

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

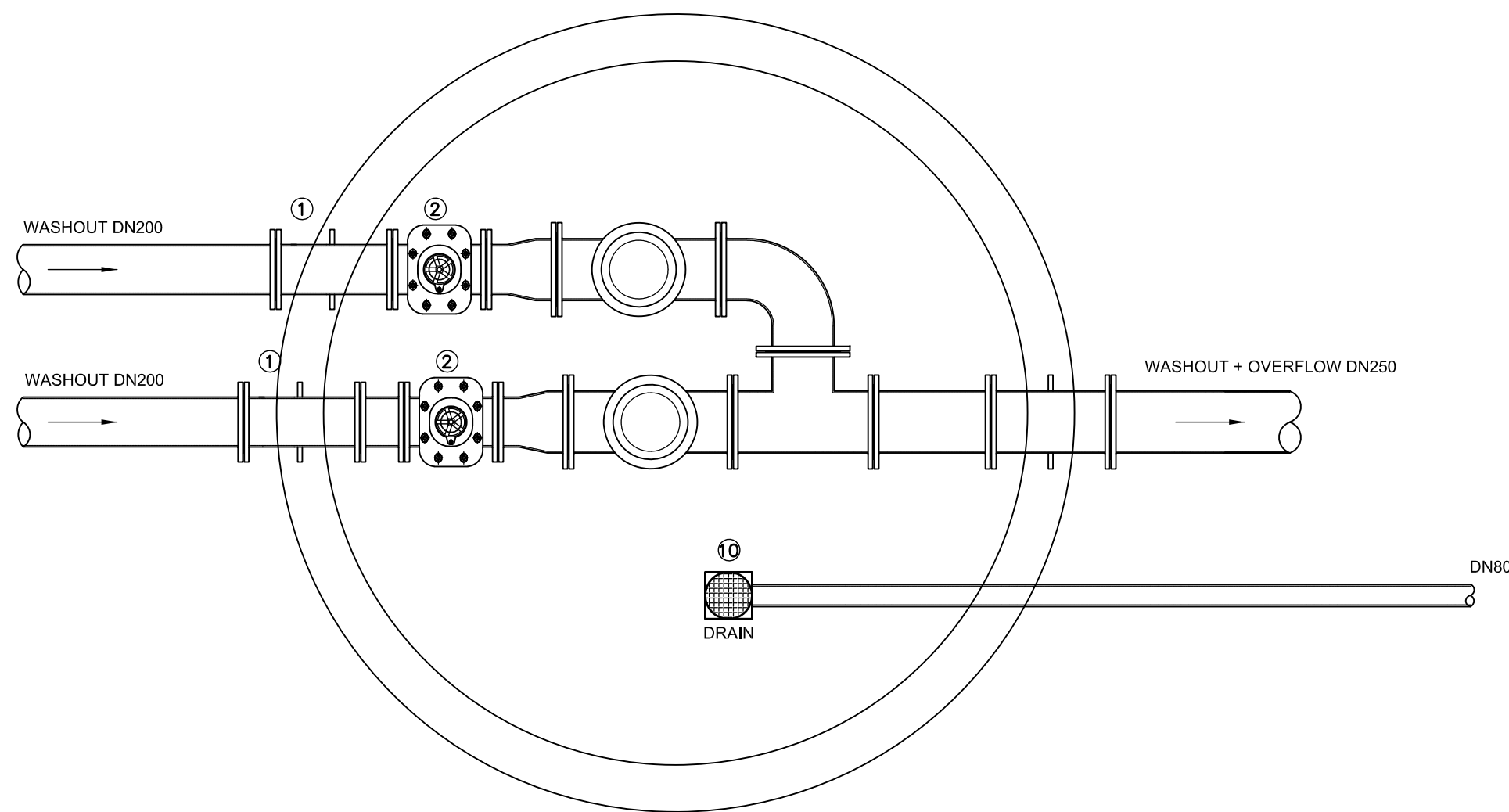
**DECEMBER
2023**

**BUREAU TECHNIQUE POUR
LE DEVELOPPEMENT
(B.T.D.) P.O.Box : 70-492
Antélias
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**MINISTRY OF ENERGY
AND WATER**

**COUNCIL FOR
DEVELOPMENT AND
RECONSTRUCTION**

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

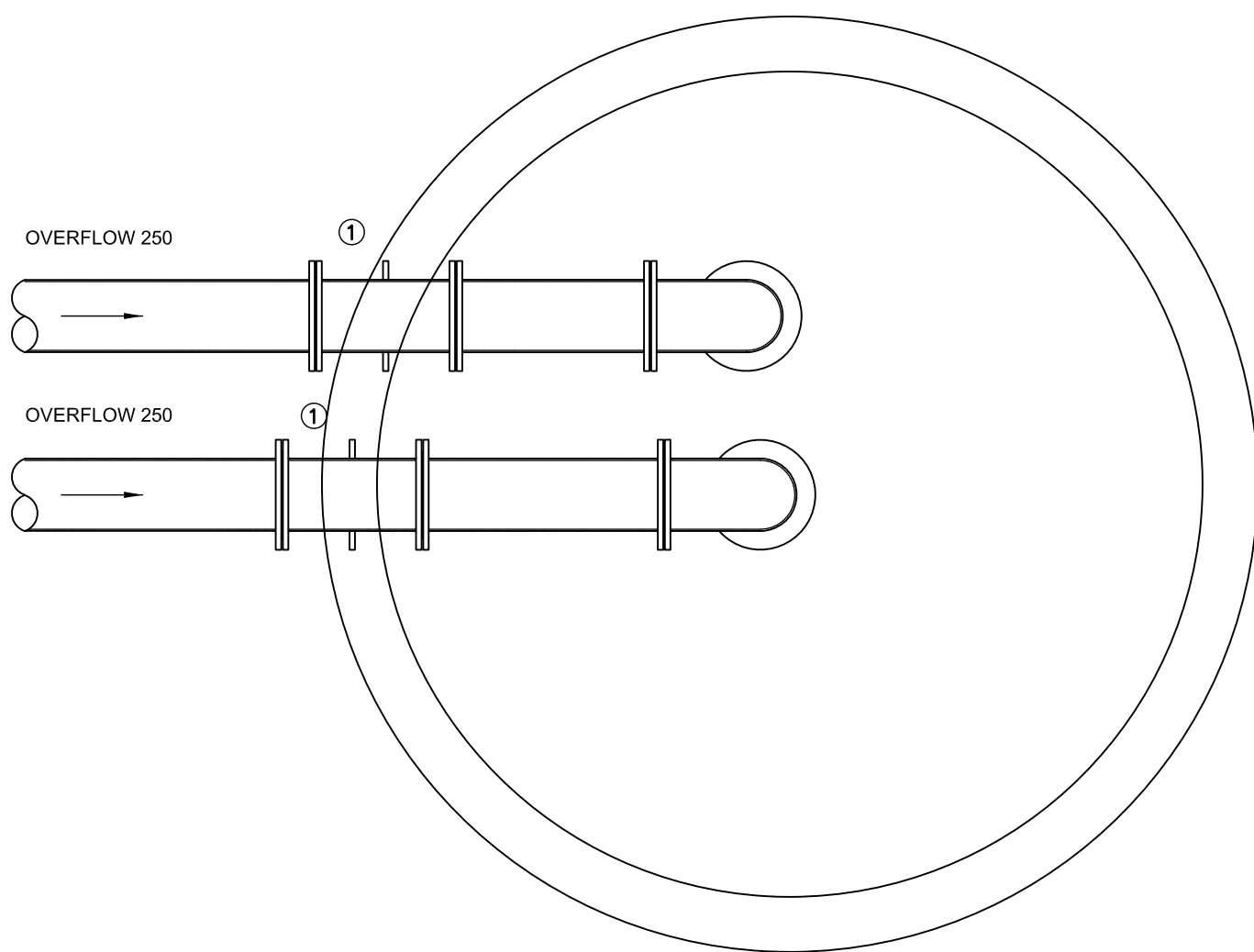


The washout and overflow should discharge
in the nearest watercourse

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



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BD

BUREAU TECHNIQUE POUR LE DEVELOPEMENT

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

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

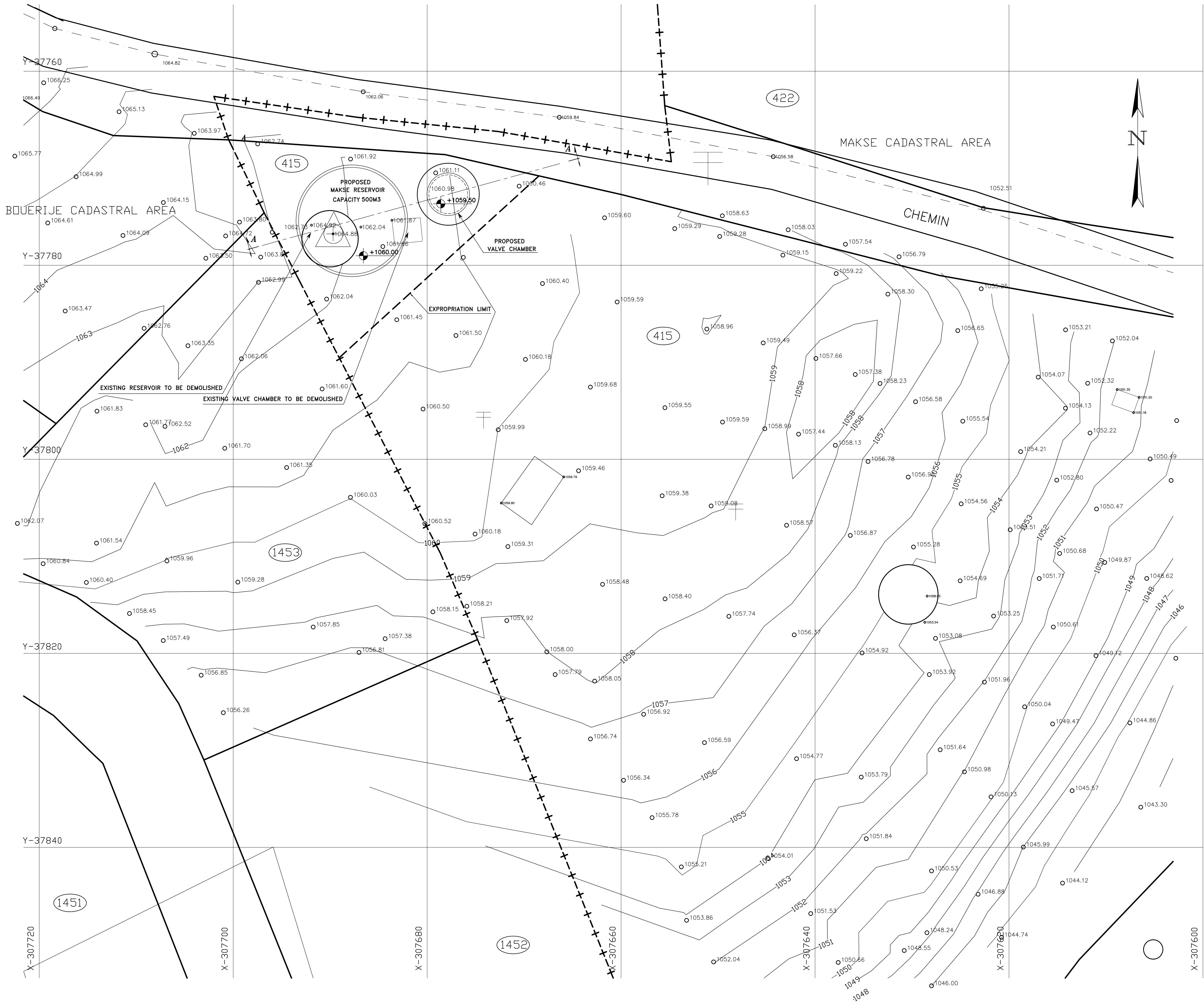
QABBB ELIAS RESERVOIRS VALVE CHAMBER	HYDRAULIC ACCESSORIES
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FILE No.	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS02-VC01	J. ZALZAL	S. AZAR	Z. SABA

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

TOPOGRAPHICAL SURVEY
SITE LAYOUT

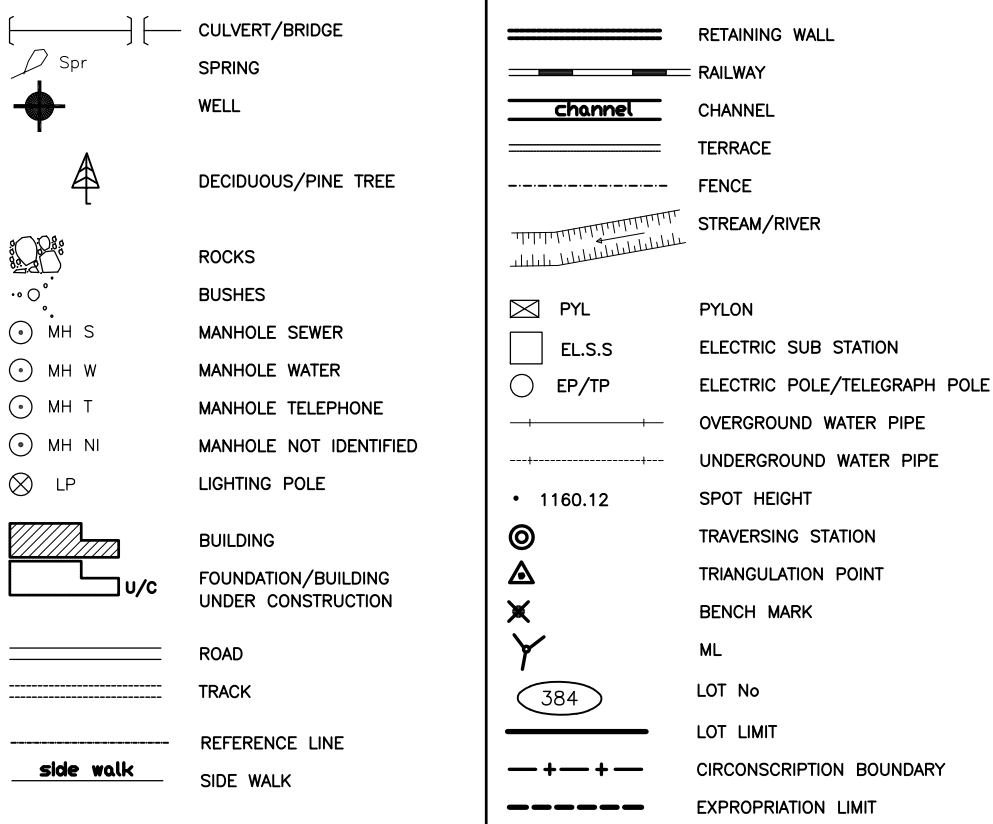
SCALE 1:200



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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BD BUREAU TECHNIQUE POUR LE DEVELOPEMENT

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

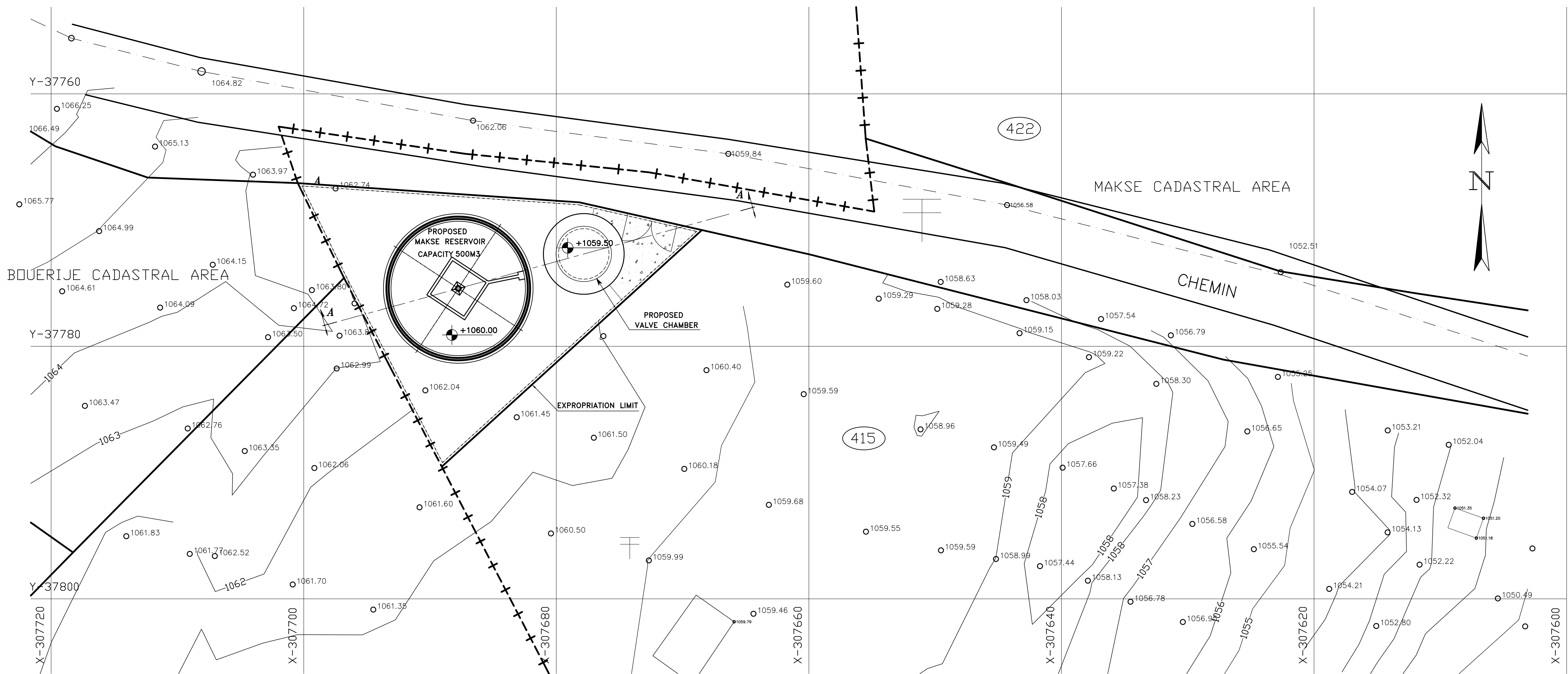
MAKSE RESERVOIR (CAPACITY 500 m³)	TOPOGRAPHICAL SURVEY SITE LAYOUT
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

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

SITE PLAN

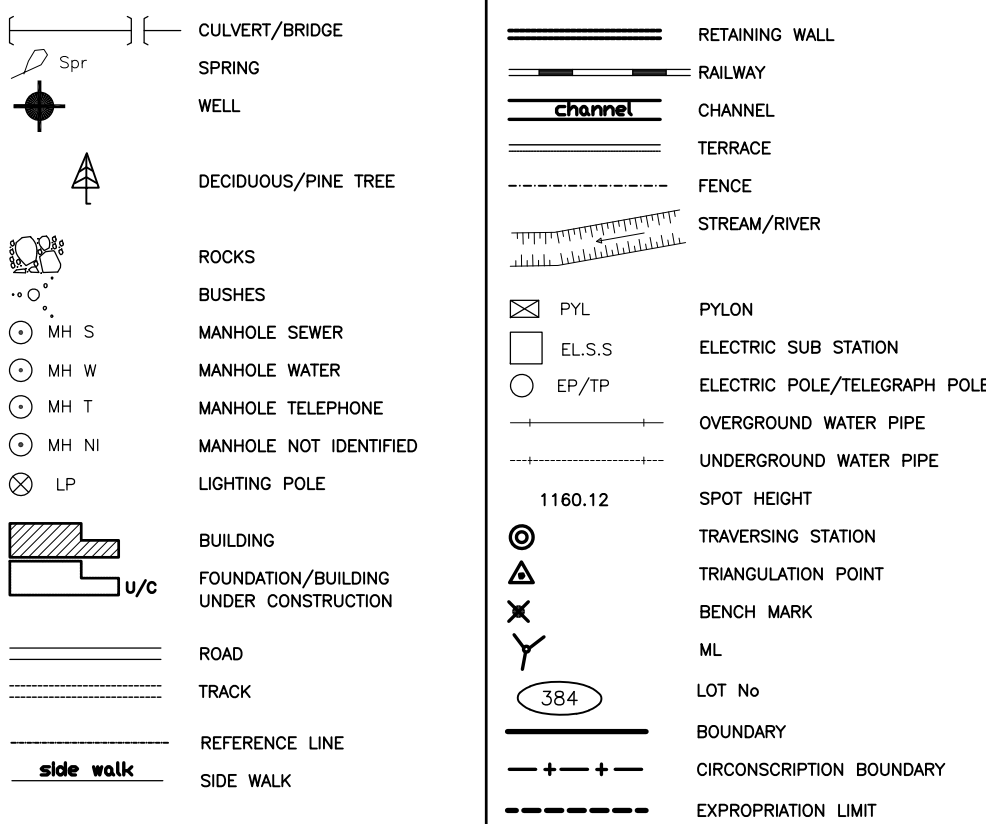
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NOTES:

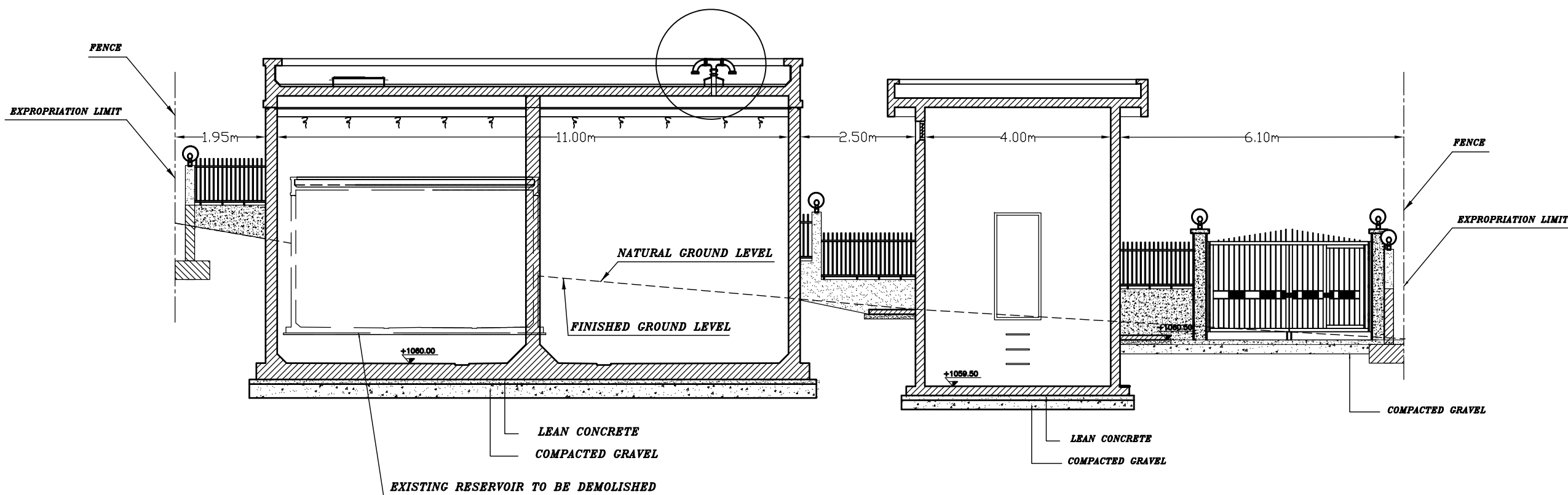
- GROUND LEVEL OF RESERVOIR = +1060.00m
- GROUND LEVEL OF VALVE CHAMBER = +1059.50m
- DO NOT SCALE FROM THIS DRAWING
- ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND



SECTION A-A

SCALE 1:100



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

MAKSE RESERVOIR
(CAPACITY 500 m³)

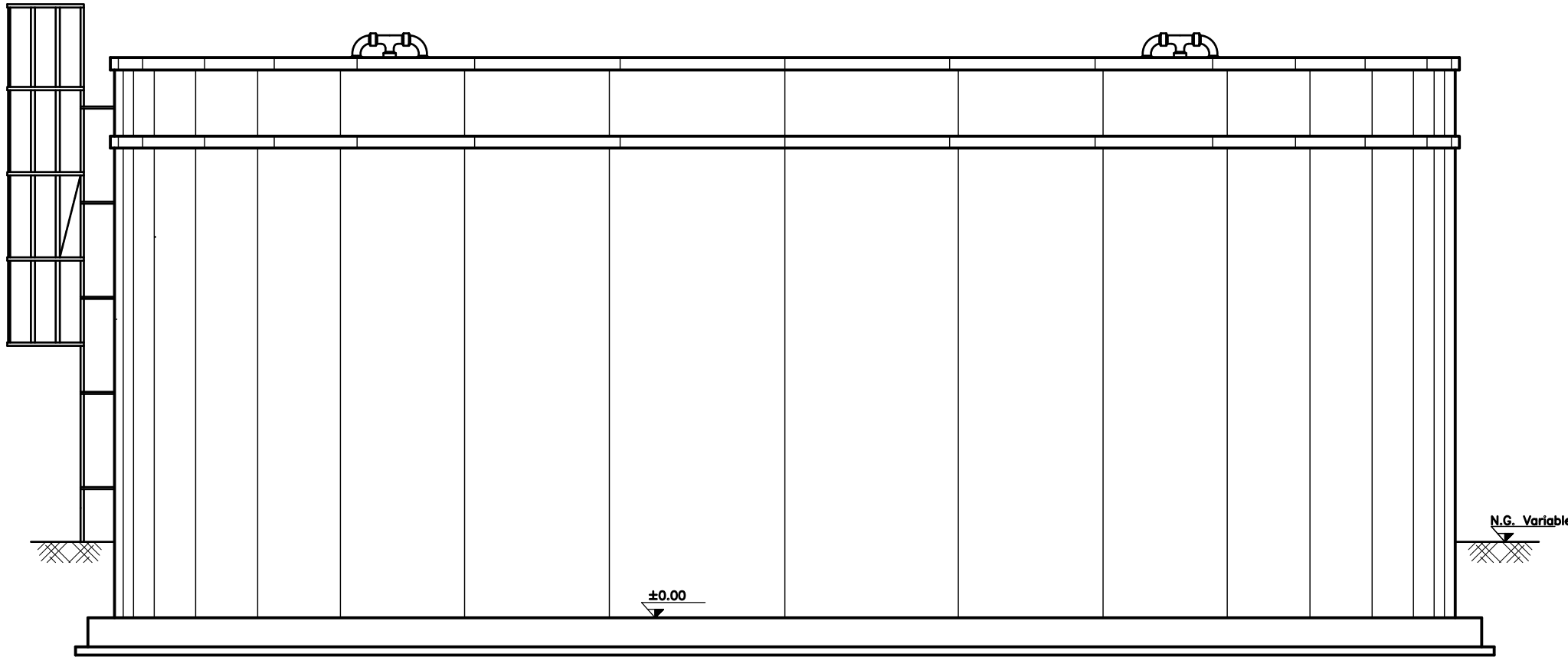
SITE PLAN
SECTION A - A

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

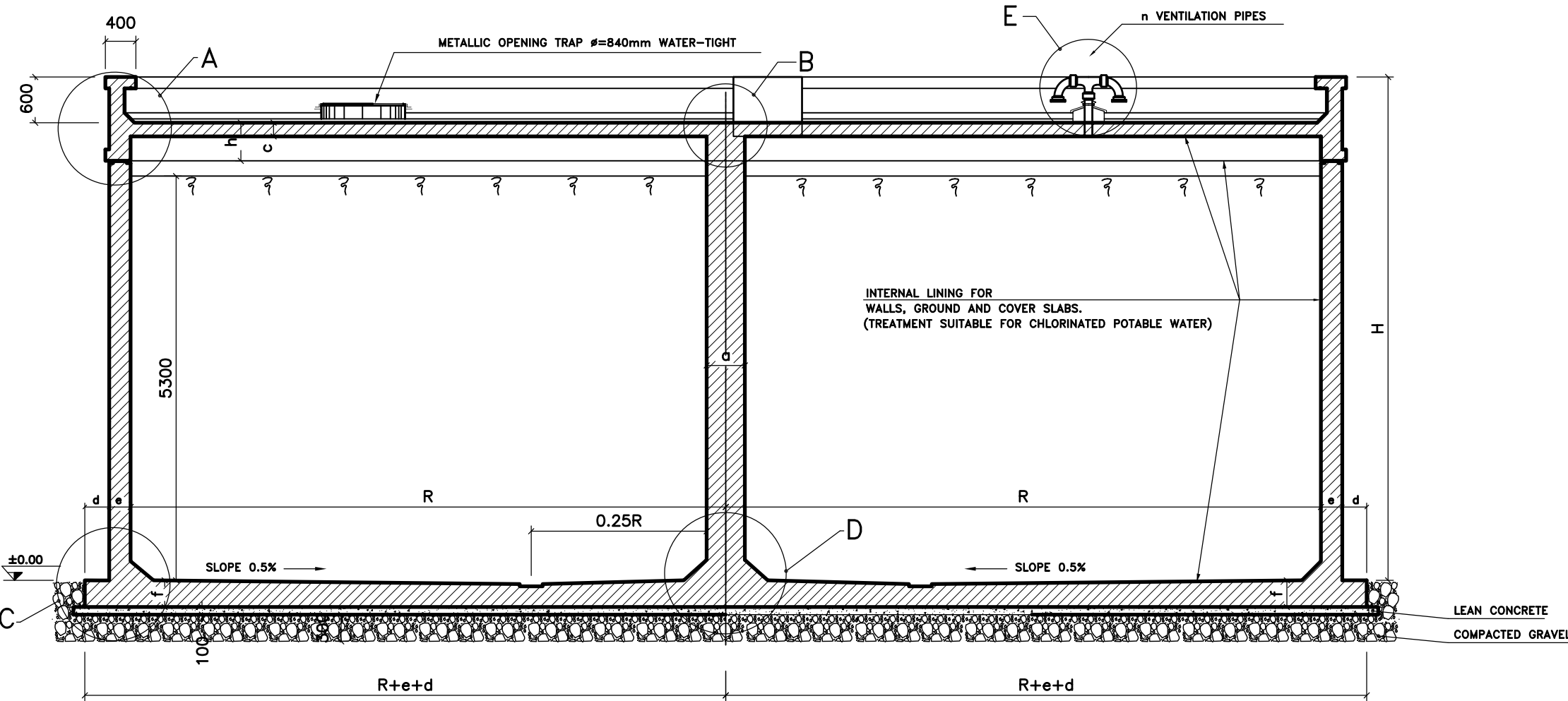
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:200 - 1:100	2/9	509W-RS03-C02

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

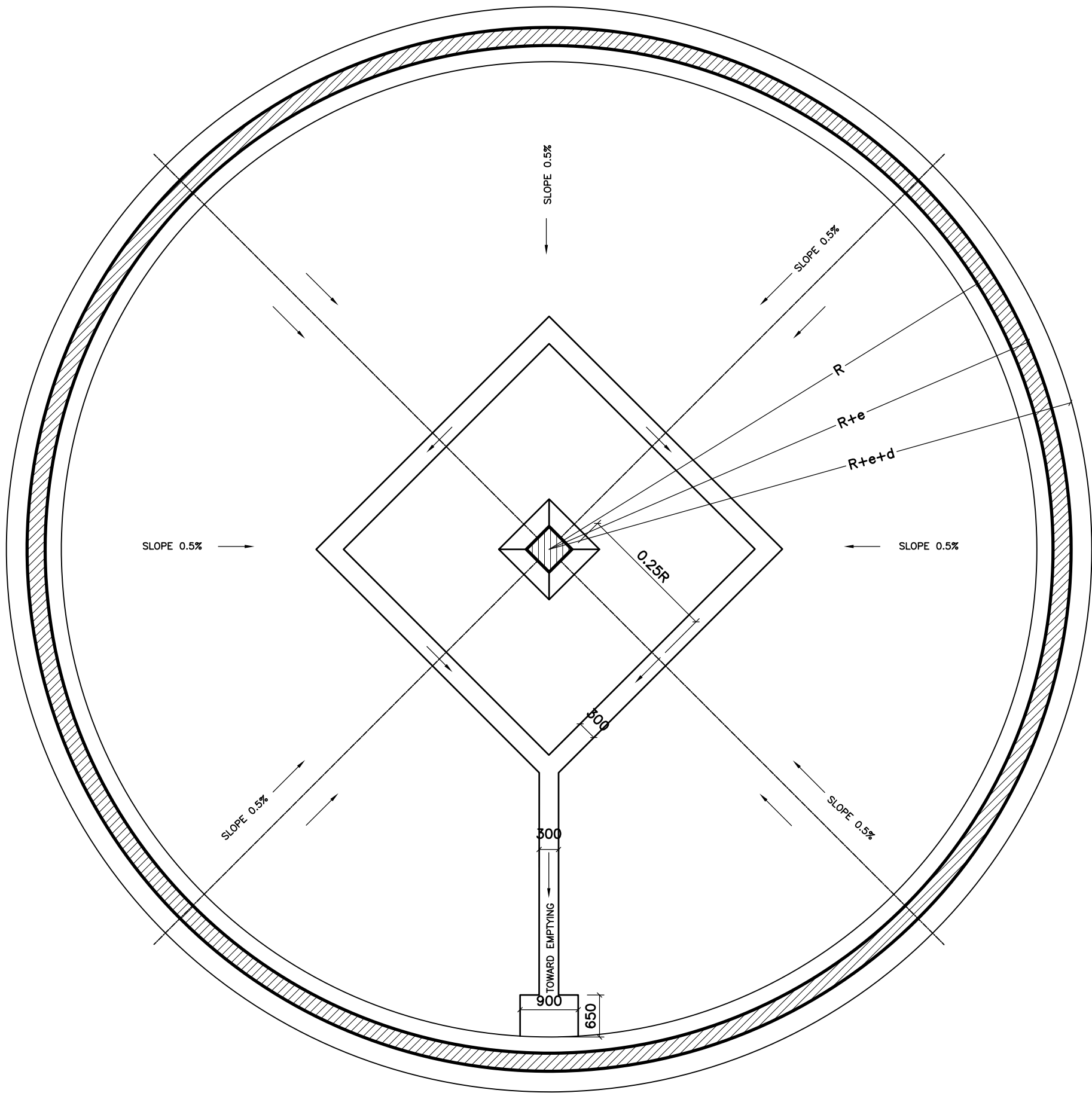
ELEVATION



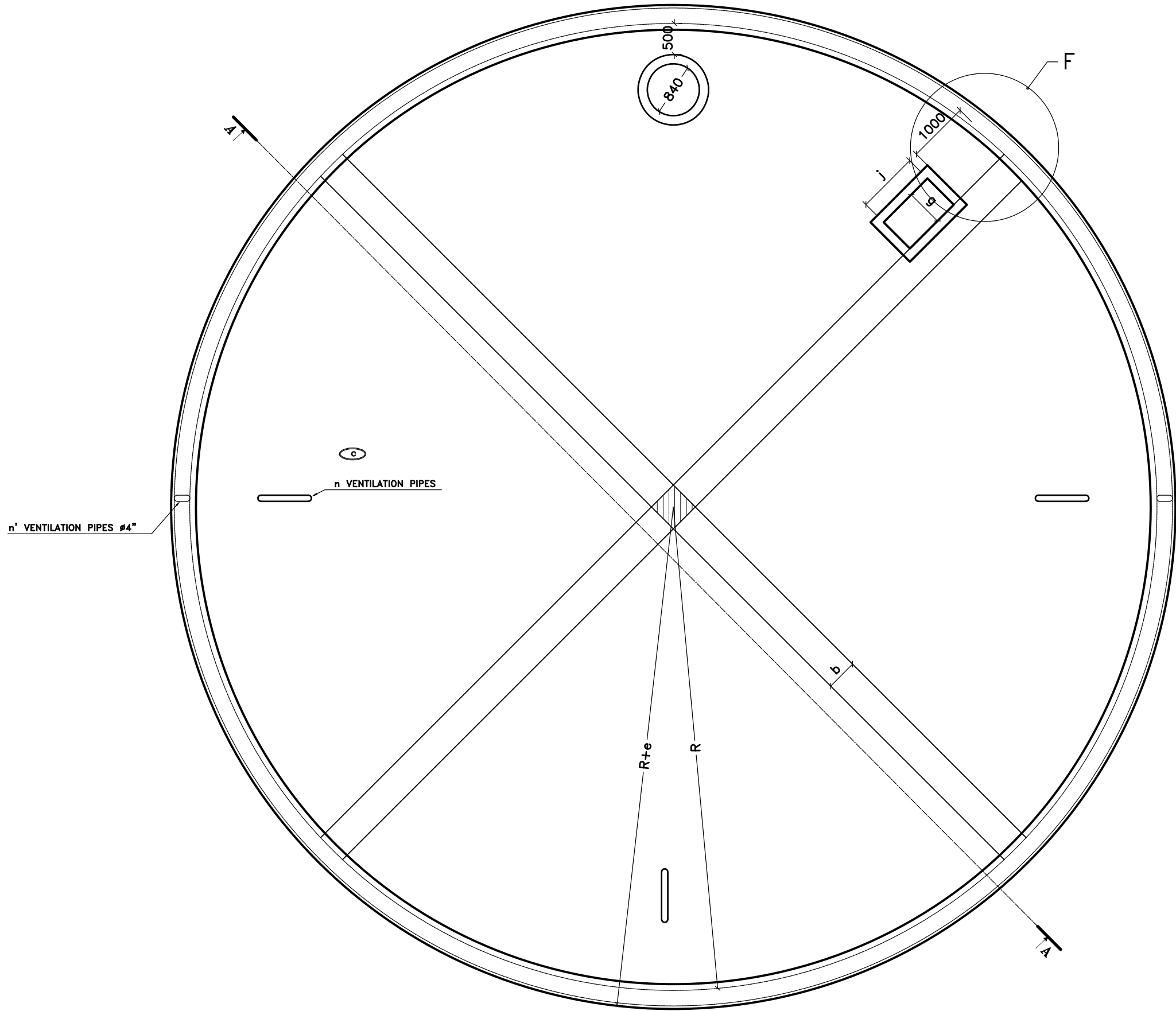
VERTICAL SECTION A-A



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: 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, e=150mm : 30 N/mm²
- ON A CYLINDER, e=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 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 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, #4" IN THE GRAVEL PROTECTION LAYER.

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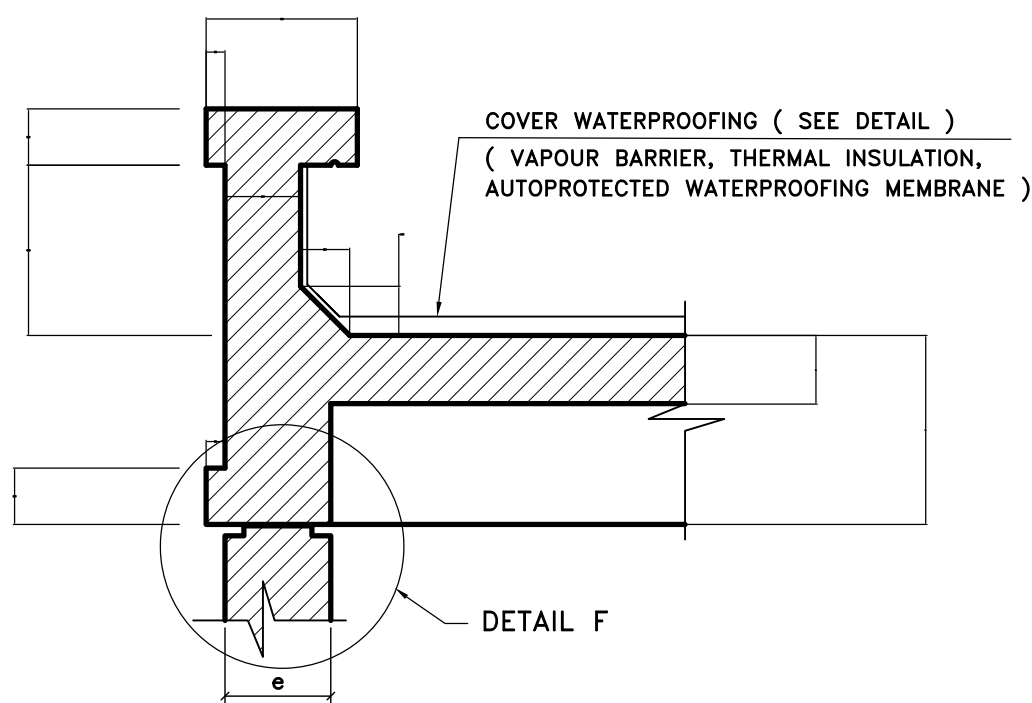
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

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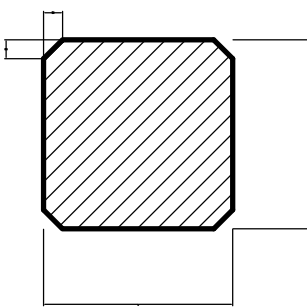
FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

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

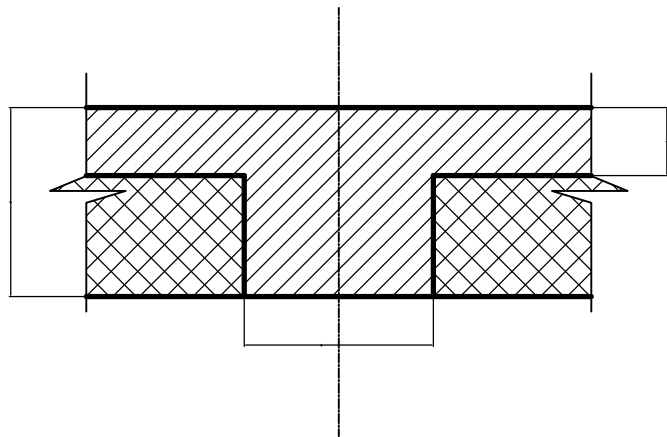
DETAIL A
PARAPET – SLAB SECTION



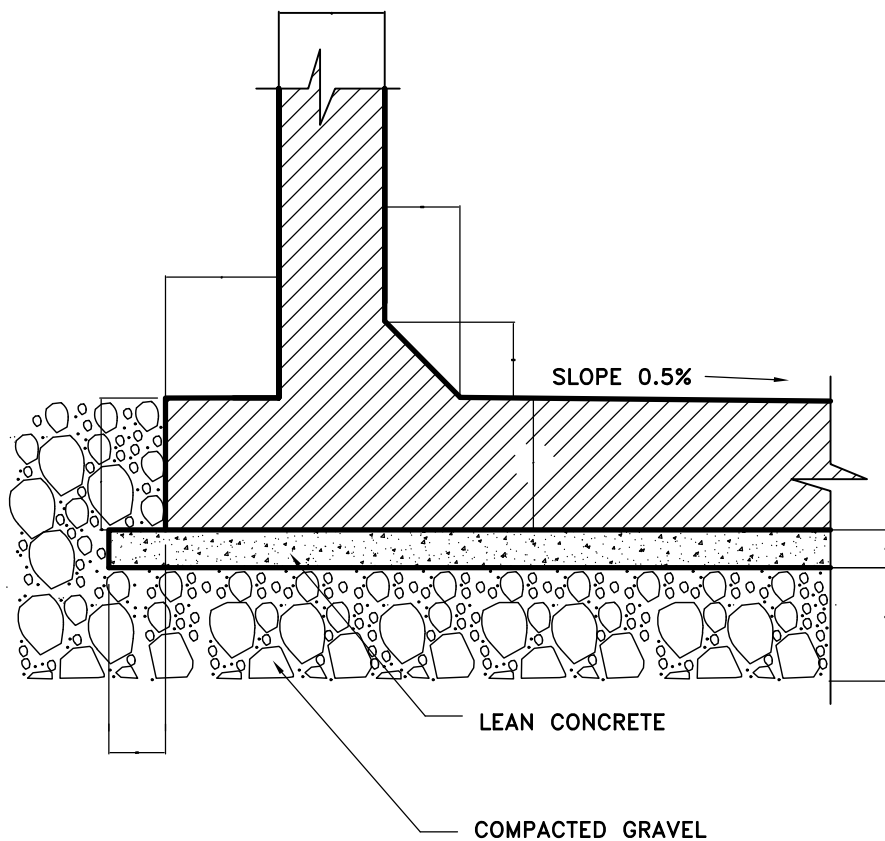
COLUMN DETAIL



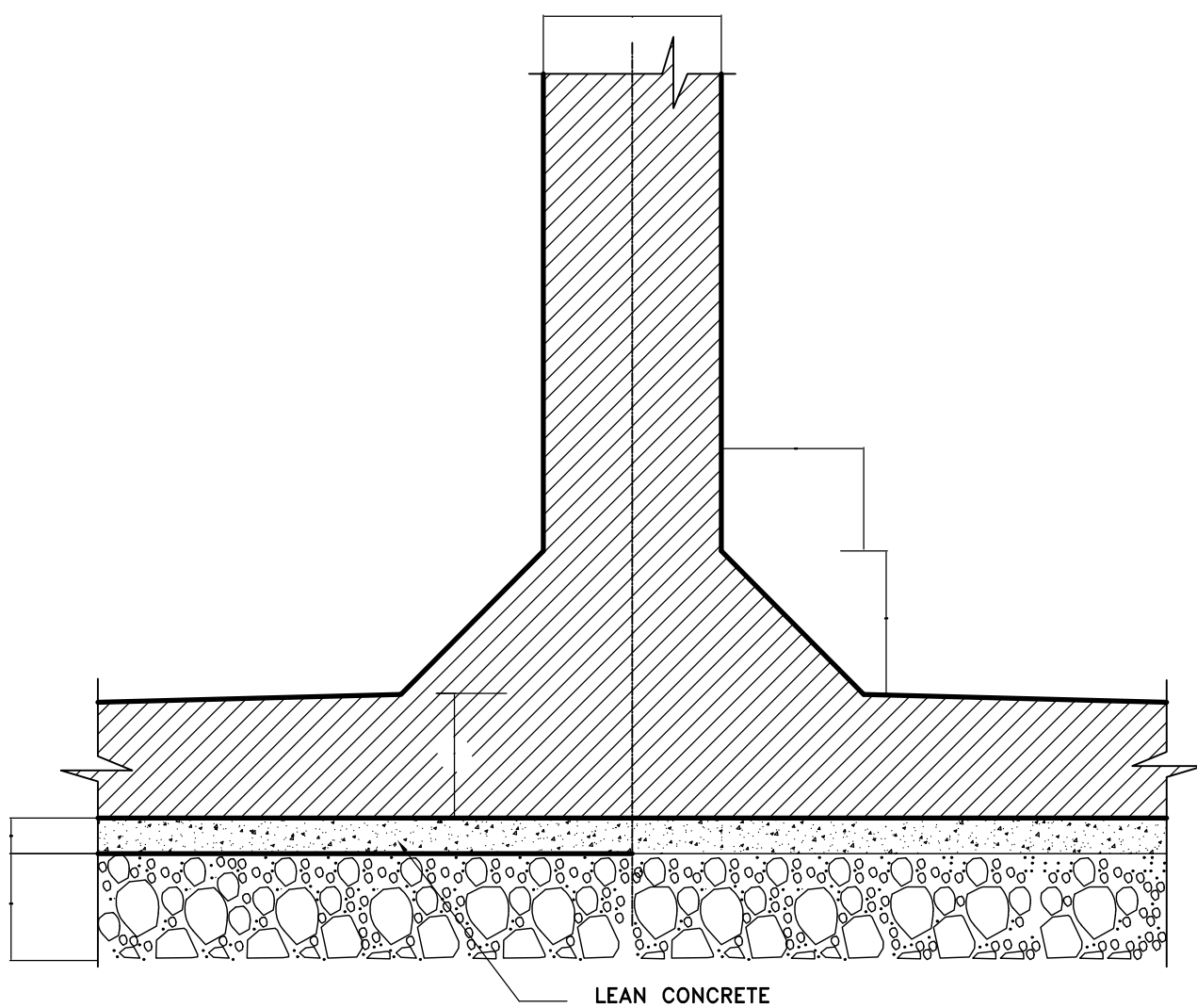
DETAIL B
BEAM–SLAB SECTION



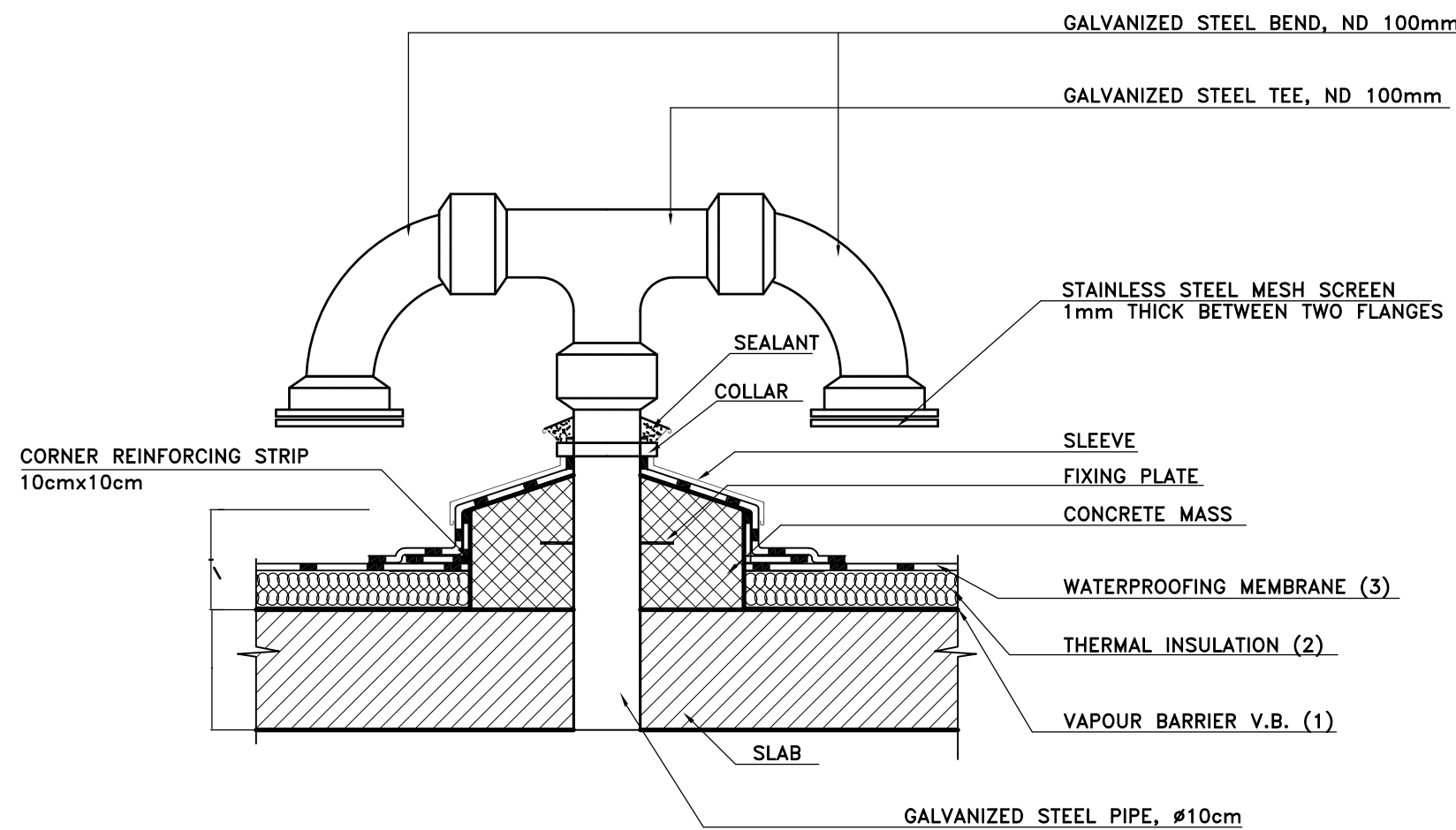
DETAIL C
MAT–WALL SECTION



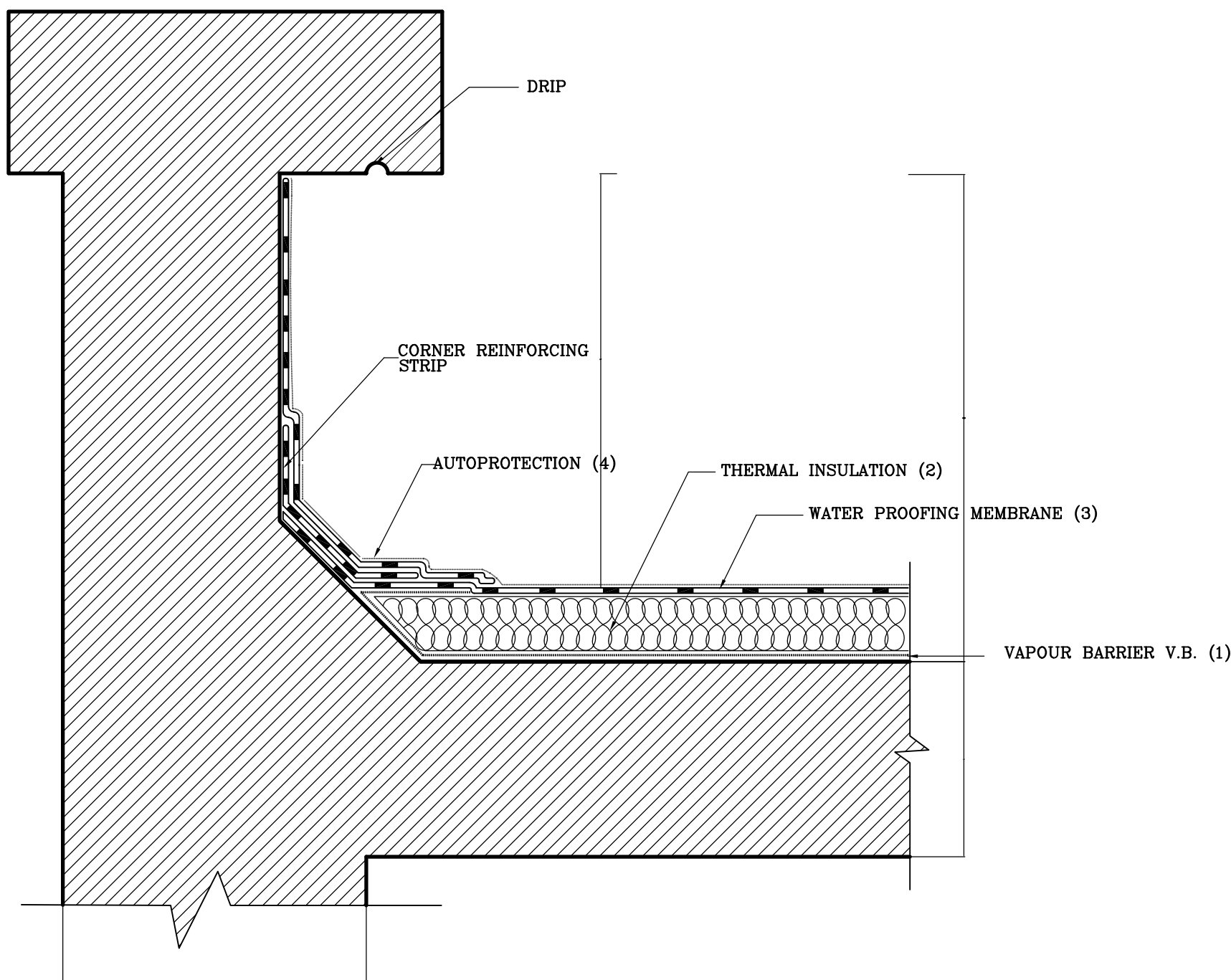
DETAIL D
COLUMN–MAT SECTION



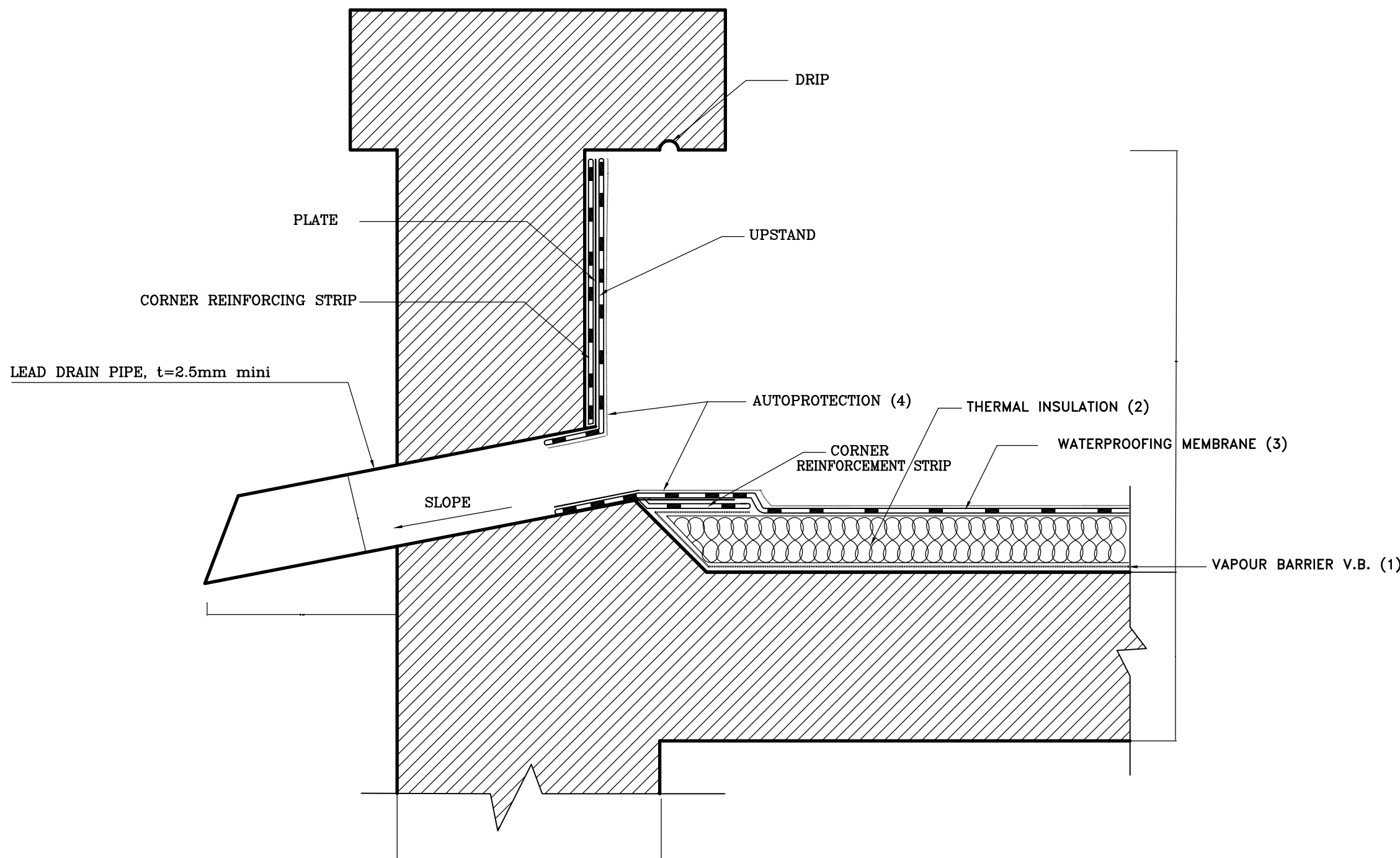
DETAIL E – VENTILATION PIPE
Scale 1:10



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.

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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.
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 2 ϕ 0k.
(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 $\lambda=0.037\text{ kcal/h.m}^2\text{.}^\circ\text{C}$
- 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.
(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

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

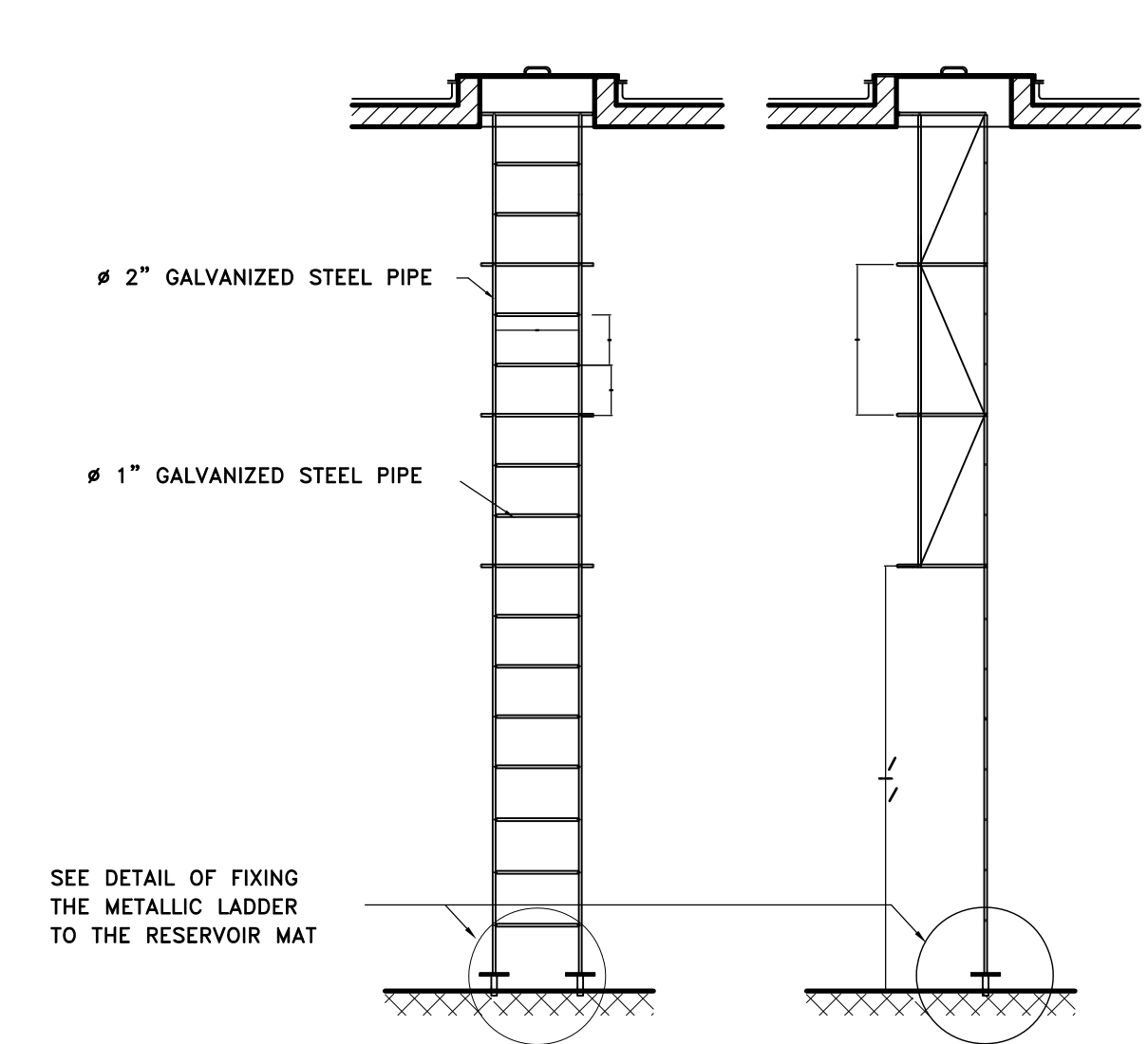
MAKSE RESERVOIR (CAPACITY 500 m ³)	DETAILS FORMWORK
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

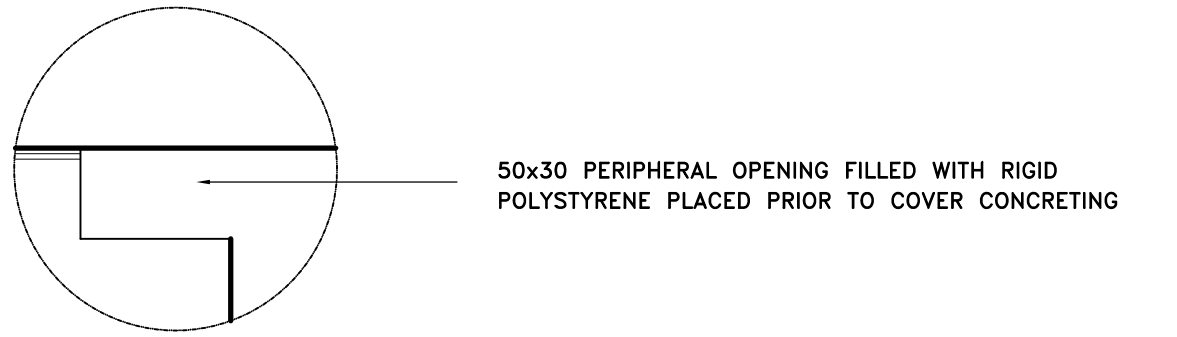
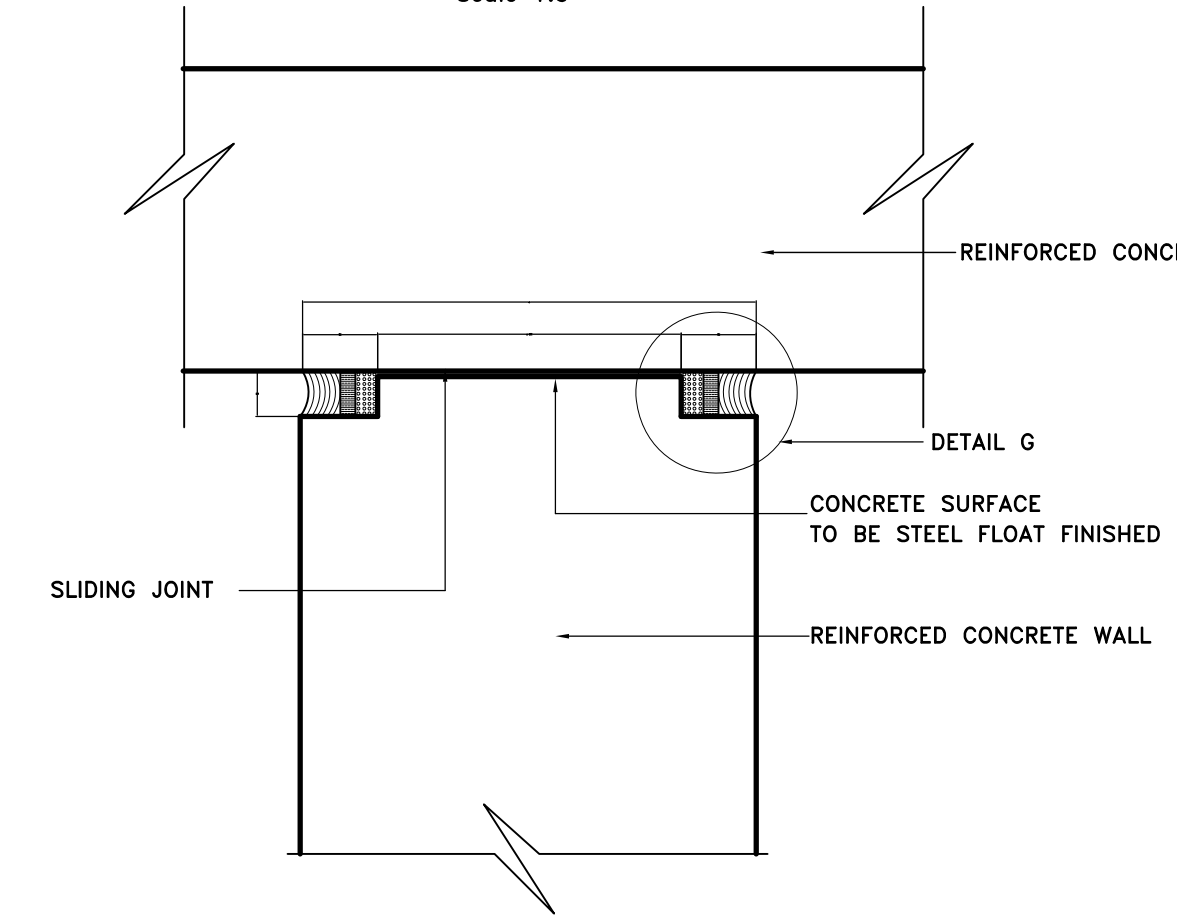
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1:50 - 1:20 - 1:10 1:5 - 1:1	5/9	509W-RS03-C05

INTERNAL METALLIC LADDER DETAIL

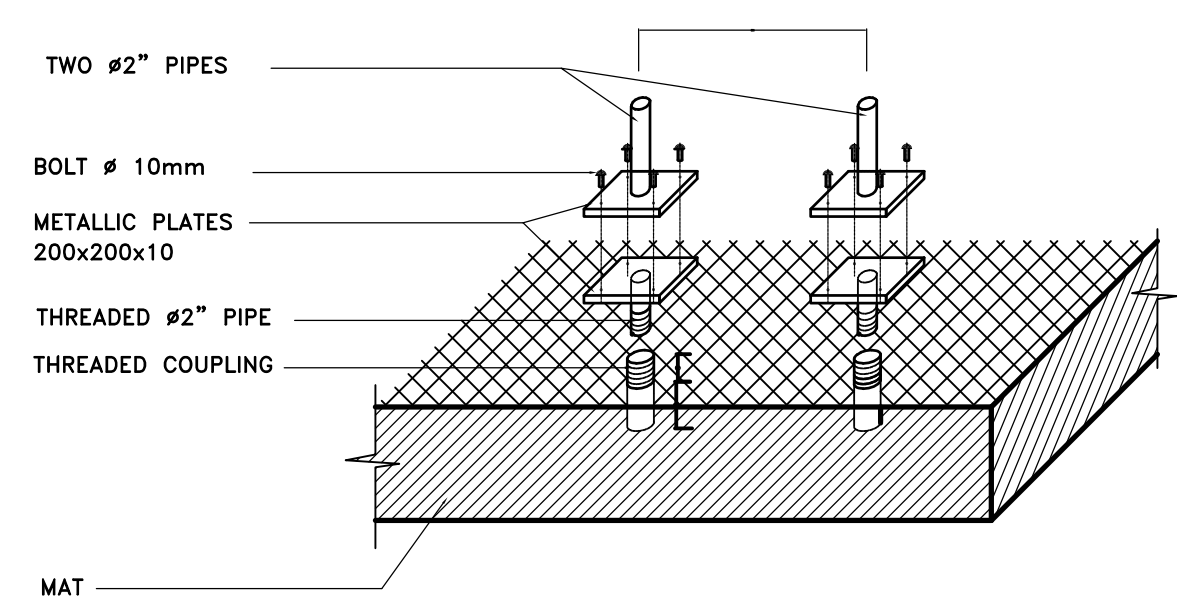
FRONT VIEW Scale 1:50
SIDE VIEW Scale 1:50



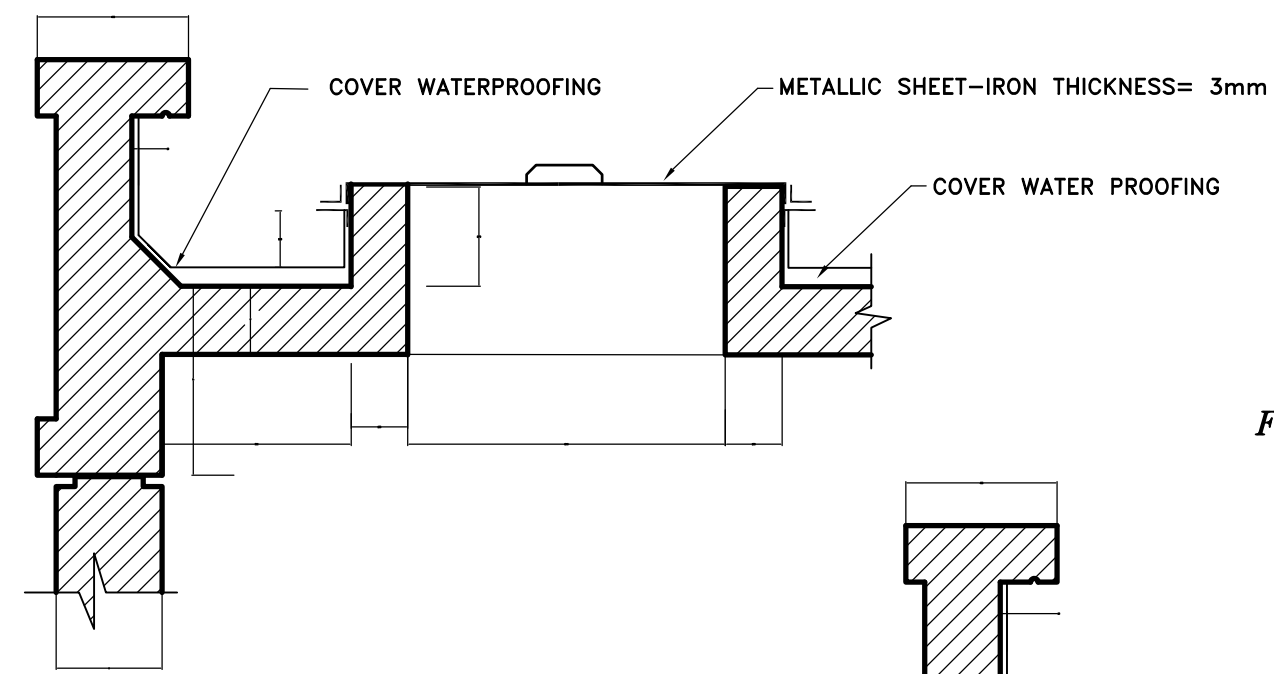
DETAIL F DU JOINT GLISSANT
Scale 1:5



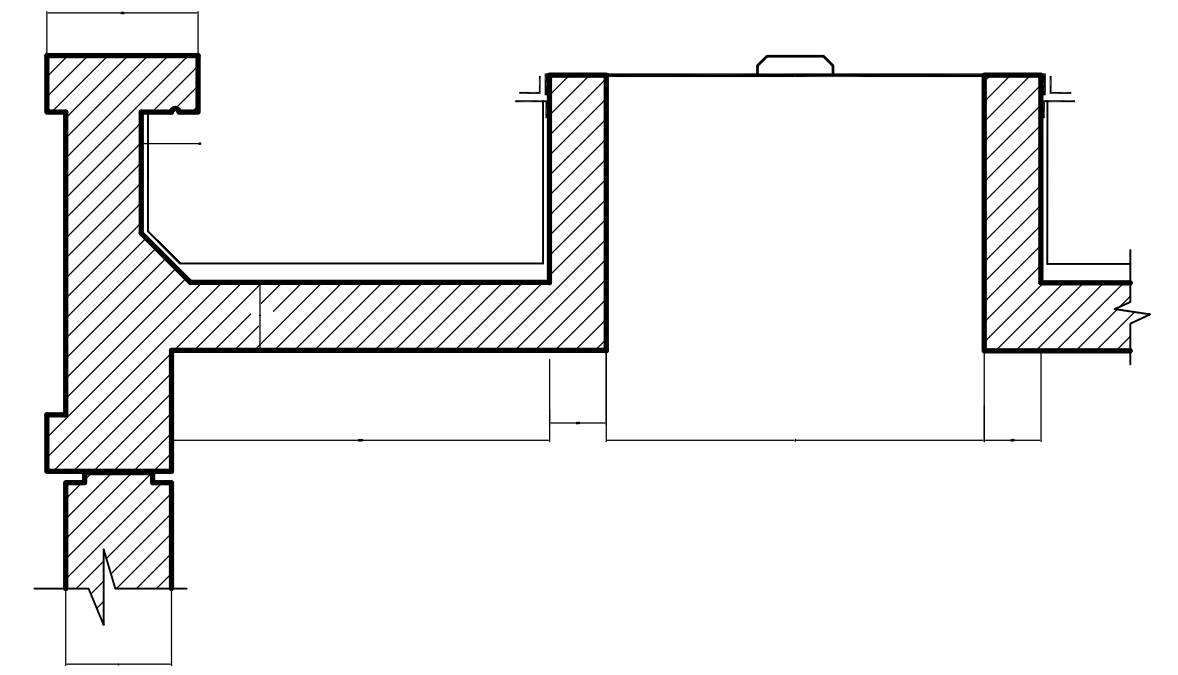
FIXING OF INTERNAL METALLIC LADDER DETAIL
Scale 1:20



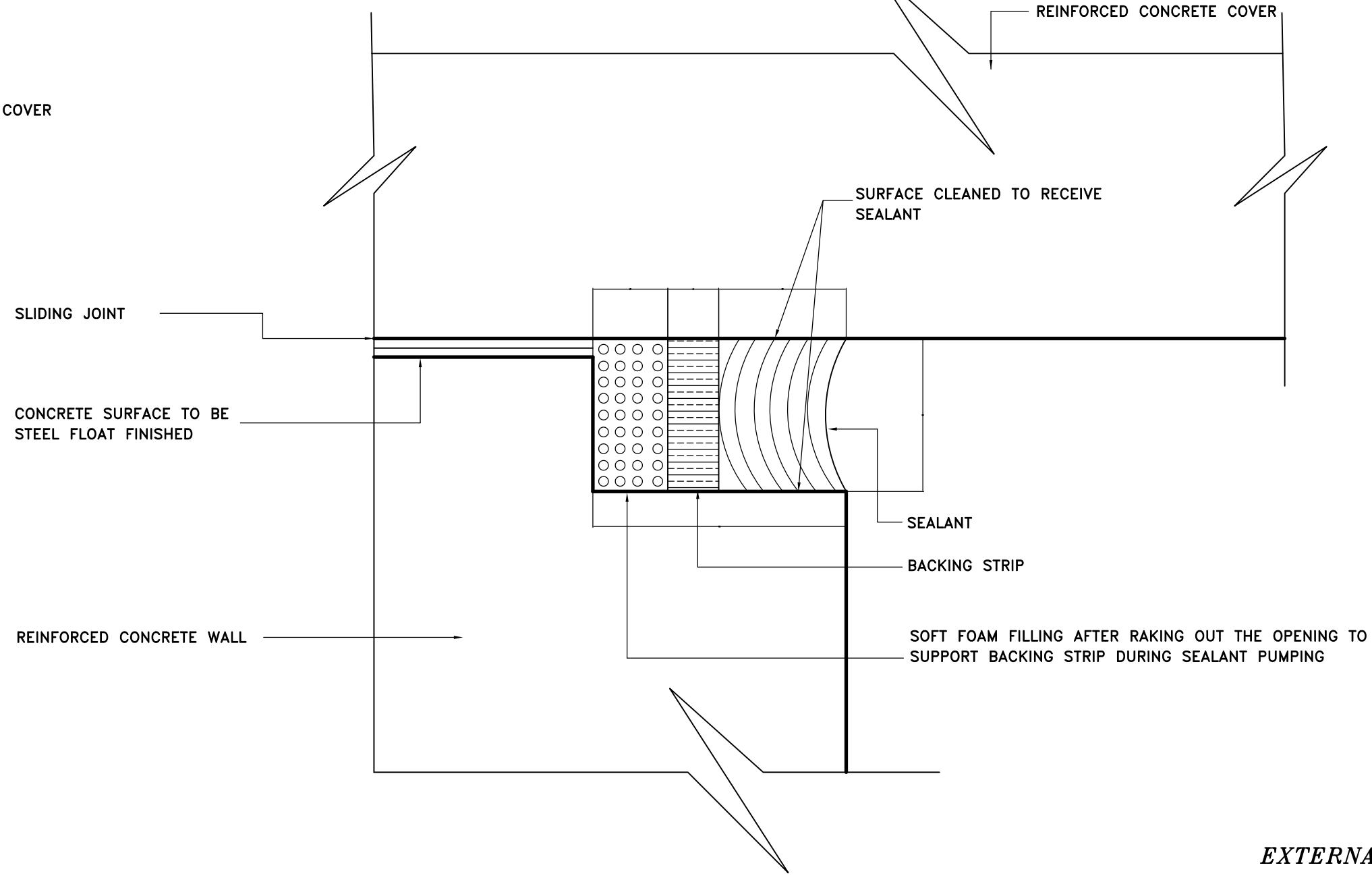
PARAPET-SLAB-TRAP DOOR SECTION



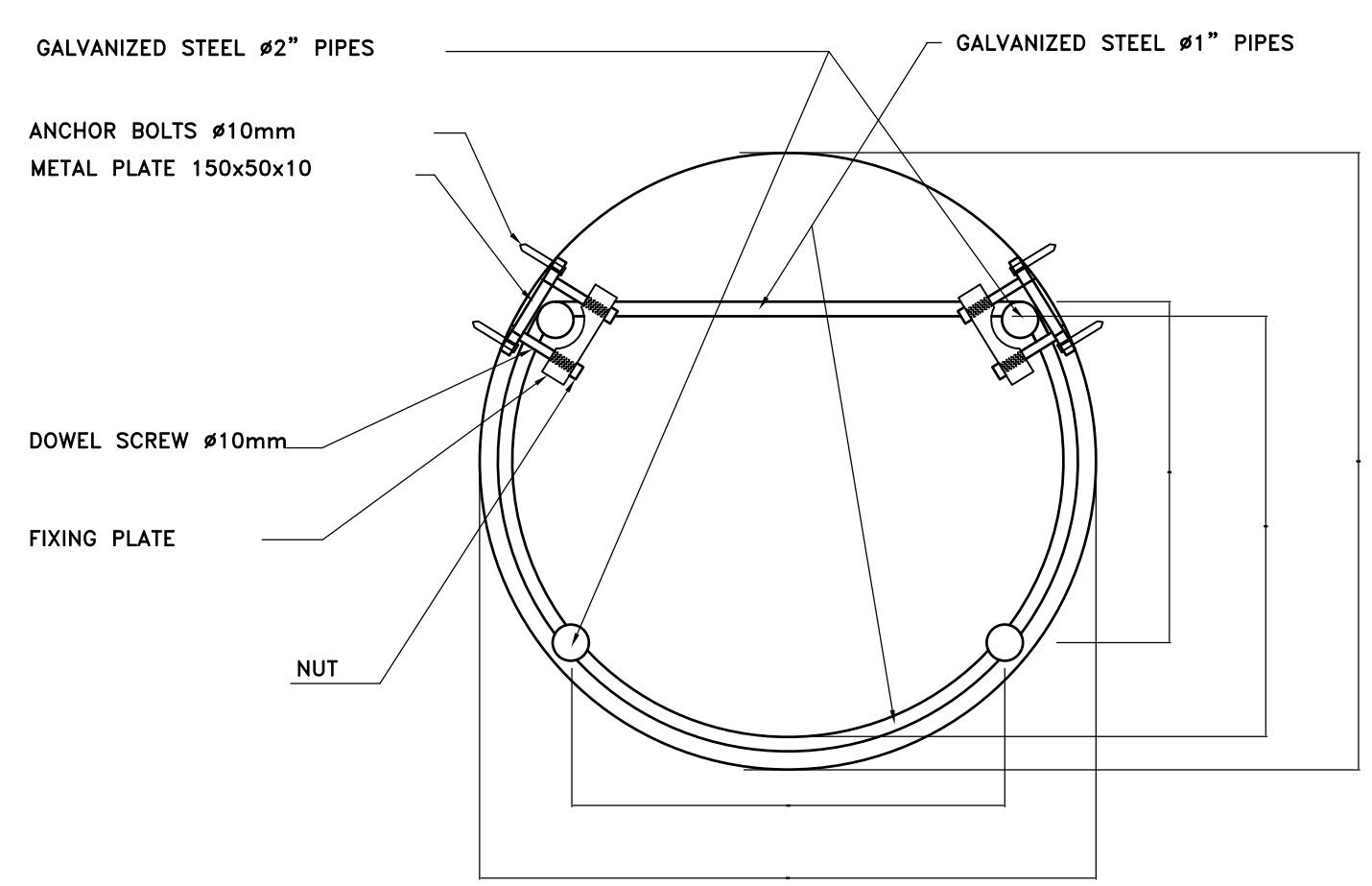
FLOAT TRAP-DOOR SECTION



DETAIL G
Scale 1:1

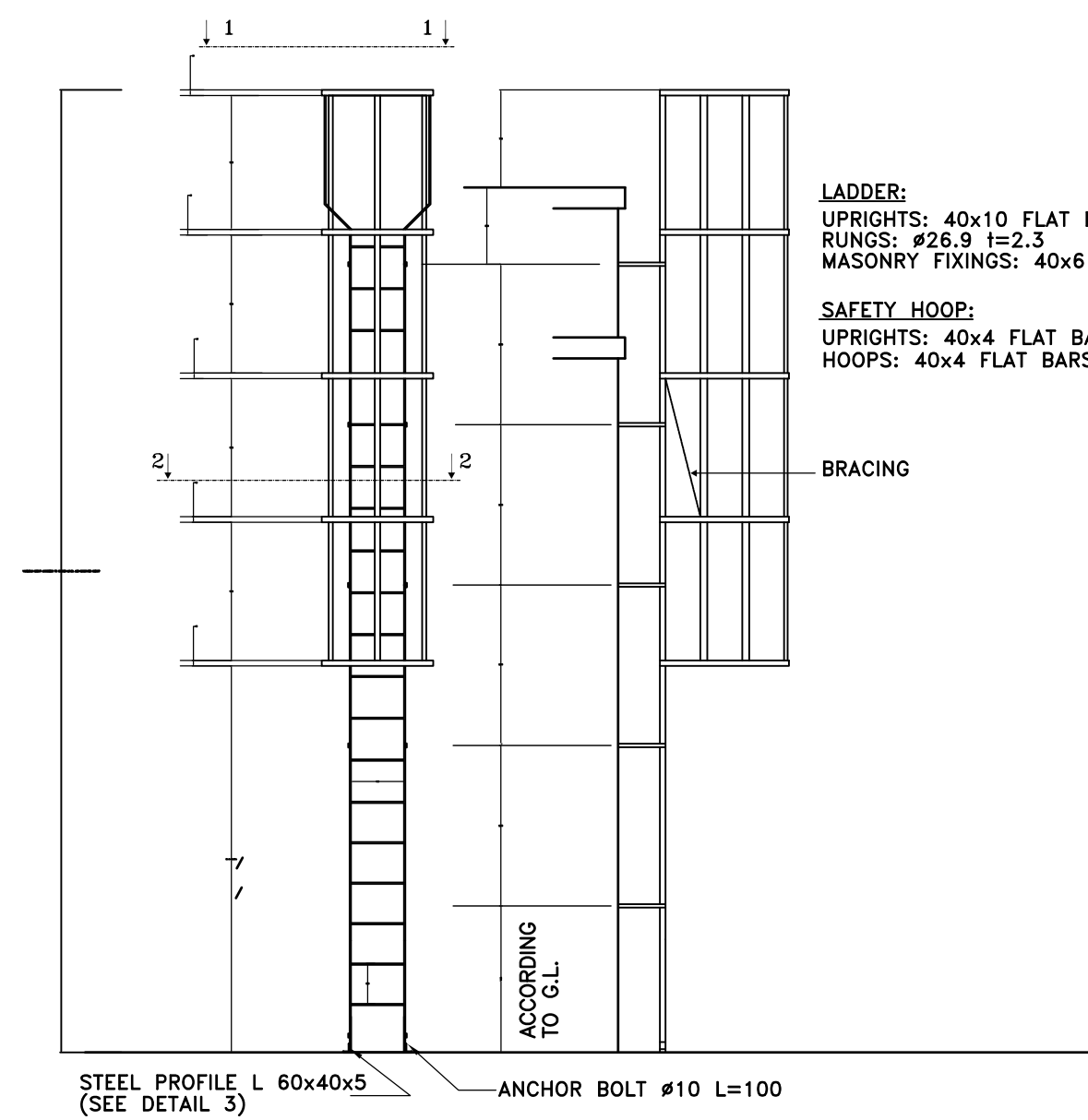


DETAIL OF INTERNAL LADDER AND UPPER FIXING
PLAN VIEW
Scale 1:10

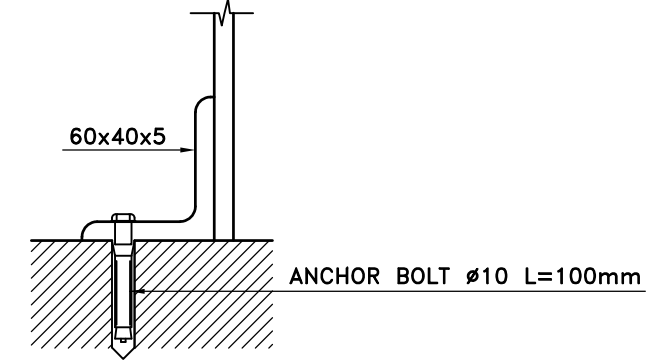


EXTERNAL METALLIC LADDER DETAIL

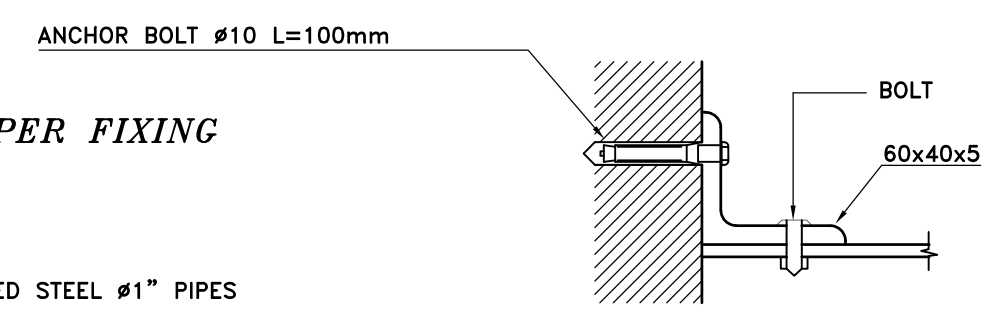
Scale 1:50



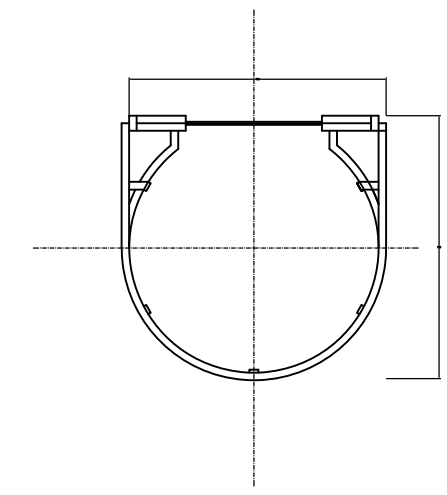
DETAIL 3: FIXING OF
EXTERNAL LADDER TO CONCRETE



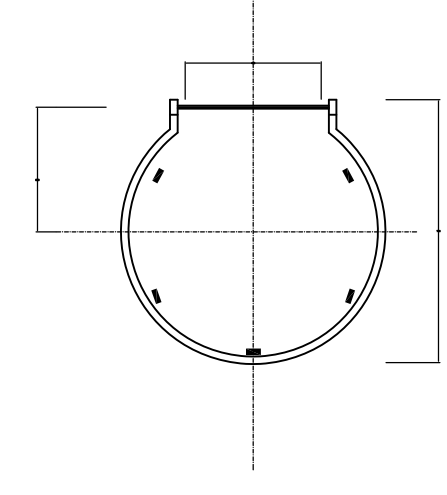
DETAIL 4: FIXING OF
EXTERNAL LADDER TO RESERVOIR WALLS



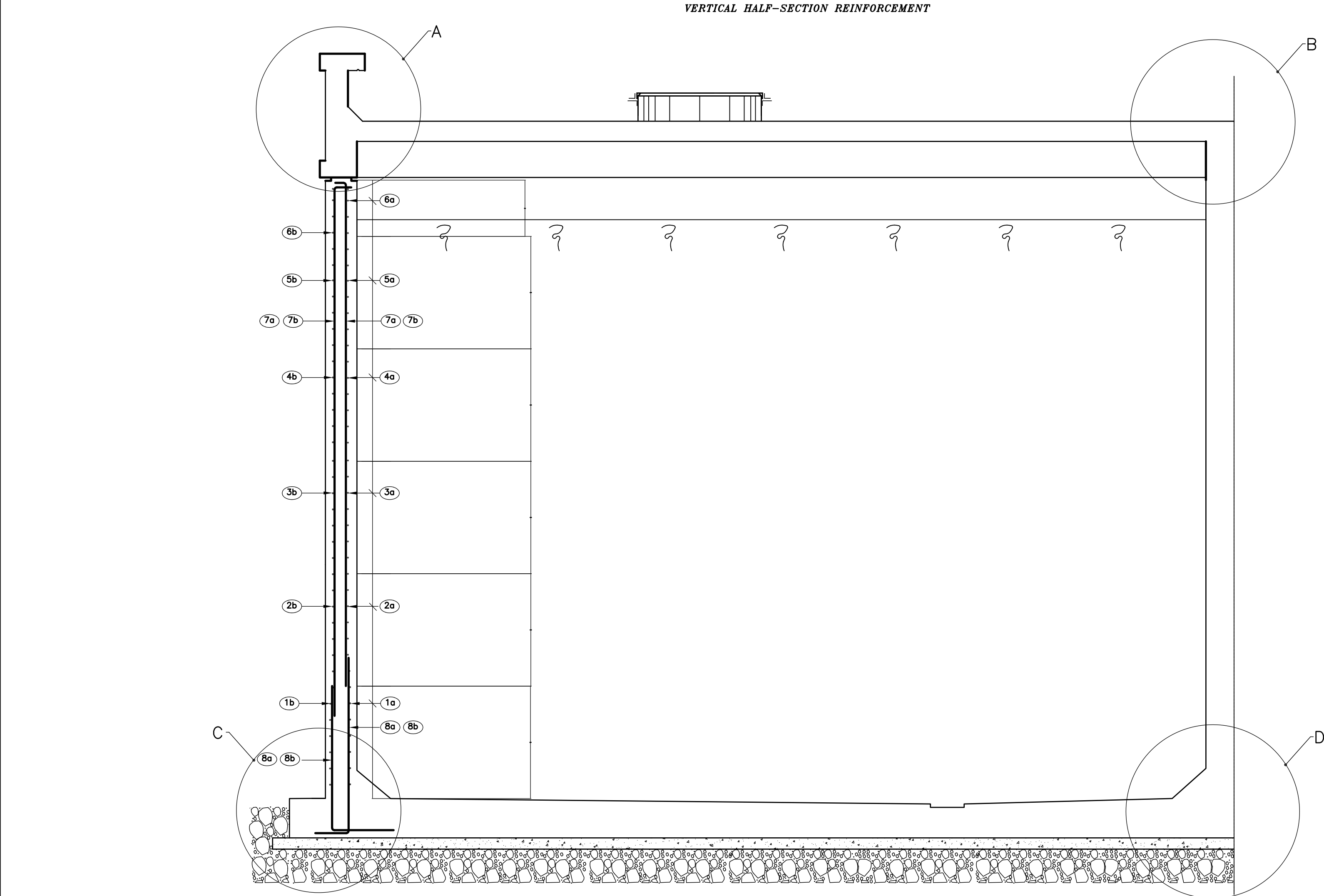
VIEW 1-1
Scale 1:10



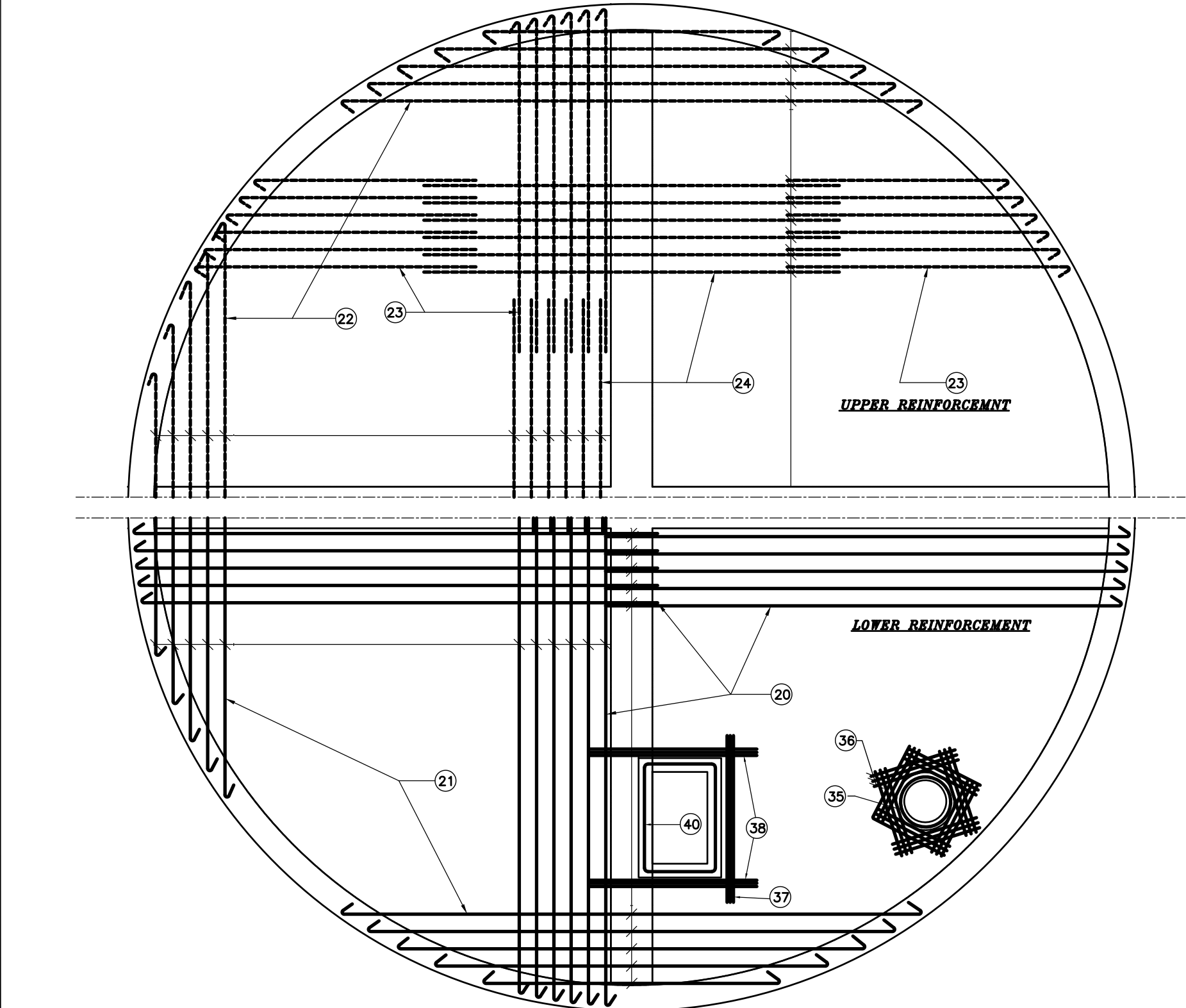
VIEW 2-2
Scale 1:10



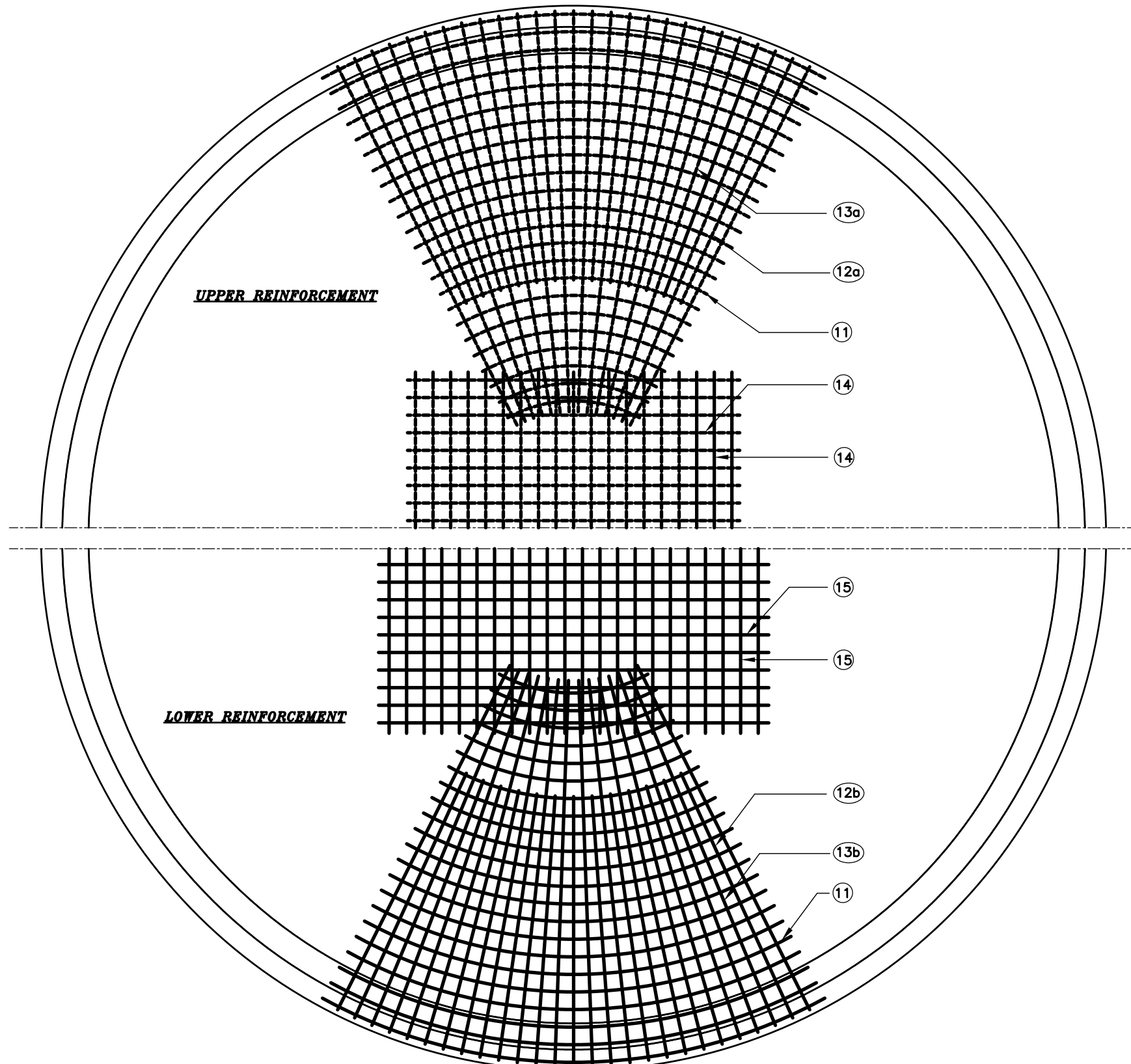
CAPACITY	500M3
R (mm)	5500
0.25R (mm)	1375
e (mm)	250
R+e (mm)	5750
c (mm)	200
f (mm)	350
d (mm)	200
R+t+d (mm)	5950
a (mm)	400
b (mm)	400
h (mm)	600
n (VENTILATION PIPES)	4
n' (DRAIN WATER)	4
H (mm)	6700
g (mm)	800
j (mm)	1200



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	5.20	8
10a	6	T12	0.50		0.50	218
10b	6	T14	1.13		0.27	218
11	7	T16	3.10 to 10.00	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	0.23	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	-	0.94	170
33a	5	Ø8	3.15	-	0.80	170
33b	5	Ø8	0.90	-	0.80	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, ø=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.
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 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
- t=variable min. t=50mm
(2) INSULATION - EXPANDED POLYSTYRENE (ρ=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

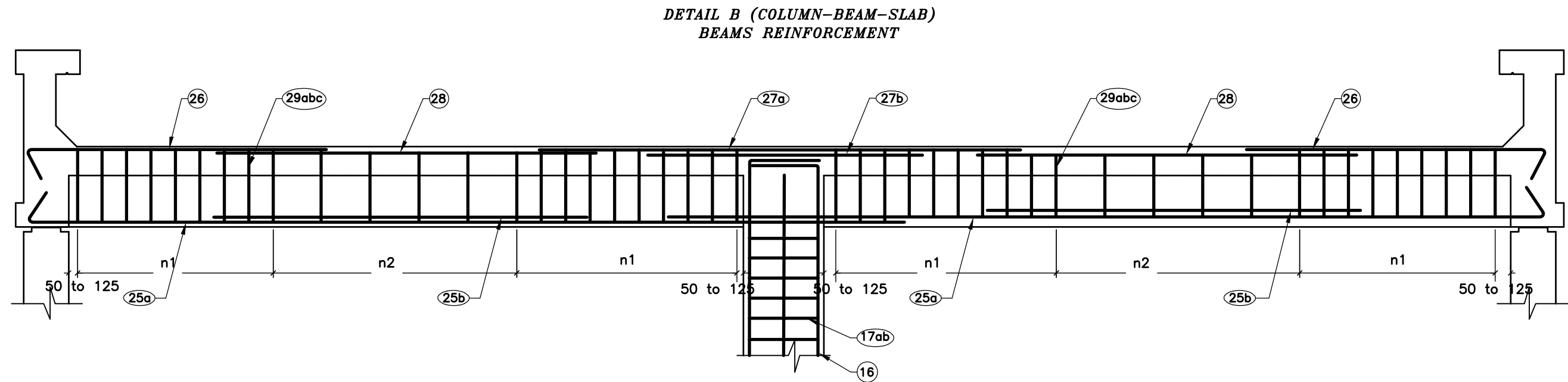
JALL ED DIB – HAJAL Bldg TEL:(04) 712157/712158
P.O.BOX:70492 – ANTELIAS FAX:(04) 712159

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

MAKSE RESERVOIR (CAPACITY 500 m ³)	VERTICAL HALF-SECTION AND PLANS REINFORCEMENT
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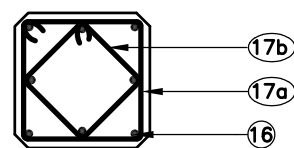
FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

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

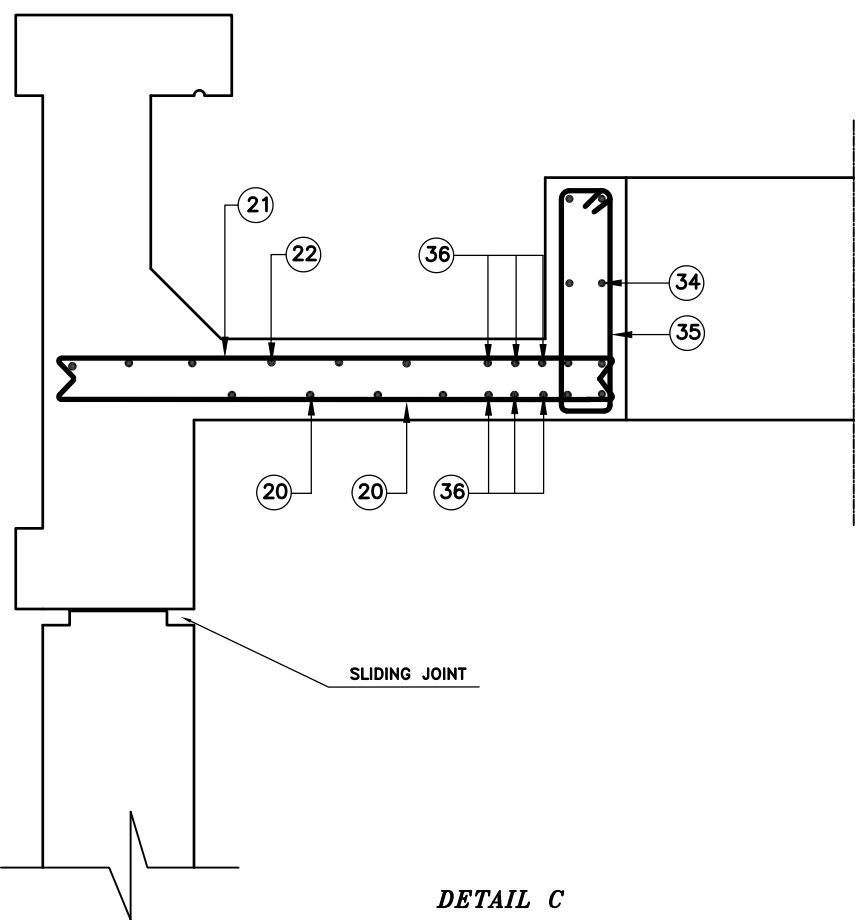


COLUMN REINFORCEMENT

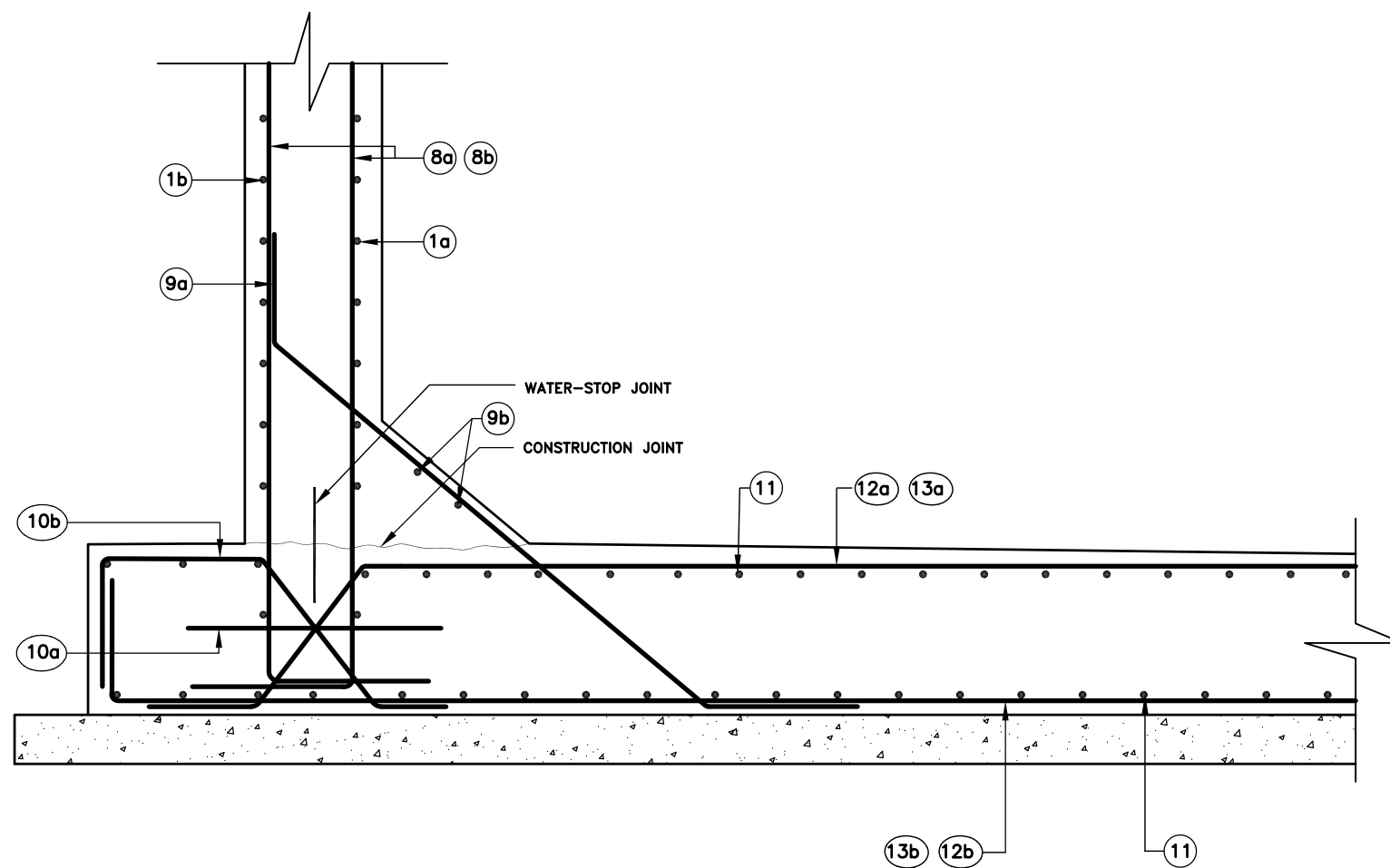
SECTION AT MID SPAN



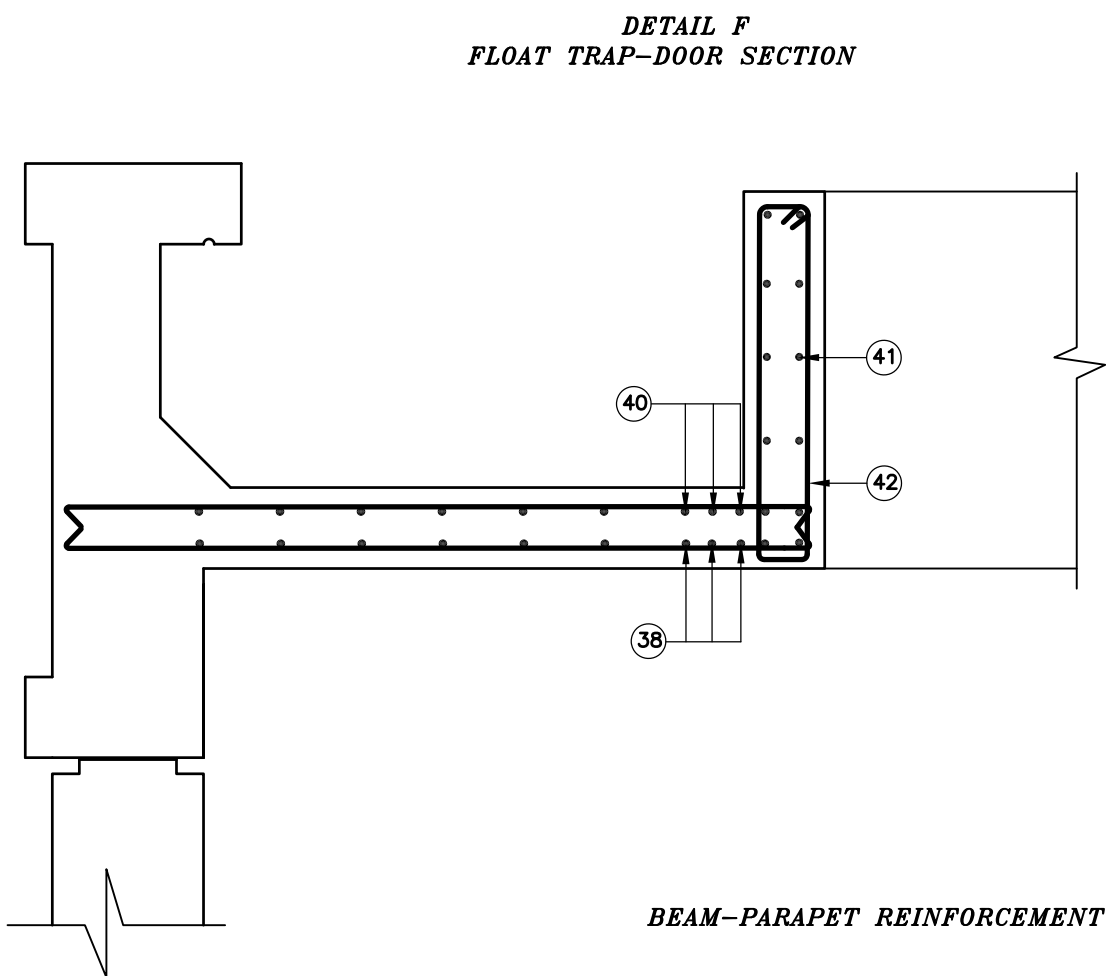
SLAB-TRAP DOOR REINFORCEMENT



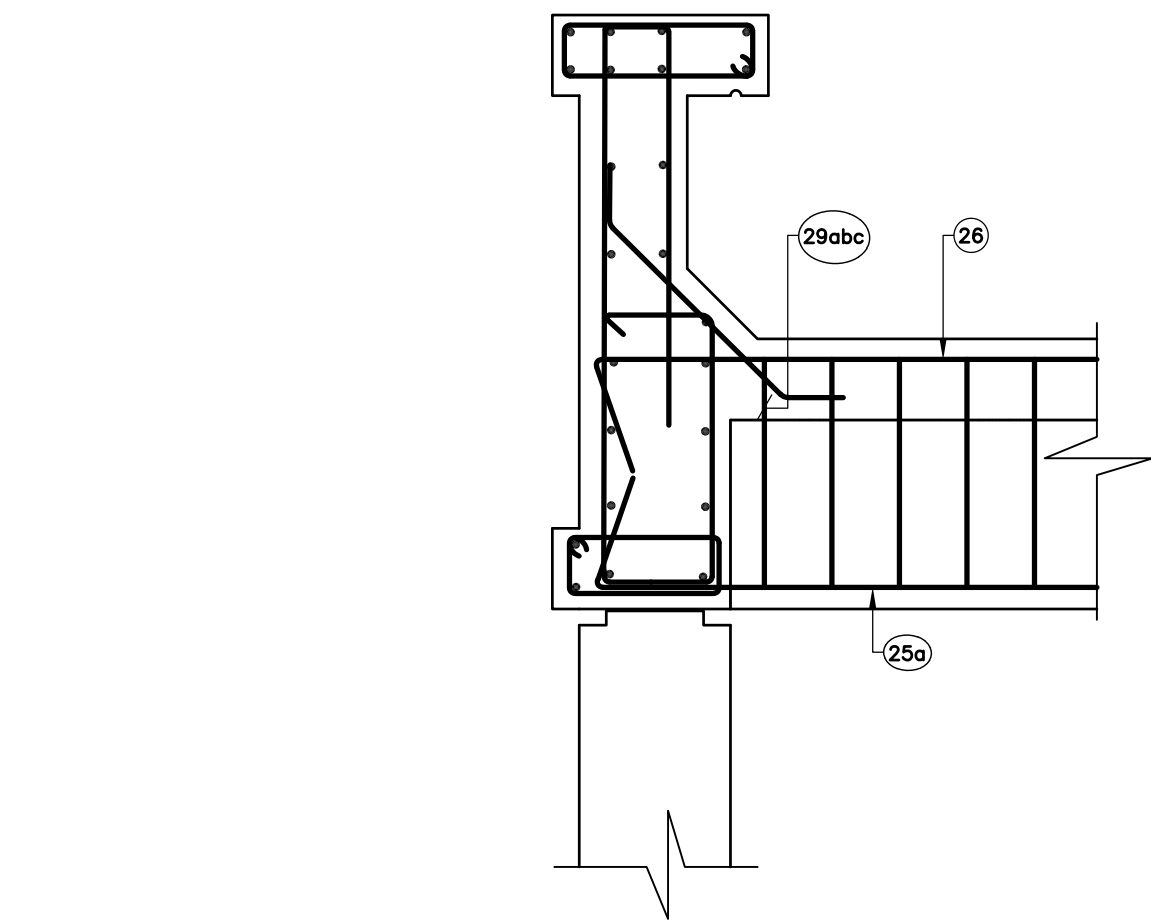
DETAIL C
MAT-WALL REINFORCEMENT



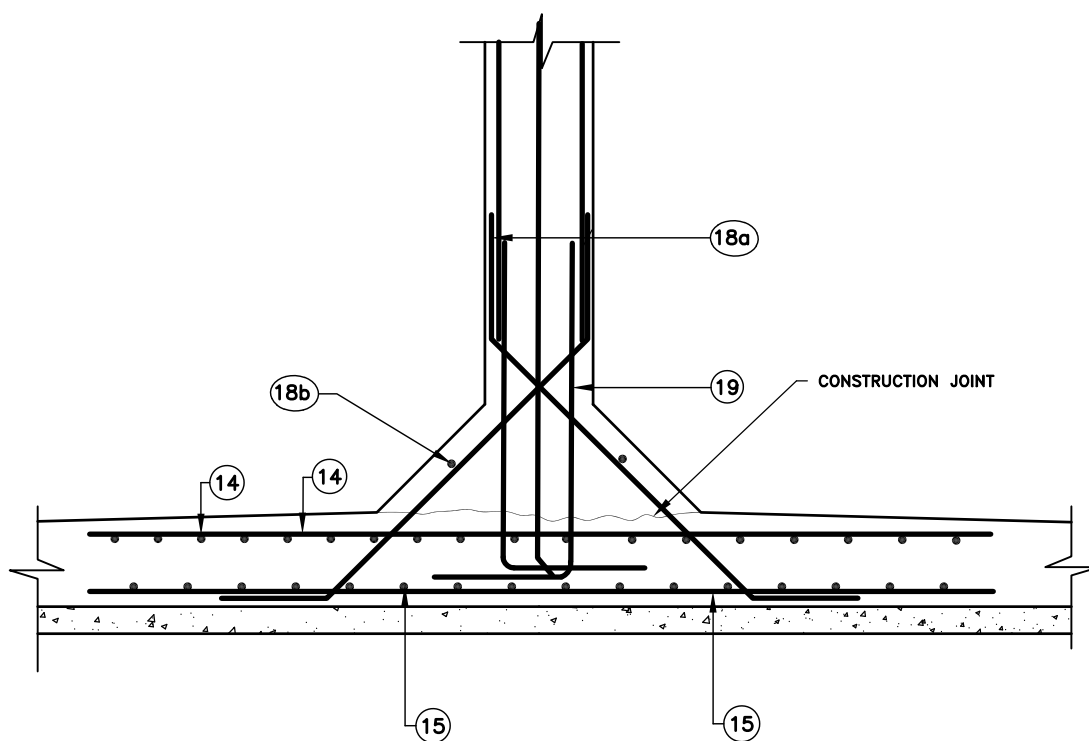
DETAIL A
SLAB-PARAPET REINFORCEMENT



DETAIL F
FLOAT TRAP-DOOR SECTION



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		0.15	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	T16	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		0.45	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	0.80	208
21	6	T12	2.85 to 8.20	1	0.80	36
22	5	T12	2.85 to 8.20	1	0.80	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	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	#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:
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 #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.

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

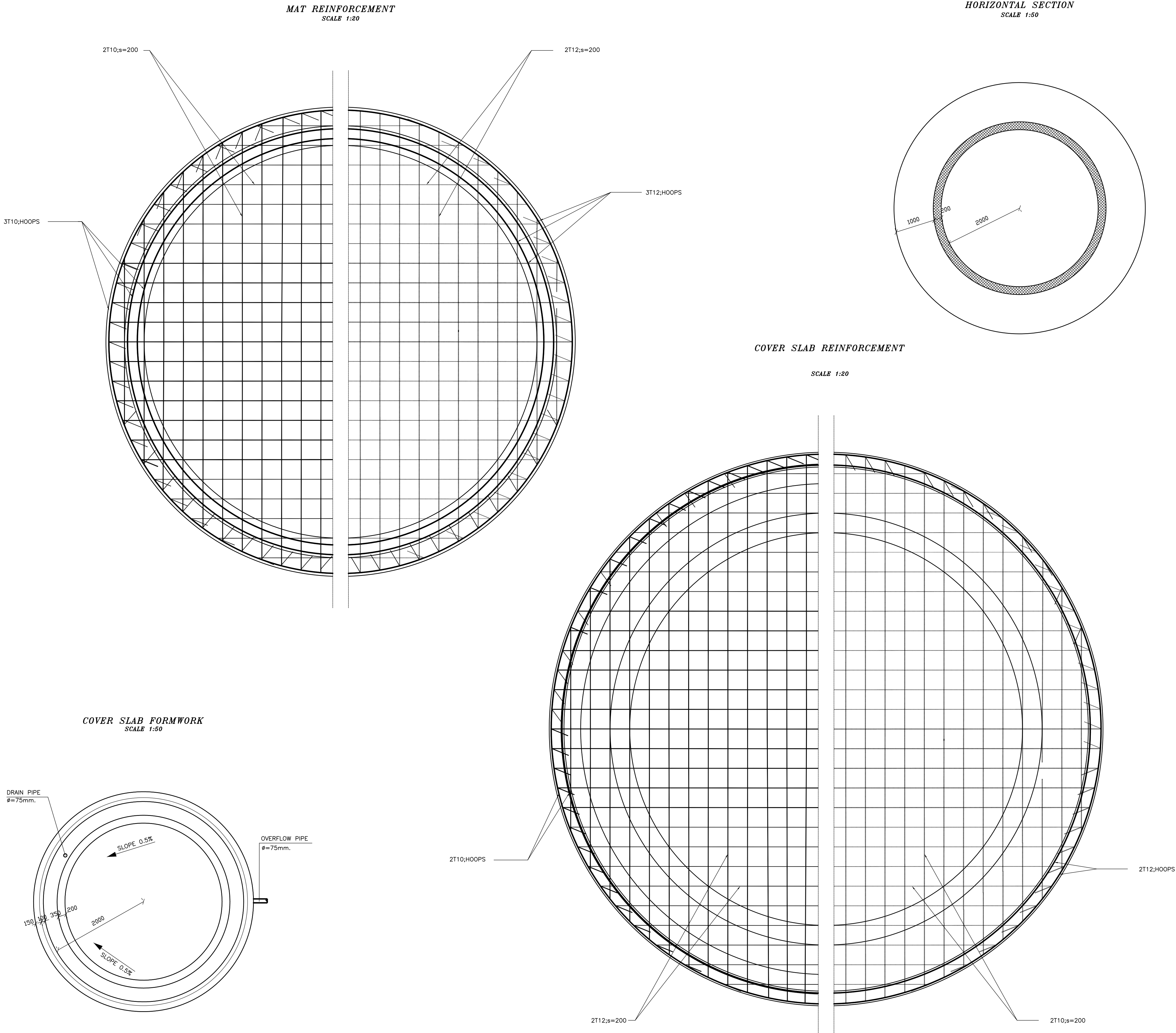
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

MAKSE RESERVOIR
(CAPACITY 500 m³)

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



NOTES:					
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: Fy= 400 N/mm2. MILD STEEL BARS : SYMBOL Ø YIELD STRESS: Fy= 215 N/mm2.					
CONCRETE STRENGTH: SEVERE CONTROL. CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: - ON A CUBE SAMPLES (DIMENSIONS= 150 x 150 x 150 mm): 37.5 N/mm2 - ON A CYLINDER SAMPLES (DIAMETER= 160mm, HEIGHT= 320mm): 30 N/mm2 CONCRETE TENSILE STRENGTH AT 28 DAYS : 2.4 N/mm2 MAXIMUM FREE DROP HEIGHT: 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 LAPPED AT LEAST 40 DIAMETERS OR TWO SQUARES, WHICHEVER IS THE GREATER. ALL LAPS OF BARS ARE TO BE TIED TIGHTLY WITH SIX LAPS OF 1.5 mm ANNEALED IRON WIRE AT INTERVALS OF TEN DIAMETERS OF THE BARS.					
BENDING: Ø > 12mm MECHANICAL. Ø < 12mm 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 _{total} > 4mm 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 DARWINGS. * 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, #4" IN THE GRAVEL PROTECTION LAYER.					
BOTTOM STEEL REINFORCEMENT TOP STEEL REINFORCEMENT					
Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

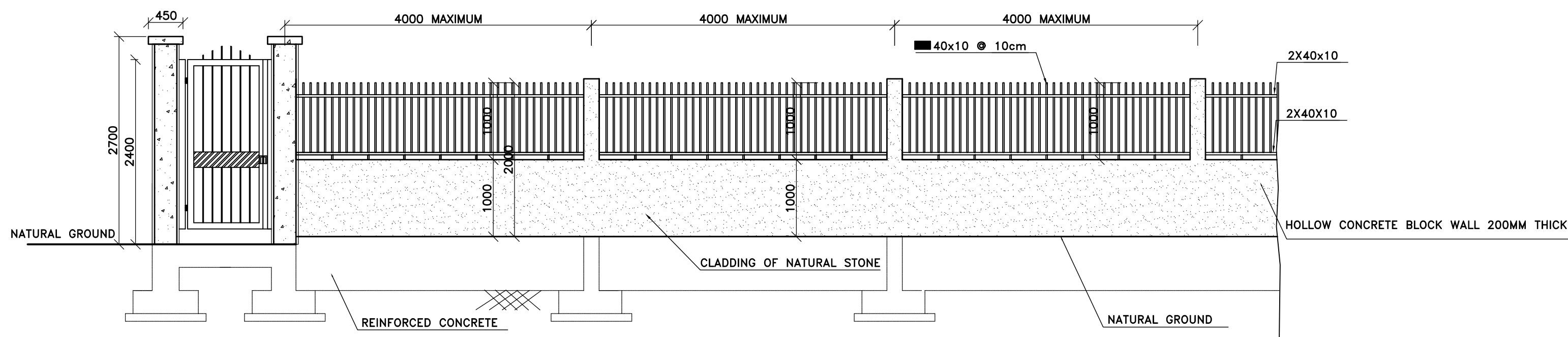
BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB – HAJAL Bldg TEL:(04) 712157/712158
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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

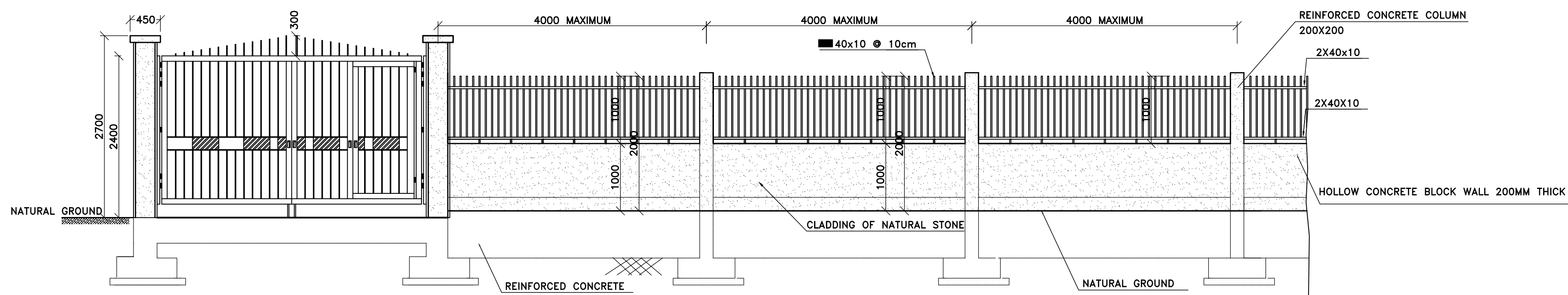
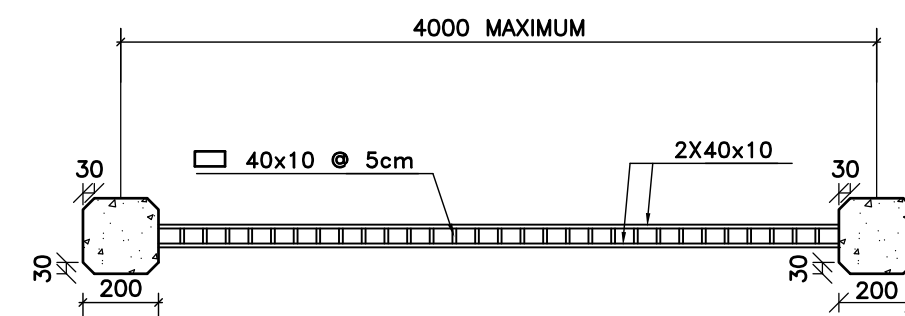
VALVE CHAMBER INSIDE DIAMETER 400 cm INSIDE HEIGHT VARIABLE BETWEEN 300 & 600cm DEPENDING ON THE GROUND LEVEL	FORMWORK REINFORCEMENT
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FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-C01-09	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

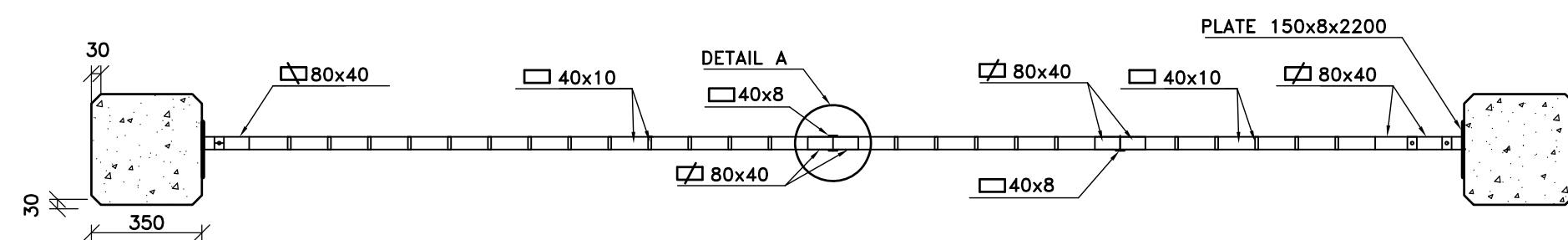
DATE	SCALE	SHEET No.	DRAWING No.
JULY 2019	1/50-1/20	9/9	509W-RS03-C09



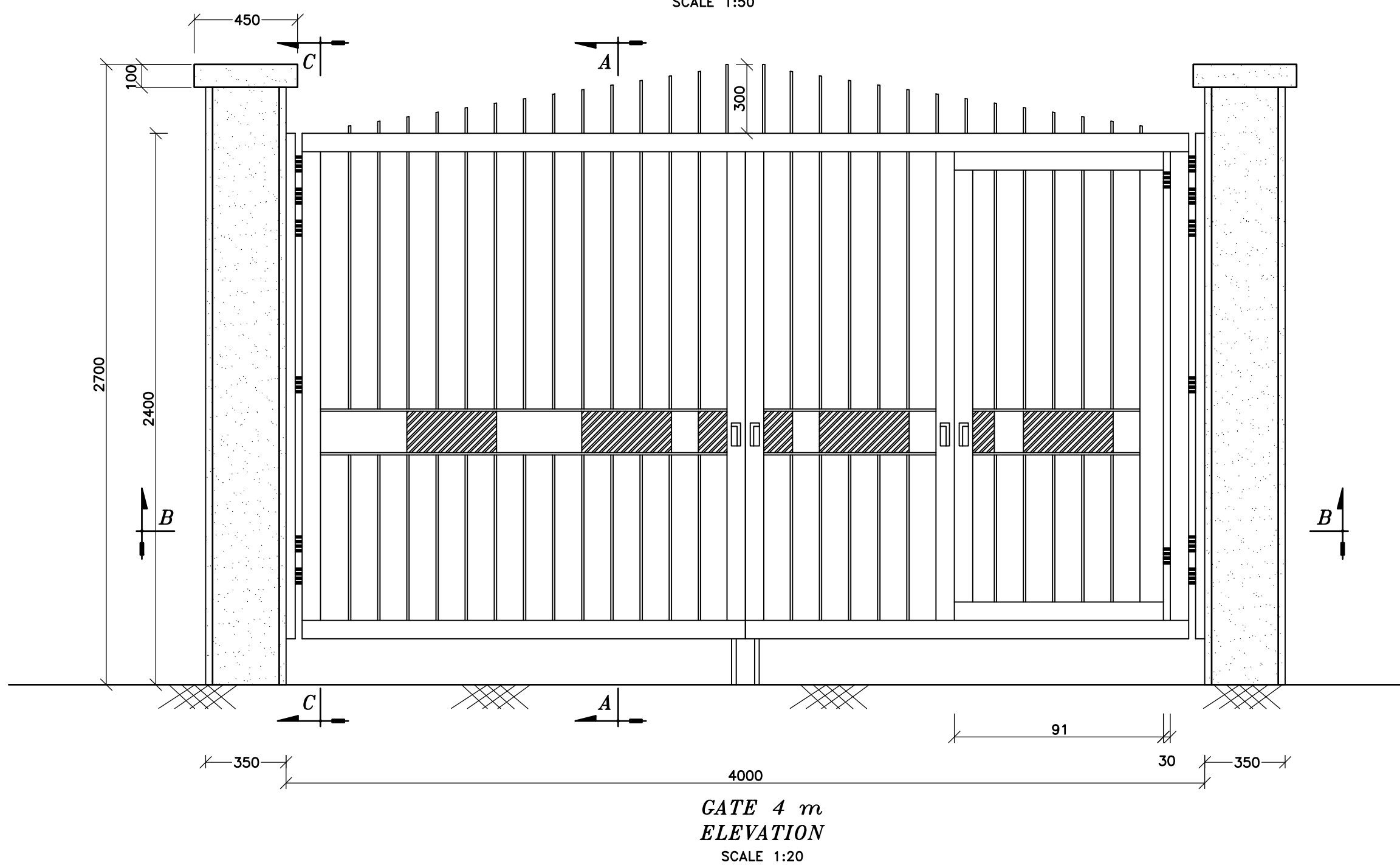
GATE 1.2 m (ELEVATION)
SCALE 1:50



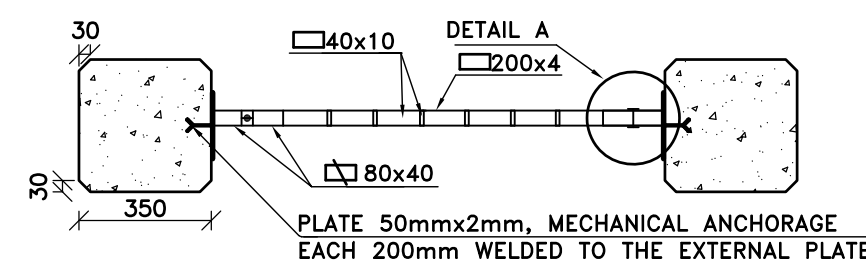
GATE 4 m (ELEVATION)
SCALE 1:50



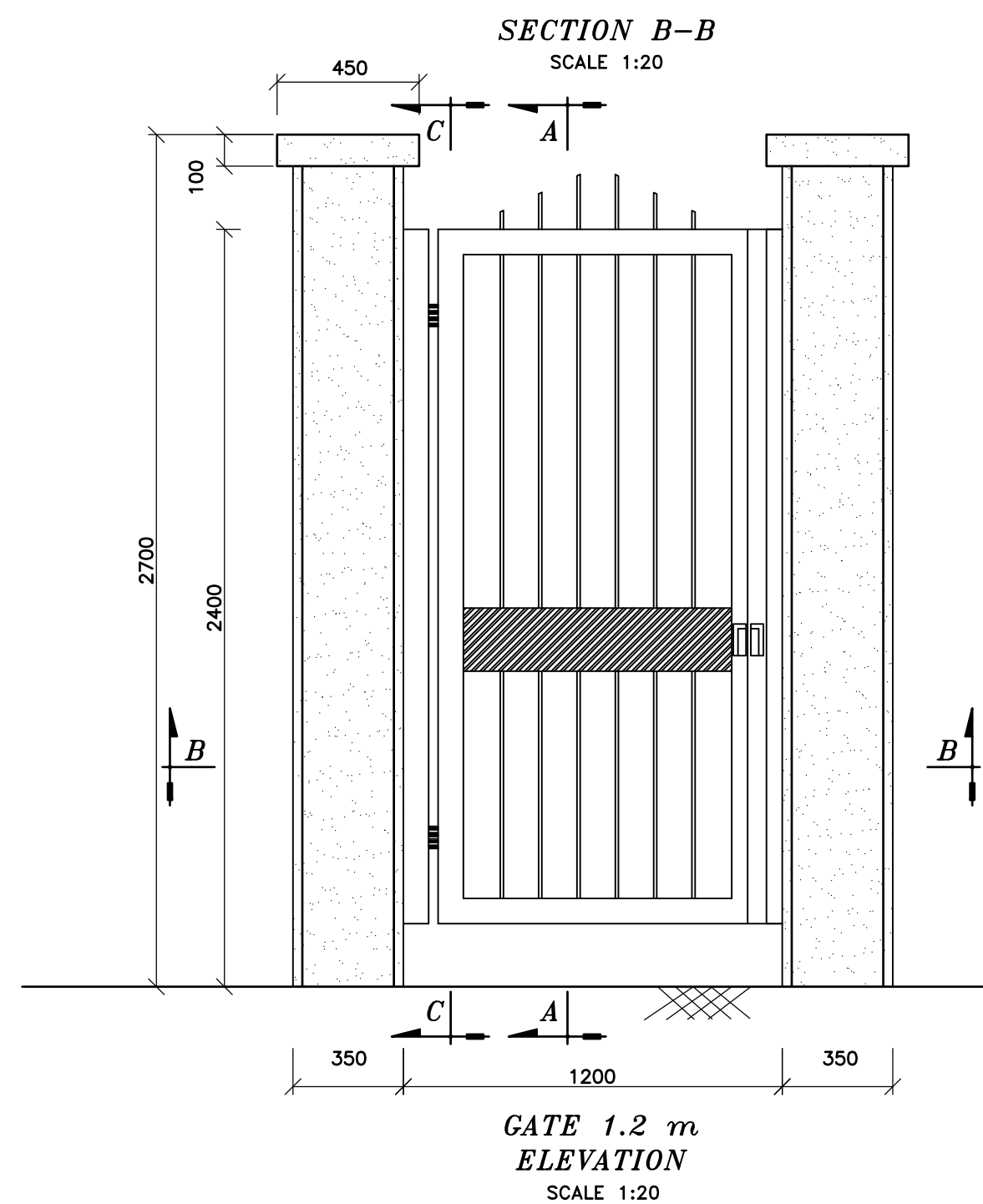
SECTION B-B
SCALE 1:50



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

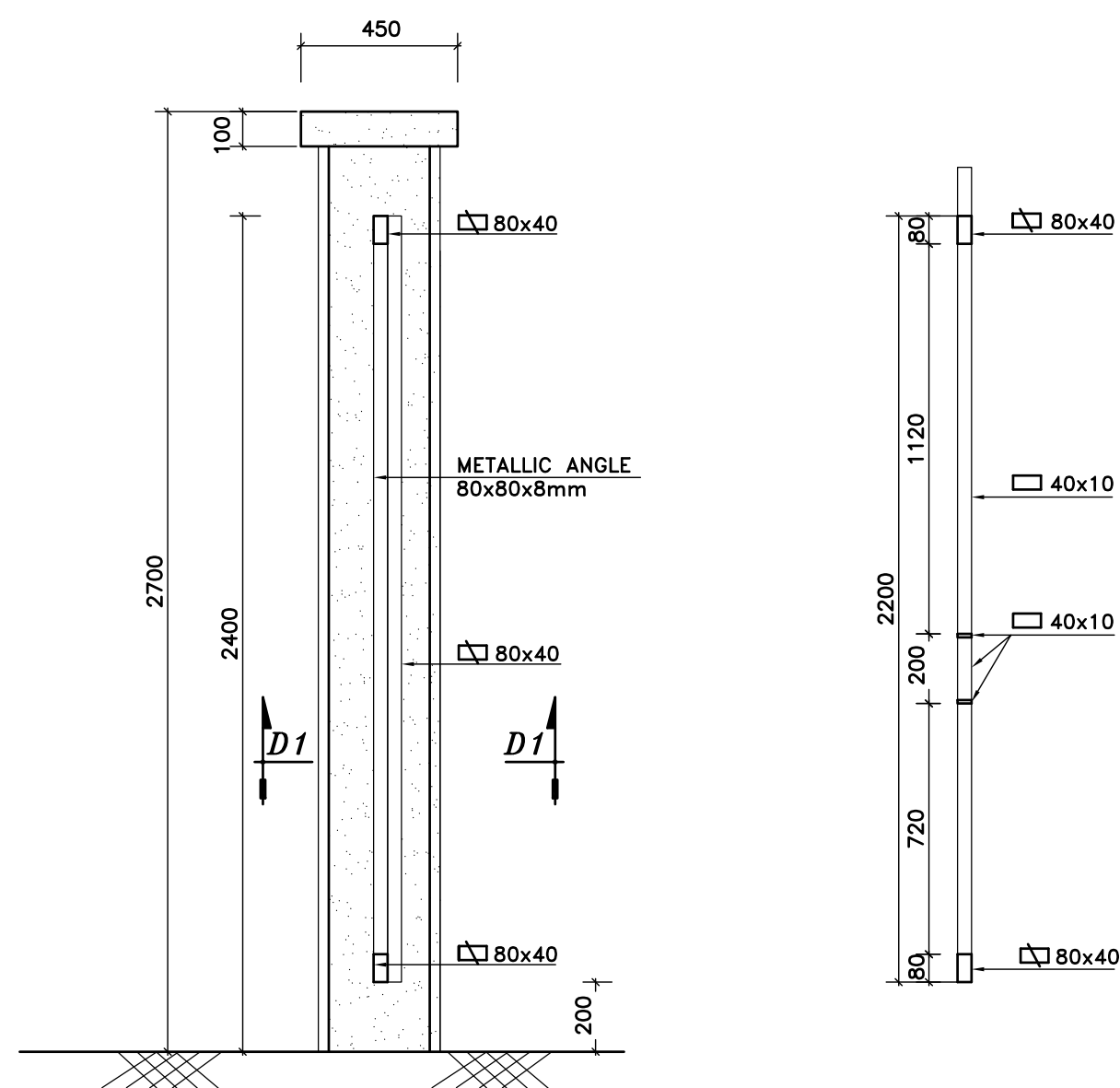
CONSTRUCTION OF WATER WORKS IN
QUADI ED DELEM-QABB ELIAS AND MRAIJAT

FENCE AND
TYPICAL GATE 4m AND 1.2m

ELEVATIONS
SECTIONS AND DETAILS

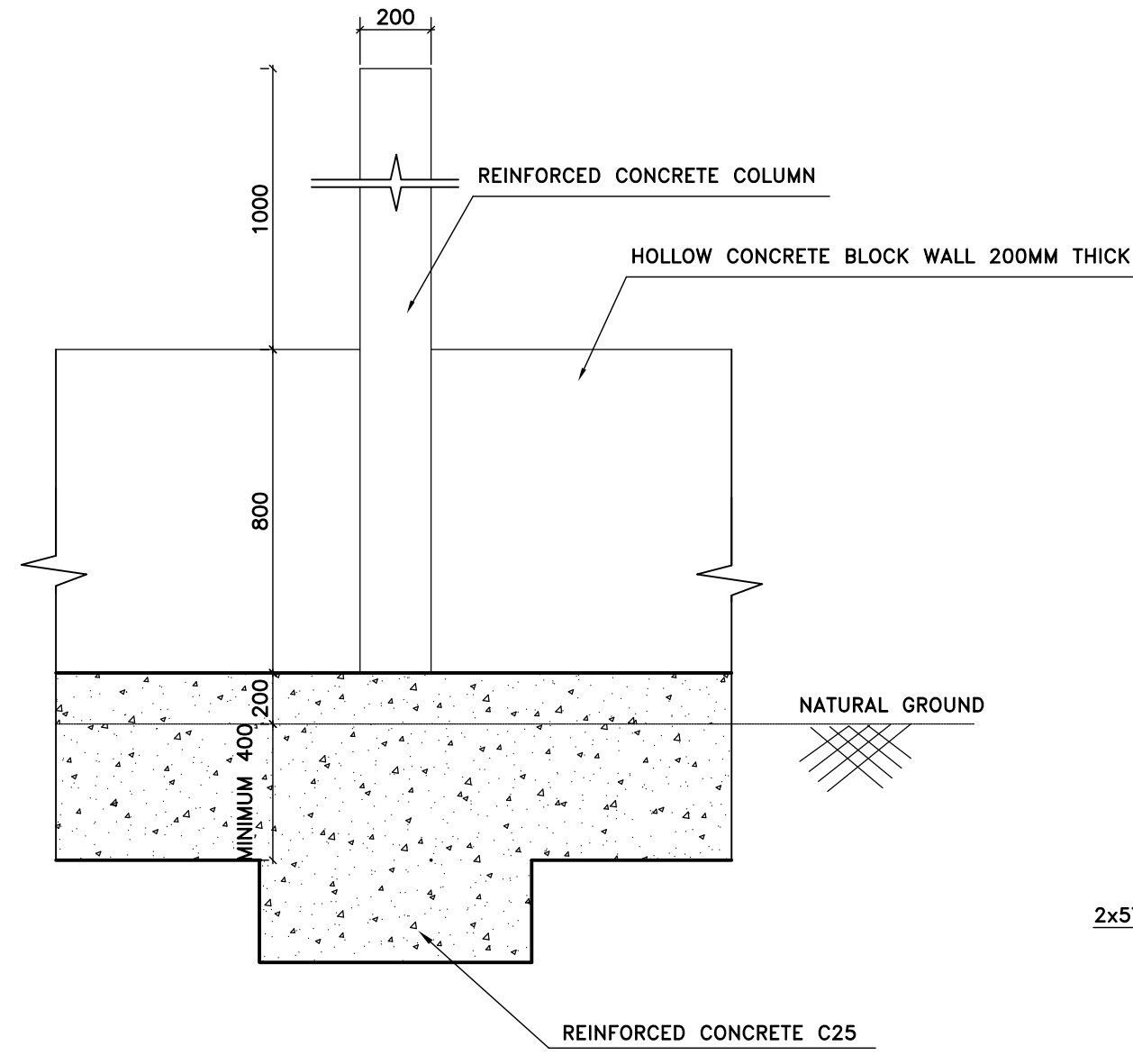
FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-SF01-02	BTD	BTD	BTD

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

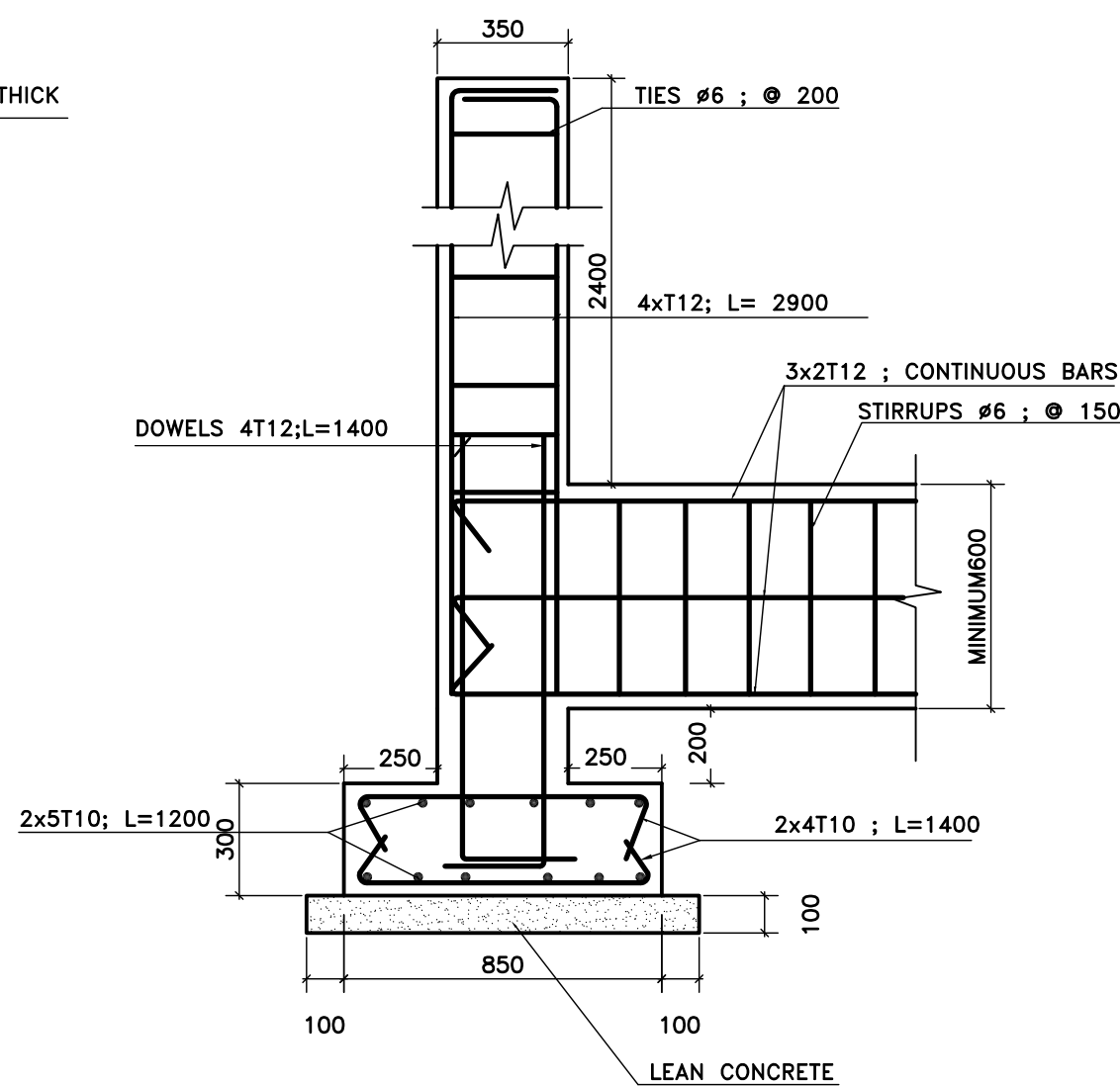


SECTION C-C
SCALE 1:20

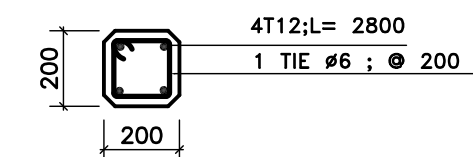
SECTION A-A
SCALE 1:20



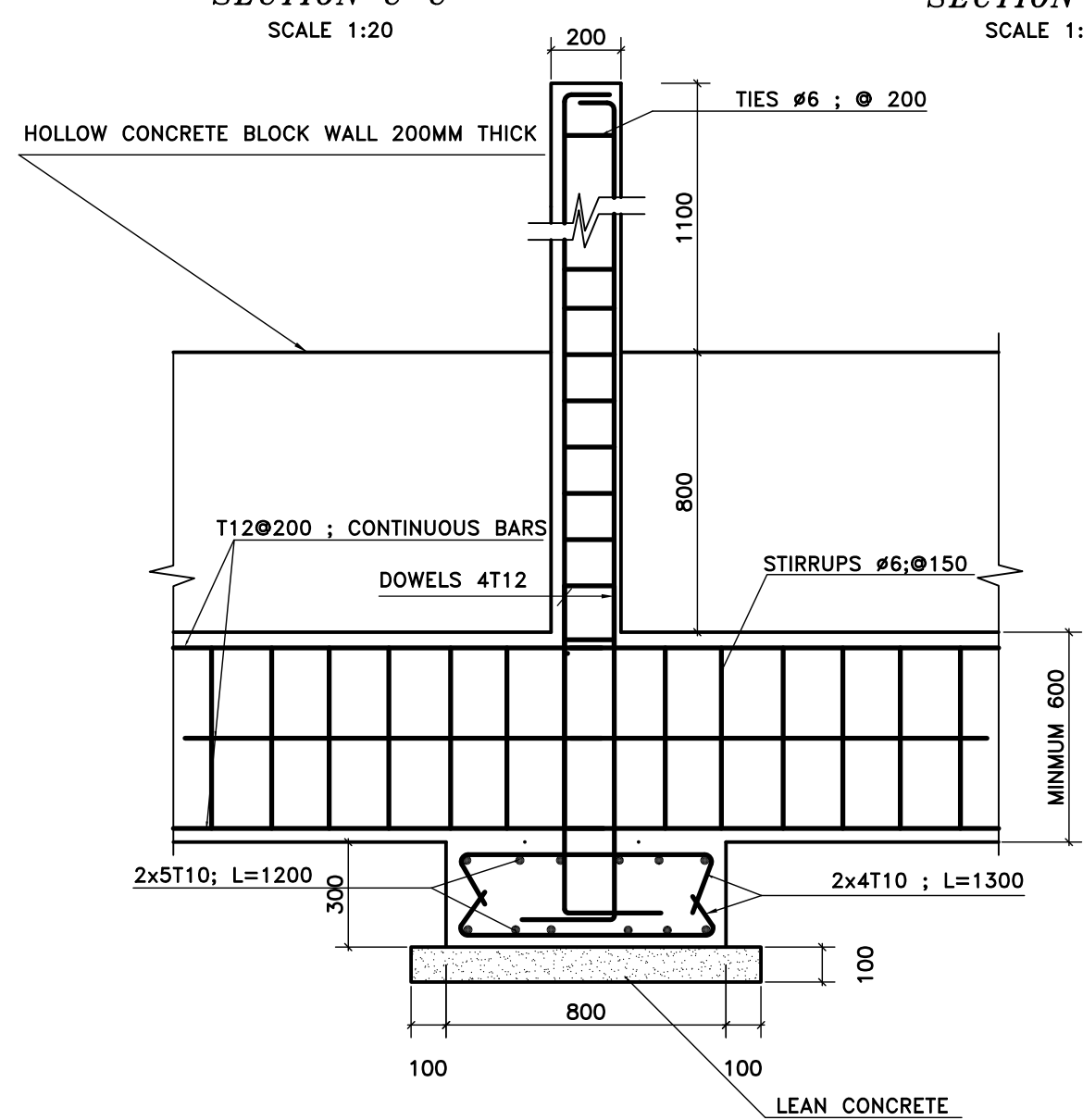
TYPICAL FENCE COLUMN
SCALE 1:20



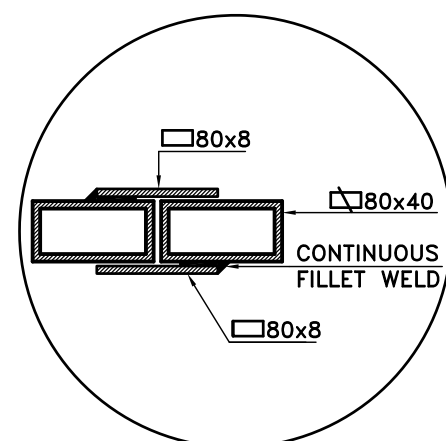
REINFORCEMENT OF TYPICAL ACCESS GATE COLUMN AND FOOTING
SCALE 1:20



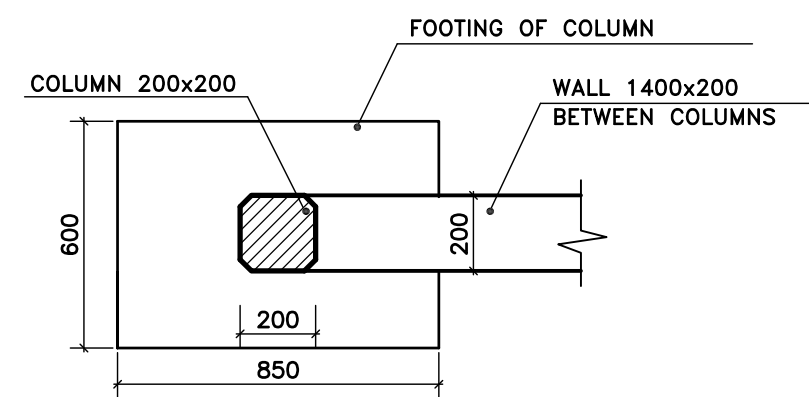
HORIZONTAL SECTION
OF COLUMN
SCALE 1:20



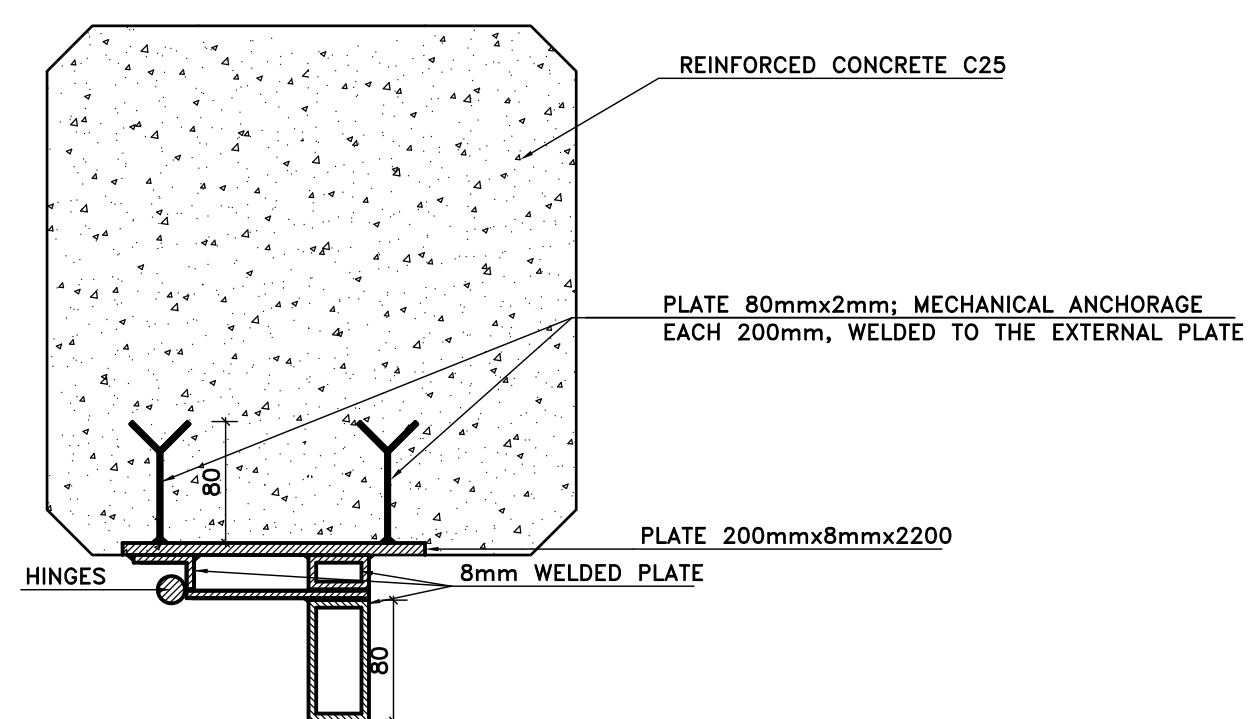
REINFORCEMENT OF TYPICAL COLUMN AND FOOTING
SCALE 1:20



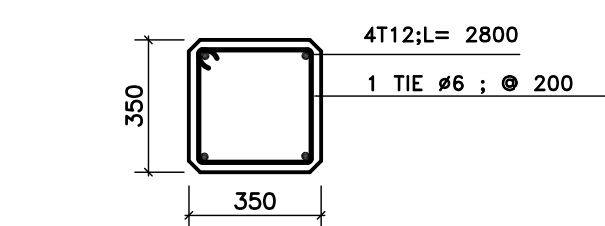
DETAIL A
SCALE 1:5



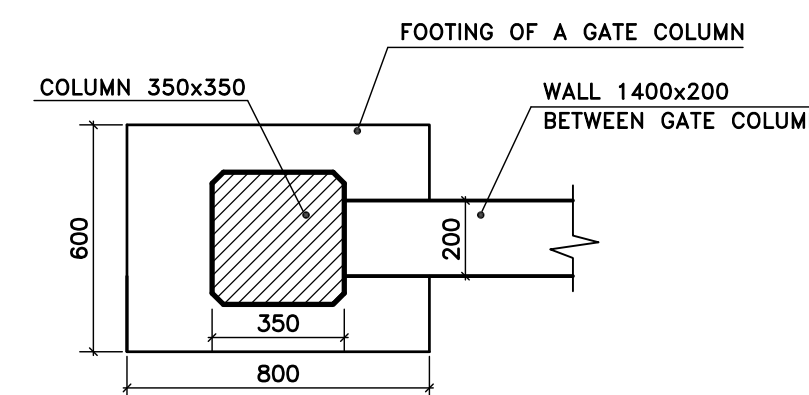
FOOTING
SCALE 1:20



SECTION D-D
SCALE 1:5



HORIZONTAL SECTION
OF GATE COLUMN
SCALE 1:20



FOOTING
SCALE 1:20

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 - ANTELIA FAX: (04) 712159

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

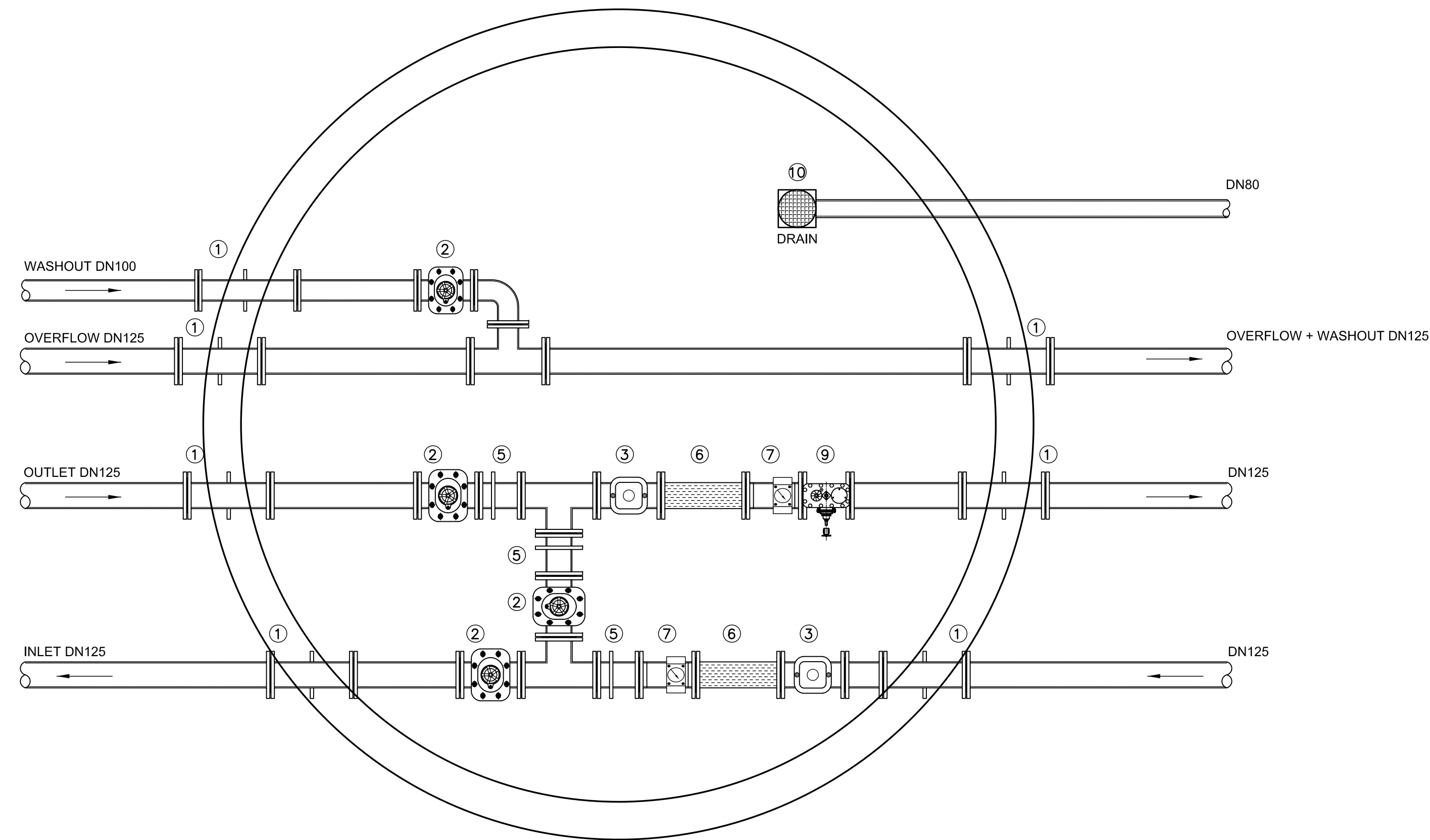
FENCE AND
TYPICAL GATE 4m AND 1.2m

ELEVATIONS
SECTIONS AND DETAILS

FILE NAME	DESIGNED BY	DRAWN BY	CHECKED BY
509W-RS03-SF01-02	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
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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JALL ED DIB – HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 – ANTELIAS FAX: (04) 712159

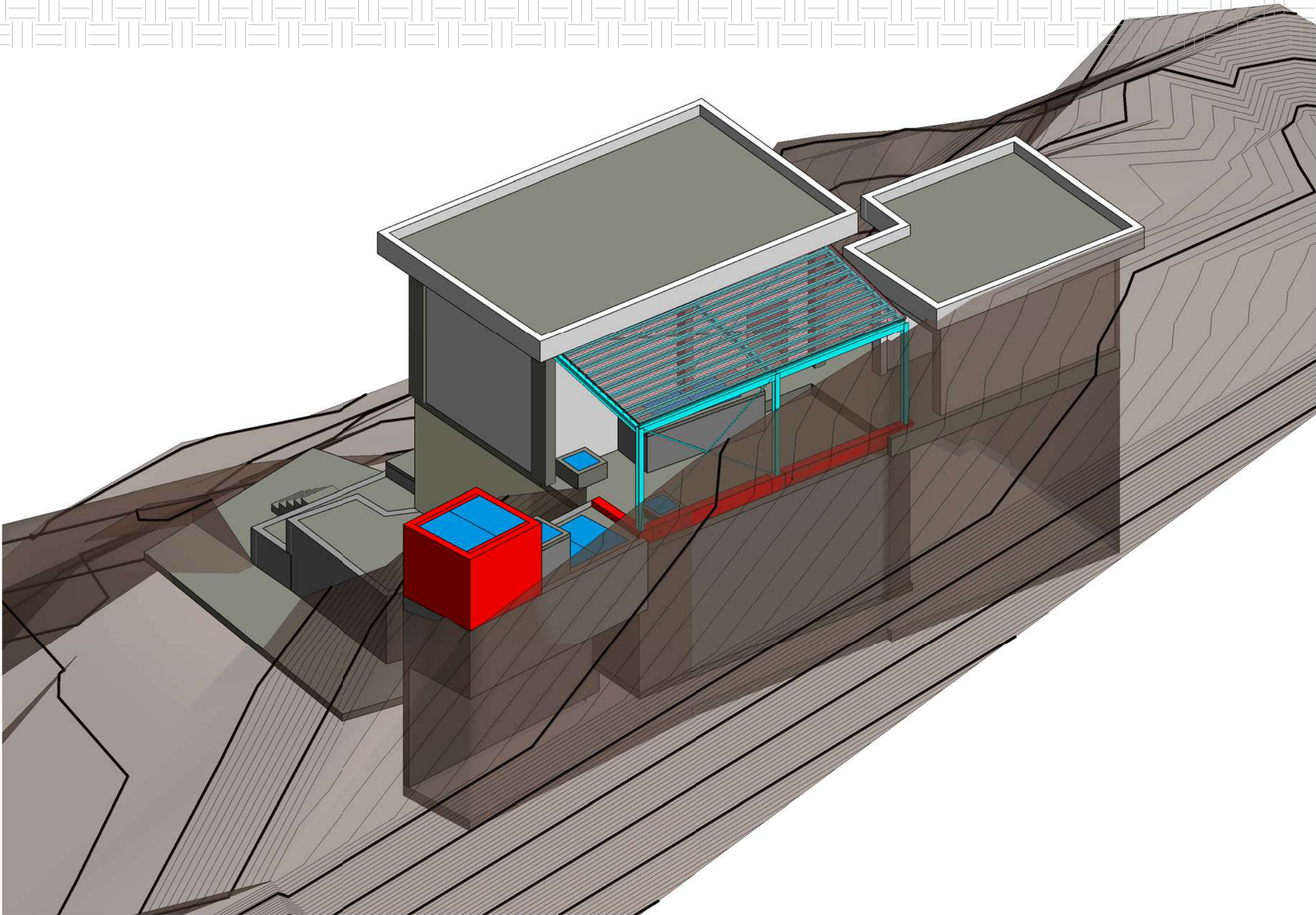
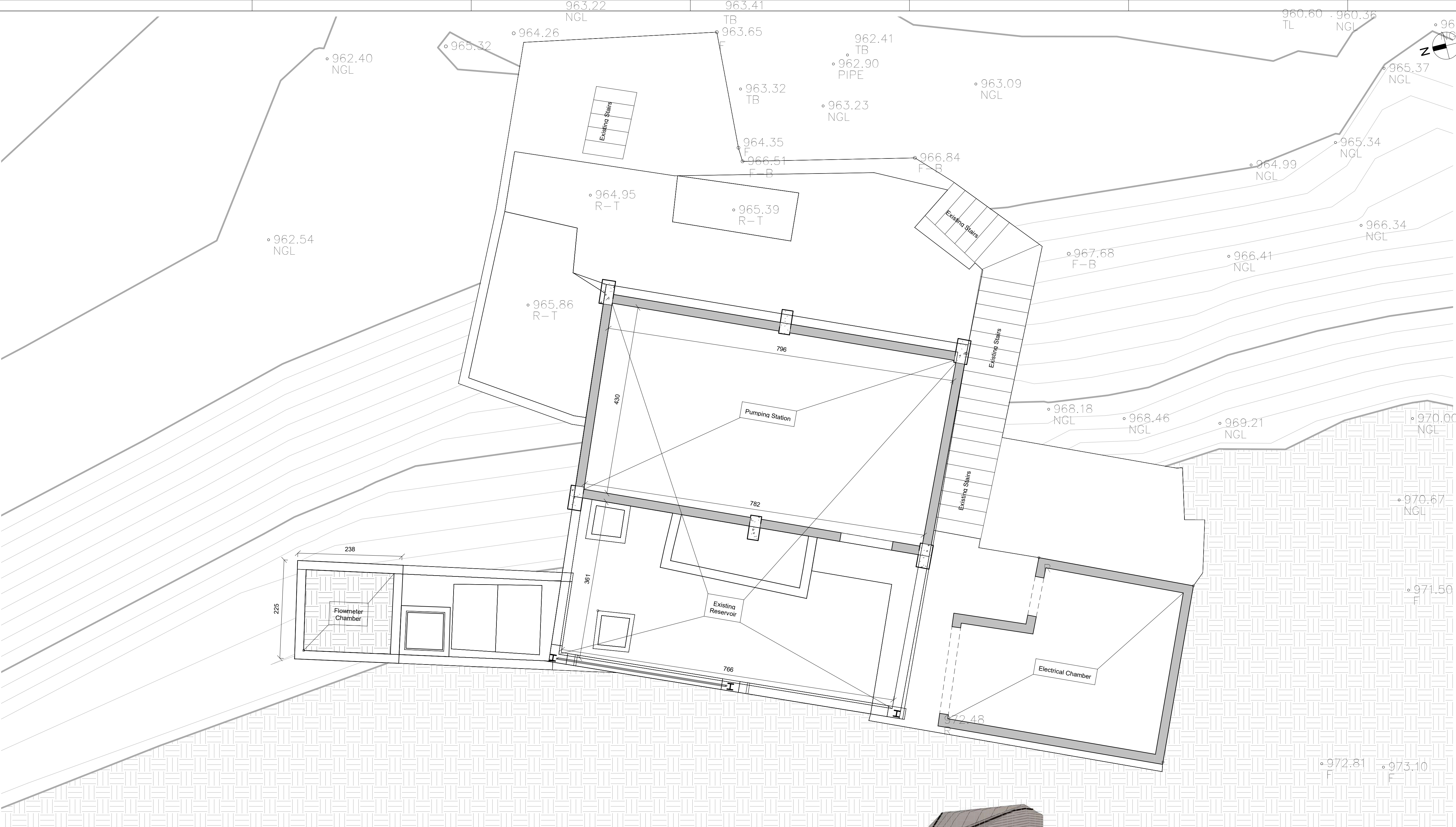
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

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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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

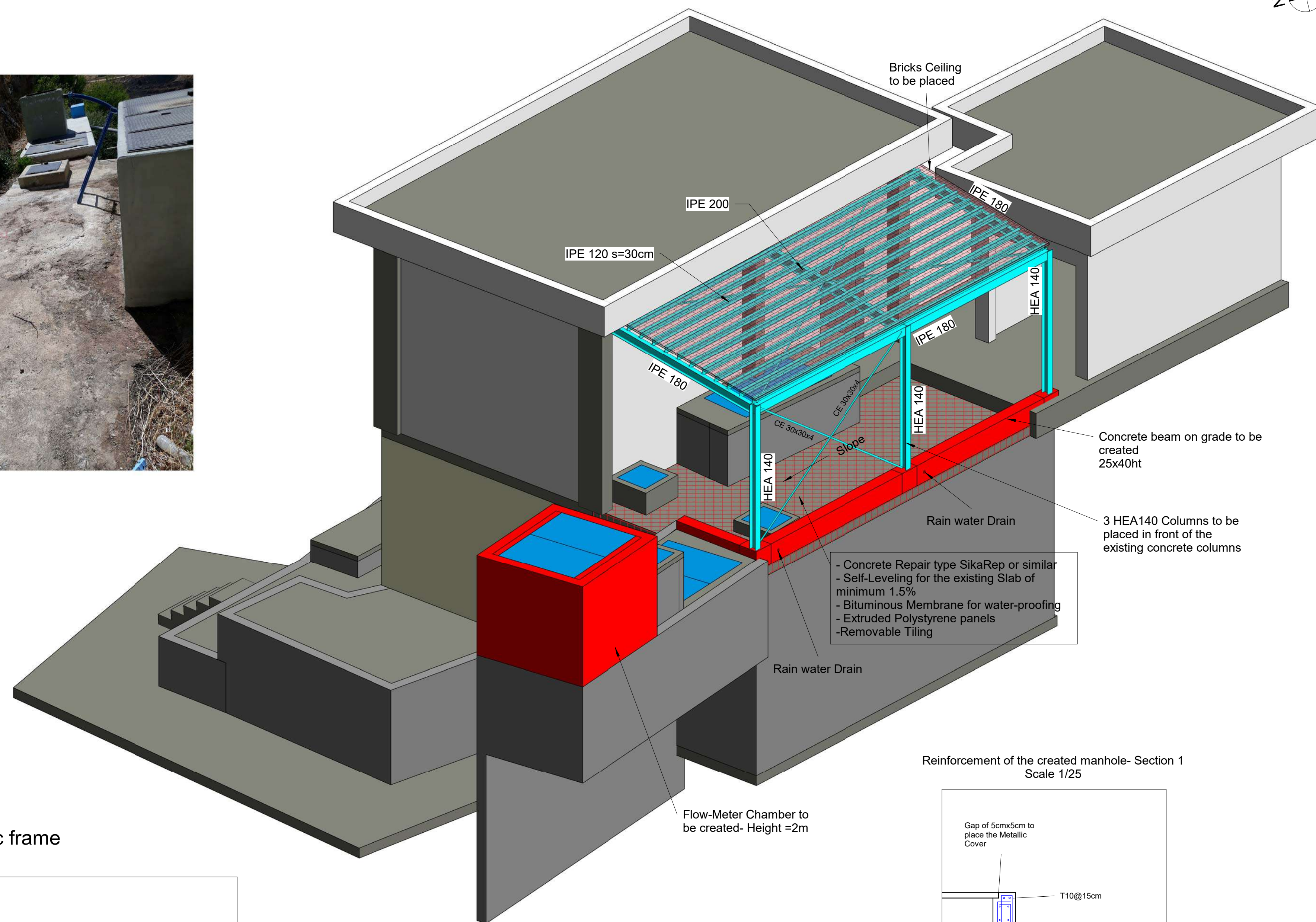
General View

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



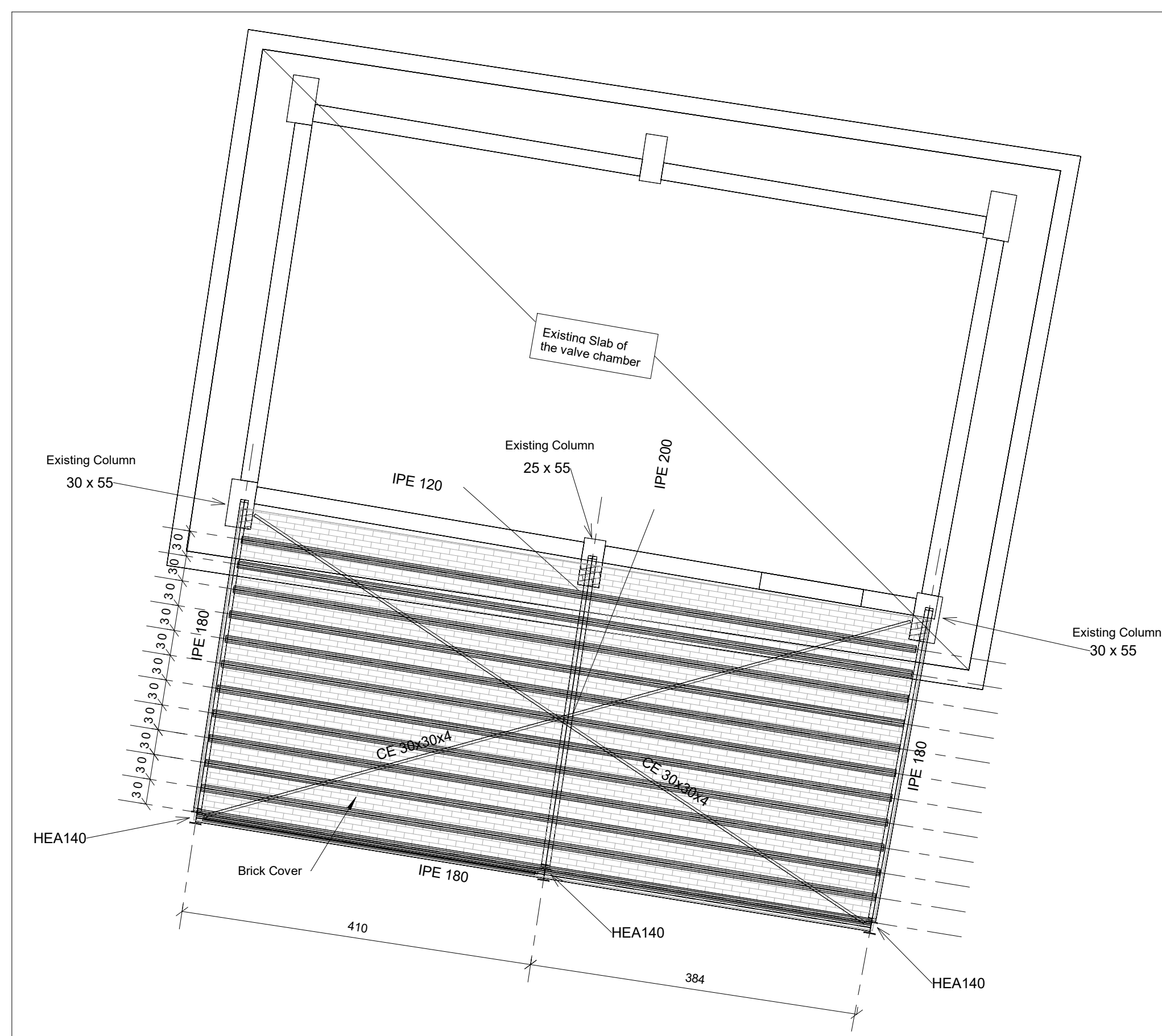
- Concrete Repair type SikaRep or similar
- Self-Leveling for the existing Slab of minimum 1.5%
- Bituminous Membrane for water-proofing
- Extruded Polystyrene panels
- Removable Tiling



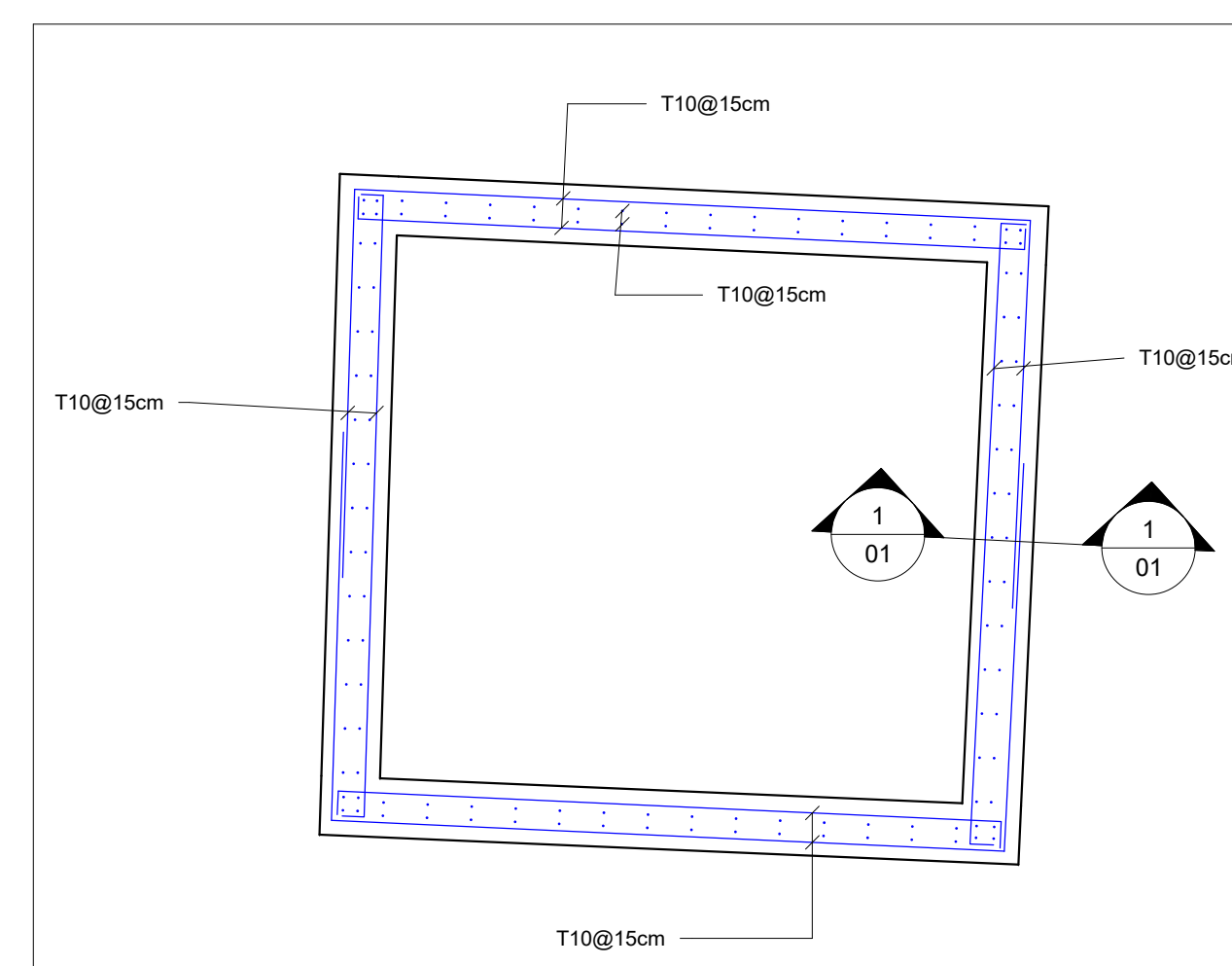
- Concrete Repair type SikaRep or similar
- Self-Leveling for the existing Slab of minimum 1.5%
- Bituminous Membrane for water-proofing
- Extruded Polystyrene panels
- Removable Tiling

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

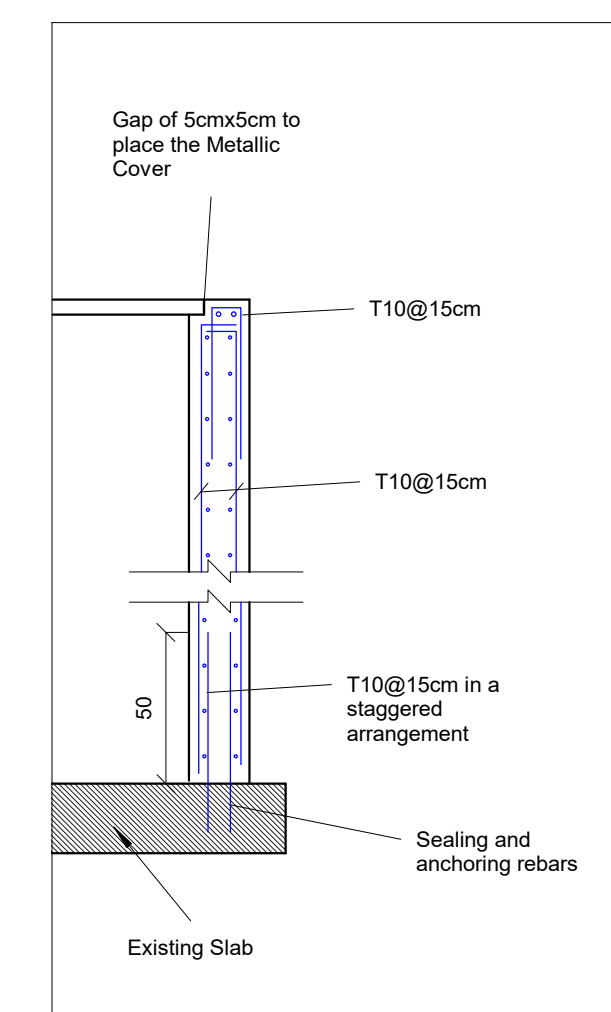
Plan View of the created metallic frame
Scale: 1/50



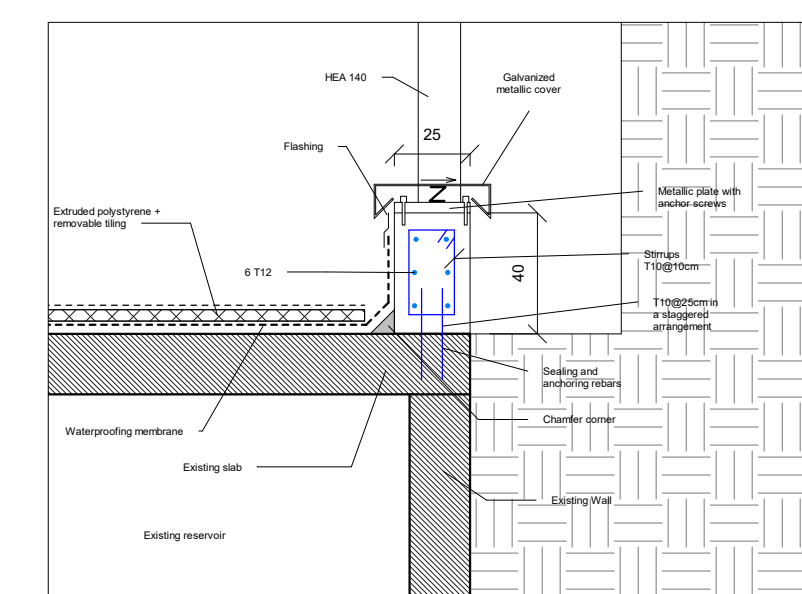
Reinforcement of the created manhole
Scale 1/25



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.

<u>Rev.</u>	<u>Date</u>	<u>Dsgn</u>	<u>Drawn</u>	<u>Chk'd</u>	<u>Appr'd</u>
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REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND
RECONSTRUCTION

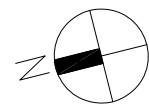


CONSTRUCTION OF WATER WORKS IN OUADI ED DELEM - QABB ELIAS AND MRAIJAT

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

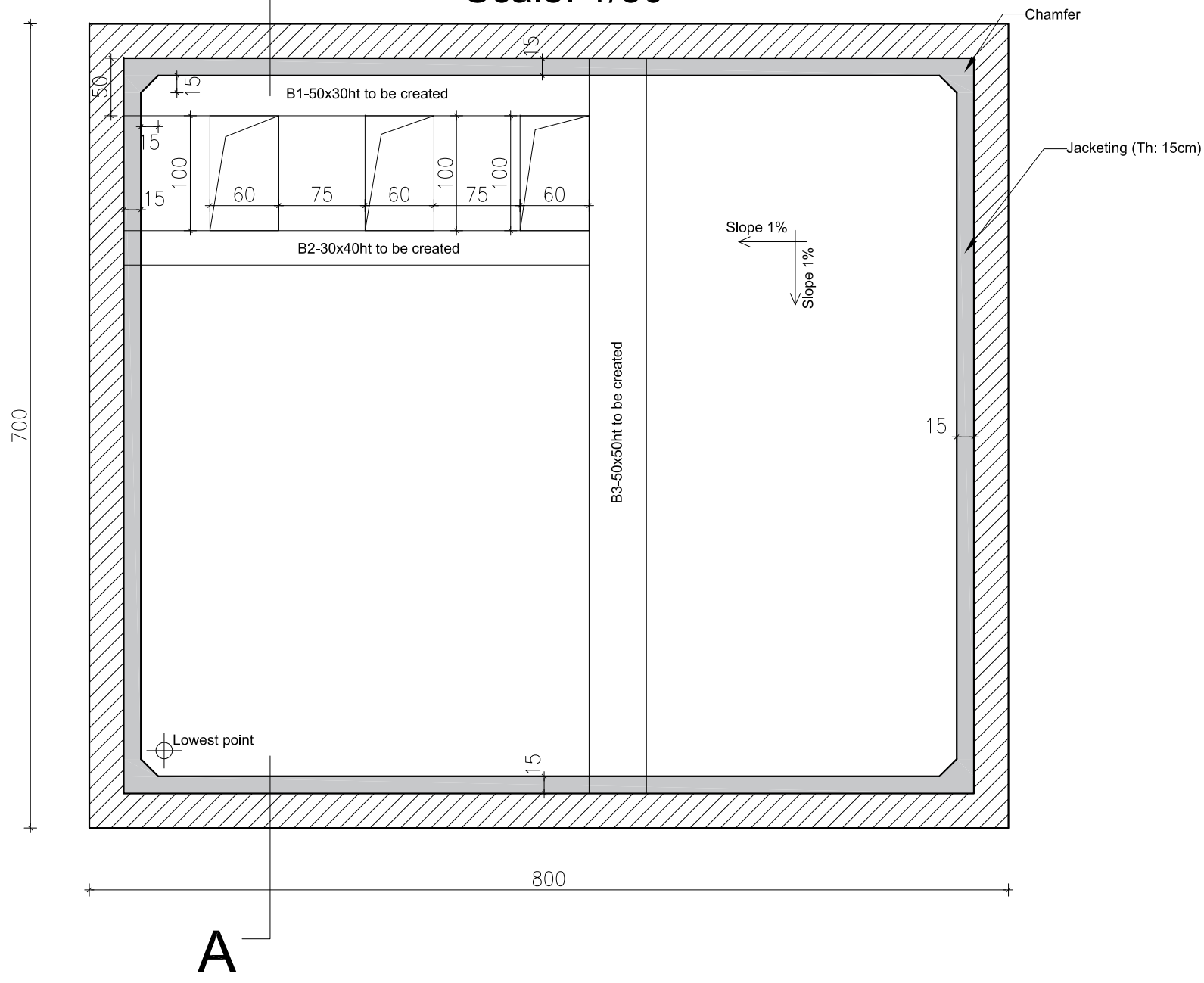
<i>DATE</i>	<i>SCALE</i>	<i>SHEET No.</i>	<i>DRAWING No.</i>
AUGUST 2019	As indicated	01	509W-RS04-P02



WATER TANK UPPER SLAB FORMWORK

A

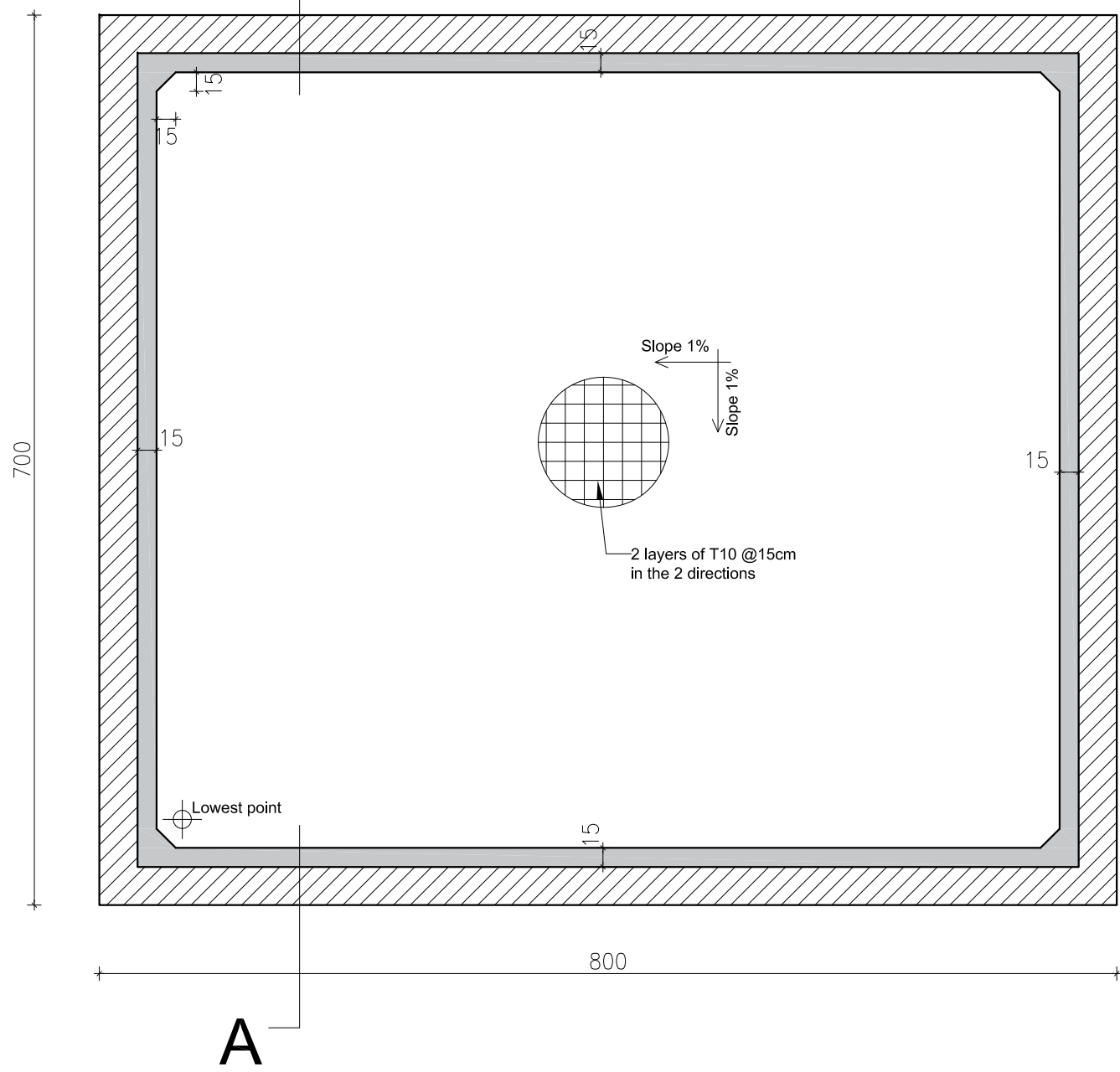
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WATER TANK BOTTOM SLAB REINFORCEMENT

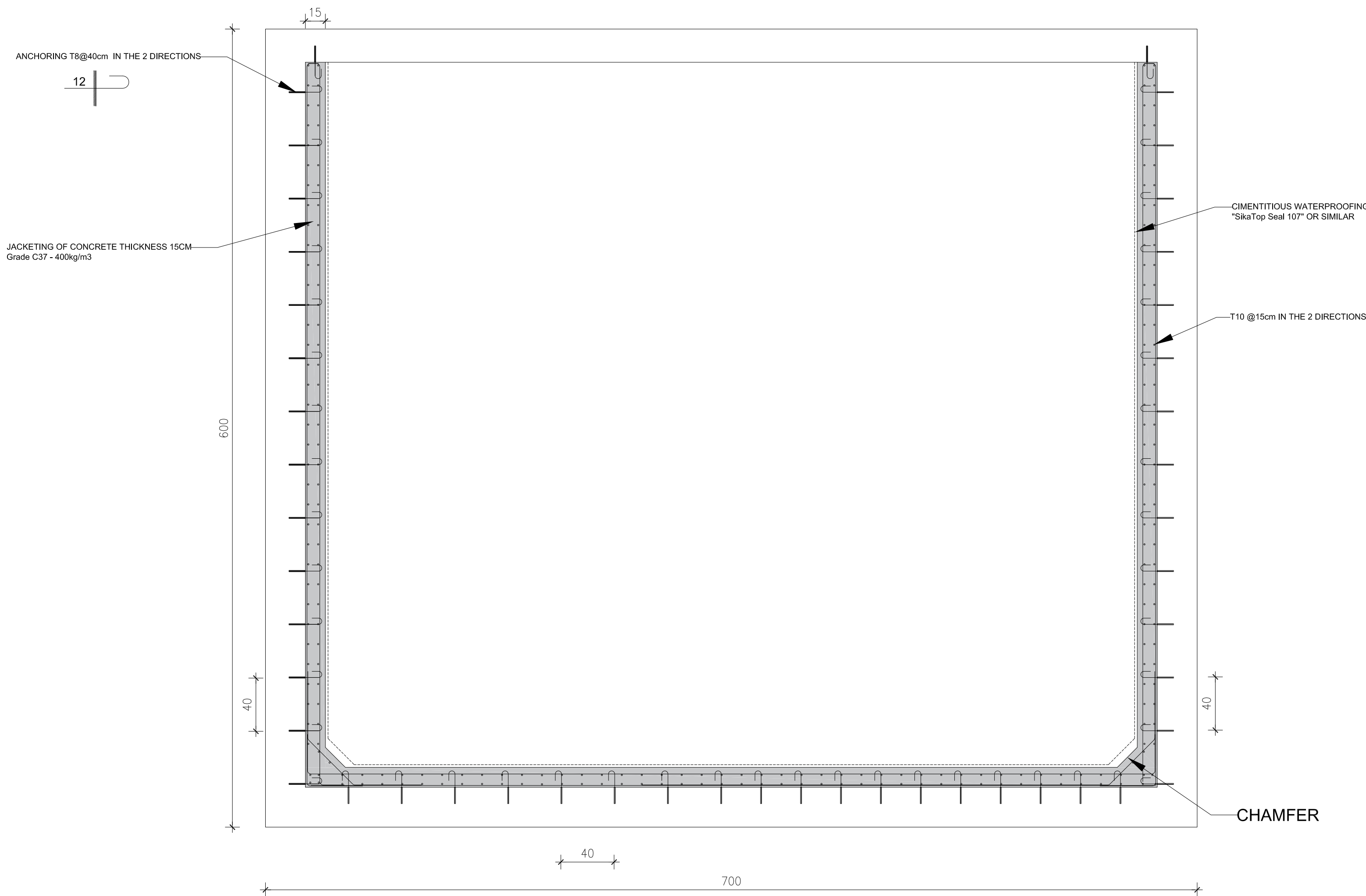
A

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.

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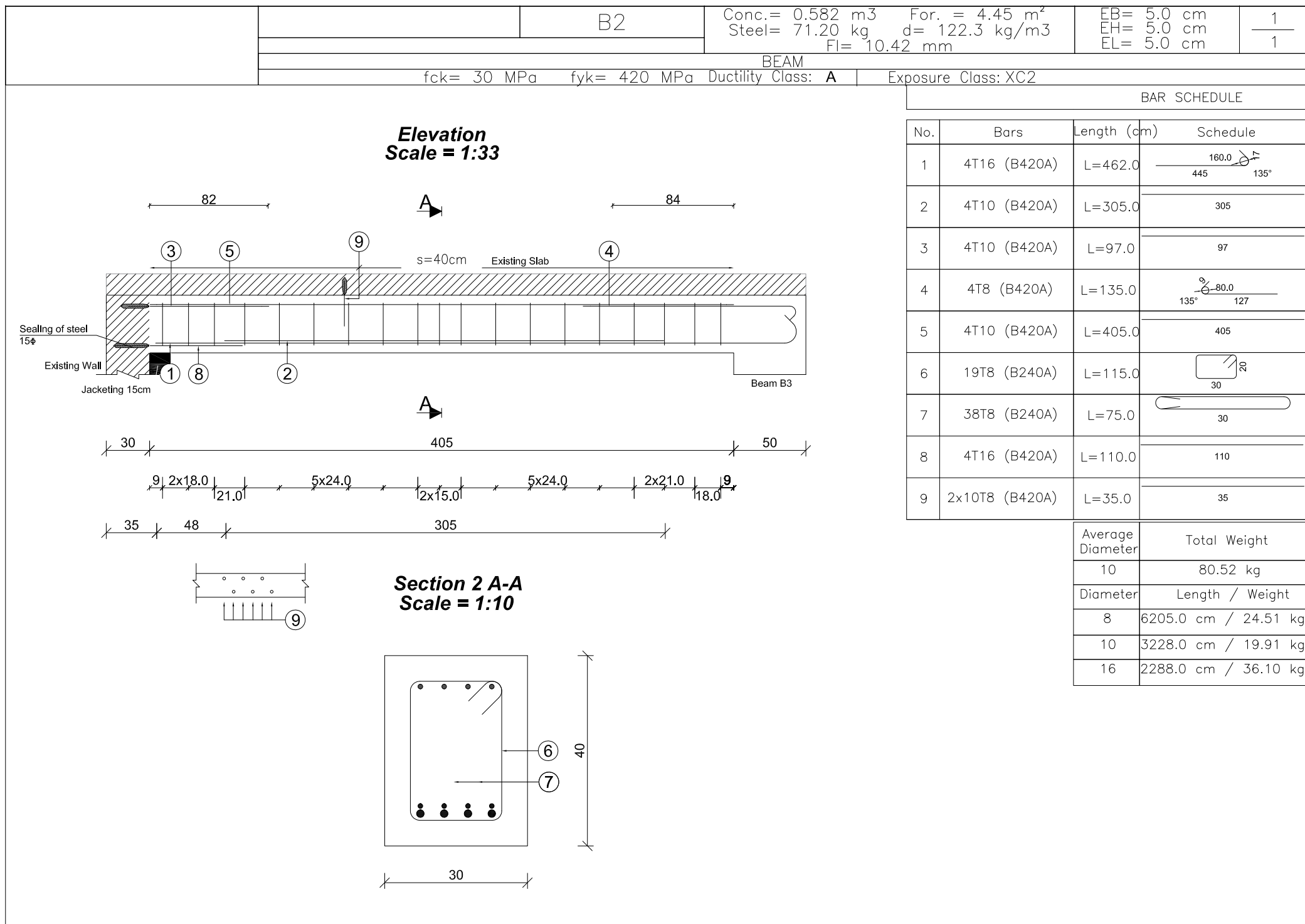
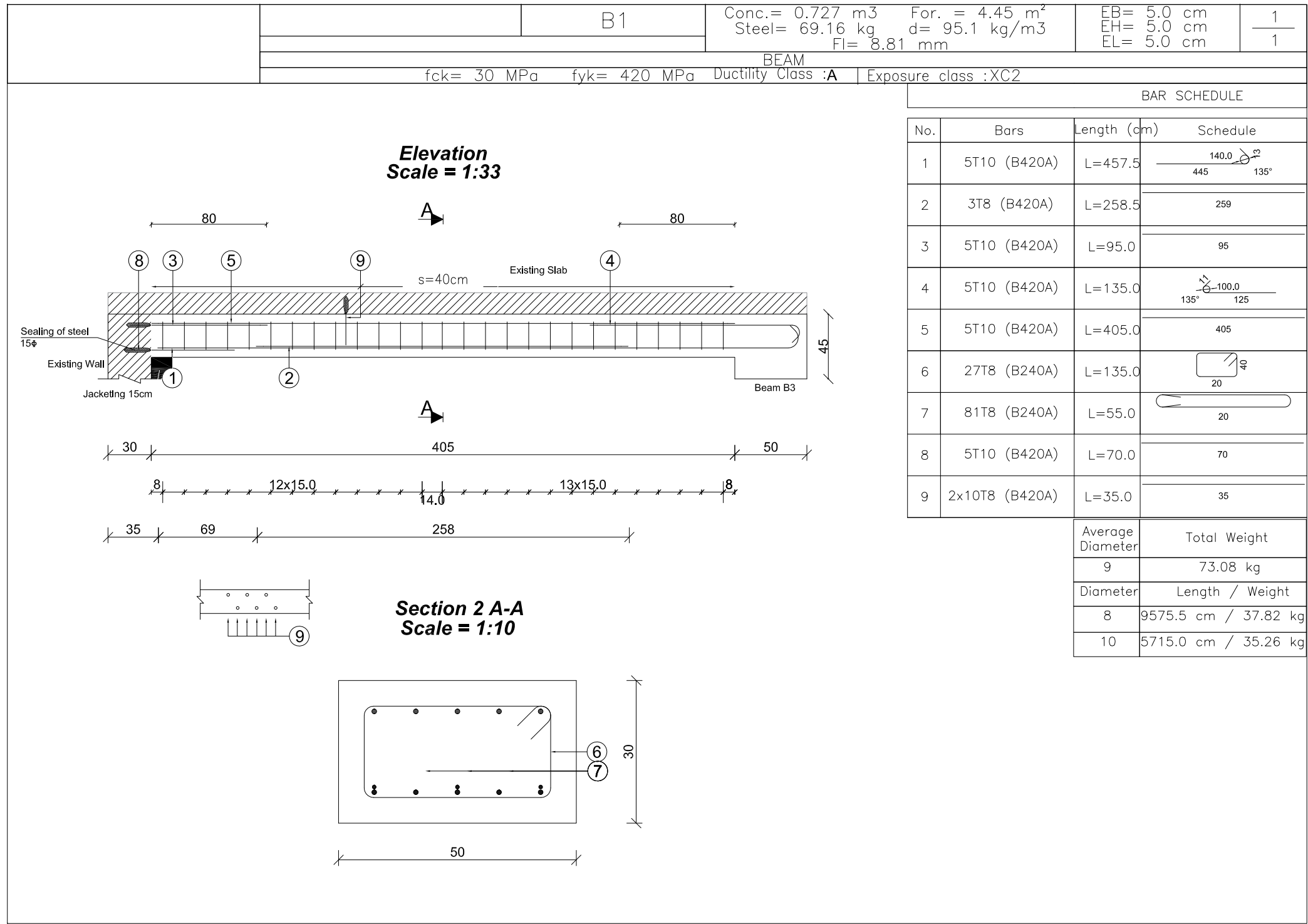
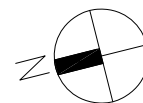
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM - QABB ELIAS AND MRAIJAT

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



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 Fy=420N/mm2.
 - 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 2x50Φ (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 Φ8 shall be used on each lap.
 - Anchoring length shall not be less than 15Φ

- Bending:
- Φ>12mm: mechanical
 - Φ<12mm: manual (possibly)
 - Straightening of bended bars is not allowed.

- Formwork:
- All executed concrete shall be fair faced concrete.
 - The use of Φ6mm 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.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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BD

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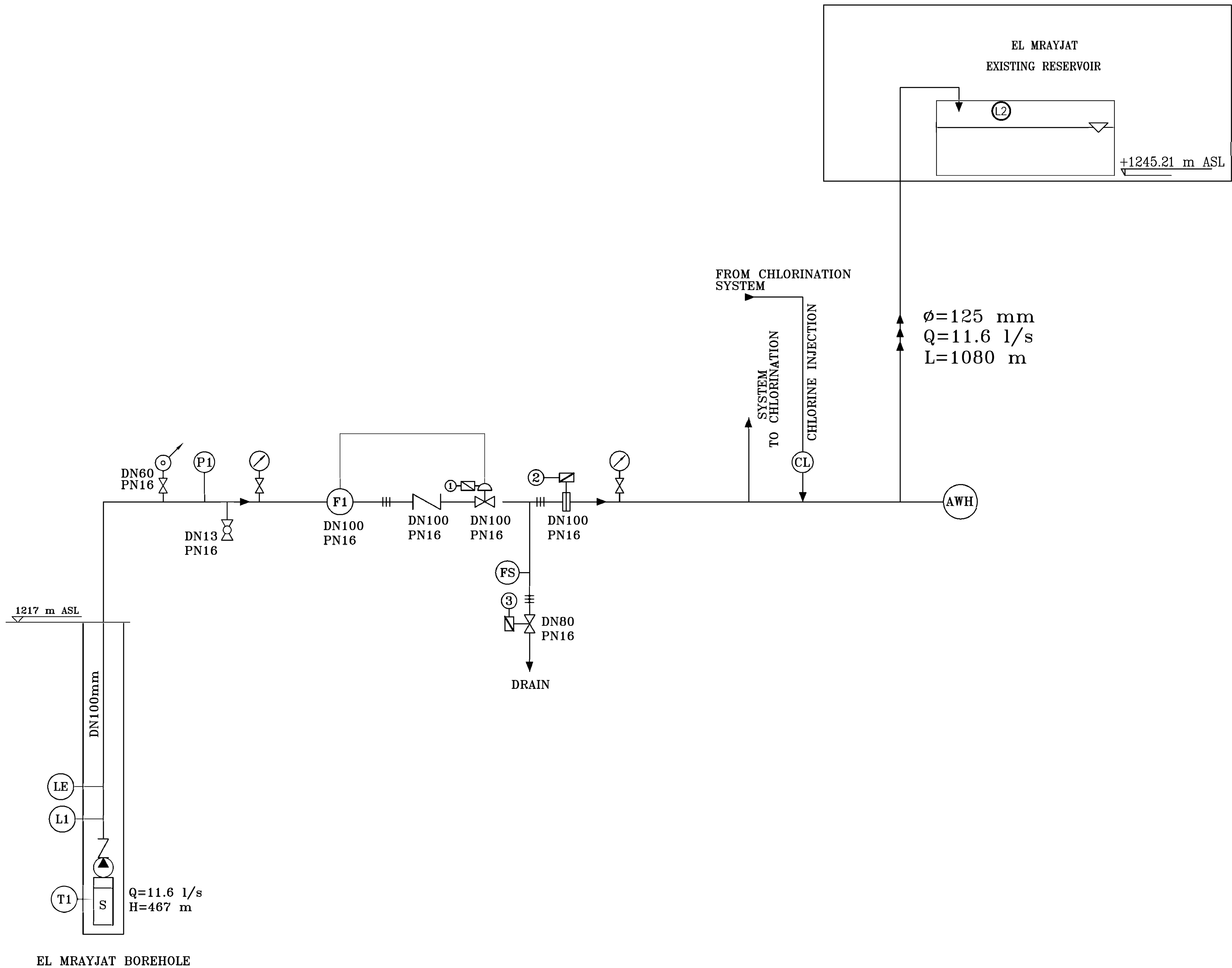
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CONSTRUCTION OF WATER WORKS IN QUADI ED DELEM - QABB ELIAS AND MRAIJAT

REHABILITATION WORKS OF QABB ELIAS WATER TANK	Beams Reinforcement
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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	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

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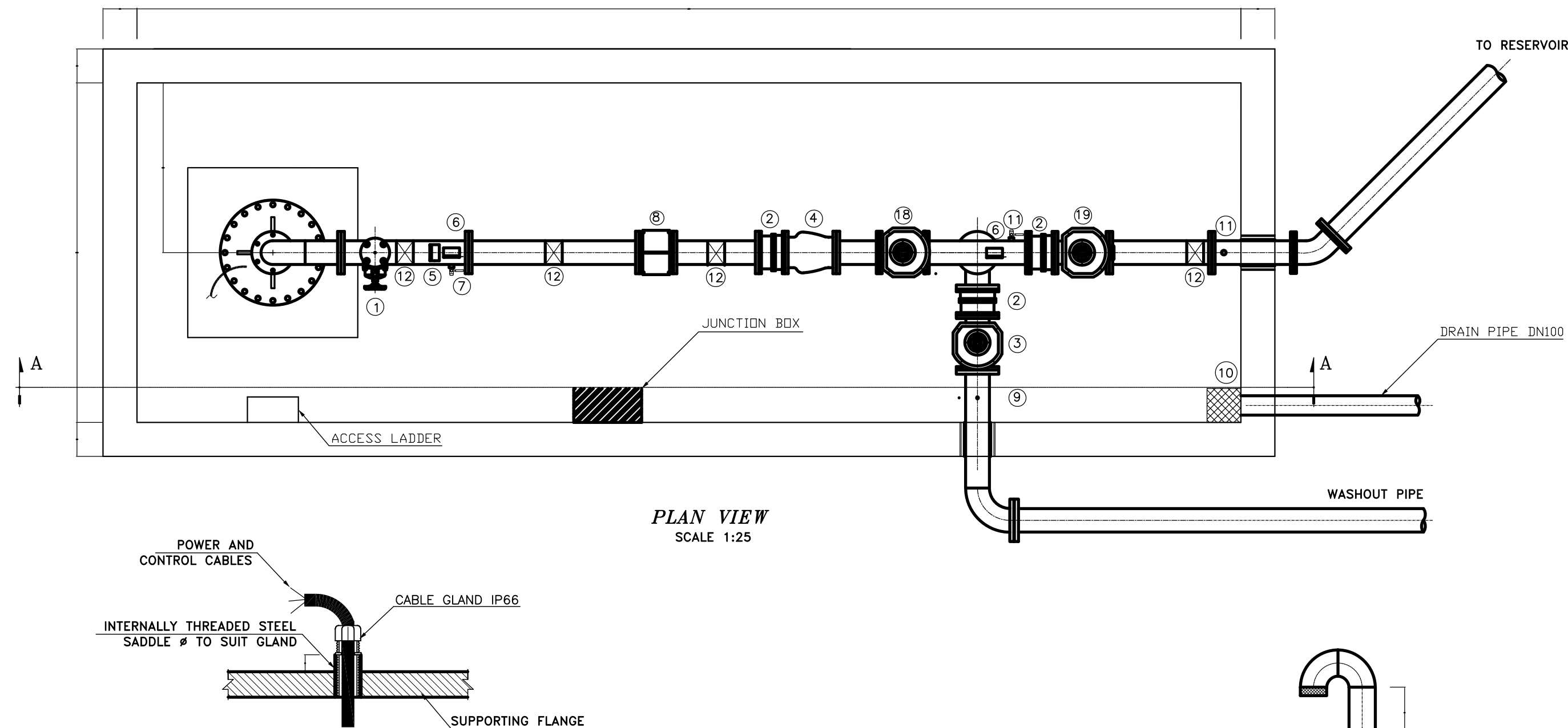
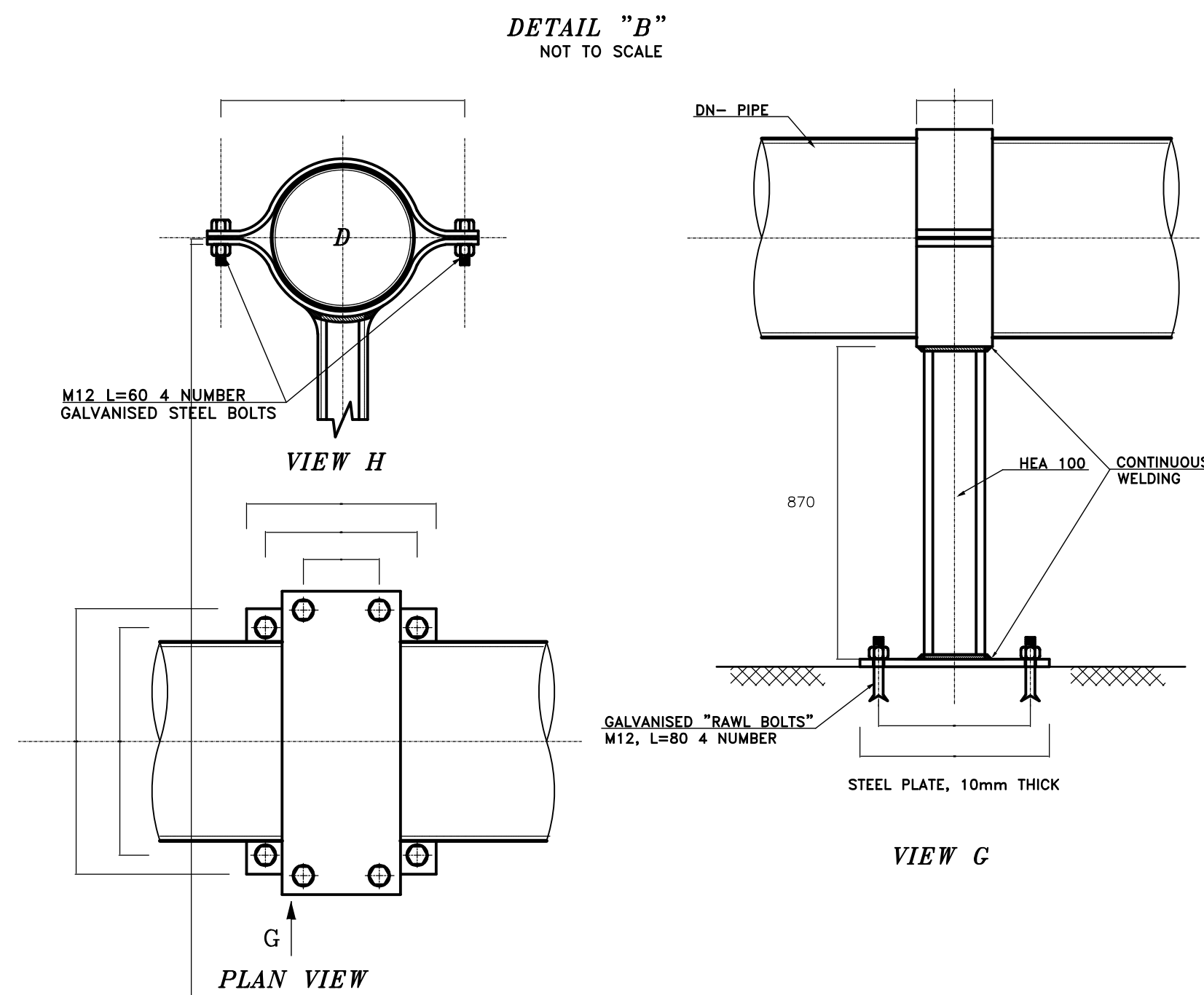
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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

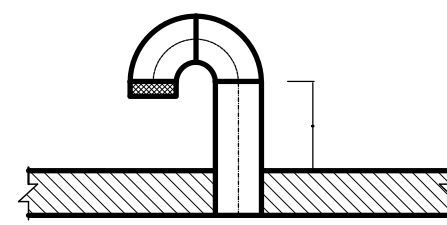
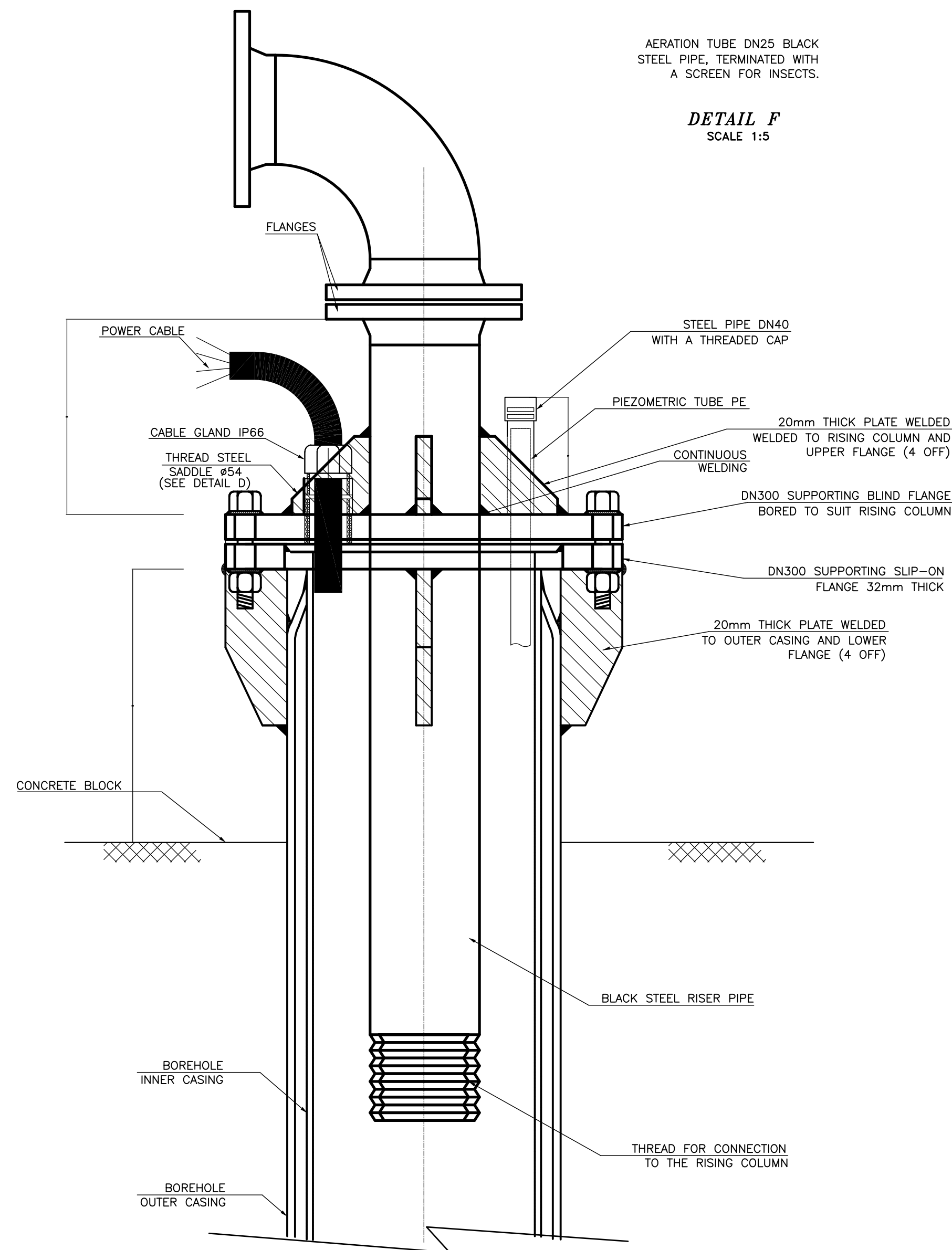
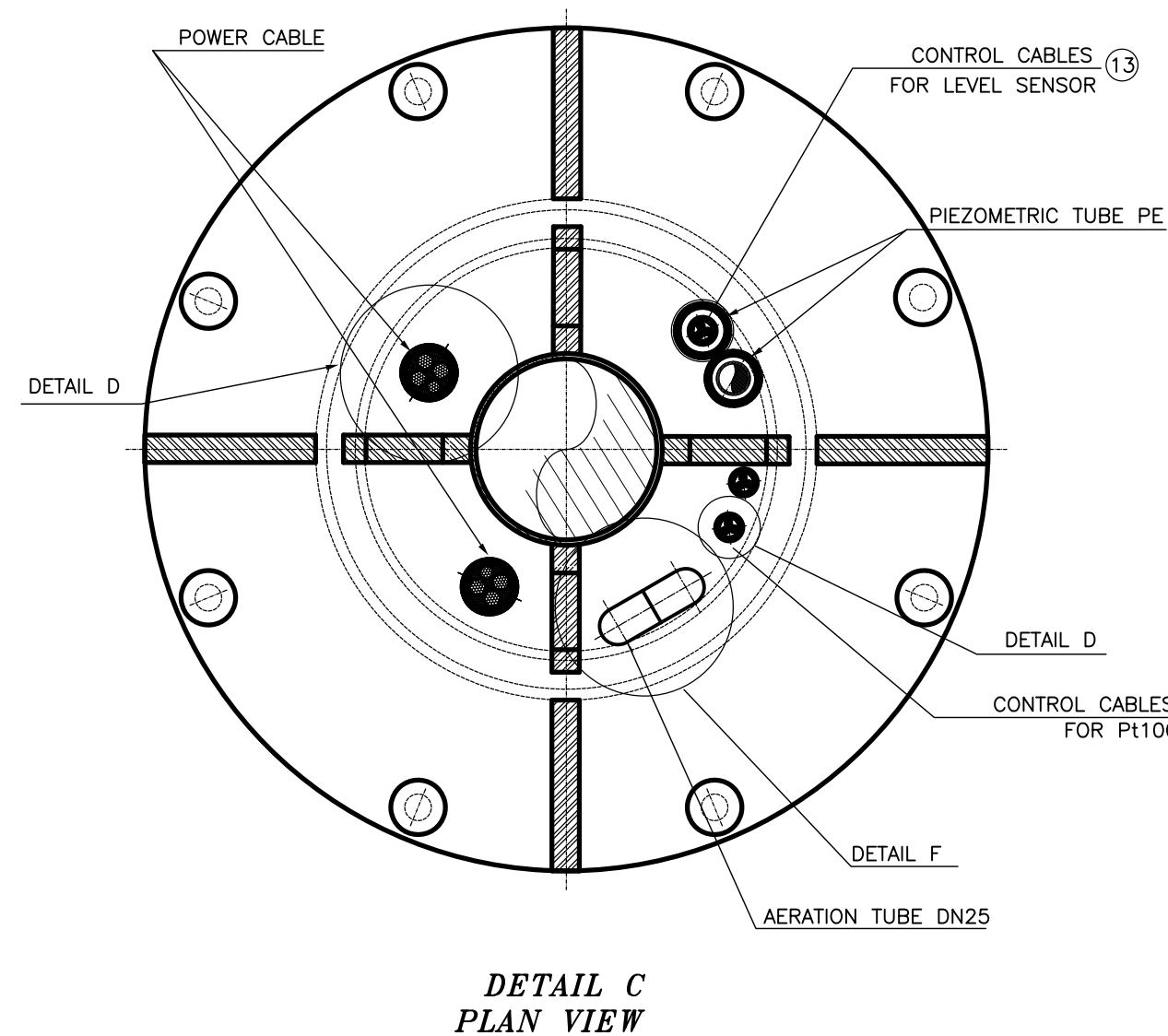
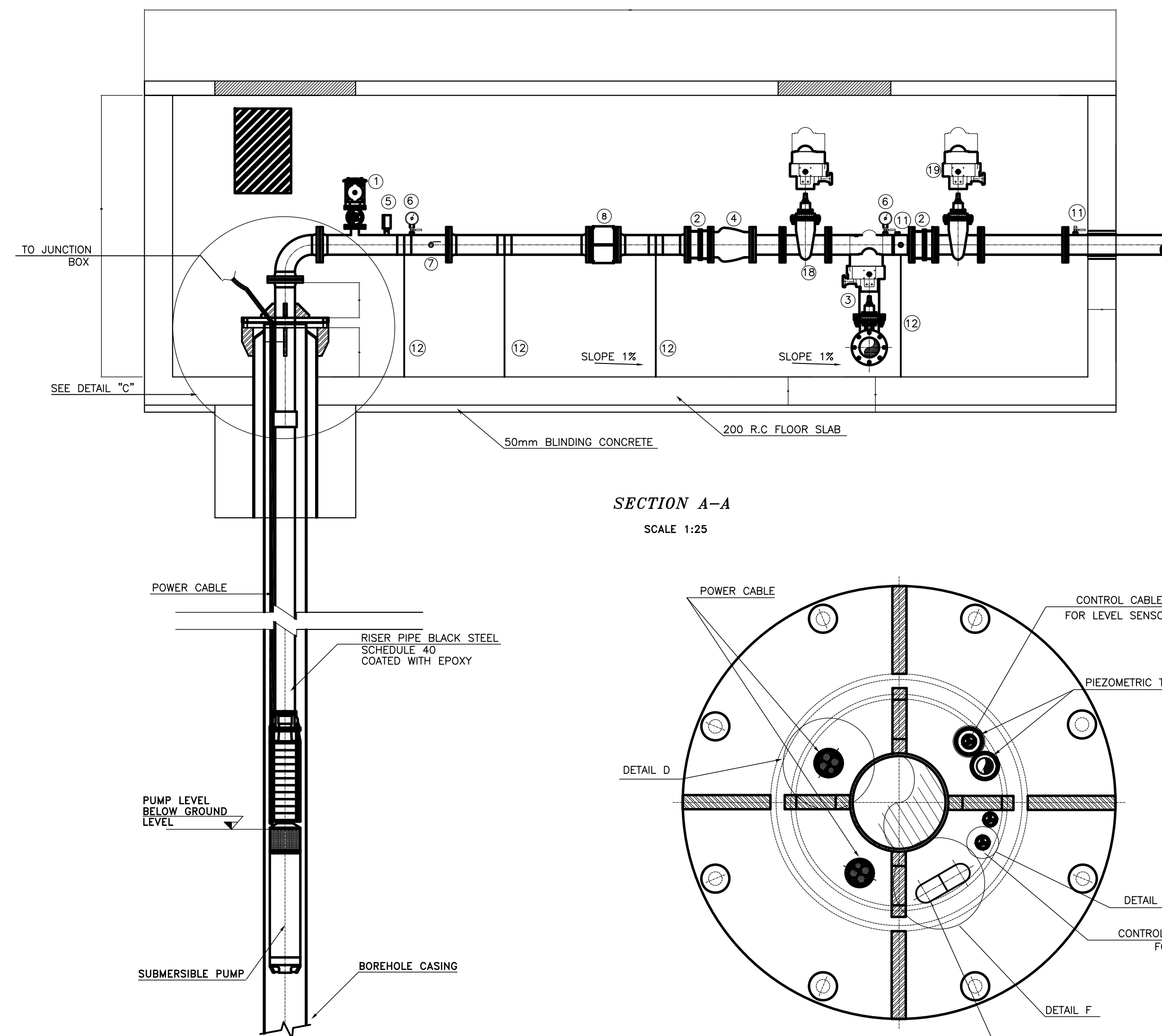
EL MRAYJAT PUMPING STATION	WELL HEAD SCHEMATIC
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DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
509W-PS01-M01	T.RMEITY	F.GHANEM	T.RMEITY

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

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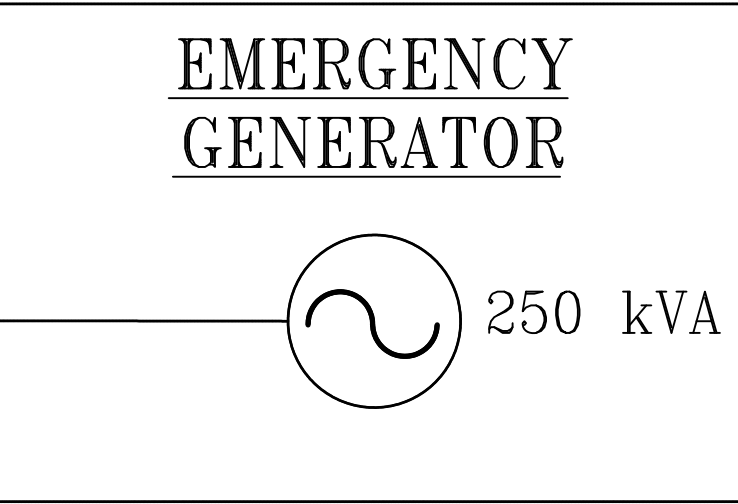
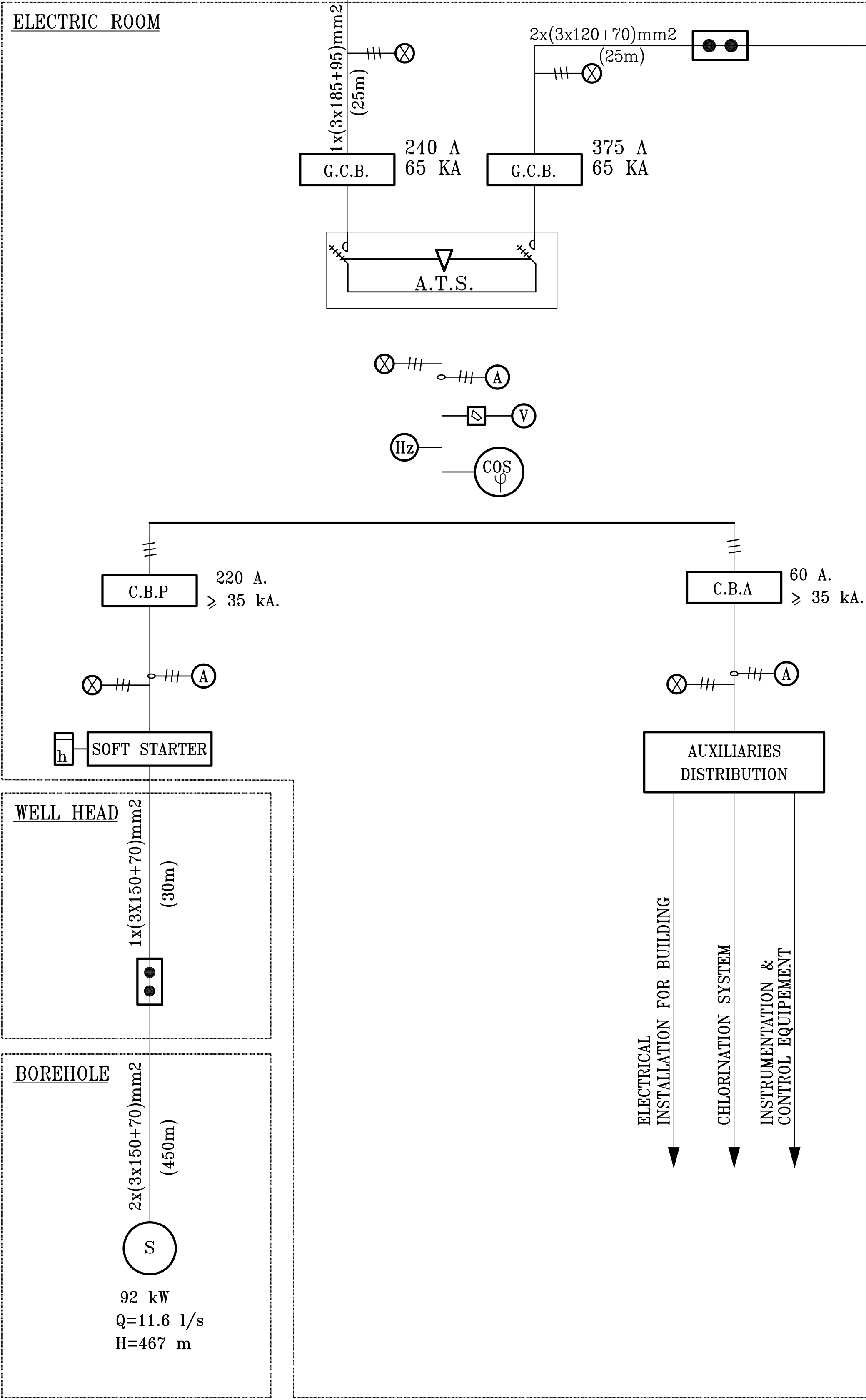
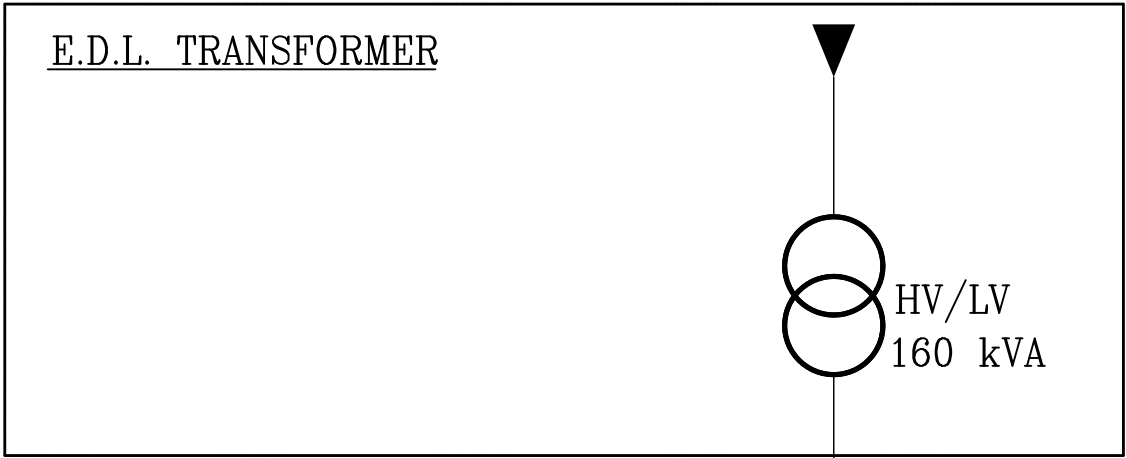
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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION MECHANICAL DRAWING
FOR WELL HEAD

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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

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BUREAU TECHNIQUE POUR LE DEVELOPEMENT

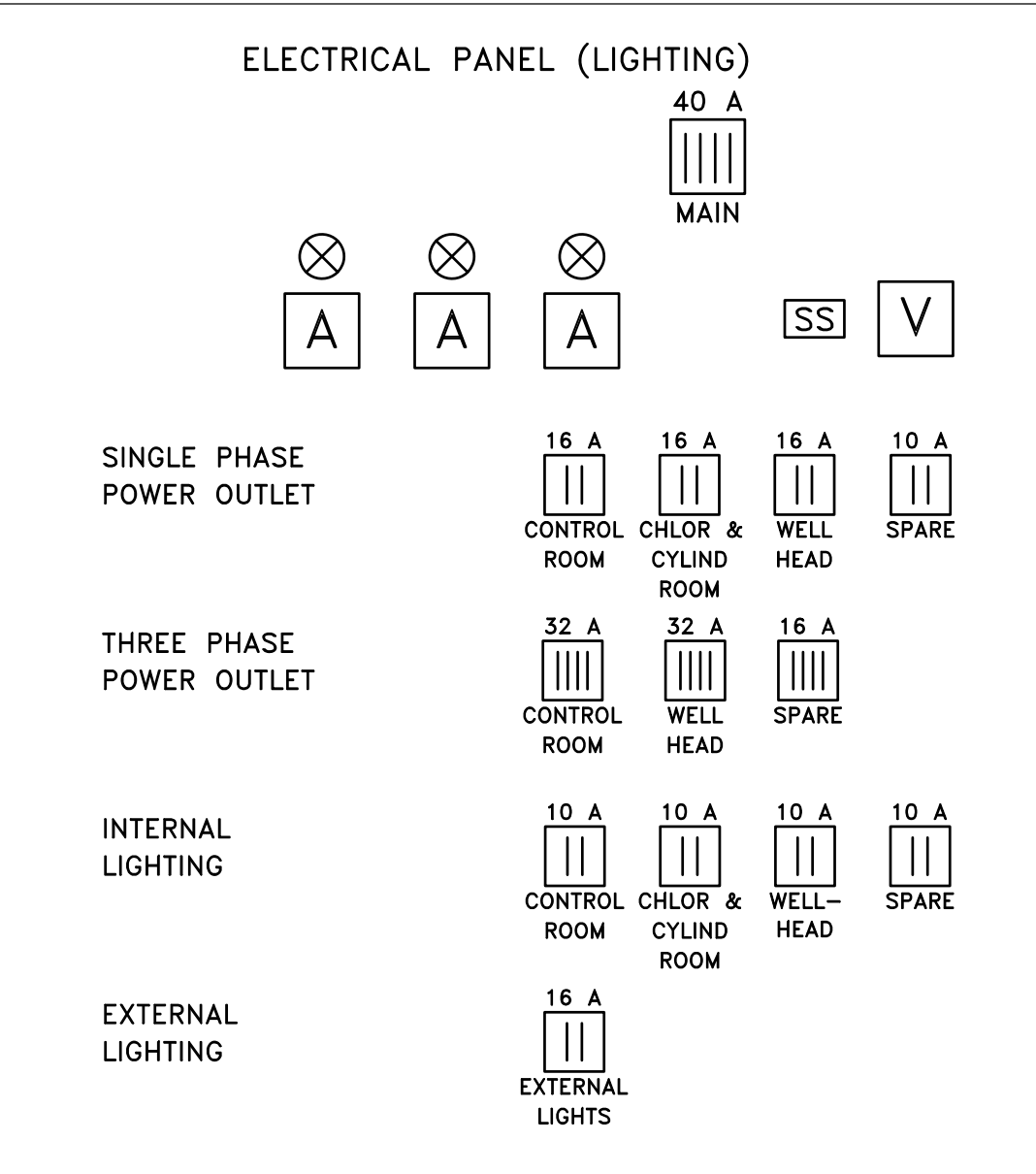
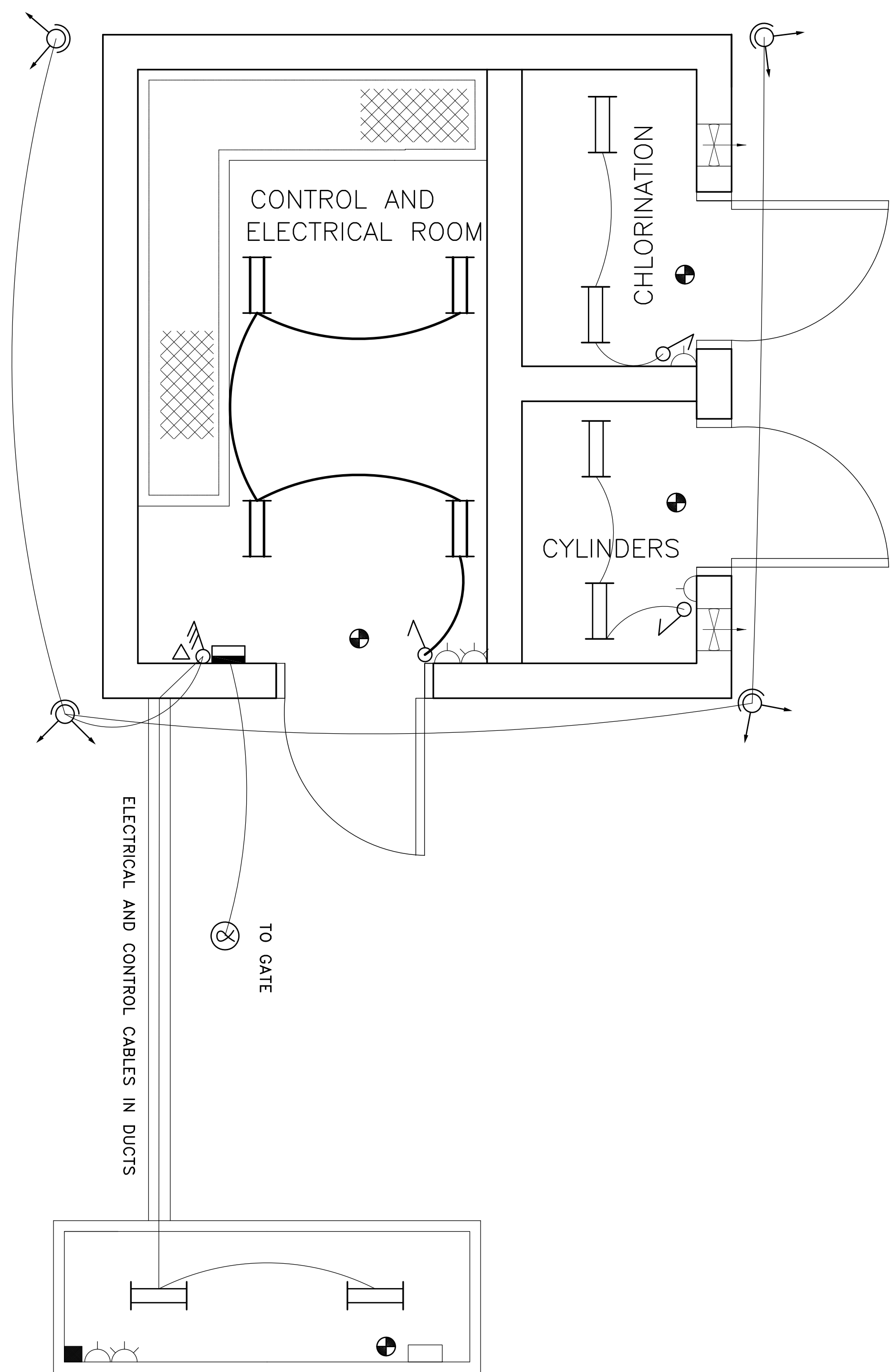
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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION	ELECTRICAL SCHEMATIC
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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

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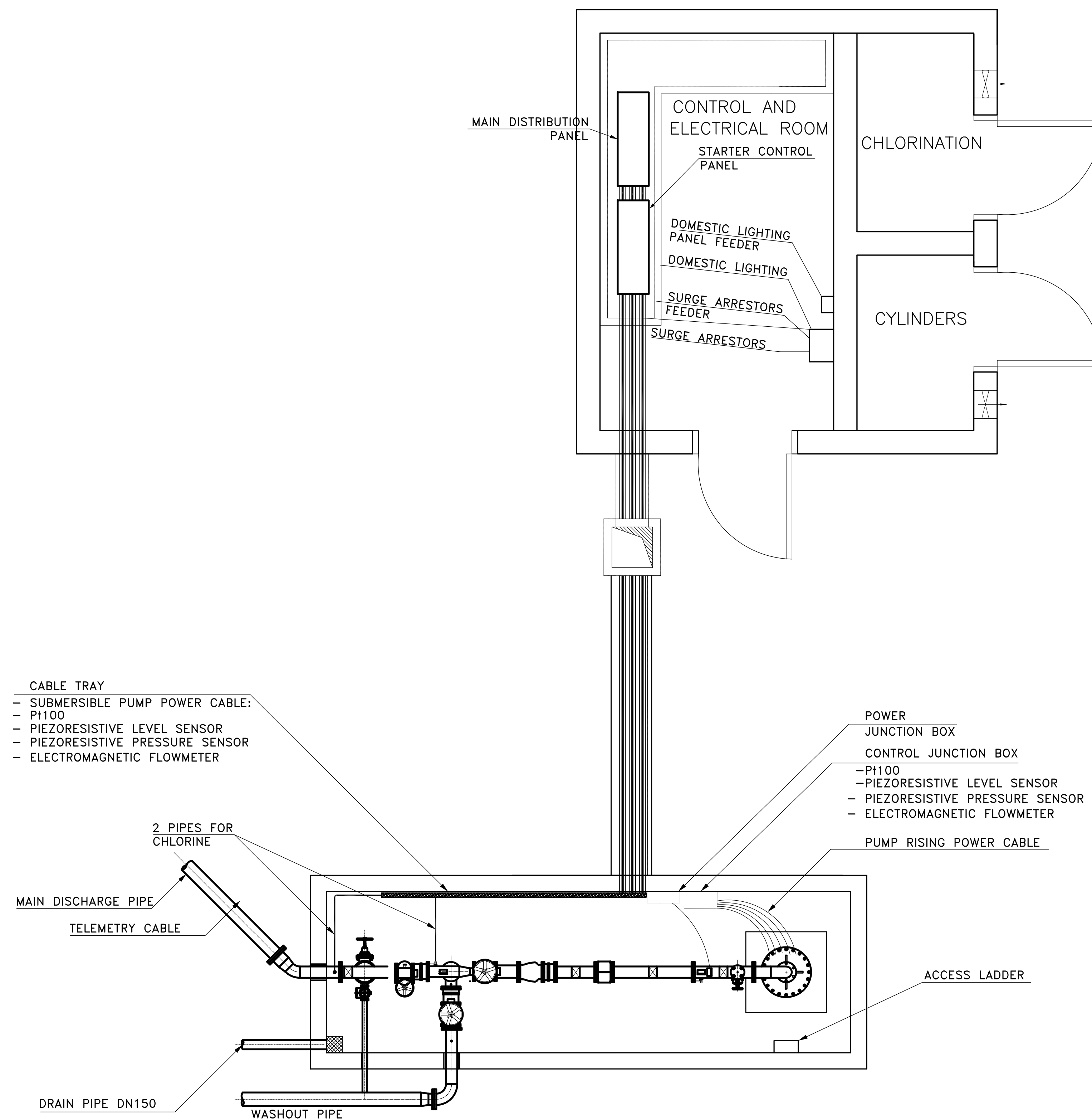
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CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

EL MRAYJAT PUMPING STATION DOMESTIC ELECTRICAL
INSTALLATION SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
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DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	5/7	509W-PS01-E02



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

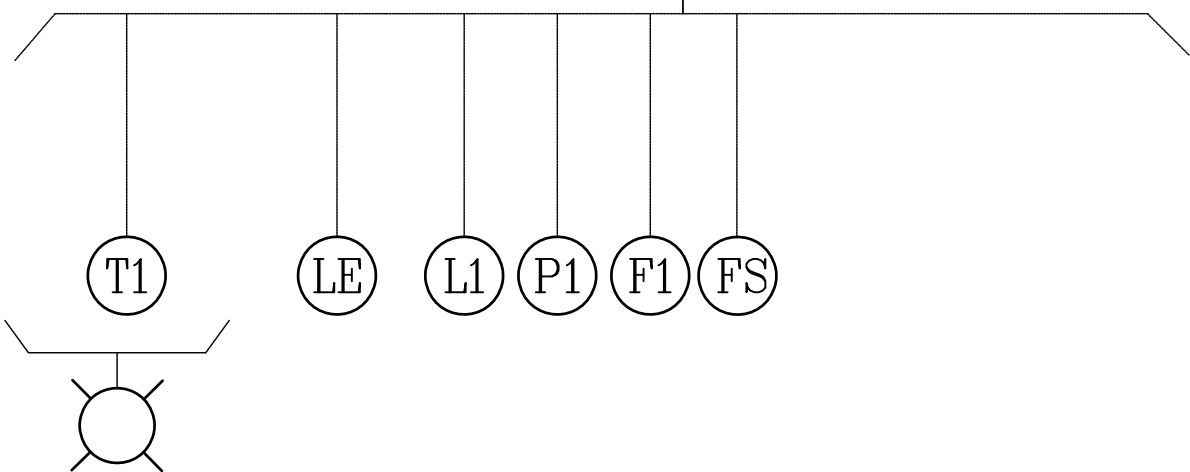
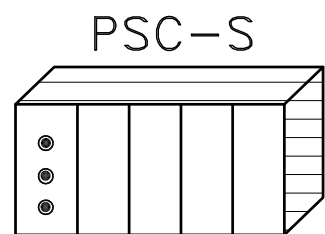
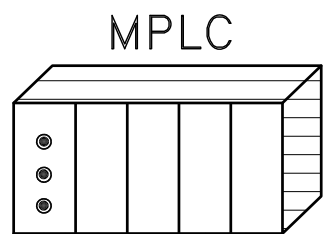
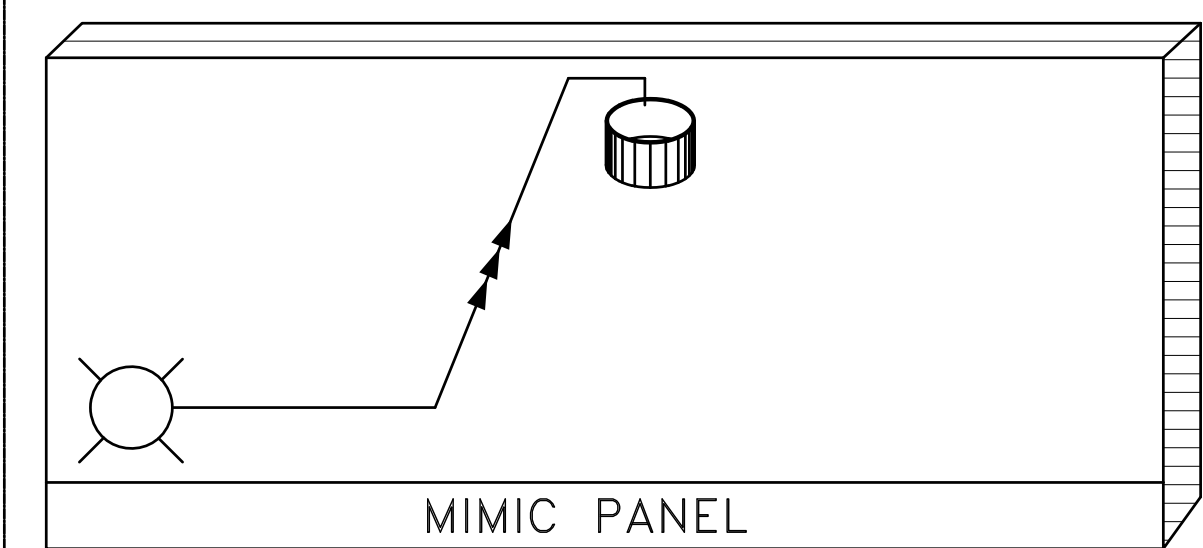
EL MRAYJAT PUMPING STATION

ELECTRICAL SCHEMATIC

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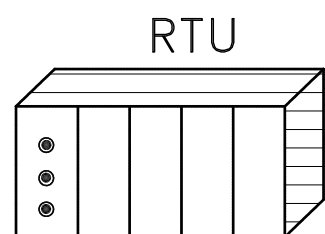
DATE	SCALE	SHEET No.	SEQ. No
JULY 2019	-	6/7	509W-PS01-E03

CONTROL SYSTEM

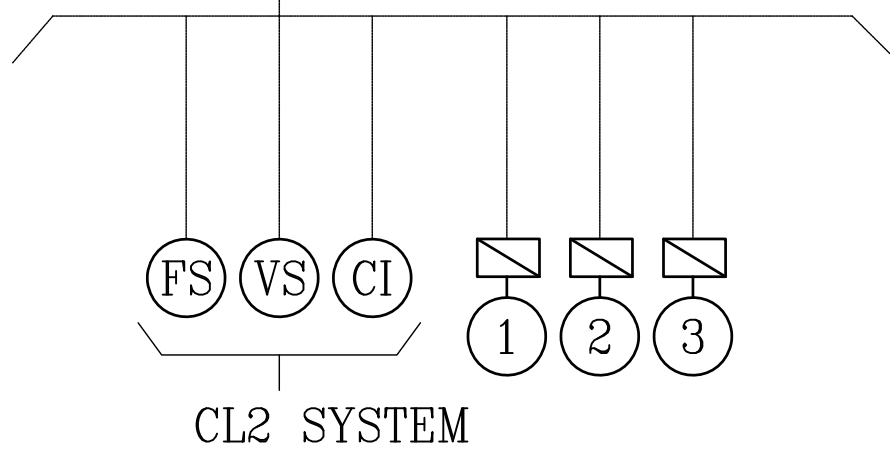


EL MRAYJAT PUMPING STATION

L=1135m



EL MRAYJAT RESERVOIR



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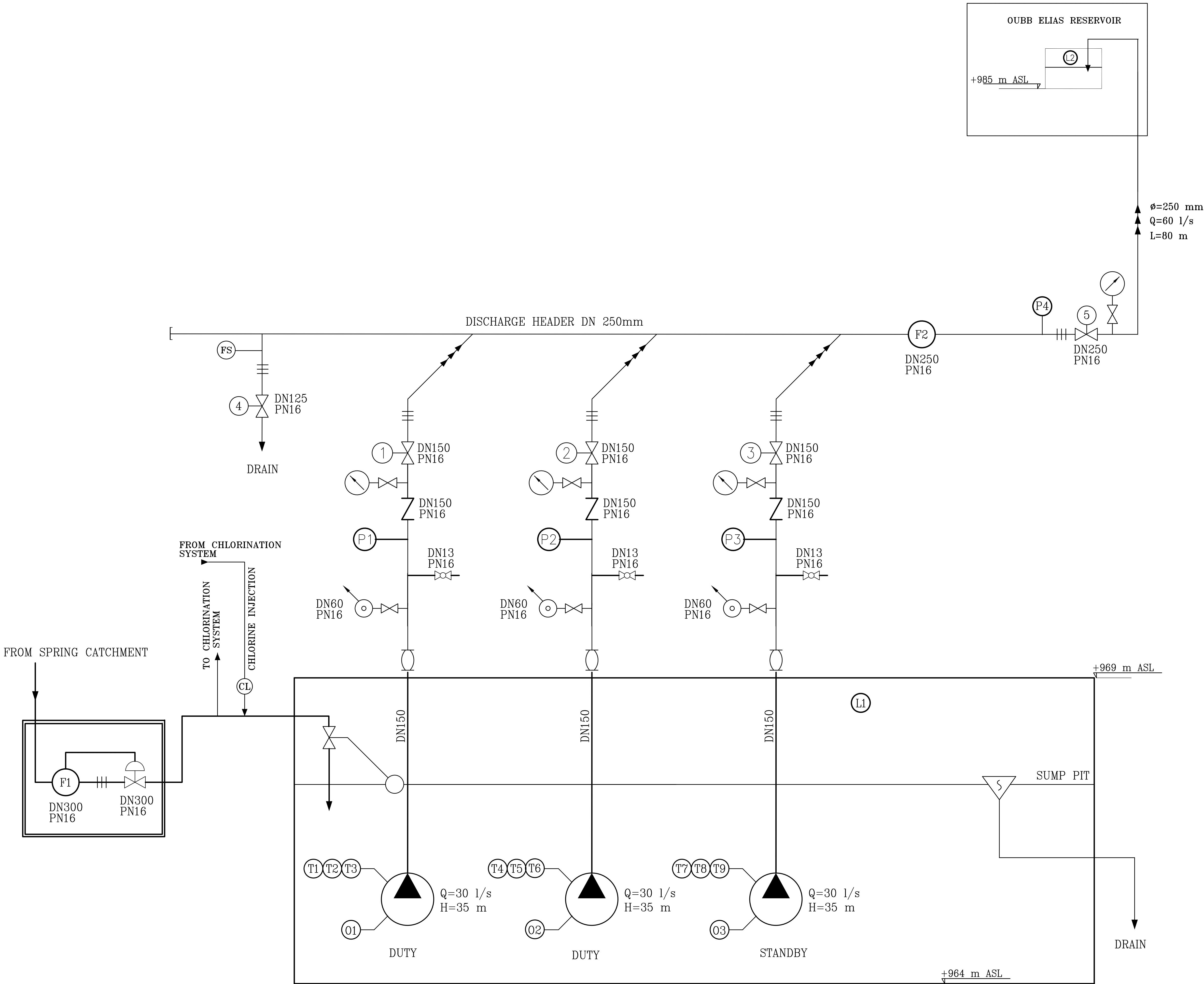
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

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

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BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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

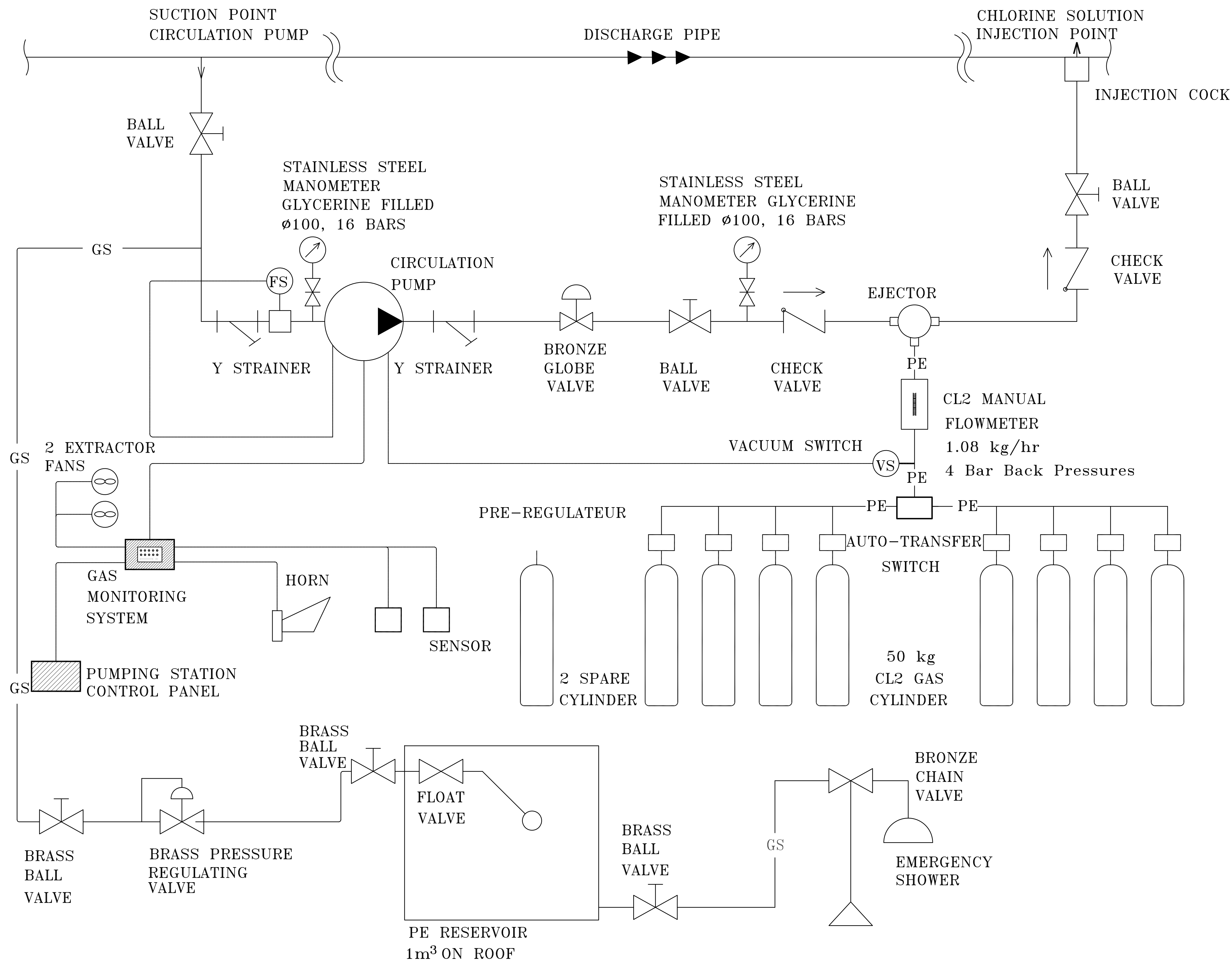
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

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
 ——— : ELECTRIC CONNECTION
 —GS— : GALVANIZED STEEL PIPE
 ⊗ : THREE WAY VALVE
 FS : FLOW SWITCH

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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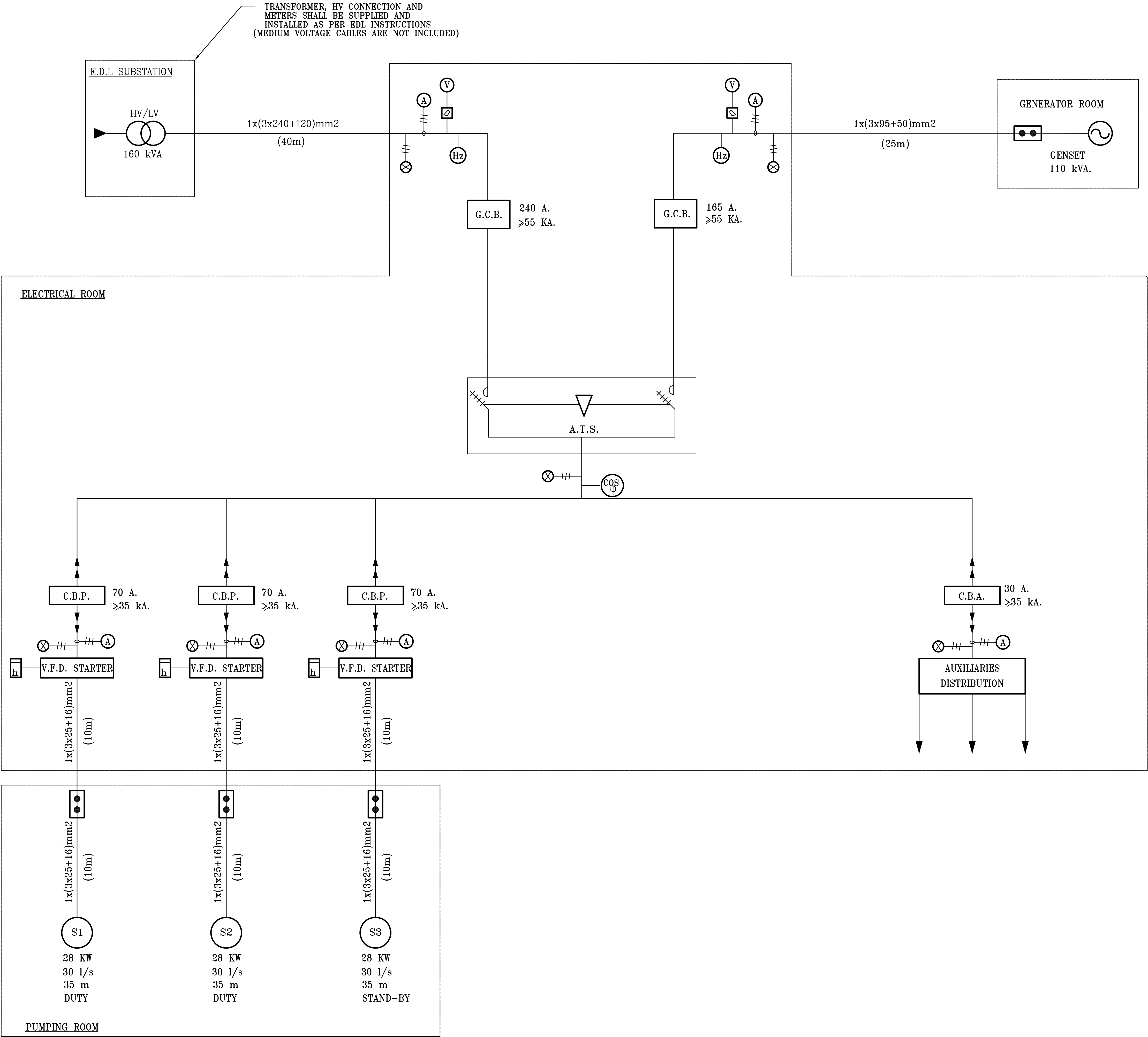
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

QABB ELIAS PUMPING STATION

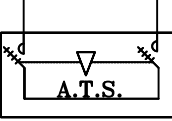
CHLORINATION SCHEMATIC

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 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
-  : EXISTING EQUIPMENT

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION



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

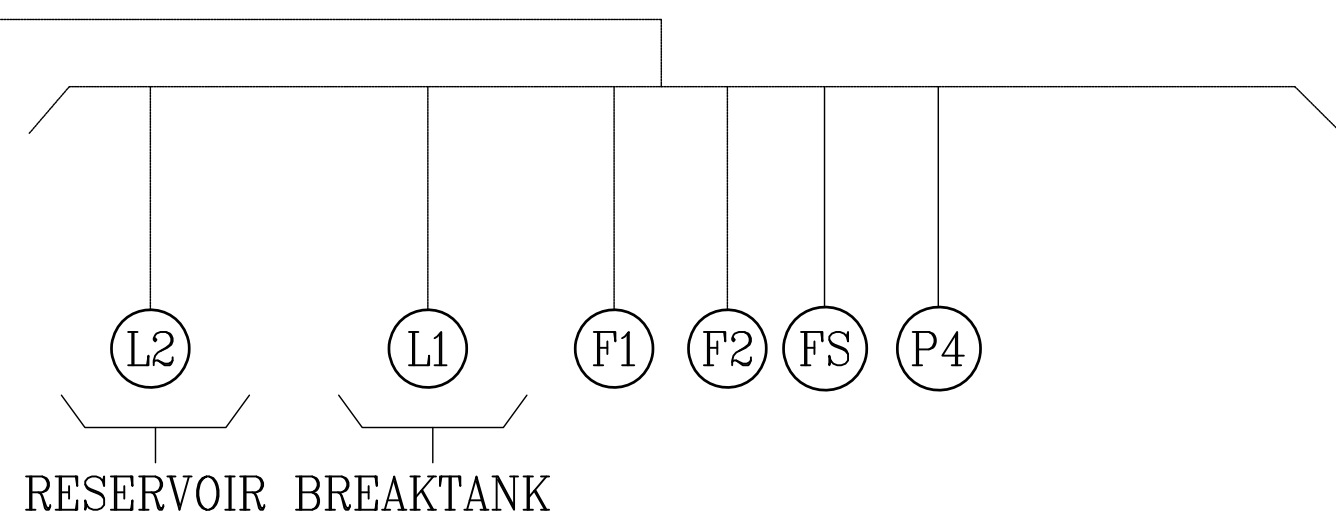
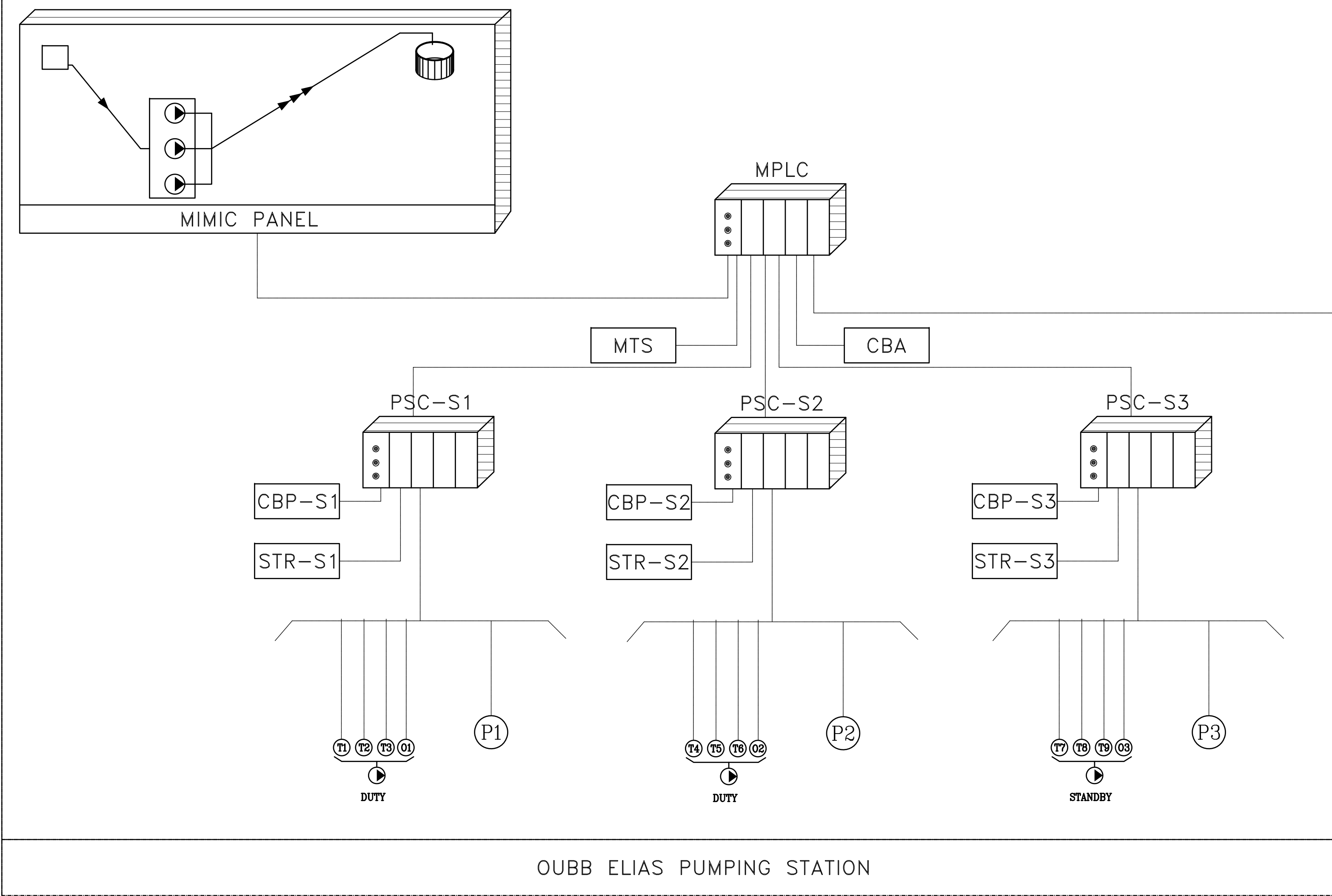
QABB ELIAS PUMPING STATION

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

REPUBLIC OF LEBANON

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

ED BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

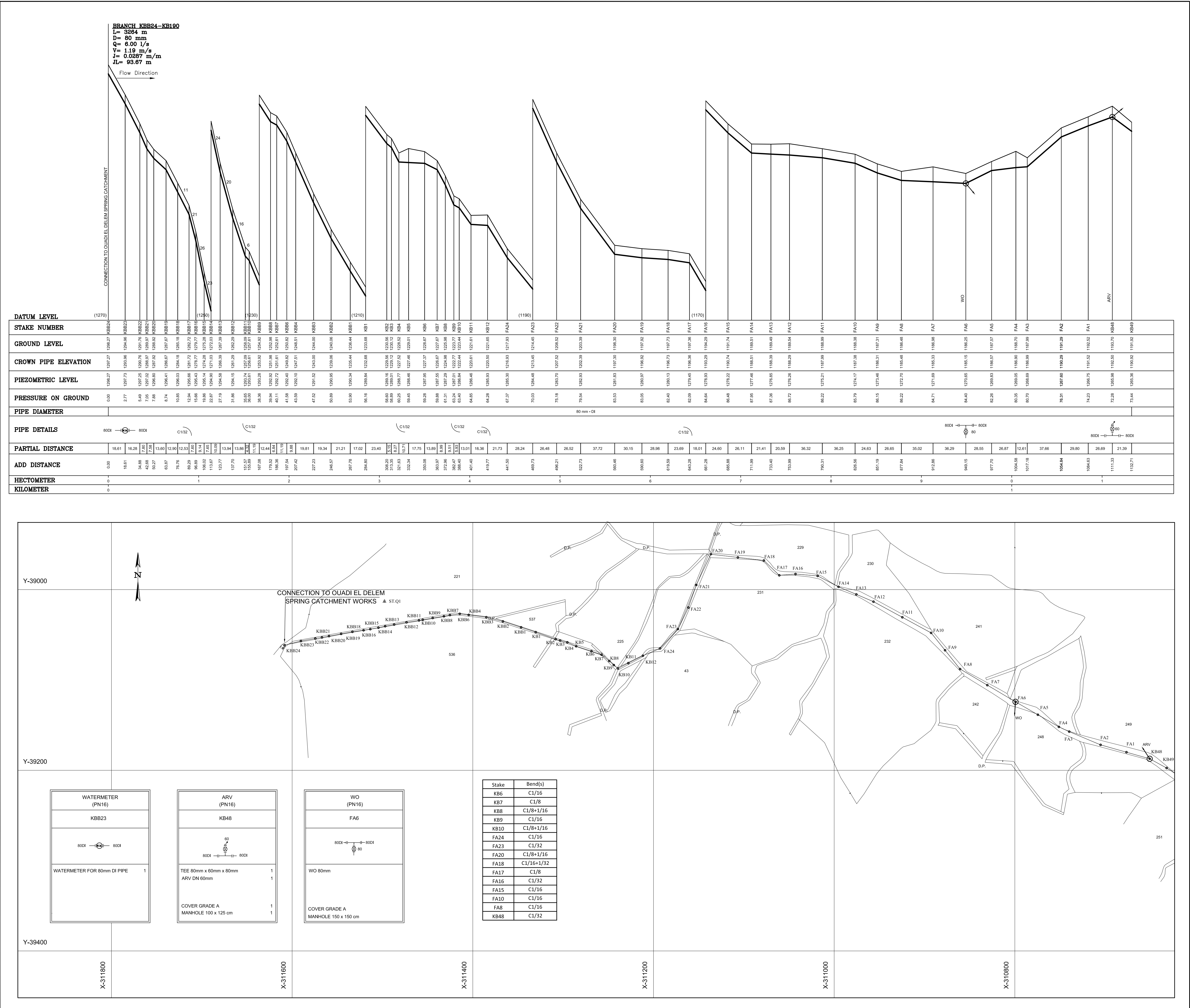
JALL ED DIB - HAIAL Bldg PHONE:(04) 712157/712158 (03) 291016
P.O.BOX:70492 - ANTELIAJ FAX: (04) 712159

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



HYDRAULIC LEGEND

PIPELINE

FLOW DIRECTION

GATE VALVE

NEEDLE VALVE

TEE

TAPER

PRESSURE REGULATING 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 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 KBB17-KBB11

TOPOGRAPHICAL LEGEND

BUILDING

PAVED ROAD

CONCRETE ROAD

TRACK

REFERENCE LINE

CHANNEL

TERRACE

FENCE

STREAM/RIVER

CULVERT/BRIDGE

SPRING

WELL

DECIDUOUS/PINE TREE

ROCKS

Down=H

High=H

MANHOLE SEWER

MANHOLE WATER

MANHOLE TELEPHONE

MANHOLE NOT IDENTIFIED

LIGHTING POLE

TELEPHONE POLE

TRIANGULATION STATION

ELECTRIC SUB STATION

ELECTRIC POLE/TELEGRAPH POLE

Num

1 160, 12

1282

BOUNDARY

CIRCUMSCRIPTION BOUNDARY

KEY PLAN

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
P.O.BOX:70492 - ANTELIAS

TEL:(04) 712157 / 712158
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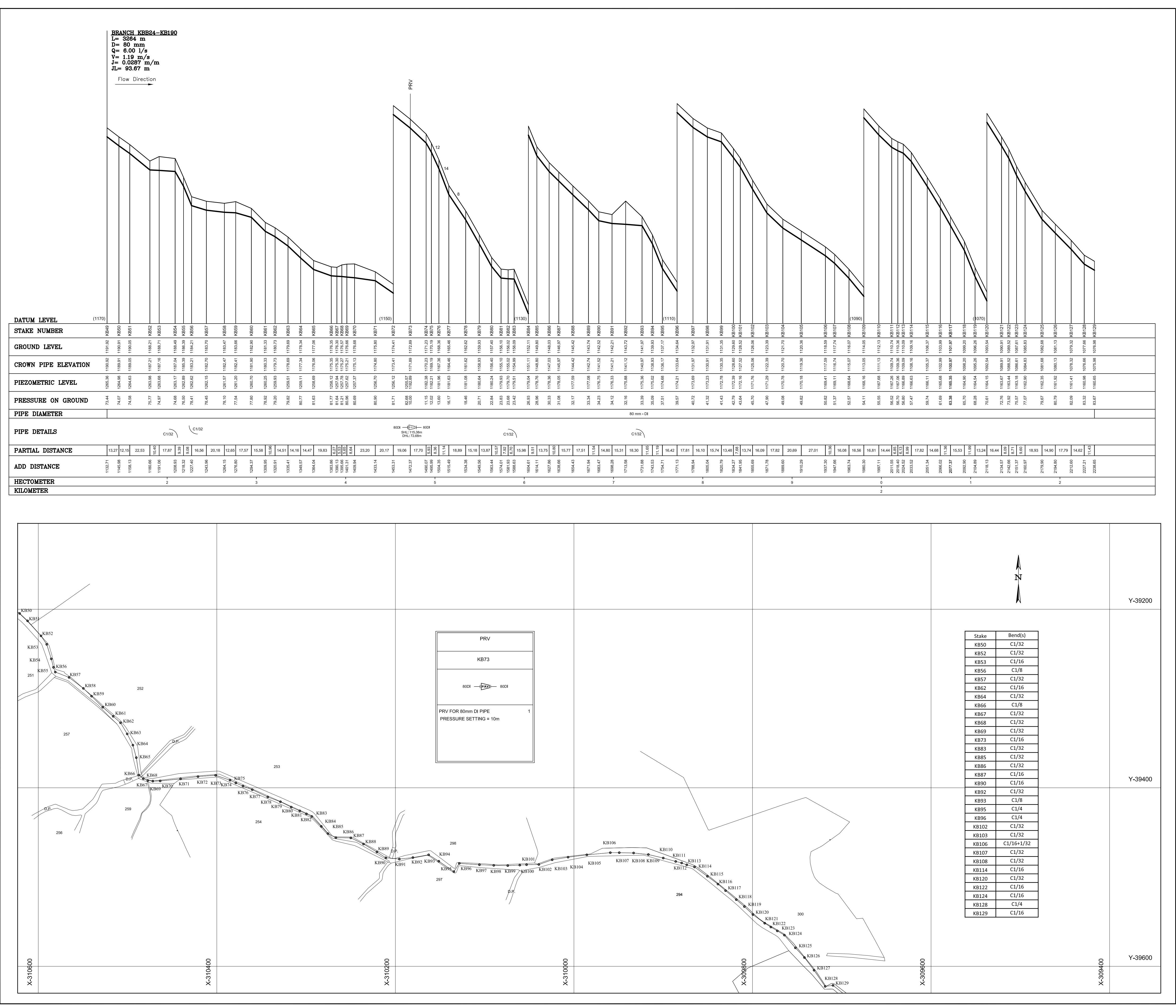
CONSTRUCTION OF WATER WORKS IN
OUADI ED DELEM-QABB ELIAS AND MRAIJAT

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	1/3	509W-TR-01P01



HYDRAULIC LEGEND

PIPELINE

FLOW DIRECTION

GATE VALVE

NEEDLE VALVE

TEE

TAPER

PRESSURE REGULATING VALVE

BEND 1/8

ARV (DOUBLE AIR VALVE - DAV)

W.O (WASHOUT)

FLANGED ADAPTER

END CAP

EXISTING PIPE

NOTES

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- 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

PAVED ROAD

CONCRETE ROAD

TRACK

REFERENCE LINE

CHANNEL

TERRACE

FENCE

STREAM/RIVER

CULVERT/BRIDGE

SPRING

WELL

DECIDUOUS/PINE TREE

ROCKS

Down=H

High=H

MANHOLE SEWER

MANHOLE WATER

MANHOLE TELEPHONE

MANHOLE NOT IDENTIFIED

LIGHTING POLE

TELEPHONE POLE

TRIANGULATION STATION

ELECTRIC SUB STATION

ELECTRIC POLE/TELEGRAPH POLE

Num

1 160, 12

1282

STAKE NUMBER

SPOT HEIGHT

PLOT No

BOUNDARY

CIRCUMSCRIPTION BOUNDARY

KEY PLAN

Y-39200

Y-39400

Y-39600

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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

OUADI ED DELEM-QABB ELIAS AND MRAIJAT

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

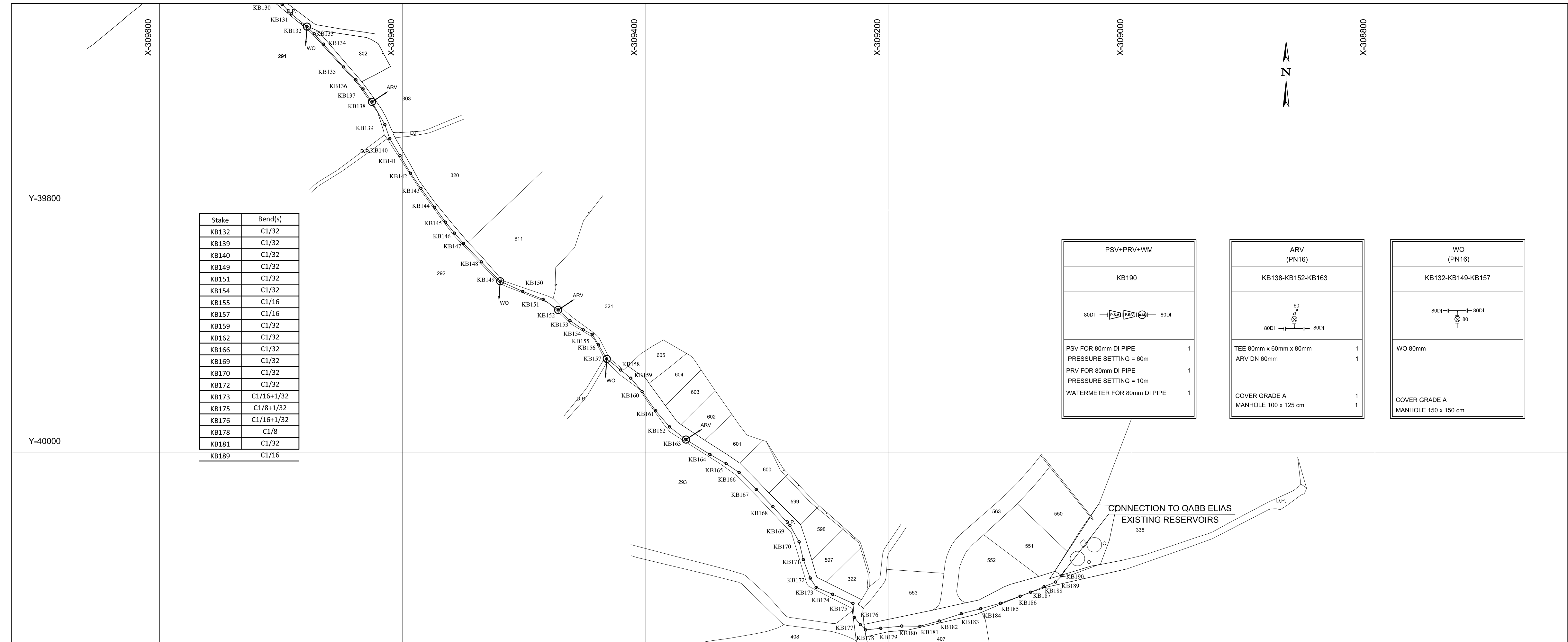
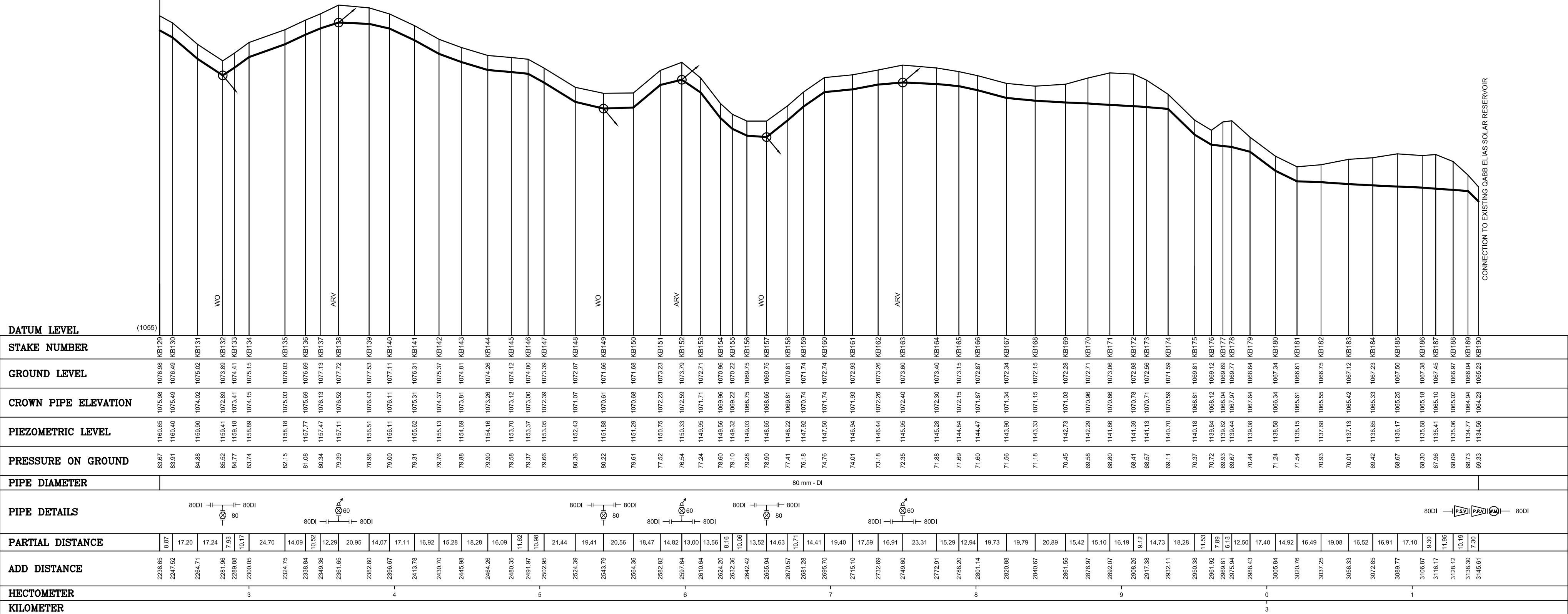
PLAN + PROFILE

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	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			

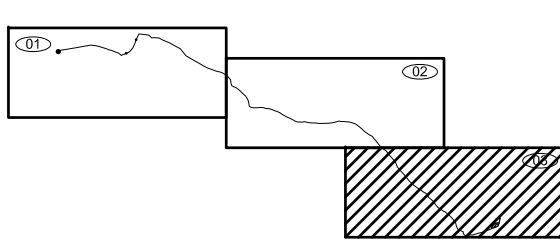
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- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 509STDPI0.
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 509STDPO3 AND DWG Nb 509STDPO4.
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 509STDPO7 AND 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		Num	
SPRING		1 160, 12	
WELL		STAKE NUMBER	
DECIDUOUS/PINE TREE		STAKE POINT	
ROCKS		PLOT No	
Down=H		BOUNDARY	
High=H		CIRCUMSCRIPTION BOUNDARY	

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd
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REPUBLIC OF LEBANON
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QUADI ED DELEM-QABB ELIAS AND MRAIJAT

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

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