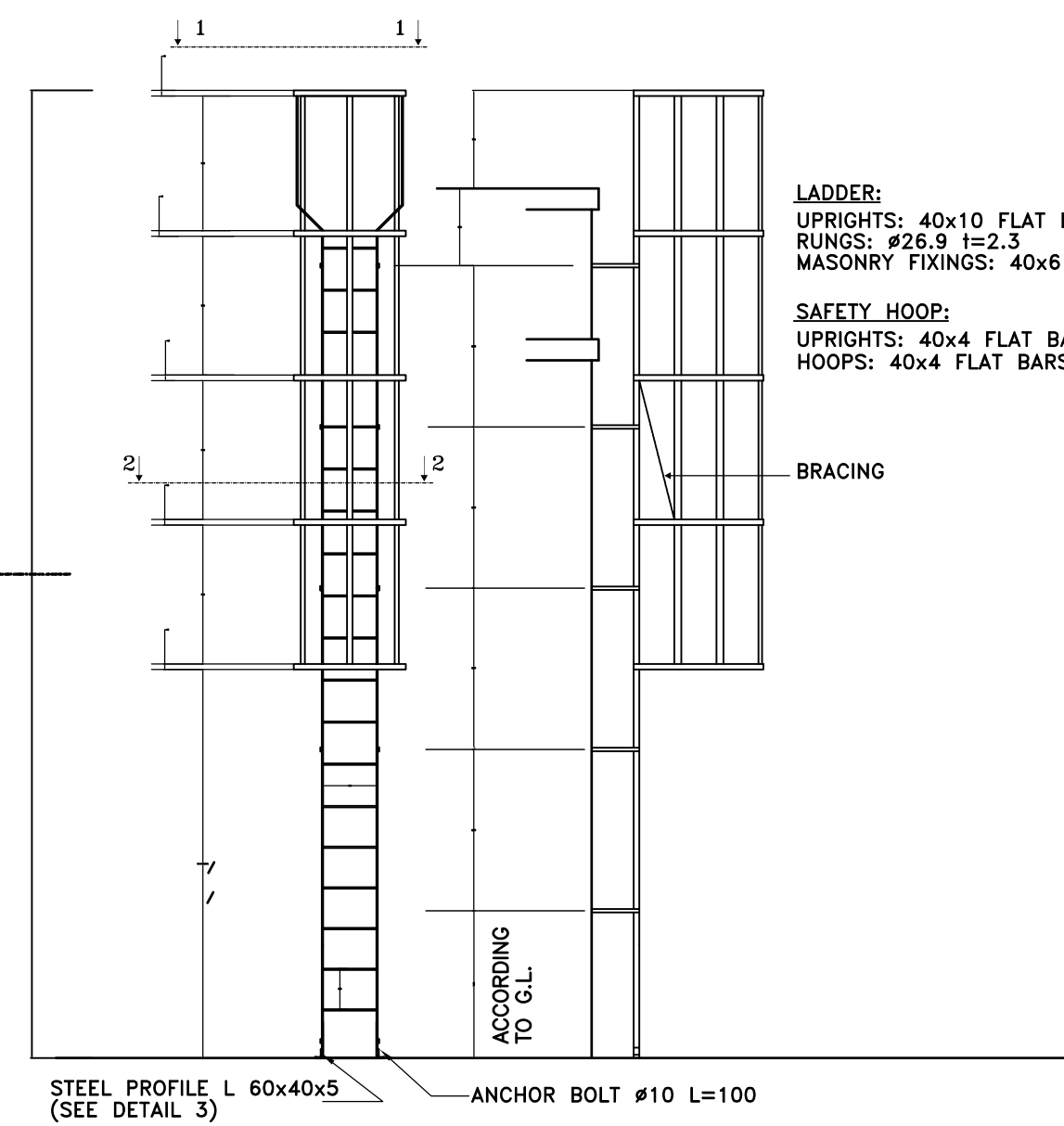


DETAIL OF INTERNAL LADDER AND UPPER FIXING
PLAN VIEW
Scale 1:10

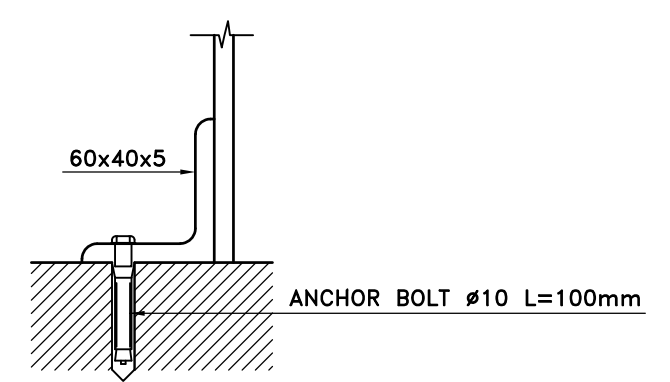


EXTERNAL METALLIC LADDER DETAIL

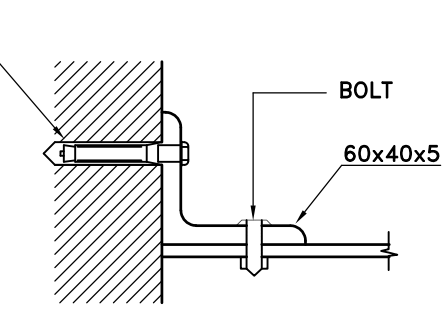
Scale 1:50



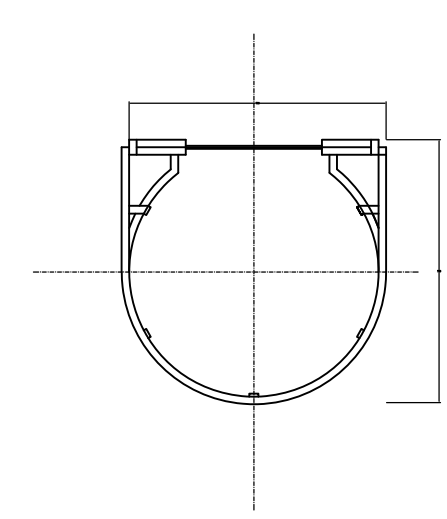
DETAIL 3: FIXING OF
EXTERNAL LADDER TO CONCRETE



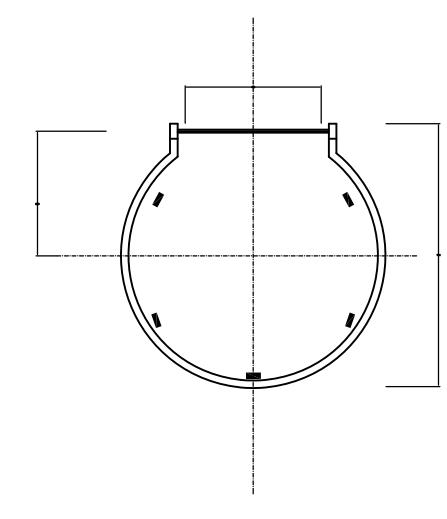
DETAIL 4: FIXING OF
EXTERNAL LADDER TO RESERVOIR WALLS



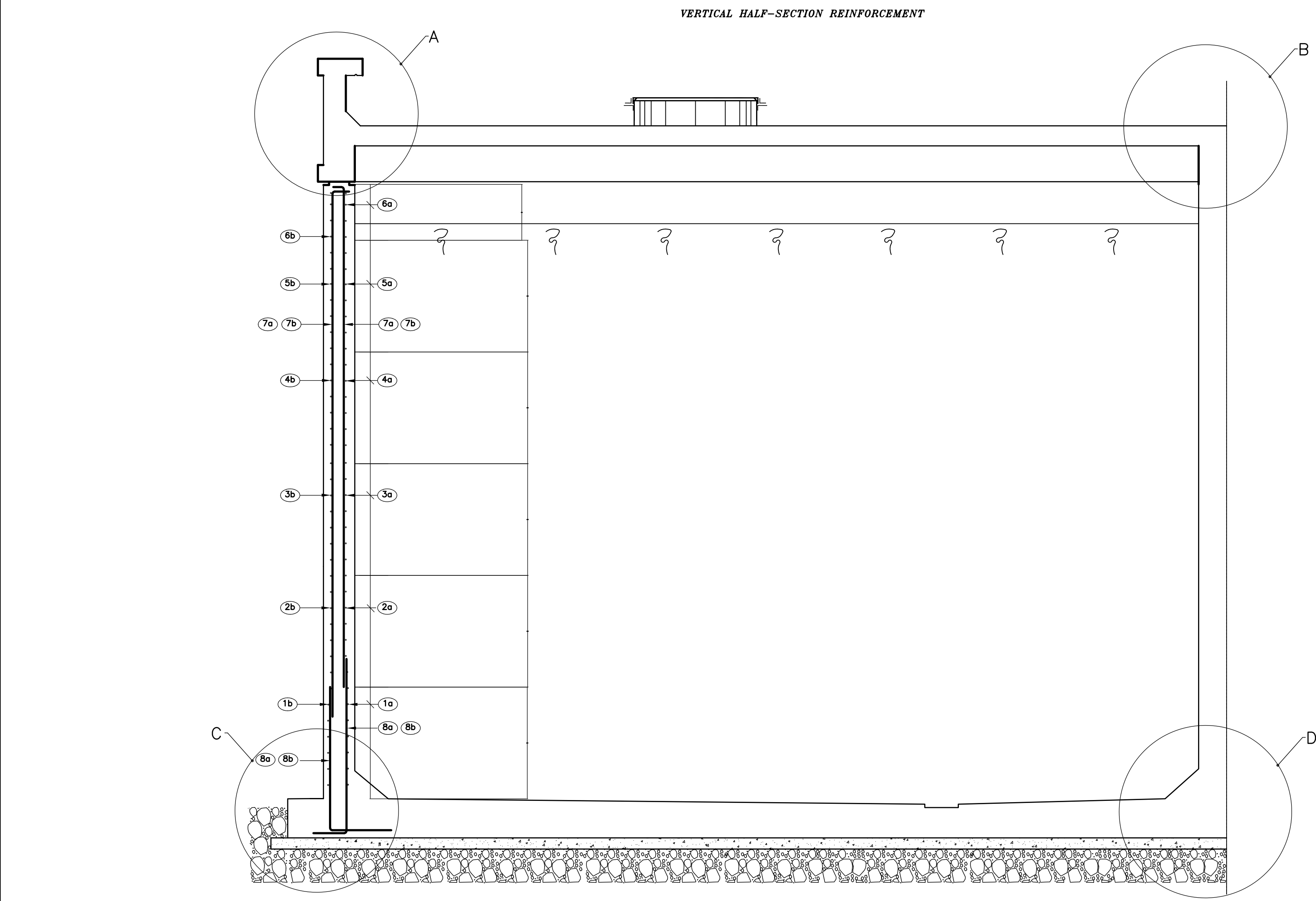
VIEW 1-1
Scale 1:10



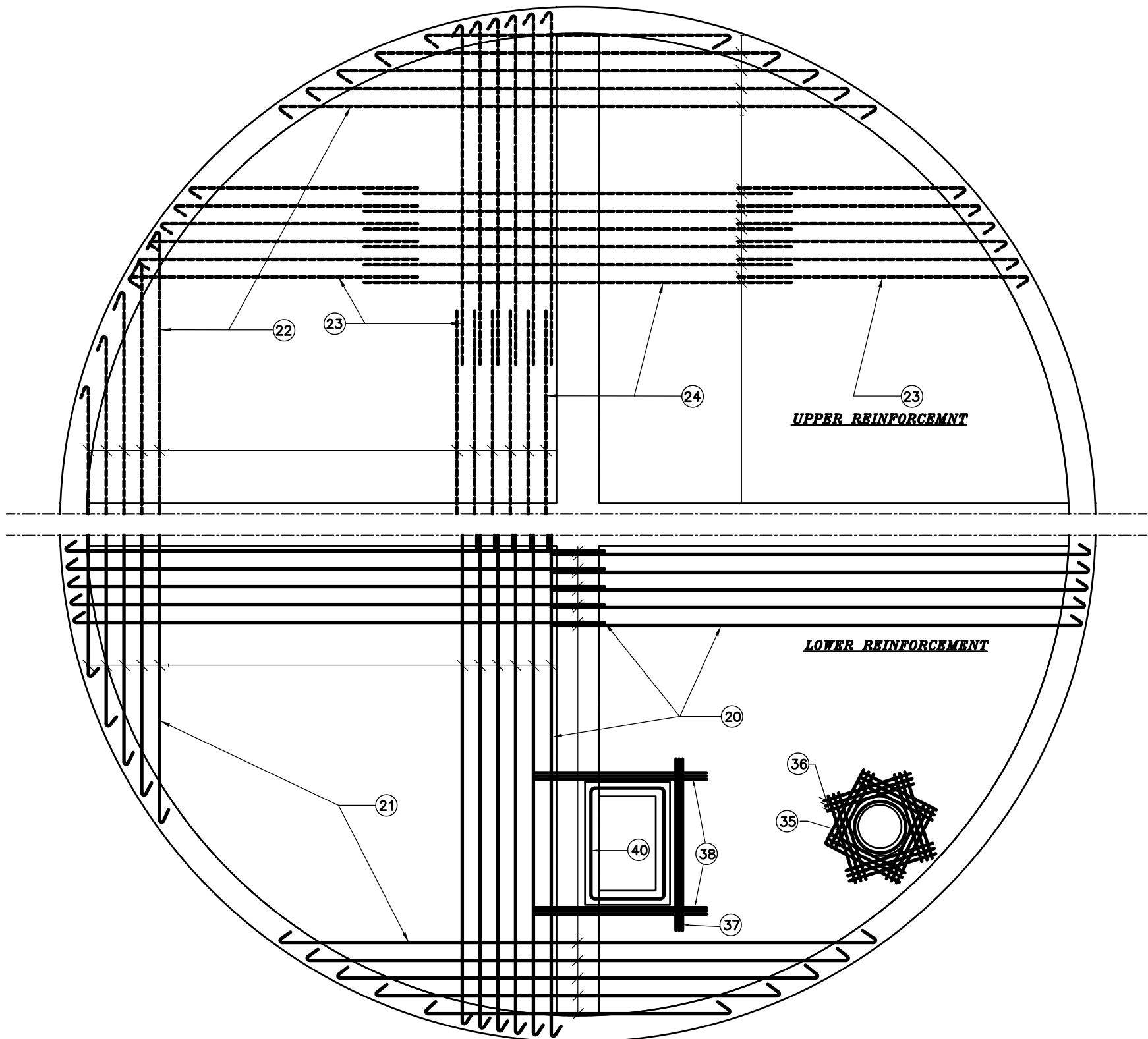
VIEW 2-2
Scale 1:10



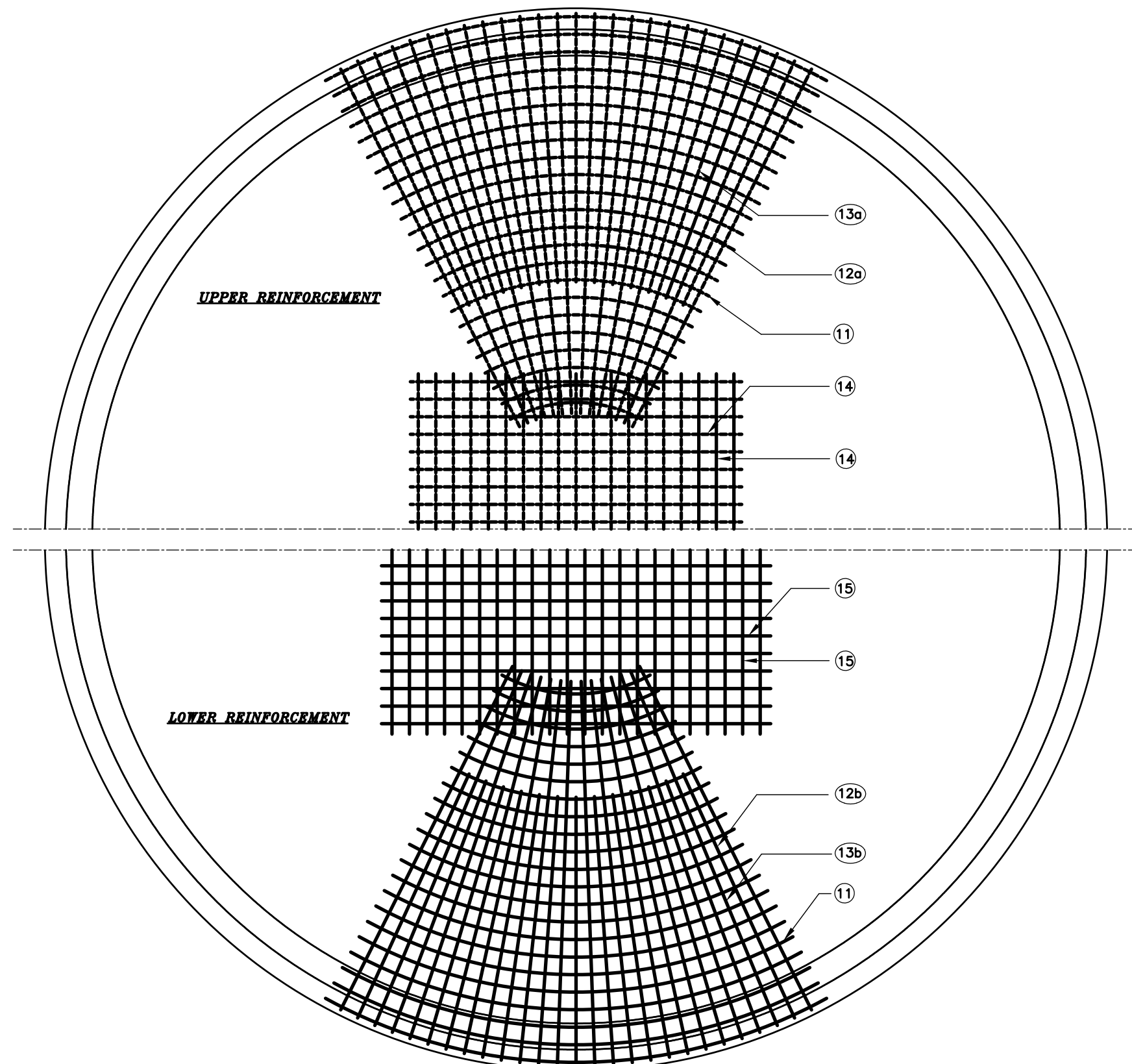
CAPACITY	500M3
R (mm)	5500
0.25R (mm)	1375
e (mm)	250
R+e (mm)	5750
c (mm)	200
f (mm)	350
d (mm)	200
R+t+d (mm)	5950
a (mm)	400
b (mm)	400
h (mm)	600
n (VENTILATION PIPES)	4
n' (DRAIN WATER)	4
H (mm)	6700
g (mm)	800
j (mm)	1200



COVER SLAB REINFORCEMENT



MAT REINFORCEMENT



CAPACITY 500						
Des.	Nber of layers per lm	Diameter T or Ø	Length (m)	Nber of bars/layer	Type	Total Nber of bars
1a	6	T18	9.50	4	5.55	24
1b	6	T16	9.80	4	5.70	24
2a	5	T16	9.50	4	5.55	20
2b	5	T16	9.80	4	5.70	20
3a	5	T14	9.50	4	5.55	20
3b	5	T14	9.80	4	5.70	20
4a	6	T12	9.50	4	5.55	24
4b	6	T12	9.80	4	5.70	24
5a	6	T12	9.50	4	5.55	24
5b	6	T12	9.80	4	5.70	24
6a	6	T12	9.50	4	5.55	12
6b	6	T12	9.80	4	5.70	12
7a	3	T12	4.00		0.20	218
7b	3	T12	4.50		0.20	218
8a	3	T16	2.80		0.40	218
8b	3	T16	2.30		0.40	218
9a	6	T16	2.08		0.15	218
9b	2 (per section)	T14	9.15	4	5.55	8
10a	6	T12	0.50		0.50	218
10b	6	T14	1.13		0.27	218
11	7	T16	3.10 to 10.00	4	1.50 to 5.50	252
12a	3	T18	3.40		0.20	108
12b	3	T16	3.50		0.20	108
13a	3	T16	4.70		0.15	108
13b	3	T16	4.90		0.20	108
14	6	T16	4.65		4.65	56
15	7	T25	5.20		5.80	74
16	8 (per section)	T12	6.00		0.20	8
17a	6	Ø8	1.50		0.35	36
17b	6	Ø8	1.35		0.28	36
18a	8 (per section)	T12	2.50		0.45	8
18b	1 (per section)	T12	2.75		0.65	1
19	8 (per section)	T12	1.50		0.40	8
20	6	T12	4.25 to 8.15	2	4.15 to 8.05	208
21	6	T12	2.85 to 8.20	1	2.85 to 8.00	36
22	5	T12	2.85 to 8.20	1	2.85 to 8.00	36
23	5	T12	1.25 to 3.15	2	1.15 to 3.05	176
24	5	T12	6.50	1	6.50	88
25a	4 (per section)	T25	7.00	2	6.70	16
25b	4 (per section)	T16	4.50	2	4.50	16
26	4 (per section)	T16	3.75	2	3.45	16
27a	4 (per section)	T25	6.75	1	6.75	8
27b	4 (per section)	T25	4.00	1	4.00	8
28	-	-	-	-	-	-
29a	Ø8	1.90	n1=10x13 n2=10x25	0.32	0.52	124
29b	Ø8	1.70	n1=10x13 n2=10x25	0.23	0.52	124
29c	-	-	-	-	-	-
30	-	-	-	-	-	-
31a	15 (per section)	T12	8.10 or 9.55	4	8.10 or 9.55	60
31b	8 (per section)	T12	8.10 or 9.55	4	8.10 or 9.55	32
31c	5	Ø8	0.80	-	0.84	170
32	5	Ø8	1.00	-	0.34	170
33a	5	Ø8	3.15	-	0.80	170
33b	5	Ø8	0.90	-	0.50	170
34	4 (per section)	T10		1	0.25 or 4.00	4
35	5	Ø8	1.10	-	0.41	15
36		T12	1.50	-	1.50	48
37		T16	3.20	-	3.20	3
38		T14	2.80	-	2.80	6
39		T10	2.60	-	2.60	3
40		T10	2.40	-	2.40	6
41	8 (per section)	T10	1.30 or 1.70	-	1.30 or 1.70	24
42	5	Ø8	1.60	-	0.64	23

NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB, 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 MPa.
MILD STEEL BARS: SYMBOL Ø YIELD STRESS: Fy=250 MPa.

STRESSES:
SEVERE CONTROL

CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, c=150mm : 30 N/mm²
- ON A CYLINDER, ø=150mm, h=300mm : 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.1 N/mm².

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
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OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2xØ.
(Ø= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS Ø8 SHALL BE USED ON EACH LAP.

BENDING:
Ø > 12mm MECHANICAL.
Ø < 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:
TOP BARS
BOTTOM BARS

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

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SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) V.B. - SBS/OR/APP t≥2.5mm
- ADHERENCE OR SEMI-ADHERENCE APPLICATION
- t=variable min. t=50mm
(2) INSULATION - EXPANDED POLYSTYRENE (λ=0.037kcal/h.m².°C)
- WITH t₁=t₂=t/2
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION ON VAPOUR BARRIER.
(3) WATERPROOFING - SBS/OR/APP t_{total} >4mm
- WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
(4) PROTECTION - IN FACTORY MINERAL AUTOPROTECTION.
(5) h> 150mm (NILL SLOPE)

REMARKS:
* FLOOR SLAB INVERT LEVEL ±0.00: SEE LAYOUT DRAWINGS.
* DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL THE DIMENSIONS ARE IN mm.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* PROVIDE PERFORATED DRAIN PIPES, Ø4" IN THE GRAVEL PROTECTION LAYER.

Rev. Date Dsgn Drwn Chk'd Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 - ANTELIAS FAX:(04) 712159

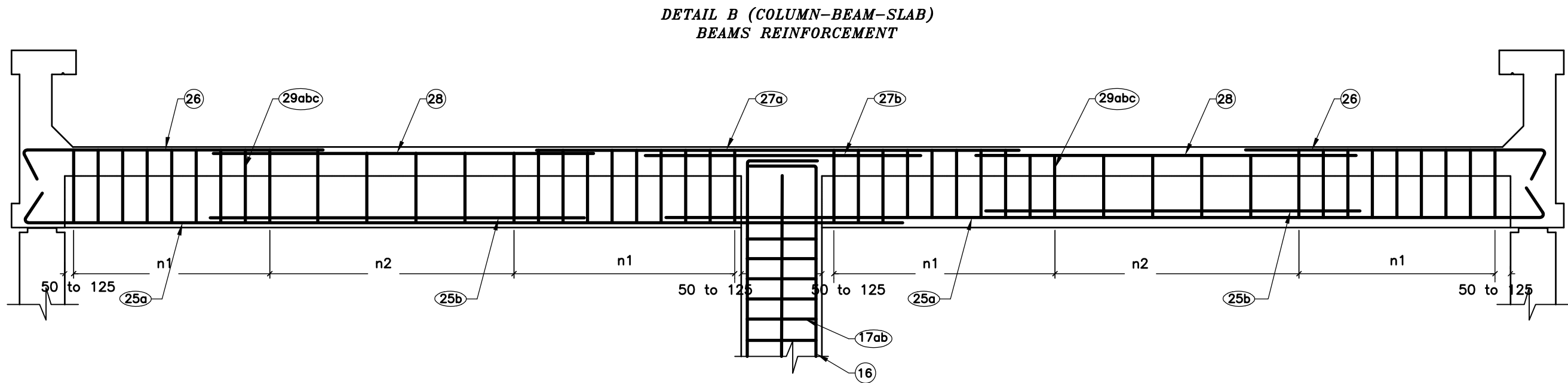
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR
(CAPACITY 500 m³)

VERTICAL HALF-SECTION AND
PLANS REINFORCEMENT

FILE NAME DESIGNED BY DRAWN BY CHECKED BY
509W-RS03-C01-09 W. SEIFEDDINE W. SEIFEDDINE W. SEIFEDDINE

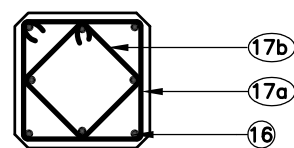
DATE SCALE SHEET No. DRAWING No.
JULY 2019 N.T.S. 6/9 509W-RS03-C06



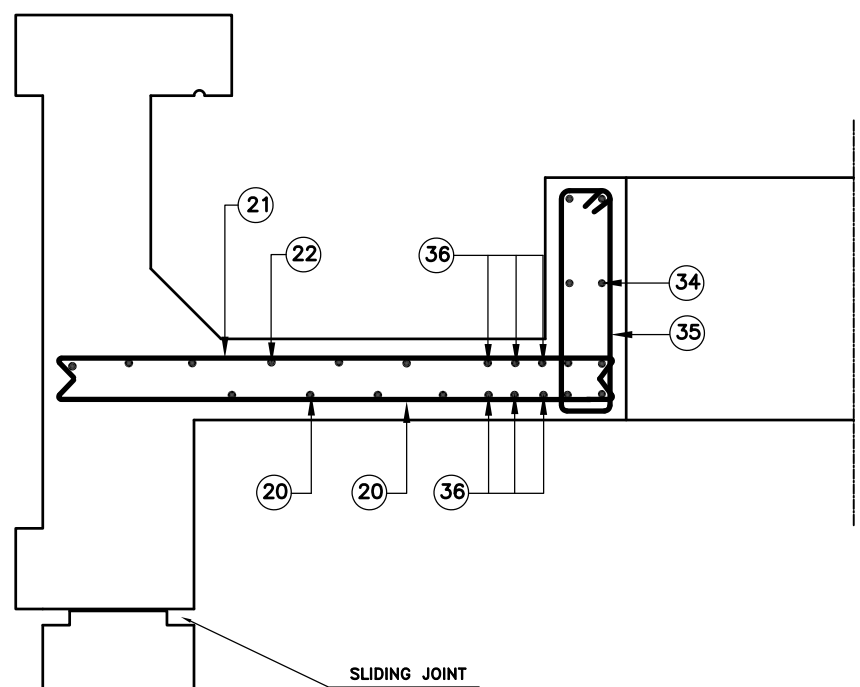
COLUMN REINFORCEMENT

SECTION AT MID SPAN

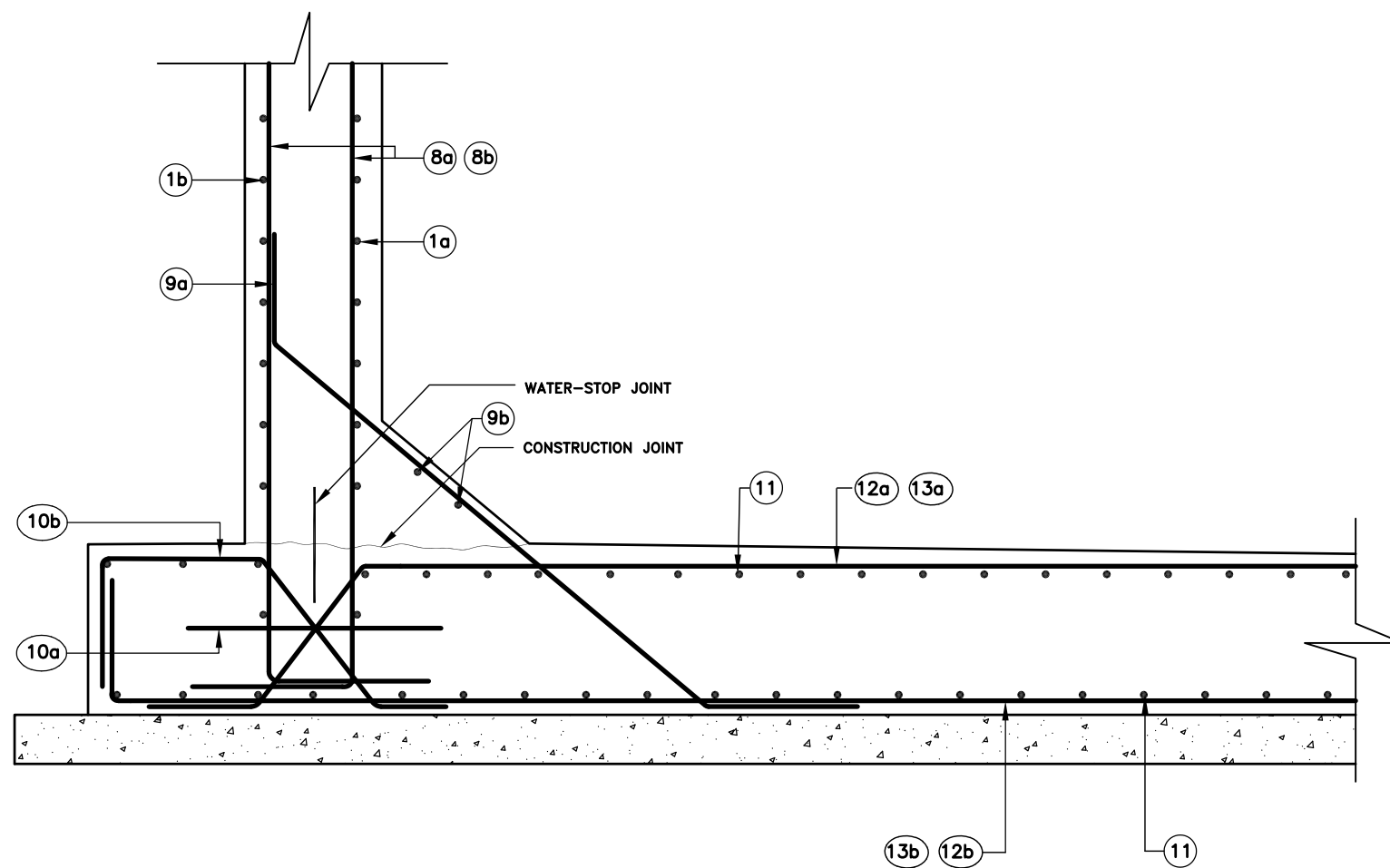
DETAIL F
FLOAT TRAP-DOOR SECTION



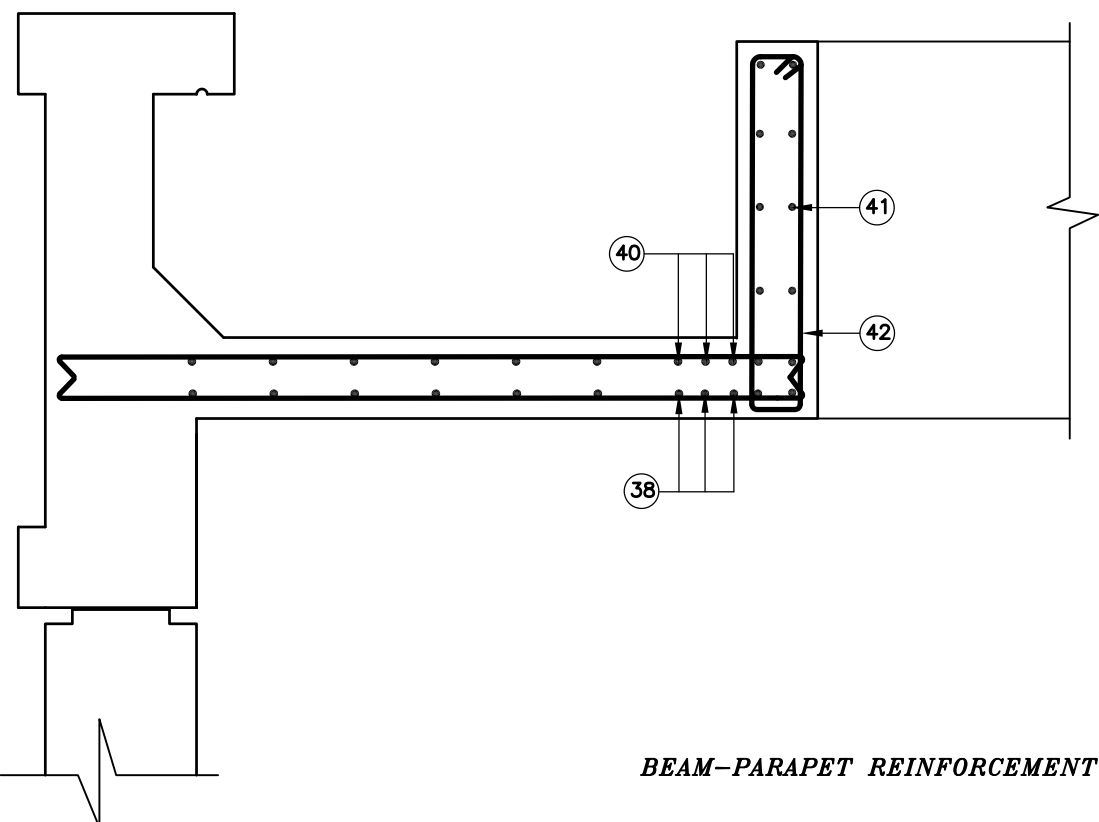
SLAB-TRAP DOOR REINFORCEMENT



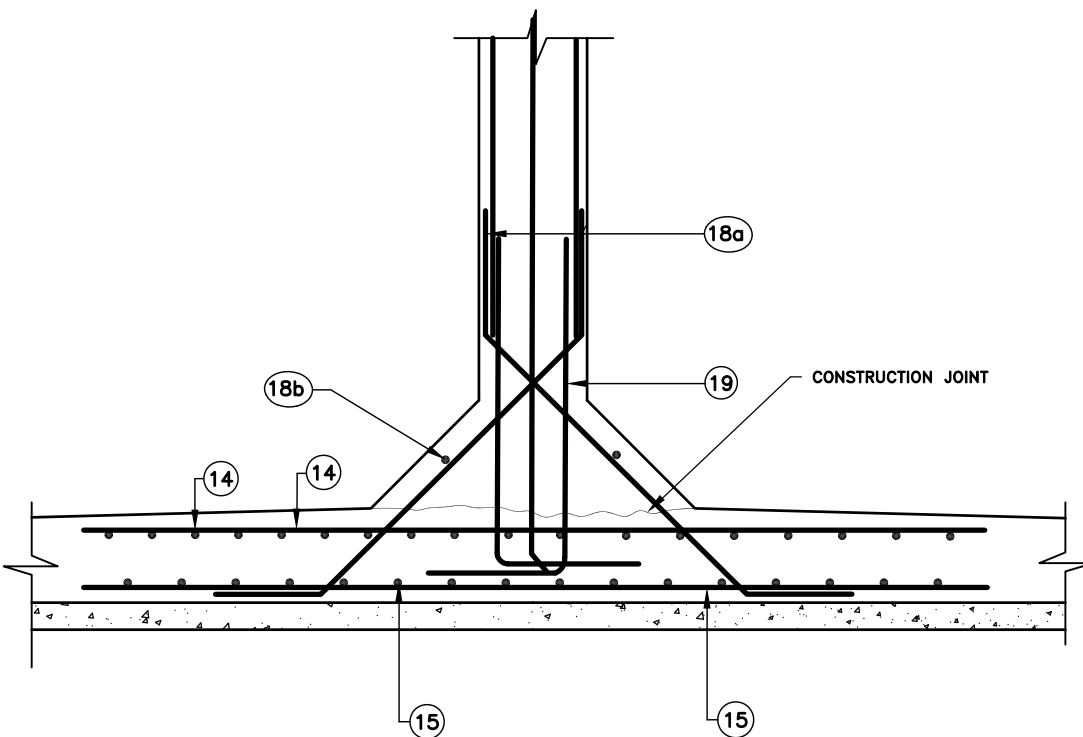
DETAIL C
MAT-WALL REINFORCEMENT



DETAIL A
SLAB-PARAPET REINFORCEMENT



BEAM-PARAPET REINFORCEMENT



DETAIL D
COLUMN-MAT REINFORCEMENT

CAPACITY 500									
Des.	Nber of layers per lm	Diameter T or #	Length (m)	Nber of bars/layer	Type	Total Nber of bars			
1a	6	T18	9.50	4	5.55	24			
1b	6	T16	9.80	4	5.70	24			
2a	5	T16	9.50	4	5.55	20			
2b	5	T16	9.80	4	5.70	20			
3a	5	T14	9.50	4	5.55	20			
3b	5	T14	9.80	4	5.70	20			
4a	6	T12	9.50	4	5.55	24			
4b	6	T12	9.80	4	5.70	24			
5a	6	T12	9.50	4	5.55	24			
5b	6	T12	9.80	4	5.70	24			
6a	6	T12	9.50	4	5.55	12			
6b	6	T12	9.80	4	5.70	12			
7a	3	T12	4.00		0.20	218			
7b	3	T12	4.50		0.20	218			
8a	3	T16	2.80		0.40	218			
8b	3	T16	2.30		0.40	218			
9a	6	T16	2.08		0.18	218			
9b	2 (per section)	T14	9.15	4	5.20	8			
10a	6	T12	0.50		0.50	218			
10b	6	T14	1.13		0.27	218			
11	7	T16	3.10 to 10.0	4	0.10	252			
12a	3	T18	3.40		0.20	108			
12b	3	T16	3.50		0.20	108			
13a	3	T16	4.70		0.15	108			
13b	3	T16	4.90		0.20	108			
14	6	T16	4.65		4.65	56			
15	7	T25	5.20		5.20	74			
16	8 (per section)	T12	6.00		0.20	8			
17a	6	#8	1.50		0.32	36			
17b	6	#8	1.35		0.28	36			
18a	8 (per section)	T12	2.50		0.25	8			
18b	1 (per section)	T12	2.75		0.65	1			
19	8 (per section)	T12	1.50		0.40	8			
20	6	T12	4.25 to 8.15	2	0.18	208			
21	6	T12	2.85 to 8.20	1	0.18	36			
22	5	T12	2.85 to 8.20	1	0.18	36			
23	5	T12	1.25 to 3.15	2	1.15 to 3.65	176			
24	5	T12	6.50	1	6.50	88			
25a	4 (per section)	T25	7.00	2	7.00	16			
25b	4 (per section)	T16	4.50	2	4.50	16			
26	4 (per section)	T16	3.75	2	3.45	16			
27a	4 (per section)	T25	6.75	1	6.75	8			
27b	4 (per section)	T25	4.00	1	4.00	8			
28	-	-	-	-	-	-			
29a	#8	1.90	n1=10x13 n2=10x25	0.32	0.52	124			
29b	#8	1.70	n1=10x13 n2=10x25	0.23	0.52	124			
29c	-	-	-	-	-	-			
30	-	-	-	-	-	-			
31a	15 (per section)	T12	8.10 to 9.55	4	8.10 to 9.55	60			
31b	8 (per section)	T12	8.10 to 9.55	4	8.10 to 9.55	32			
31c	5	#8	0.80	-	0.09	170			
32	5	#8	1.00	-	0.09	170			
33a	5	#8	3.15	-	0.13	170			
33b	5	#8	0.90	-	0.09	170			
34	4 (per section)	T10		1	3.25 to 4.00	4			
35	5	#8	1.10	-	0.09	15			
36		T12	1.50	-	1.50	48			
37		T16	3.20	-	3.20	3			
38		T14	2.80	-	2.80	6			
39		T10	2.60	-	2.60	3			
40		T10	2.40	-	2.40	6			
41	8 (per section)	T10	1.30 to 1.70	-	1.30 to 1.70	24			
42	5	#8	1.60	-	0.09	23			

NOTES FOR RESERVOIRS:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES.

MIX ELEMENTS:
ORDINARY PORTLAND CEMENT(400 Kg/m³ FOR LATERAL WALLS, FLOOR SLAB, AND THE COVER SLAB, 350 kg/m³ ELSEWHERE) SHOULD COMPLY WITH BS12.
AGGREGATES (SAND AND GRAVELS) FROM NATURAL QUARRIES, SHOULD COMPLY WITH BS882.
WATER SHOULD COMPLY WITH THE REQUIREMENTS OF BS5328.

LEAN CONCRETE / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, CONCRETE GRADE C20
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 MPa.
MILD STEEL BARS: SYMBOL # YIELD STRESS: Fy=250 MPa.

STRESSES:

SEVERE CONTROL:
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
- ON A CUBE, $\phi=150\text{mm}$: 30 N/mm²
- ON A CYLINDER, $\phi=150\text{mm}$, $h=30\text{mm}$: 25 N/mm²
CONCRETE TENSILE STRENGTH AT 28 DAYS: 2.1 N/mm².

CONSTRUCTION JOINTS:
PROHIBITED IN RESERVOIR WALLS.
REDUCED TO THE STRICT MINIMUM ELSEWHERE PROVIDED THAT NECESSARY PRECAUTIONS ARE TAKEN, SUCH AS: SETTING RETARDERS, BONDING MATERIALS, WATER-STOP JOINTS.
MAXIMUM POURING HEIGHT: 1.50 m.

ADDMIXTURES:
SETTING RETARDERS (CONSTRUCTION JOINTS).
WATERPROOFING ADMIXTURE (TO IMPROVE WATER PROOFNESS OF WALLS, FLOOR SLAB AND COVER SLAB).
THE USE OF CHLORINE BASED ADMIXTURES IS NOT ALLOWED.
EVERY ADMIXTURE SHALL BE APPROVED BY THE ADMINISTRATION.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 4 cm FOR THE RESERVOIR FLOOR SLAB AND WALLS, 3 cm ELSEWHERE.

OVERLAPPING:
SPICES SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x ϕ .
(ϕ = NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.

BENDING:
 $\phi > 12\text{mm}$ MECHANICAL.
 $\phi < 12\text{mm}$ MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

DRAWINGS CONSIDERATION:
TOP BARS
BOTTOM BARS

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
SURFACE WATERPROOFING TREATMENT OF RESERVOIR WALLS, COVER AND FLOOR SLAB.
COVER WATERPROOFING CONSISTING OF A VAPOUR BARRIER, A THERMAL INSULATION, A WATERPROOFING MEMBRANE AND ITS PROTECTION.

WATERPROOFING DETAILS:
(1) V.B.
- SBS/OR/APP $t \geq 2.5\text{mm}$
- ADHERENCE OR SEMI-ADHERENCE APPLICATION
- t =variable min. $t=50\text{mm}$
(2) INSULATION
- EXPANDED POLYSTYRENE $\lambda=0.037\text{ kcal/h.m}^2\text{.}^\circ\text{C}$
- WITH $t_1=t_2=t$
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION ON VAPOUR BARRIER.
(3) WATERPROOFING
- SBS/OR/APP $t_{\text{total}} > 4\text{mm}$
- WITH MINERAL PROTECTION.
- SEMI-ADHERENCE OR TOTAL ADHERENCE APPLICATION.
- IN FACTORY MINERAL AUTOPROTECTION.
(5) $h > 150\text{mm}$ (NILL SLOPE)

REMARKS:
* FLOOR SLAB INVERT LEVEL ± 0.00 : SEE LAYOUT DRAWINGS.
* DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL THE DIMENSIONS ARE IN mm.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* PROVIDE PERFORATED DRAIN PIPES, #4" IN THE GRAVEL PROTECTION LAYER.

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 - ANTELIAS FAX:(04) 712159

CONSTRUCTION OF WATER WORKS IN

QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR
(CAPACITY 500 m³)

SECTIONS AND DETAILS
REINFORCEMENT

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S.	7/9	509W-RS03-C07

A diagram of a circular domain with a shaded annular region. The domain is a large circle with a radius of 2000. Inside this domain, there is a shaded annular region (a ring) with an inner radius of 1000 and an outer radius of 2000. The shaded region is defined by the area between the inner circle of radius 1000 and the outer circle of radius 2000. The center of the circles is marked with a point labeled γ_i . The inner radius is labeled 1000, and the outer radius is labeled 2000.

SCALE 1:20

Technical drawing of a circular manhole. The drawing shows a top-down view of the manhole structure. The outermost circle is labeled "DRAIN PIPE" with a diameter of $\phi=75\text{mm}$. The next circle inward is labeled "OVERFLOW PIPE" with a diameter of $\phi=75\text{mm}$. The main body of the manhole is a large circle with a diameter of 2000mm. The bottom of the manhole is sloped at 0.5% in two directions, indicated by arrows and the text "SLOPE 0.5%". The drawing also shows a cross-section of the manhole wall, with a thickness of 150mm and a radius of 200mm. The manhole is shown with a 100mm wide opening at the bottom.

2T12;s=200

2T10;s=200

BOTTOM STEEL REINFORCEMENT
 TOP STEEL REINFORCEMENT

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

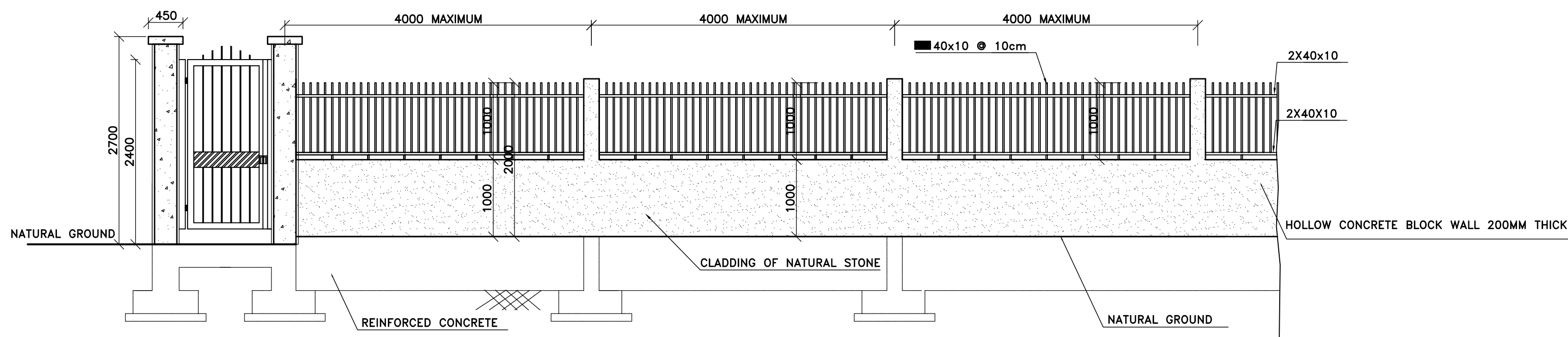
JALL ED DIB - HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 - ANTELIAS FAX:(04) 712159

CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM-QABB ELIAS AND MRAIJAT

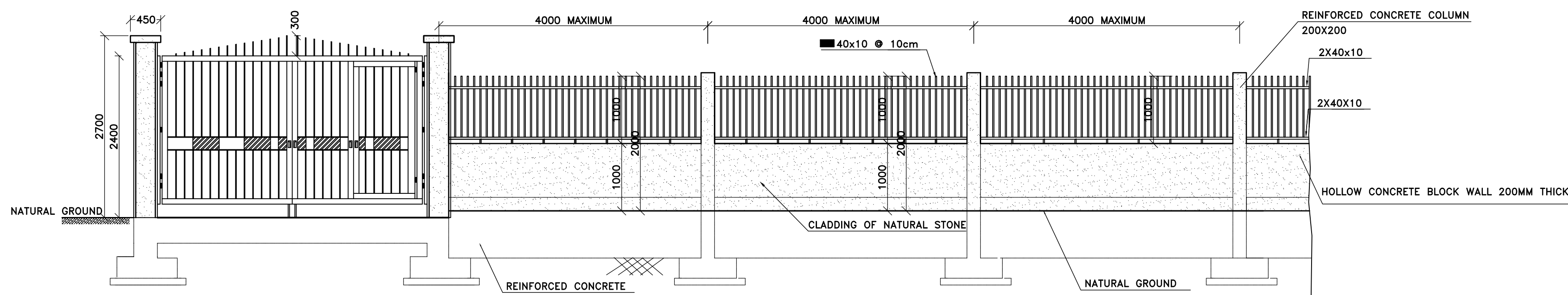
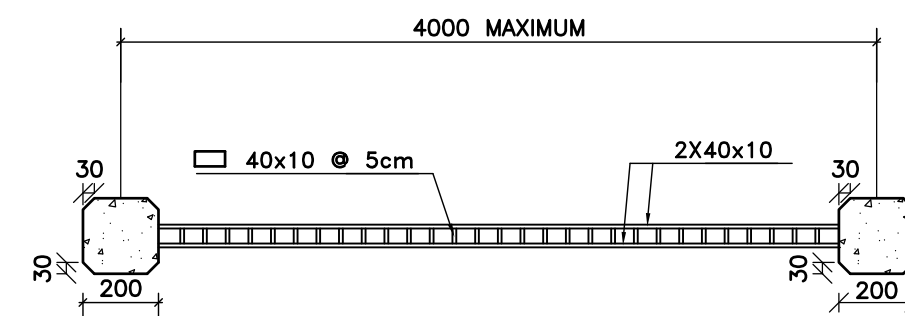
<p>VALVE CHAMBER</p> <p>INSIDE DIAMETER 400 cm</p> <p>INSIDE HEIGHT VARIABLE BETWEEN</p> <p>300 & 600cm DEPENDING ON</p> <p>THE GROUND LEVEL</p>	<p>FORMWORK</p> <p>REINFORCEMENT</p>
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<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

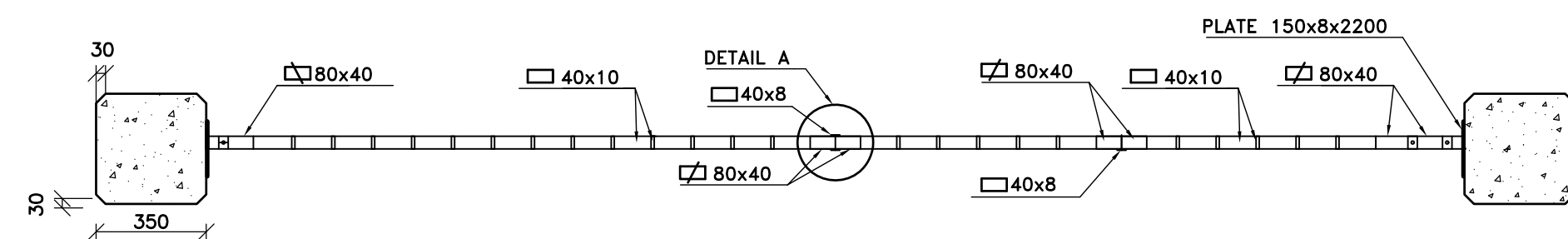
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JULY 2019	1/50-1/20	9/9	509W-RS03-C09



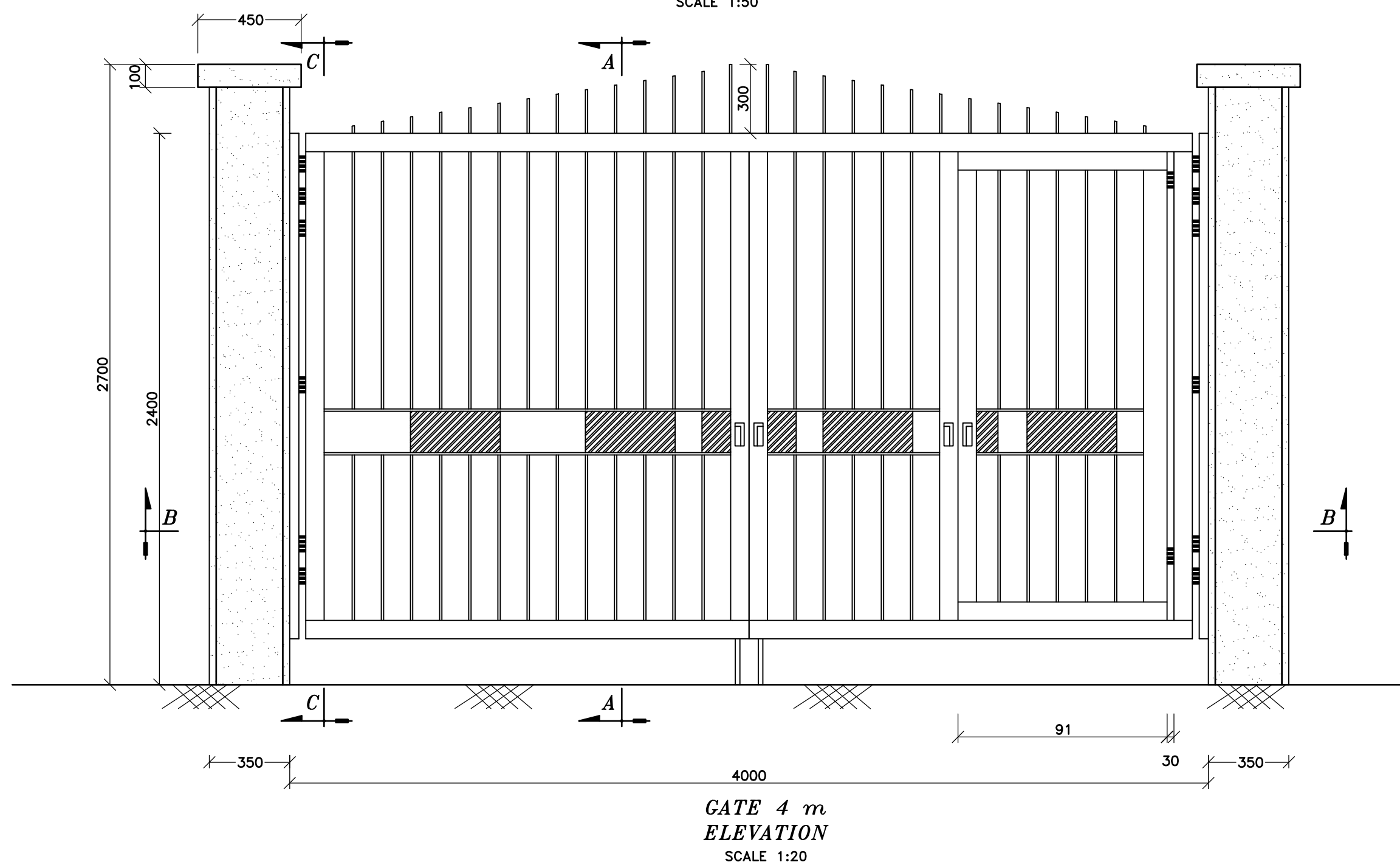
GATE 1.2 m (ELEVATION)
SCALE 1:50



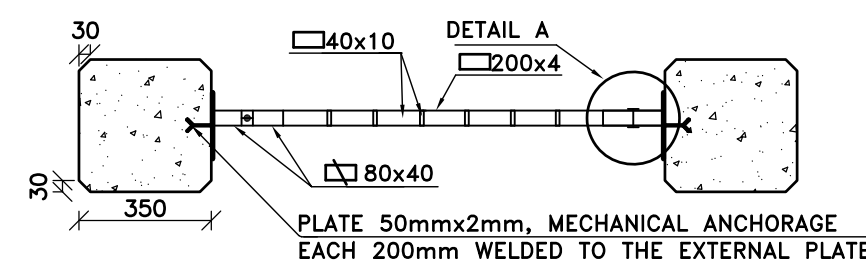
GATE 4 m (ELEVATION)
SCALE 1:50



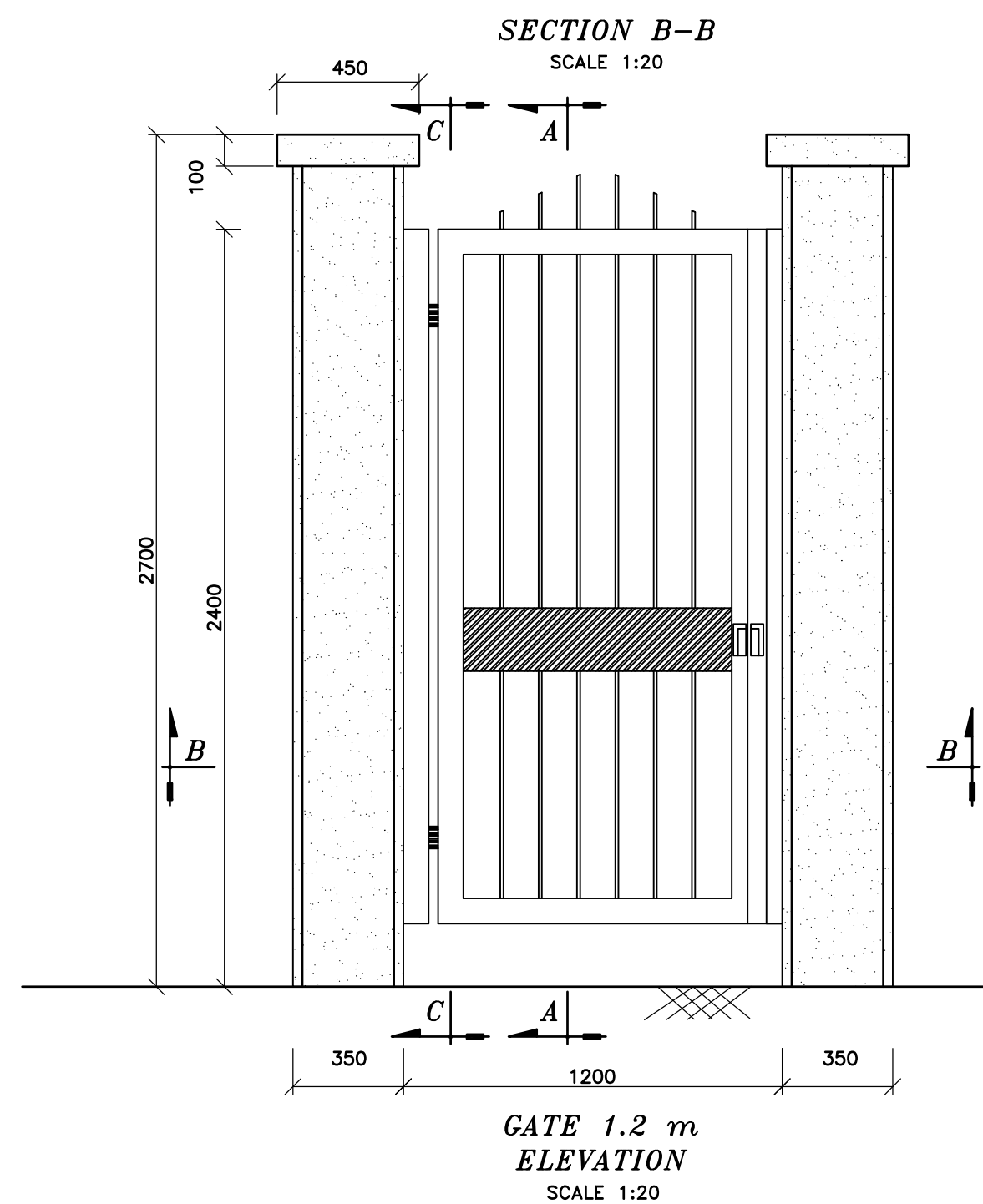
SECTION B-B
SCALE 1:50



GATE 4 m
ELEVATION
SCALE 1:20



SECTION B-B
SCALE 1:20



GATE 1.2 m
ELEVATION
SCALE 1:20

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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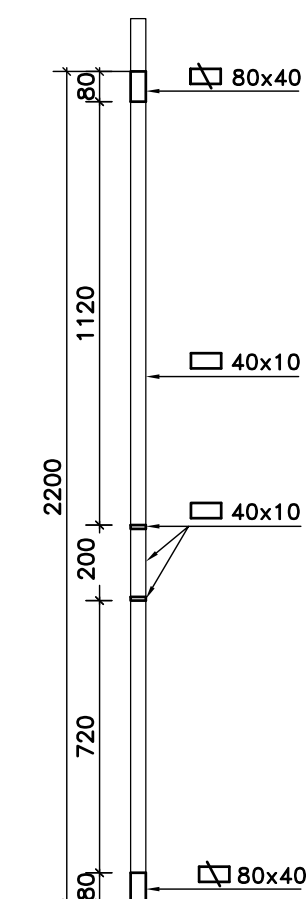
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

FENCE AND
TYPICAL GATE 4m AND 1.2m

ELEVATIONS
SECTIONS AND DETAILS

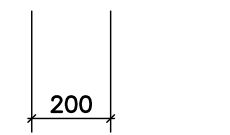
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509W-RS03-SF01-02	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20	1/2	509W-RS03-SF01

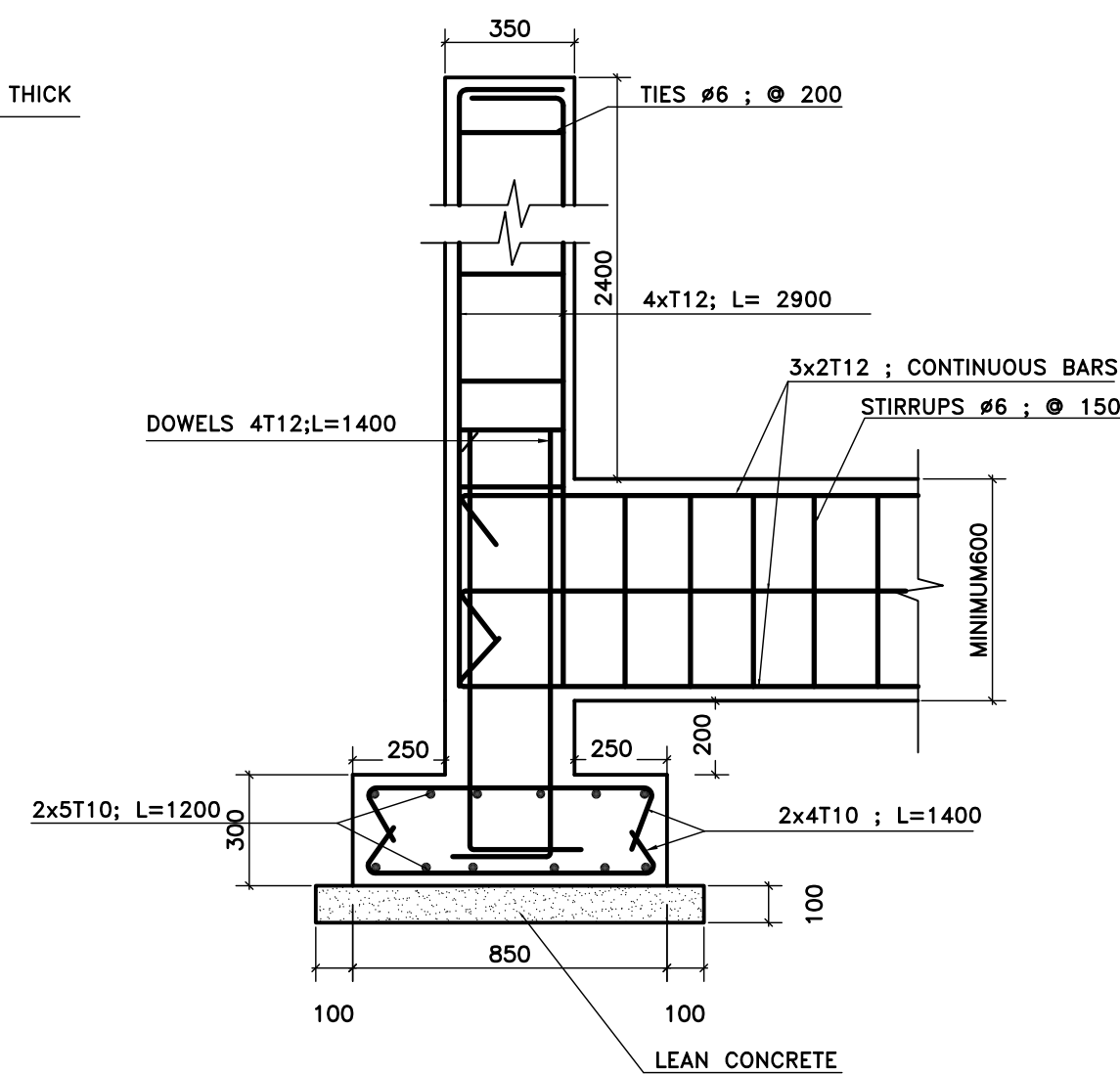


SECTION C-C
SCALE 1:20

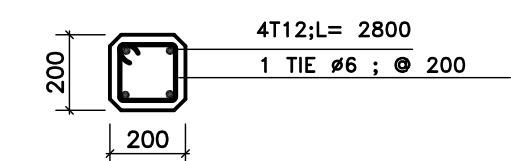
SECTION A-A
SCALE 1:20



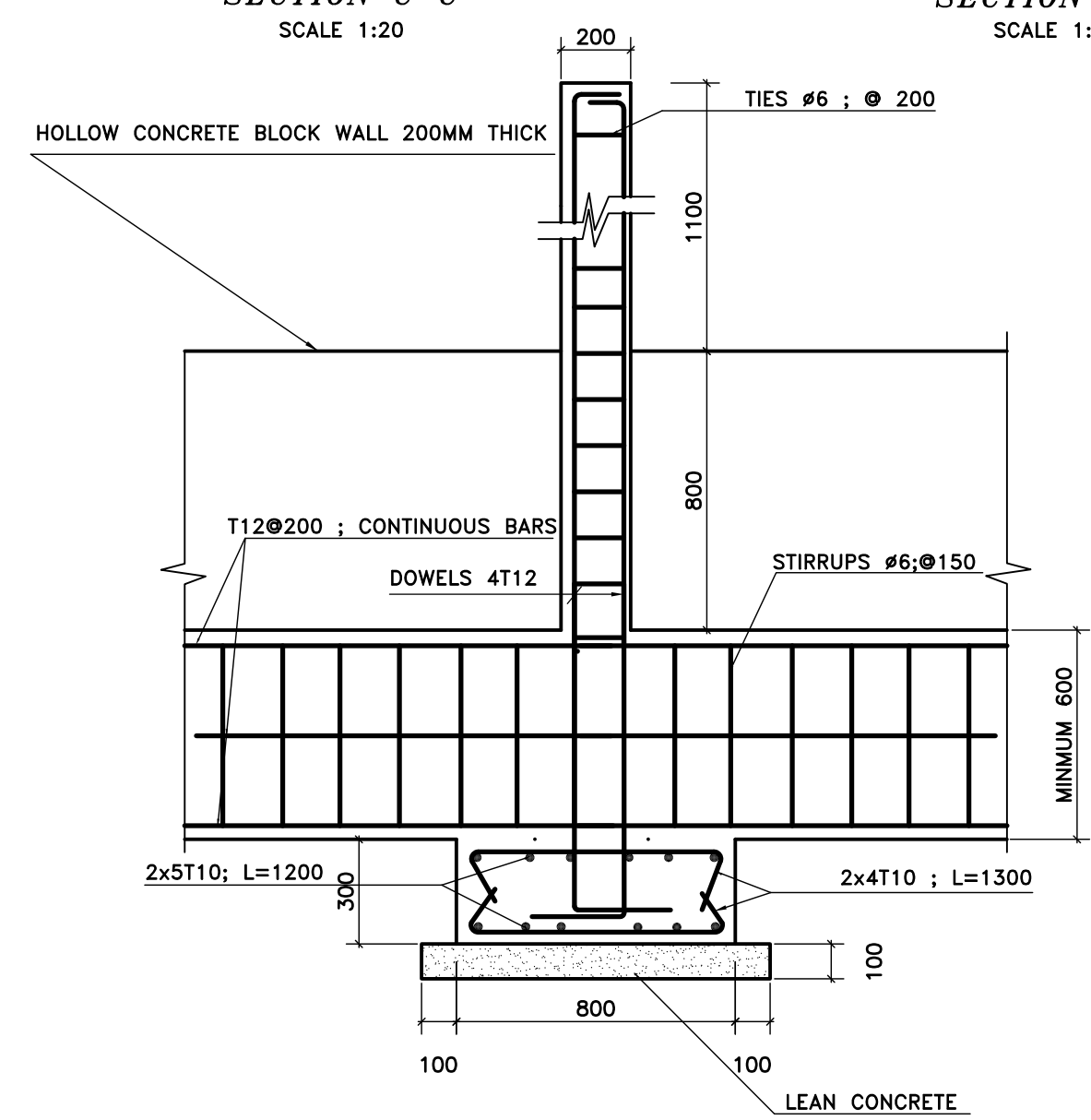
TYPICAL FENCE COLUMN
SCALE 1:20



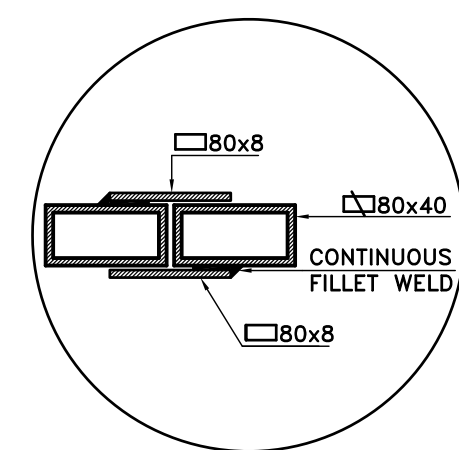
REINFORCEMENT OF TYPICAL ACCESS GATE COLUMN AND FOOTING
SCALE 1:20



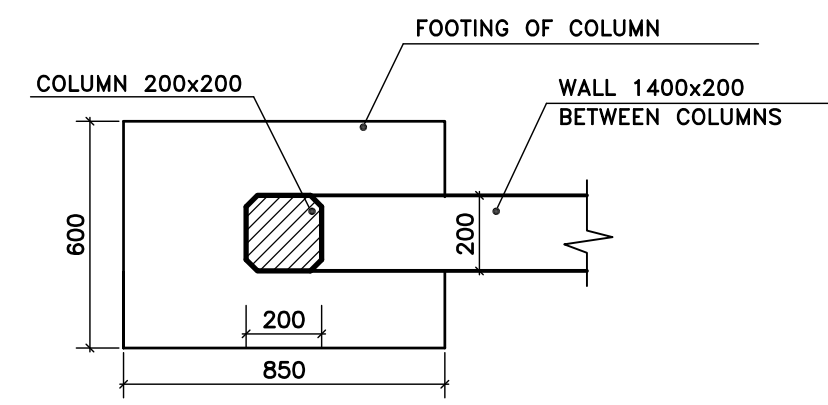
**HORIZONTAL SECTION
OF COLUMN**
SCALE 1:20



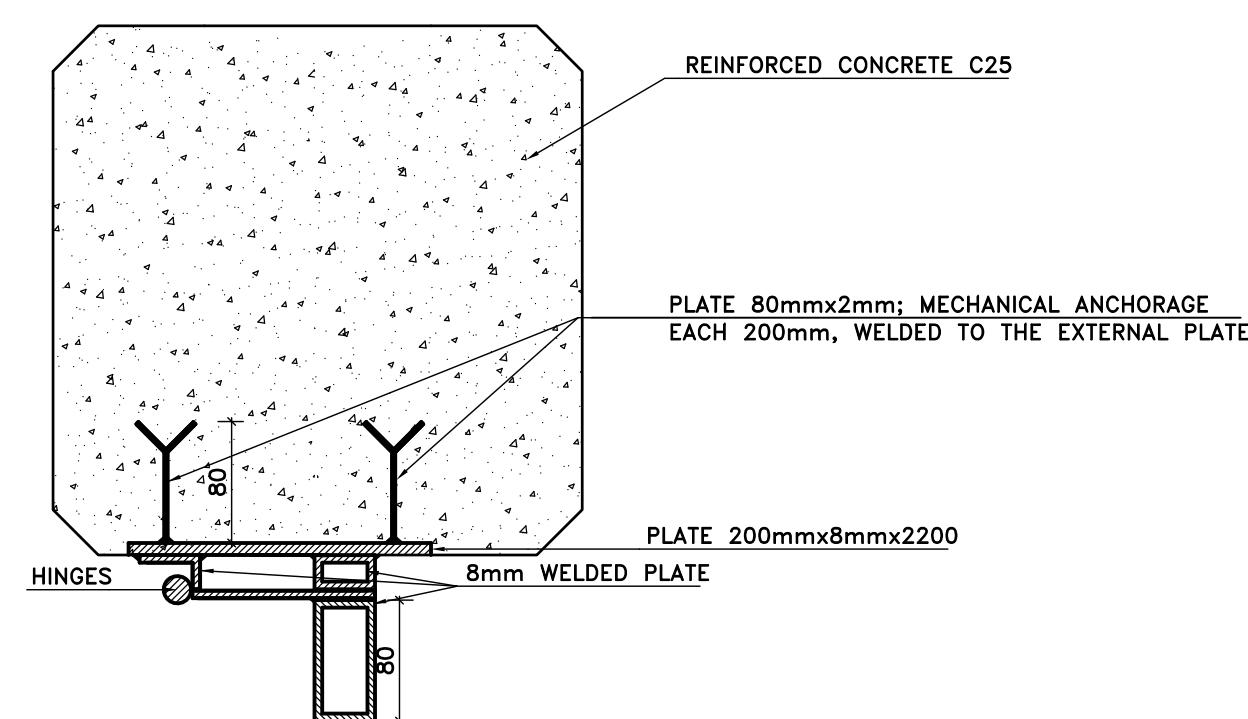
REINFORCEMENT OF TYPICAL COLUMN AND FOOTING
SCALE 1:20



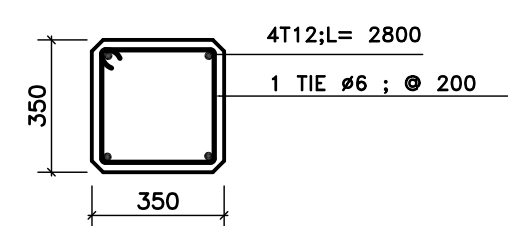
DETAIL A
SCALE 1:5



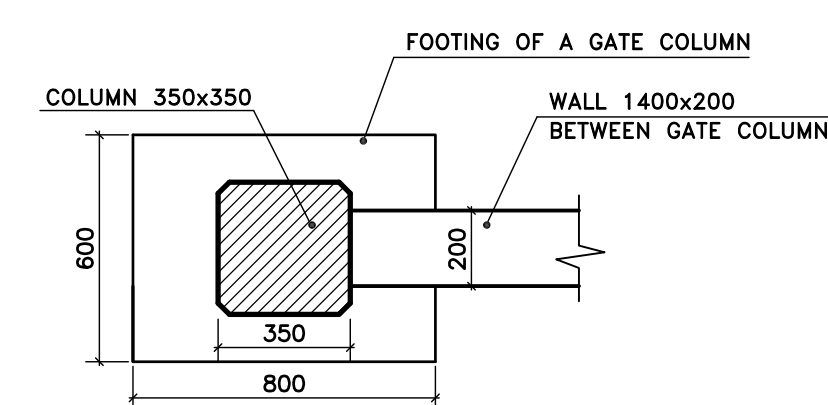
FOOTING
SCALE 1:20



SECTION D-D
SCALE 1:5



**HORIZONTAL SECTION
OF GATE COLUMN**
SCALE 1:20

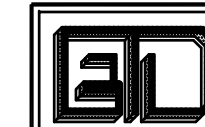


FOOTING
SCALE 1:20

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

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JALL ED DIB - HAJAL Bldg
P.O.BOX:70492 - ANTELIAS

TEL:(04) 712157 / 712158
FAX: (04) 712159

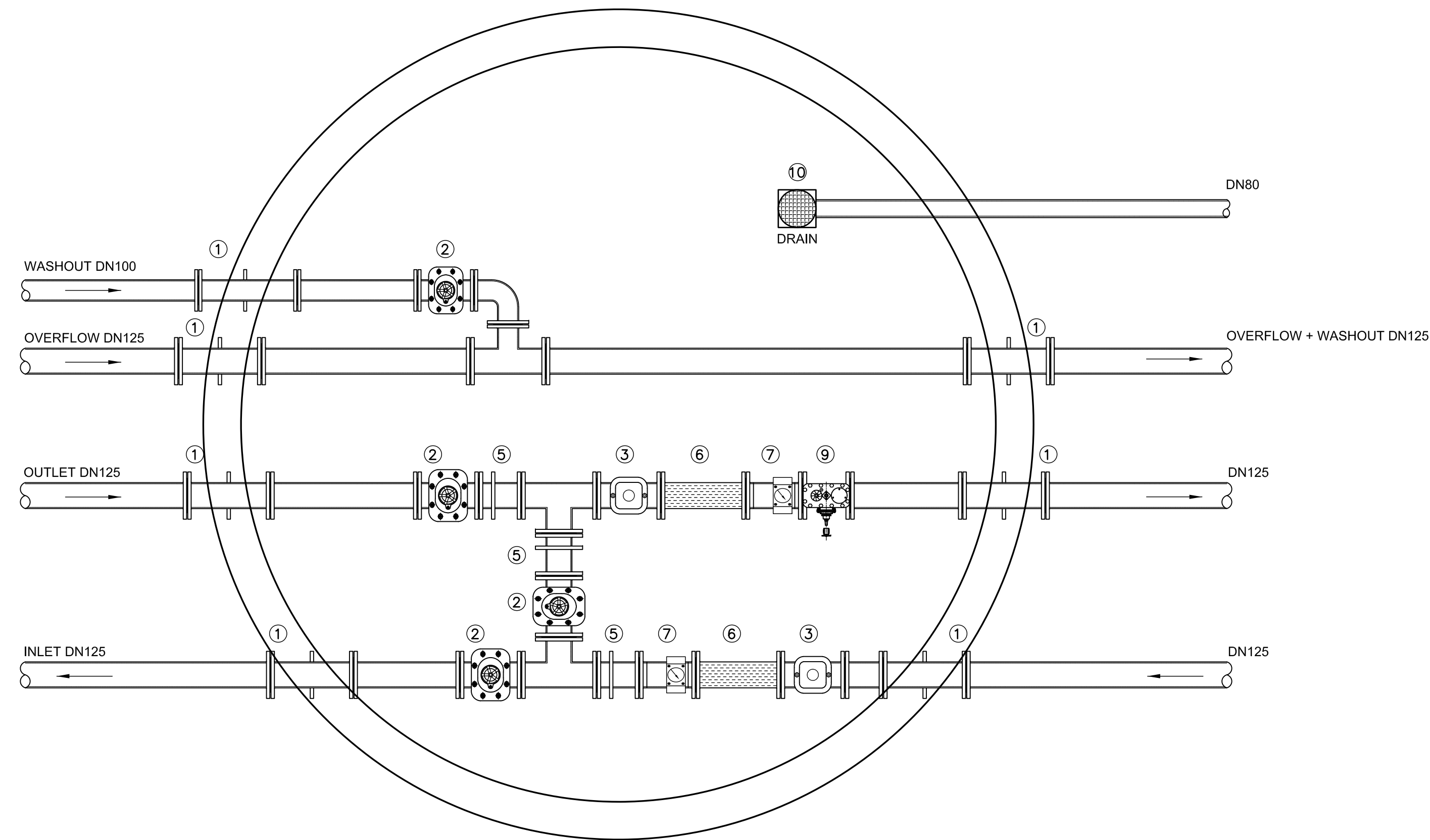
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

FENCE AND TYPICAL GATE 4m AND 1.2m	ELEVATIONS SECTIONS AND DETAILS
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<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS03-SF01-02	BTD	BTD	BTD

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
JULY 2019	1:2 - 1:5 - 1:20	2/2	509W-RS03-SF02

MAKSE RESERVOIR VALVE CHAMBER
D=4000mm



LEGEND:

- ① : INSERT
- ② : GATE VALVE
- ③ : FILTER
- ④ : PRESSURE REDUCING AND SUSTAINING VALVE
- ⑤ : DISMANTLING JOINT
- ⑥ : FLOW STRAIGHTENER
- ⑦ : WATER METER
- ⑧ : BUTTERFLY VALVE
- ⑨ : AIR RELEASE VALVE + GATE VALVE
- ⑩ : FLOOR DRAIN

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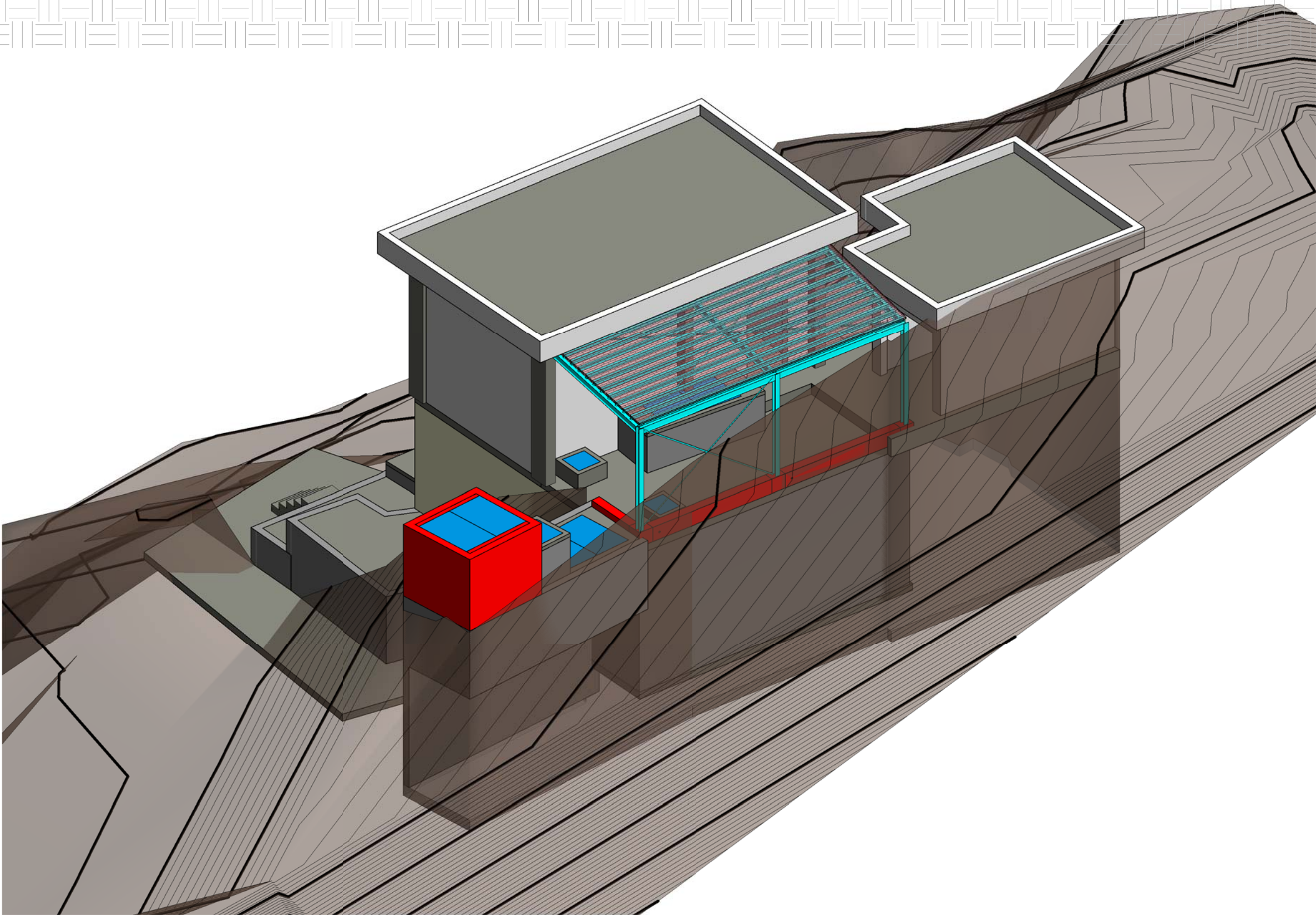
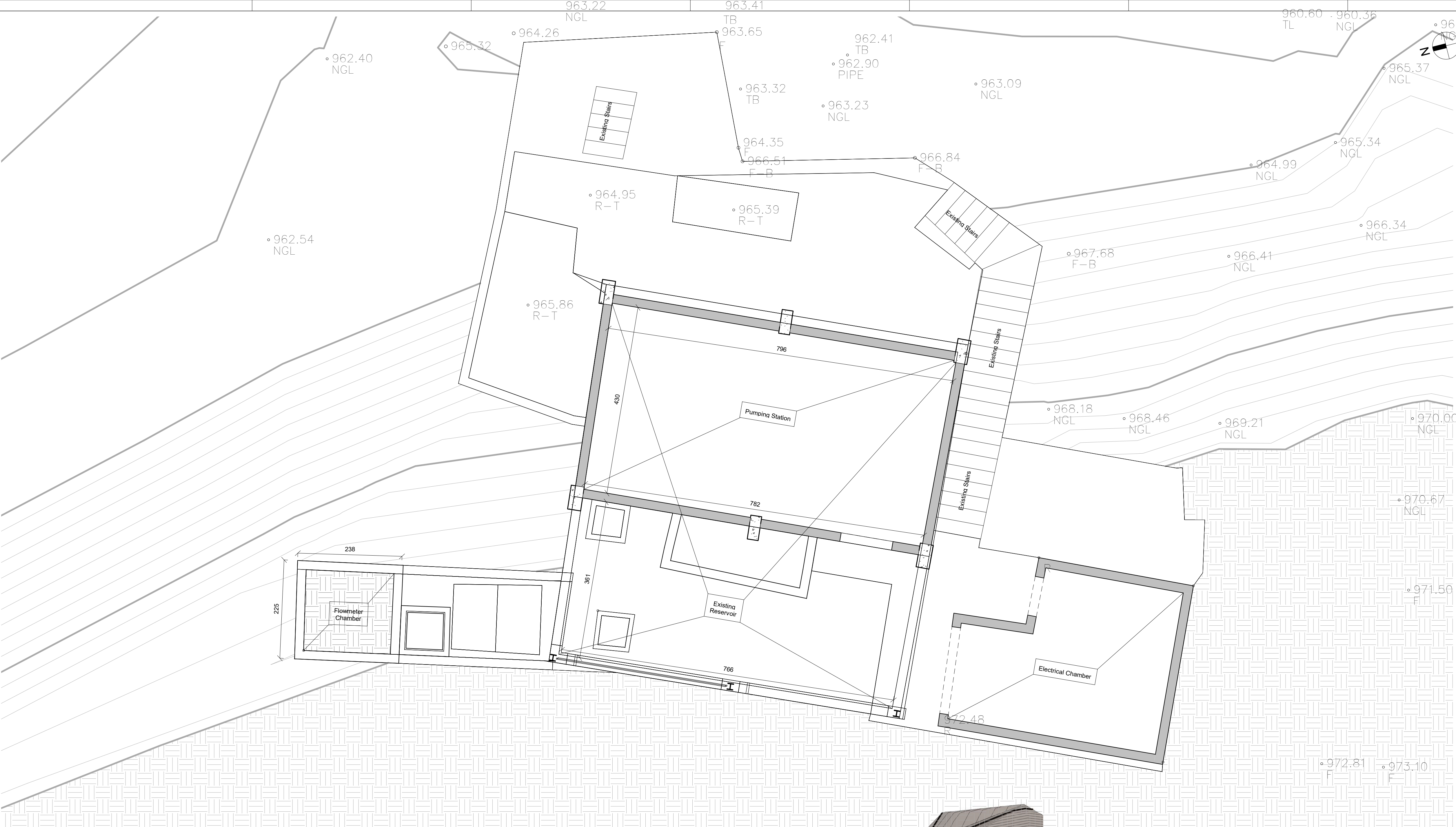
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR
VALVE CHAMBER

HYDRAULIC ACCESSORIES

FILE No.	DESIGNED BY	DRAWN BY	CHECKED BY
503W-RS03-VC01	J. ZALZAL	J. ZALZAL	I. HADDAD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	N.T.S	1/1	509W-RS03-VC01



REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND
RECONSTRUCTION

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JALL EL DIB - HAJAL Bldg TEL: (04) 712157/712158
P.O.BOX: 70492 - ANTELIAS FAX: (04) 712159_

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM - QABB ELIAS AND MRAIJAT

REHABILITATION WORKS
OF QABB ELIAS WATER TANK

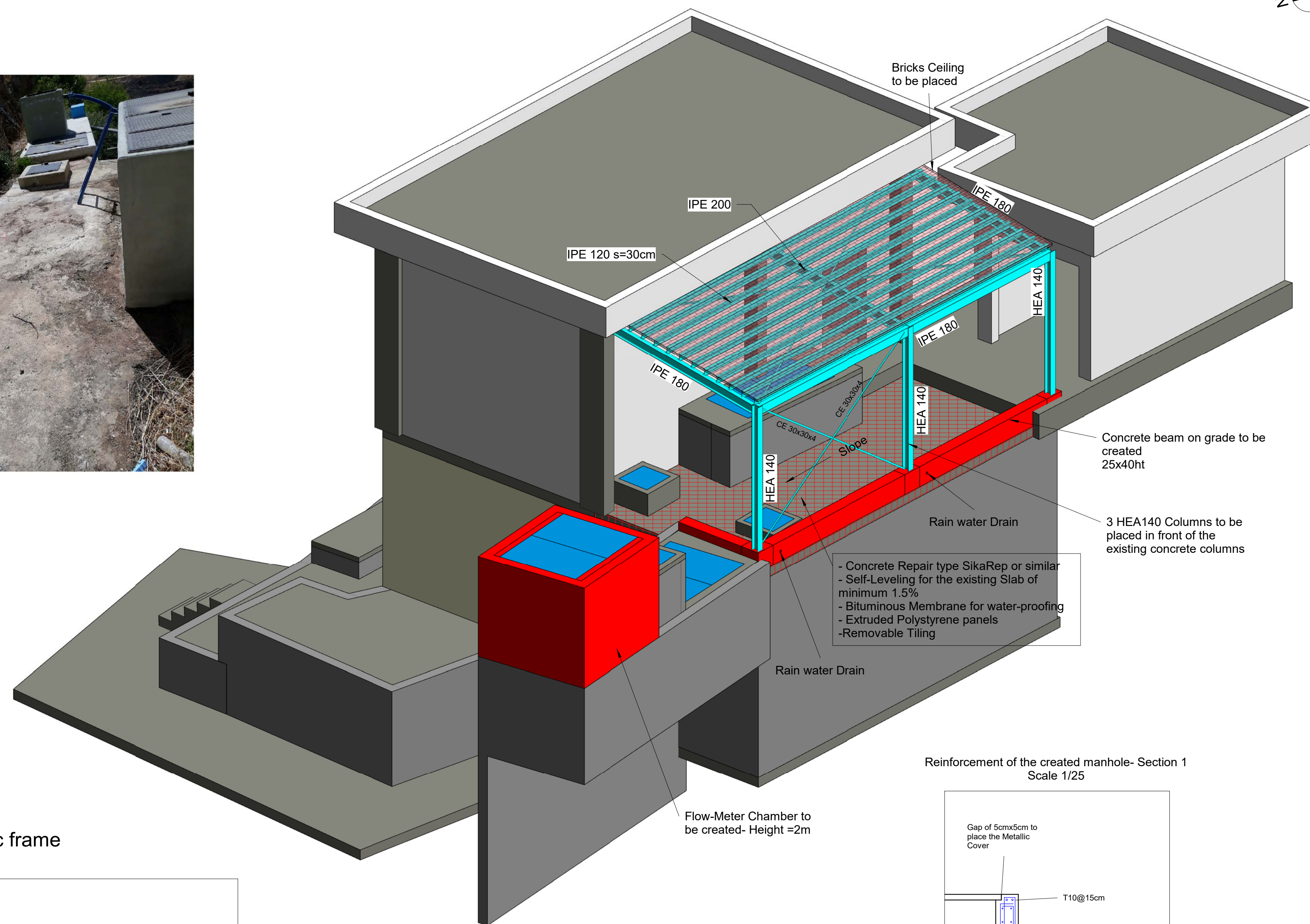
General View

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS04	B.T.D	B.T.D	B.T.D

DATE	SCALE	SHEET No.	DRAWING No.
AUGUST 2019	1 : 50	00	509W-RS04-P01

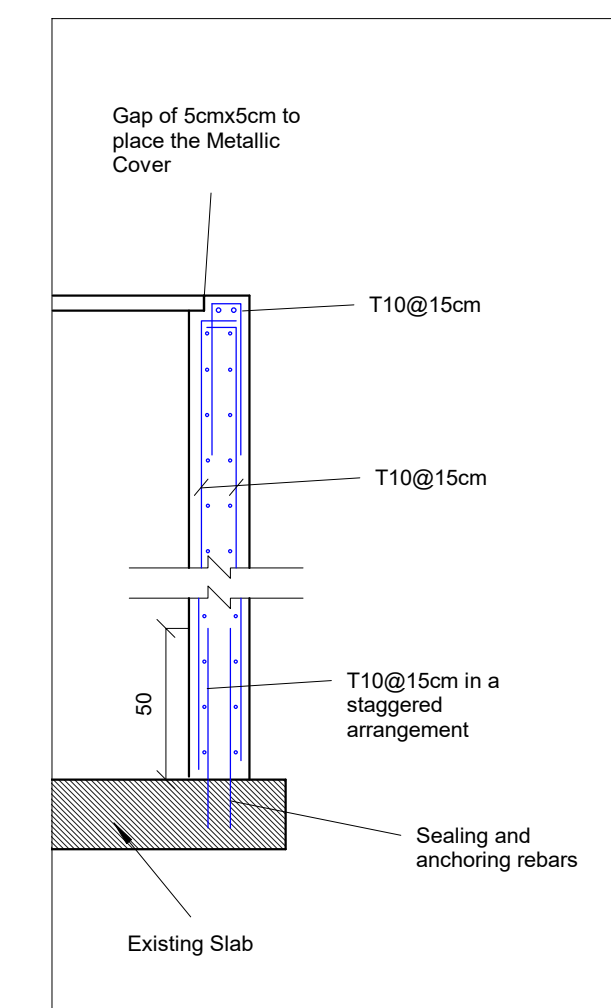


- Concrete Repair type SikaRep or similar
- Self-Leveling for the existing Slab of minimum 1.5%
- Bituminous Membrane for water-proofing
- Extruded Polystyrene panels
- Removable Tiling

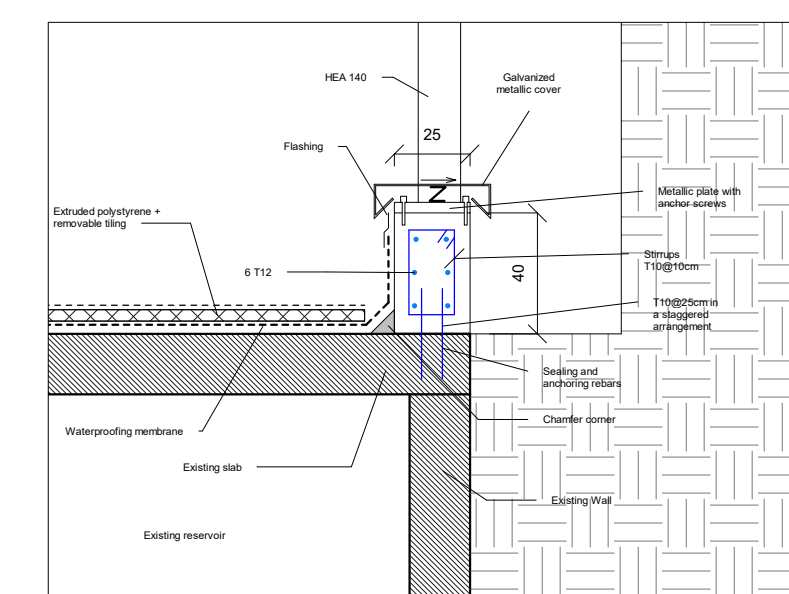


Flow-Meter Chamber to be created- Height = 2m

Reinforcement of the created manhole- Section 1
Scale 1/25



Reinforcement of steel column foundation- Section
Scale 1/25



Note:

Reinforced Concrete:

- Ordinary Portland Cement.
- Grade C37: Dosing 400 Kg/m³ for concrete and shotcrete.
- Grade C30: Dosing 350 Kg/m³ for thrust blocks.
- Grade C20: Dosing 250 Kg/m³ for mass concrete/lean concrete/cyclopean concrete.

Stresses:

- Severe Control
- Concrete compressive strength at 28 days:
 - Grade 30 on a cube, $a=150\text{mm}$, $=30\text{N/mm}^2$
 - on a cylinder, $\Phi=150\text{mm}$ $h=300\text{mm}$, $=25\text{N/mm}^2$
 - Grade 37 on a cube, $a=150\text{mm}$, $=37\text{N/mm}^2$
 - on a cylinder, $\Phi=150\text{mm}$ $h=300\text{mm}$, $=30\text{N/mm}^2$

Reinforcement:

- Deformed high strength steel bars: symbol T yield stress $F_y = 420 \text{ N/mm}^2$.
- Mild steel bars.
- Maximum pouring height: 1500mm.

Cover:

The concrete cover for all steel bars including stirrups shall not be less than:

- 50mm for the concrete in contact with water and soil
- 35mm for the other cases.

Overlapping:

- Laps shall not be less than fifty times the bar diameter.
- Where splice bars are used, their strength shall not be less than $2 \times 50\Phi$ (Φ : bar nominal diameter).
- Laps shall be staggered from one hoop to the other and/or one bar to the other in order to reduce the number of laps in the same section.
- Pins $\Phi 8$ shall be used on each lap.
- Anchoring length shall not be less than 15Φ

Bending:

- $\Phi > 12\text{mm}$: mechanical
- $\Phi < 12\text{mm}$: manual (possibly)
- Straightening of bended bars is not allowed.

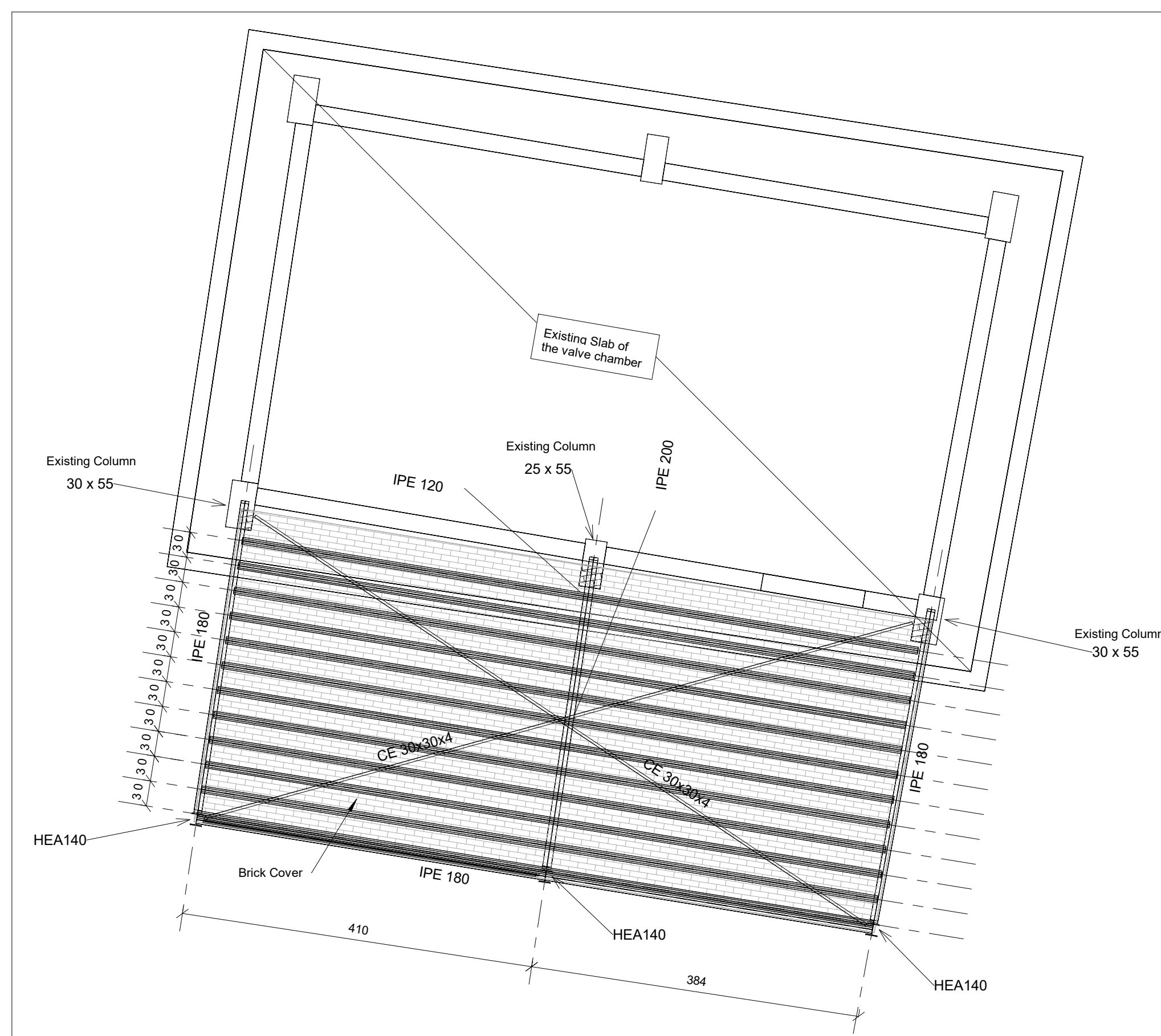
Formwork:

- All executed concrete shall be fair faced concrete.
- The use of $\Phi 6\text{mm}$ bars as tie-rods is not allowed.
- Holes made by tie-rods shall be filled with a non-shrink grout by means of special injection methods.

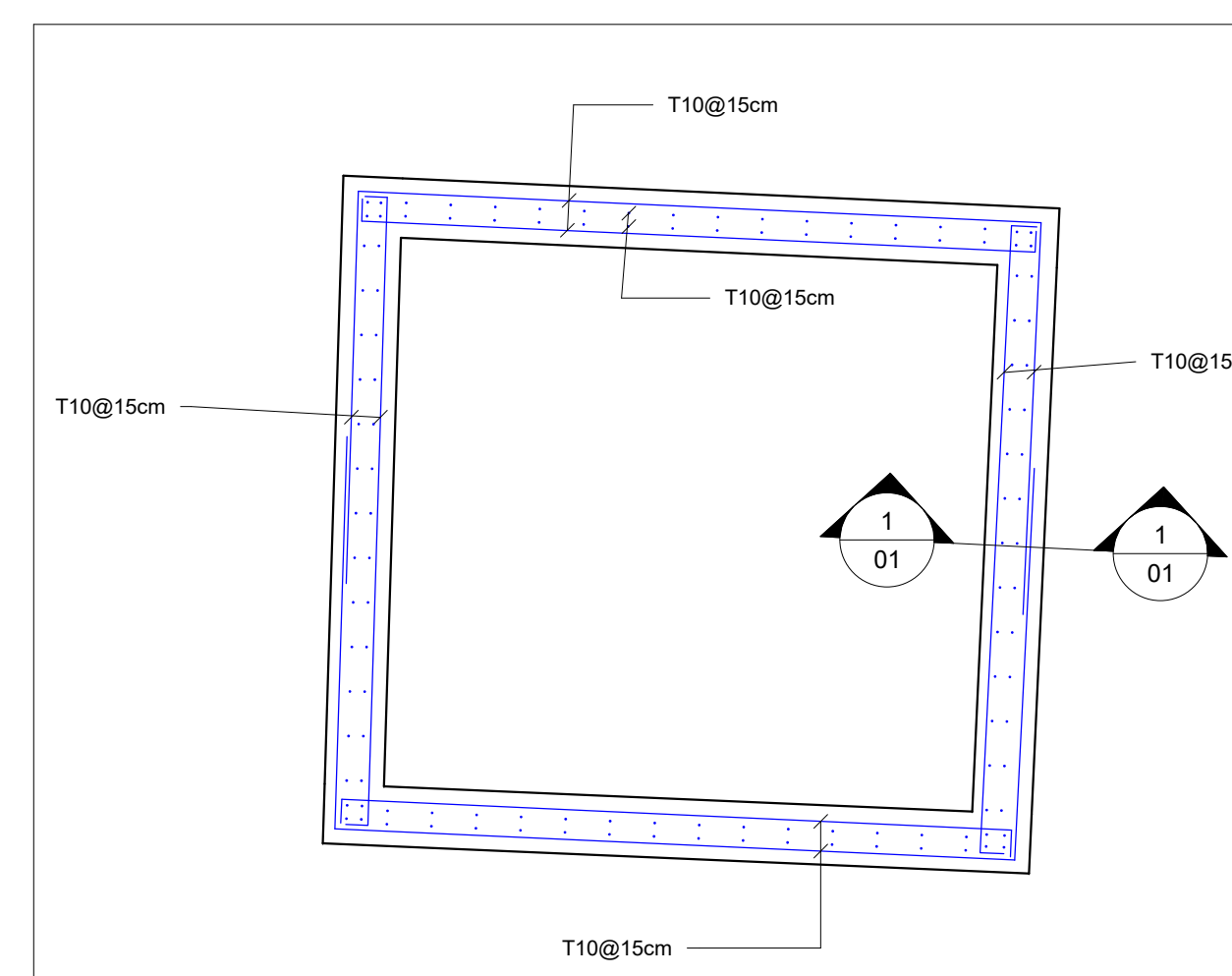
Remarks:

- All the dimensions are in cm unless otherwise specified.
- Scaling from these drawings is not allowed.
- All levels and dimensions must be verified by a topographer at the contractor's expenses.

Plan View of the created metallic frame
Scale: 1/50



Reinforcement of the created manhole
Scale 1/25



<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND
RECONSTRUCTION

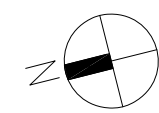


CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM - QABB ELIAS AND MRAIJAT

REHABILITATION WORKS OF QABB ELIAS WATER TANK	Metallic Frame and Flowmeter Chamber
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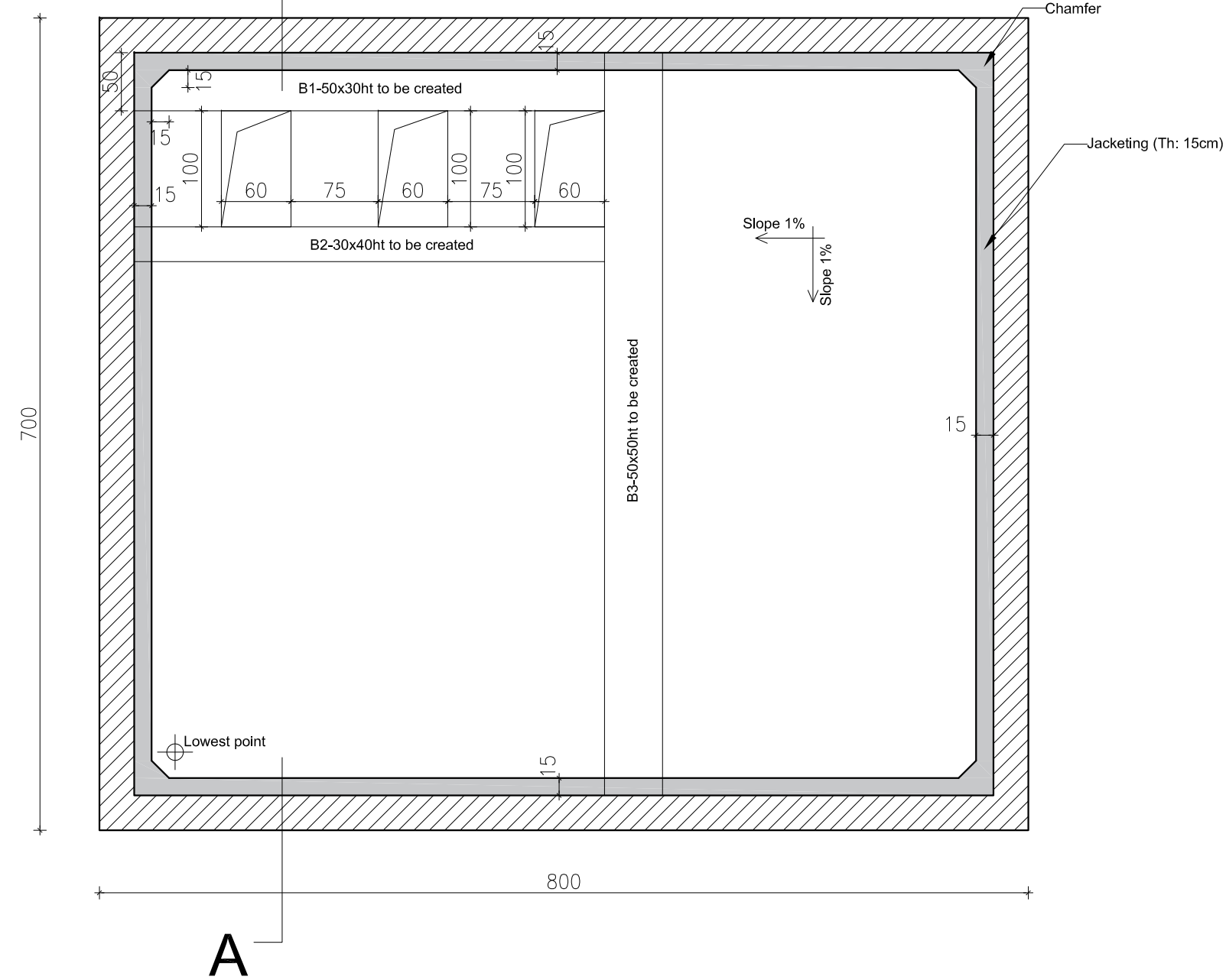
<i>FILE</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS04	B.T.D	B.T.D	B.T.D

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
AUGUST 2019	As indicated	01	509W-RS04-P02



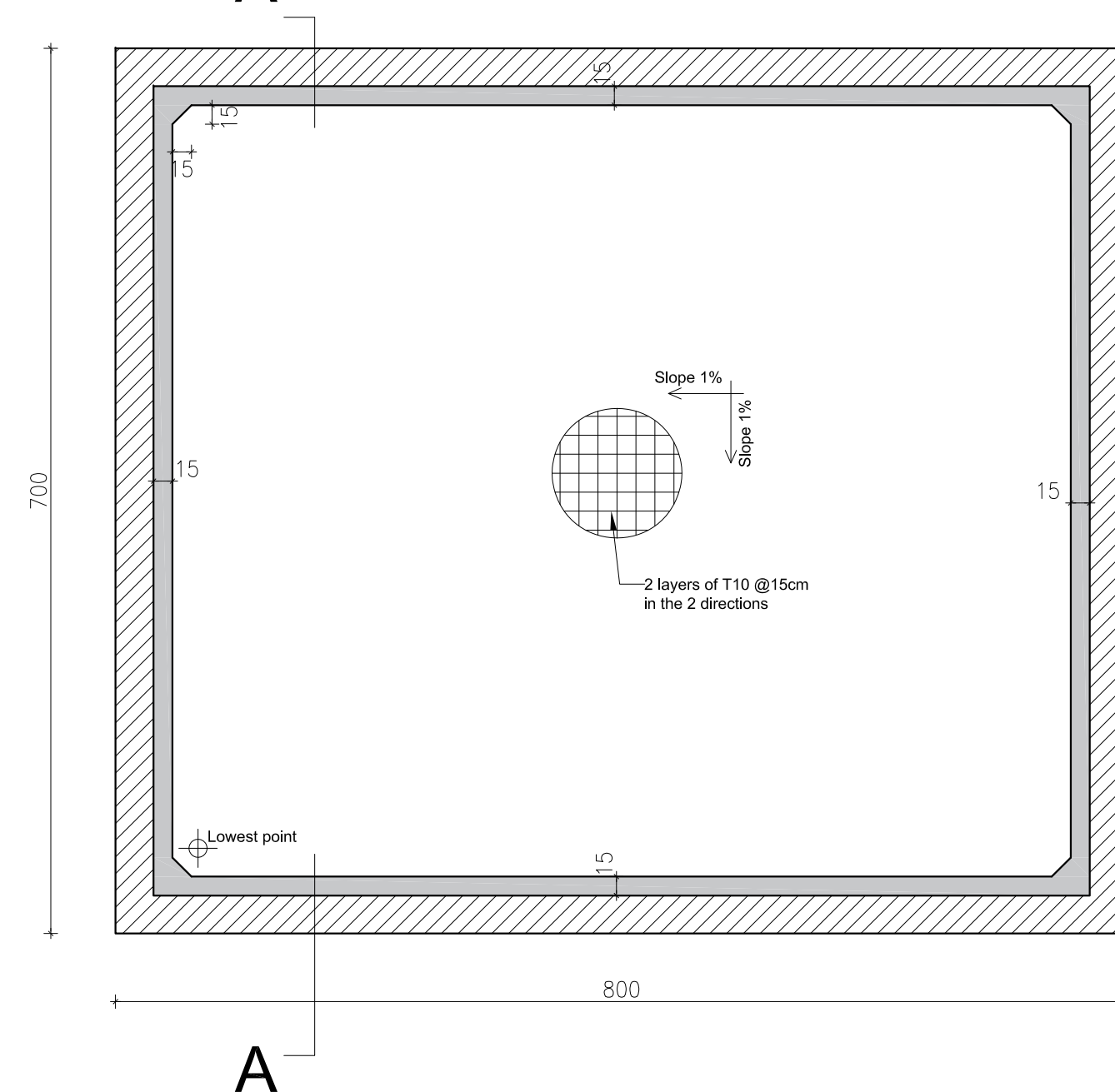
WATER TANK UPPER SLAB FORMWORK

Scale: 1/50



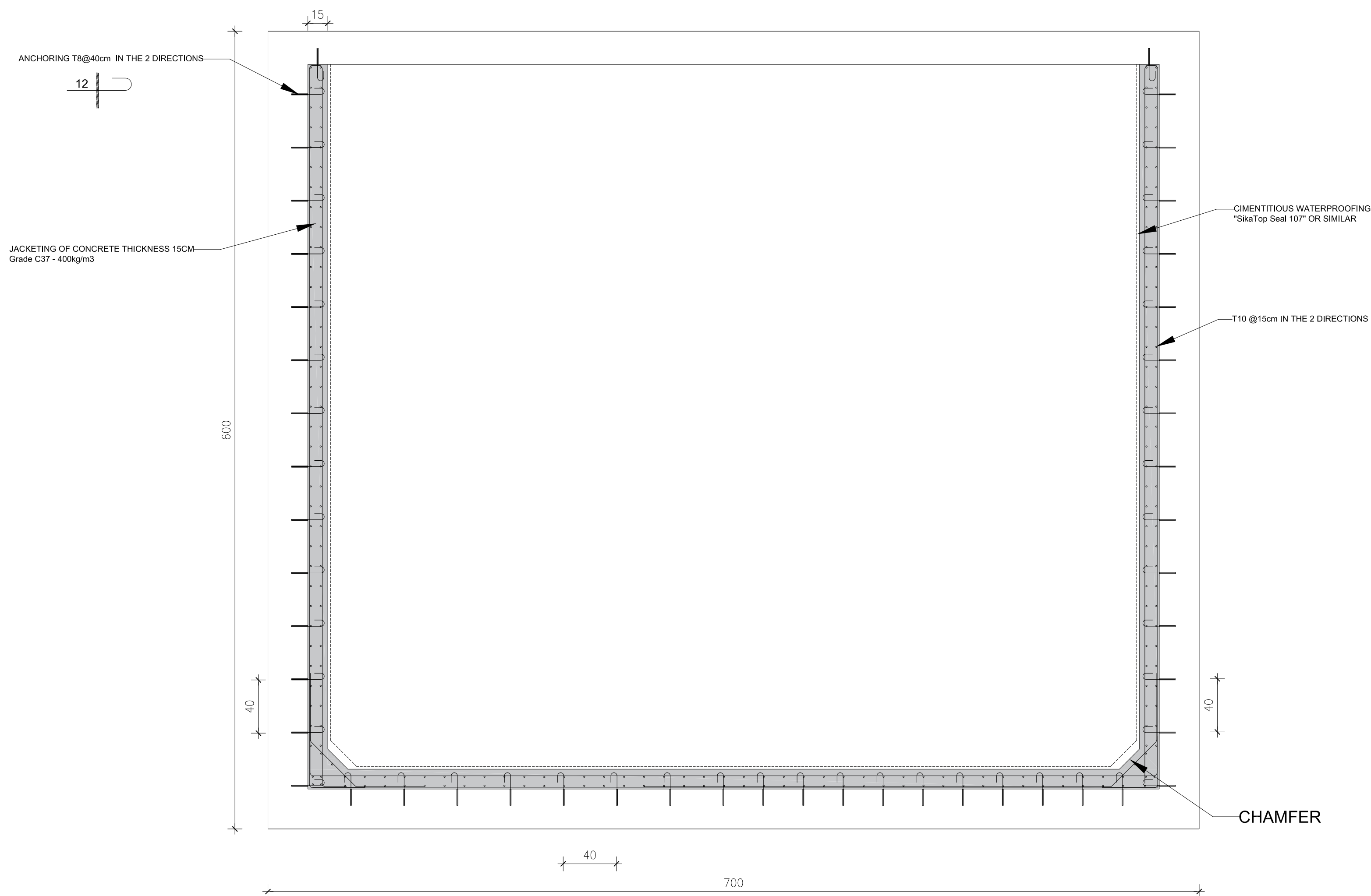
WATER TANK BOTTOM SLAB REINFORCEMENT

Scale: 1/50



SECTION A-A

Scale: 1/25



Note:

- Reinforced Concrete:
- Ordinary Portland Cement.
 - Grade C37: Dosing 400 Kg/m3 for concrete and shotcrete.
 - Grade C30: Dosing 350 Kg/m3 for thrust blocks.
 - Grade C20: Dosing 250 Kg/m3 for mass concrete/lean concrete/cyclopean concrete.

Stresses:

- Severe Control
- Concrete compressive strength at 28 days:
Grade 30 on a cube, a=150mm, =30N/mm2
on a cylinder, Φ=150mm h=300mm, =25N/mm2
Grade 37 on a cube, a=150mm, =37N/mm2
on a cylinder, Φ=150mm h=300mm, =30N/mm2

Reinforcement:

- Deformed high strength steel bars: symbol T yield stress $F_y=420\text{N/mm}^2$.
- Mild steel bars.
- Maximum pouring height: 1500mm.

Cover:

- The concrete cover for all steel bars including stirrups shall not be less than:
- 50mm for the concrete in contact with water and soil
 - 35mm for the other cases.

Overlapping:

- Laps shall not be less than fifty times the bar diameter.
- Where splice bars are used, their strength shall not be less than $2 \times 50\Phi$ (Φ : bar nominal diameter).
- Laps shall be staggered from one hoop to the other and/or one bar to the other in order to reduce the number of laps in the same section.
- Pins $\Phi 8$ shall be used on each lap.
- Anchoring length shall not be less than 15Φ

Bending:

- $\Phi > 12\text{mm}$: mechanical
- $\Phi < 12\text{mm}$: manual (possibly)
- Straightening of bended bars is not allowed.

Formwork:

- All executed concrete shall be fair faced concrete.
- The use of $\Phi 6\text{mm}$ bars as tie-rods is not allowed.
- Holes made by tie-rods shall be filled with a non-shrink grout by means of special injection methods.

Remarks:

- All the dimensions are in cm unless otherwise specified.
- Scaling from these drawings is not allowed.
- All levels and dimensions must be verified by a topographer at the contractor's expenses.
- If any changes, Reinforcement should be recalculated according to the new dimensions.
- For lowest point, slope direction and plumbing equipment, refer to hydraulic design.

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND
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BD BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL EL DIB - HAJAL Bldg TEL: (04) 712157/712158
P.O.BOX: 70492 - ANTELIAS FAX: (04) 712159

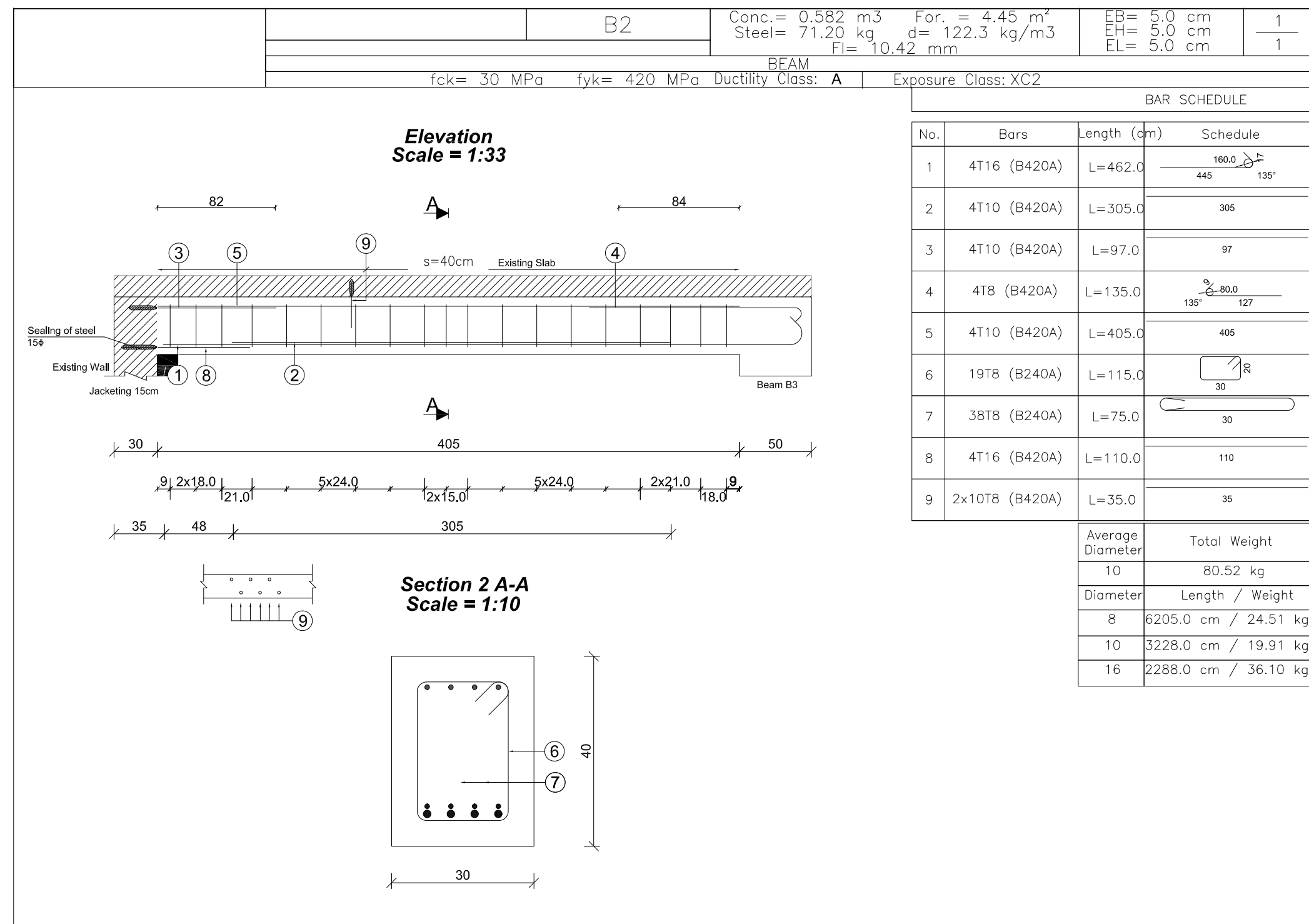
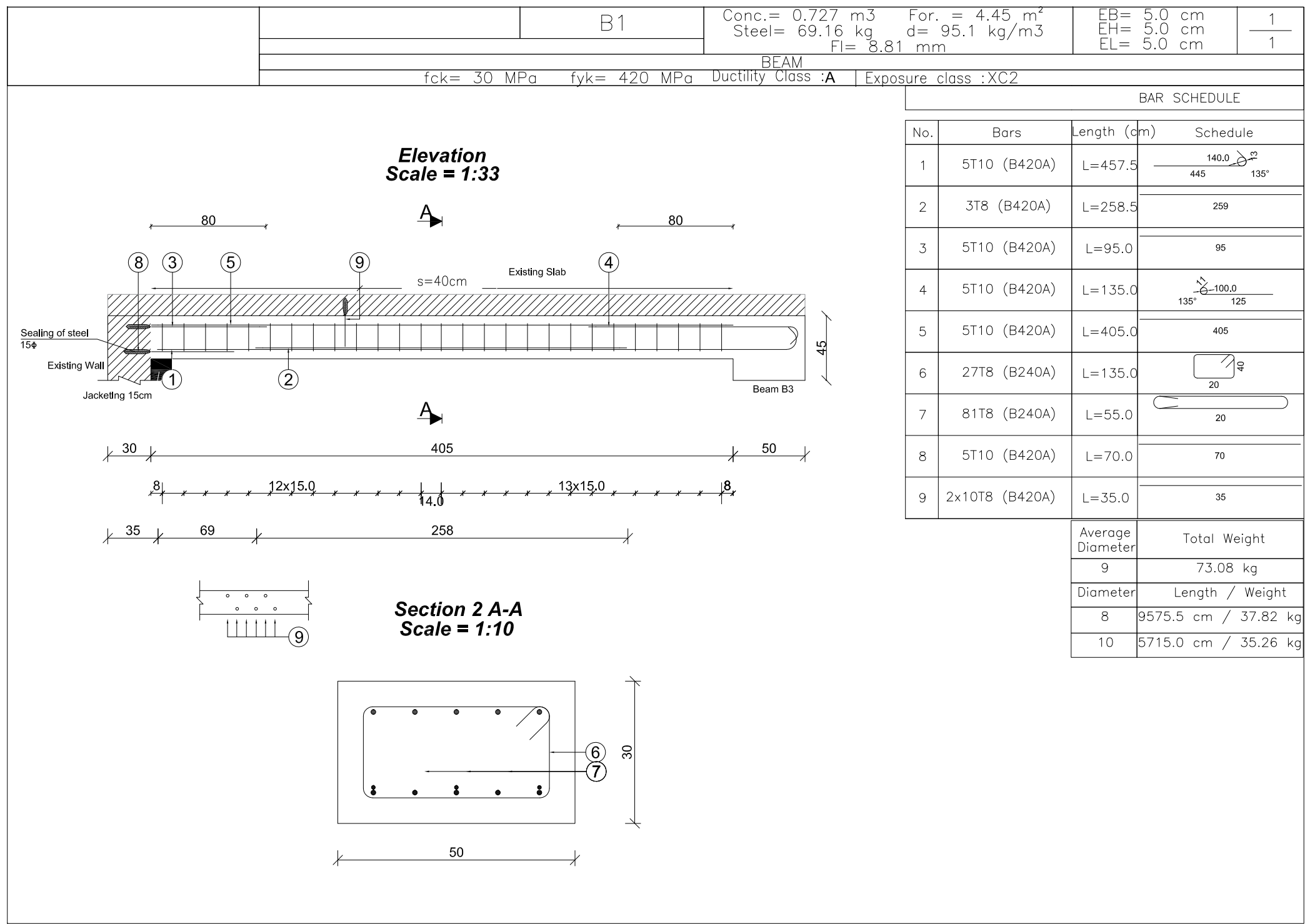
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM - QABB ELIAS AND MRAIJAT

REHABILITATION WORKS
OF QABB ELIAS WATER TANK

Water Tank Formwork And
Reinforcement

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS04	B.T.D	B.T.D	B.T.D

DATE	SCALE	SHEET No.	DRAWING No.
AUGUST 2019	1/25	03	509W-RS04-P03



Reinforced Concrete:

- Ordinary Portland Cement.
- Grade C37: Dosing 400 Kg/m3 for concrete and shotcrete.
- Grade C30: Dosing 350 Kg/m3 for thrust blocks
- Grade C20: Dosing 250 Kg/m3 for mass concrete/lean concrete/cyclopean concrete.

Stresses:

- Severe Control
- Concrete compressive strength at 28 days:

Grade 30 on a cube, $a=150\text{mm}$, $=30\text{N/mm}^2$
on a cylinder, $\Phi=150\text{mm}$ $h=300\text{mm}$, $=25\text{N/mm}^2$

Grade 37 on a cube, $a=150\text{mm}$, $=37\text{N/mm}^2$
on a cylinder, $\Phi=150\text{mm}$ $h=300\text{mm}$, $=30\text{N/mm}^2$

Reinforcement:

- Deformed high strength steel bars: symbol T yield stress $F_y=420\text{N/mm}^2$.
- Mild steel bars.
- Maximum pouring height: 1500mm.

Cover:
The concrete cover for all steel bars including stirrups shall not be less than:

- 50mm for the concrete in contact with water and soil
- 35mm for the other cases.

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 - Laps shall not be less than fifty times the bar diameter.
 - Where splice bars are used, their strength shall not be less than $2 \times 50\Phi$ (Φ : bar nominal diameter).
 - Laps shall be staggered from one hoop to the other and/or one bar to the other in order to reduce the number of laps in the same section.
- Pins $\Phi 8$ shall be used on each lap.
- Anchoring length shall not be less than 15Φ

Bending:

- $\Phi > 12\text{mm}$: mechanical
- $\Phi < 12\text{mm}$: manual (possibly)
- Straightening of bended bars is not allowed

Formwork:

- All executed concrete shall be fair faced concrete
- The use of $\Phi 6\text{mm}$ bars as tie-rods is not allowed.
- Holes made by tie-rods shall be filled with a non-shrink grout by means of special injection methods.

Remarks:

- All the dimensions are in cm unless otherwise specified.
- Scaling from these drawings is not allowed.
- All levels and dimensions must be verified by a topographer at the contractor's expenses.
- If any changes, Reinforcement should be recalculated according to the new dimensions.
- For lowest point, slope direction and plumbing equipment, refer to hydraulic design.

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

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COUNCIL FOR DEVELOPMENT AND
RECONSTRUCTION

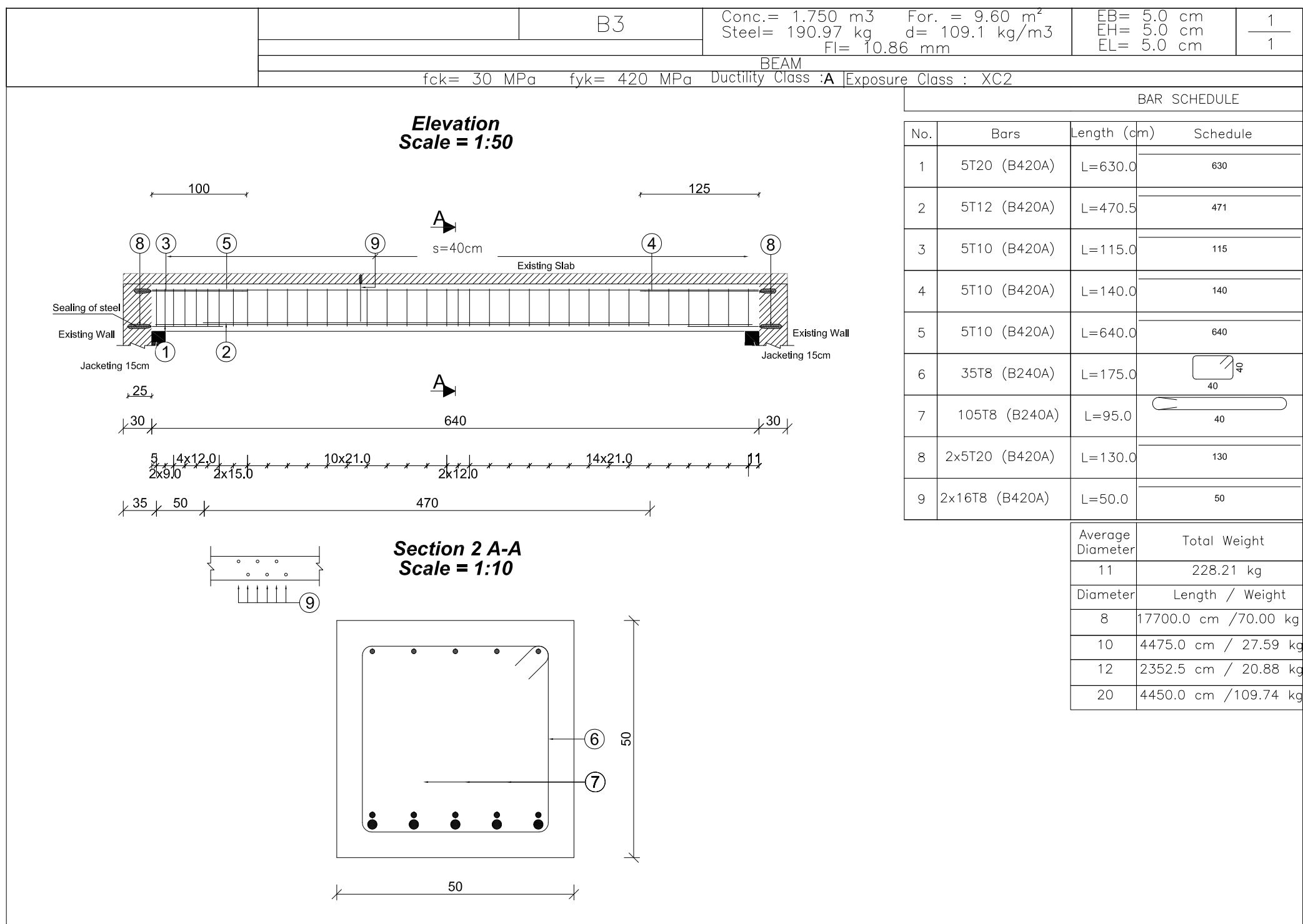


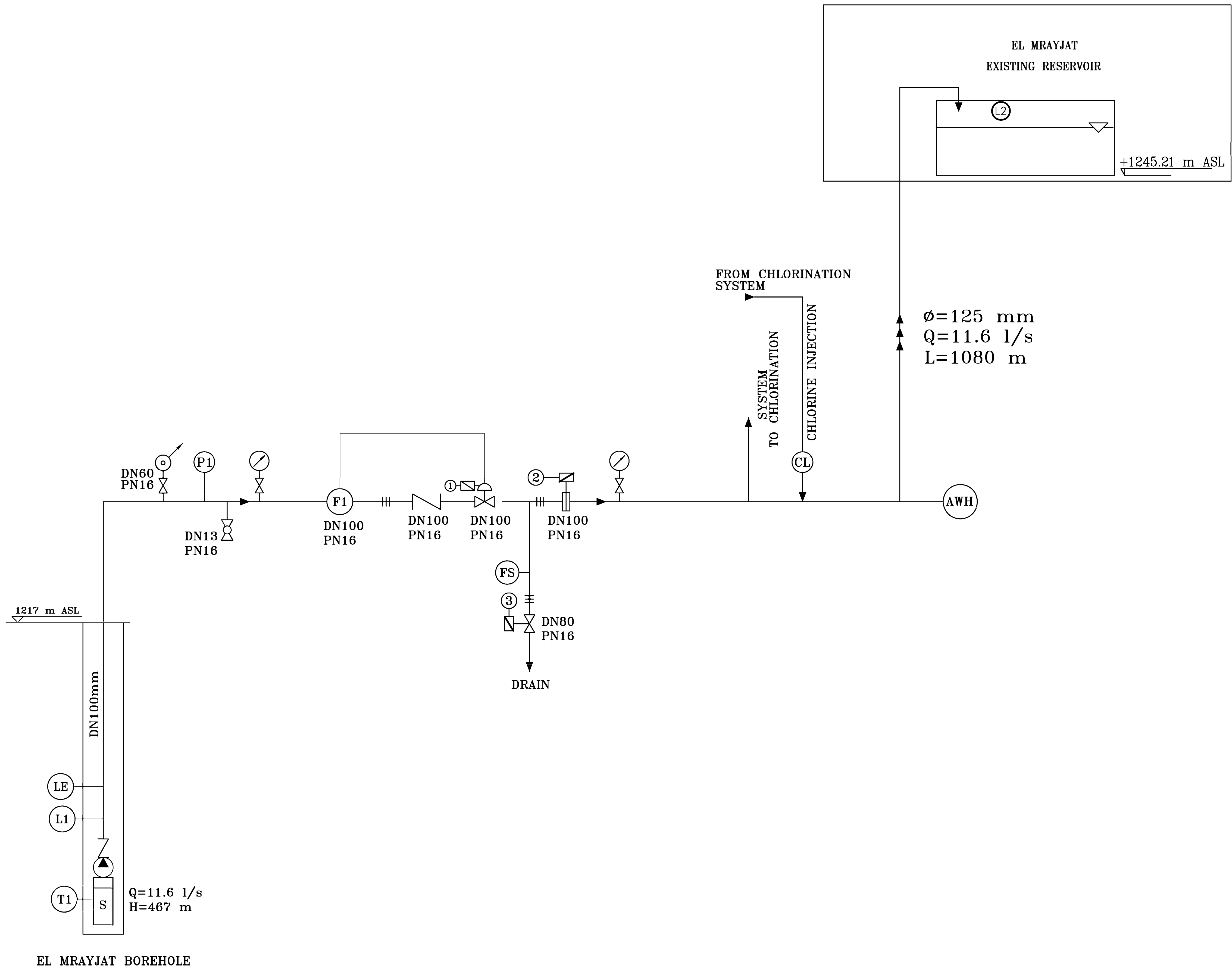
CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM - QABB ELIAS AND MRAIJAT

REHABILITATION WORKS OF QABB ELIAS WATER TANK	Beams Reinforcement
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<i>FILE</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-RS04	B.T.D	B.T.D	B.T.D

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
AUGUST 2019	As indicated	04	509W-RS04-P04





- LEGEND:
- : SUBMERSIBLE PUMP
 - DN : NOMINAL DIAMETER
 - PN : NOMINAL PRESSURE
 - : PRESSURE MEASUREMENT
 - : FLOW SWITCH
 - : TEMPERATURE MEASUREMENT
 - : LEVEL MEASUREMENT
 - : FLOW MEASUREMENT
 - : GLYCERINE FILLED MANOMETER ø100 WITH 3 WAY VALVE.
 - : SURGE SUPPRESSION EQUIPMENT.
 - : PIPELINE
 - : ANTI-SHOCK AIR RELEASE VALVE WITH ISOLATING VALVE.
 - : ELECTRIC ACTUATOR
 - : GATE VALVE
 - : CHECK VALVE (ANTI SLAM SPRING LOADED TYPE)
 - : SAMPLING VALVE
 - : PERFORATED CHECK VALVE
 - : DEMOUNTABLE JOINT
 - : SURGE ANTICIPATION VALVE
 - : GLOBE VALVE
 - : BUTTERFLY VALVE
 - : PUMPING LINE
 - : GRAVITY LINE
 - : REGULATING VALVE
 - : FLEXIBLE JOINT
 - : CHLORINE INJECTION
 - : STRAINER
 - : RUBBER SPHERICAL FLEXIBLE JOINT.
 - : STAINLESS STEEL FLEXIBLE JOINT.
 - : PRESSURE REDUCING VALVE
 - : Y STRAINER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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BUREAU TECHNIQUE POUR LE DEVELOPEMENT

JALL ED DIB – HAJAL Bldg
P.O.BOX:70492 – ANTELIAS

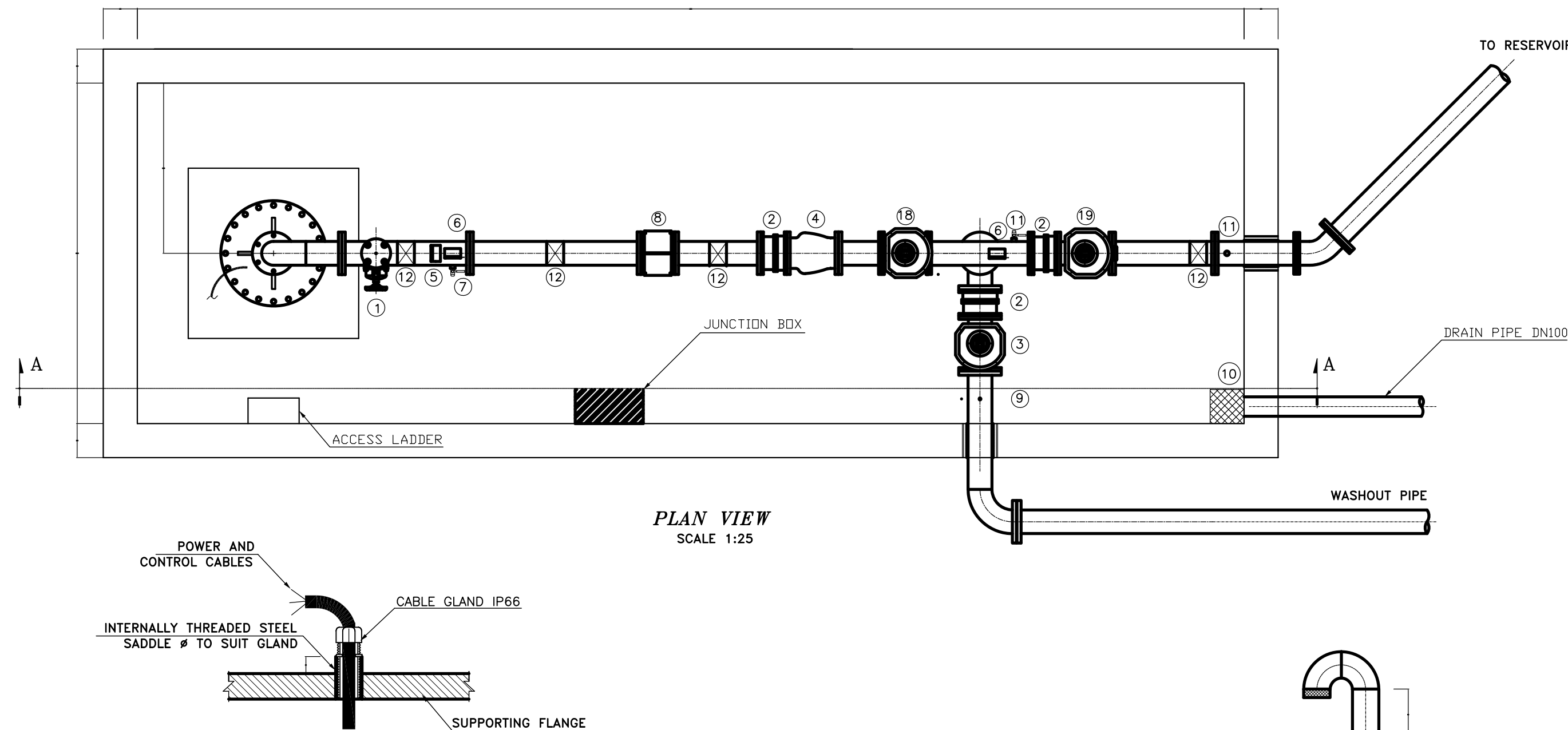
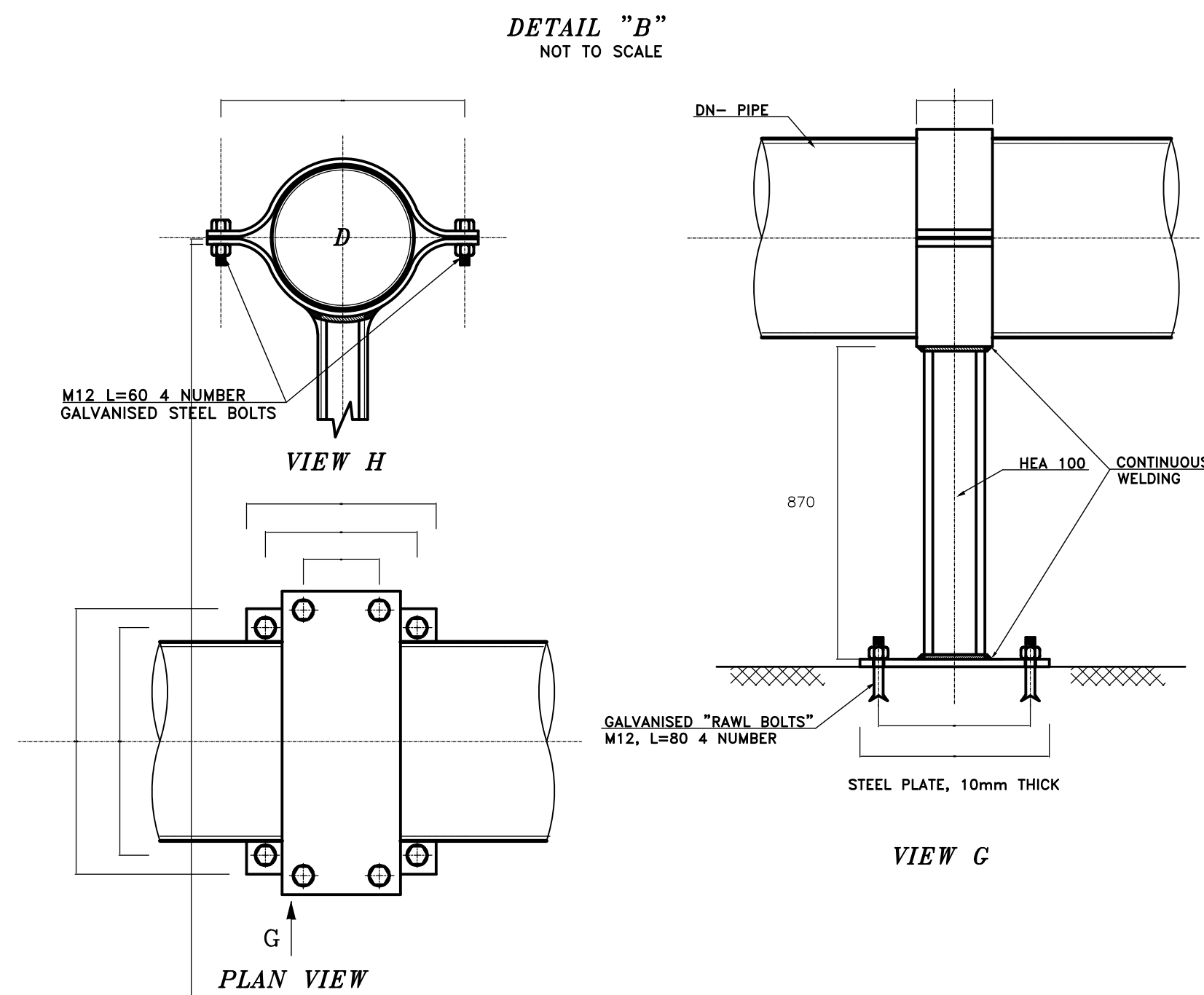
TEL:(04) 712157 / 712158
FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

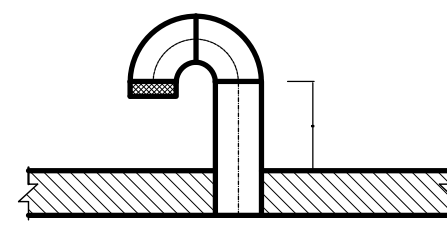
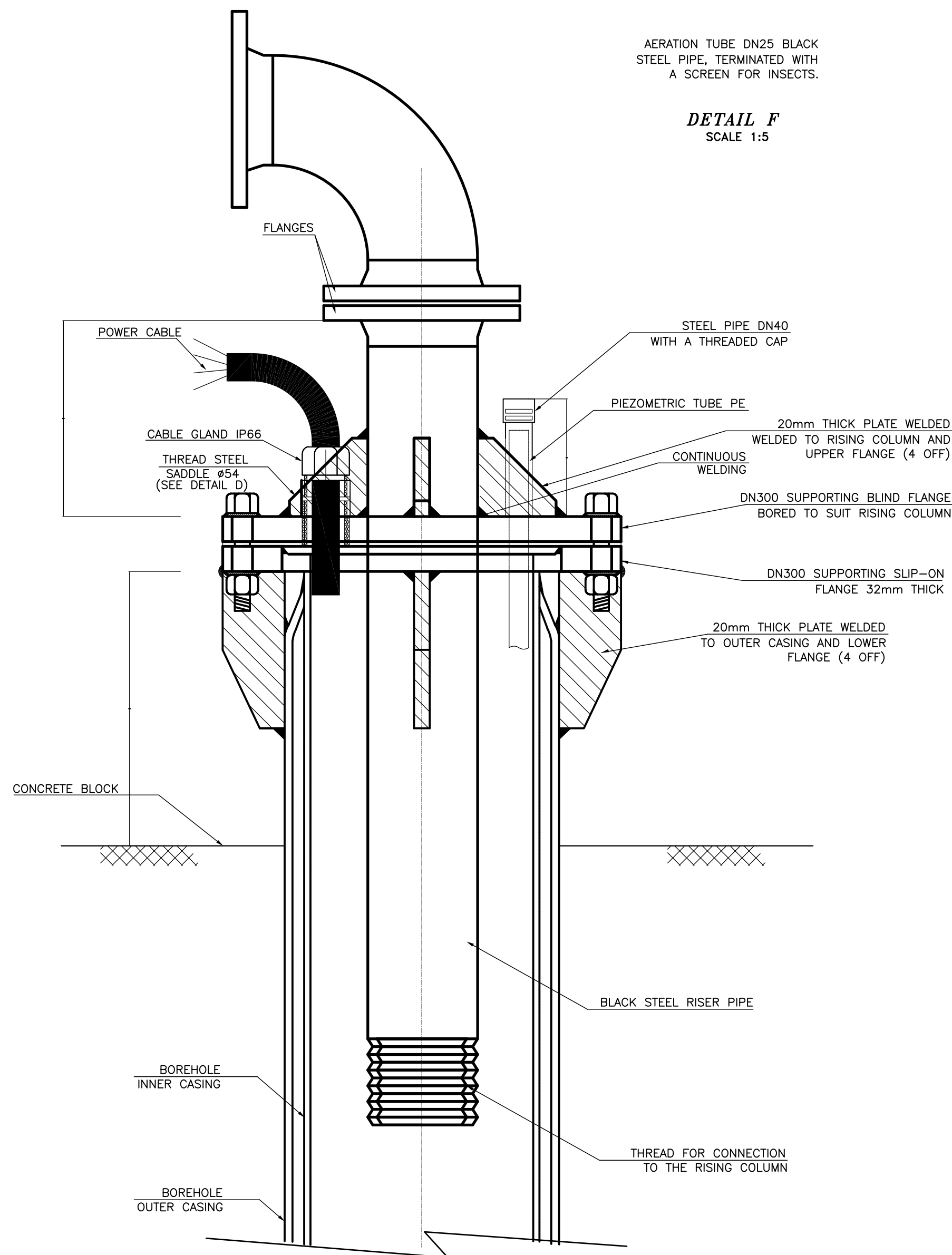
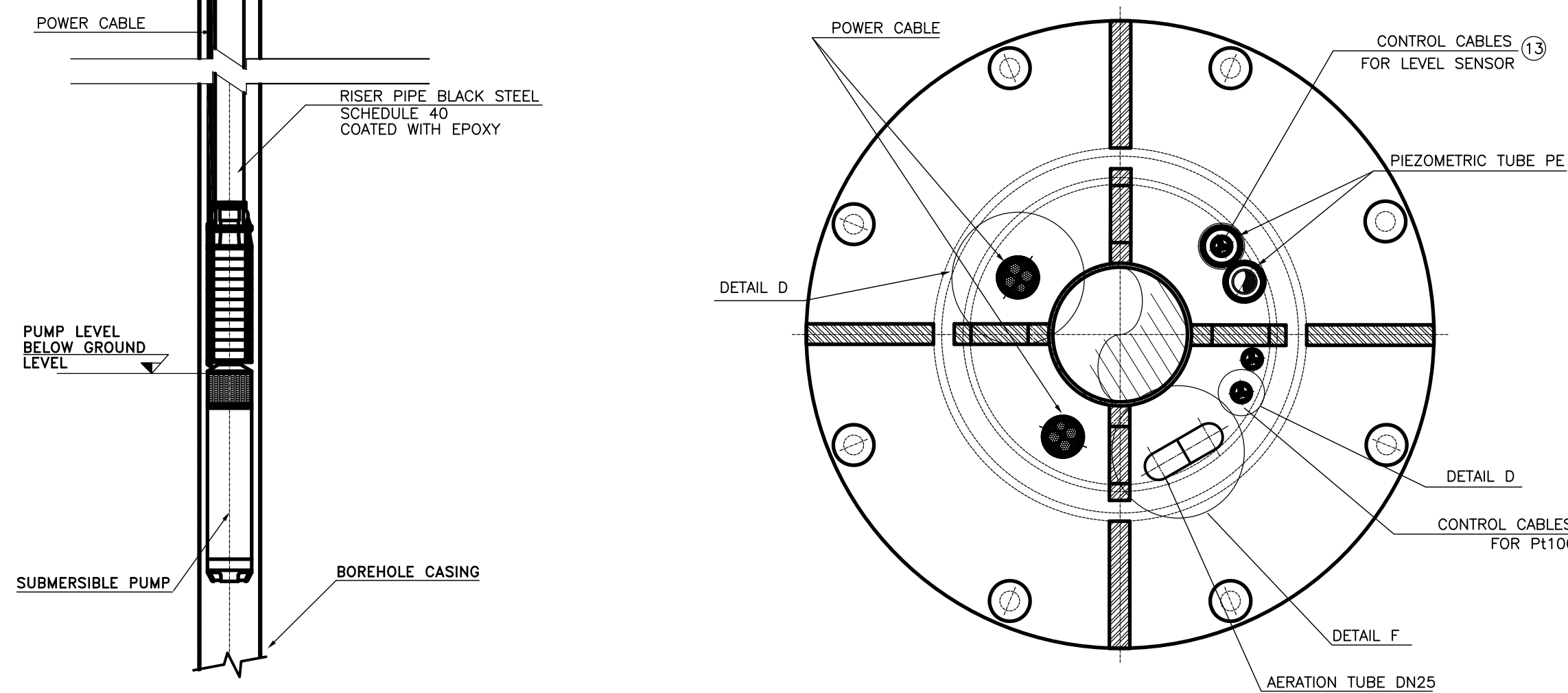
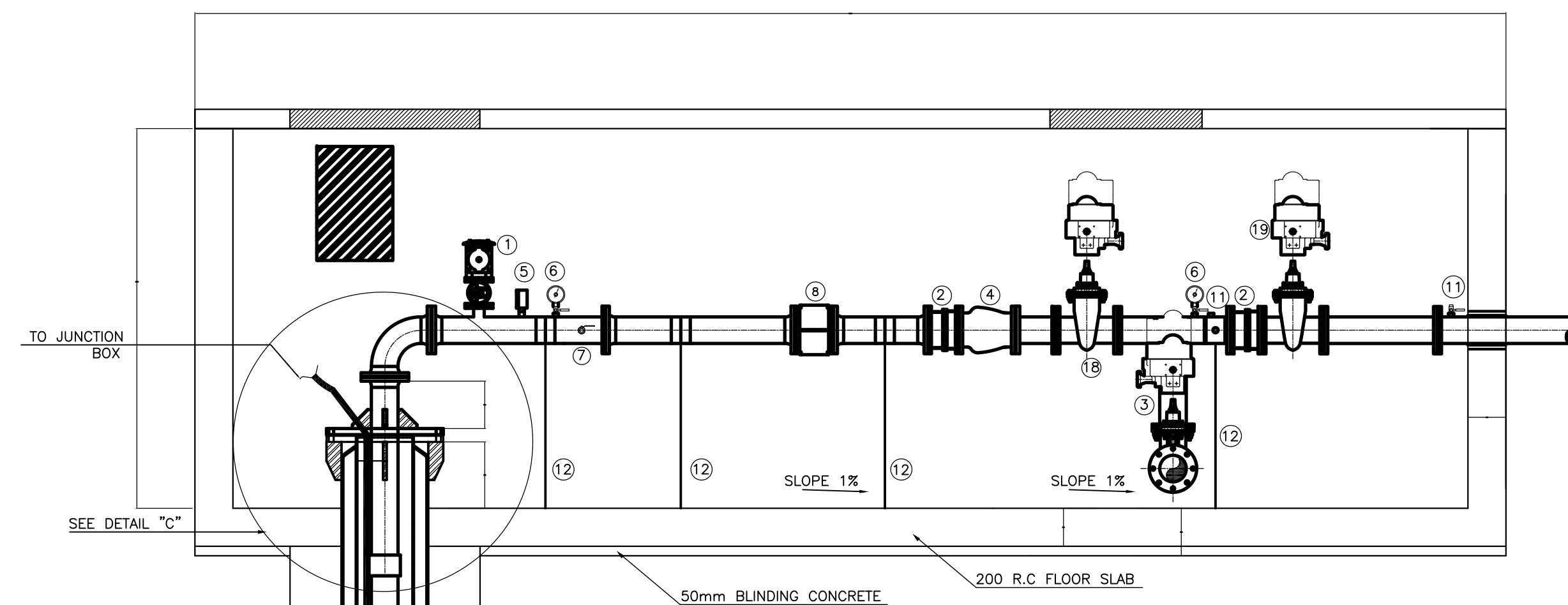
EL MRAYJAT PUMPING STATION	WELL HEAD SCHEMATIC
----------------------------	---------------------

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-M01	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	1/7	509W-PS01-M01



DETAIL D
N.T.S.



LEGEND

- 1 : DOUBLE AIR RELEASE VALVE WITH ISOLATING VALVE
- 2 : DISMANTLING JOINT
- 3 : MOTORISED GATE VALVE
- 4 : NON RETURN VALVE
(CHECK-VALVE)
- 5 : PIESORESISTIVE PRESSURE SENSOR
- 6 : MANOMETER WITH THREE WAY ISOLATING VALVE
- 7 : SAMPLING VALVE 1/2"
- 8 : FLOWMETER
- 9 : FLOW SWITCH
- 10 : DRAIN
- 11 : NIPPEL 1" FOR CHLORE
- 12 : PIPE SUPPORT
- 13 : LEVEL SENSOR
- 14 : MANUAL GATE VALVE
- 15 : SURGE ANTICIPATION VALVE
- 16 : REINFORCED PIPE SUPPORT
- 17 : SUCTION STRAINER
- 18 : MOTORIZED GLOBE VALVE
- 19 : MOTORIZED BUTTERFLY VALVE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

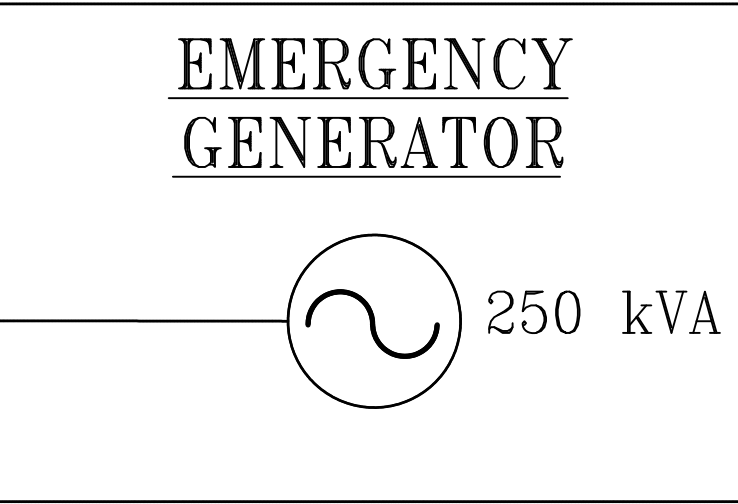
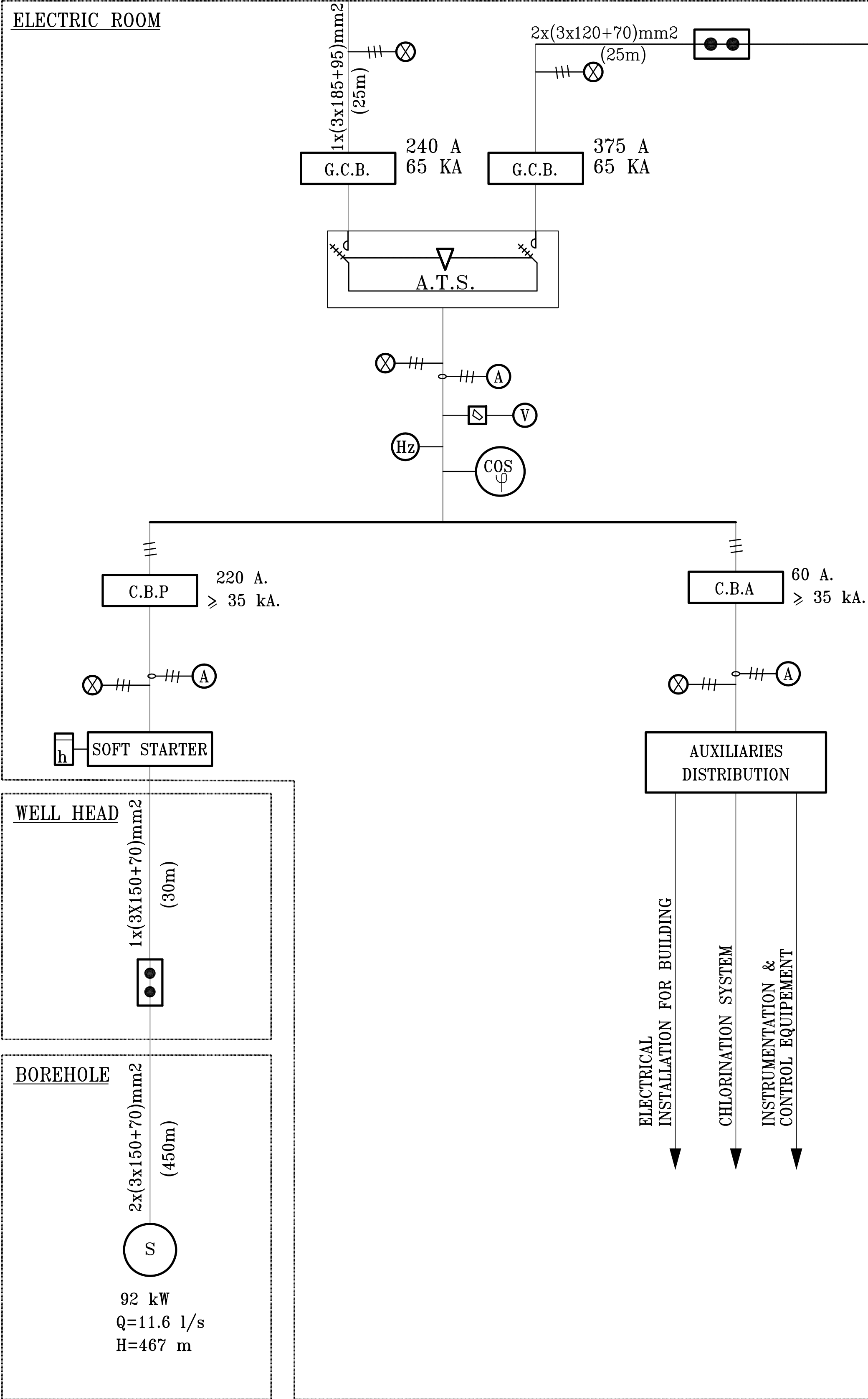
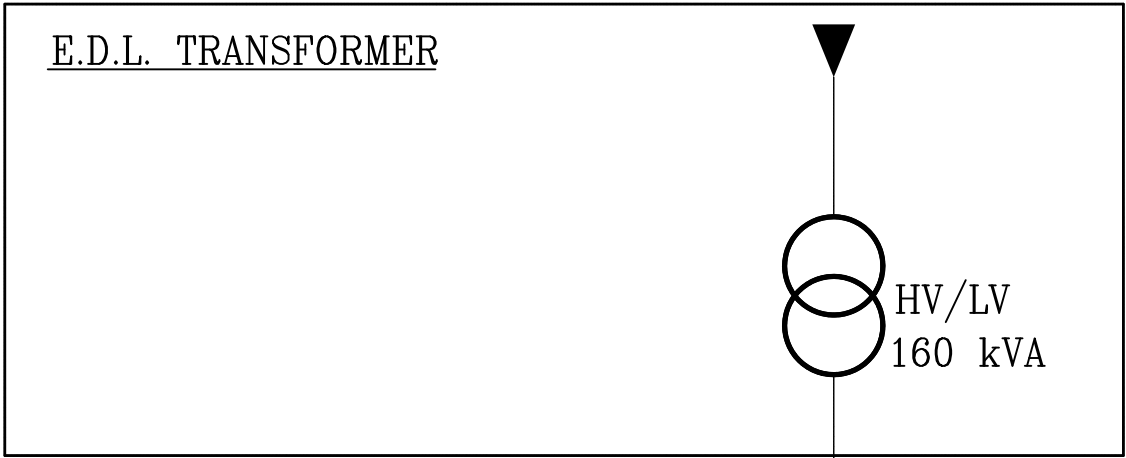
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION

MECHANICAL DRAWING
FOR WELL HEAD

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-M03	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	3/7	509W-PS01-M03



- LEGEND**
- : POWER FACTOR MEASUREMENT
 - : INDICATING LAMP
 - : SELECTOR SWITCH
 - : FREQUENCY METER
 - : VOLTMETER
 - : AMPERMETER
 - : HOURMETER
 - : CIRCUIT BREAKER
 - : JUNCTION BOX IP67
 - : TRANSFORMER HV/LV
 - : SUBMERSIBLE MOTOPUMPSET
 - : SURFACE MOTOPUMPSET
 - : AUTOMATIC TRANSFER SWITCH (A.T.S.)
 - : EMERGENCY GENERATOR
 - : GENERAL CIRCUIT BREAKER
 - : CIRCUIT BREAKER FOR PUMPSET
 - : CIRCUIT BREAKER FOR AUXILIARIES

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

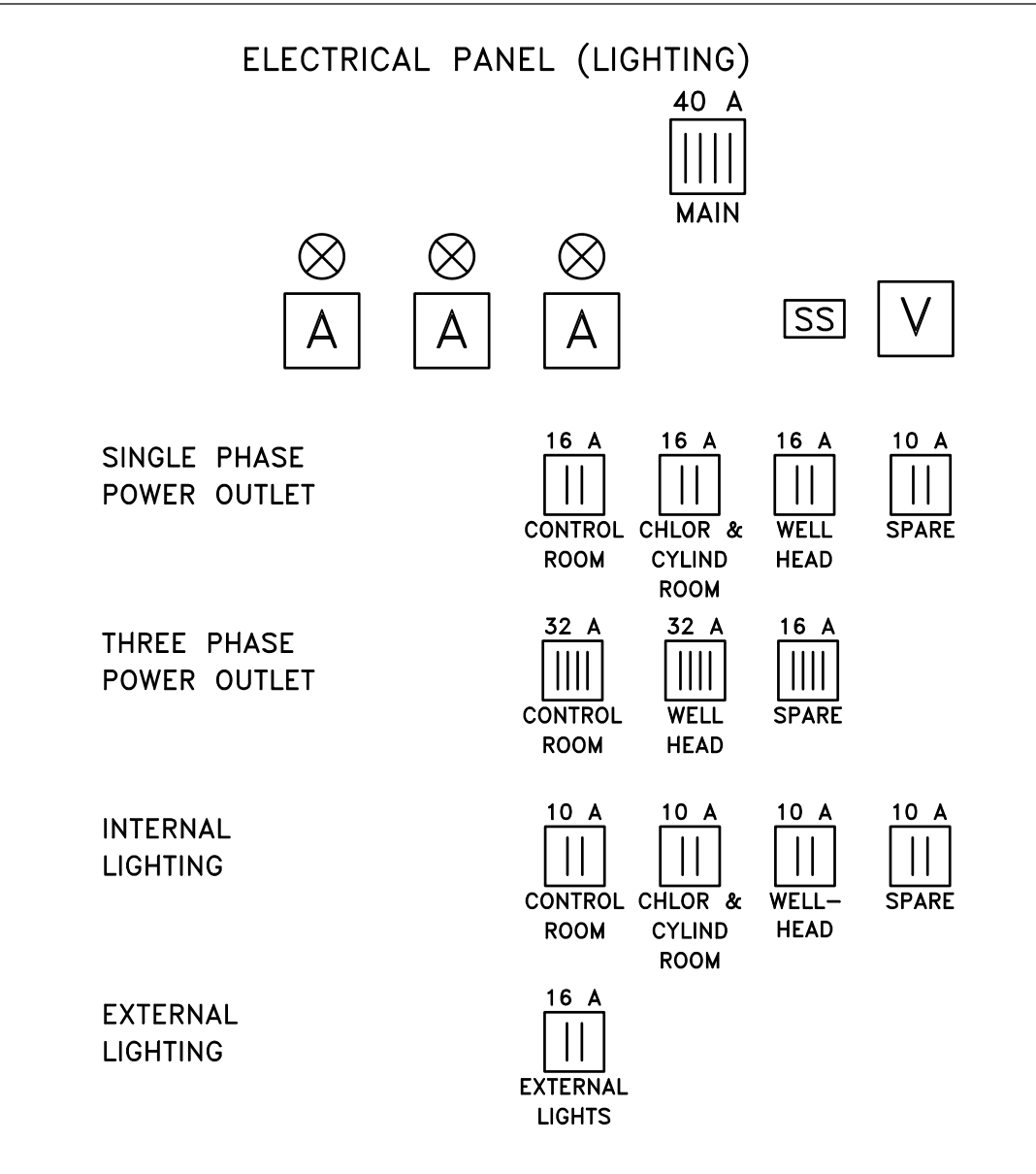
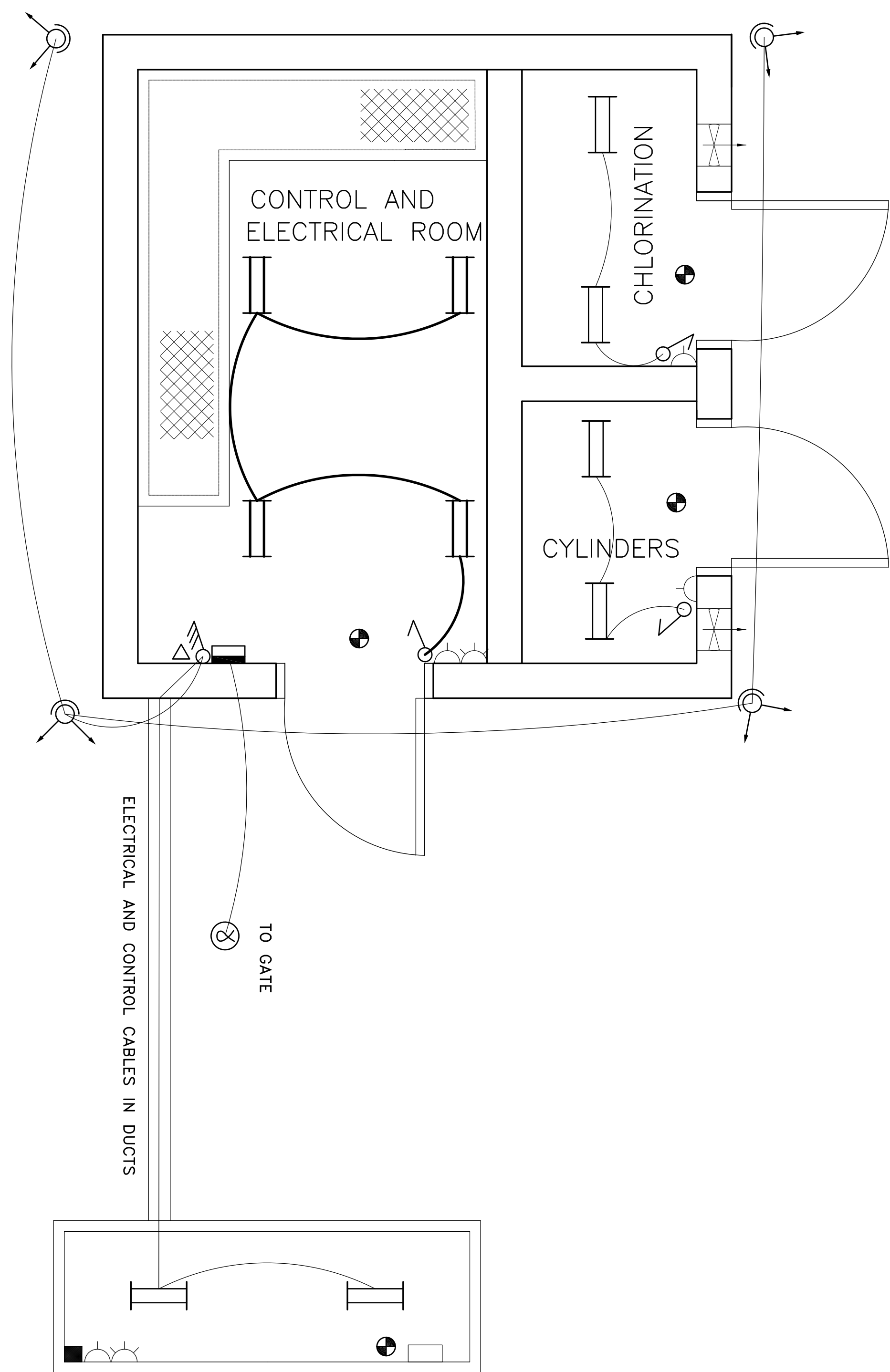
JALL ED DIB – HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 – ANTELIAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION	ELECTRICAL SCHEMATIC
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DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-E01	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	4/7	509W-PS01-E01



- LEGEND:**
- EXHAUST FAN
 - SIMPLE SWITCH
 - DOUBLE SWITCH
 - TRIPPLE SWITCH
 - DOUBLE DIRECTION SWITCH
 - DOUBLE SWITCH, DOUBLE DIRECTION
 - TRIPPLE SWITCH, DOUBLE DIRECTION
 - TRIPPLE DIRECTION SWITCH
 - SINGLE PHASE POWER OUTLET (1-PH P.O.)
 - 3-PHASE POWER OUTLET (3-PH P.O.)
 - 220 V_{AC} HANDLAMP OUTLET
 - TELEPHONE OUTLET
 - ANTENNA OUTLET
 - UPS OUTLET
 - INCANDESCENT LIGHTING FIXTURE
 - FLUORESCENT LIGHTING FIXTURE (2 LAMPS)
 - FLUORESCENT LIGHTING FIXTURE (1 LAMP)
 - HALOGEN LIGHTING FIXTURE
 - EMERGENCY LIGHTING FIXTURE
 - HIGH BAY REFLECTORS
 - EXTERNAL ROAD LIGHTING FIXTURE
 - EXTERNAL WALKWAY LIGHTING FIXTURE
 - ELECTRICAL PANEL BOARD-PRINCIPAL OR COMPLETE
 - ELECTRICAL PANEL BOARD-SECONDARY
 - FLOOR DRAIN (FD)
 - VOLTMETER
 - AMMETER
 - 4-POLE CIRCUIT BREAKER (4P-C.B.)
 - 3-POLE CIRCUIT BREAKER (3P-C.B.)
 - 2-POLE CIRCUIT BREAKER (2P-C.B.)
 - SELECTOR SWITCH
 - VENTILATION

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

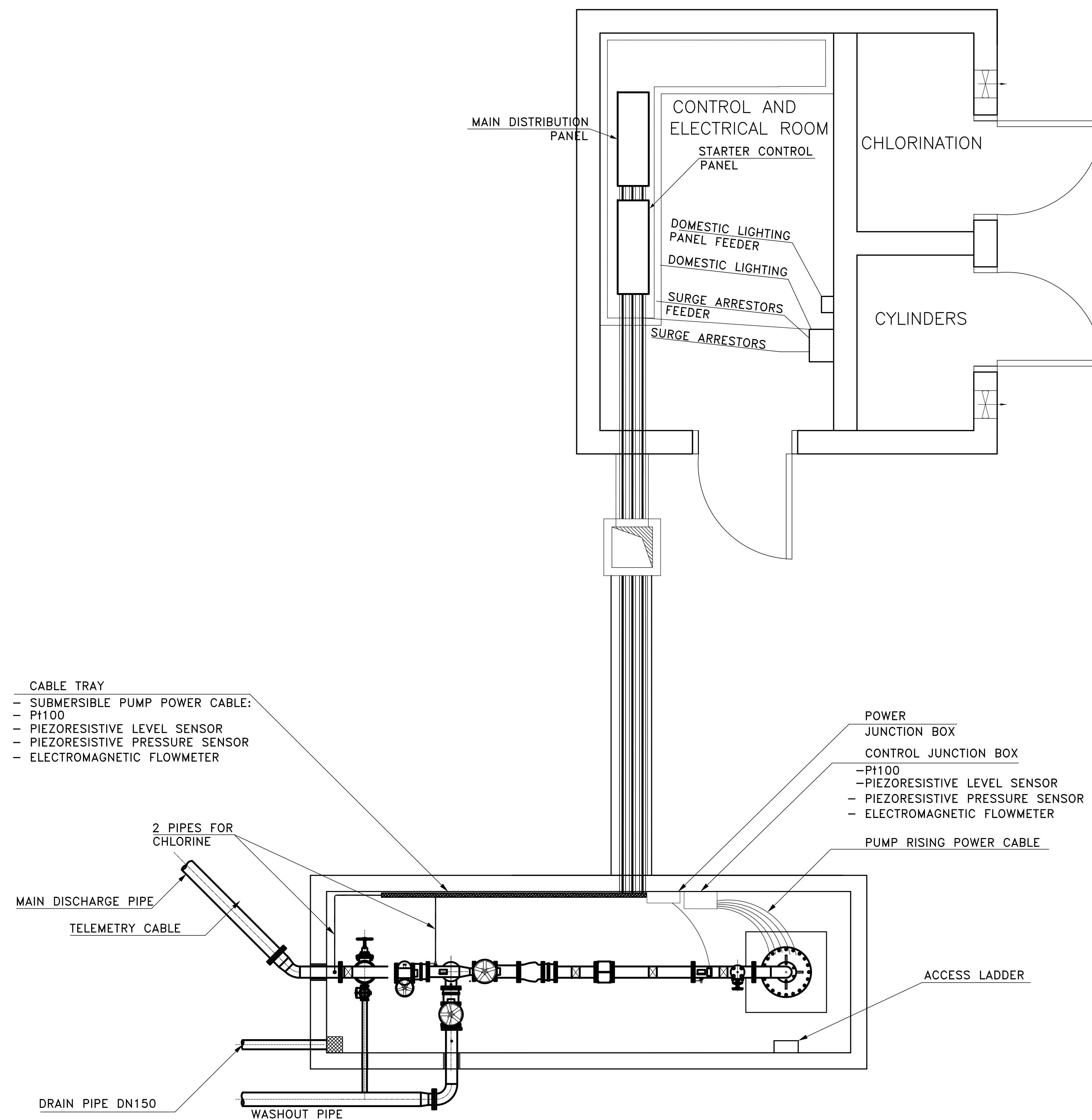
BUREAU TECHNIQUE POUR LE DEVELOPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIAF FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION DOMESTIC ELECTRICAL
INSTALLATION SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-E02	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	5/7	509W-PS01-E02



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COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD BUREAU TECHNIQUE POUR LE DEVELOPEMENT

JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIA FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

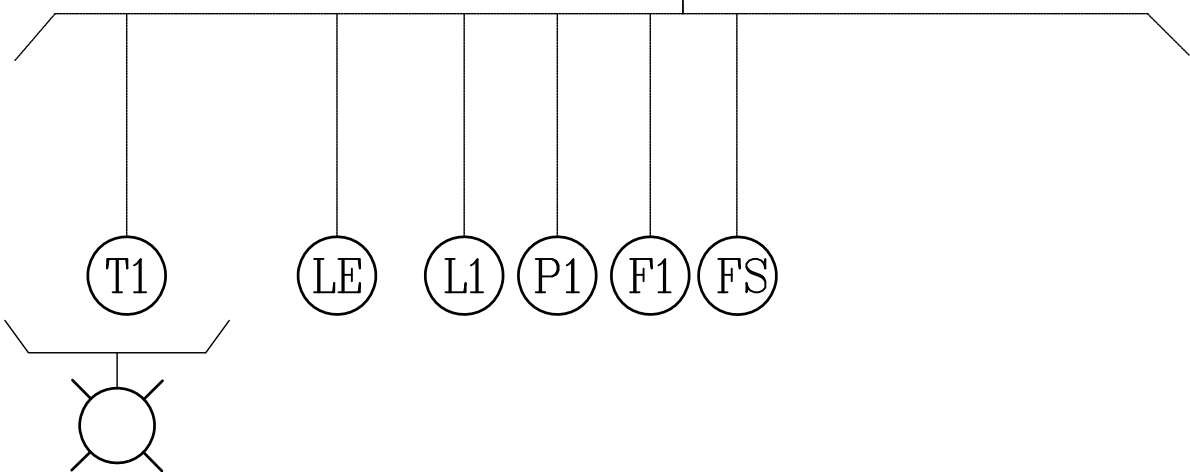
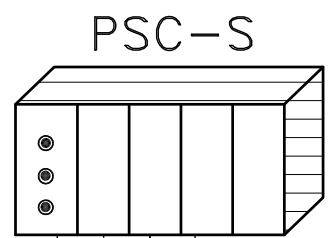
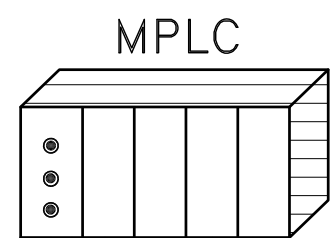
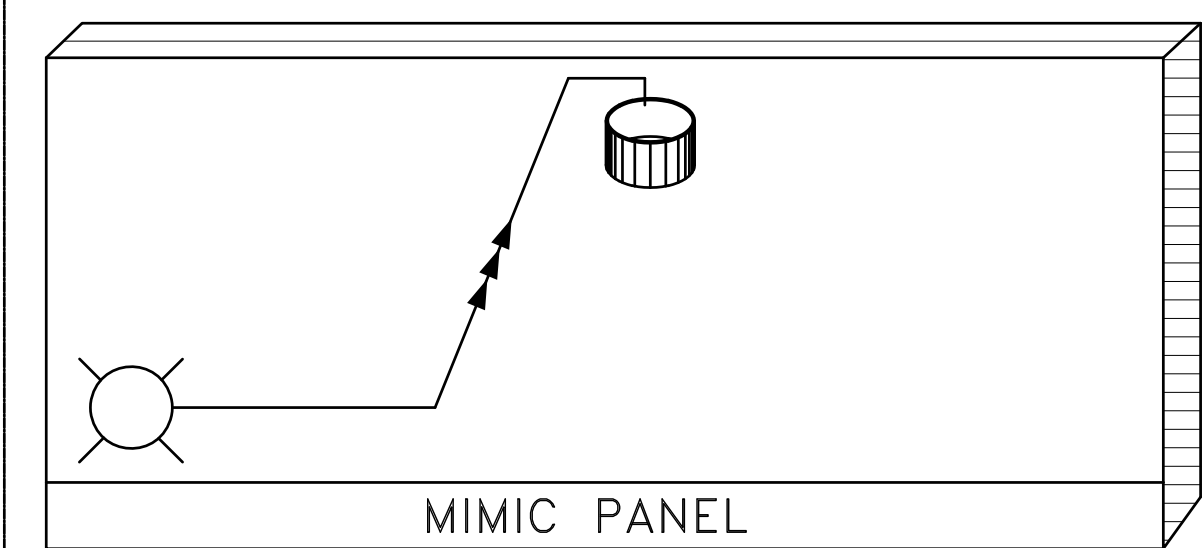
EL MRAYJAT PUMPING STATION

ELECTRICAL SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-E03	T.RMEITY	F.GHANEM	T.RMEITY

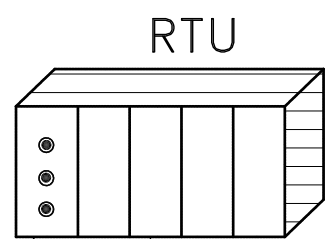
DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	6/7	509W-PS01-E03

CONTROL SYSTEM



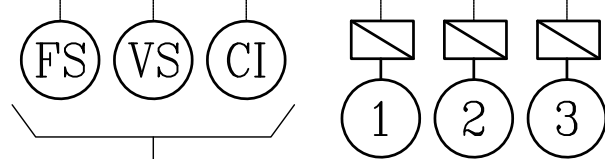
EL MRAYJAT PUMPING STATION

L=1135m



L2

EL MRAYJAT RESERVOIR



CL2 SYSTEM

LEGEND:

- : PROGRAMMABLE LOGICAL CONTROLLER (PLC)
MPLC : MAIN PLC
RTU : REMOTE TERMINAL UNIT
— : DATA CABLES
—^{TC} : TELEMETRY CABLE IN CONDUIT
AWH : ANTI WATER HAMMER
FS : FLOW SWITCH
VS : VACUUM SWITCH
 : RESERVOIR
 : BOREHOLE MOTOPUMPSET
ATS : AUTOMATIC TRANSFER SWITCH
PSC : PUMPSET CONTROLLER
 : FLOW MEASUREMENT
 : LEVEL MEASUREMENT
 : PRESSURE MEASUREMENT
 : TEMPERATURE MEASUREMENT
 : CHLORINE
STR : STARTER
CBP : CIRCUIT BREAKER FOR PUMPSET
CBA : CIRCUIT BREAKER FOR AUXILIARIES
GCB : GENERAL CIRCUIT BREAKER
 : SURFACE MOTOPUMPSET
 : ELECTRIC ACTUATOR
 : ANTI WATER HAMMER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD BUREAU TECHNIQUE POUR LE DEVELOPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIAF FAX: (04) 712159

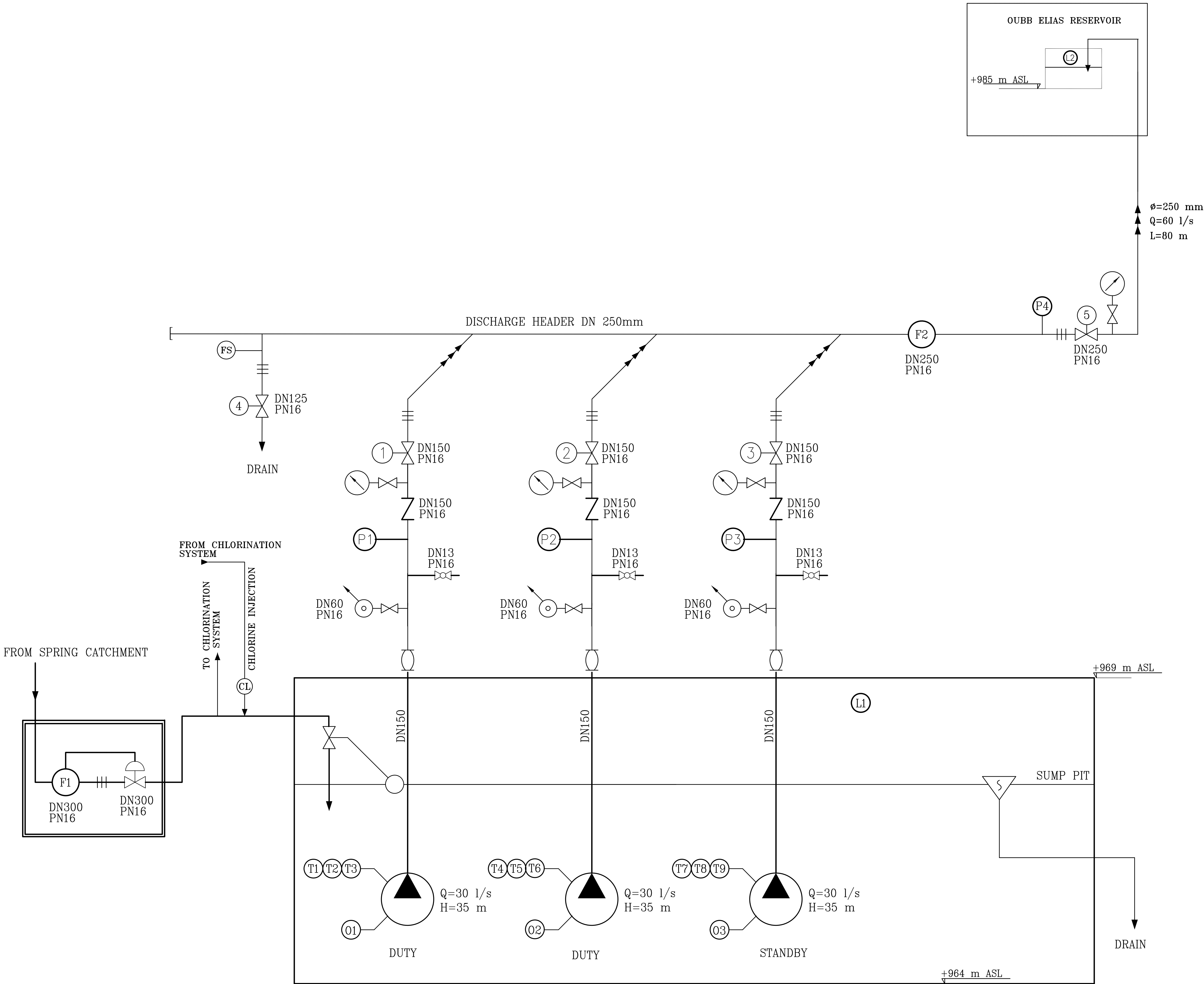
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION

CONTROL SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-I01	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	7/7	509W-PS01-I01



- LEGEND:**
- : SUBMERSIBLE PUMP
 - DN : NOMINAL DIAMETER
 - PN : NOMINAL PRESSURE
 - : PRESSURE MEASUREMENT
 - : FLOW SWITCH
 - : TEMPERATURE MEASUREMENT
 - : LEVEL MEASUREMENT AND/OR FLOAT SWITCH
 - : FLOW MEASUREMENT
 - : GLYCERINE FILLED MANOMETER ø100 WITH 3 WAY VALVE.
 - : SURGE SUPPRESSION EQUIPMENT.
 - : PIPELINE
 - : FLOAT VALVE
 - : DOUBLE AIR RELEASE VALVE WITH ISOLATING VALVE.
 - : ELECTRIC ACTUATOR
 - : GATE VALVE
 - : CHECK VALVE (ANTI SLAM TYPE)
 - : SAMPLING VALVE
 - : PERFORATED CHECK VALVE
 - : DEMOUNTABLE JOINT
 - : SURGE ANTICIPATION VALVE
 - : GLOBE VALVE
 - : BUTTERFLY VALVE
 - : PUMPING LINE
 - : GRAVITY LINE
 - : REGULATING VALVE
 - : FLEXIBLE JOINT
 - : CHLORINE INJECTION
 - : STRAINER
 - : RUBBER SPHERICAL FLEXIBLE JOINT.
 - : STAINLESS STEEL FLEXIBLE JOINT.
 - : PRESSURE REDUCING VALVE
 - : Y STRAINER

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

ED BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

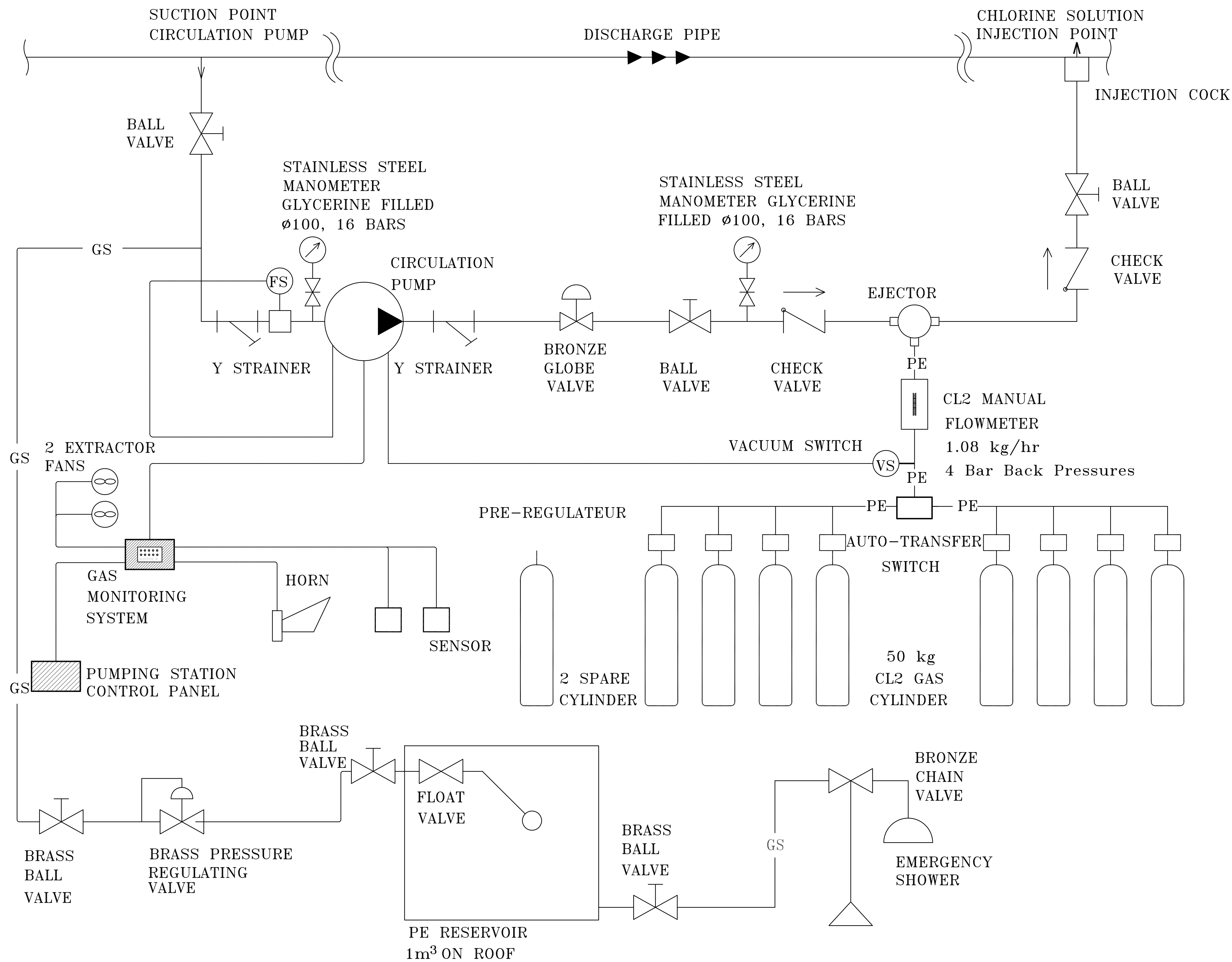
JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELJAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS PUMPING STATION HYDRAULIC SCHEMATICS

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS02-M01	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	1/4	509W-PS02-M01



LEGEND:

- PE— : POLYETHYLENE TUBE
- GS— : GALVANIZED STEEL PIPE
- ⊗ : THREE WAY VALVE
- FS : FLOW SWITCH

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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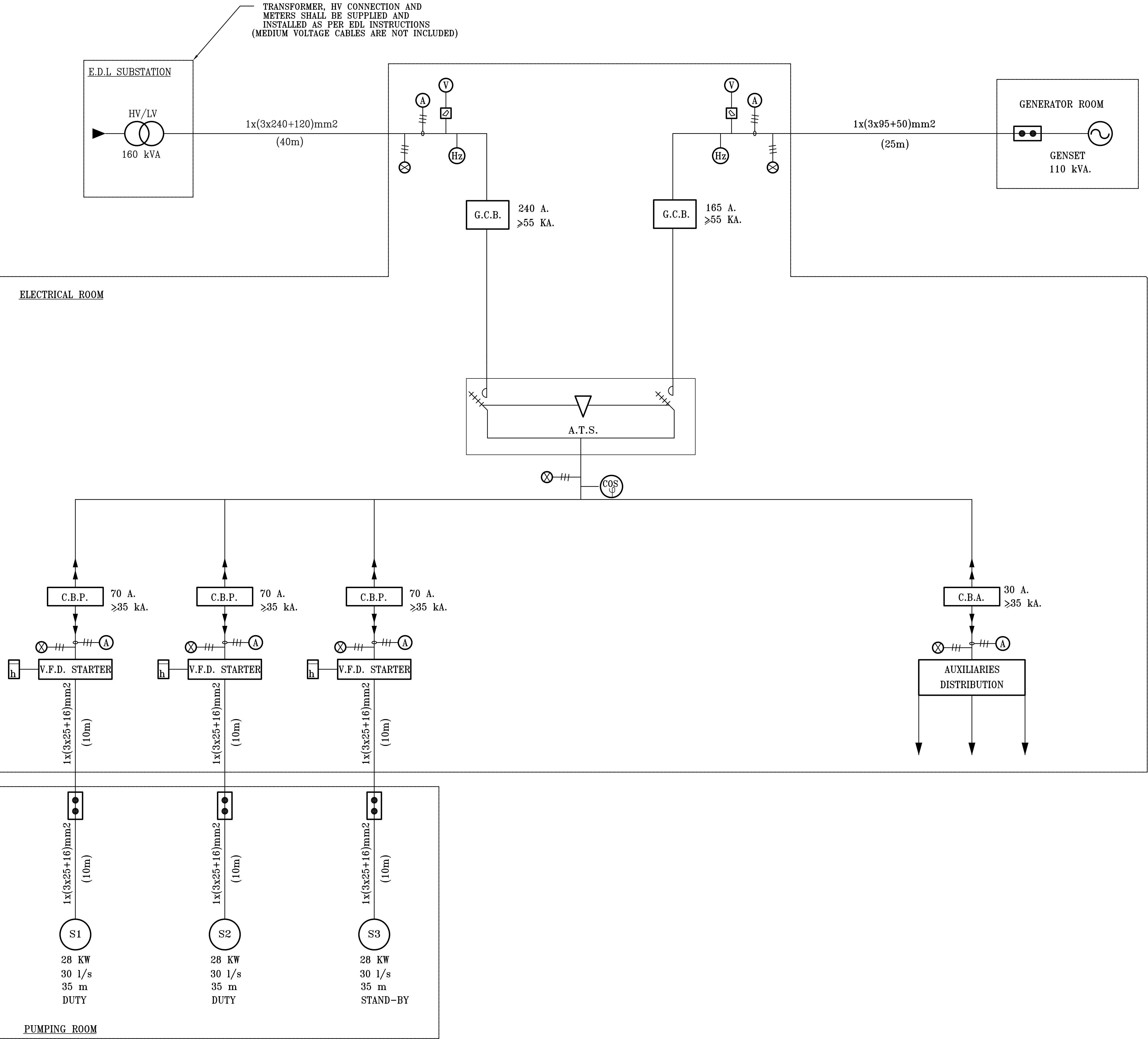
ED BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT













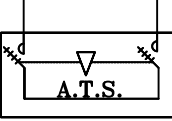





QABB ELIAS PUMPING STATION CHLORINATION SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS02-M02	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	2/4	509W-PS02-M02



LEGEND

-  : POWER FACT MEASUREMENT
-  : INDICATING LAMP
-  : SELECTOR SWITCH
-  : FREQUENCY METER
-  : VOLTMETER
-  : AMPERMETER
-  : HOURMETER
-  : CIRCUIT BREAKER
-  : JUNCTION BOX IP67
-  : TRANSFORMER HV/LV
-  : SUBMERSIBLE MOTOPUMPSET
-  : SURFACE MOTOPUMPSET
-  : AUTOMATIC TRANSFER SWITCH (A.T.S.)
-  : EMERGENCY GENERATOR
-  : GENERAL CIRCUIT BREAKER
-  : CIRCUIT BREAKER FOR PUMPSET
-  : CIRCUIT BREAKER FOR AUXILIARIES
-  : EXISTING EQUIPMENT

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BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

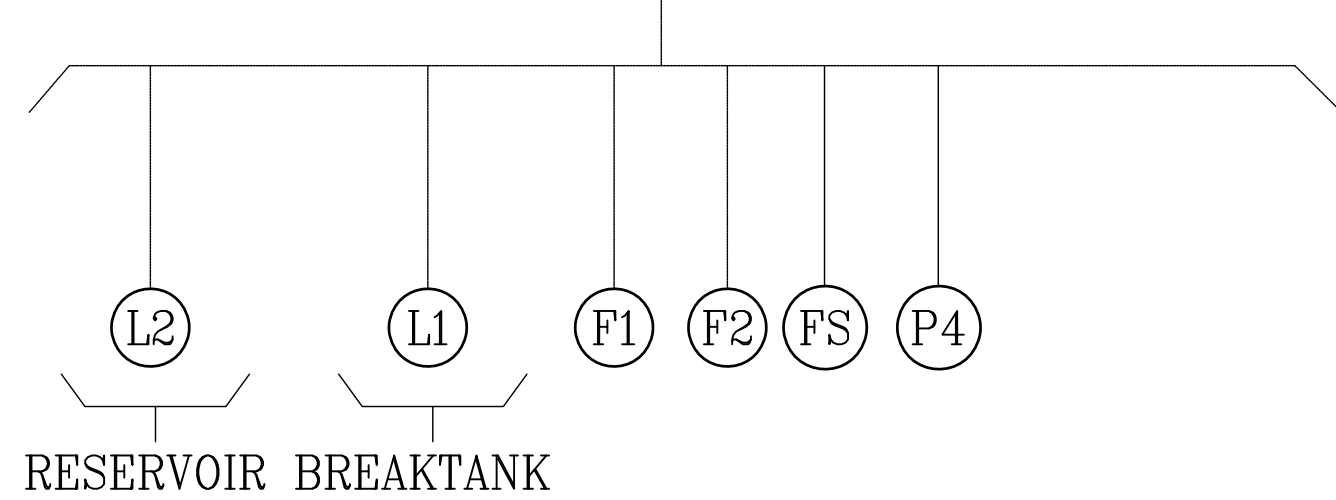
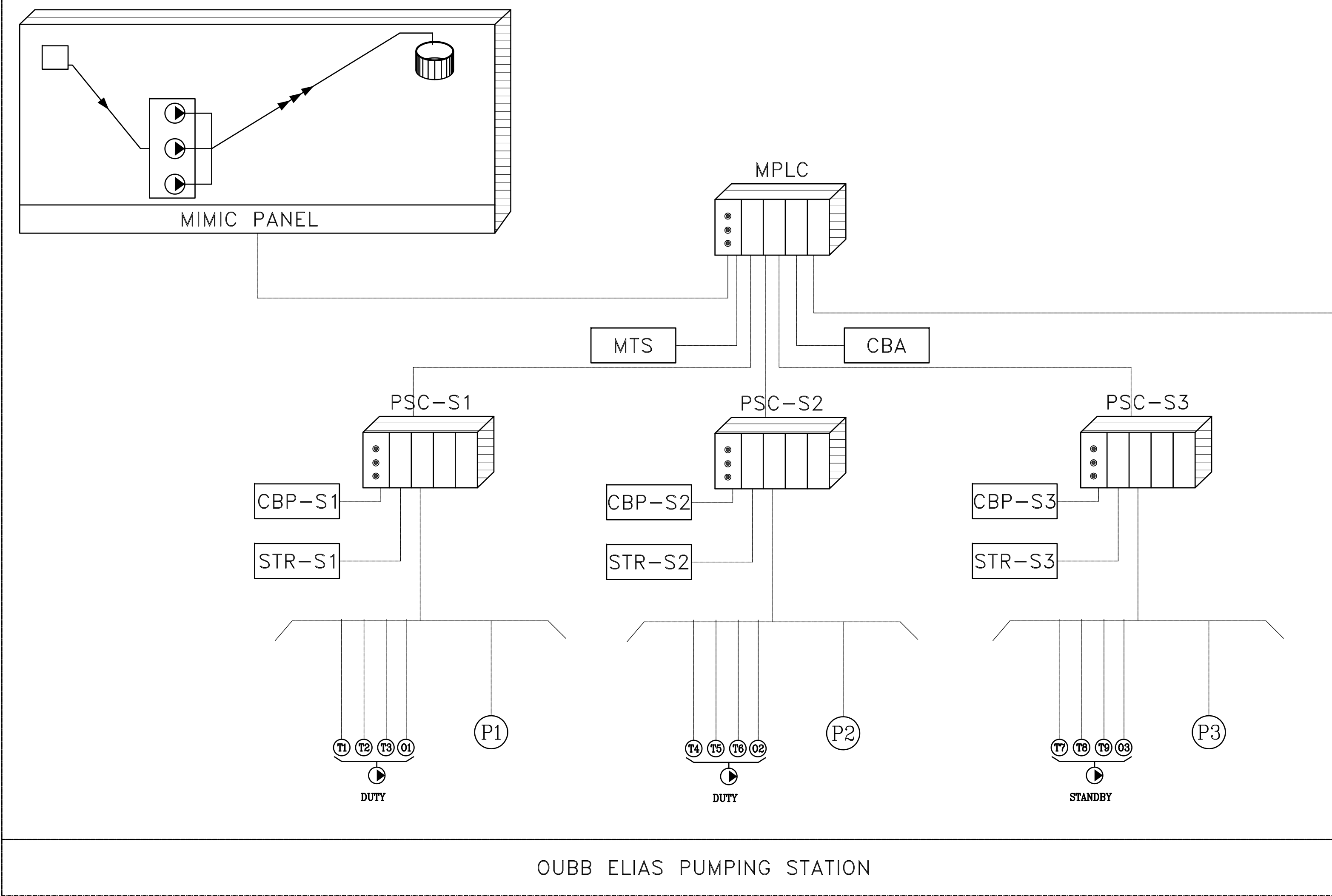
QABB ELIAS PUMPING STATION

ELECTRICAL SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS02-E01	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	3/4	509W-PS02-E01

CONTROL SYSTEM



- LEGEND:
- : PROGRAMMABLE LOGICAL CONTROLLER (PLC)
 - MPLC : MAIN PLC
 - RTU : REMOTE TERMINAL UNIT
 - : DATA CABLES
 - : TELEMETRY CABLE IN CONDUIT
 - AWH : ANTI WATER HAMMER
 - FS : FLOW SWITCH
 - VS : VACUUM SWITCH
 - : RESERVOIR
 - : BOREHOLE MOTOPUMPSET
 - ATS : AUTOMATIC TRANSFER SWITCH
 - PSC : PUMPSET CONTROLLER
 - : FLOW MEASUREMENT
 - : LEVEL MEASUREMENT
 - : PRESSURE MEASUREMENT
 - : TEMPERATURE MEASUREMENT
 - : CHLORINE
 - STR : STARTER
 - CBP : CIRCUIT BREAKER FOR PUMPSET
 - CBA : CIRCUIT BREAKER FOR AUXILIARIES
 - GCB : GENERAL CIRCUIT BREAKER
 - : SURFACE MOTOPUMPSET
 - : ELECTRIC ACTUATOR
 - : ANTI WATER HAMMER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

ED BUREAU TECHNIQUE POUR LE DEVELOPEMENT

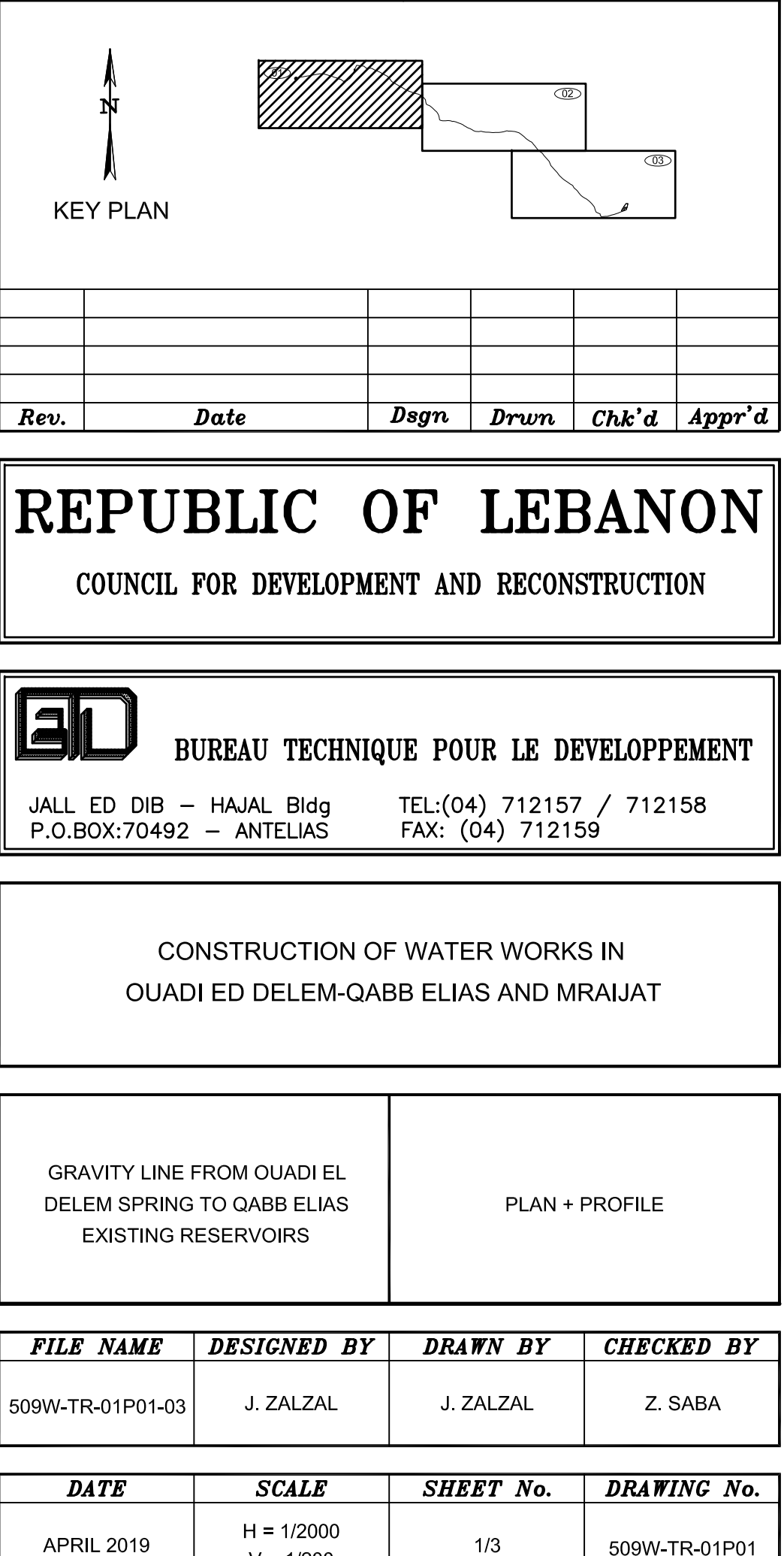
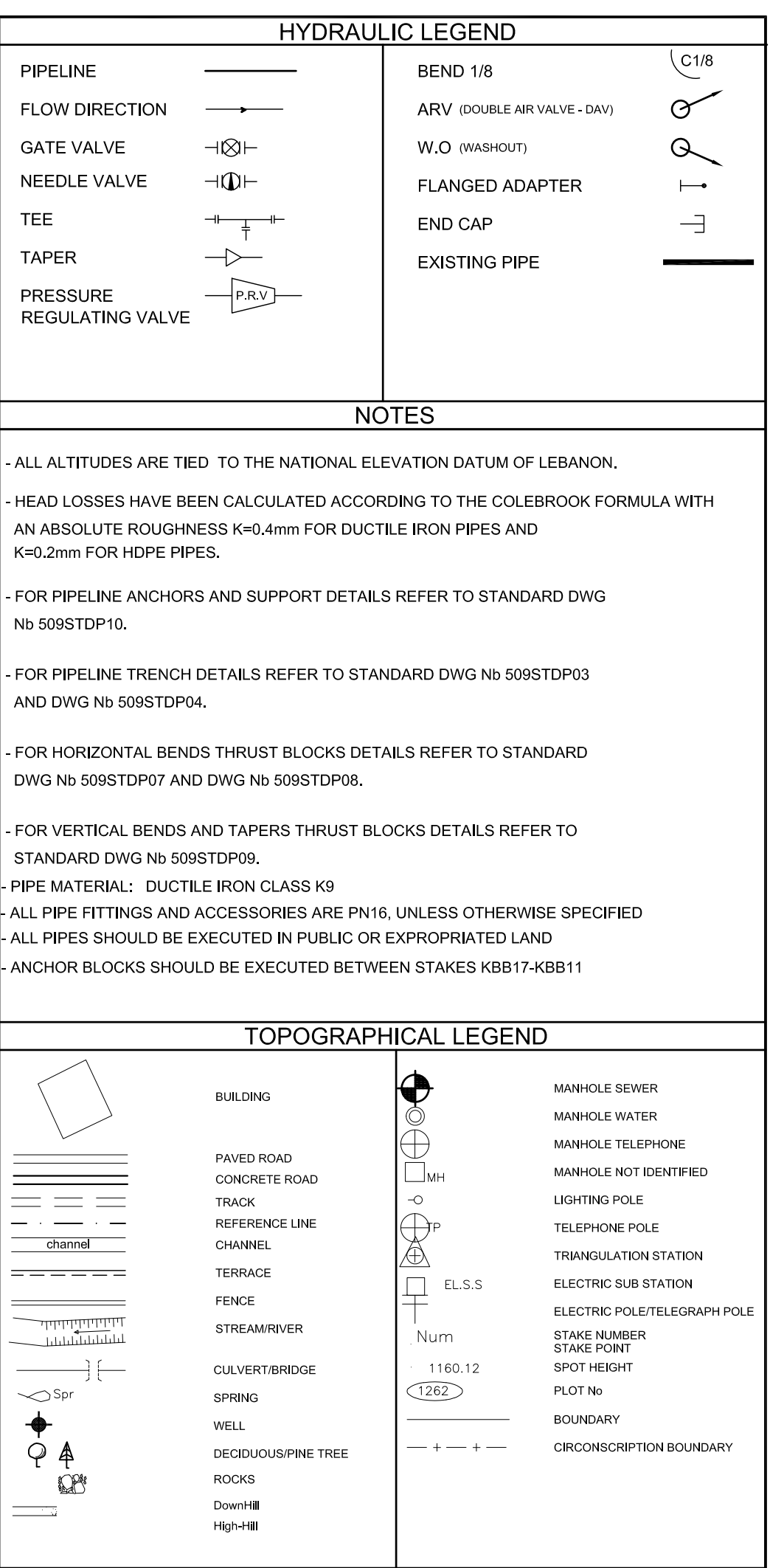
JALL ED DIB - HAIAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAJ FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS PUMPING STATION	CONTROL SCHEMATIC
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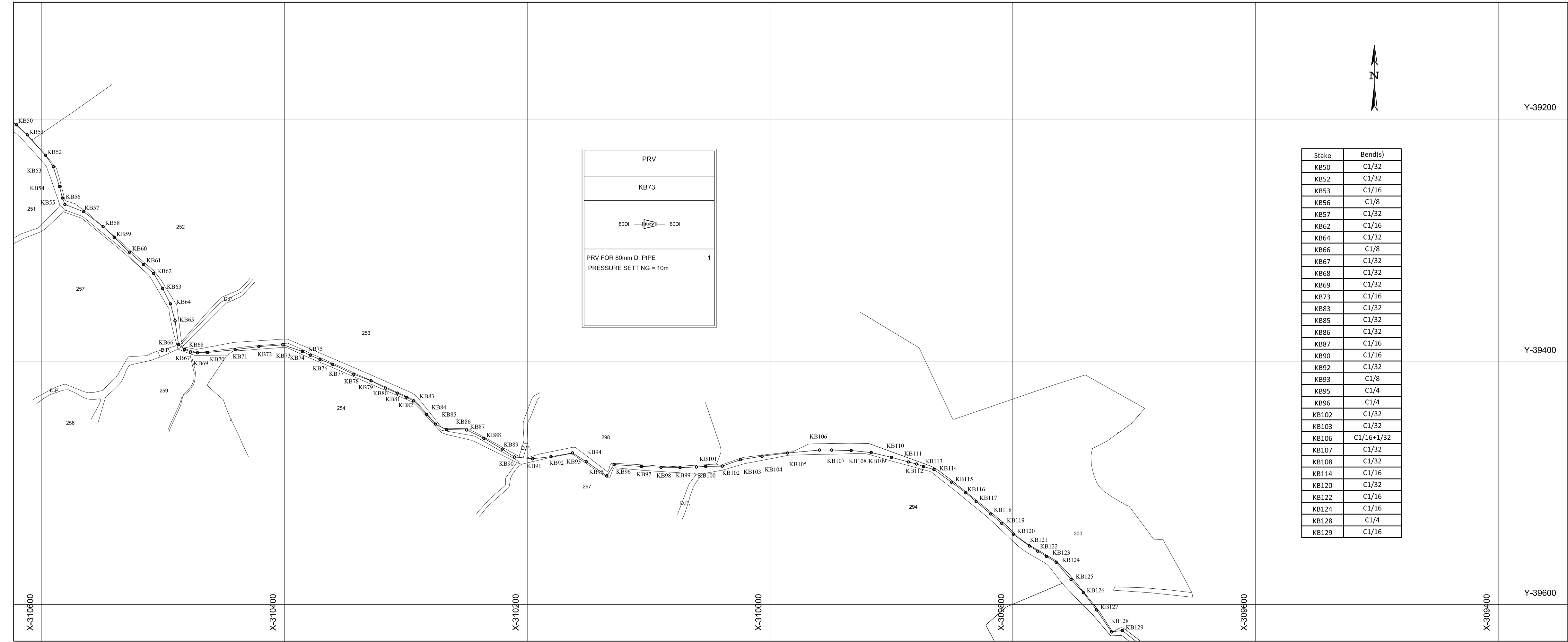
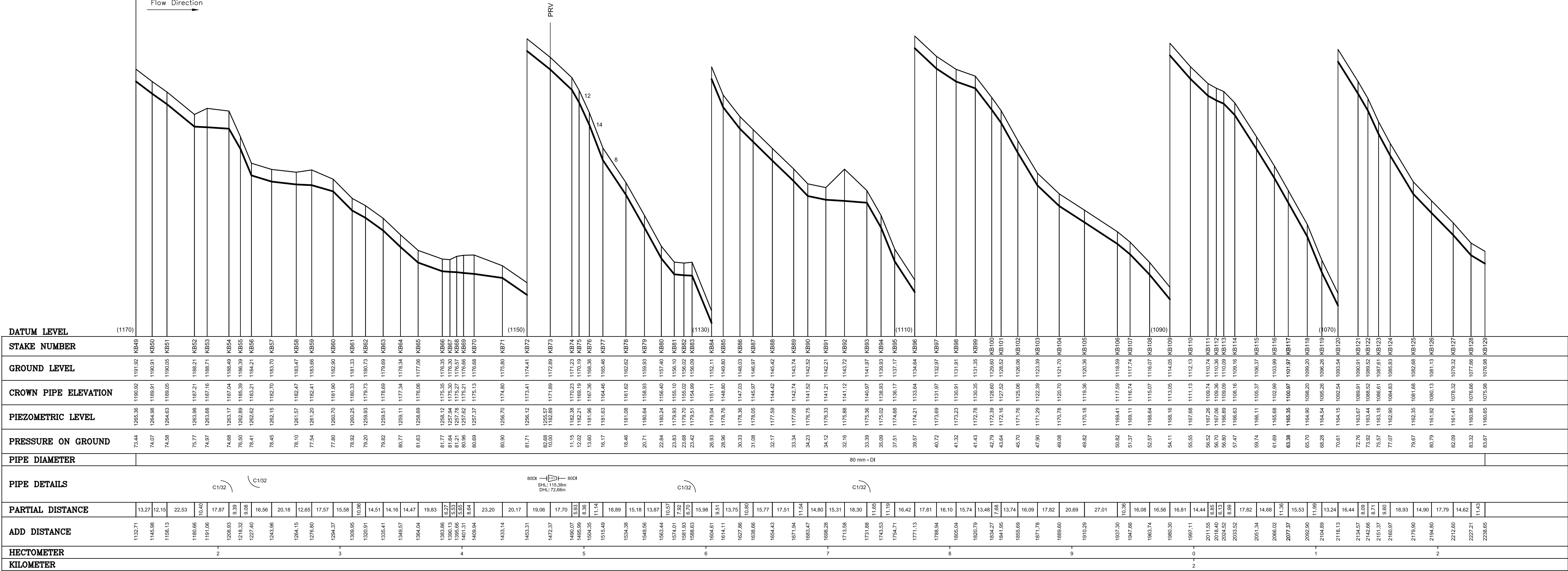
DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS02-E02	T.RMEITY	F.GHANEM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	4/4	509W-PS02-E02



BRANCH KBB24-KB190
L= 3264 m
D= 80 mm
Q= 6.00 l/s
V= 1.19 m/s
J= 0.0087 m/m
JL= 93.67 m

Flow Direction



HYDRAULIC LEGEND

PIPELINE	—	BEND 1/8	
FLOW DIRECTION	→	ARV (DOUBLE AIR VALVE - DAV)	
GATE VALVE		W.O (WASHOUT)	
NEEDLE VALVE		FLANGED ADAPTER	
TEE		END CAP	
TAPER		EXISTING PIPE	
PRESSURE REGULATING VALVE			

NOTES

- ALL ALTITUDES ARE TIED TO THE NATIONAL ELEVATION DATUM OF LEBANON.
- HEAD LOSSES HAVE BEEN CALCULATED ACCORDING TO THE COLEBROOK FORMULA WITH AN ABSOLUTE ROUGHNESS K=0.4mm FOR DUCTILE IRON PIPES AND K=0.2mm FOR HDPE PIPES.
- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 509STDP10.
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 509STDP03 AND DWG Nb 509STDP04.
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDP07 AND DWG Nb 509STDP08.
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDP09.
- PIPE MATERIAL: DUCTILE IRON CLASS K9
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED LAND
- ANCHOR BLOCKS SHOULD BE EXECUTED BETWEEN STAKES KB76-KB77

TOPOGRAPHICAL LEGEND

BUILDING		MANHOLE SEWER	
PAVED ROAD		MANHOLE WATER	
CONCRETE ROAD		MANHOLE TELEPHONE	
TRACK		MANHOLE NOT IDENTIFIED	
REFERENCE LINE		LIGHTING POLE	
CHANNEL		TELEPHONE POLE	
TERRACE		TRIANGULATION STATION	
FENCE		ELECTRIC SUB STATION	
STREAM/RIVER		ELECTRIC POLE/TELEGRAPH POLE	
CULVERT/BRIDGE		Num	
SPRING		1 160.12	
WELL		1282	
DECEIDUOUS/PINE TREE		STAKE NUMBER	
ROCKS		PLOT No	
Down=H		BOUNDARY	
High=H		CIRCUMSCRIPTION BOUNDARY	

KEY PLAN

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPEMENT

JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIA FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN OUADI DELEM-QABB ELIAS AND MRAIJAT

GRAVITY LINE FROM OUADI EL
DELEM SPRING TO QABB ELIAS
EXISTING RESERVOIRS

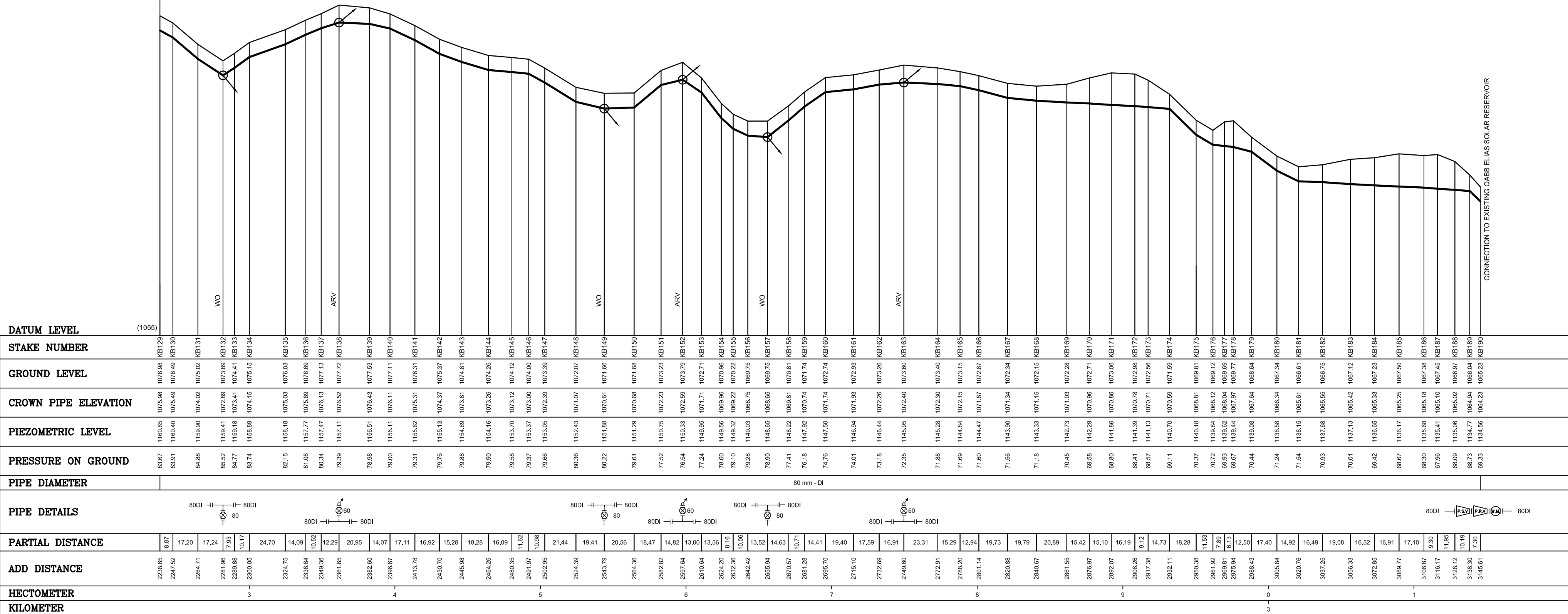
PLAN + PROFILE

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-TR-01P01-03	J. ZALZAL	J. ZALZAL	Z. SABA

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2019	H = 1/2000 V = 1/200	2/3	509W-TR-01P02

BRANCH KBB24-KB190
L= 3284 m
D= 80 mm
Q= 6.00 l/s
V= 1.19 m/s
J= 0.0087 m/m
JL= 93.67 m

Flow Direction



HYDRAULIC LEGEND

PIPELINE		BEND 1/8	
FLOW DIRECTION		ARV (DOUBLE AIR VALVE - DAV)	
GATE VALVE		W.O (WASHOUT)	
NEEDLE VALVE		FLANGED ADAPTER	
TEE		END CAP	
TAPER		EXISTING PIPE	
PRESSURE REGULATING VALVE		WATERMETER	
PRESSURE SUSTAINING VALVE			

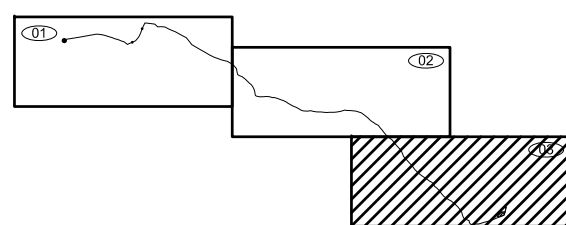
NOTES

- ALL ALTITUDES ARE TIED TO THE NATIONAL ELEVATION DATUM OF LEBANON.
- HEAD LOSSES HAVE BEEN CALCULATED ACCORDING TO THE COLEBROOK FORMULA WITH AN ABSOLUTE ROUGHNESS K=0.4mm FOR DUCTILE IRON PIPES AND K=0.2mm FOR HDPE PIPES.
- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 509STDPI0.
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 509STDPO3 AND DWG Nb 509STDPO4.
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDPO7 AND DWG Nb 509STDPO8.
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDPO9.
- PIPE MATERIAL: DUCTILE IRON CLASS K9
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED LAND

TOPOGRAPHICAL LEGEND

	BUILDING		MANHOLE SEWER
	PAVED ROAD		MANHOLE WATER
	CONCRETE ROAD		MANHOLE TELEPHONE
	TRACK		MANHOLE NOT IDENTIFIED
	REFERENCE LINE		LIGHTING POLE
	CHANNEL		TELEPHONE POLE
	TERRACE		TRIANGULATION STATION
	FENCE		ELECTRIC SUB STATION
	STREAM/RIVER		ELECTRIC POLE/TELEGRAPH POLE
	CULVERT/BRIDGE		STAKE NUMBER
	SPRING		SPOT HEIGHT
	WELL		PLOT No
	DECIDUOUS/PINE TREE		BOUNDARY
	ROCKS		CIRCUMSCRIPTION BOUNDARY
	Down Hill		
	Up Hill		

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPEMENT
JALL ED DIB - HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 - ANTELIAS FAX: (04) 712159

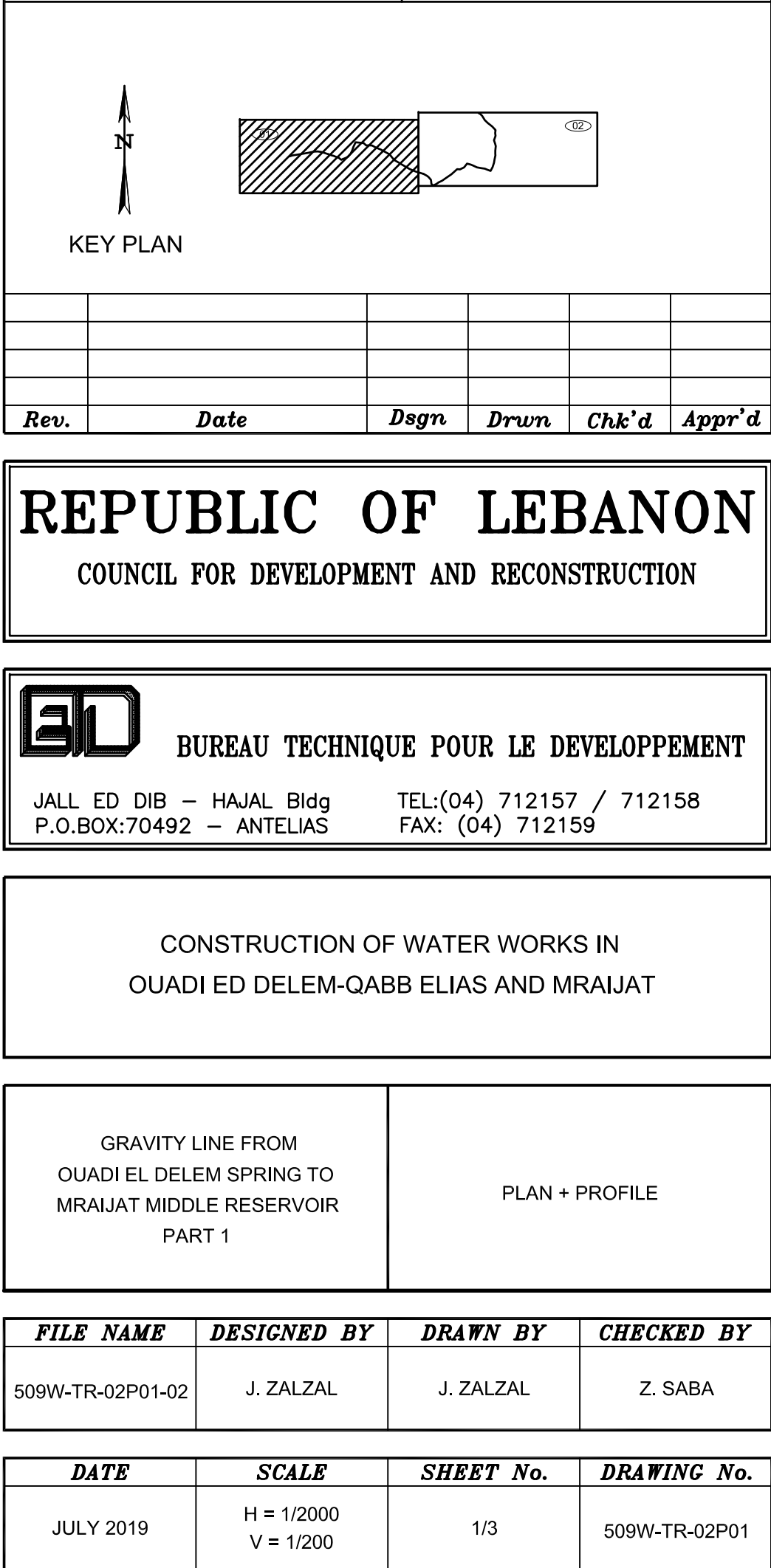
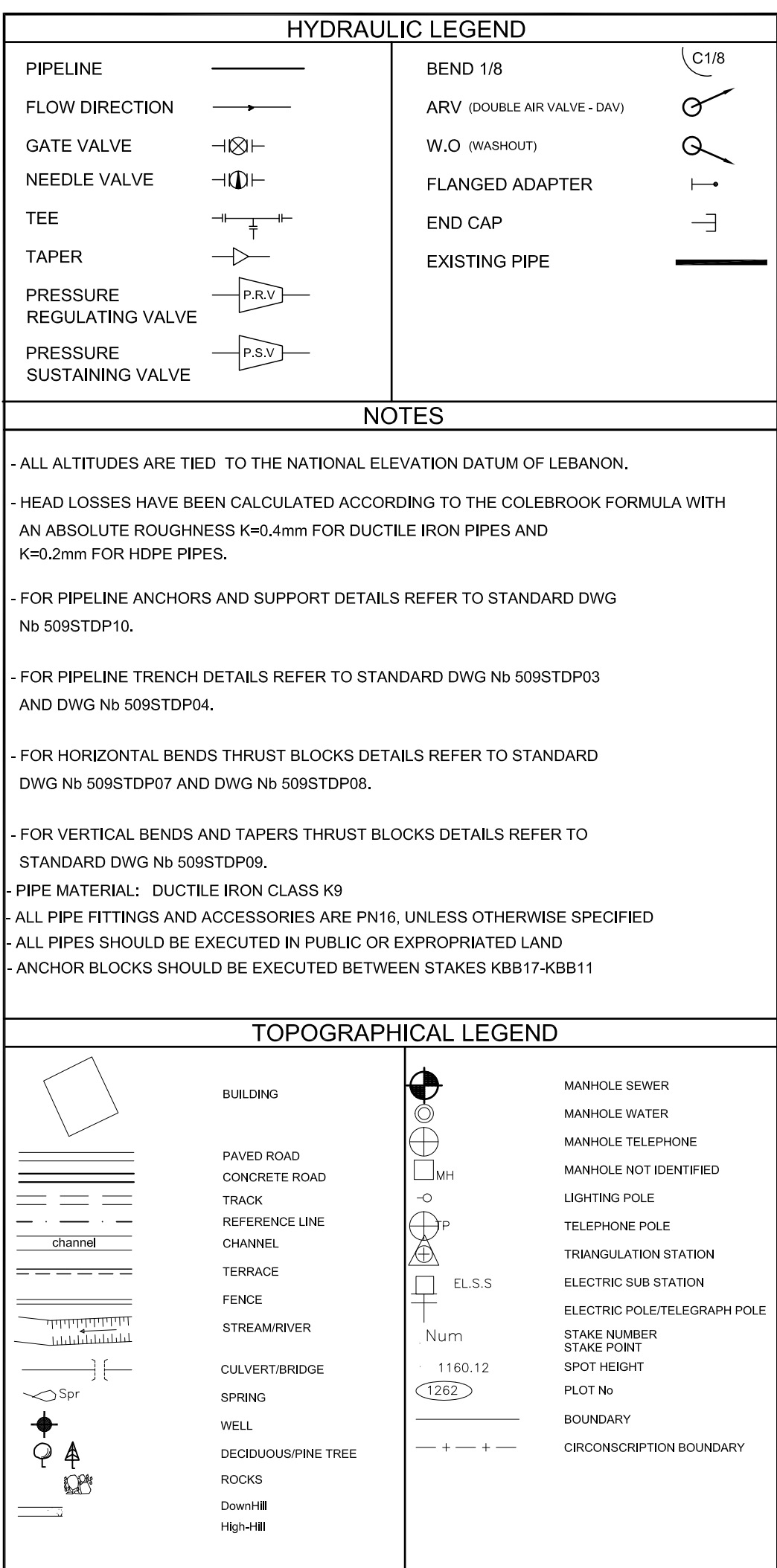
CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT

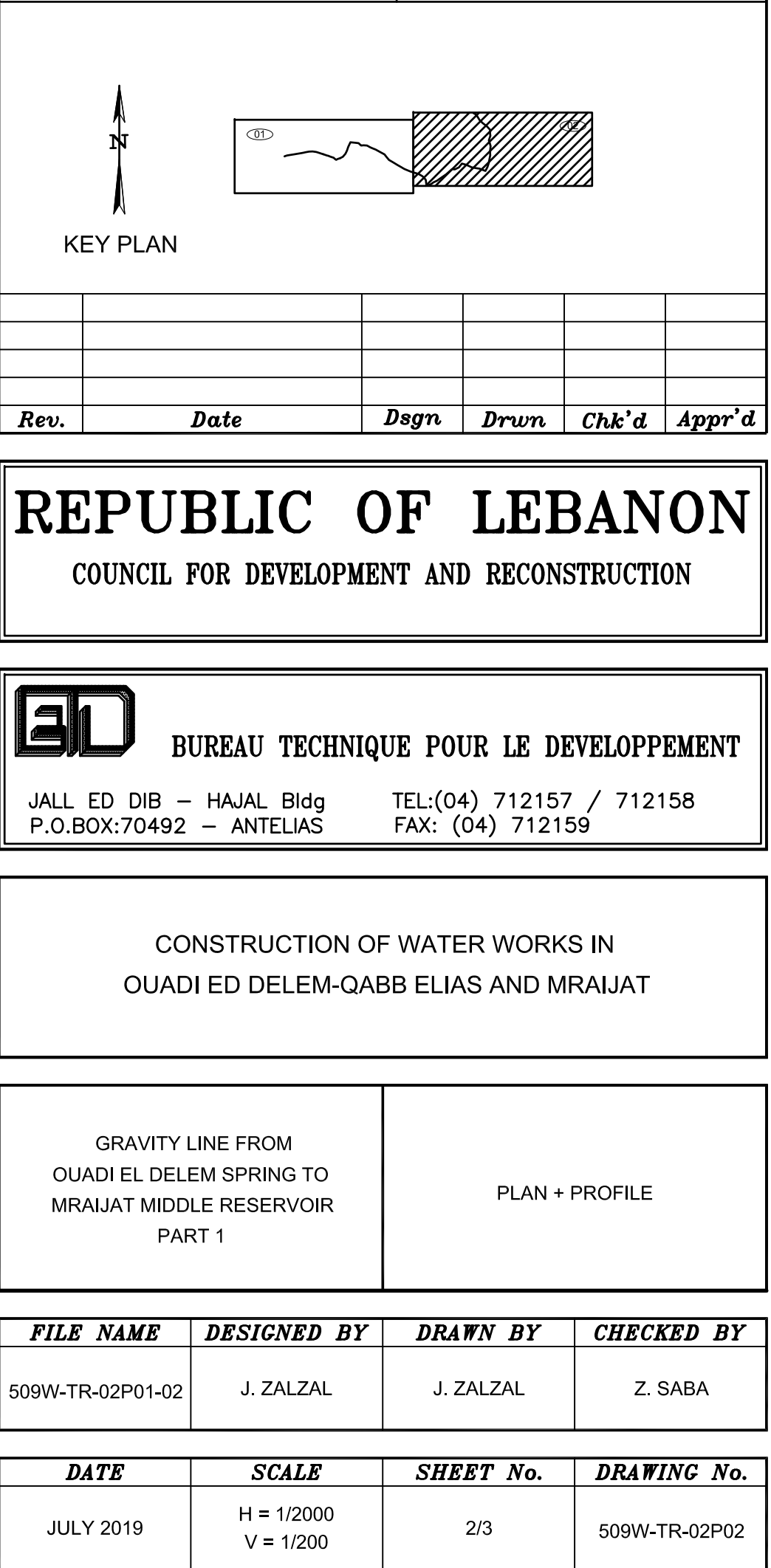
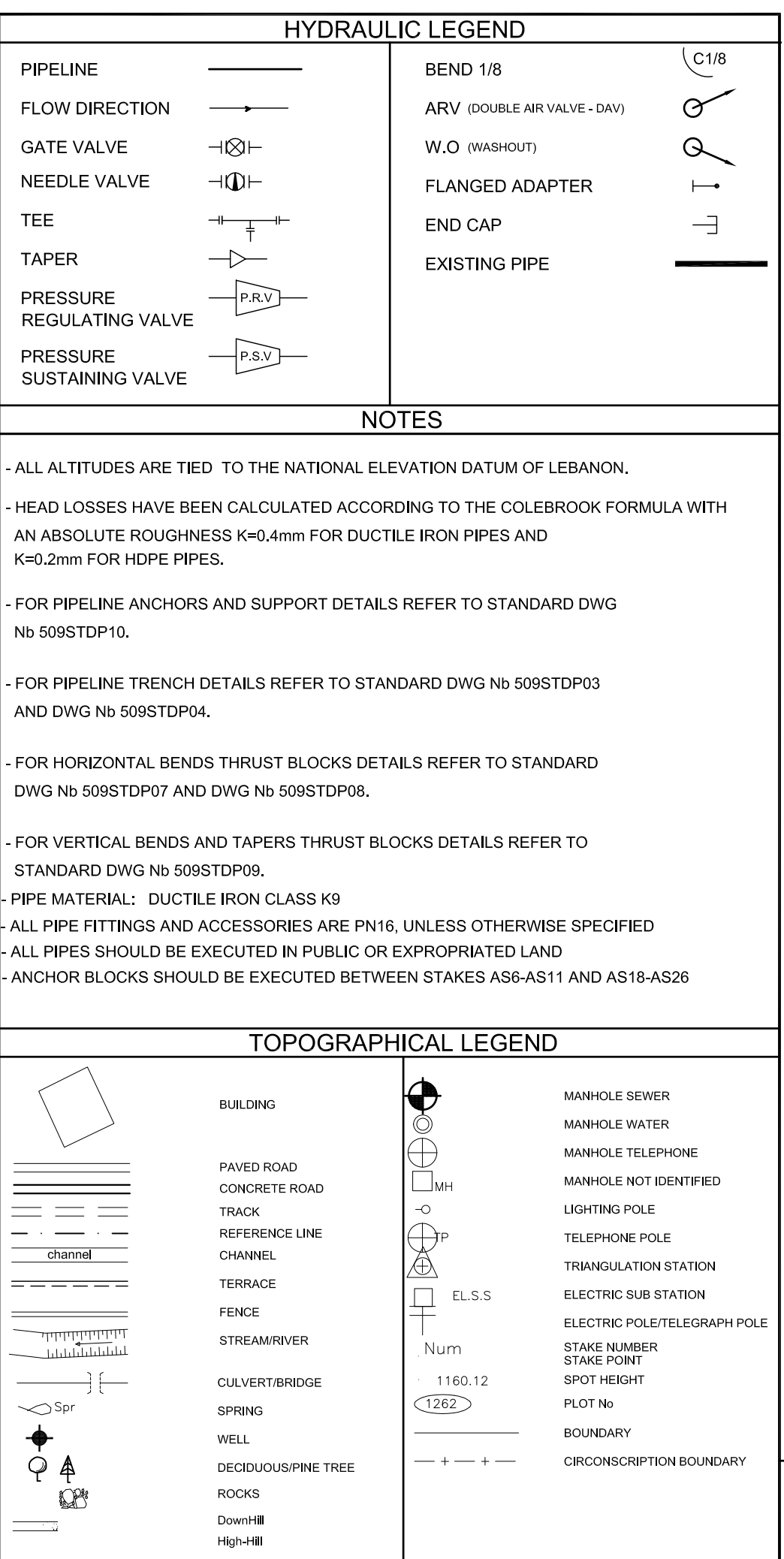
GRAVITY LINE FROM OUADI EL
DELEM SPRING TO QABB ELIAS
EXISTING RESERVOIRS

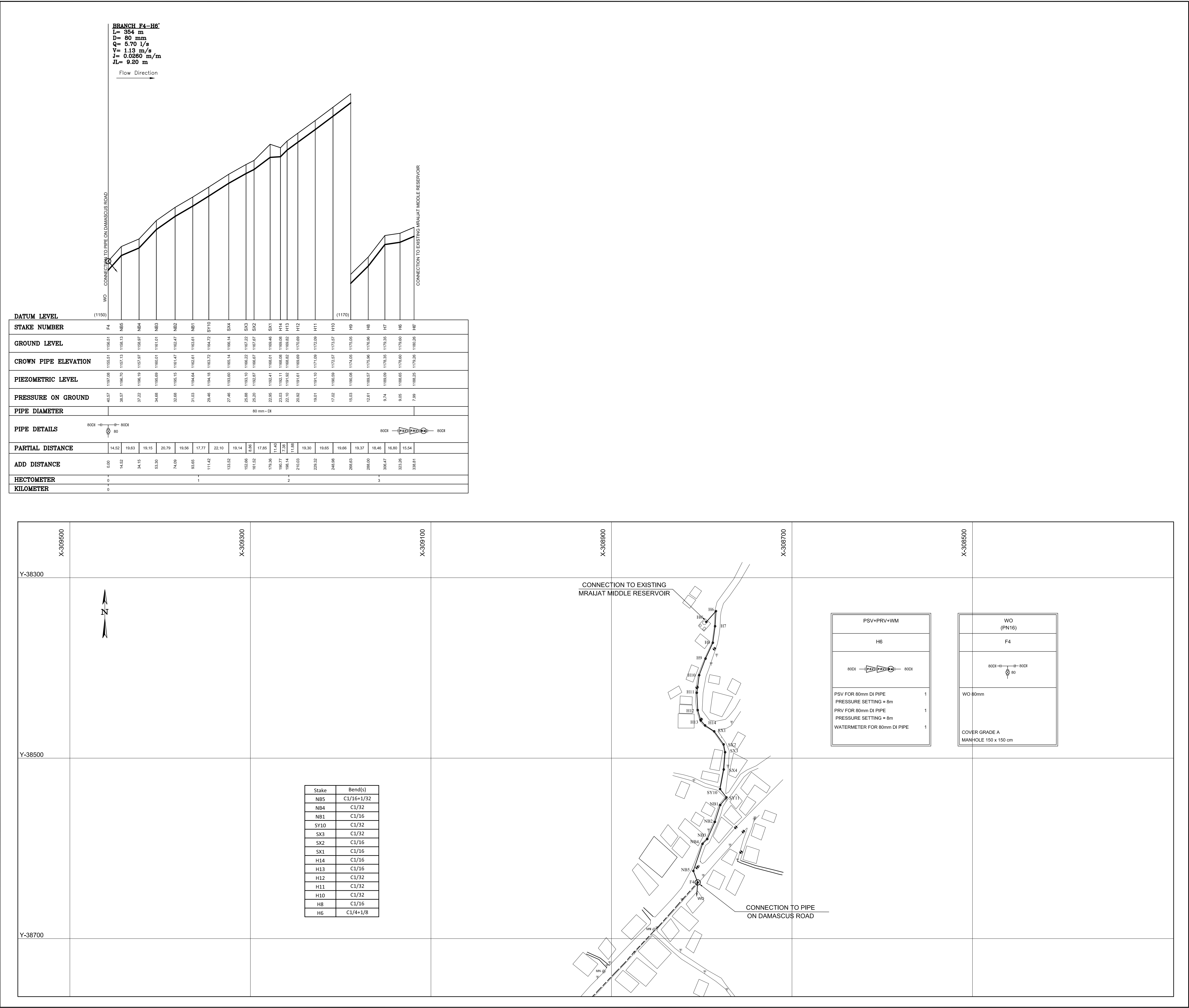
PLAN + PROFILE

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-TR-01P01-03	J. ZALZAL	J. ZALZAL	Z. SABA

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2019	H = 1/2000 V = 1/200	3/3	509W-TR-01P03







HYDRAULIC LEGEND

PIPELINE

FLOW DIRECTION

GATE VALVE

NEEDLE VALVE

TEE

TAPER

PRESSURE REGULATING VALVE

PRESSURE SUSTAINING VALVE

BEND 1/8

ARV (DOUBLE AIR VALVE - DAV)

W.O (WASHOUT)

FLANGED ADAPTER

END CAP

EXISTING PIPE

NOTES

- ALL ALTITUDES ARE TIED TO THE NATIONAL ELEVATION DATUM OF LEBANON.

- HEAD LOSSES HAVE BEEN CALCULATED ACCORDING TO THE COLEBROOK FORMULA WITH AN ABSOLUTE ROUGHNESS K=0.4mm FOR DUCTILE IRON PIPES AND K=0.2mm FOR HDPE PIPES.

- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 509STDPI0.

- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 509STDPI3 AND DWG Nb 509STDPI4.

- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDPI7 AND DWG Nb 509STDPI8.

- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDPI9.

- PIPE MATERIAL: DUCTILE IRON CLASS K9

- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED

- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED LAND

TOPOGRAPHICAL LEGEND

BUILDING

PAVED ROAD

CONCRETE ROAD

TRACK

REFERENCE LINE

CHANNEL

TERRACE

FENCE

STREAM/RIVER

CULVERT/BRIDGE

SPRING

WELL

DEODUCOUS/PINE TREE

ROCKS

DownH

High+H

MANHOLE SEWER

MANHOLE WATER

MANHOLE TELEPHONE

MANHOLE NOT IDENTIFIED

LIGHTING POLE

TELEPHONE POLE

TRIANGULATION STATION

ELECTRIC SUB STATION

ELECTRIC POLE/TELEGRAPH POLE

STAKE NUMBER

SPOT HEIGHT

PLOT No

BOUNDARY

CIRCUMSCRIPTION BOUNDARY

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

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BD

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TEL:(04) 712157 / 712158
FAX: (04) 712159

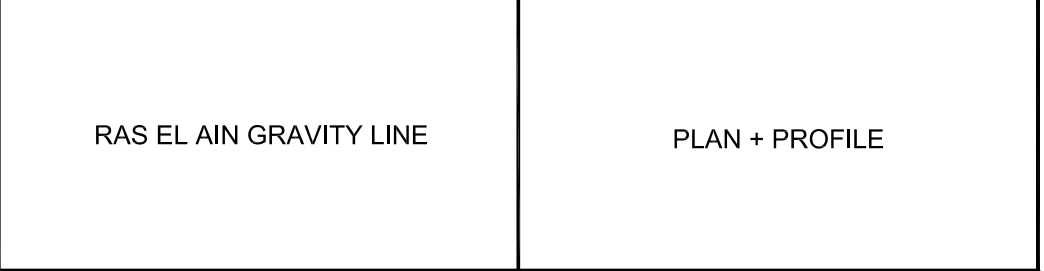
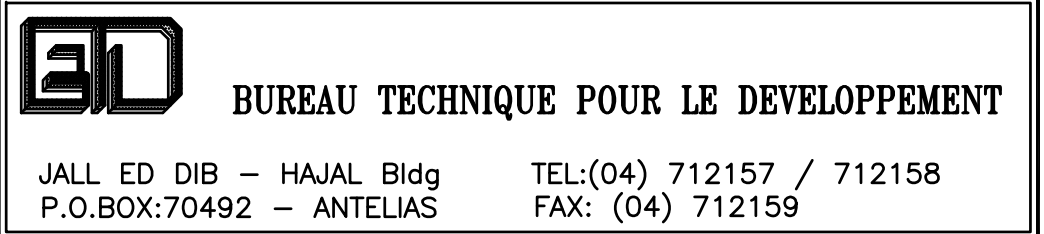
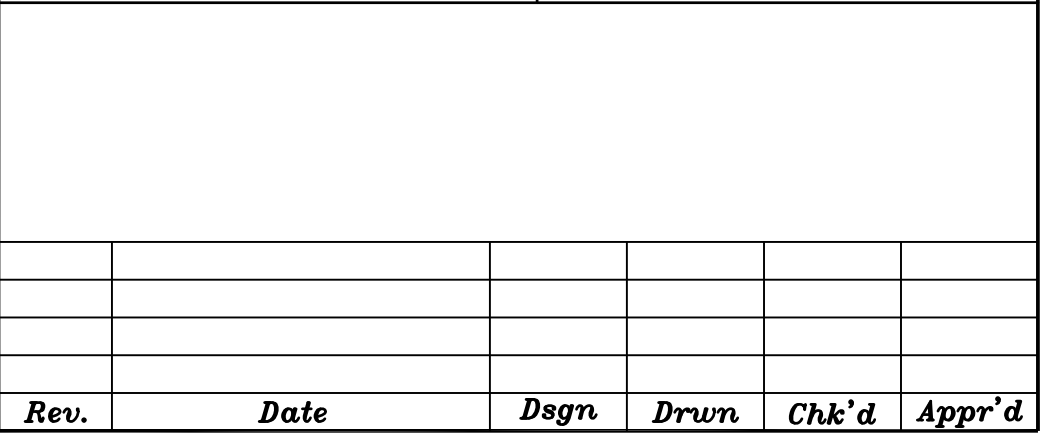
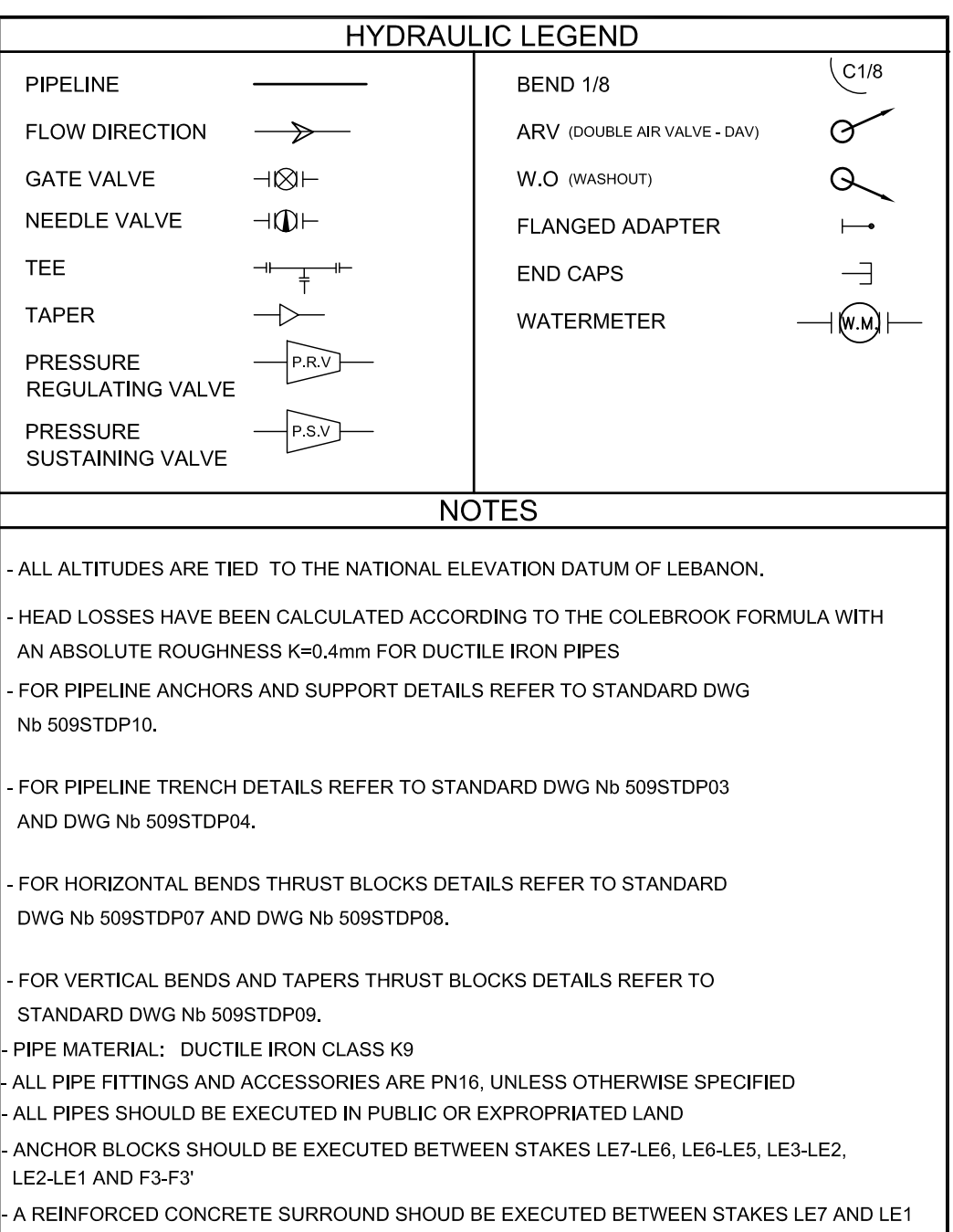
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAJAT

GRAVITY LINE FROM
OUADI EL DELEM SPRING TO
MRAJAT MIDDLE RESERVOIR
PART 2

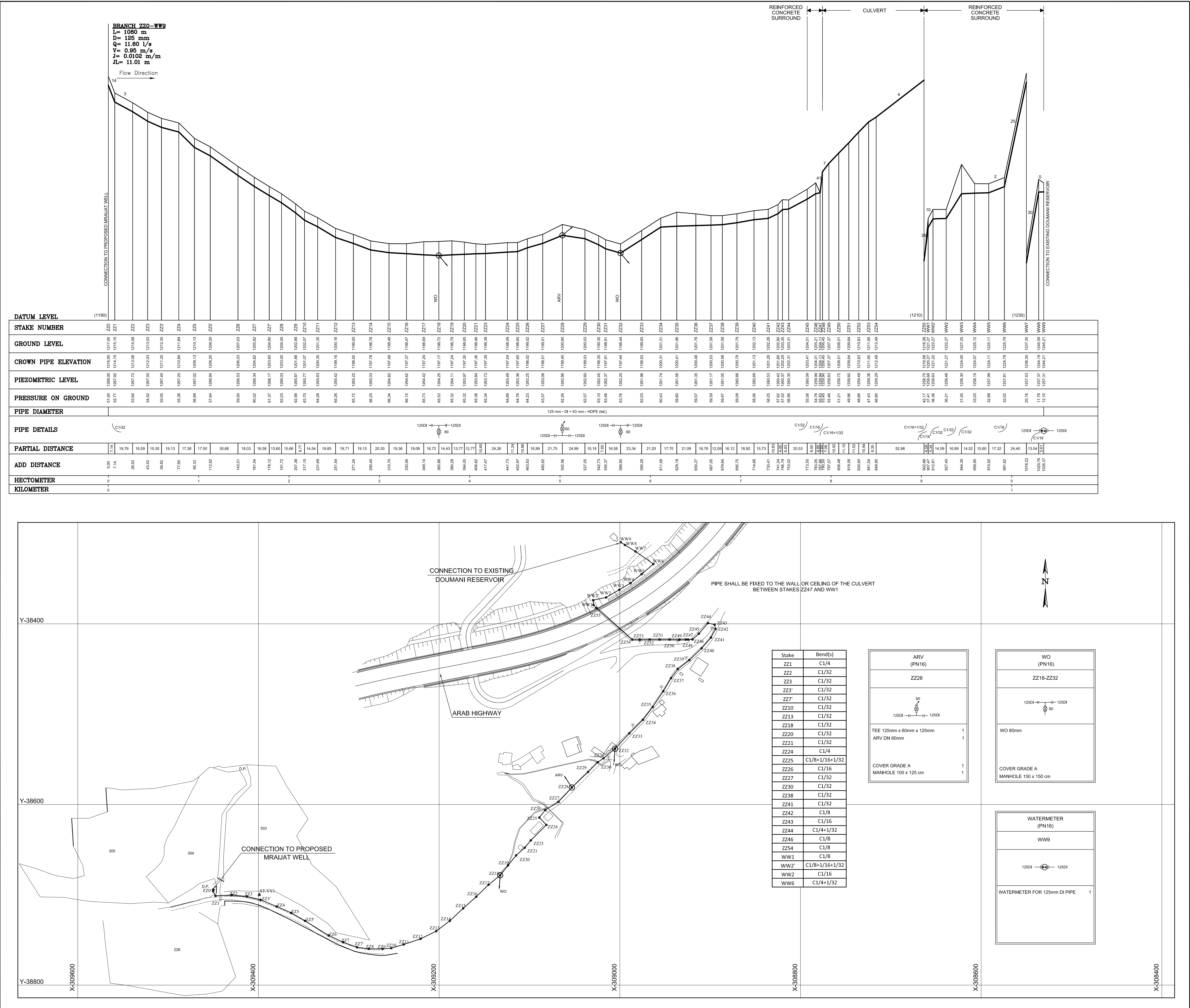
PLAN + PROFILE

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-TR-02P03-03	J. ZALZAL	J. ZALZAL	Z. SABA

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	H = 1/2000 V = 1/200	3/3	509W-TR-02P03



<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
JULY 2019	H = 1/2000 V = 1/200	1/1	509W-TR-03P01



HYDRAULIC LEGEND	
PIPELINE	BEND 1/8
FLOW DIRECTION	ARV (DOUBLE AIR VALVE - DAV)
GATE VALVE	W.O (WASHOUT)
NEEDLE VALVE	FLANGED ADAPTER
TEE	END CAP
TAPER	EXISTING PIPE
PRESSURE REGULATING VALVE	

NOTES	
- ALL ALTITUDES ARE TIED TO THE NATIONAL ELEVATION DATUM OF LEBANON.	
- HEAD LOSSES HAVE BEEN CALCULATED ACCORDING TO THE COLEBROOK FORMULA WITH AN ABSOLUTE ROUGHNESS K=0.4mm FOR DUCTILE IRON PIPES AND K=0.2mm FOR HDPE PIPES.	
- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 509STDP10.	
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 509STDP03 AND DWG Nb 509STDP04.	
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDP07 AND DWG Nb 509STDP08.	
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDP09.	
- PIPE MATERIAL: DUCTILE IRON CLASS K9	
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED	
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED LAND	
- ANCHOR BLOCKS SHOULD BE EXECUTED BETWEEN STAKES ZZ47-ZZ48, ZZ55-WW1, WW6-WW7 AND WW6-WW5	

TOPOGRAPHICAL LEGEND	
BUILDING	MANHOLE SEWER
PAVED ROAD	MANHOLE WATER
CONCRETE ROAD	MANHOLE TELEPHONE
TRACK	MANHOLE NOT IDENTIFIED
REFERENCE LINE	LIGHTING POLE
CHANNEL	TELEPHONE POLE
TERRACE	TRIANGULATION STATION
FENCE	ELECTRIC SUB STATION
STREAM/RIVER	ELECTRIC POLE/TELEGRAPH POLE
CULVERT/BRIDGE	Num
SPRING	1160, 12
WELL	1252
DEODUOUS/PINE TREE	STAKE NUMBER
ROCKS	PLOT No
Down=H	SPOT HEIGHT
High=H	STAKE POINT
	BOUNDARY
	CIRCUMSCRIPTION BOUNDARY

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB – HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 – ANTELIAS FAX: (04) 712159

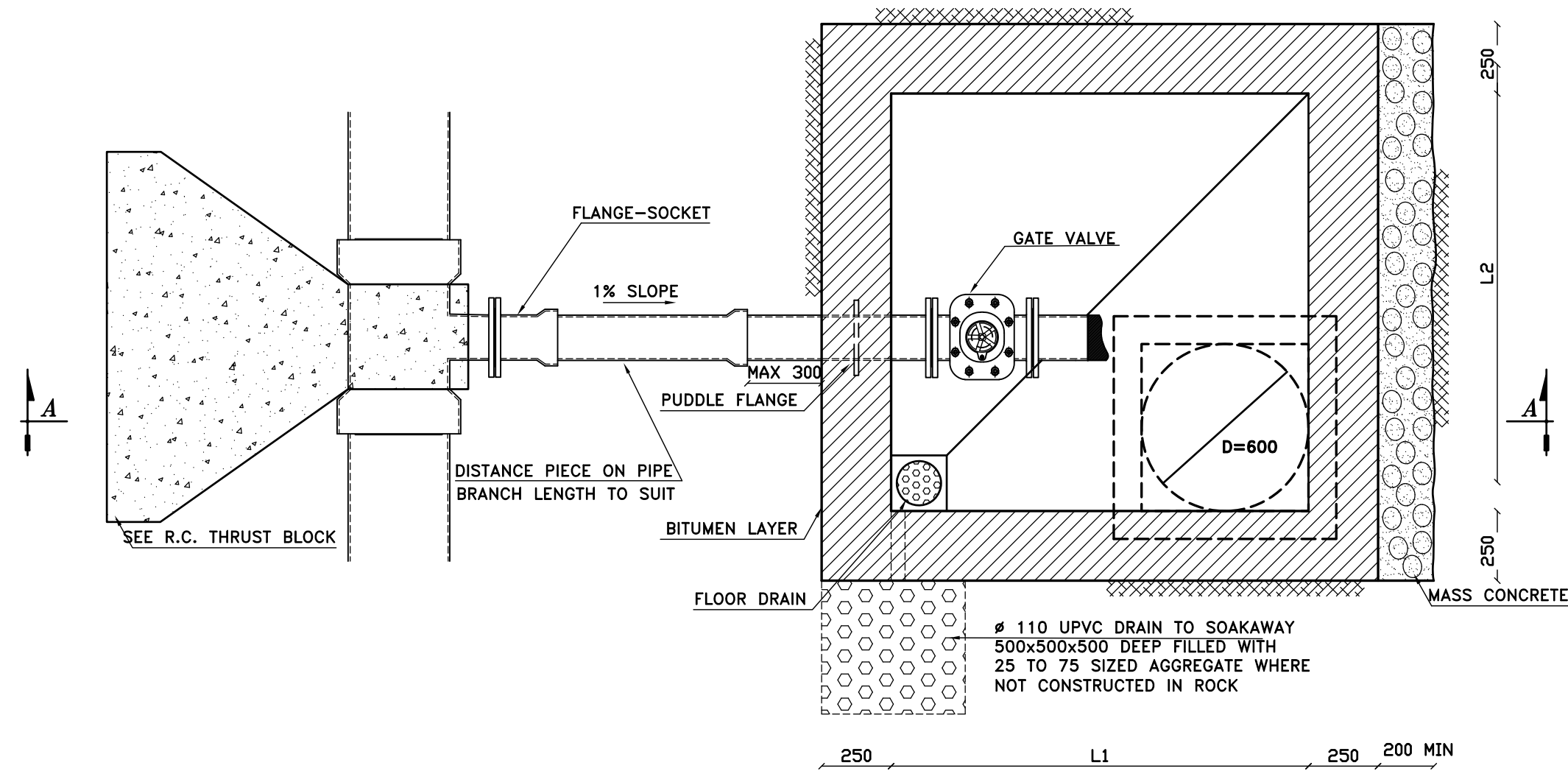
CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT

LIFT LINE FROM PROPOSED MRAIJAT WELL TO EXISTING DOUMANI RESERVOIR	PLAN + PROFILE
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-TR-05P	J. ZALZAL	J. ZALZAL	Z. SABA

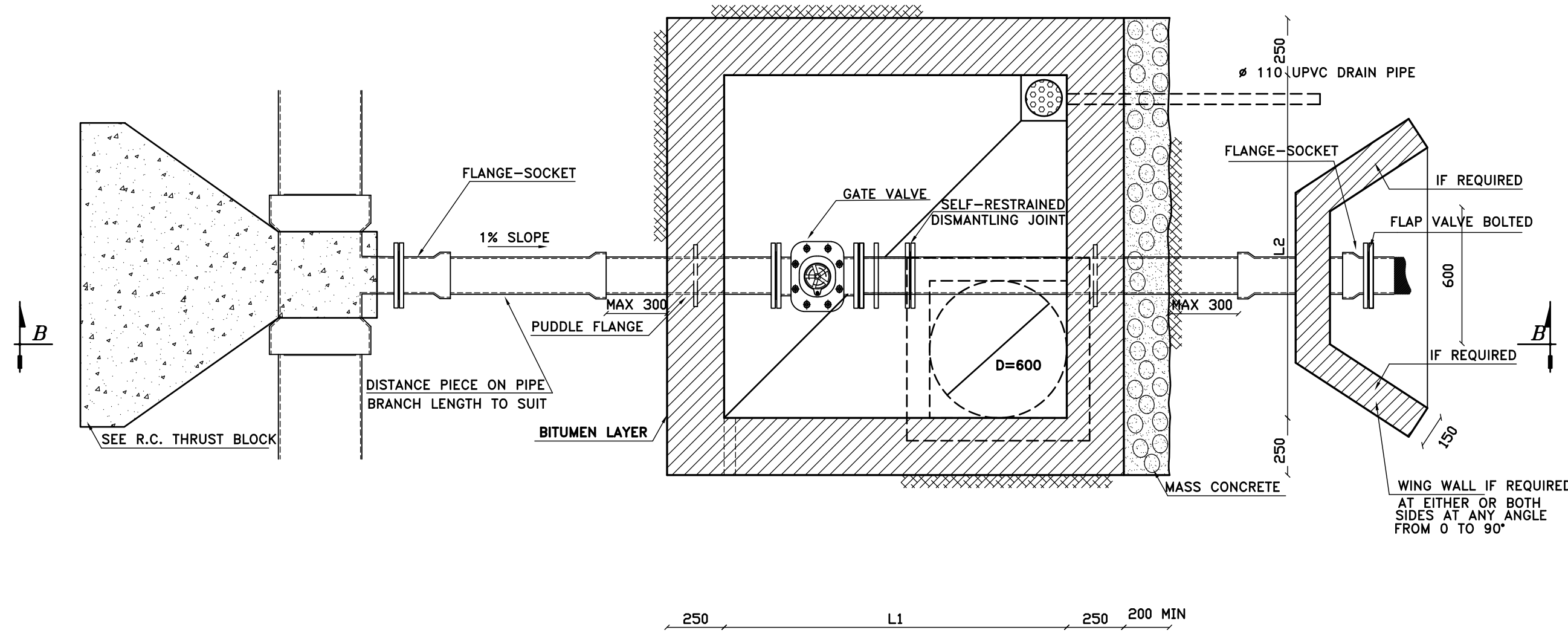
DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2019	H = 1/2000 V = 1/200	1/1	509W-TR-05P01

TYPICAL WASHOUT CHAMBER DETAIL
TYPE I

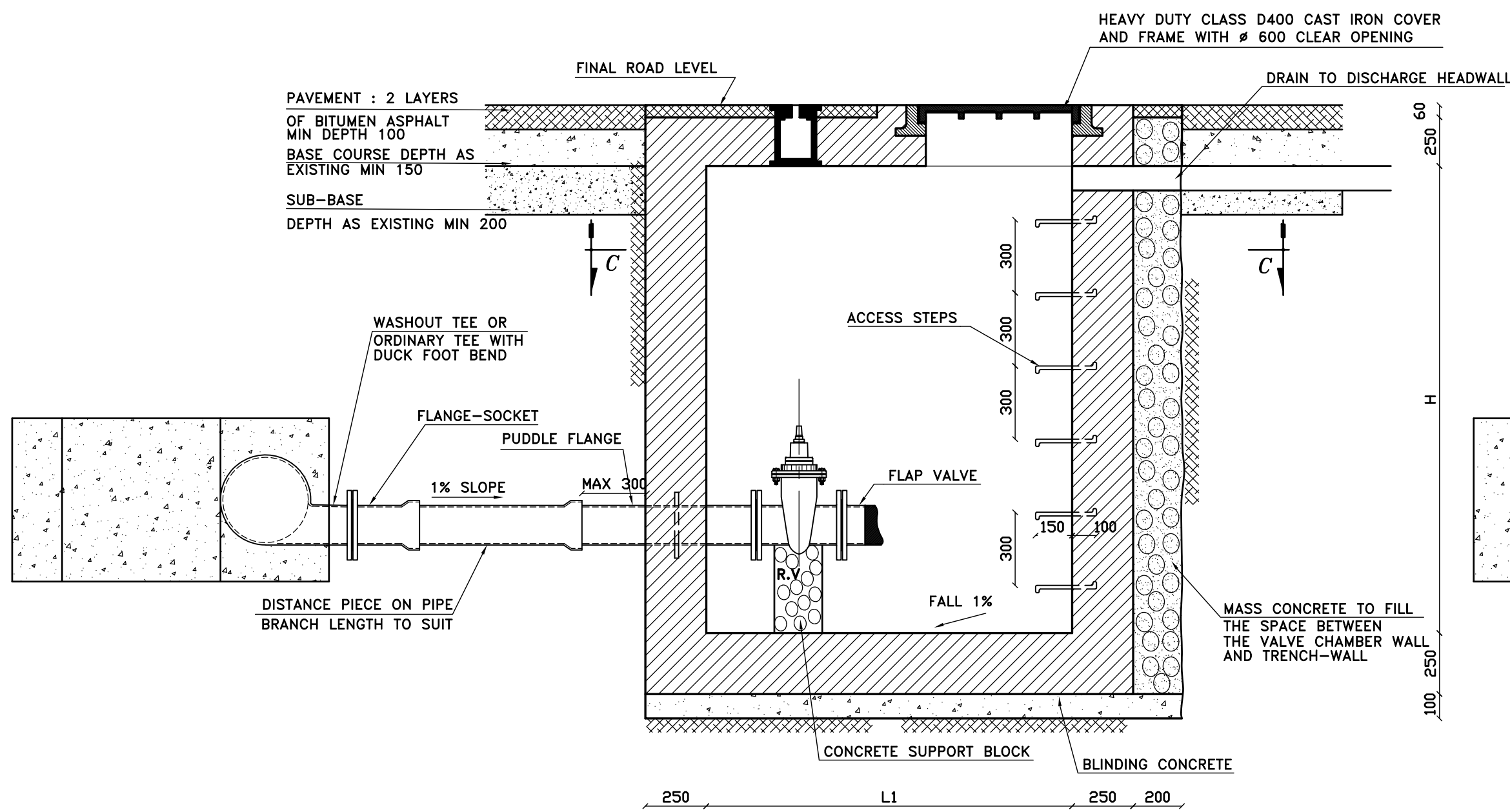


SECTION C-C

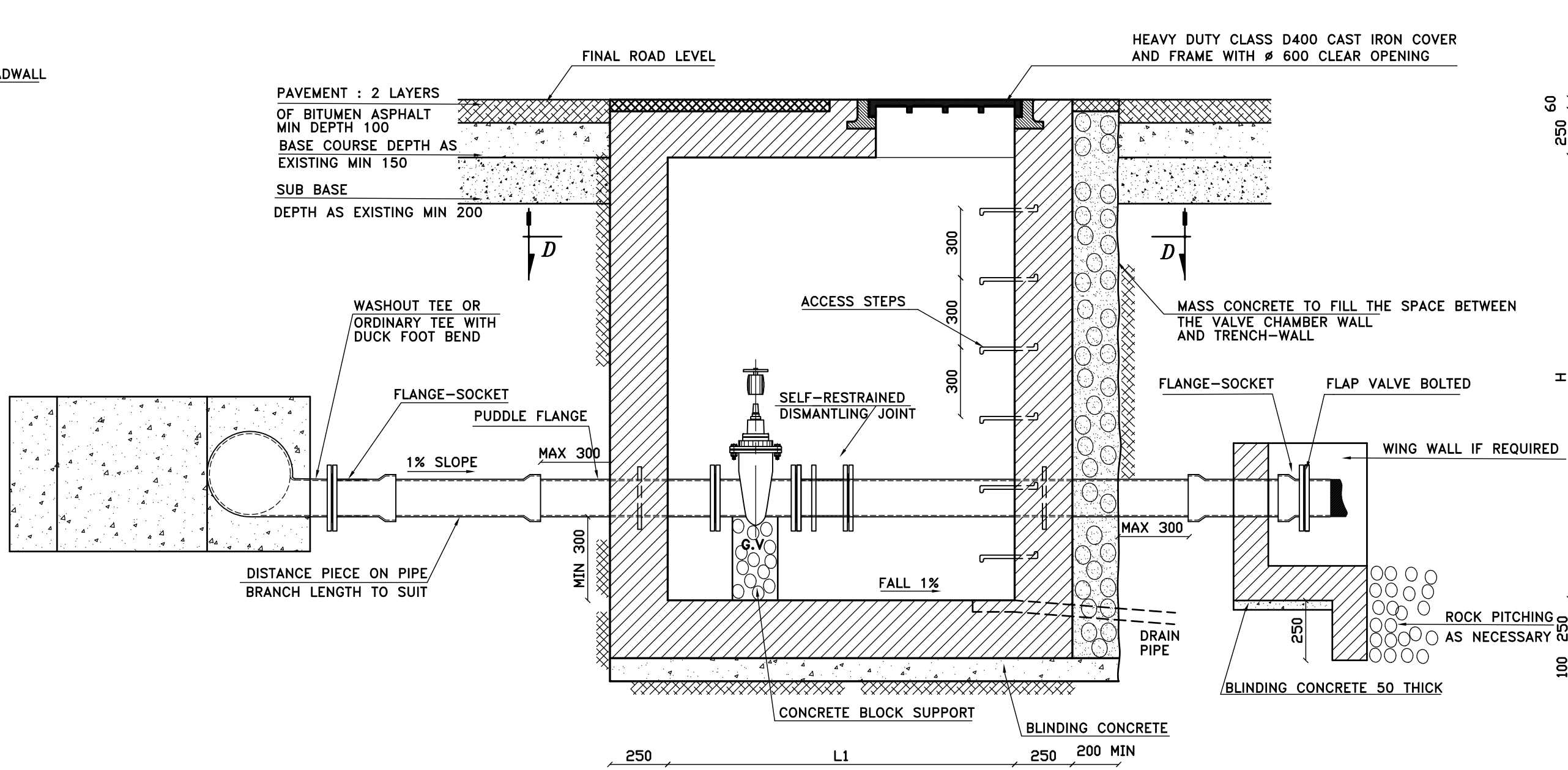
TYPICAL WASHOUT CHAMBER DETAIL
TYPE II



SECTION D-D

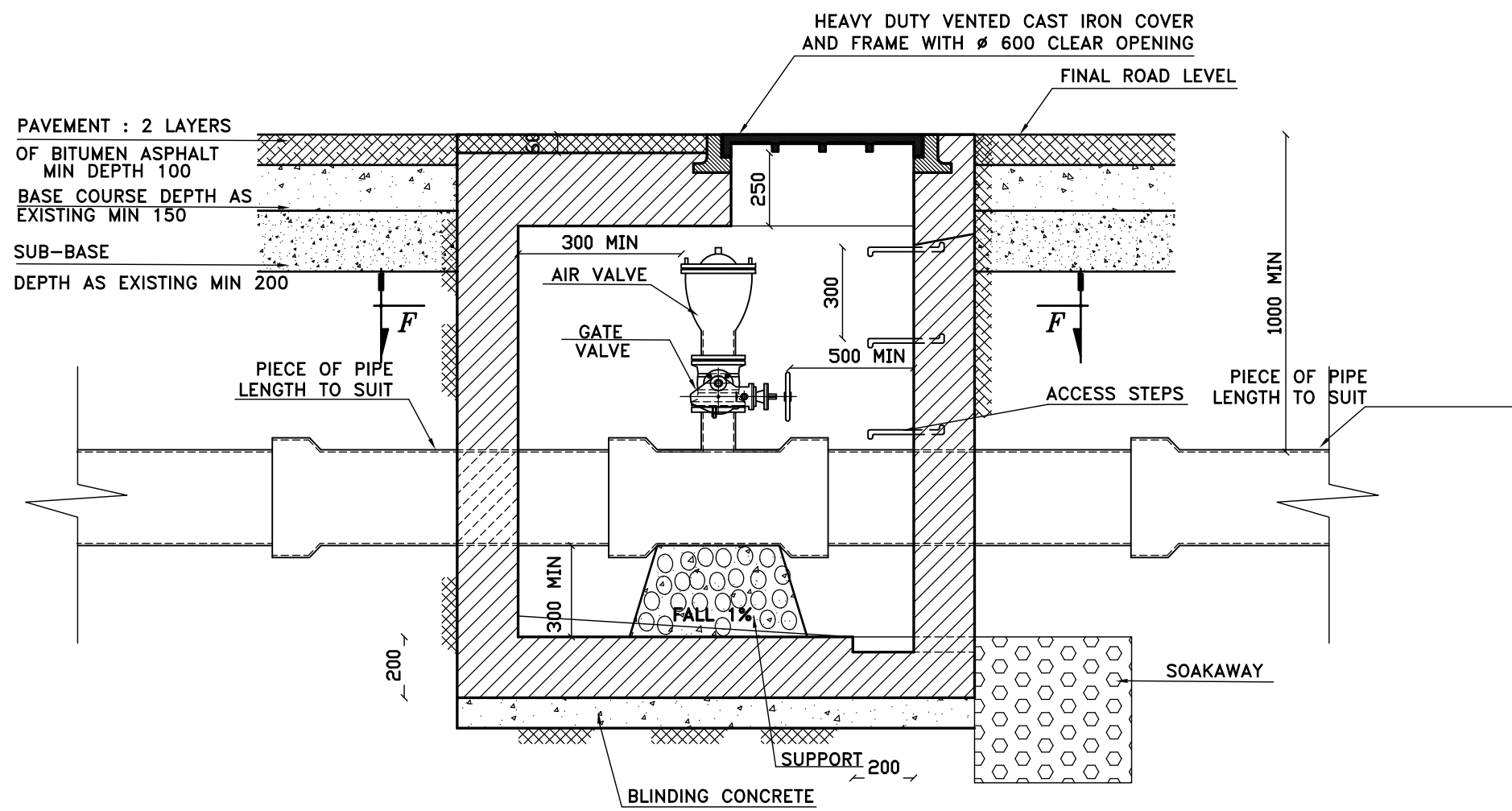


SECTION A-A

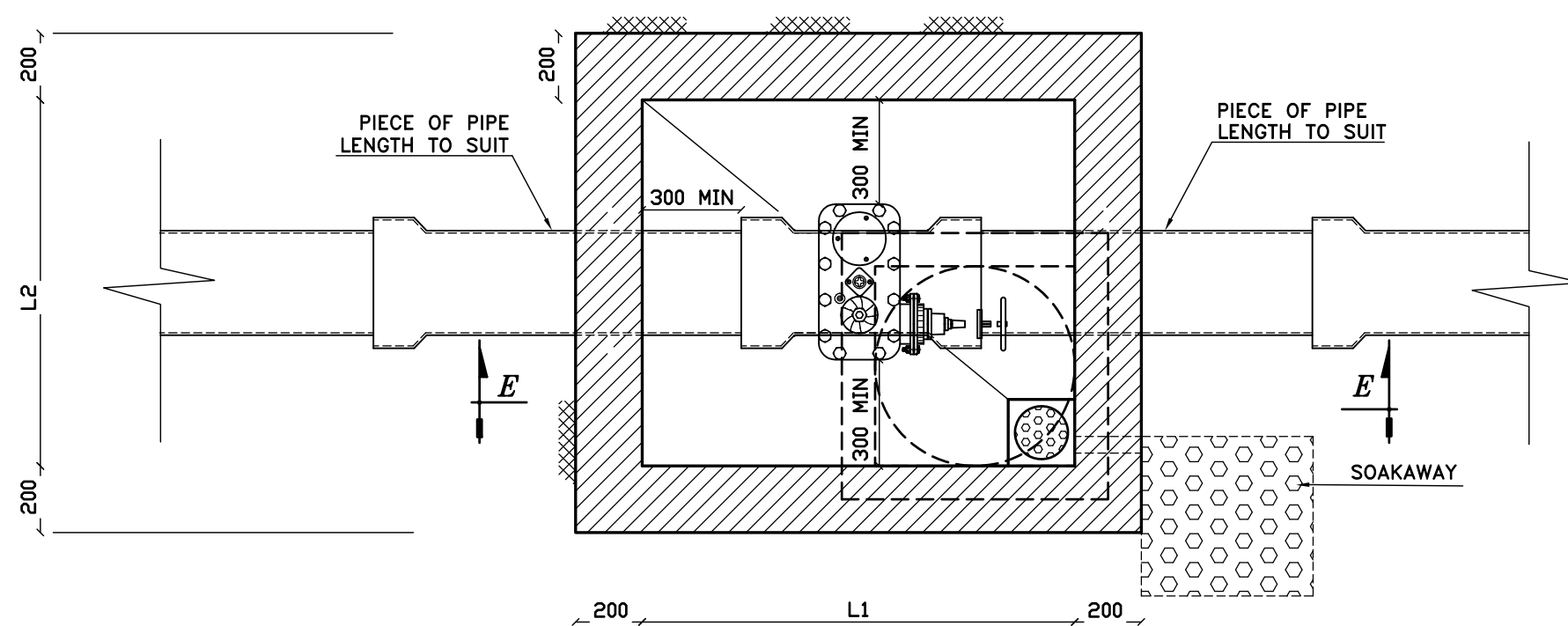


SECTION B-B

TYPICAL AIR VALVE CHAMBER DETAIL
NOT TO SCALE



SECTION E-E



SECTION F-F

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 kg/m³

BLINDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS: SYMBOL Ø YIELD STRESS: F_y=215 MPa.

STRESSES:
SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c = 25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t = 2.1 MPa.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50Ø.
(Ø = NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS Ø8 SHALL BE USED ON EACH LAP.

BENDING:
Ø > 12mm MECHANICAL.
Ø < 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE
(METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE

REMARKS:
• HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
• ALL DIMENSIONS ARE IN MILLIMETERS.
• SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
• SOIL FRICTION ANGLE SHALL BE 25°
• GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 tg Ø
• THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS "200".

SOAKAWAY
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO
A FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.

WASHOUT CHAMBER DIMENSIONS :
IN THE CASES WHERE THE WASHOUT CHAMBER IS TO HOUSE, AT THE SAME TIME,
THE WASHOUT GATE VALVE AND THE MAIN PIPE, THE CHAMBER DIMENSIONS MAY
VARY FROM THOSE INDICATED ON THIS DRAWING. CONSEQUENTLY, THE EXACT
DIMENSIONS ARE TO BE TAKEN FROM THE RELEVANT SPECIFICATIONS AND/OR
DRAWINGS IN THE TENDER DOCUMENTS OR AS DIRECTED BY THE ENGINEER.

• T.P. = TEST PRESSURE

• WASHOUT CHAMBER TYPE II SHALL BE USED NORMALLY, IF DETERMINED BY THE
ENGINEER NOT TO BE APPLICABLE, TYPE I WILL BE USED.

Rev. Date Dsgn Drwn Chk'd Appr'd

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

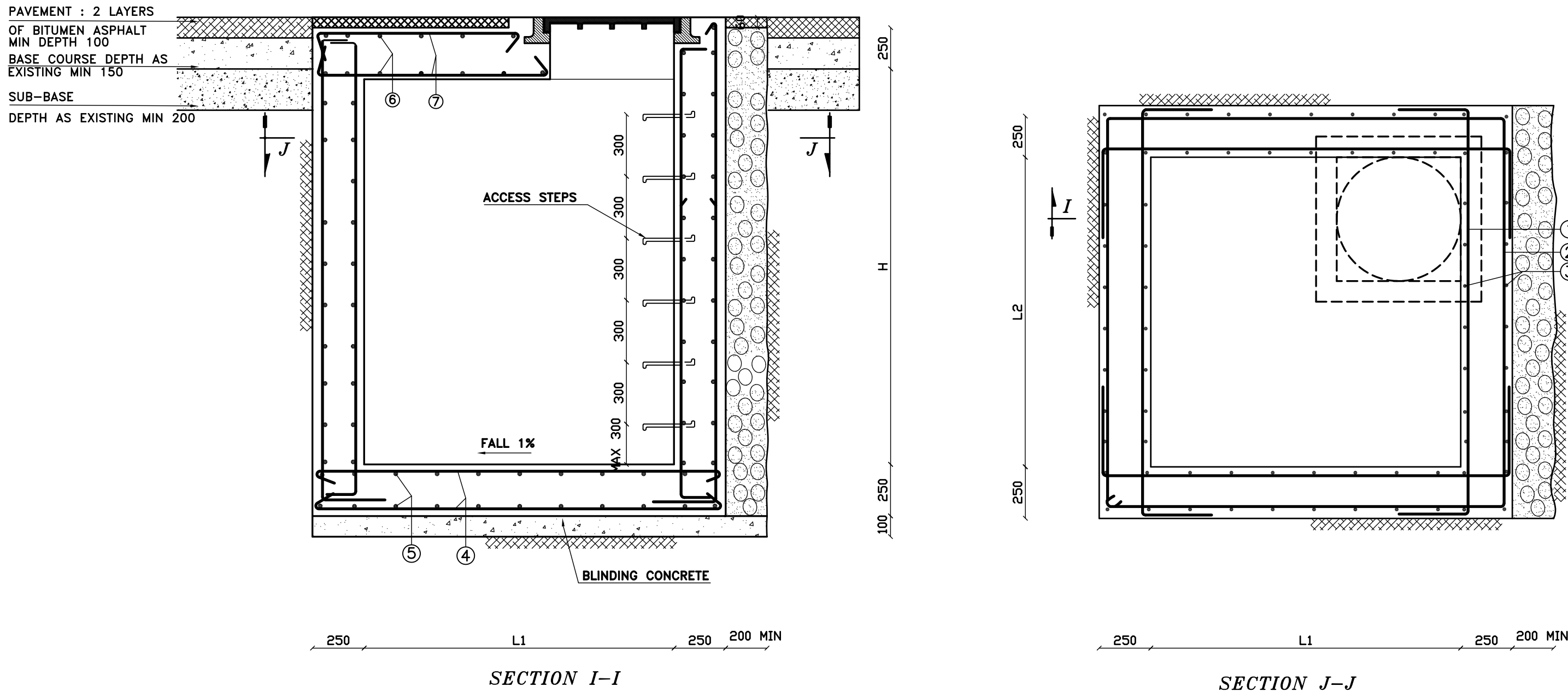
TRANSMISSION AND
DISTRIBUTION SYSTEMS

WASHOUT AND AIR VALVE
CHAMBER DETAILS

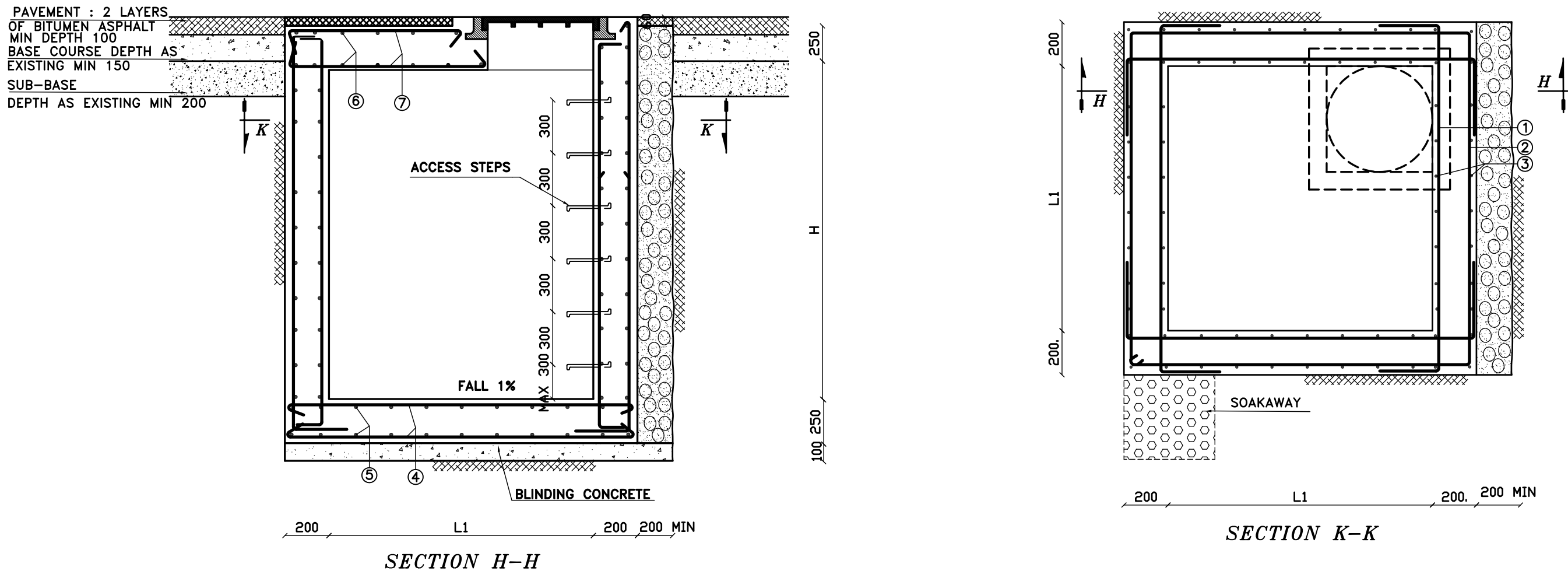
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509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	1/16	509W-STDP01

TYPICAL REINFORCEMENT DETAIL FOR WASHOUT CHAMBER
NOT TO SCALE



TYPICAL REINFORCEMENT DETAIL FOR AIR VALVE CHAMBER
NOT TO SCALE



TYPICAL SINGLE OR DOUBLE AIR VALVE CHAMBER
REINFORCEMENT STEEL TABLE

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
80-150	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
200-250	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
300-400	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
450-600	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
700-800	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
900-1000	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200

TYPICAL DOUBLE AIR VALVE CHAMBER

DIMENSIONS TABLE

MAIN LINE DIAMETER	AIR VALVE DIAMETER	L2	L1	H
ø mm	ø mm	mm	mm	mm
80-150	60	1000	1250	1200
200-250	60	1250	1500	1300
300-400	100	1250	1500	1500
450-600	100	1500	1500	2000
700-800	150	1500	1500	2100
900-1000	200	1750	2000	2300

TYPICAL SINGLE AIR VALVE CHAMBER

DIMENSIONS TABLE

MAIN LINE DIAMETER	AIR VALVE DIAMETER	L2	L1	H
ø mm	ø mm	mm	mm	mm
80-200	60	1000	1250	1200
250	60	1000	1500	1300
300-400	100	1000	1500	1500
450-600	100	1250	1750	2000

TYPICAL WASHOUT CHAMBER FOR TRANSMISSION PIPELINES-DIMENSIONS

TABLE 1 OF 2

MAIN PIPE DIAMETER	WASHOUT DIAMETER	DIMENSIONS		
		L1 mm	L2 mm	H mm
80-150	80	1500	1500	1500
200	100	1500	1500	1500
250	150	1500	1500	1500
300-350	150	1500	1500	1500

TABLE 2 OF 2

MAIN PIPE DIAMETER	WASHOUT DIAMETER	T.P < 15 BARS		T.P > 15 BARS		H mm
		L1 mm	L2 mm	L1 mm	L2 mm	
400-450	200	1500	1500	1500	1500	1600
500	250	1500	1500	2000	2000	2000
600<D<900	300	1500	1500			2150
600<D<900	250			2000	2000	2250

TYPICAL WASHOUT CHAMBER FOR TRANSMISSION PIPELINES-REINFORCEMENT

TABLE 1 OF 2

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
80-150	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
250	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
300-350	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200

TABLE 2 OF 2

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
400-450	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
500	T14 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
600<D<900	T14 Ø200	T14 Ø200	T14 Ø200	T14 Ø200	T14 Ø200	T14 Ø200	T14 Ø200

TYPICAL WASHOUT CHAMBER DETAIL FOR DISTRIBUTION PIPELINES

DIMENSIONS TABLE

MAIN PIPE DIAMETER	WASHOUT DIAMETER	DIMENSIONS		
		L1 mm	L2 mm	H mm
80-125	60	1500	1500	1500
150	80	1500	1500	1500
200	100	1500	1500	1500
250	150	1500	1500	1500
300 < ø < 600	150	1500	1500	1650

REINFORCEMENT STEEL TABLE

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
80-125	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
150	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
200	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
250	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200
300 < ø < 600	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T14 Ø200	T14 Ø200

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m3

BLINDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 kg/m3.

REINFORCEMENT:
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SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c =25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t =2.1 MPa.

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SHALL BE 30 mm

OVERLAPPING:
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STIRRUPS ø8 SHALL BE USED ON EACH LAP.

BENDING:
ø > 12mm MECHANICAL.
ø < 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
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BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
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* SOIL FRICTION ANGLE SHALL BE 25°
* GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 tg ø
* THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS "200".

SOAKAWAY
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WASHOUT CHAMBER DIMENSIONS :
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* T.P. =TEST PRESSURE

* WASHOUT CHAMBER TYPE II SHALL BE USED NORMALLY.IF DETERMINED BY THE
ENGINEER NOT TO BE APPLICABLE , TYPE I WILL BE USED.

Rev. Date Dsgn Drwn Chk'd Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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P.O.BOX:70492 - ANTELJAS FAX: (04) 712159

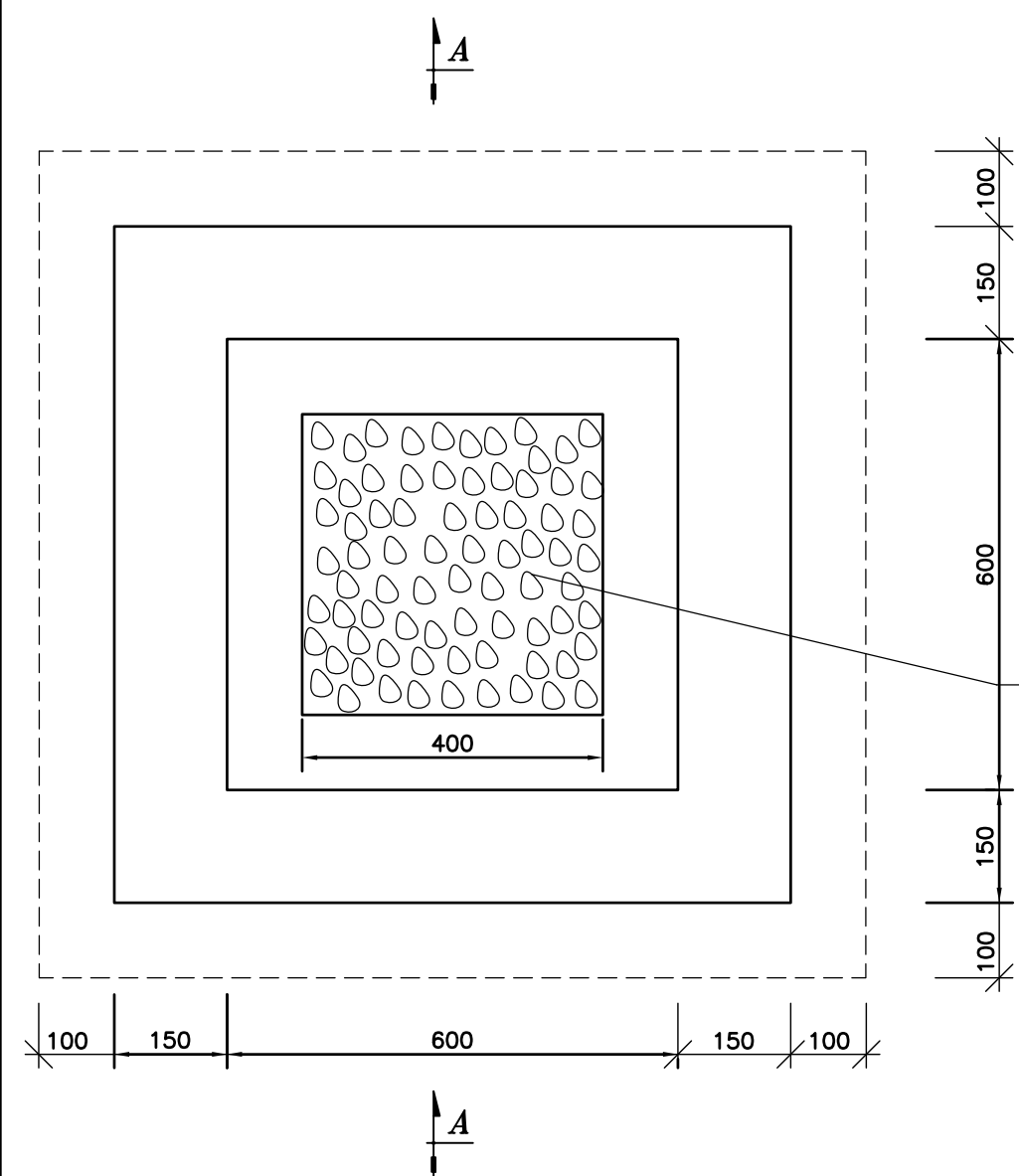
CONSTRUCTION OF WATER WORKS IN
OUADI DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

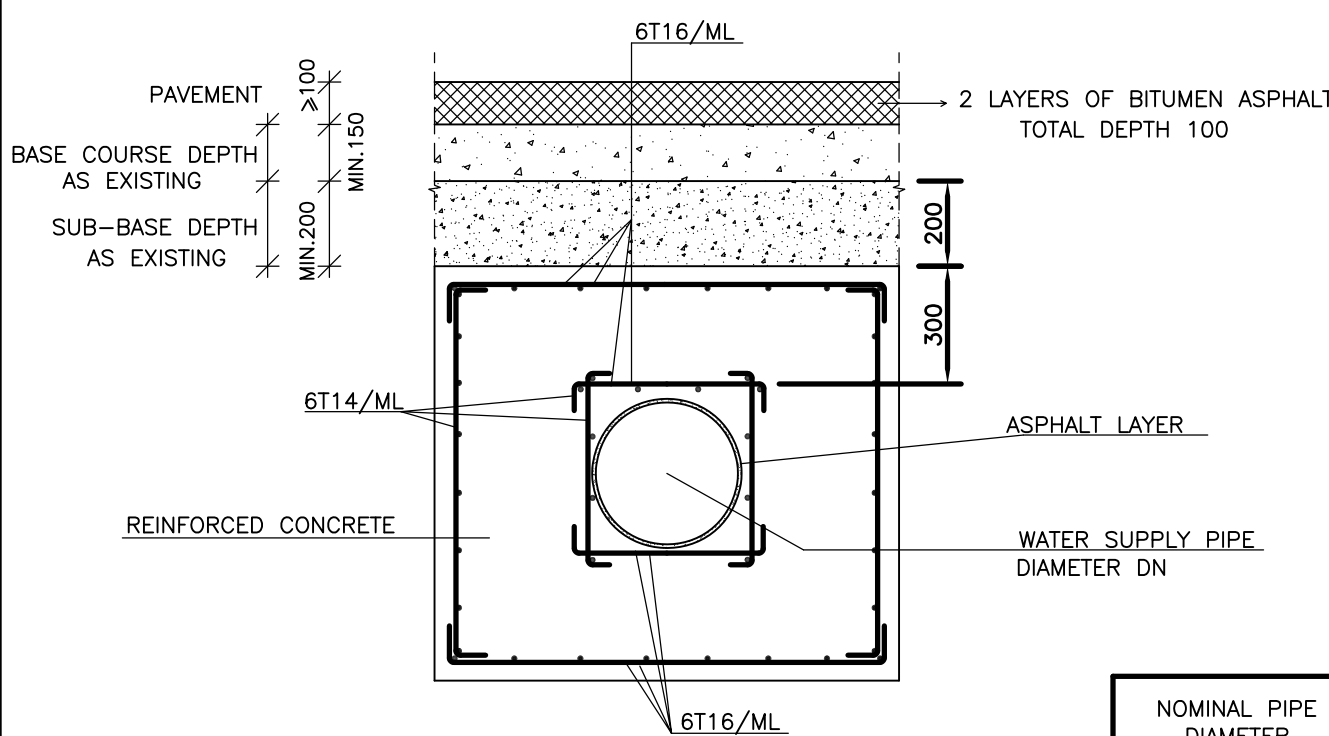
WASHOUT AND AIR VALVE
CHAMBER DETAILS

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509W-STD01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20	2/16	509W-STD02

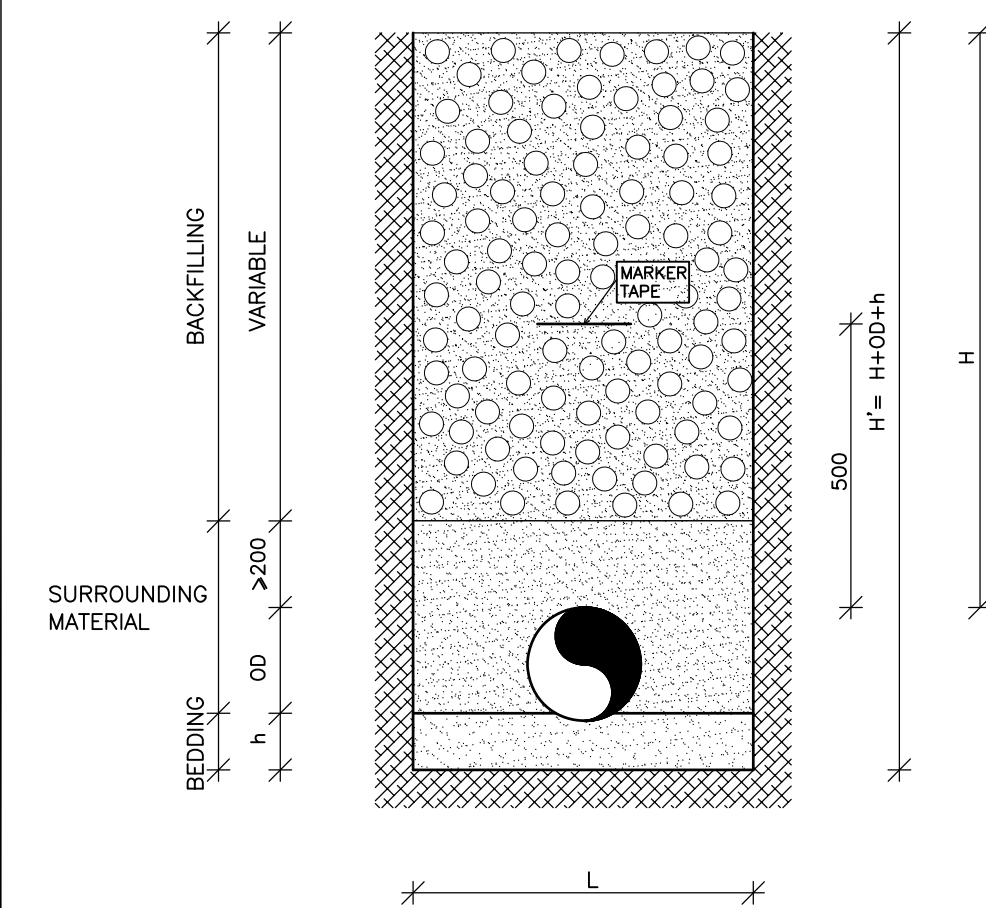


SECTION B-B
TYPICAL TELEMETRY CABLE DRAW PIT
SCALE 1:10

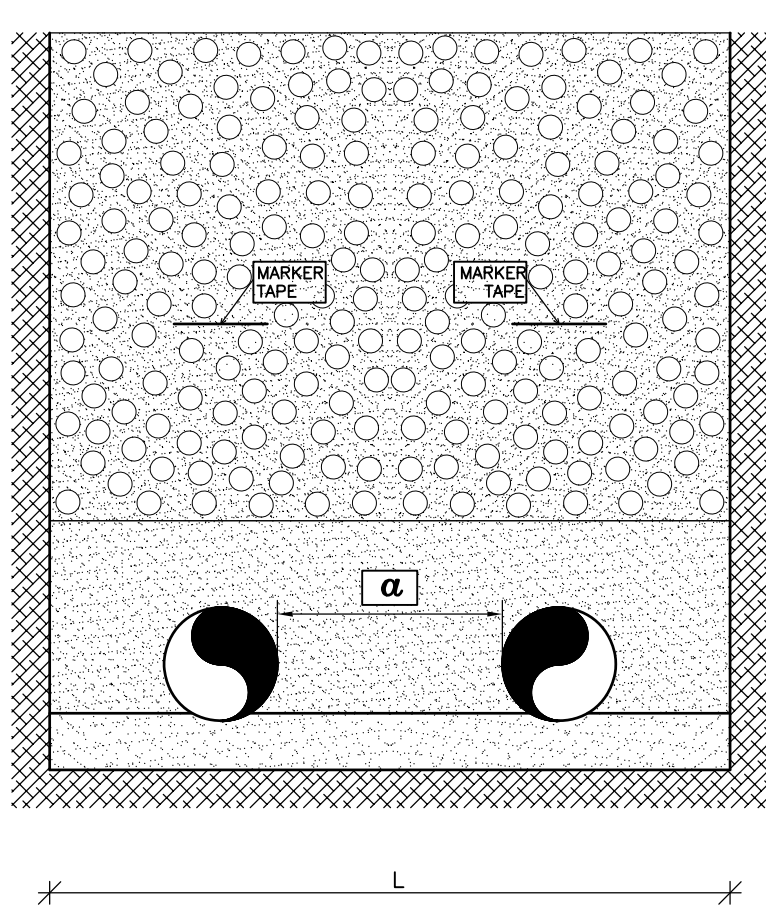


IN ROAD TRENCH SHALLOW DEPTH
NOT TO SCALE

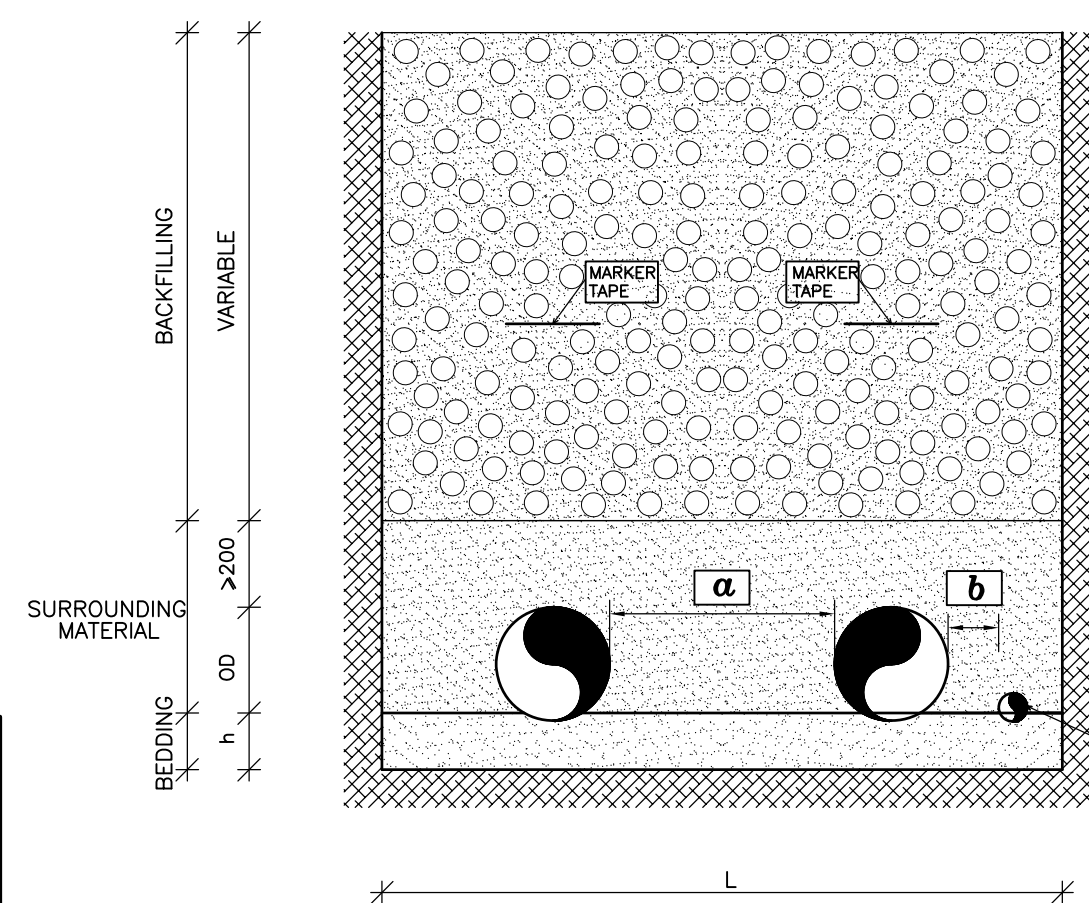
NOMINAL PIPE DIAMETER DN mm	PIPELINE COVER	
	H mm	
	DISTRIBUTION	TRANSMISSION
80-150	800	1000
200-350	1000	1000
400-450	1100	1200
>500	1200	1300



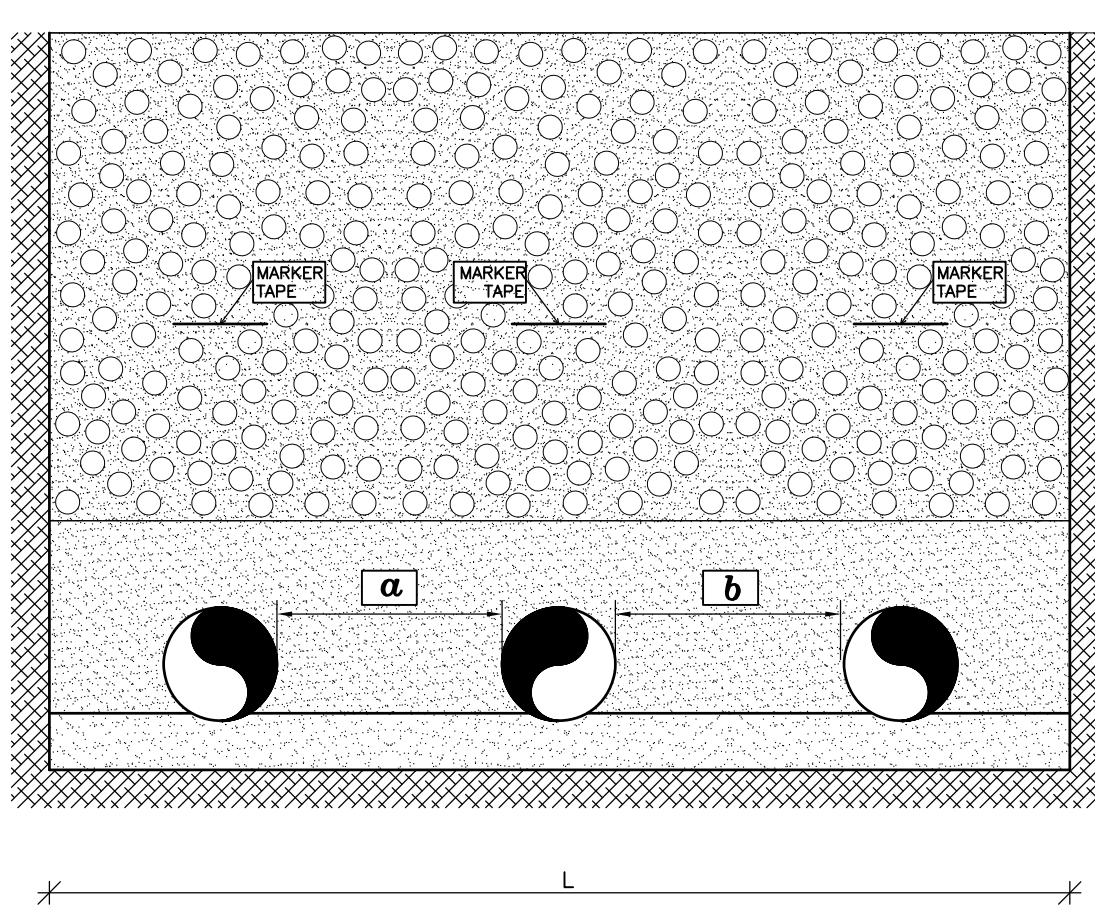
L: TRENCH WIDTH $L = 4/3 \text{ OD} + 450 (L \geq 600)$
h: BEDDING DEPTH $h = 100 + \frac{\text{DN}}{10}$
TRENCH OFF ROAD FOR ONE PIPE
NOT TO SCALE



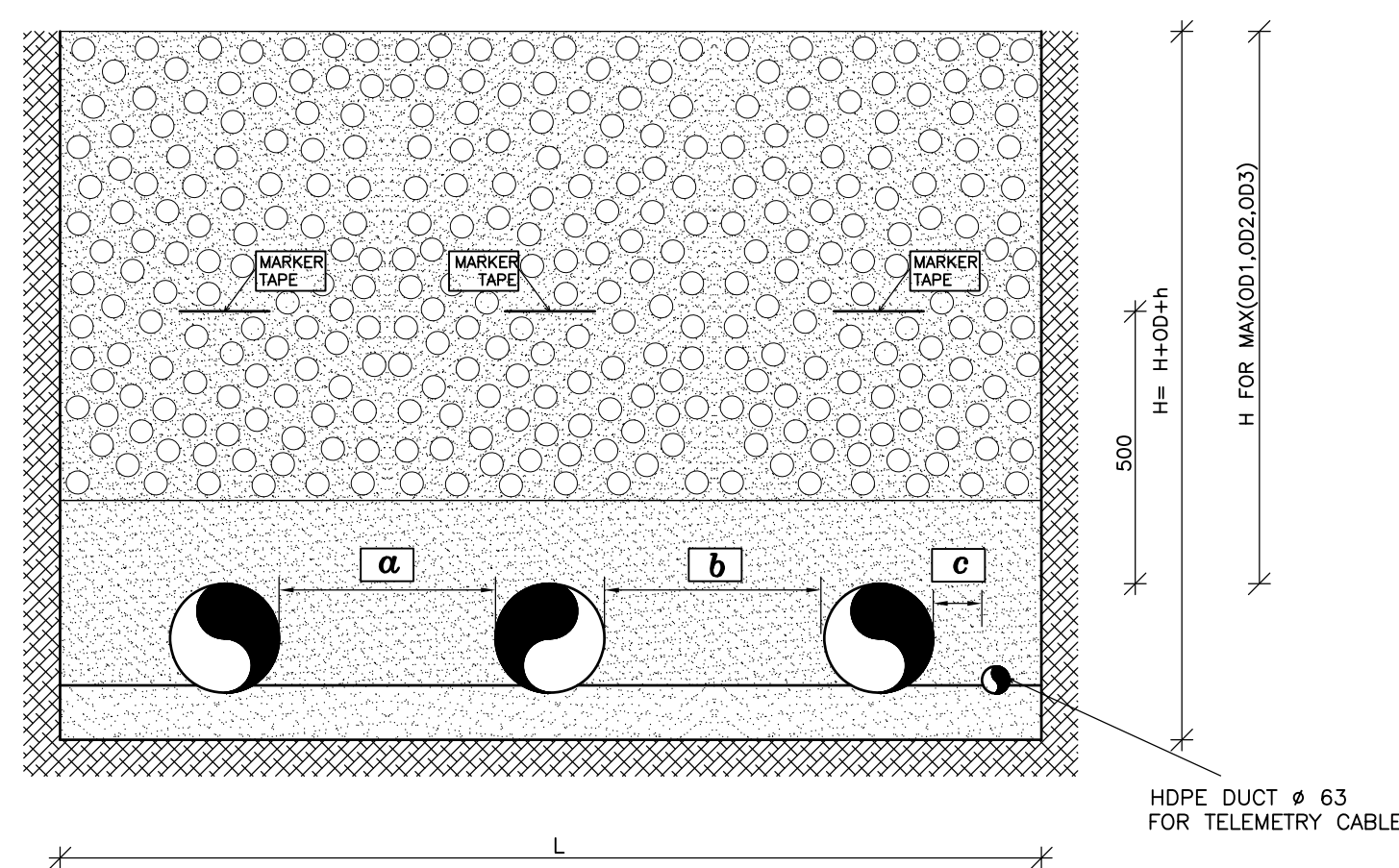
L: TRENCH WIDTH $L = 5/4 (\text{OD1} + \text{OD2}) + 800$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(\text{DN1}, \text{DN2})}{10}$
 $a = \frac{\text{MAX}(\text{DN1}, \text{DN2}, 300)}{2}$
TRENCH OFF ROAD FOR TWO PIPES
NOT TO SCALE



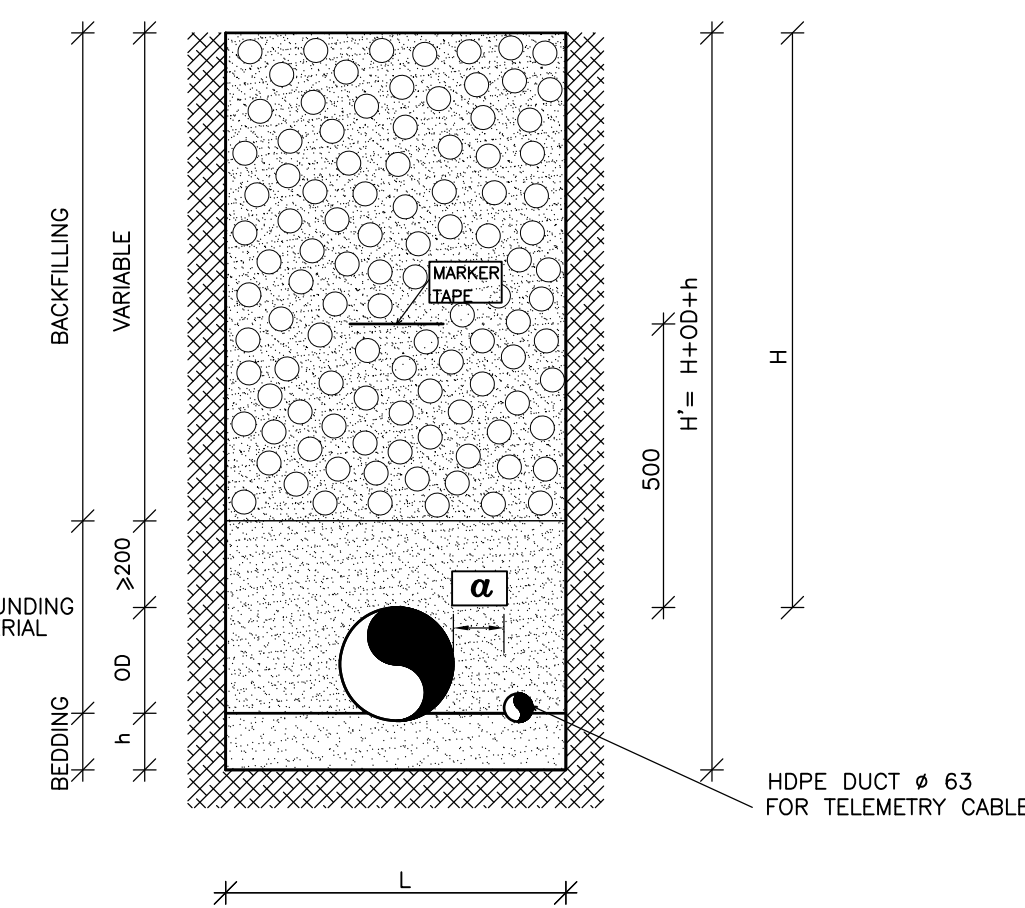
L: TRENCH WIDTH $L = 5/4 (\text{OD1} + \text{OD2}) + 1000$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(\text{DN1}, \text{DN2})}{10}$
 $a = \frac{\text{MAX}(\text{DN1}, \text{DN2}, 300)}{2}$
 $b \geq 200$
TRENCH OFF ROAD WITH HDPE DUCT Ø 63
FOR TELEMETRY CABLE
NOT TO SCALE



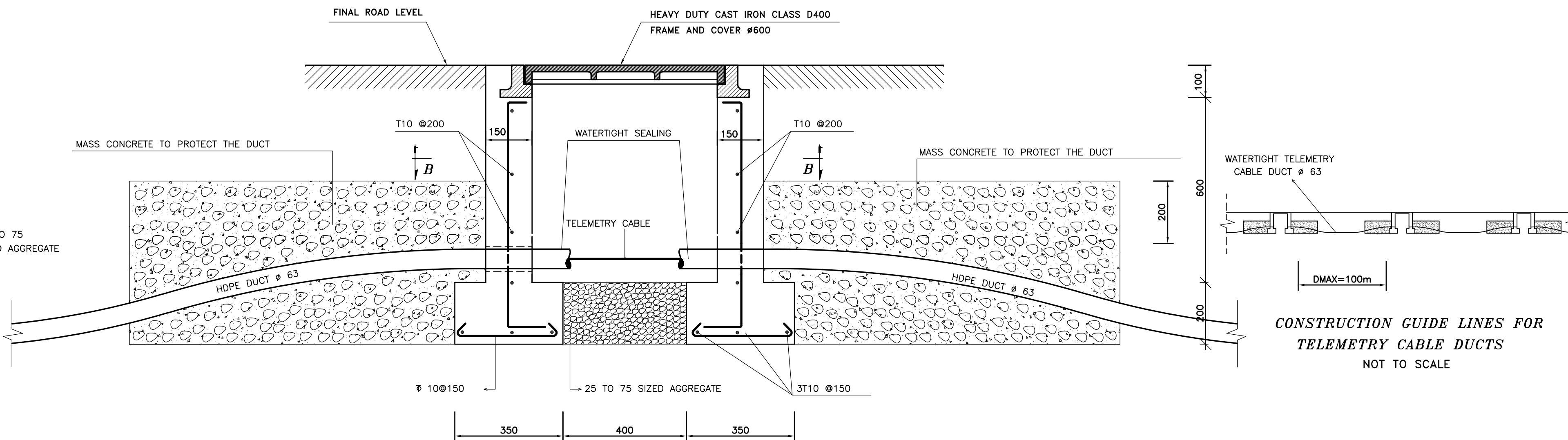
L: TRENCH WIDTH $L = 6/5 (\text{OD1} + \text{OD2} + \text{OD3}) + 1100$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(\text{DN1}, \text{DN2}, \text{DN3})}{10}$
 $a = \frac{\text{MAX}(\text{DN1}, \text{DN2}, 300)}{2}$
 $b = \frac{\text{MAX}(\text{DN2}, \text{DN3}, 300)}{2}$
TRENCH OFF ROAD FOR THREE PIPES
NOT TO SCALE



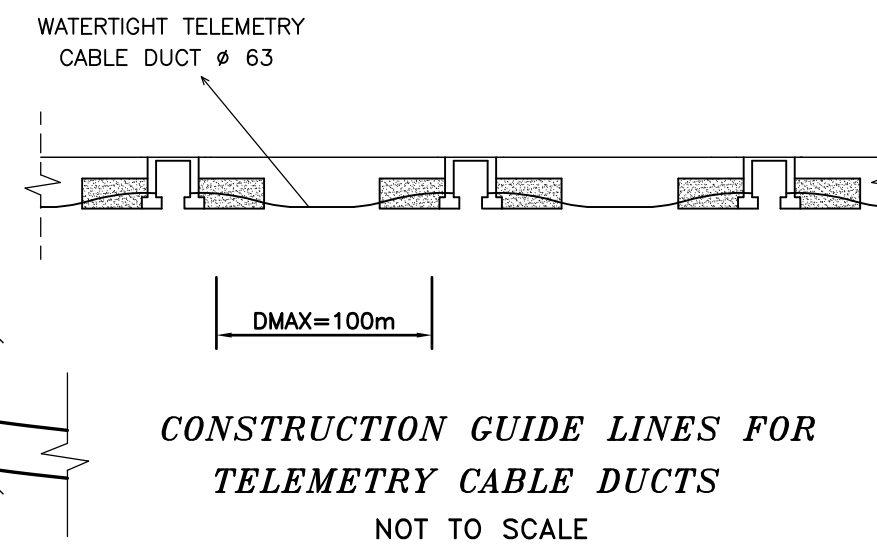
L: TRENCH WIDTH $L = 6/5 (\text{OD1} + \text{OD2}) + 1300$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(\text{DN1}, \text{DN2}, \text{DN3})}{10}$
 $a = \frac{\text{MAX}(\text{DN1}, \text{DN2}, 300)}{2}$
 $b = \frac{\text{MAX}(\text{DN2}, \text{DN3}, 300)}{2}$
 $c \geq 200$
TRENCH OFF ROAD WITH HDPE DUCT Ø 63
FOR TELEMETRY CABLE
NOT TO SCALE



L: TRENCH WIDTH $L = 4/3 \text{ OD} + 600$
h: BEDDING DEPTH $h = 100 + \frac{\text{DN}}{10}$
TRENCH OFF ROAD WITH HDPE DUCT Ø 63
FOR TELEMETRY CABLE
NOT TO SCALE



SECTION A-A
TYPICAL TELEMETRY CABLE DRAW PIT
SCALE 1:10



NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- OD : OUTER PIPE DIAMETER
- DN : NOMINAL PIPE DIAMETER

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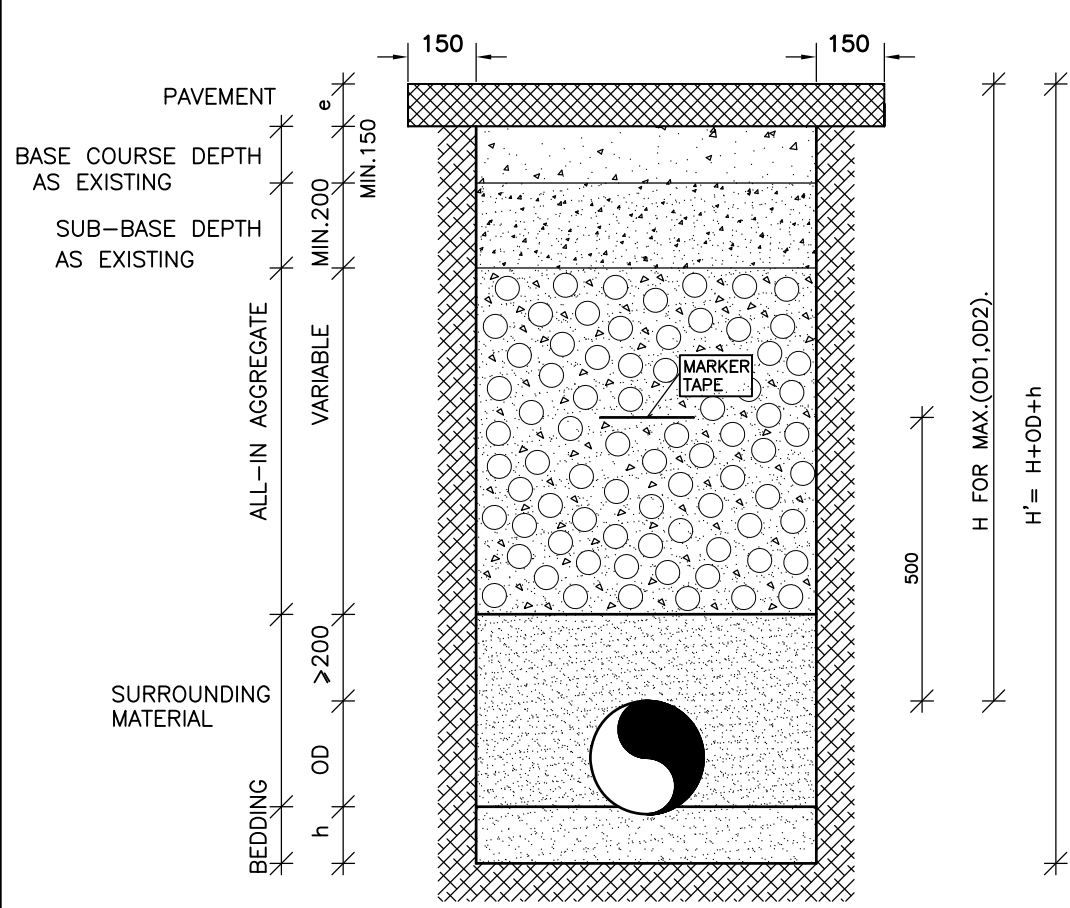
CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND DISTRIBUTION SYSTEMS

TYPICAL TRENCH DETAILS AND TELEMETRY CABLE DRAW PIT

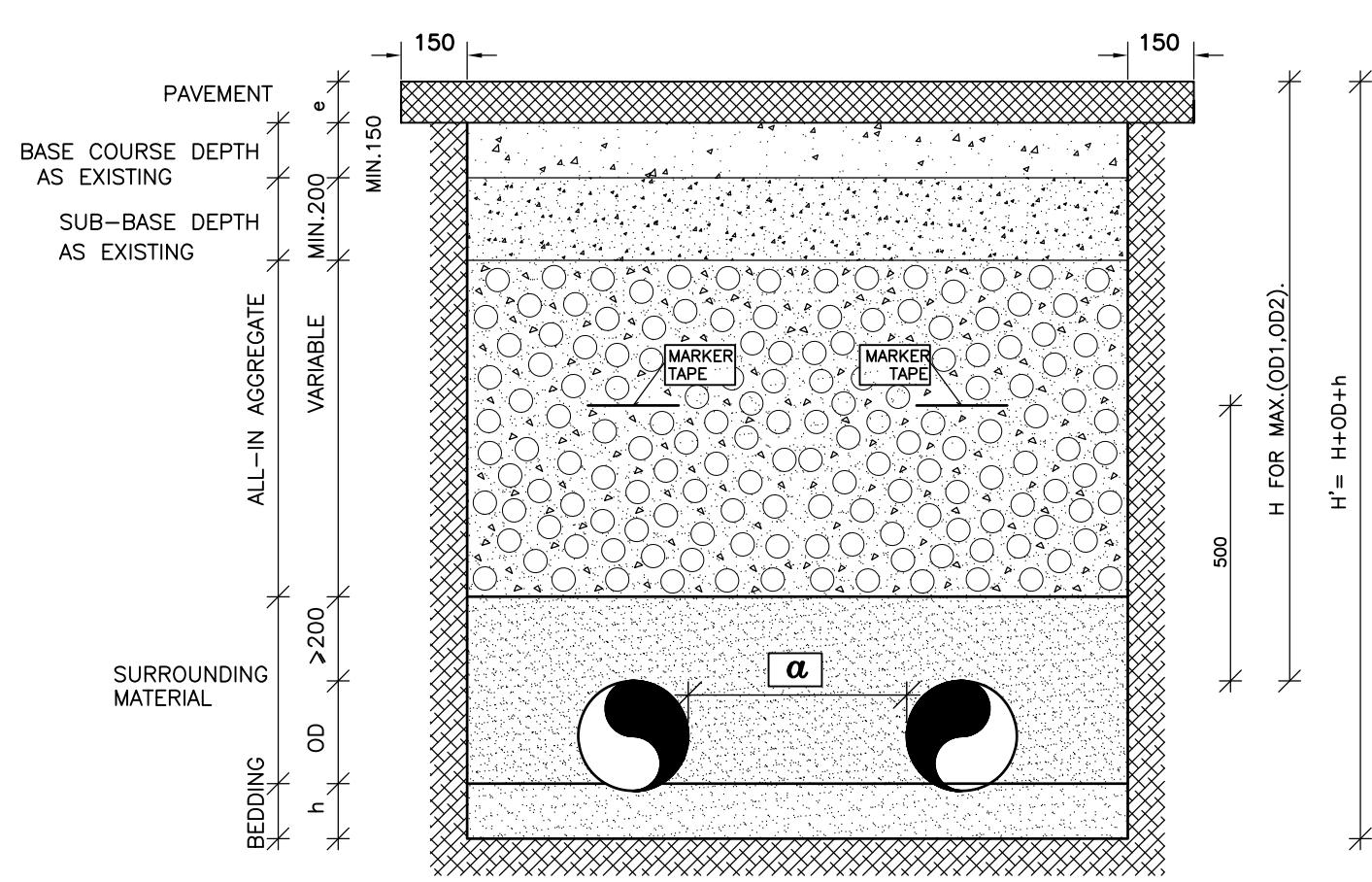
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509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20	3/16	509W-STDP03



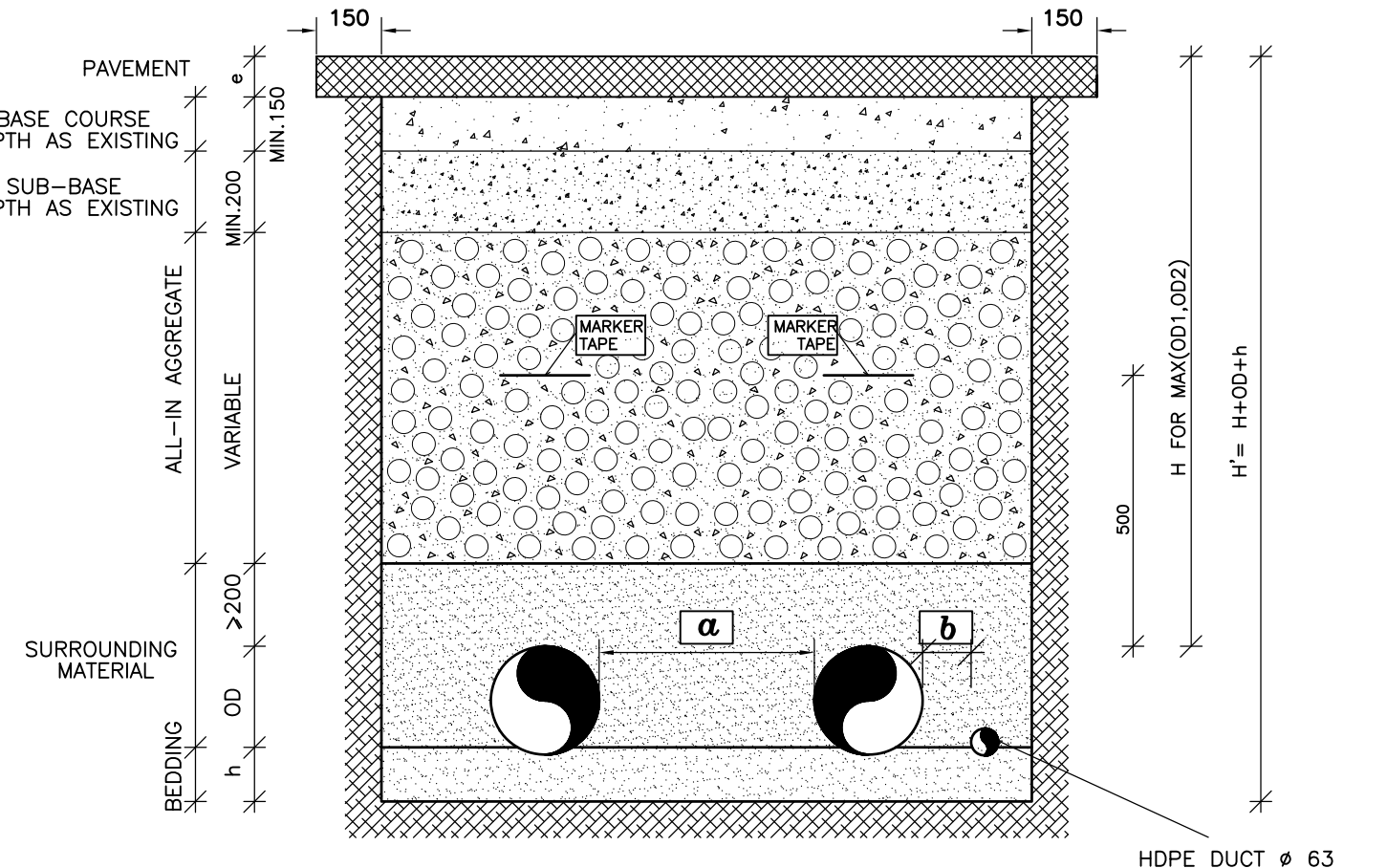
L: TRENCH WIDTH $L = \frac{4}{3} OD + 450 (L > 600)$
h: BEDDING DEPTH $h = 100 + \frac{DN}{10}$

TRENCH IN ROAD FOR ONE PIPE
NOT TO SCALE



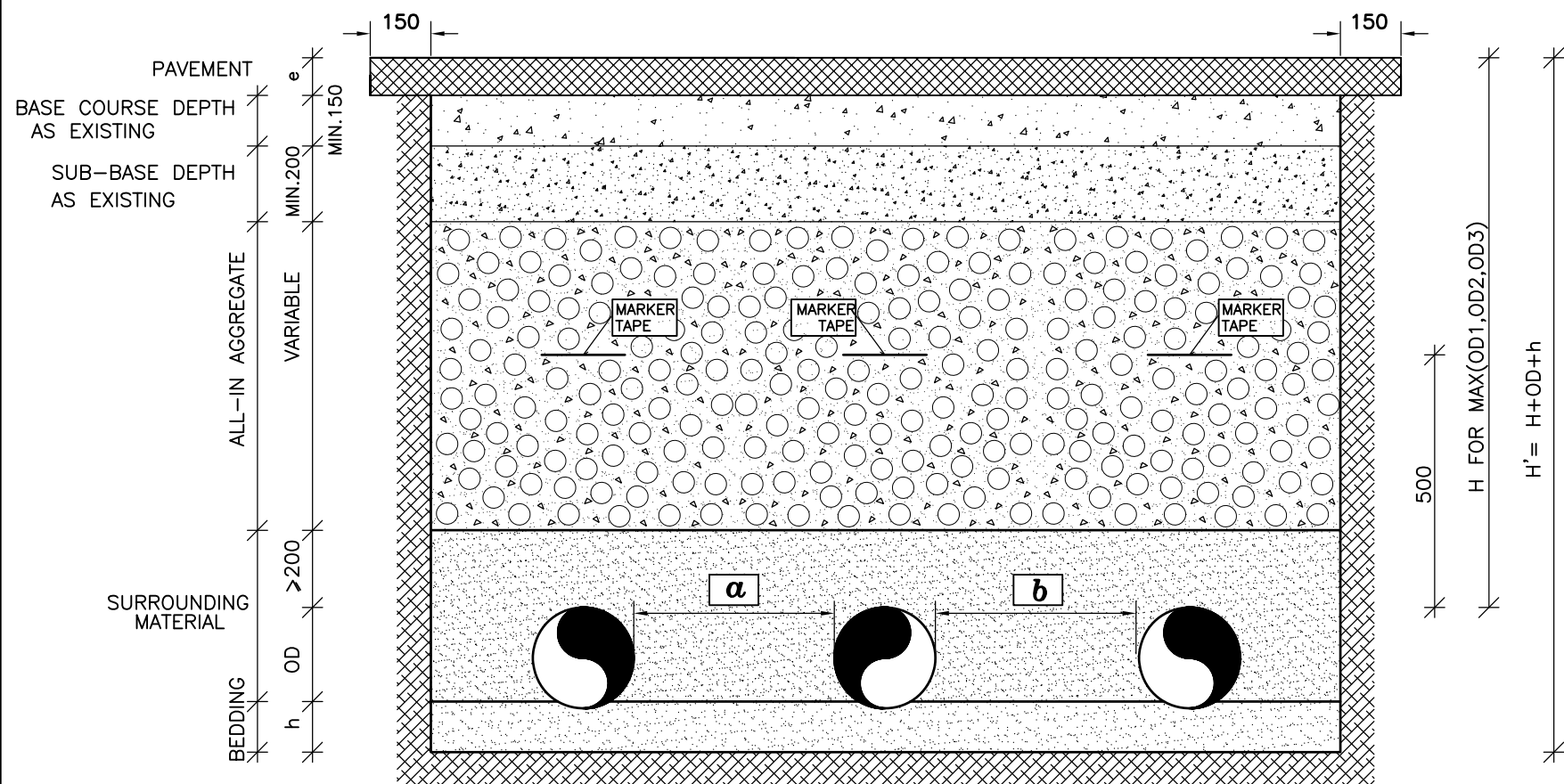
L: TRENCH WIDTH $L = \frac{5}{4} (OD1 + OD2) + 800$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(DN1, DN2)}{10}$
 $a = \frac{\text{MAX}(DN1, DN2, 300)}{2}$

TRENCH IN ROAD FOR TWO PIPES
NOT TO SCALE



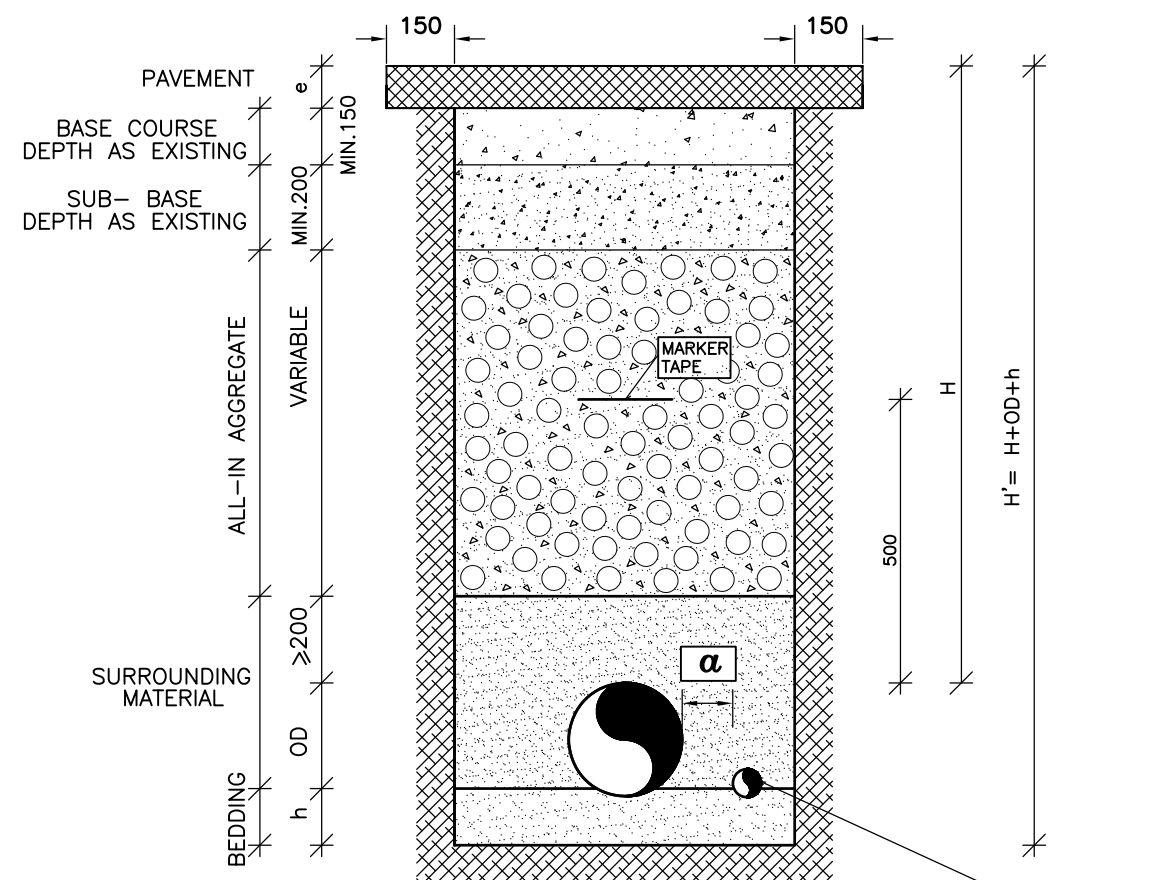
L: TRENCH WIDTH $L = \frac{5}{4} (OD1 + OD2) + 1000$
h: BEDDING DEPTH $h = 100 + \frac{DN}{10}$
 $a = \frac{\text{MAX}(DN1, DN2, 300)}{2}$
 $b > 200$

TRENCH IN ROAD WITH HDPE DUCT Ø 63 FOR TELEMETRY CABLE
NOT TO SCALE



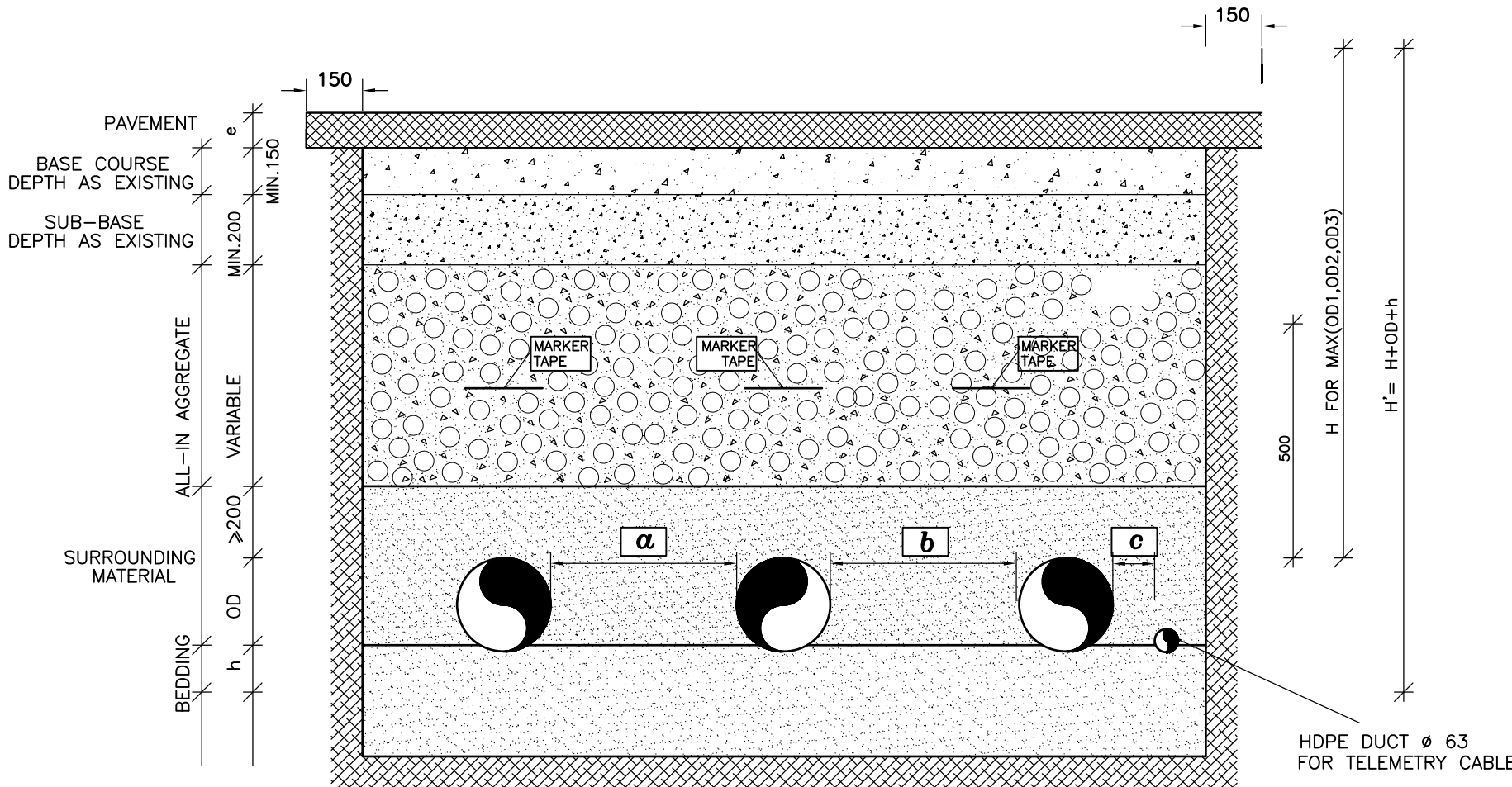
L: TRENCH WIDTH $L = \frac{6}{5} (OD1 + OD2 + OD3) + 1100$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(DN1, DN2, DN3)}{10}$
 $a = \frac{\text{MAX}(DN1, DN2, 300)}{2}$
 $b = \frac{\text{MAX}(DN2, DN3, 300)}{2}$

TRENCH IN ROAD FOR THREE PIPES
NOT TO SCALE



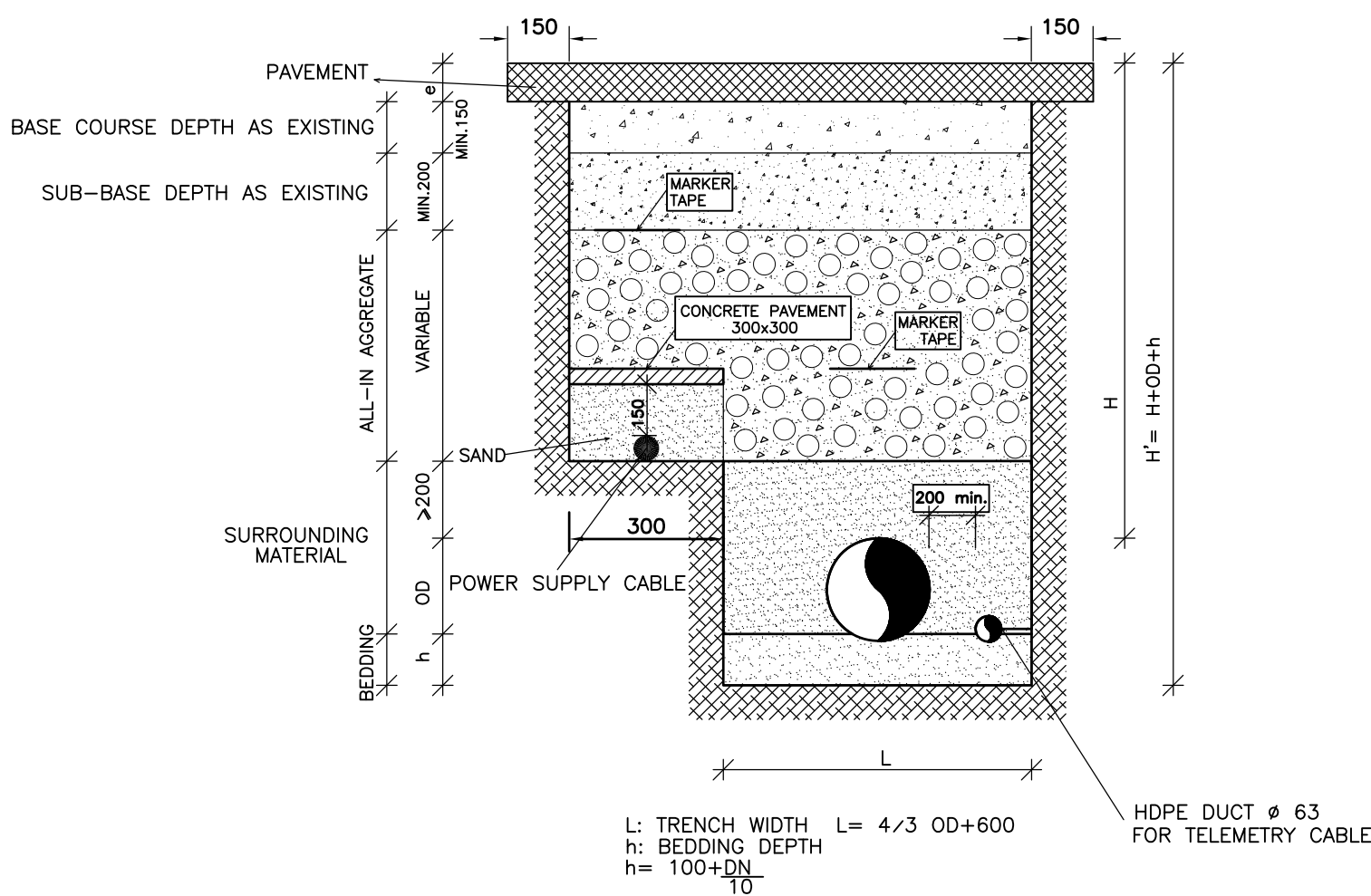
L: TRENCH WIDTH $L = \frac{4}{3} OD + 600$
h: BEDDING DEPTH $h = 100 + \frac{DN}{10}$
 $a > 200$

TRENCH IN ROAD WITH HDPE DUCT Ø 63 FOR TELEMETRY CABLE
NOT TO SCALE

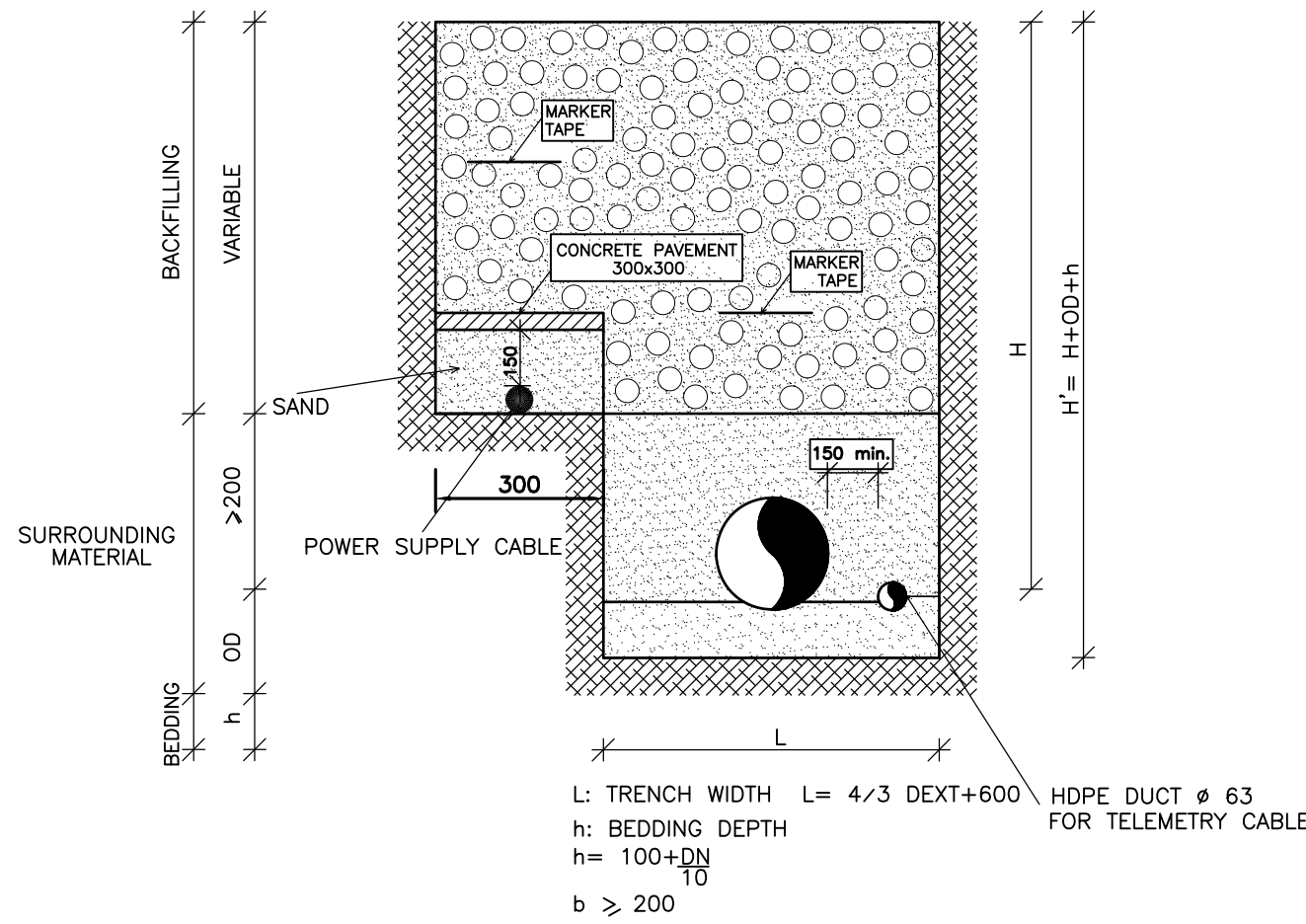


L: TRENCH WIDTH $L = \frac{6}{5} (OD1 + OD2 + OD3) + 1300$
h: BEDDING DEPTH $h = 100 + \frac{\text{MAX}(DN1, DN2, DN3)}{10}$
 $a = \frac{\text{MAX}(DN1, DN2, 300)}{2}$
 $b = \frac{\text{MAX}(DN2, DN3, 300)}{2}$
 $c > 200$

TRENCH IN ROAD WITH HDPE DUCT Ø 63 FOR TELEMETRY CABLE
NOT TO SCALE



TRENCH IN ROAD WITH HDPE DUCT Ø 63 FOR TELEMETRY CABLE AND POWER SUPPLY CABLE
NOT TO SCALE



TRENCH OFF ROAD WITH HDPE DUCT Ø 63 FOR TELEMETRY CABLE AND POWER SUPPLY CABLE
NOT TO SCALE

NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- OD : OUTER PIPE DIAMETER
- DN : NOMINAL PIPE DIAMETER
- e : ASPHALT LAYER THICKNESS:
FOR MAIN ROADS: 2 LAYERS TOTAL $e \geq 9\text{cm}$
FOR OTHER ROADS: 1 LAYER total $e \geq 5\text{cm}$

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT

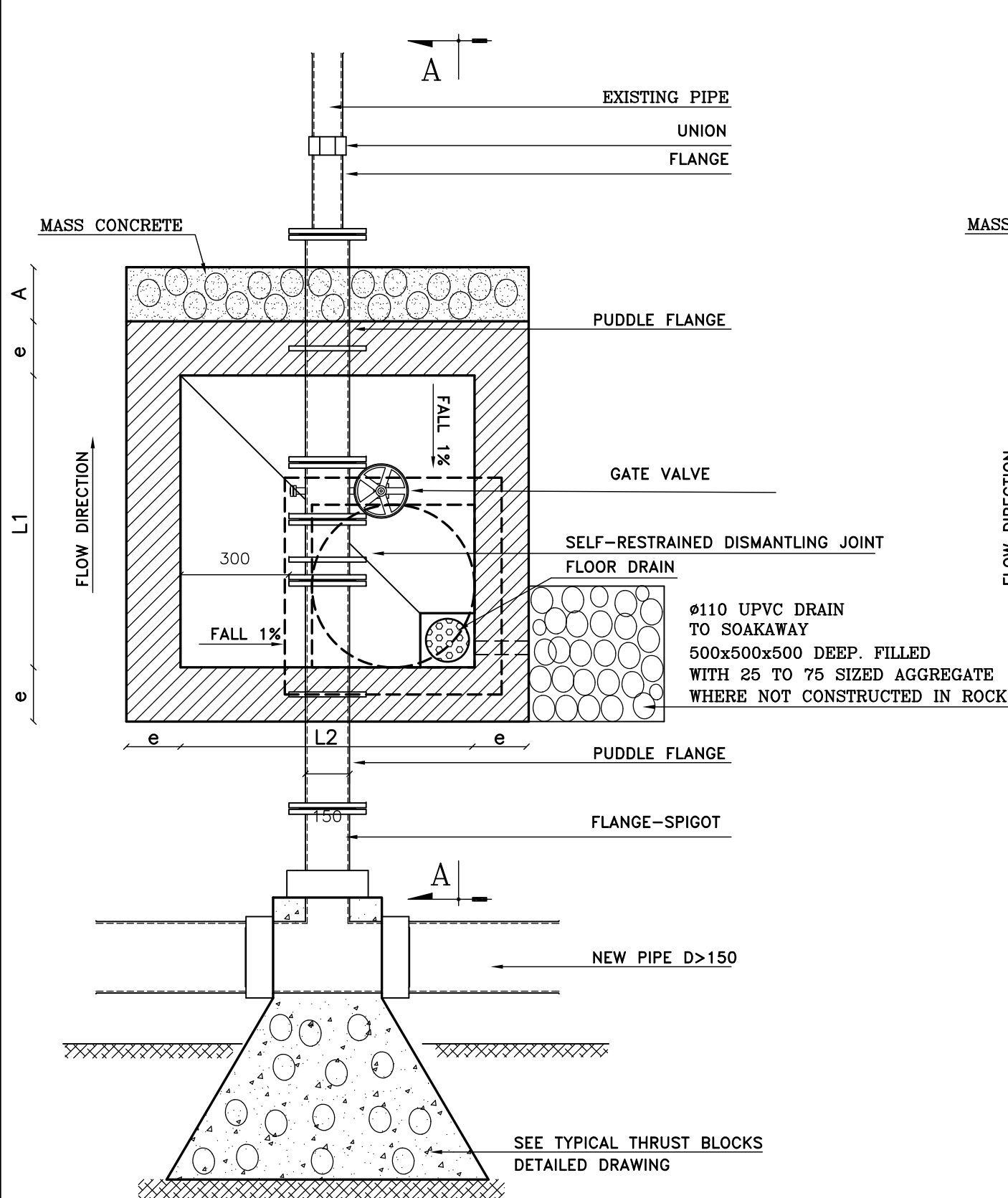
TRANSMISSION AND
DISTRIBUTION SYSTEMS

TYPICAL TRENCH DETAILS
AND TELEMETRY CABLE DRAW PIT

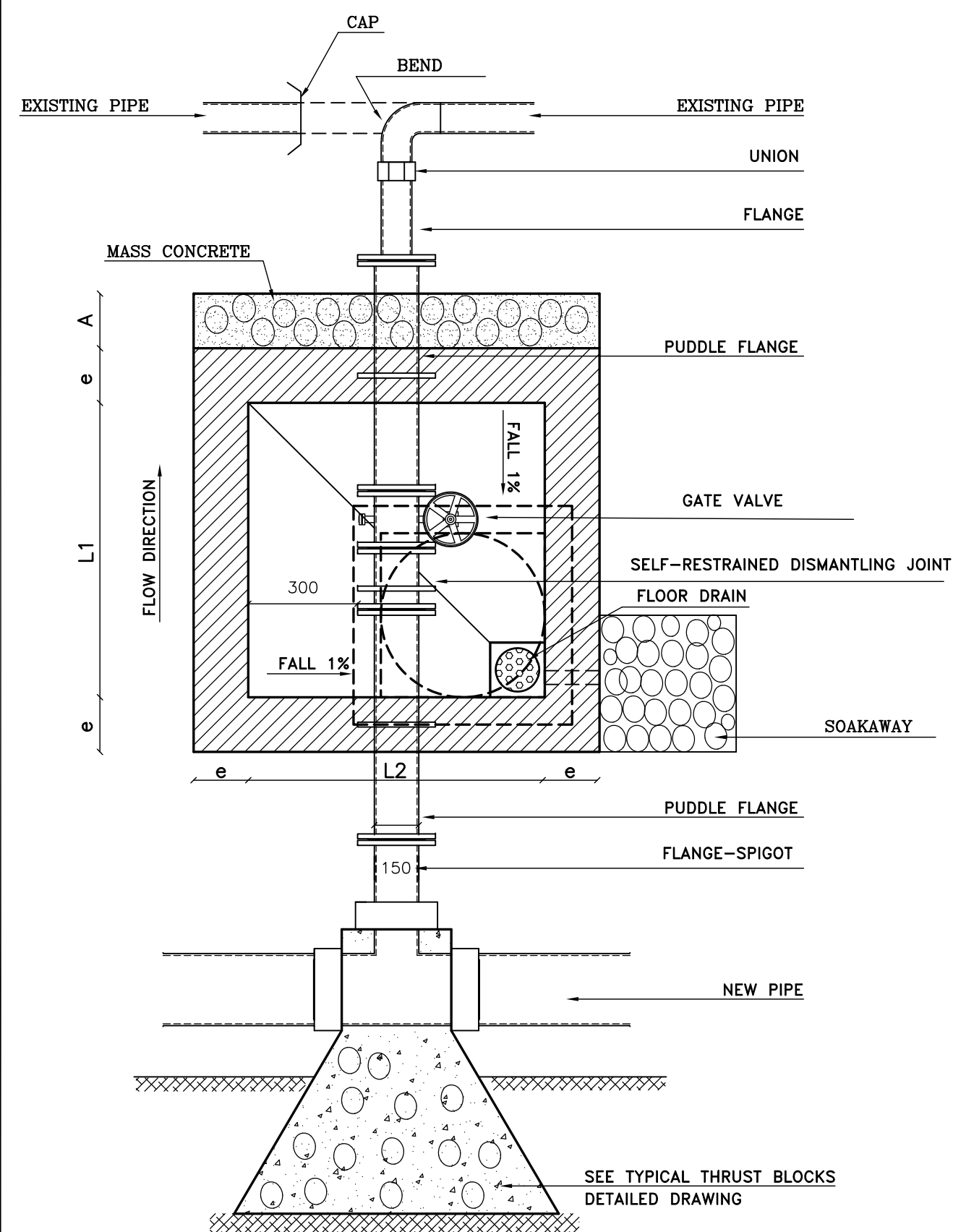
FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	4/16	509W-STDP04

TYPE 1
SECTION C-C

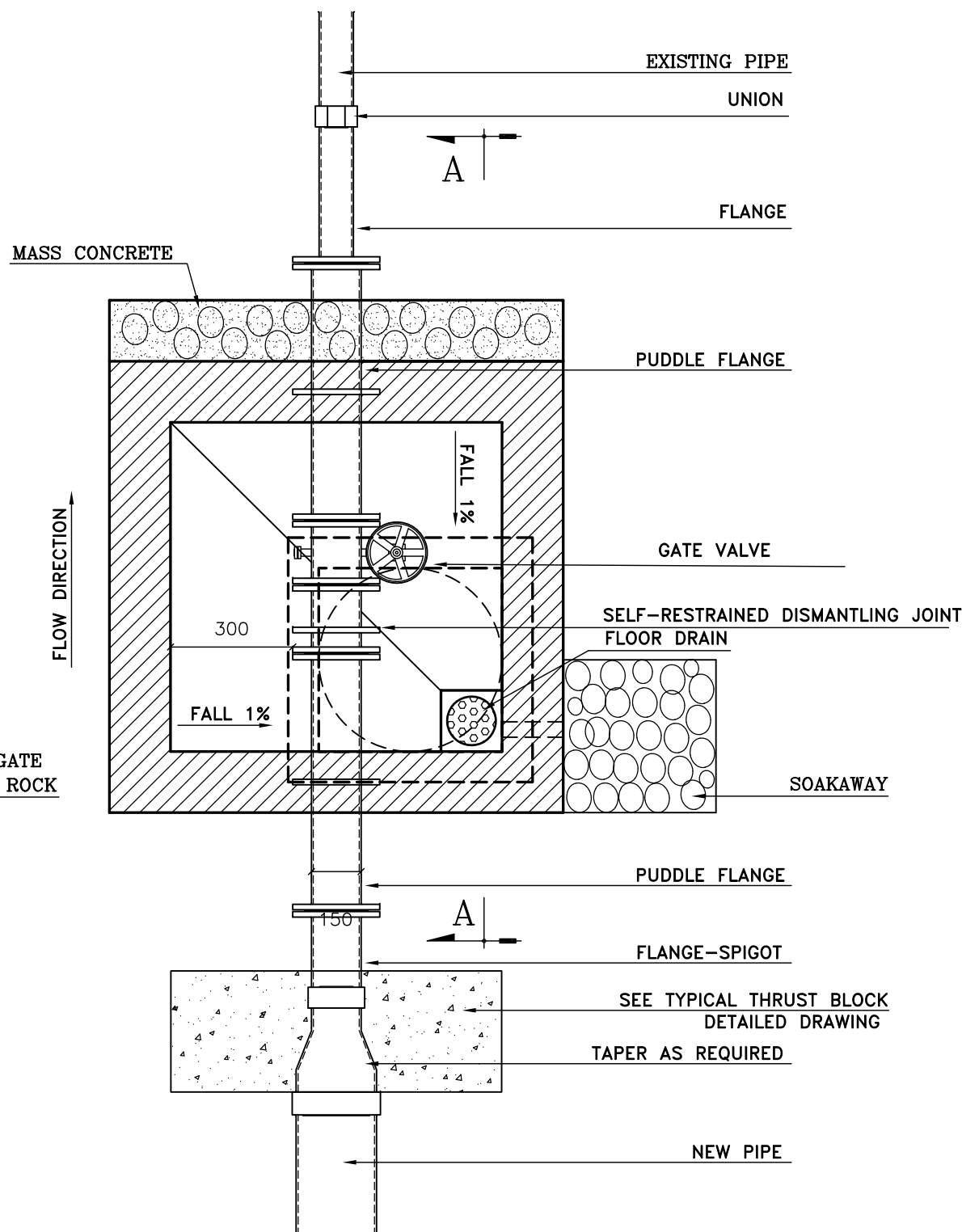


TYPE 1-A

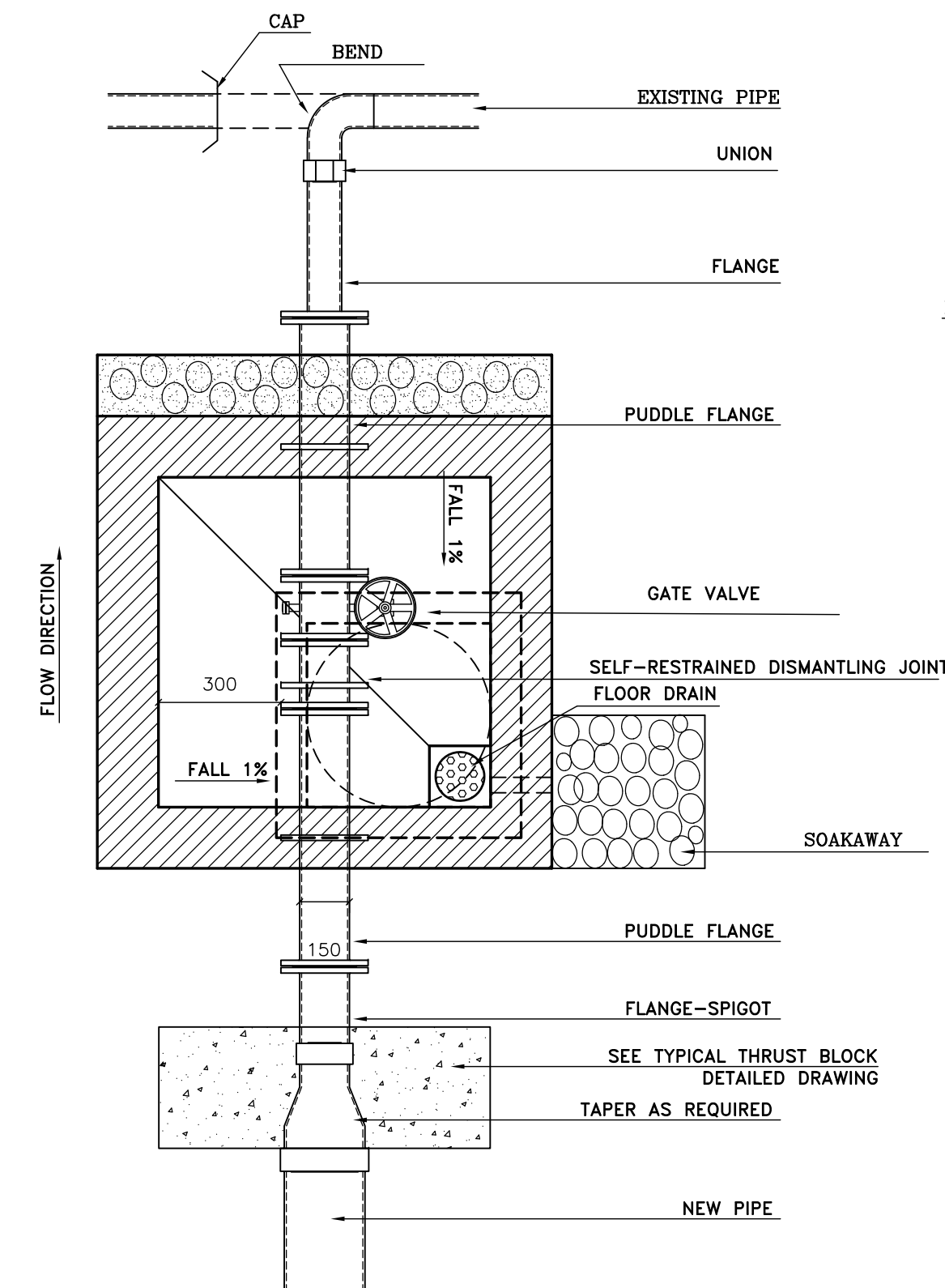


TYPE 1-B

TYPE 2
SECTION C-C

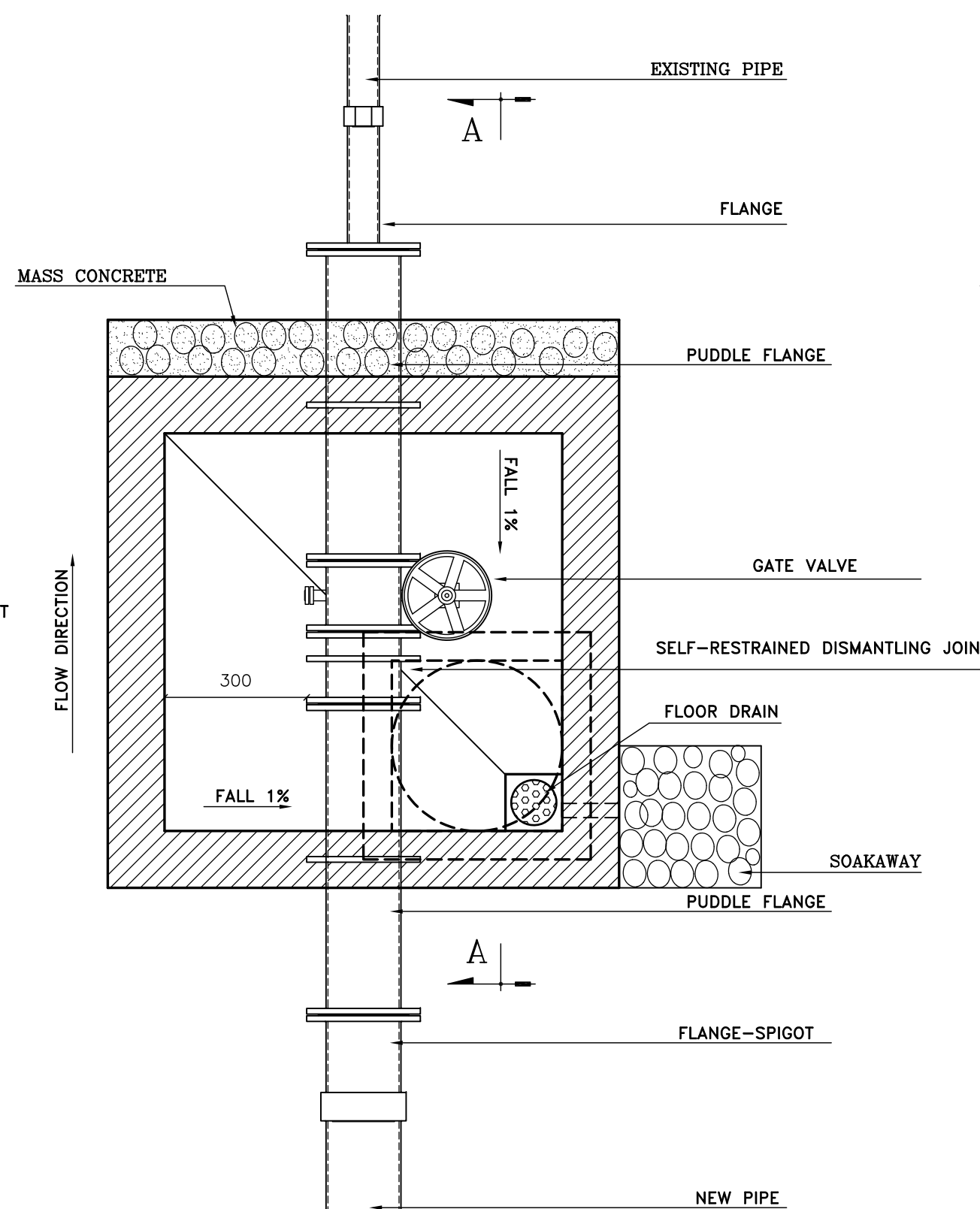


TYPE 2-A

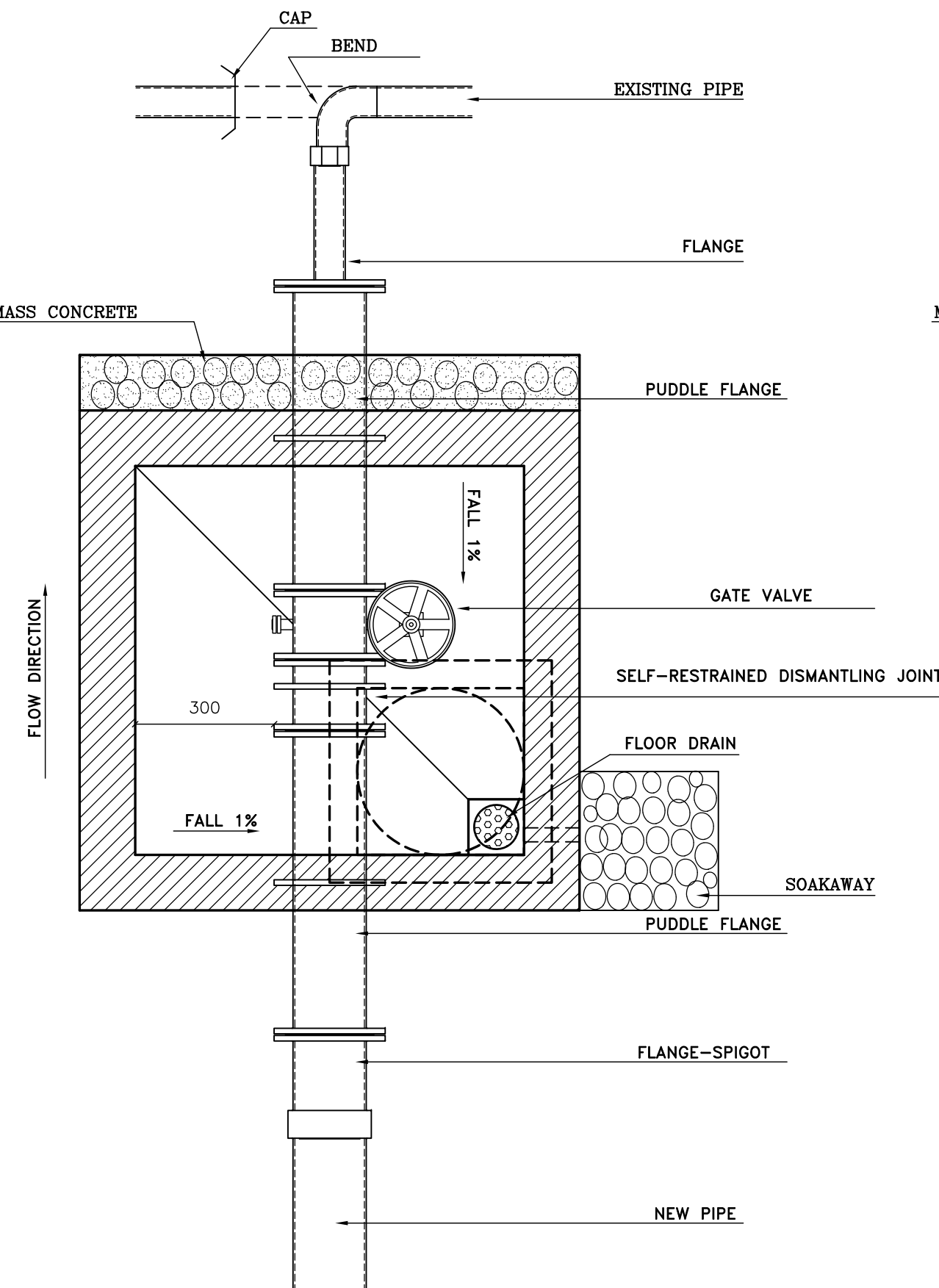


TYPE 2-B

TYPE 3
SECTION C-C

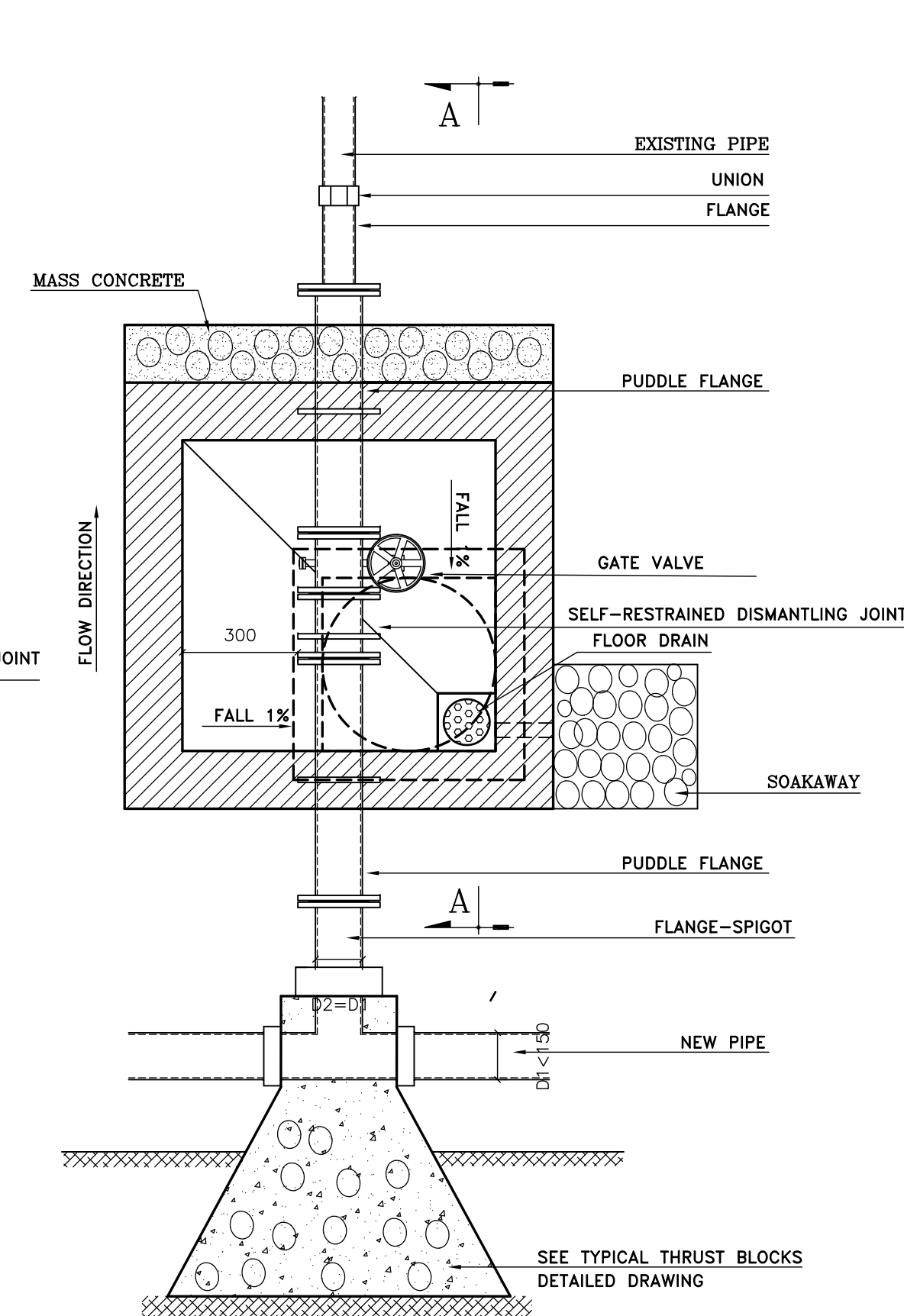


TYPE 3-A

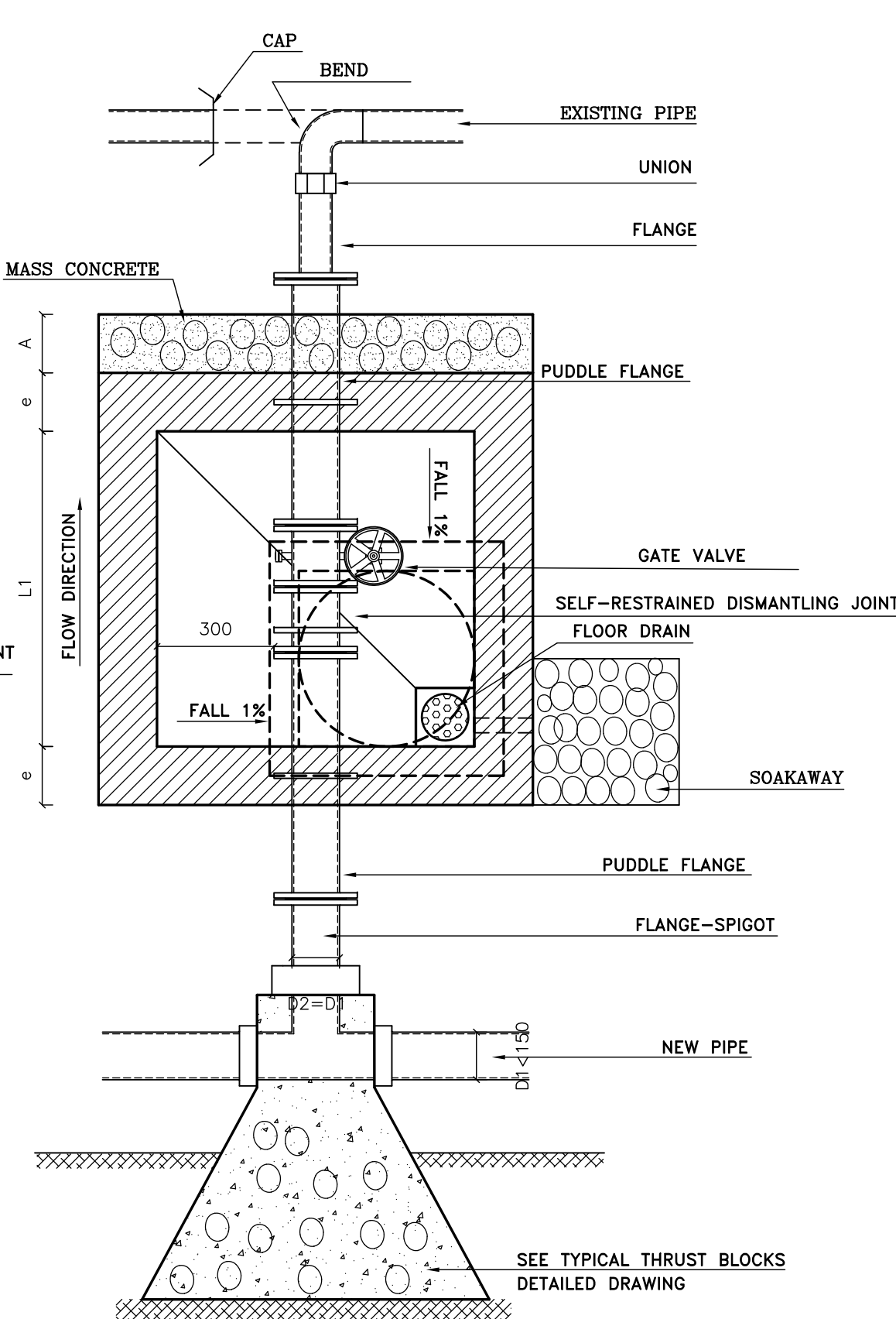


TYPE 3-B

TYPE 4
SECTION C-C



TYPE 4-A



TYPE 4-B

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m³

BLINDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS : SYMBOL Ø YIELD STRESS: F_y=215 MPa.

STRESSES:
SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c =25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t =2.1 MPa.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50Ø.
(Ø= NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION
STIRRUPS Ø8 SHALL BE USED ON EACH LAP.

BENDING:
Ø > 12mm MECHANICAL.
Ø < 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE
(METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE

REMARKS:
• HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
• ALL DIMENSIONS ARE IN MILLIMETERS.
• SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
• SOIL FRICTION ANGLE SHALL BE 25°
• GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 tg Ø
• THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS "200".

SOAKAWAY
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO
A FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.

WASHOUT CHAMBER DIMENSIONS :
IN THE CASES WHERE THE WASHOUT CHAMBER IS TO HOUSE, AT THE SAME TIME,
THE WASHOUT GATE VALVE AND THE MAIN PIPE,THE CHAMBER DIMENSIONS MAY
VARY FROM THOSE INDICATED ON THIS DRAWING. CONSEQUENTLY, THE EXACT
DIMENSIONS ARE TO BE TAKEN FROM THE RELEVANT SPECIFICATIONS AND/OR
DRAWINGS IN THE TENDER DOCUMENTS OR AS DIRECTED BY THE ENGINEER.

• T.P. =TEST PRESSURE

• WASHOUT CHAMBER TYPE II SHALL BE USED NORMALLY,IF DETERMINED BY THE
ENGINEER NOT TO BE APPLICABLE , TYPE I WILL BE USED.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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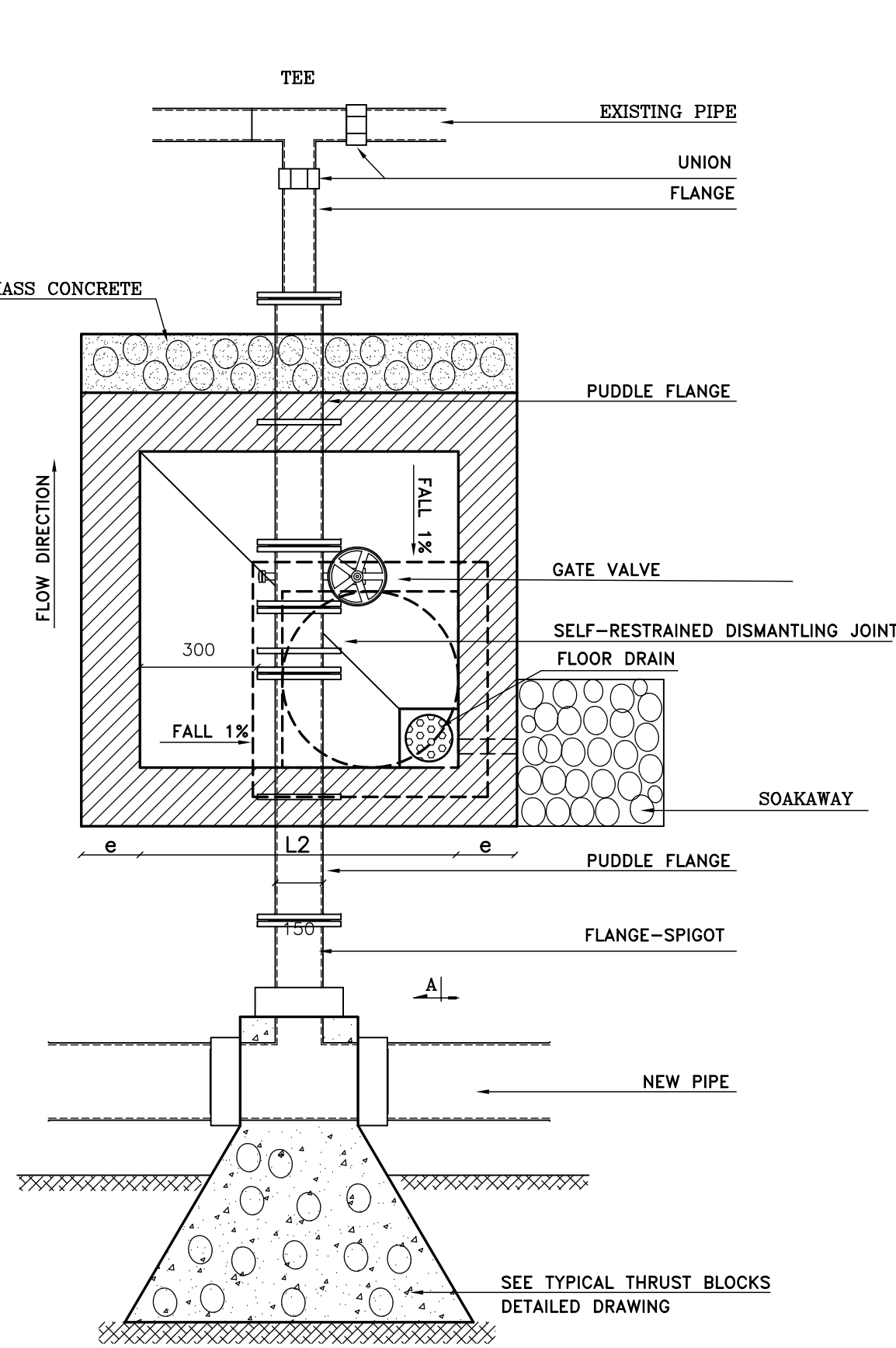
CONSTRUCTION OF WATER WORKS IN
OUADI ED LEEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

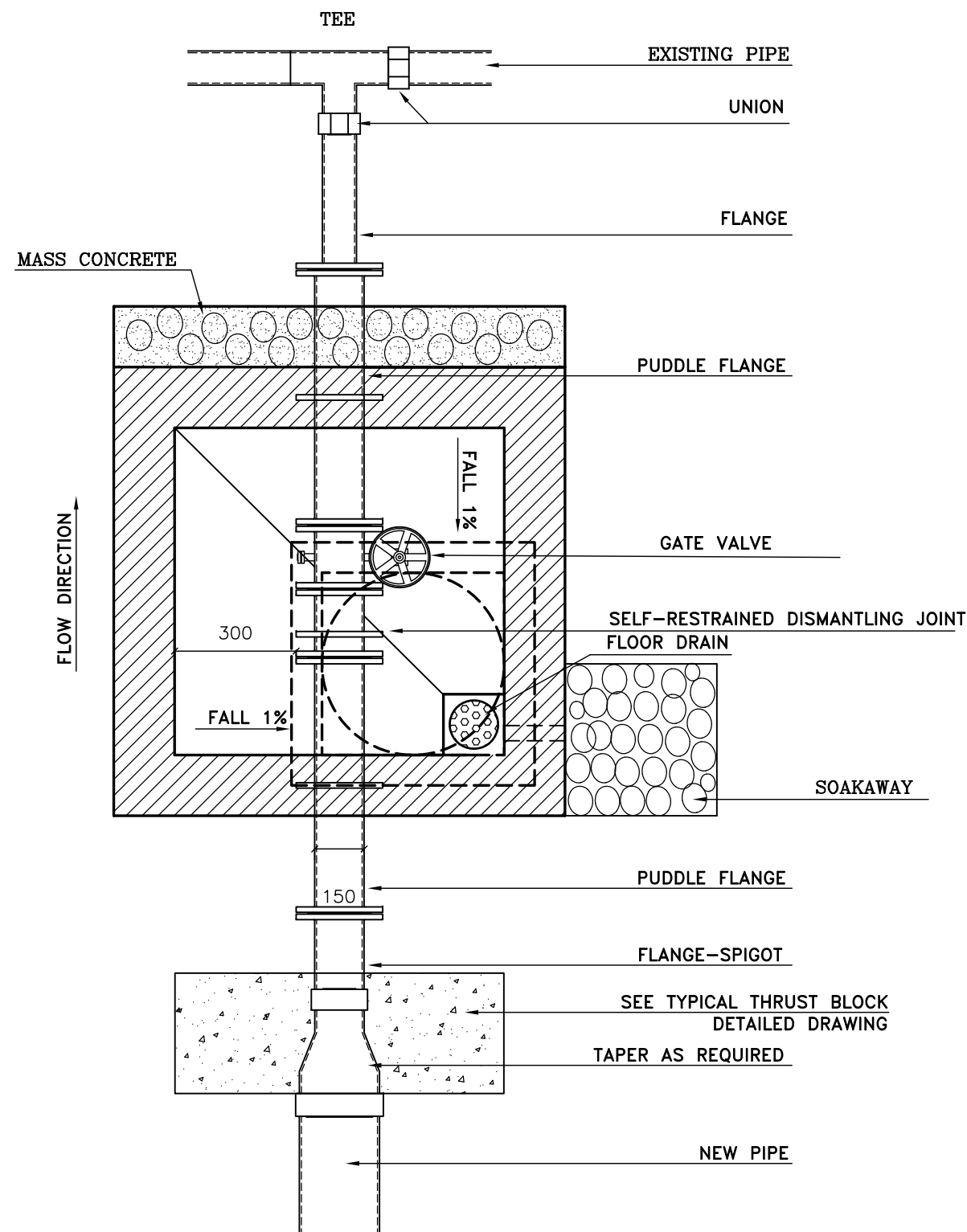
TYPICAL CONNECTIONS OF
NEW PIPES TO EXISTING
PIPES

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

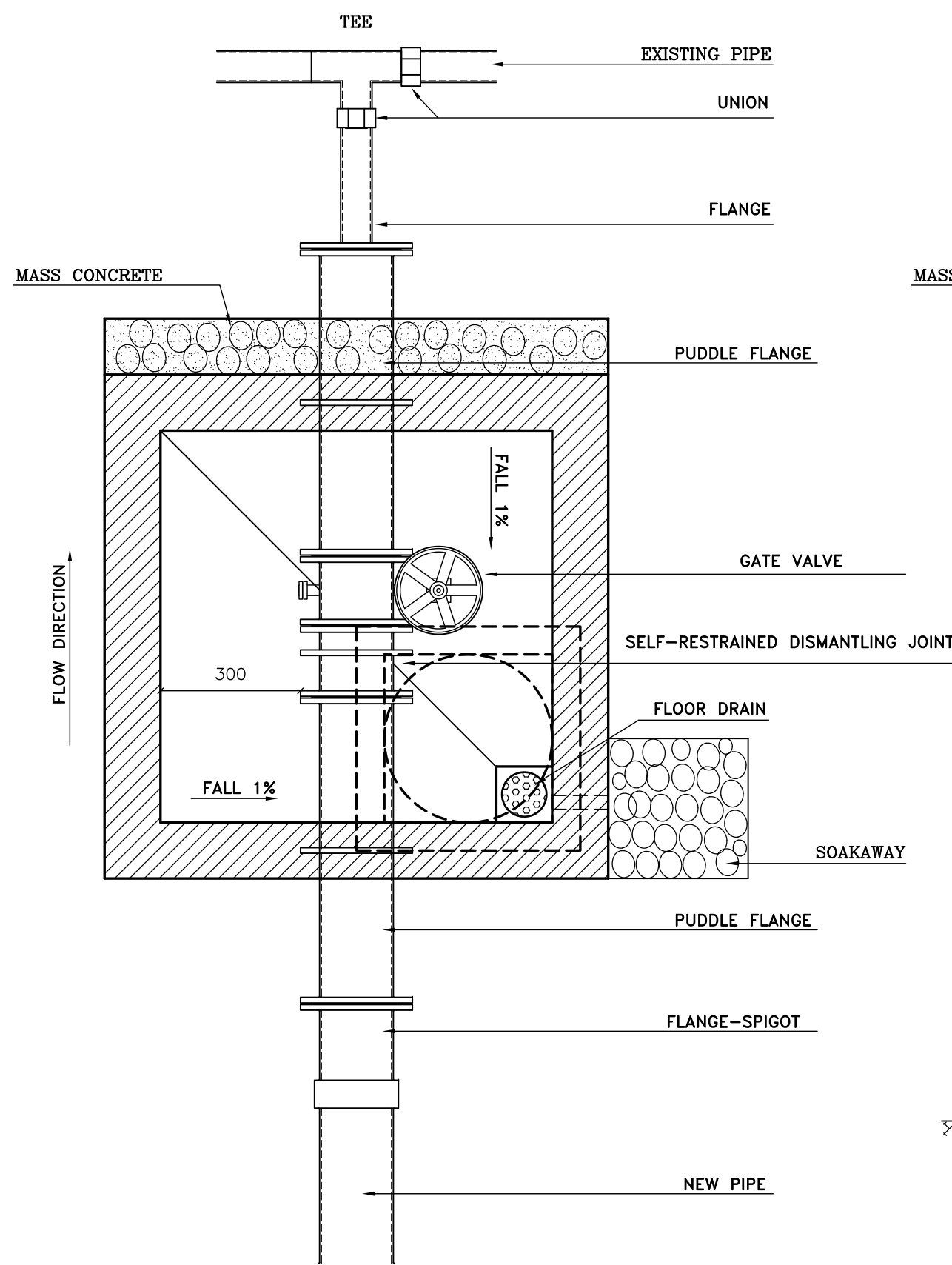
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	5/16	509W-STDP05



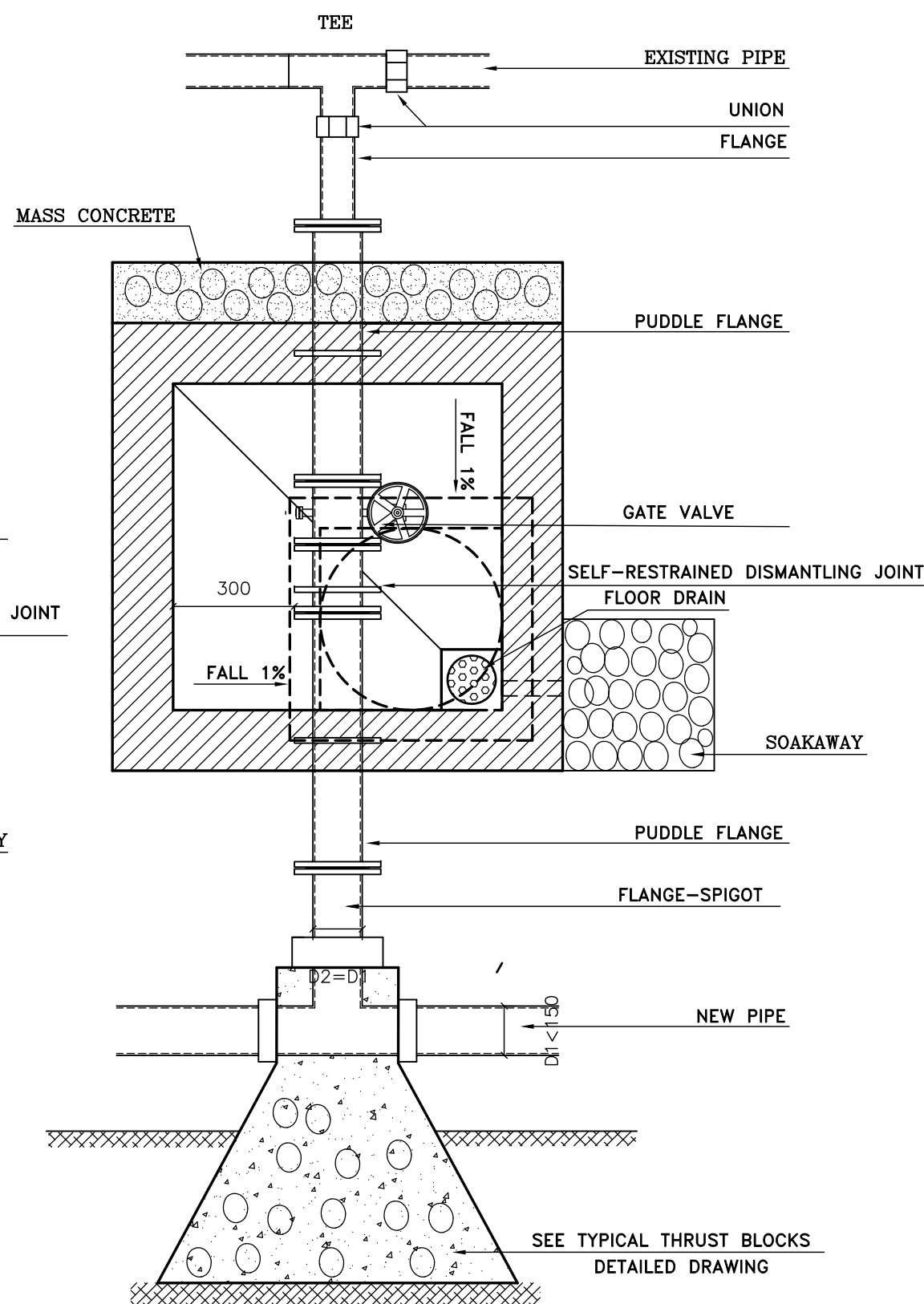
TYPE 1-C



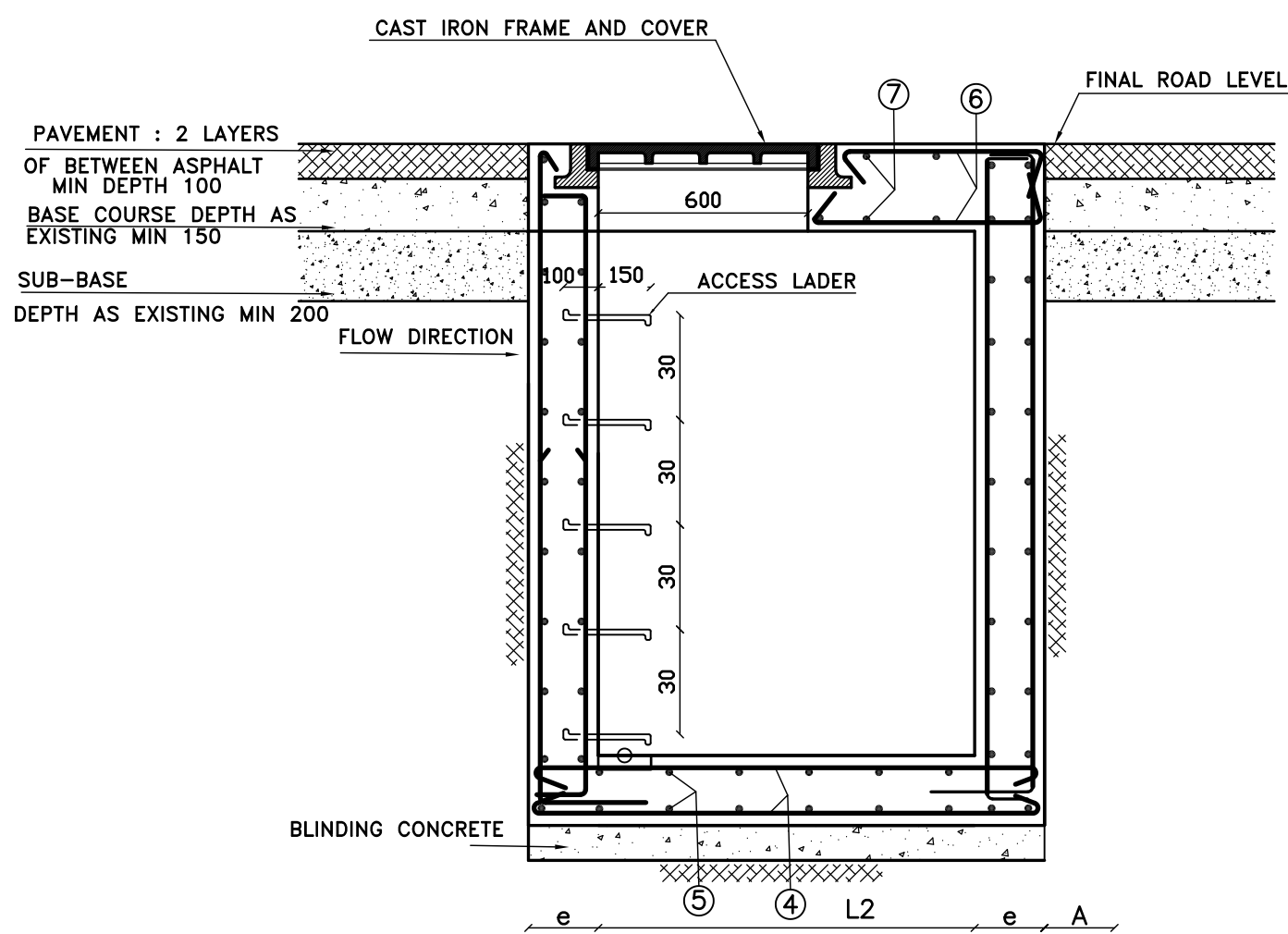
TYPE 2-C



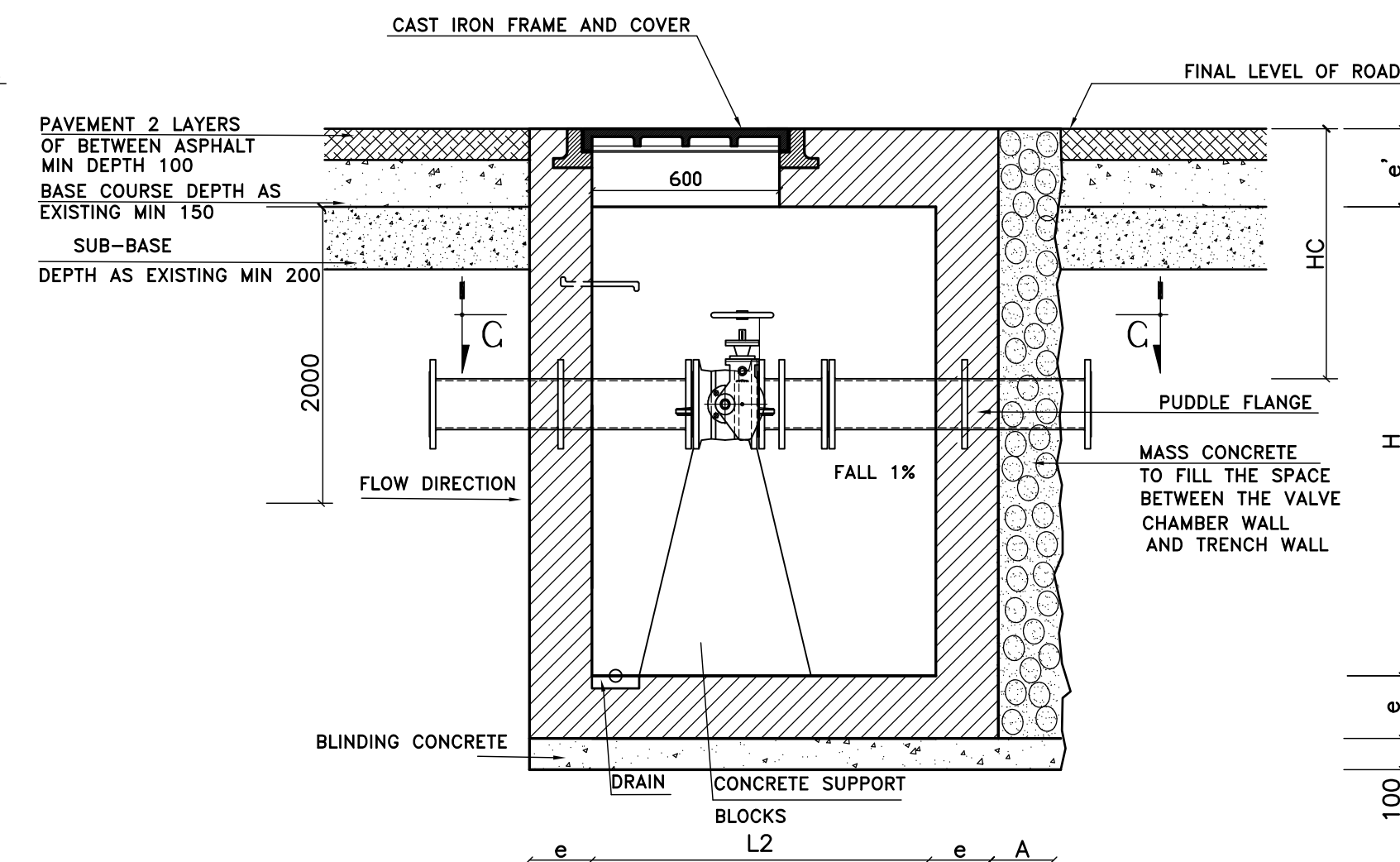
TYPE 3-C



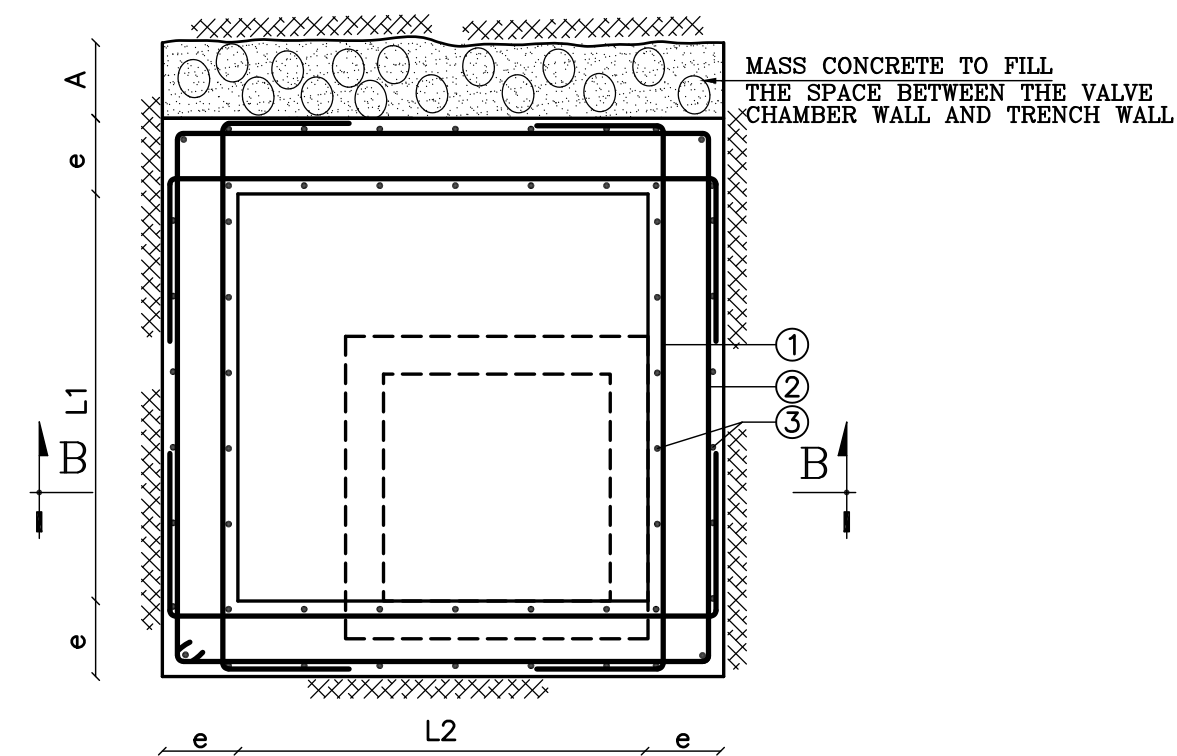
TYPE 4-C



TYPICAL SECTION B-B



TYPICAL SECTION A-A



TYPICAL REINFORCEMENT OF VALVE CHAMBER

PIPE DIAMETER	LENGTH	WIDTH	HEIGHT	WALL & SLAB THICKNESS	UPPER SLAB THICKNESS	MASS CONCRETE THICKNESS	PIPE COVER
D mm	L1 mm	L2 mm	H mm	e mm	e' mm	A mm	HC mm
80-150	1100	1100	1500	200	250	200	800
200	1200	1200	1500	200	250	200	1000
250	1400	1400	1500	200	250	200	1000
300	1500	1500	2000	250	250	200	1000
350	1500	1500	2000	250	250	200	1000
400	1700	1700	2400	250	300	200	1100
450	1700	1700	2400	250	300	200	1100
500	2000	2000	2400	300	300	200	1200
600	2100	2100	2500	300	300	200	1200

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
80-150	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
200	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
250	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
300	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
350	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
400	T12 Ø200	T12 Ø200	T10 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
450	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200	T12 Ø200
500	T14 Ø200	T14 Ø200	T12 Ø200	T14 Ø200	T14 Ø200	T12 Ø200	T12 Ø200
600	T14 Ø200	T14 Ø200	T14 Ø200	T14 Ø200	T14 Ø200	T12 Ø200	T12 Ø200

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 kg/m³

BLINDING AND MASS CONCRETE:
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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

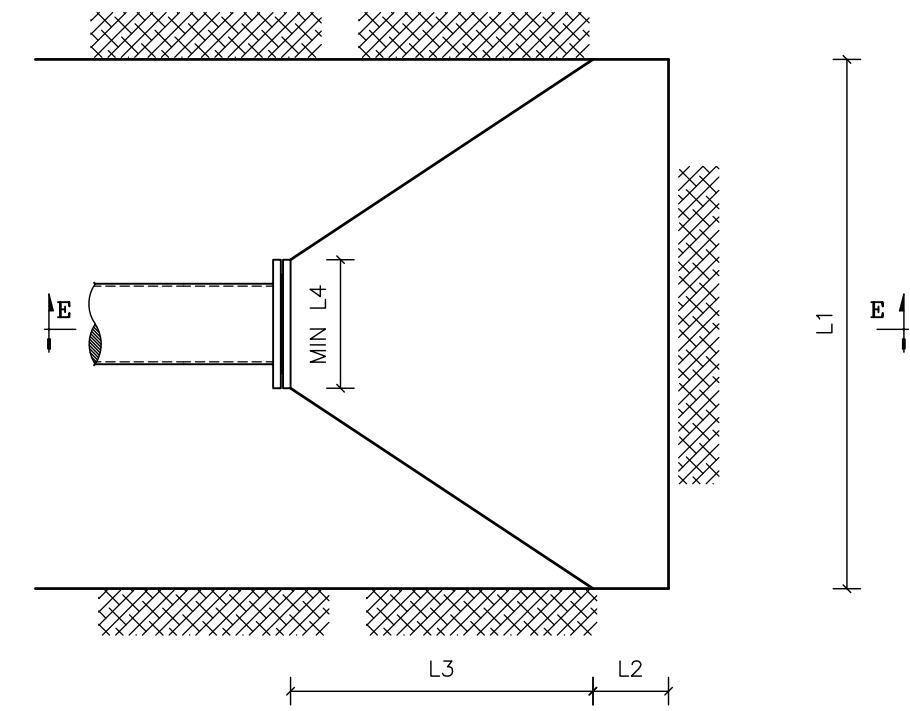
TRANSMISSION AND
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TYPICAL CONNECTIONS OF
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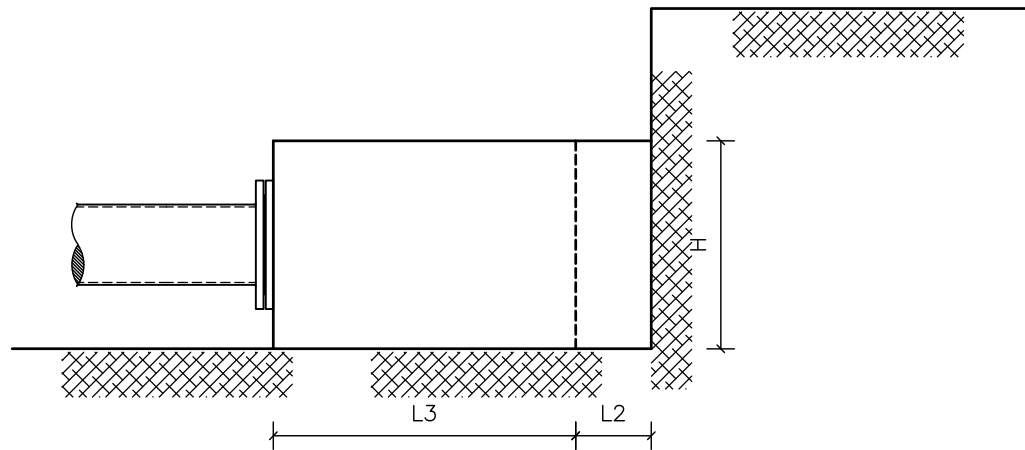
FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	6/16	509W-STDP06

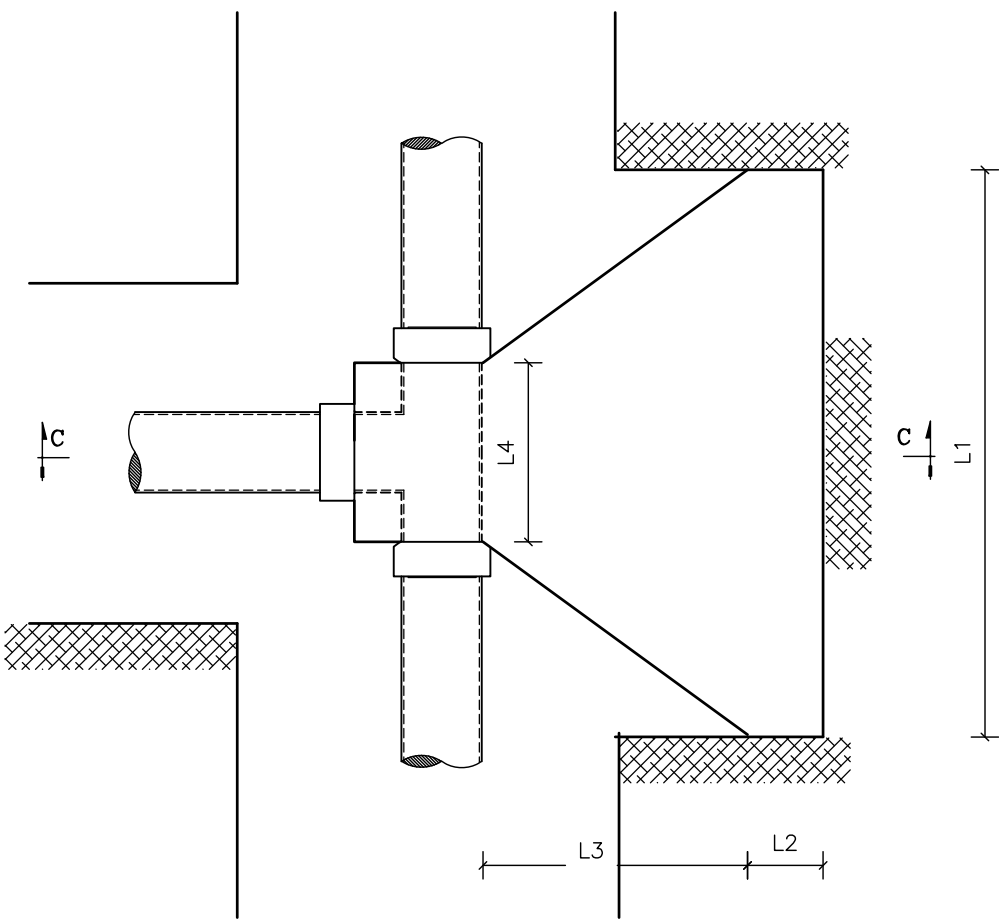
TYPICAL THRUST BLOCKS FOR TEES – HORIZONTAL BENDS – END CAPS



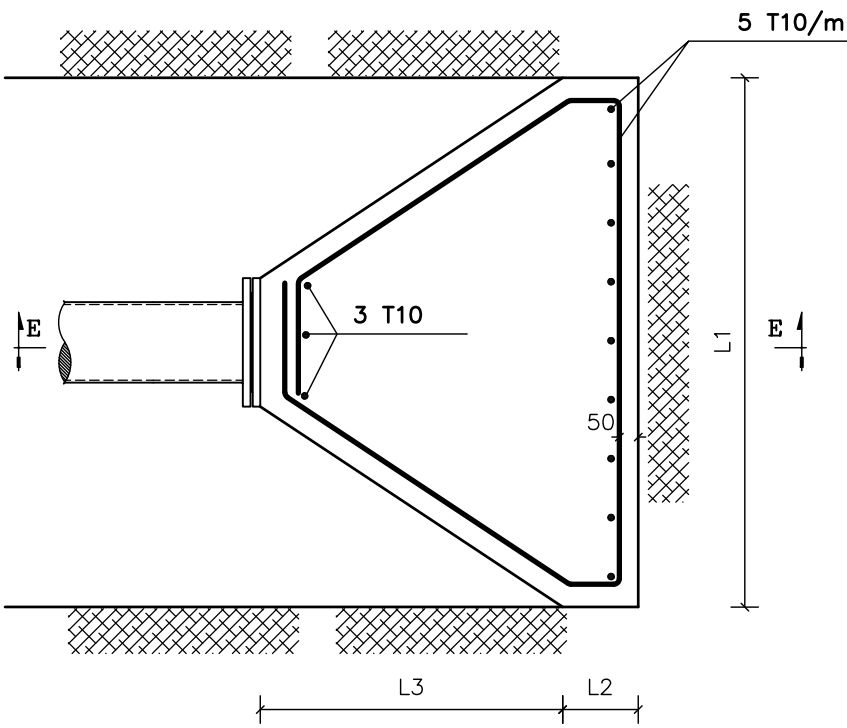
PLAN
END-CAP THRUST BLOCK



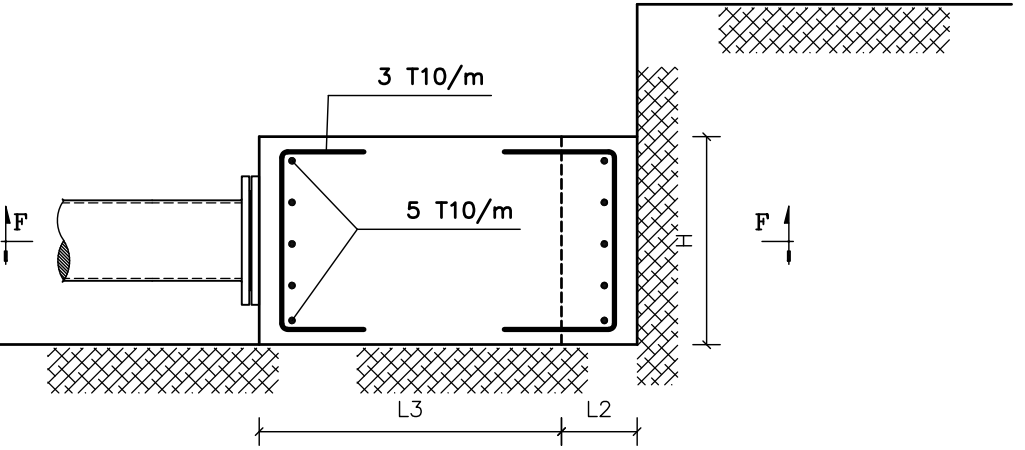
SECTION E-E
END-CAP THRUST BLOCK



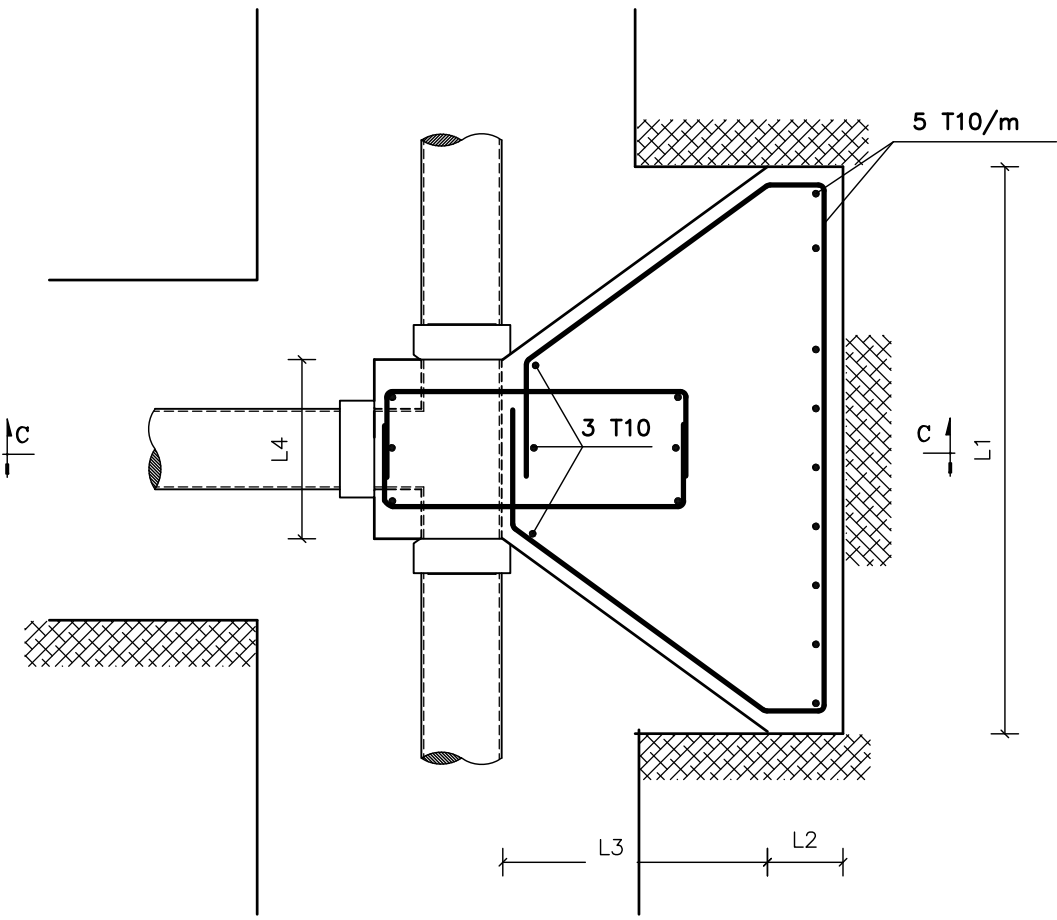
PLAN
TEE THRUST BLOCK



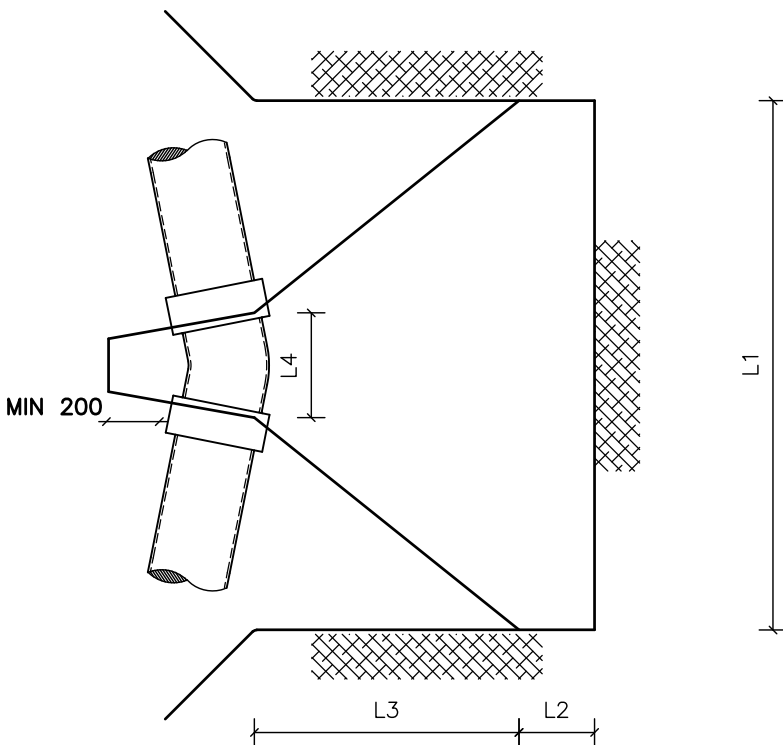
SECTION F-F
END-CAP THRUST BLOCK
TYPICAL REINFORCEMENT



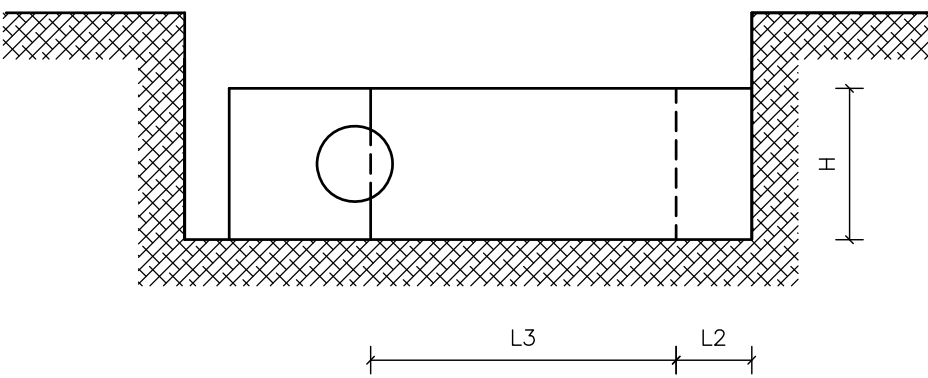
SECTION E-E
END-CAP THRUST BLOCK
TYPICAL REINFORCEMENT



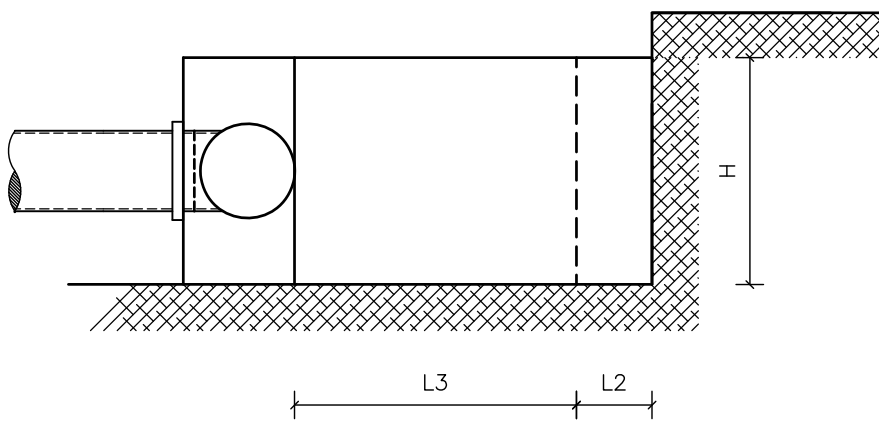
SECTION D-D
TEE THRUST BLOCK
TYPICAL REINFORCEMENT



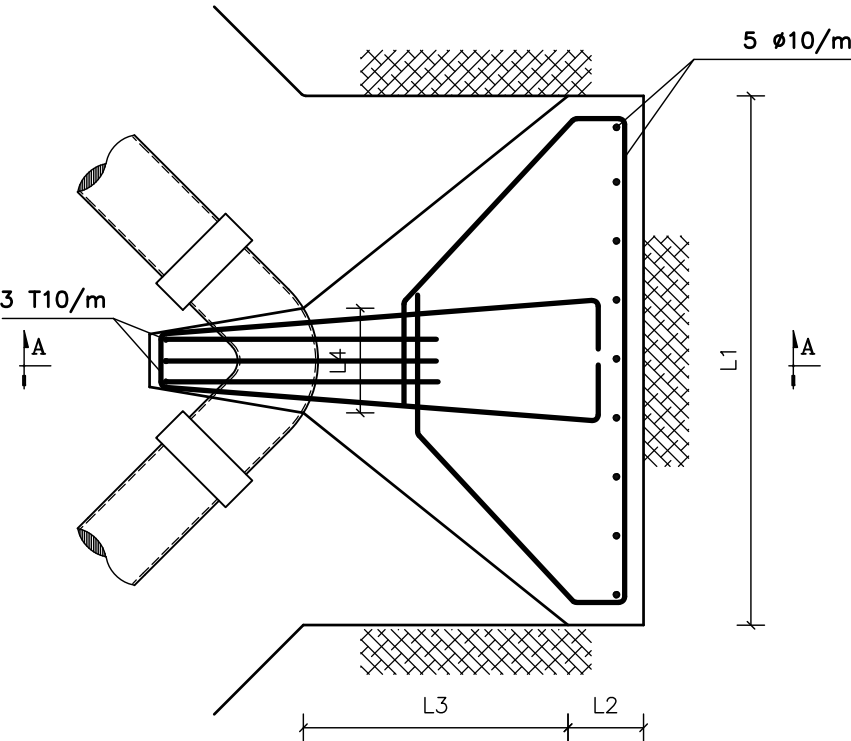
PLAN
TYPICAL HORIZONTAL BEND
THRUST BLOCK



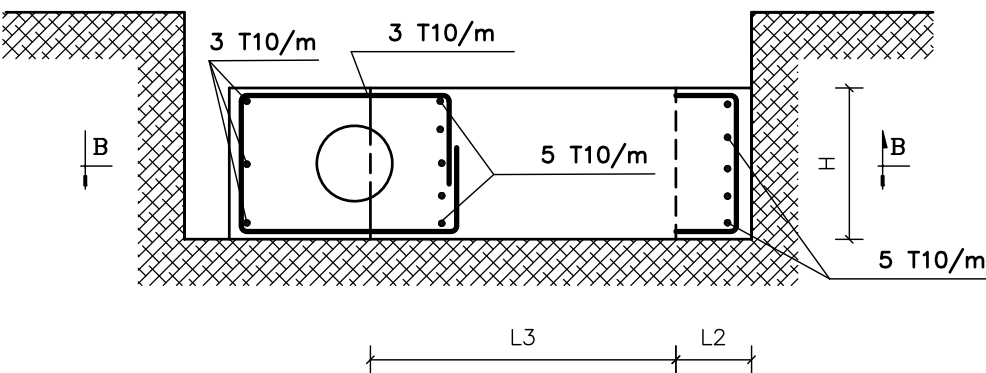
SECTION A-A
TYPICAL HORIZONTAL BEND
THRUST BLOCK



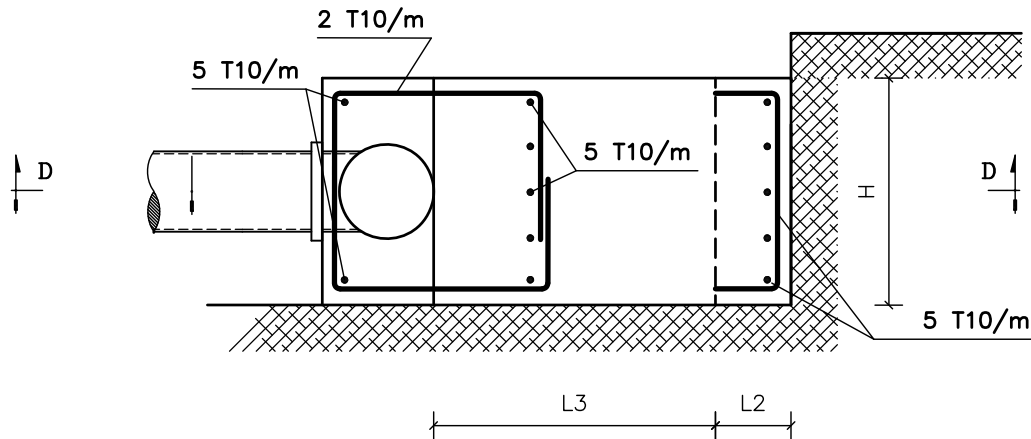
SECTION C-C
TEE THRUST BLOCK



SECTION B-B
HORIZONTAL BEND
THRUST BLOCK
TYPICAL REINFORCEMENT



SECTION A-A
HORIZONTAL BEND
THRUST BLOCK
TYPICAL REINFORCEMENT



SECTION C-C
TEE THRUST BLOCK
TYPICAL REINFORCEMENT

NOTES:

BASIC DATA :

SOIL DENSITY	1800	kg/m3
PIPE MATERIAL DENSITY (DUCTILE IRON)	7050	kg/m3
WATER SPECIFIC WEIGHT	1000	kg/m3
CONCRETE SPECIFIC WEIGHT	2300	kg/m3
SOIL INTERNAL FRICTION ANGLE	ϕ	'
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm2
SOIL-CONCRETE FRICTION ANGLE	$2/3 * \phi$	'

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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
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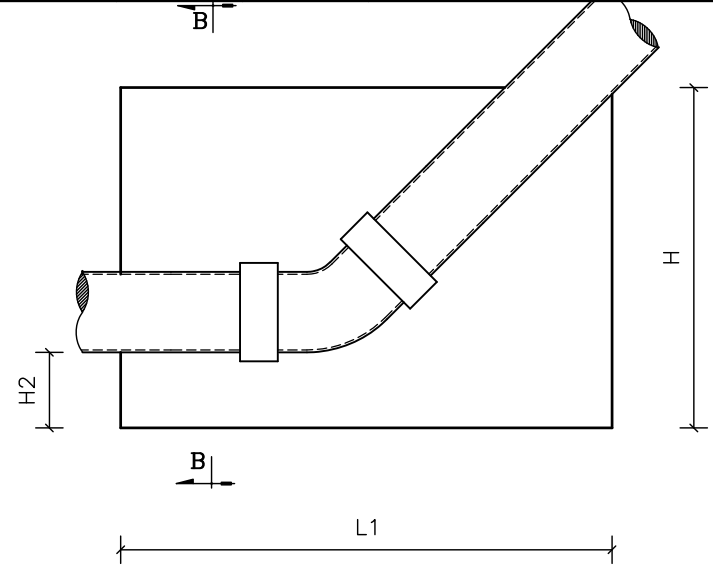
PIPELINE THRUST BLOCKS

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

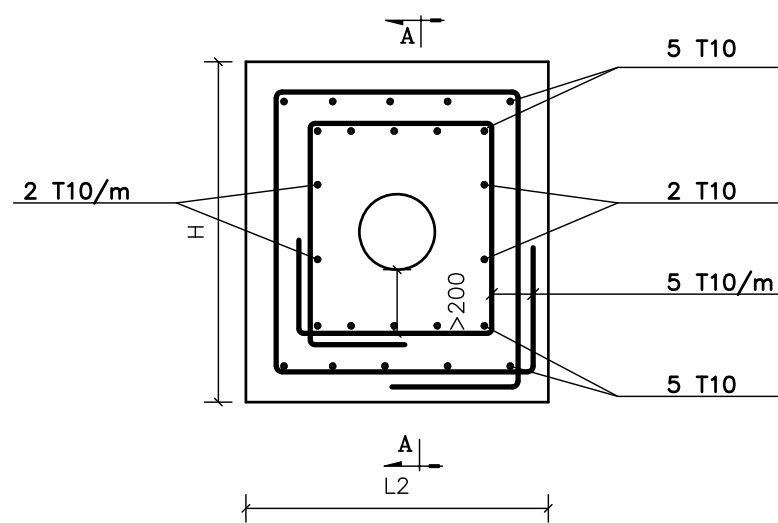
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	7/16	509W-STDP07

DIMENSIONS OF THRUST BLOCKS FOR VERTICAL BENDS

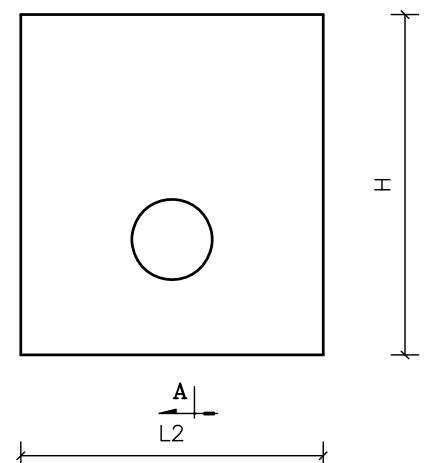
Diam (mm)	Beta angle (°)	cover depth (m)	1	5	10	15	20	Test pressure	25	30	35	40	45	50	55	60
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1000	120	1,20	12	12	12	12	12	12	12	12	12	12	12	12	12	12
1000	22,5	1,20	12	12	12	12	12	12	12	12	12	12	12	12	12	12
1000	11,25	1,20	12	12	12	12	12	12	12	12	12	12	12	12	12	12
900	90	1,20	11	—	—	—	—	—	—	—	—	—	—	—	—	—
900	120	1,20	11	11	11	11	11	11	11	11	11	11	11	11	11	11
900	22,5	1,20	11	11	11	11	11	11	11	11	12	—	—	—	—	—
900	11,25	1,20	11	11	11	11	11	11	11	11	11	11	11	11	11	12
800	90	1,20	11	—	—	—	—	—	—	—	—	—	—	—	—	—
800	120	1,20	11	11	11	11	11	12	—	—	—	—	—	—	—	—
800	22,5	1,20	11	11	11	11	11	11	11	11	12	12	—	—	—	—
800	11,25	1,20	11	11	11	11	11	11	11	11	11	11	11	11	11	11
700	90	1,20	10	12	—	—	—	—	—	—	—	—	—	—	—	—
700	120	1,20	10	10	10	10	11	12	—	—	—	—	—	—	—	—
700	22,5	1,20	10	10	10	10	10	10	10	10	10	11	11	11	12	12
700	11,25	1,20	10	10	10	10	10	10	10	10	10	10	10	10	10	10
600	90	1,20	10	11	—	—	—	—	—	—	—	—	—	—	—	—
600	120	1,20	10	10	10	10	10	11	11	12	12	12	—	—	—	—
600	22,5	1,20	10	10	10	10	10	10	10	10	10	10	10	10	11	11
600	11,25	1,20	10	10	10	10	10	10	10	10	10	10	10	10	10	10
500	90	1,20	9	10	12	—	—	—	—	—	—	—	—	—	—	—
500	120	1,20	9	9	9	9	9	10	10	10	10	11	11	12	12	12
500	22,5	1,20	9	9	9	9	9	9	9	9	9	9	9	9	10	10
500	11,25	1,20	9	9	9	9	9	9	9	9	9	9	9	9	9	9
450	90	1,10	8	10	12	—	—	—	—	—	—	—	—	—	—	—
450	110	1,10	8	8	8	8	8	9	10	10	10	10	11	11	11	12
450	22,5	1,10	8	8	8	8	8	8	8	8	8	8	8	8	8	9
450	11,25	1,10	8	8	8	8	8	8	8	8	8	8	8	8	8	8
400	90	1,10	8	9	11	—	—	—	—	—	—	—	—	—	—	—
400	110	1,10	8	8	8	8	8	8	9	10	10	10	10	10	11	11
400	22,5	1,10	8	8	8	8	8	8	8	8	8	8	8	8	8	8
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350	90	1,00	7	8	11	12	—									



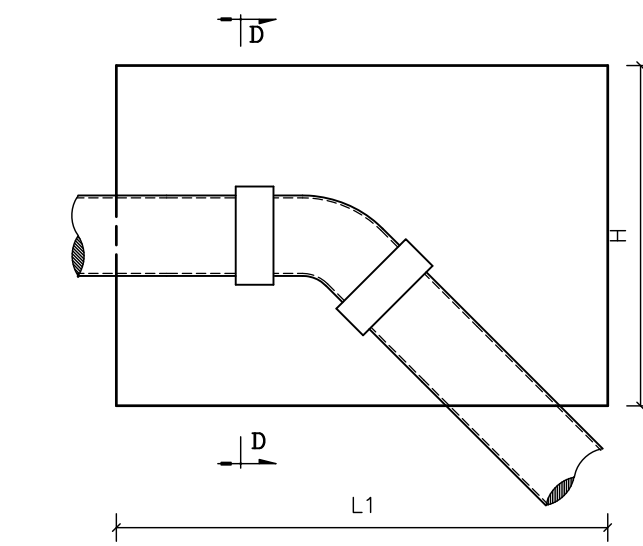
SECTION A-A
UPWARD FLOW DIRECTION



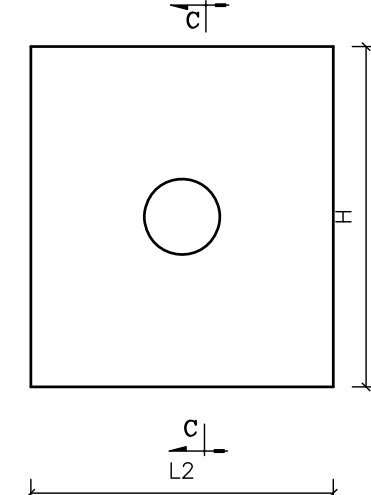
SECTION B-B
VERTICAL BEND ANCHOR BLOCK
TYPICAL REINFORCEMENT DETAIL



SECTION B-B
VERTICAL BEND ANCHOR BLOCK
UPWARD FLOW DIRECTION



SECTION C-C
DOWNWARD FLOW DIRECTION

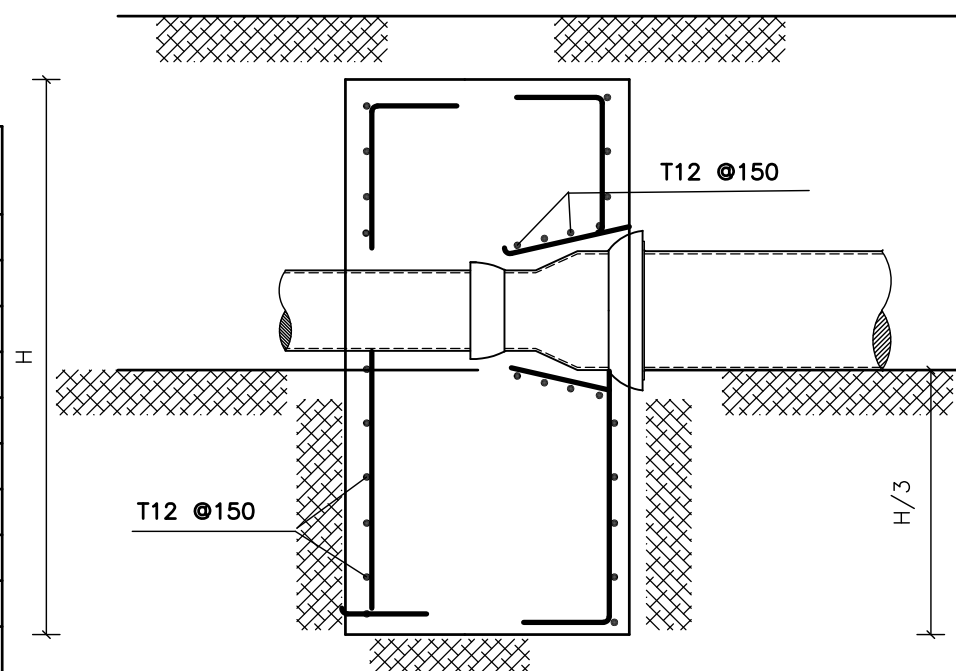


SECTION D-D
VERTICAL BEND ANCHOR BLOCK
DOWNWARD FLOW DIRECTION

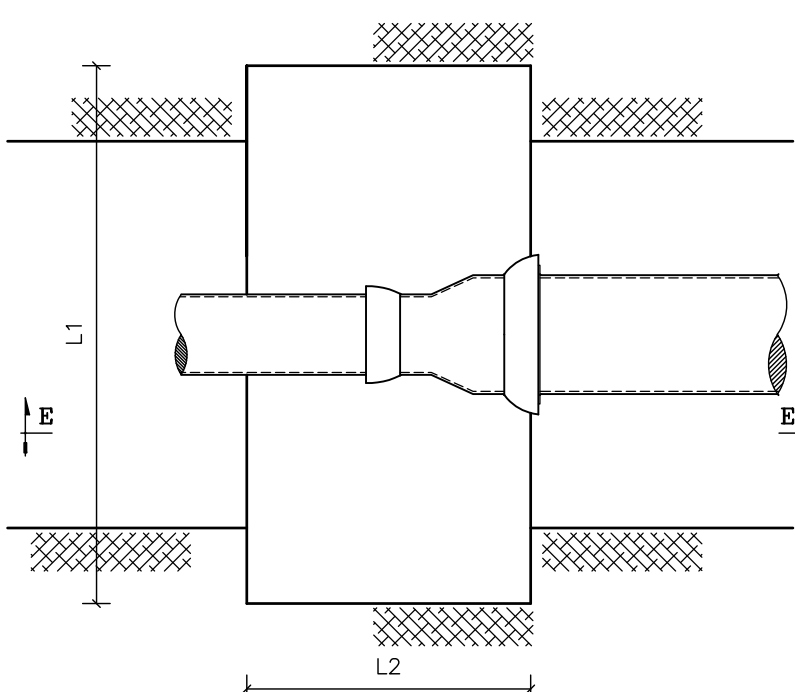
[illegible]

THRUST BLOCK DIMENSIONS

Type	L1 (m)	L2 (m)	H (m)	Volume (m ³)
1	0.50	0.40	0.50	0.10
2	0.60	0.48	0.60	0.17
3	0.70	0.56	0.70	0.27
4	0.80	0.64	0.80	0.41
5	0.90	0.72	0.90	0.58
6	1.00	0.80	1.00	0.80
7	1.20	0.96	1.20	1.38
8	1.40	1.12	1.40	2.20
9	1.60	1.28	1.60	3.28
10	1.80	1.44	1.80	4.67
11	2.00	1.60	2.00	6.40



SECTION I-I
TYPICAL REINFORCEMENT DETAILS



PLAN

Large Diam (mm)	Small Diam (mm)	PRESSURE (BARS)													
		1	5	10	15	20	25	30	35	40	45	50	55	60	
1000	900	9	—	—	—	—	—	—	—	—	—	—	—	—	
1000	800	10	—	—	—	—	—	—	—	—	—	—	—	—	
900	800	8	—	—	—	—	—	—	—	—	—	—	—	—	
900	700	10	—	—	—	—	—	—	—	—	—	—	—	—	
800	700	8	—	—	—	—	—	—	—	—	—	—	—	—	
800	600	9	—	—	—	—	—	—	—	—	—	—	—	—	
800	500	10	—	—	—	—	—	—	—	—	—	—	—	—	
700	600	7	—	—	—	—	—	—	—	—	—	—	—	—	
700	500	9	—	—	—	—	—	—	—	—	—	—	—	—	
600	500	7	11	—	—	—	—	—	—	—	—	—	—	—	
600	450	8	—	—	—	—	—	—	—	—	—	—	—	—	
600	400	8	—	—	—	—	—	—	—	—	—	—	—	—	
500	450	6	9	11	—	—	—	—	—	—	—	—	—	—	
500	400	6	11	—	—	—	—	—	—	—	—	—	—	—	
500	350	7	—	—	—	—	—	—	—	—	—	—	—	—	
450	400	5	8	10	—	—	—	—	—	—	—	—	—	—	
450	350	6	10	—	—	—	—	—	—	—	—	—	—	—	
450	300	7	—	—	—	—	—	—	—	—	—	—	—	—	
400	350	5	8	10	—	—	—	—	—	—	—	—	—	—	
400	300	5	10	—	—	—	—	—	—	—	—	—	—	—	
400	250	6	11	—	—	—	—	—	—	—	—	—	—	—	
350	300	4	8	10	11	—	—	—	—	—	—	—	—	—	
300	250	4	7	9	10	11	—	—	—	—	—	—	—	—	
300	200	4	9	11	—	—	—	—	—	—	—	—	—	—	
300	150	5	10	—	—	—	—	—	—	—	—	—	—	—	
250	200	3	7	9	10	11	—	—	—	—	—	—	—	—	
250	150	3	8	10	—	—	—	—	—	—	—	—	—	—	
250	125	4	9	11	—	—	—	—	—	—	—	—	—	—	
200	150	3	6	8	9	10	11	11	—	—	—	—	—	—	
200	125	3	7	9	10	11	—	—	—	—	—	—	—	—	
200	100	3	7	9	11	—	—	—	—	—	—	—	—	—	
150	125	2	3	5	7	7	8	8	9	9	9	10	10	10	
150	100	2	5	7	8	9	9	10	11	11	—	—	—	—	
150	80	2	6	8	9	10	10	11	—	—	—	—	—	—	
125	100	2	2	4	6	7	7	8	8	9	9	9	9	10	
125	80	2	4	6	7	8	9	9	10	10	10	11	11	11	
100	80	2	2	3	4	5	6	7	7	7	8	8	8	8	

BASIC DATA :

SOIL DENSITY	1800	kg/m ³
PIPE MATERIAL DENSITY (DUCTILE IRON)	7050	kg/m ³
WATER SPECIFIC WEIGHT	1000	kg/m ³
CONCRETE SPECIFIC WEIGHT	2300	kg/m ³
SOIL INTERNAL FRICTION ANGLE	25°	
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm ²
SOIL—CONCRETE FRICTION ANGLE	2/3 × 25°	

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION



BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

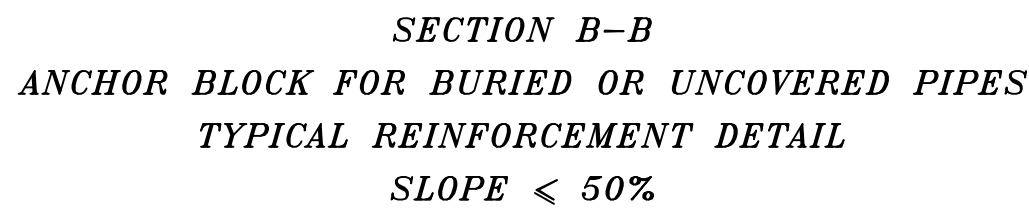
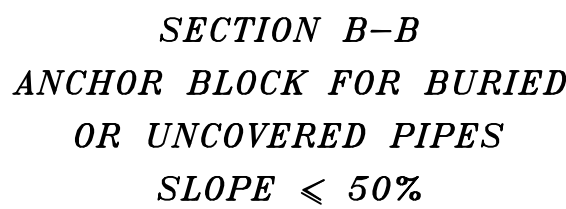
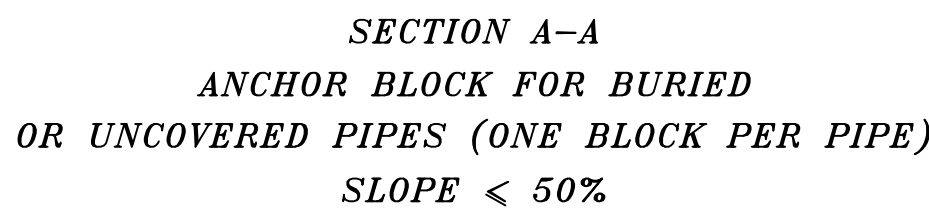
JALL ED DIB - HAJAL Bldg
P.O.BOX:70492 - ANTELIA

CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND DISTRIBUTION SYSTEMS	PIPELINE THRUST BLOCKS
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<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-STDP01-16	BTD	BTD	BTD

<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
JULY 2019	NOT TO SCALE	9/16	509W-STDP09



Diam (mm)	SLOPE																	
	25%			30%			35%			40%			45%			50% *		
	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)
1000	0.300	1.650	1.850	0.300	1.700	1.850	0.300	1.750	1.850	0.500	1.800	1.850	0.650	1.900	1.850	0.800	1.950	1.850
900	0.300	1.550	1.750	0.300	1.600	1.750	0.300	1.650	1.750	0.450	1.700	1.750	0.600	1.750	1.750	0.750	1.850	1.750
800	0.300	1.450	1.600	0.300	1.500	1.600	0.300	1.550	1.600	0.400	1.600	1.600	0.550	1.650	1.600	0.650	1.700	1.600
700	0.300	1.350	1.450	0.300	1.400	1.450	0.300	1.450	1.450	0.400	1.450	1.450	0.500	1.500	1.450	0.600	1.600	1.450
600	0.300	1.250	1.350	0.300	1.300	1.350	0.300	1.350	1.350	0.350	1.350	1.350	0.450	1.400	1.350	0.550	1.450	1.350
500	0.300	1.150	1.200	0.300	1.200	1.200	0.300	1.200	1.200	0.300	1.250	1.200	0.350	1.250	1.200	0.450	1.300	1.200
450	0.300	1.100	1.150	0.300	1.150	1.150	0.300	1.150	1.150	0.300	1.200	1.150	0.350	1.200	1.150	0.400	1.250	1.150
400	0.300	1.050	1.050	0.300	1.100	1.050	0.300	1.100	1.050	0.300	1.150	1.050	0.300	1.150	1.050	0.400	1.200	1.050
350	0.300	1.000	1.000	0.300	1.050	1.000	0.300	1.050	1.000	0.300	1.100	1.000	0.300	1.100	1.000	0.350	1.150	1.000
300	0.300	0.950	0.950	0.300	1.000	0.950	0.300	1.000	0.950	0.300	1.000	0.950	0.300	1.050	0.950	0.300	1.050	0.950
250	0.300	0.900	0.850	0.300	0.950	0.850	0.300	0.950	0.850	0.300	0.950	0.850	0.300	1.000	0.850	0.300	1.000	0.850
200	0.300	0.850	0.800	0.300	0.900	0.800	0.300	0.900	0.800	0.300	0.900	0.800	0.300	0.950	0.800	0.300	0.950	0.800
150	0.300	0.800	0.750	0.300	0.850	0.750	0.300	0.850	0.750	0.300	0.850	0.750	0.300	0.900	0.750	0.300	0.900	0.750
125	0.300	0.800	0.700	0.300	0.800	0.700	0.300	0.800	0.700	0.300	0.850	0.700	0.300	0.850	0.700	0.300	0.850	0.700
100	0.300	0.750	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.850	0.650
80	0.300	0.700	0.650	0.300	0.750	0.650	0.300	0.750	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.800	0.650

700

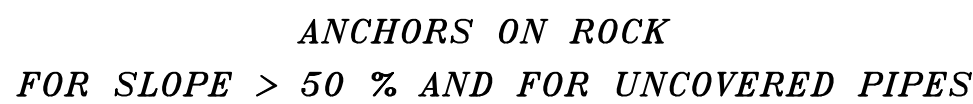
200

4T16

1STIRRUP T8 @100mm

[illegible]

Diam (mm)	Slope																	
	25%			30%			35%			40%			45%			50%		
	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)	L (m)	H (m)	B (m)
1000	1.200	1.800	1.800	1.350	1.900	1.850	1.450	1.950	1.850	1.550	2.050	1.850	1.600	2.100	1.850	1.650	2.200	1.850
900	1.100	1.700	1.500	1.250	1.750	1.750	1.350	1.850	1.750	1.400	1.900	1.750	1.450	1.950	1.750	1.500	2.050	1.750
800	1.050	1.600	1.400	1.150	1.650	1.600	1.250	1.700	1.600	1.300	1.750	1.600	1.350	1.850	1.600	1.400	1.900	1.600
700	0.950	1.450	1.300	1.050	1.500	1.450	1.150	1.600	1.450	1.200	1.650	1.450	1.250	1.700	1.450	1.300	1.750	1.450
600	0.800	1.350	1.200	0.900	1.400	1.350	0.950	1.450	1.350	1.050	1.500	1.350	1.100	1.550	1.350	1.100	1.600	1.350
500	0.650	1.250	1.100	0.750	1.250	1.200	0.800	1.300	1.200	0.850	1.350	1.200	0.900	1.400	1.200	0.950	1.450	1.200
450	0.600	1.150	1.050	0.700	1.200	1.150	0.750	1.250	1.150	0.800	1.300	1.150	0.850	1.350	1.150	0.850	1.350	1.150
400	0.550	1.100	1.000	0.650	1.150	1.050	0.700	1.200	1.050	0.750	1.200	1.050	0.750	1.250	1.050	0.800	1.300	1.050
350	0.500	1.050	0.750	0.550	1.100	1.000	0.600	1.100	1.000	0.650	1.150	1.000	0.700	1.200	1.000	0.700	1.200	1.000
300	0.450	1.000	0.700	0.500	1.000	0.950	0.550	1.050	0.950	0.550	1.050	0.950	0.600	1.100	0.950	0.600	1.150	0.950
250	0.350	0.950	0.650	0.400	0.950	0.850	0.450	1.000	0.850	0.500	1.000	0.850	0.500	1.050	0.850	0.500	1.050	0.850
200	0.300	0.850	0.600	0.300	0.900	0.800	0.350	0.900	0.800	0.400	0.950	0.800	0.400	0.950	0.800	0.400	0.950	0.800
150	0.300	0.800	0.550	0.300	0.850	0.750	0.300	0.850	0.750	0.300	0.850	0.750	0.350	0.900	0.750	0.350	0.900	0.750
125	0.300	0.800	0.525	0.300	0.800	0.700	0.300	0.800	0.700	0.300	0.850	0.700	0.300	0.850	0.700	0.300	0.850	0.700
100	0.300	0.750	0.500	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.850	0.650
80	0.300	0.750	0.480	0.300	0.750	0.650	0.300	0.750	0.650	0.300	0.800	0.650	0.300	0.800	0.650	0.300	0.800	0.650



SOIL DENSITY	1800	kg/m ³
PIPE MATERIAL DENSITY (DUCTILE IRON)	7050	kg/m ³
WATER SPECIFIC WEIGHT	1000	kg/m ³
CONCRETE SPECIFIC WEIGHT	2300	kg/m ³
SOIL INTERNAL FRICTION ANGLE	25°	
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm ²
SOIL-CONCRETE FRICTION ANGLE	2/3 × 25°	

<i>Rev.</i>	<i>Date</i>	<i>Dsgn</i>	<i>Drwn</i>	<i>Chk'd</i>	<i>Appr'd</i>

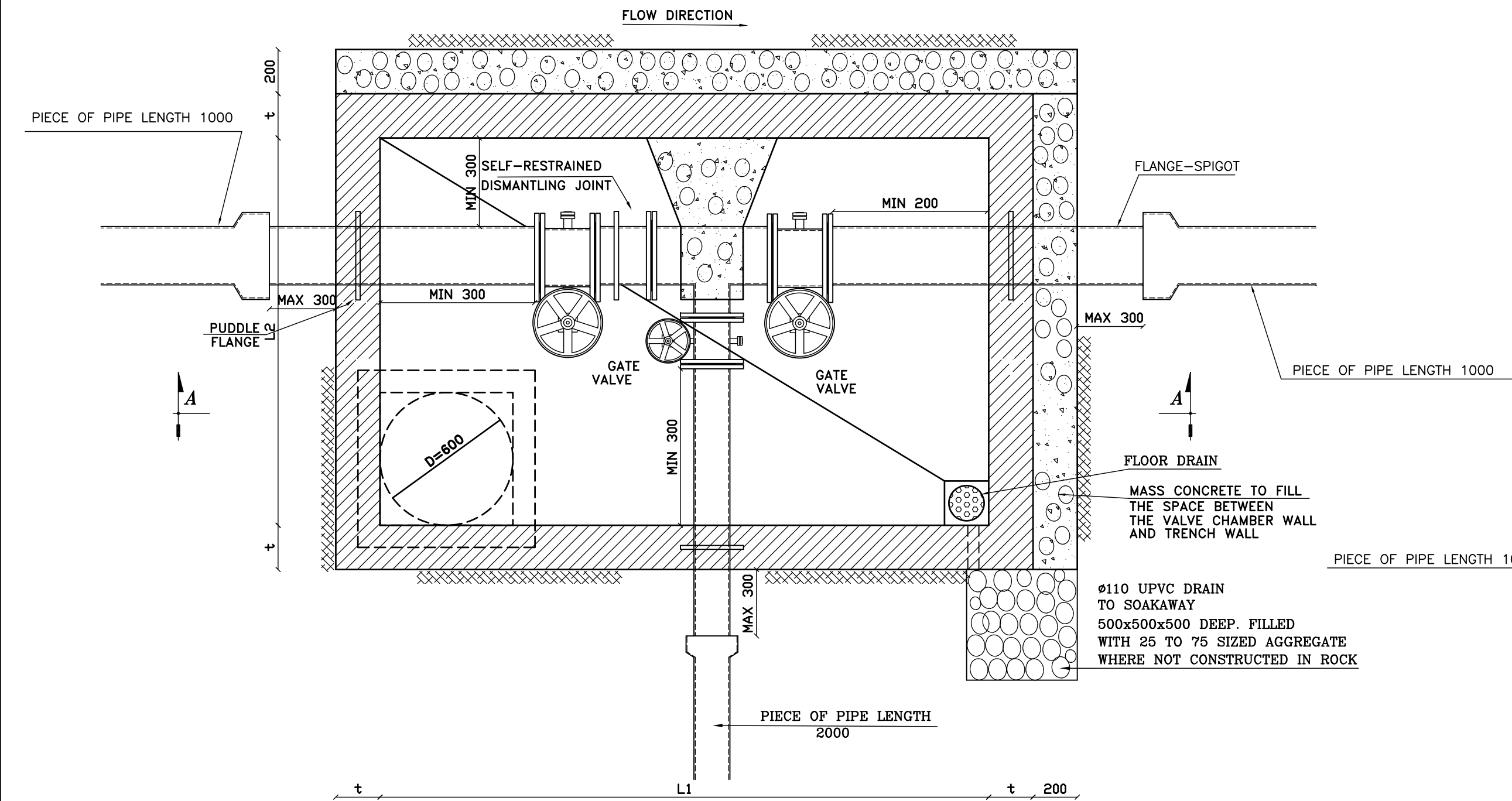
ED BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg PHONE: (04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANELIAS FAX: (04) 712159

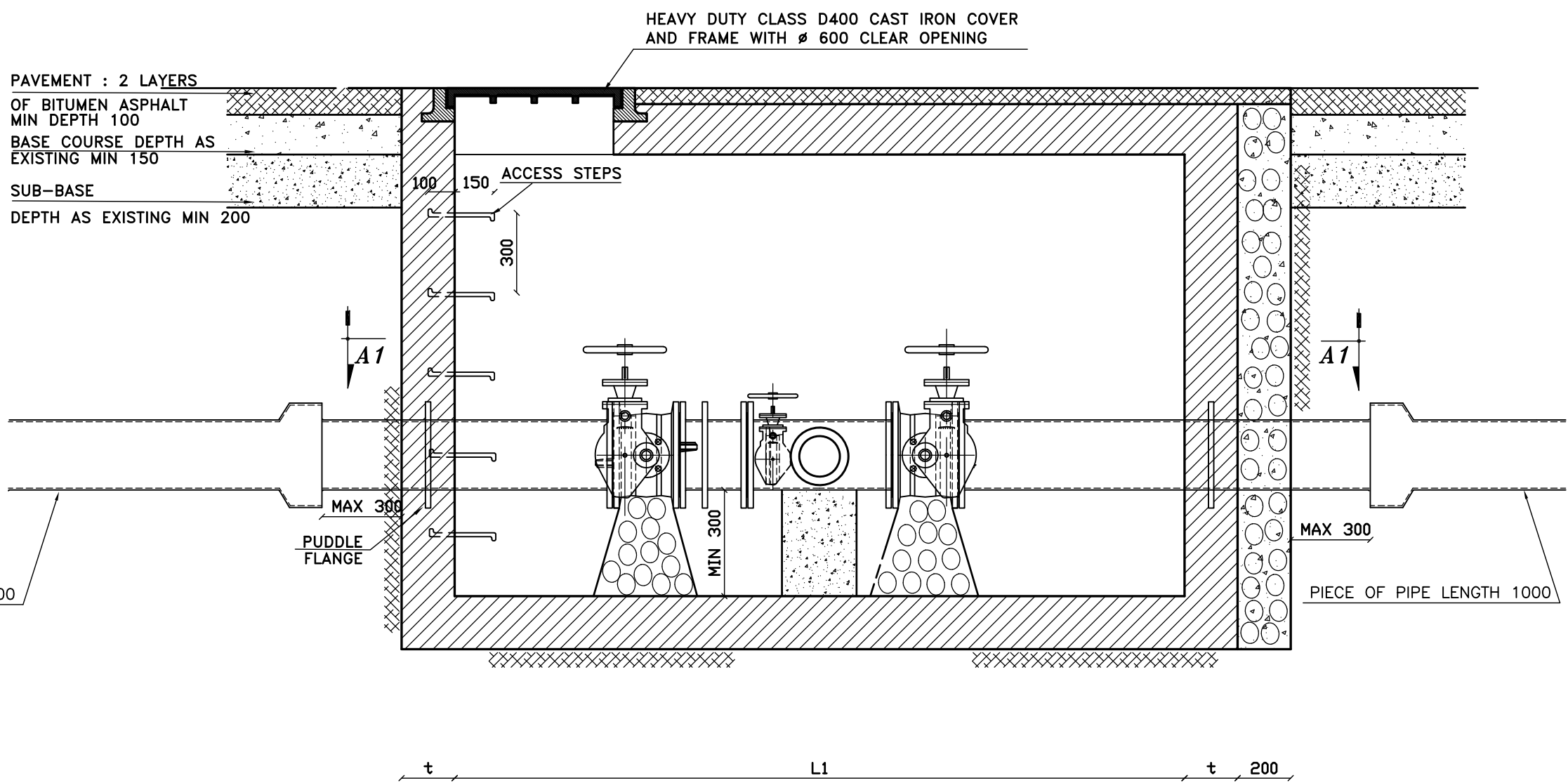
PIPELINE ANCHOR BLOCKS

<i>FILE NAME</i>	<i>DESIGNED BY</i>	<i>DRAWN BY</i>	<i>CHECKED BY</i>
509W-STDP01-16	BTD	BTD	BTD

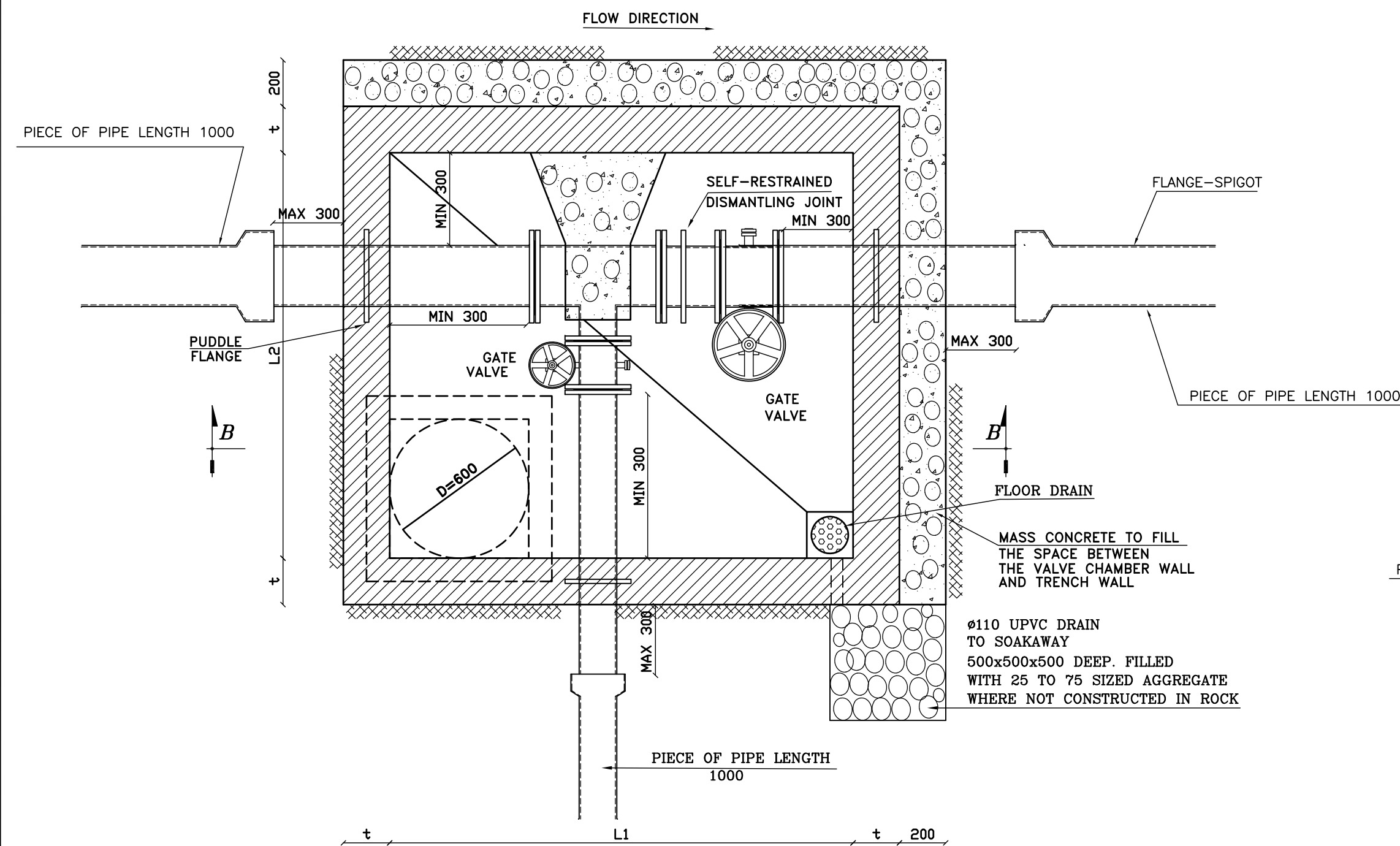
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JULY 2019	NOT TO SCALE	10/16	509W-STDP10



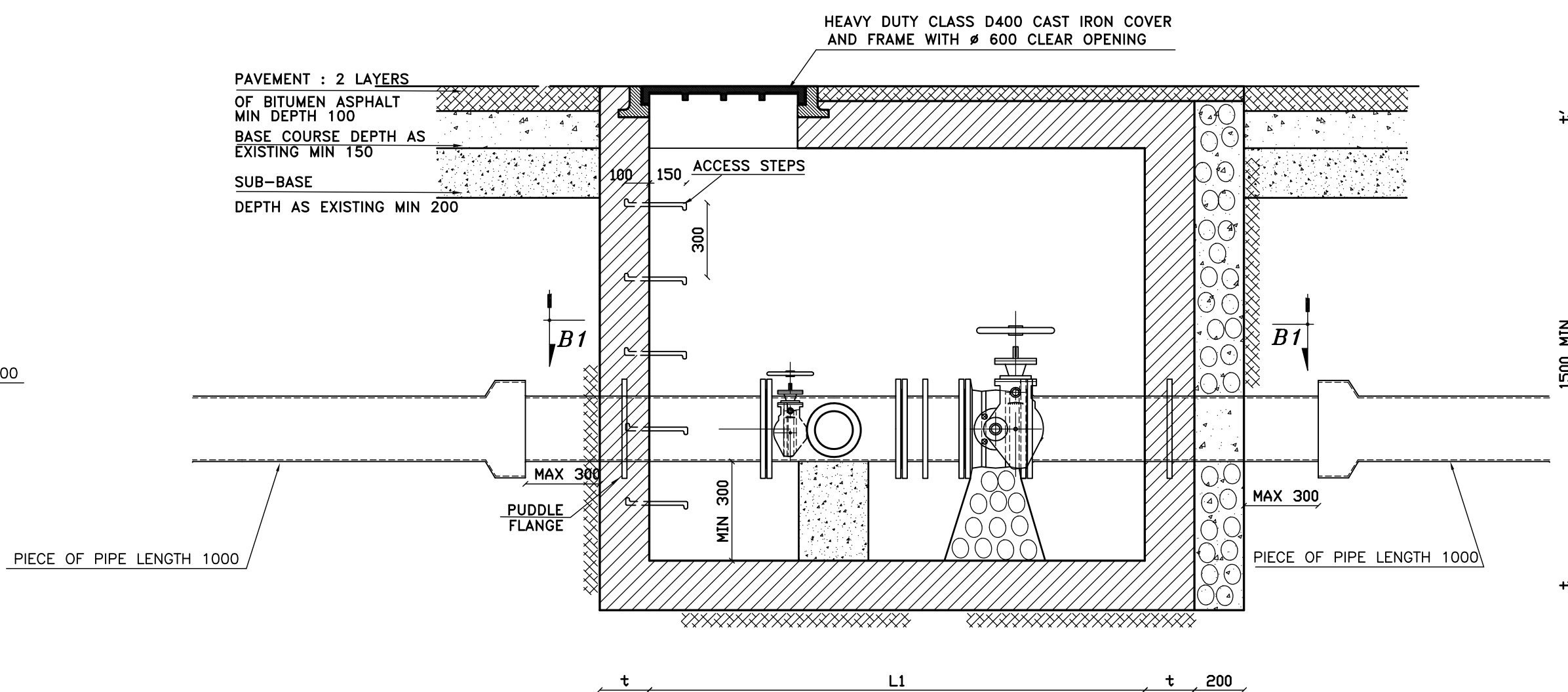
SECTION A1-A1



SECTION A-A



SECTION B1-B1



SECTION B-B

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m³

BLINDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=400 MPa.
MILD STEEL BARS: SYMBOL Ø YIELD STRESS: Fy=215 MPa.

STRESSES:
SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c =25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t =2.1 MPa.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50Ø.
(Ø= NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS Ø8 SHALL BE USED ON EACH LAP.

BENDING:
Ø > 12mm MECHANICAL.
Ø ≤ 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE
(METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE

REMARKS:
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL DIMENSIONS ARE IN MILLIMETERS.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* SOIL FRICTION ANGLE SHALL BE 25°
* GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 tg Ø
* THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS "200".

SOAKAWAY
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO
A FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.

* T.P. =TEST PRESSURE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

ED BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB - HAJIAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAJ FAX: (04) 712159

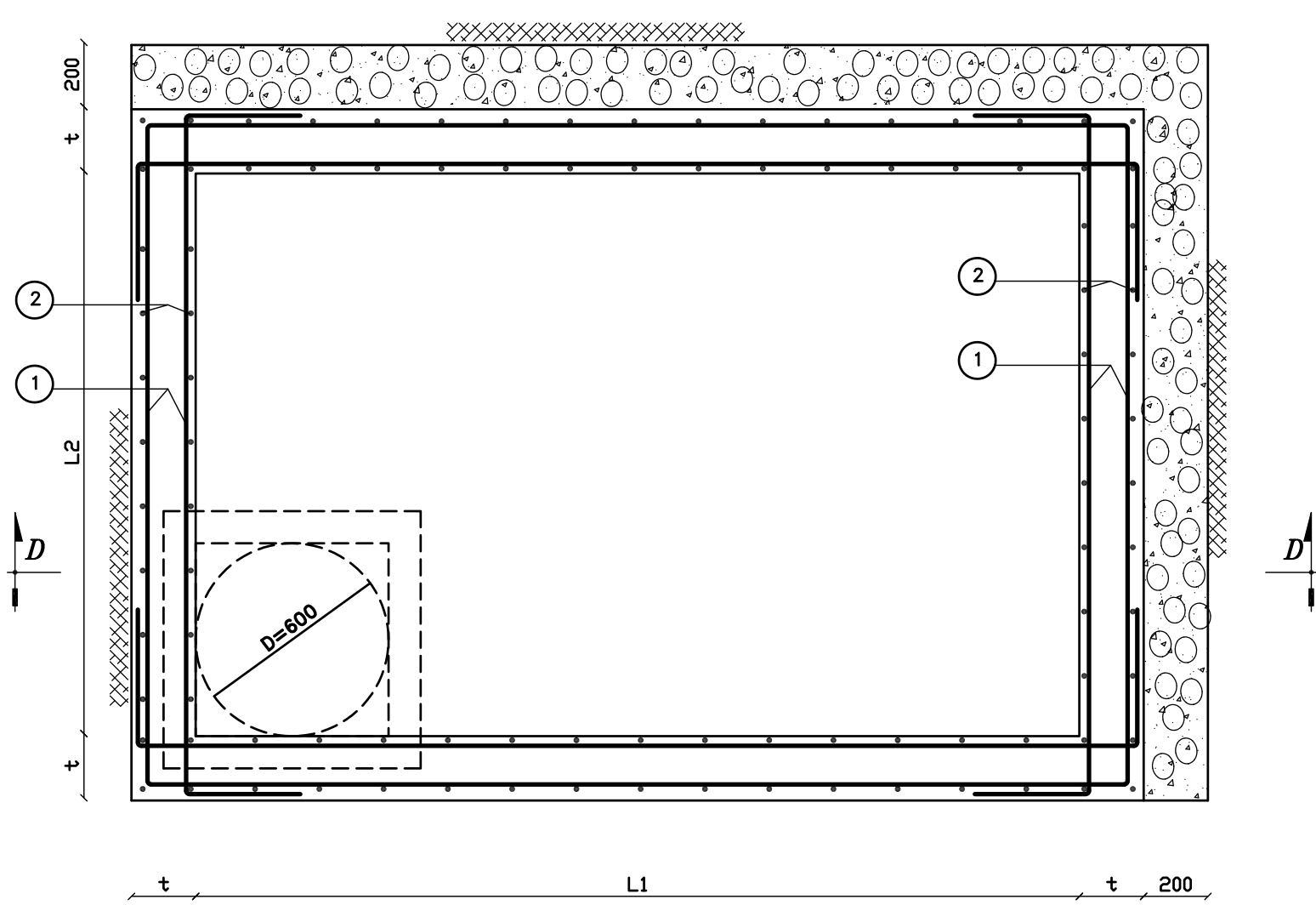
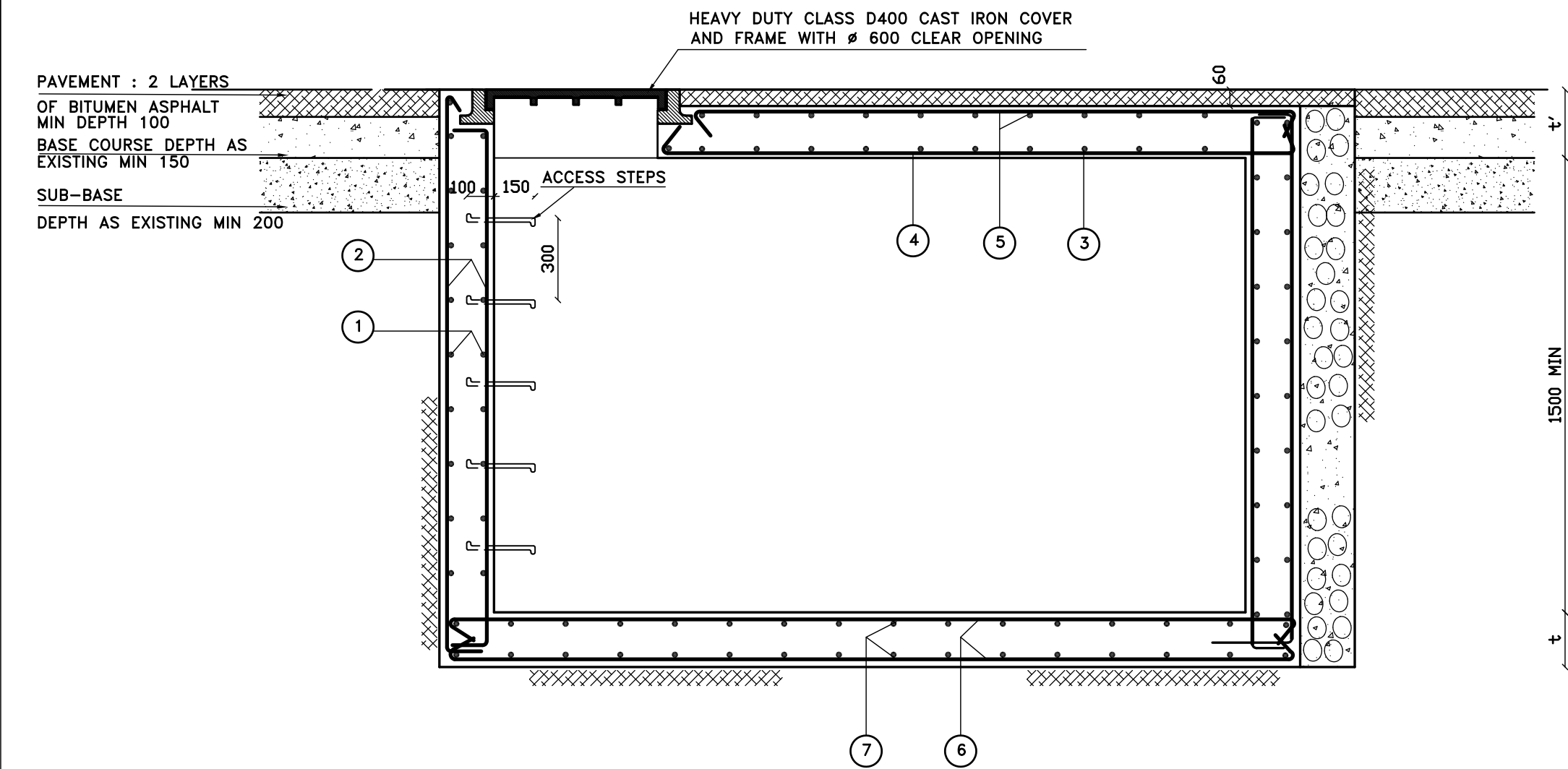
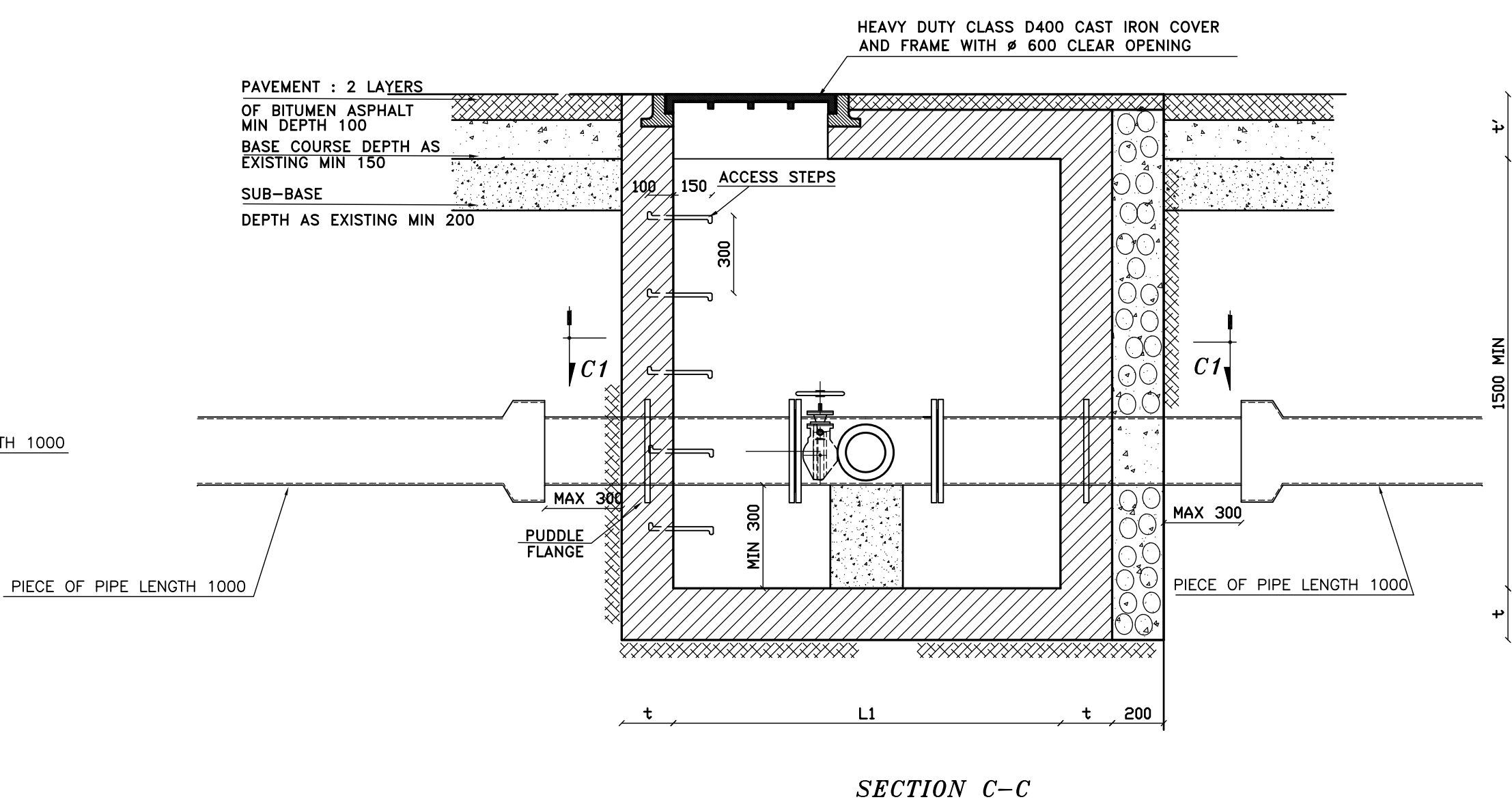
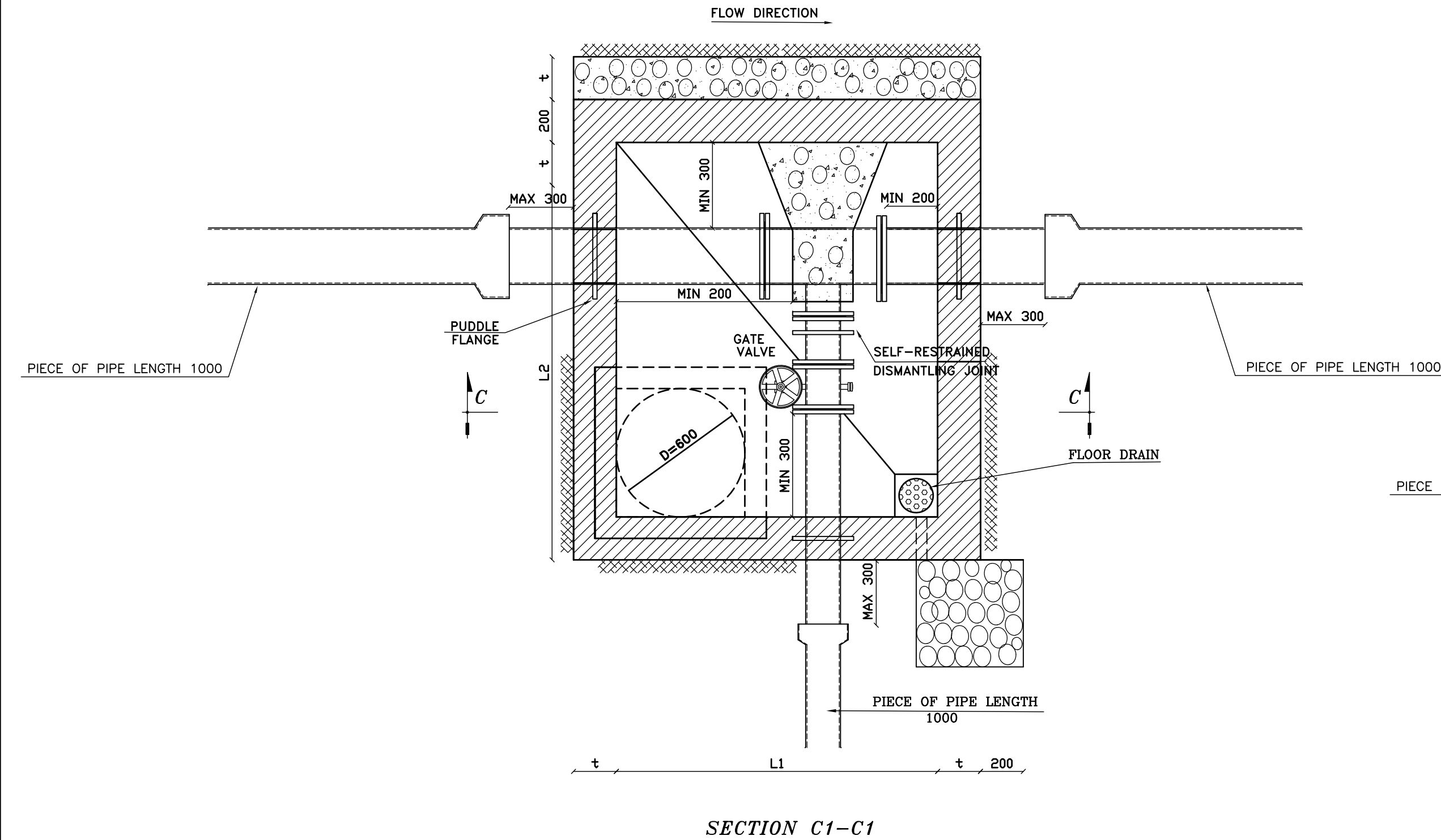
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

TYPICAL VALVE CHAMBER DETAILS

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	11/16	509W-STDP11



VALVE CHAMBER DIMENSIONS	
TYPE	LxLxL2
R1	1000x1250
R2	1250x1000
R3	1250x1500
R4	1250x1750
R5	1500x1000
R6	1500x1500
R7	1500x1750
R8	1750x1250
R9	1750x1500
R10	1750x2000
R11	1750x2250
R12	2000x1500
R13	2000x1750
R14	2250x1500
R15	2250x1750
R16	2250x2000
R17	2500x1500
R18	2500x1750
R19	2500x2000
R20	2500x2250
R21	2750x1500

VALVE CHAMBER DIMENSIONS	
TYPE	LxLxL2
R22	2750x1750
R23	2750x2000
R24	2750x2250
R25	2750x2500
R26	3000x1750
R27	3000x2000
R28	3000x2250
R29	3000x2500
R30	3000x2750
R31	3250x1750
R32	3500x1750
R33	3500x2000
R34	3500x2250
R35	3750x1750
R36	3750x2000
R37	3750x2250
R38	3750x2500
R39	4250x2000
R40	4250x2250
R41	4250x2500
R42	4250x2750

VALVE CHAMBER TYPE

BRANCH DIAM NBR OF MAIN PIPE VALVES	60			80			100			125			150			200			250			300			350			400			450			500			600		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
80	R1	-	-	-	R6	R12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
100	R1	-	-	-	R3	R6	R12	-	R6	R12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
125	R1	-	-	-	R3	R9	R14	R3	R9	R14	-	R9	R14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
150	-	-	-	-	R3	R9	R17	R3	R9	R17	R3	R9	R17	-	R9	R17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
200	-	-	-	-	R3	R12	R21	R4	R12	R21	R4	R12	R21	-	R13	R22	-	R13	R22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
250	-	-	-	-	-	R12	R21	-	R12	R21	R4	R12	R21	R7	R13	R22	-	R13	R22	-	R13	R22	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
300	-	-	-	-	-	R14	R26	-	R15	R26	-	R15	R26	R7	R15	R26	R7	R15	R26	-	R15	R26	-	R16	R27	-	-	-	-	-	-	-	-	-	-	-			
350	-	-	-	-	-	R15	R31	-	R18	R32	-	R20	R34	R7	R18	R32	R7	R18	R32	R10	R19	R33	-	R19	R33	-	R19	R33	-	-	-	-	-	-	-				
400	-	-	-	-	-	R18	R32	-	R18	R32	-	R20	R34	-	R18	R32	R10	R19	R33	R10	R19	R33	-	R19	R33	-	R20	R34	-	R20	R34	-	-	-	-	-			
450	-	-	-	-	-	R19	R33	-	R18	R32	-	R20	R34	-	R19	R33	R10	R19	R33	R10	R19	R33	R11	R20	R34	-	R20	R34	-	R20	R34	-	R20	R34	-	-			
500	-	-	-	-	-	R23	R36	-	R22	R35	-	R24	R37	-	R23	R36	-	R23	R36	R10	R23	R36	R11	R24	R37	R11	R24	R37	-	R24	R37	-	R25	R38	-	-			
600	-	-	-	-	-	R28	R40	-	R27	R39	-	R29	R41	-	R27	R39	-	R27	R39	R11	R28	R40	R11	R28	R40	R11	R28	R40	R11	R29	R41	-	R29	R41	-	R29	R41	-	R30

REINFORCEMENT STEEL TABLE

VALVE CHAMBER	THICKNESS		REINFORCEMENT							
TYPE	t mm	t' mm	1	2	3	4	5	6	7	
R1-R5	200	250	T14 Ø200	T14 Ø200	T16 Ø200	T14 Ø200	2xT12 Ø200	T14 Ø200	T14 Ø200	
R6-R11	200	250	T14 Ø165	T14 Ø165	T16 Ø165	T14 Ø165	2xT12 Ø165	T14 Ø165	T14 Ø165	
R11-R23	200	250	T14 Ø150	T14 Ø150	T14 Ø150	T14 Ø150	2xT12 Ø150	T14 Ø150	T14 Ø150	
R23-R38	250	300	T16 Ø200	T16 Ø200	T20 Ø200	T14 Ø200	2xT12 Ø200	T16 Ø200	T16 Ø200	
R39-R42	300	300	T16 Ø165	T16 Ø165	T20 Ø165	T14 Ø165	2xT12 Ø165	T16 Ø165	T16 Ø165	

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m3

BLINDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 kg/m3.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: $F_y=400$ MPa.
MILD STEEL BARS: SYMBOL Ø YIELD STRESS: $F_y=215$ MPa.

STRESSES:
SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: $f_c=25$ MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: $f_t=2.1$ MPa.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN $2 \times 50 \phi$.
(ϕ = NOMINAL DIAMETER OF BAR).
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS Ø8 SHALL BE USED ON EACH LAP.

BENDING:
 $\phi > 12$ mm MECHANICAL.
 $\phi \leq 12$ mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE
(METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE

REMARKS:
* HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
* ALL DIMENSIONS ARE IN MILLIMETERS.
* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* SOIL FRICTION ANGLE SHALL BE 25°
* GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE $2/3 \tan \phi$
* THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS "200".

SOAKAWAY
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO
A FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.

* T.P.=TEST PRESSURE

Rev. Date Dsgn Drwn Chk'd Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
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P.O.BOX:70492 - ANTELJAS FAX: (04) 712159

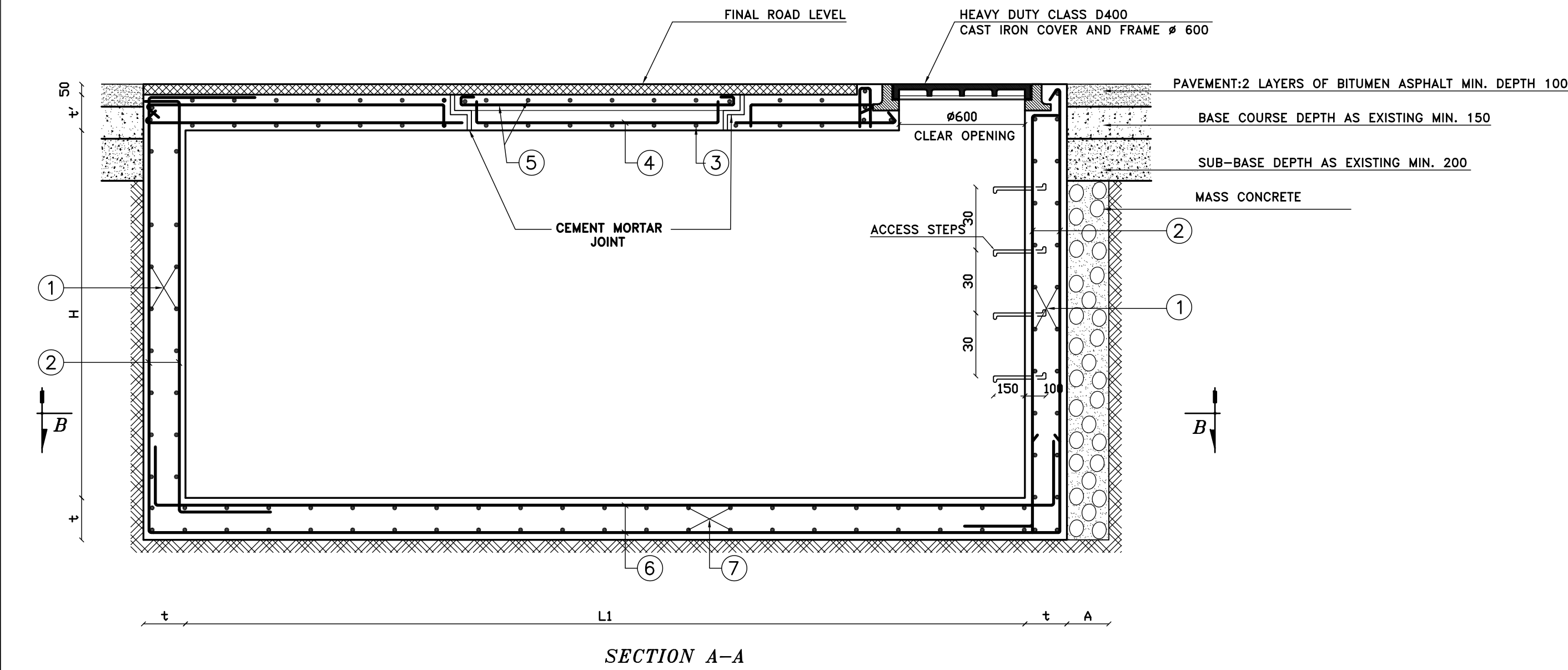
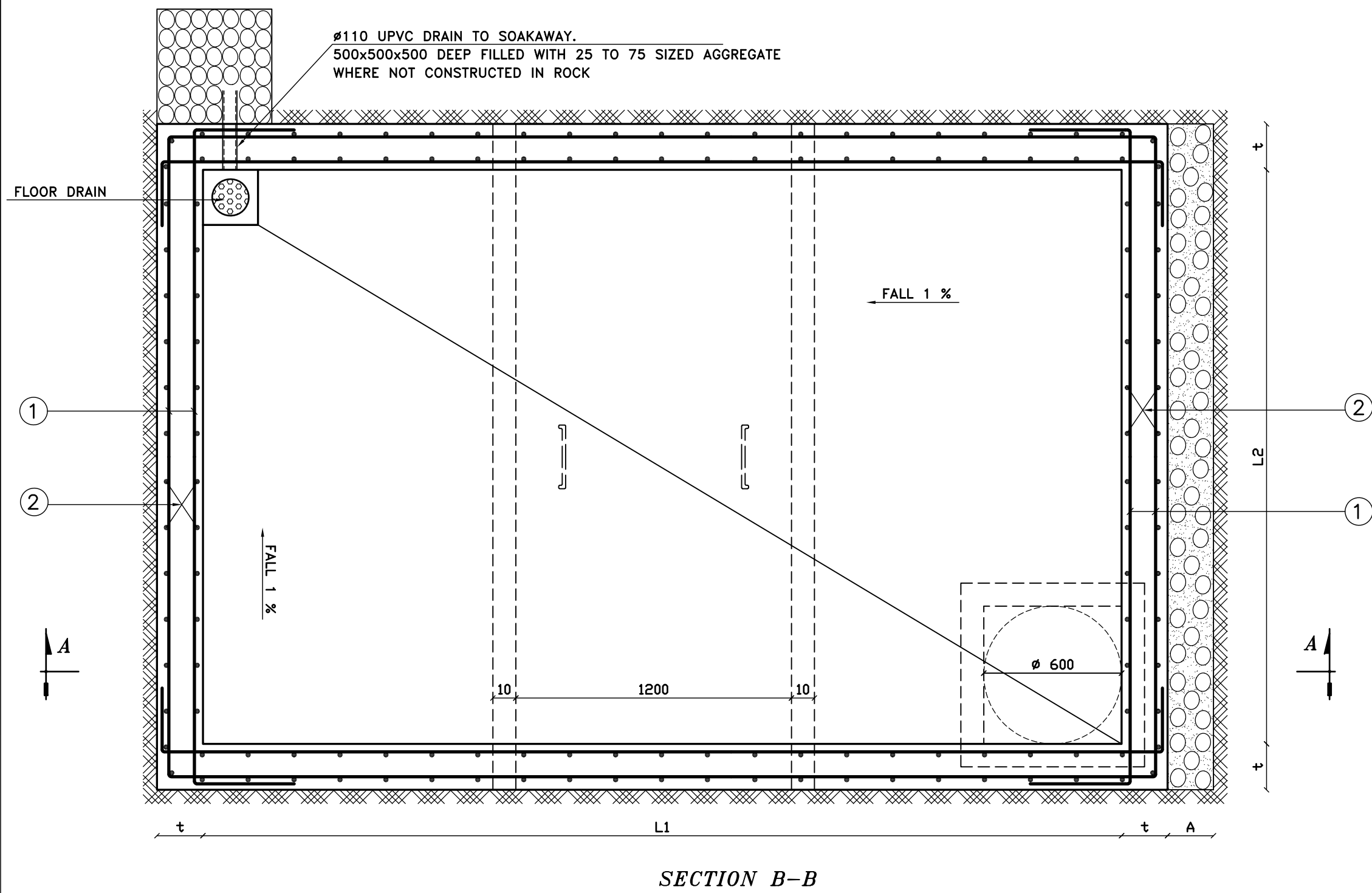
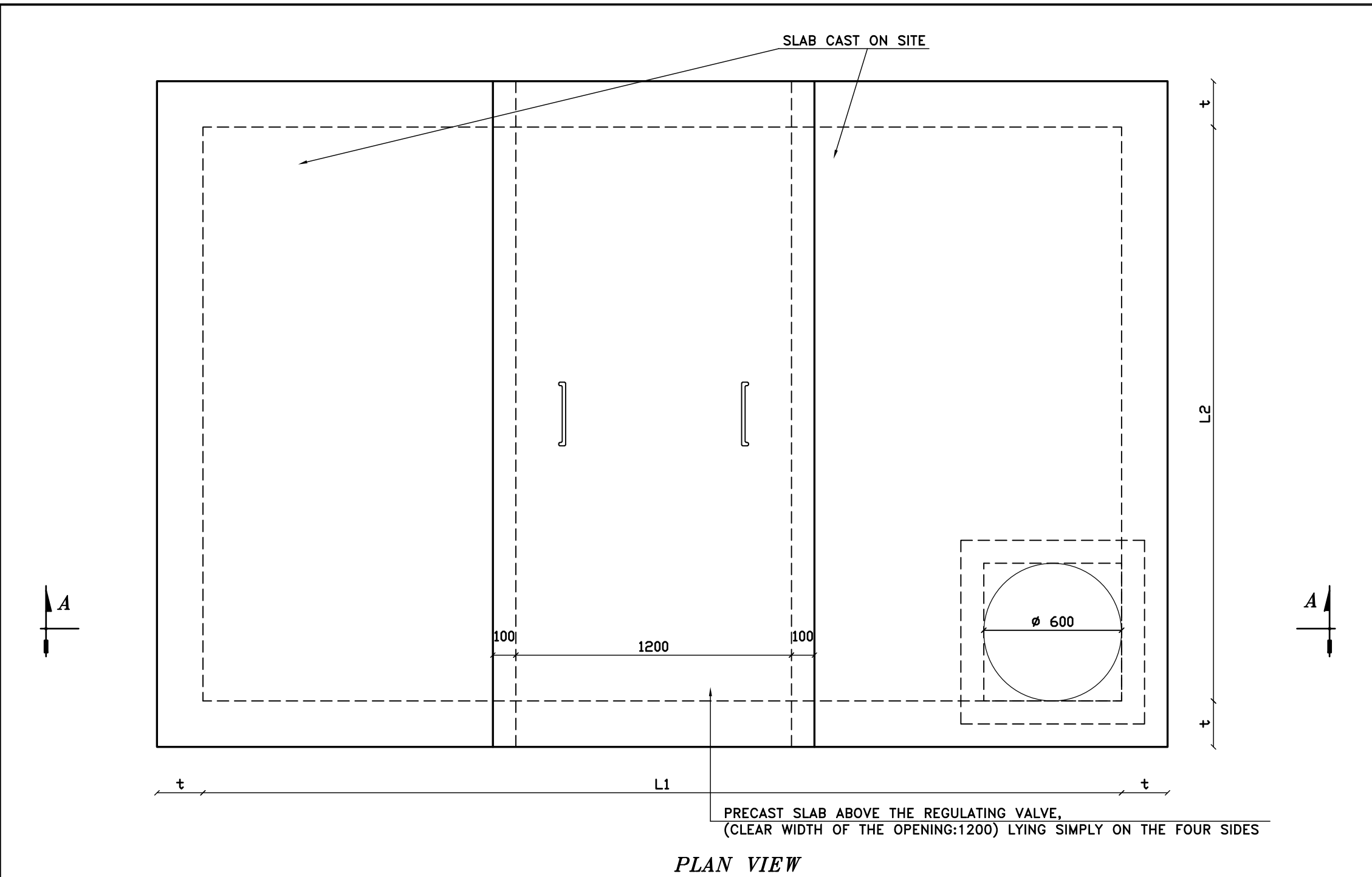
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

TYPICAL VALVE CHAMBER DETAILS

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	NOT TO SCALE	12/16	509W-STDP12



MAIN PIPE DIAMETER	REGULATING PIPE DIAMETER	BY PASS DIAMETER	UPSTREAM PRESSURE-DOWNSTREAM PRESSURE <25 BARS				
			AIR RELIEF VALVE DIAMETER	LENGTH	WIDTH	HEIGHT	BLOCK THICKNESS
D mm	dr mm	db mm	dv mm	L1 mm	L2 mm	H mm	A mm
80	80	80	60	2500	1750	2000	200
100	80	80	60	2500	1750	2000	200
150	100	80	60	2500	1750	2000	200
200	150	100	60	3600	2000	2000	200
250	200	150	60	3600	2000	2000	200
300	250	200	80	3600	2000	2000	200
350	300	250	80	4000	2500	2000	200
400	300	250	80	4000	2500	2000	200
450	350	250	100	4000	2500	2000	200
500	400	300	100	4200	2750	2000	200
600	500	400	100	5000	3100	2000	200
700	500	400	150	5000	3100	2000	200
800	600	400	150	5500	3100	2100	200

* UPSTREAM PRESSURE - DOWNSTREAM PRESSURE < 16 BARS.

MAIN PIPE DIAMETER	REGULATING PIPE DIAMETER	BYPASS DIAMETER	UP STREAM PRESSURE-DOWN STREAM PRESSURE < 20 BARS										20 BARS < UPSTREAM PRESSURE-DOWNSTREAM PRESSURE <25 BARS									
			REINFORCEMENT							THICKNESS			REINFORCEMENT							THICKNESS		
D mm	dr mm	db mm	1	2	3	4	5	6	7	t mm	t' mm		1	2	3	4	5	6	7	t mm	t' mm	
80	80	80	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250		
100	80	80	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250		
150	100	80	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250		
200	150	100	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250		
250	200	150	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250		
300	250	200	T14Ø165	T14Ø165	T16Ø165	T12Ø165	2xT12Ø165	T14Ø165	T14Ø165	200	250	T16Ø200	T16Ø200	T16Ø165	T12Ø165	2xT12Ø165	T16Ø200	T16Ø200	250	250		
350	300	250	T16Ø200	T16Ø200	T20Ø200	T12Ø200	2xT12Ø200	T16Ø200	T16Ø200	250	300	T16Ø165	T16Ø165	T20Ø165	T12Ø165	2xT12Ø165	T16Ø165	T16Ø165	300	300		
400	300	250	T16Ø200	T16Ø200	T20Ø200	T12Ø200	2xT12Ø200	T16Ø200	T16Ø200	250	300	T16Ø165	T16Ø165	T20Ø165	T12Ø165	2xT12Ø165	T16Ø165	T16Ø165	300	300		
450	350	250	T16Ø200	T16Ø200	T20Ø200	T12Ø200	2xT12Ø200	T16Ø200	T16Ø200	250	300	T16Ø165	T16Ø165	T20Ø165	T12Ø165	2xT12Ø165	T16Ø165	T16Ø165	300	300		
500	400	300	T16Ø165	T16Ø165	T20Ø165	T12Ø165	2xT12Ø165	T16Ø165	T16Ø165	300	300	T16Ø165	T16Ø165	T20Ø165	T12Ø165	2xT12Ø165	T16Ø165	T16Ø165	350	300		
600	500	400	T14Ø200	T14Ø200	T20Ø165	T12Ø165	2xT12Ø165	T14Ø200	T14Ø200	350	300											
700	500	400	T14Ø200	T14Ø200	T20Ø165	T12Ø165	2xT12Ø165	T14Ø200	T14Ø200	400	300											
800*	600	400	T16Ø200	T16Ø200	T20Ø165	T12Ø165	2xT12Ø165	T16Ø200	T16Ø200	400	300											

* UPSTREAM PRESSURE - DOWNSTREAM PRESSURE < 16 BARS.

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m³

BUILDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 Kg/m³

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS: SYMBOL A YIELD STRESS: F_y=235 MPa.

STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c=25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t=2.1 MPa.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50d.
(d= NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.

BENDING:
> 12mm MECHANICAL.
< 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE

REMARKS:

- HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK GROUT BY MEANS OF SPECIAL INJECTION METHODS.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
- SOIL FRICTION ANGLE SHALL BE 25°
- GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 kg #
- THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS 100°.

SOAKAWAY:
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO A FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.

* T.P. =TEST PRESSURE

- LEGEND:**
- (A) PIECE OF PIPE MAX. LENGTH 1000
 - (B) FLANGED REDUCER
 - (C) INTAKE COLLAR
 - (D) PRESSURE GAUGE
 - (E) BUTTERFLY VALVE
 - (F) FILTER WITH WASHOUT VALVE
 - (G) PRESSURE REGULATING VALVE
 - (H) SELF-RESTRAINED DISMANTLING JOINT
 - (I) AIR RELIEF VALVE+ISOLATING BUTTERFLY VALVE
 - (J) PUDDLE FLANGE
 - (K) FLANGE-SPIGOT
 - (L) FLANGE-SOCKET
 - (M) PRESSURE REDUCING DIAPHRAGM

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON

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P.O.BOX:70492 - ANTILIAS FAX: (04) 712159

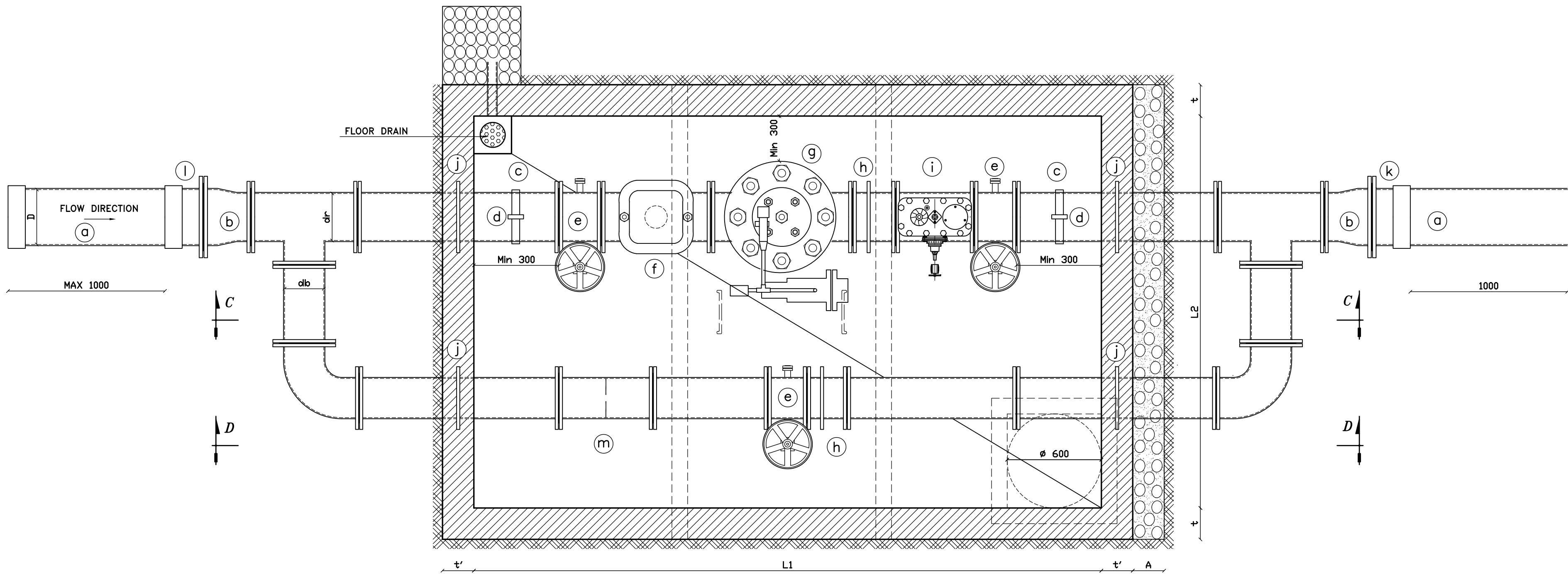
CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

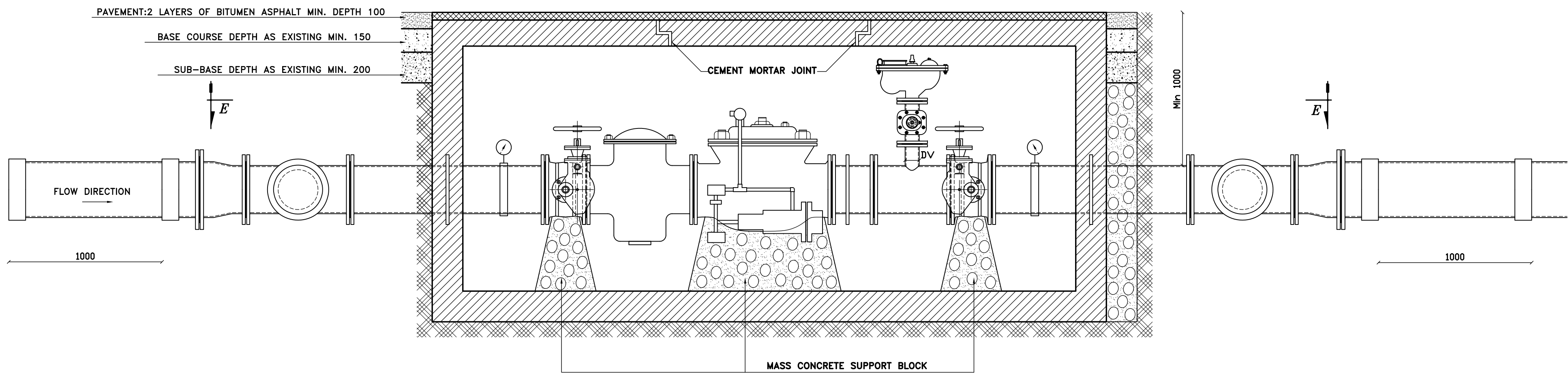
PRESSURE REGULATING AND
PRESSURE SUSTAINING VALVE
DETAILS OF INSTALLATION
AND PROTECTION CHAMBER

DRAWING No.	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

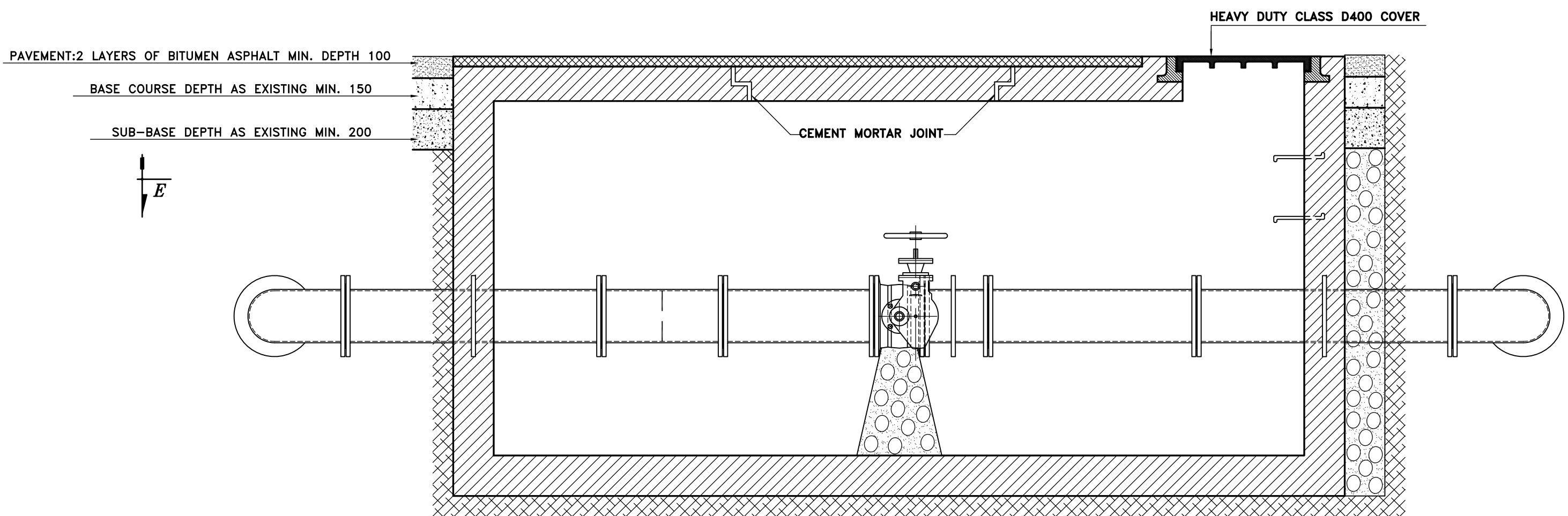
DATE	SCALE	SHEET No.	SEQ No.
JULY 2019	NOT TO SCALE	13/16	509W-STDP13



SECTION E-E



SECTION C-C



SECTION D-D

NOTES:

- REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m³
- BUILDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 Kg/m³
- REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL 7 YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS: SYMBOL 8 YIELD STRESS: F_y=235 MPa.
- STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c = 25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t = 2.1 MPa.
- CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm
- OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 250d.
(d= NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.
- BENDING:
> 12mm MECHANICAL.
< 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.
- FORMWORK:
ALL EXCUTTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).
- WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE
- REMARKS:
• HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
• ALL DIMENSIONS ARE IN MILLIMETERS.
• SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
• SOIL FRICTION ANGLE SHALL BE 25°
• GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 kg #
• THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS 300°.
- SHOWBURY
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO A
FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.
- * T.P. =TEST PRESSURE

LEGEND:

- (a) PIECE OF PIPE MAX. LENGTH 1000
(b) FLANGED REDUCER
(c) INTAKE COLLAR
(d) PRESSURE GAUGE
(e) BUTTERFLY VALVE
(f) FILTER WITH WASHOUT VALVE
(g) PRESSURE REGULATING VALVE or PRESSURE SUSTAINING VALVE
(h) SELF-RESTRAINED DISMANTLING JOINT
(i) AIR RELIEF VALVE+ISOLATING BUTTERFLY VALVE
(j) PUDDLE FLANGE
(k) FLANGE-SPIGOT
(l) FLANGE-SOCKET
(m) PRESSURE REDUCING DIAPHRAGM

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
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CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

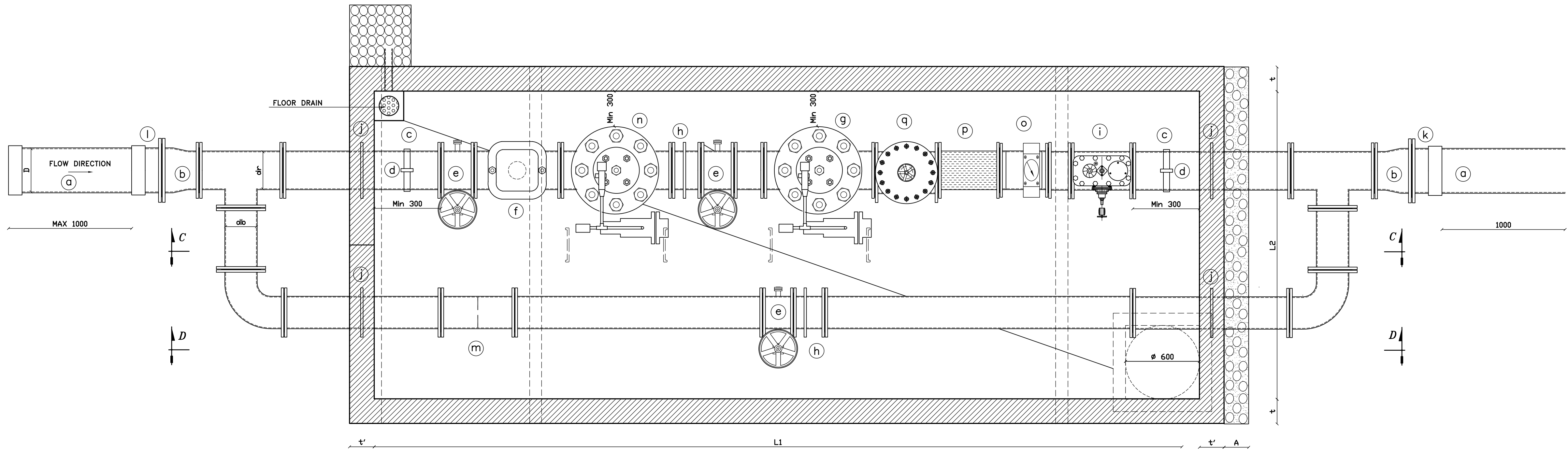
TRANSMISSION AND
DISTRIBUTION SYSTEMS

PRESSURE SUSTAINING AND
PRESSURE REGULATING VALVES
DETAILS OF INSTALLATION
AND PROTECTION CHAMBER

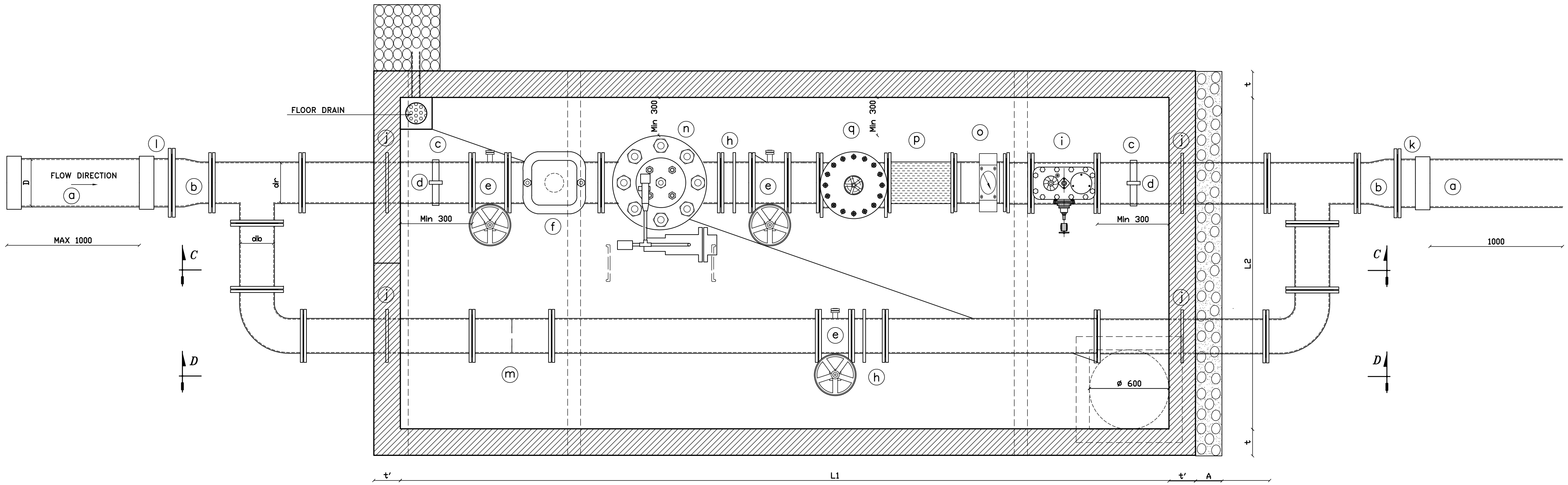
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509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ No.
JULY 2019	NOT TO SCALE	14/16	509W-STDP14

A-TYPICAL DETAIL FOR INSTALLATION OF PRV, PSV AND WATERMETER



B-TYPICAL DETAIL FOR INSTALLATION OF PRV/PSV AND WATERMETER



NOTES:

- REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m³
- BUILDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 Kg/m³
- REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS: SYMBOL # YIELD STRESS: F_y=215 MPa.
- STRESSES:
SEVERE CONTROL:
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: F_c=25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: F_t=2.1 MPa.
- CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm
- OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPLICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50d.
(d= NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #6 SHALL BE USED ON EACH LAP.
- BENDING:
> 12mm MECHANICAL.
< 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.
- FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).
- WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE
- REMARKS:
• HOLES MADE BY THE TIE-RODS SHALL BE FILLED WITH A NON SHRINK
GROUT BY MEANS OF SPECIAL INJECTION METHODS.
• ALL DIMENSIONS ARE IN MILLIMETERS.
• SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
• SOIL FRICTION ANGLE SHALL BE 25°
• GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 kg #
• THE PASSIVE EARTH PRESSURE SHALL BE TAKEN INTO ACCOUNT FOR MANHOLE
STABILITY BY FILLING THE VOID BETWEEN THE MANHOLE AND THE TRENCH
WALL WITH MASS CONCRETE OF A MINIMUM THICKNESS "200".
- REMARKS:
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO A
FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.
- * T.P. =TEST PRESSURE

LEGEND:

- (a) PIECE OF PIPE MAX. LENGTH 1000
(b) FLANGED REDUCER
(c) INTAKE COLLAR
(d) PRESSURE GAUGE
(e) BUTTERFLY VALVE
(f) FILTER WITH WASHOUT VALVE
(g) PRESSURE REGULATING VALVE SPRING LOADED
(h) SELF-RESTRAINED DISMANTLING JOINT
(i) AIR RELIEF VALVE-ISOLATING BUTTERFLY VALVE
(j) PUDDLE FLANGE
(k) FLANGE-SPIGOT
(l) FLANGE-SOCKET
(m) PRESSURE REDUCING DIAPHRAGM
(n) PRESSURE SUSTAINING VALVE SPRING LOADED
(o) WATERMETER
(p) STRAIGHTNER
(q) GLOBE VALVE

Rev. Date Dsgn Drwn Chk'd Appr'd

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JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAJ FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

PRESSURE REGULATING VALVES,
PRESSURE SUSTAINING VALVES,
AND WATERMETERS
DETAILS OF INSTALLATION
AND PROTECTION CHAMBER

DRAWING No. DESIGNED BY DRAWN BY CHECKED BY
509W-STDP01-16 BTB BTB BTB

DATE SCALE SHEET No. SEQ No.
JULY 2019 NOT TO SCALE 15/16 509W-STDP15

A-TYPICAL DETAIL FOR INSTALLATION OF PRV, PSV AND WATERMETER

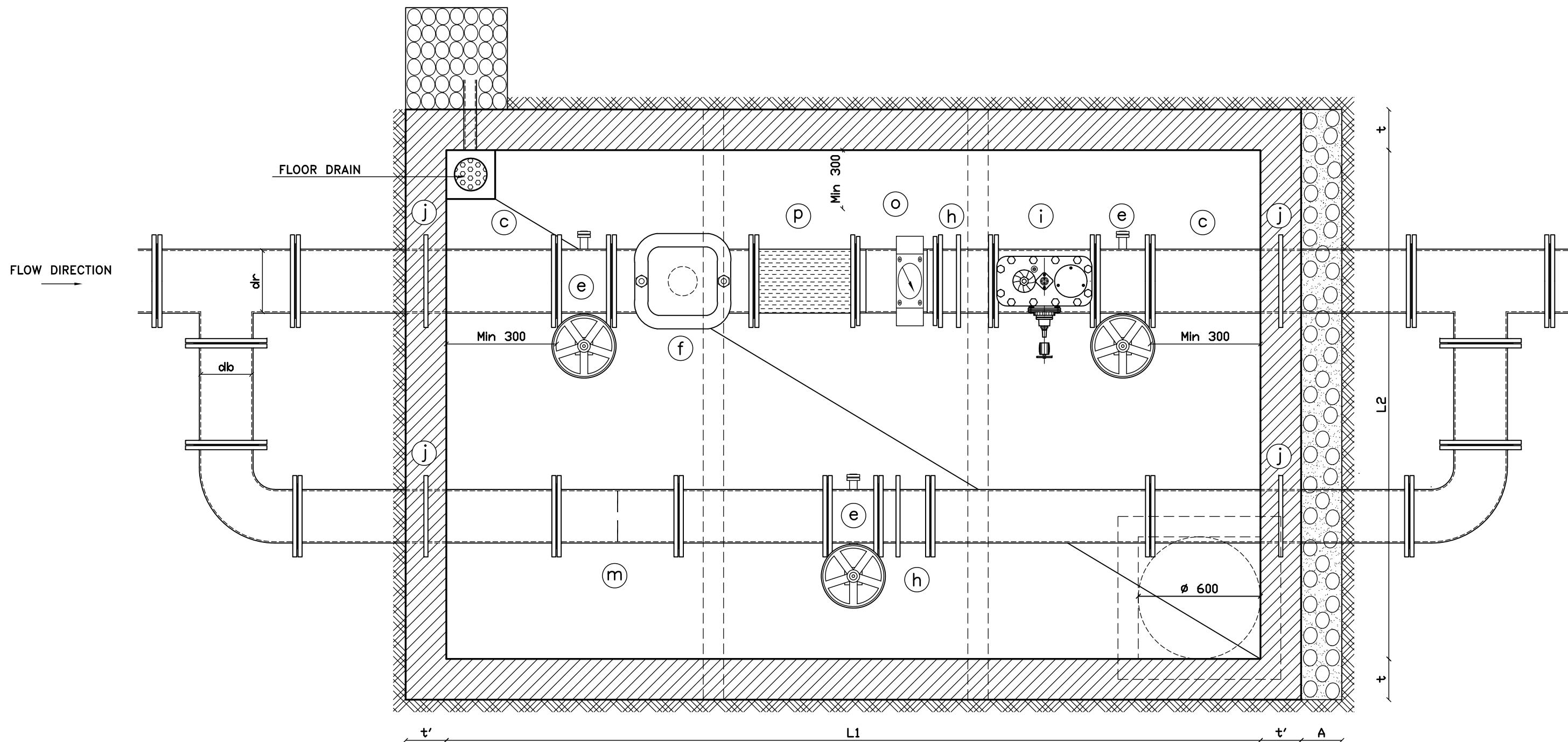
MAIN PIPE DIAMETER	REGULATING PIPE DIAMETER	BY PASS DIAMETER	UPSTREAM PRESSURE-DOWNSTREAM PRESSURE ≤25 BARS				
			AIR RELIEF VALVE DIAMETER	LENGTH	WIDTH	HEIGHT	BLOCK THICKNESS
D mm	dr mm	db mm	dv mm	L1 mm	L2 mm	H mm	A mm
80	80	80	60	3800	1750	2000	200
100	80	80	60	3800	1750	2000	200
150	100	80	60	3800	1750	2000	200
200	150	100	60	5000	2000	2000	200
250	200	150	60	5000	2000	2000	200
300	250	200	80	5000	2000	2000	200

* UPSTREAM PRESSURE - DOWNSTREAM PRESSURE < 16 BARS.

B-TYPICAL DETAIL FOR INSTALLATION OF PRV/PSV AND WATERMETER

MAIN PIPE DIAMETER	REGULATING PIPE DIAMETER	BY PASS DIAMETER	UPSTREAM PRESSURE-DOWNSTREAM PRESSURE ≤25 BARS				
			AIR RELIEF VALVE DIAMETER	LENGTH	WIDTH	HEIGHT	BLOCK THICKNESS
D mm	dr mm	db mm	dv mm	L1 mm	L2 mm	H mm	A mm
80	80	80	60	3300	1750	2000	200
100	80	80	60	3300	1750	2000	200
150	100	80	60	3300	1750	2000	200
200	150	100	60	4500	2000	2000	200
250	200	150	60	4500	2000	2000	200
300	250	200	80	4500	2000	2000	200

* UPSTREAM PRESSURE - DOWNSTREAM PRESSURE < 16 BARS.



SECTION E-E

MAIN PIPE DIAMETER	WATERMETER PIPE DIAMETER	BY PASS DIAMETER	UPSTREAM PRESSURE-DOWNSTREAM PRESSURE ≤25 BARS				
			AIR RELIEF VALVE DIAMETER	LENGTH	WIDTH	HEIGHT	BLOCK THICKNESS
D mm	dr mm	db mm	dv mm	L1 mm	L2 mm	H mm	A mm
80	80	80	60	2500	1750	2000	200
100	100	100	60	2500	1750	2000	200
150	150	150	60	3600	2000	2000	200
200	200	200	80	3600	2000	2000	200
250	250	250	80	4000	2500	2000	200
300	300	300	100	4000	2500	2000	200

* UPSTREAM PRESSURE - DOWNSTREAM PRESSURE < 16 BARS.

NOTES:

REINFORCED CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 350 Kg/m³

BUILDING AND MASS CONCRETE:
NORMAL PORTLAND CEMENT, GRADE C45.
DOSING 250 Kg/m³.

REINFORCEMENT:
DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: F_y=400 MPa.
MILD STEEL BARS: SYMBOL # YIELD STRESS: F_y=215 MPa.

STRESSES:
SEVERE CONTROL
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f_c = 25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: f_t = 2.1 MPa.

CONCRETE COVER:
CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS
SHALL BE 30 mm

OVERLAPPING:
LAPS SHALL NOT BE LESS THAN FIFTY TIMES THE BAR DIAMETER.
WHERE SPICE BARS ARE USED, THEIR LENGTH SHALL NOT BE LESS THAN 2x50d.
(d= NOMINAL DIAMETER OF BAR)
LAPS SHALL BE STAGGERED FROM ONE HOOP TO THE OTHER AND/OR ONE BAR
TO THE OTHER IN ORDER TO REDUCE THE NUMBER OF LAPS IN THE SAME SECTION.
STIRRUPS #8 SHALL BE USED ON EACH LAP.

BENDING:
> 12mm MECHANICAL.
< 12mm MANUAL (POSSIBLY).
STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

FORMWORK:
ALL EXECUTED CONCRETE SHALL BE FAIR FACE CONCRETE (METALLIC OR PLYWOOD FORMWORK).

WATERPROOFING:
BITUMEN LAYER ON EXTERNAL SURFACES OF VALVE CHAMBER
WALLS EXCEPT WHERE THERE IS MASS CONCRETE

REMARKS:

- Holes made by the tie-rods shall be filled with a non shrink
grout by means of special injection methods.
- All dimensions are in millimeters.
- Scaling from these drawings is not allowed.
- Soil friction angle shall be 25°
- Ground/ manhole friction coefficient shall be 2/3 tg φ
- The passive earth pressure shall be taken into account for manhole
stability by filling the void between the manhole and the trench
wall with mass concrete of a minimum thickness 200°.

REMARKS:
TO BE USED ONLY IF THE INSTALLATION OF AN ADEQUATE GRAVITY DRAIN PIPE TO A
FREE OUTLET IS DETERMINED BY THE ENGINEER NOT TO BE POSSIBLE.

* T.P. = TEST PRESSURE

- LEGEND:**
- (a) PIECE OF PIPE MAX. LENGTH 1000
 - (b) FLANGED REDUCER
 - (c) INTAKE COLLAR
 - (d) PRESSURE GAUGE
 - (e) BUTTERFLY VALVE
 - (f) FILTER WITH WASHOUT VALVE
 - (g) PRESSURE REGULATING VALVE SPRING LOADED
 - (h) SELF-RESTRAINED DISMANTLING JOINT
 - (i) AIR RELIEF VALVE-ISOLATING BUTTERFLY VALVE
 - (j) PUDDLE FLANGE
 - (k) FLANGE-SPIGOT
 - (l) FLANGE-SOCKET
 - (m) PRESSURE REDUCING DIAPHRAGM
 - (n) PRESSURE SUSTAINING VALVE SPRING LOADED
 - (o) WATERMETER
 - (p) STRAIGHTENER
 - (q) GLOBE VALVE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

ED BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB - HAJAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELJAS FAX: (04) 712159

CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

TRANSMISSION AND
DISTRIBUTION SYSTEMS

WATERMETERS
DETAILS OF INSTALLATION
AND PROTECTION CHAMBER

DRAWING No.	DESIGNED BY	DRAWN BY	CHECKED BY
509W-STDP01-16	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ No.
JULY 2019	NOT TO SCALE	16/16	509W-STDP16