REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

CONTRACT No.19841

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

VOLUME 6

DRAWINGS

APRIL 2024

BUREAU TECHNIQUE
POUR LE
DEVELOPPEMENT

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TITLE1	TITLE2	DRAWING Nb.	SHEET Nb.	SEQ.Nb.
GENERAL LIST OF DRAWINGS	LIST OF DRAWINGS	477W-DS-LOD00	1/1	00
BEINO WELL PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	TOPOGRAPHICAL SURVEY SITE LAYOUT SITE PLAN	477W-01RS-C01	1/5	01
BEINO WELL PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FORMWORK MECHANICAL ROOM AND FOUNDATIONS PLAN VIEWS	477W-01RS-C02	2/5	02
BEINO WELL PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FORMWORK RESERVOIR AND BRACING PLAN VIEWS	477W-01RS-C03	3/5	03
BEINO WELL PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FORMWORK ELEVATION AND SECTIONS	477W-01RS-C04	4/5	04
BEINO WELL PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	SLIDING JOINT, WATERPROOFING, FIXING AND FINISHING DETAILS	477W-01RS-C05	5/5	05
BEINO WELL PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	RAFT AND MECHANICAL ROOM UPPER SLAB REINFORCEMENT	477W-01RS-C-F01	1/10	06
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TITLE1	TITLE2	DRAWING Nb.	SHEET Nb.	SEQ.Nb.
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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

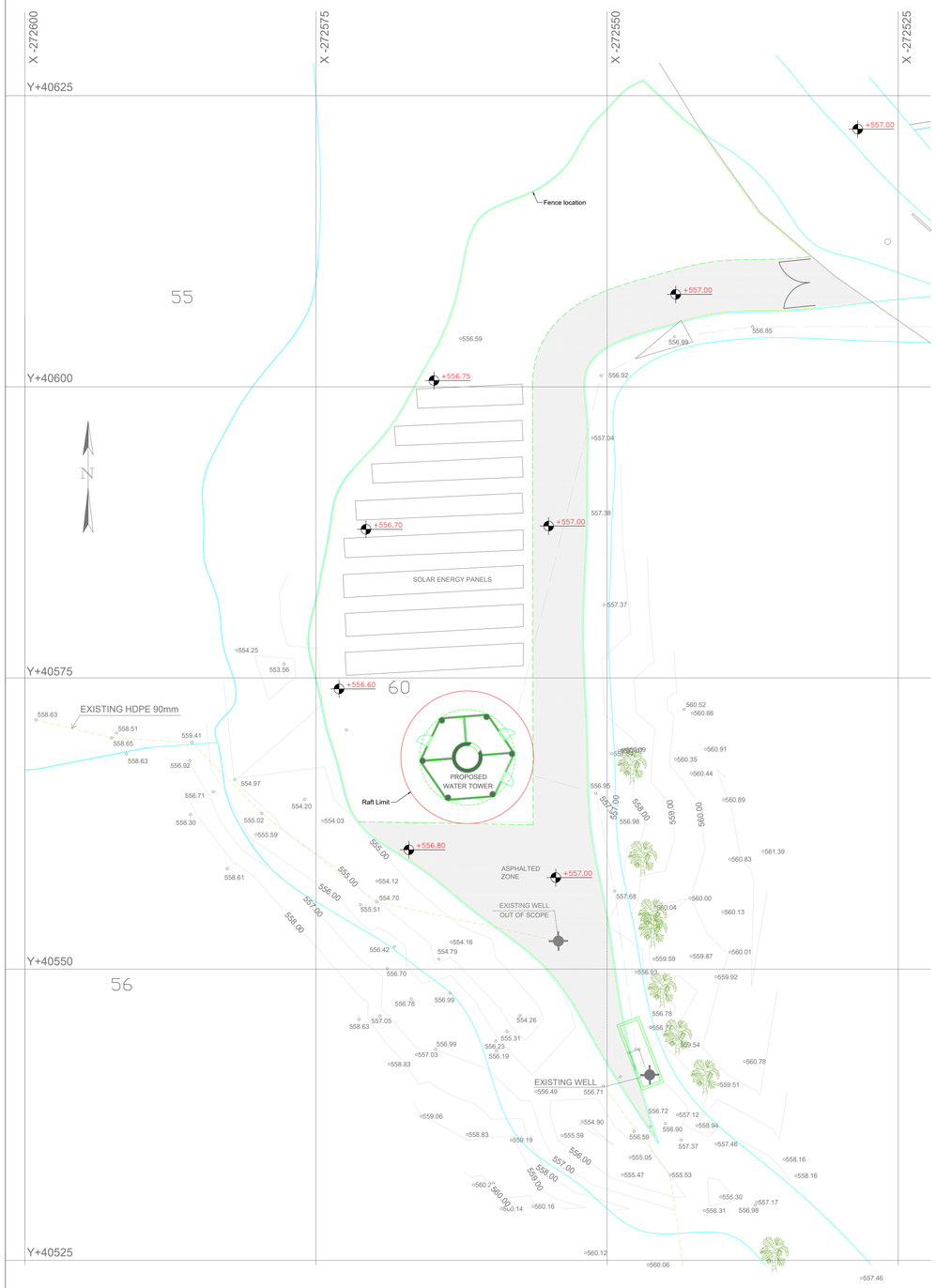
GENERAL LIST OF DRAWING

LIST OF DRAWINGS

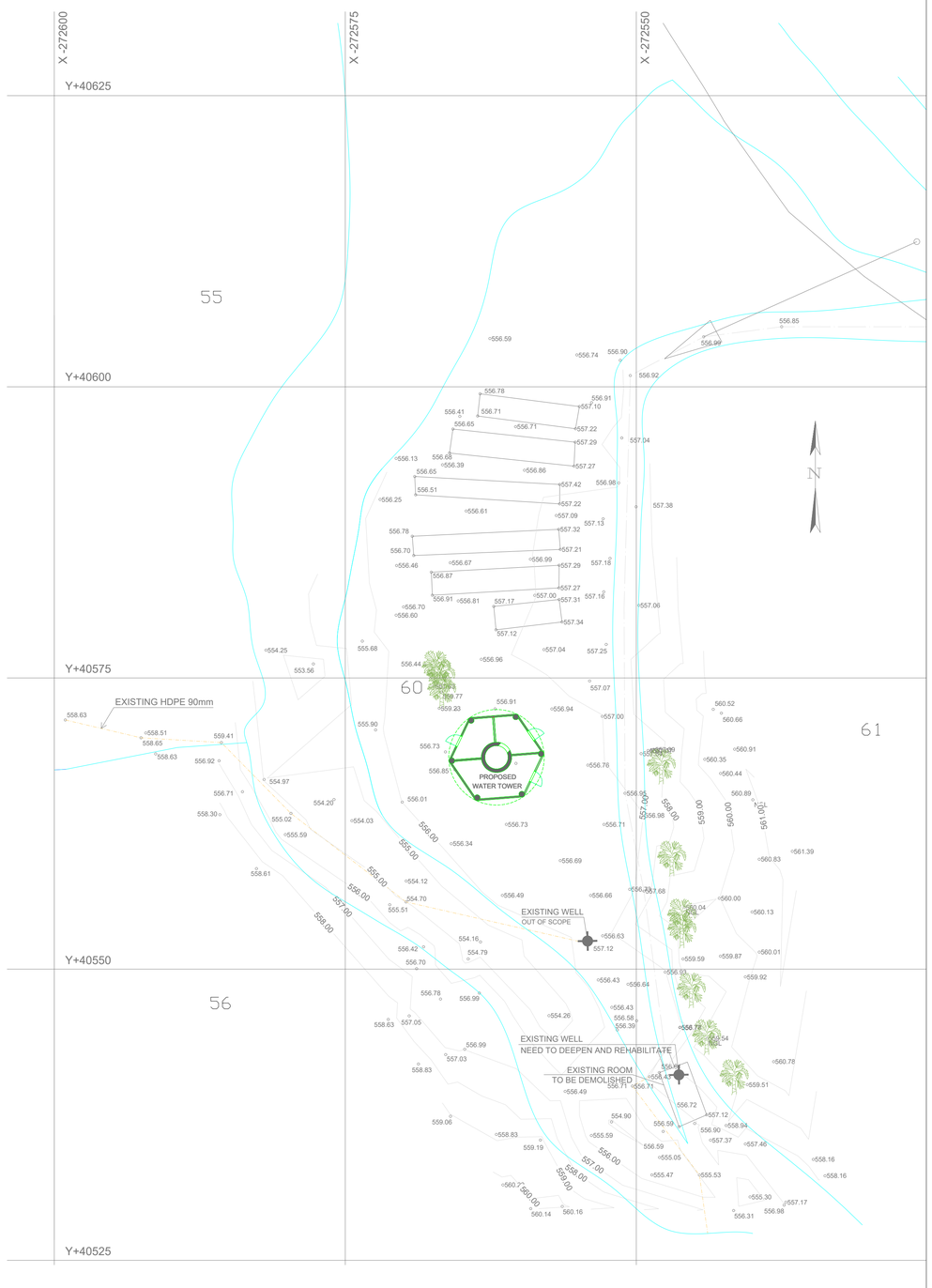
DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	1/1	

TOPOGRAPHICAL SURVEY
SITE PLAN



TOPOGRAPHICAL SURVEY
SITE LAYOUT



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

FORMWORK:

ALL EXECUTED CONCRETE SHALL BE FAIR FACED CONCRETE.

DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE–RODS.

THE USE OF ø6mm 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.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

N.B.

THE LEVEL +0.00 IS EQUIVALENT TO +657.10m

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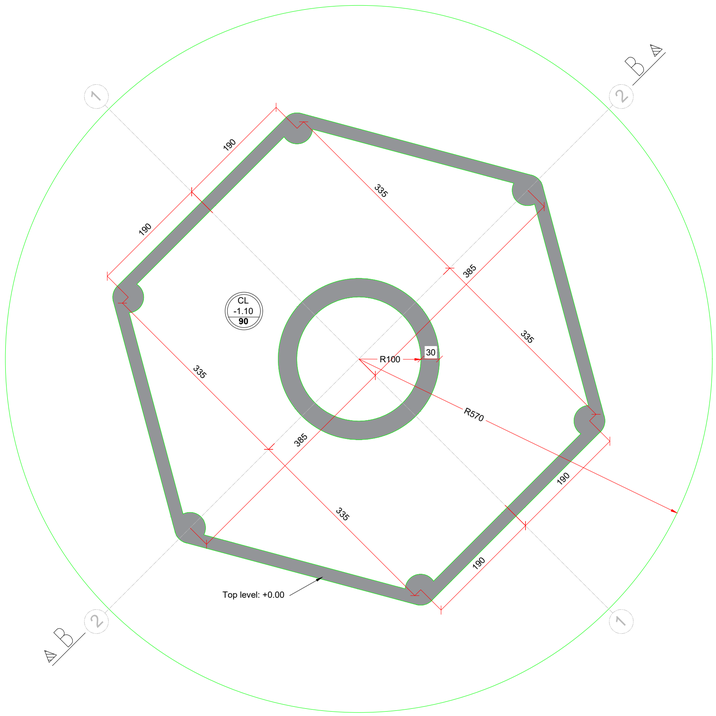
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

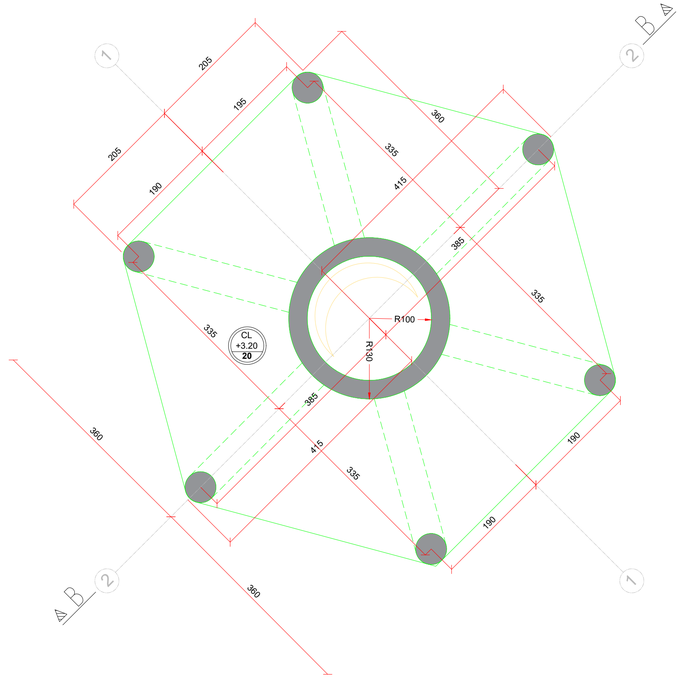
BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	TOPOGRAPHICAL SURVEY SITE LAYOUT SITE PLAN

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	BTD	BTD	BTD

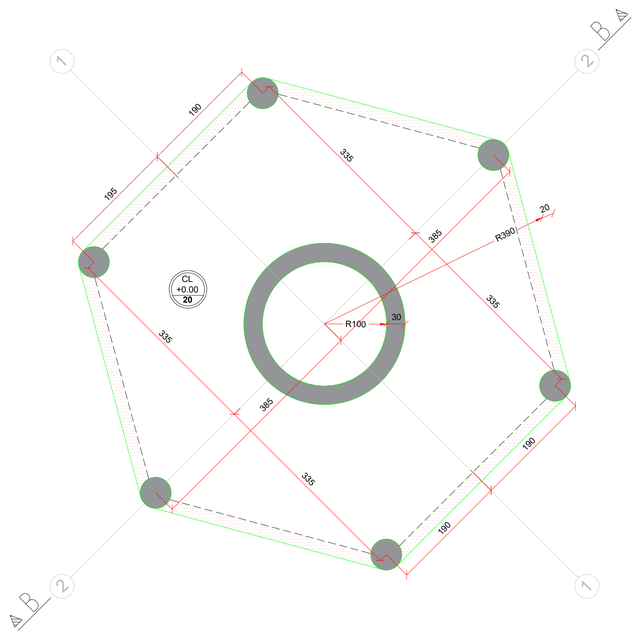
DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	1/250	1/5	477W-01RS-C01



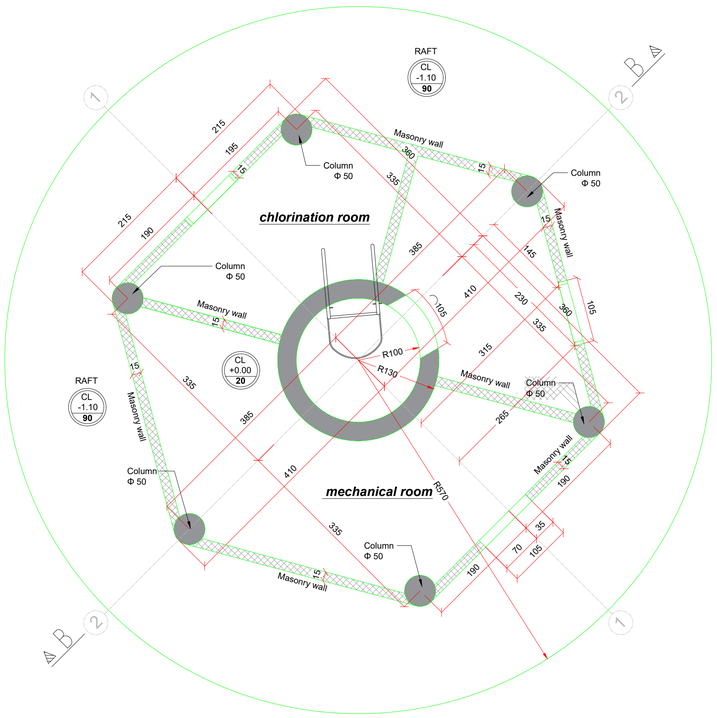
RAFT FOUNDATION PLAN VIEW
SCALE 1:50



PUMPING STATION AND MECHANICAL ROOM ROOF PLAN VIEW
SCALE 1:50



SLAB ON GRADE PLAN VIEW
SCALE 1:50



PUMPING STATION AND MECHANICAL ROOM FLOOR PLAN VIEW
SCALE 1:50

NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY. (CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

FORMWORK:

ALL EXECUTED CONCRETE SHALL BE FAIR FACED CONCRETE.

DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE–RODS.

THE USE OF ø6mm 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.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

N.B.

THE LEVEL +0.00 IS EQUIVALENT TO +657.10m

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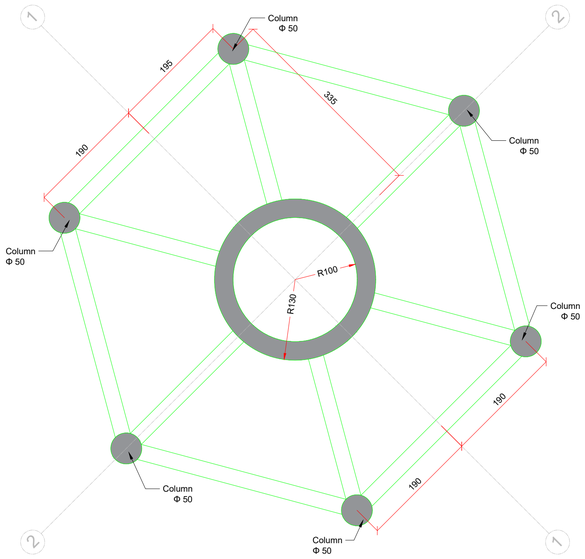
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

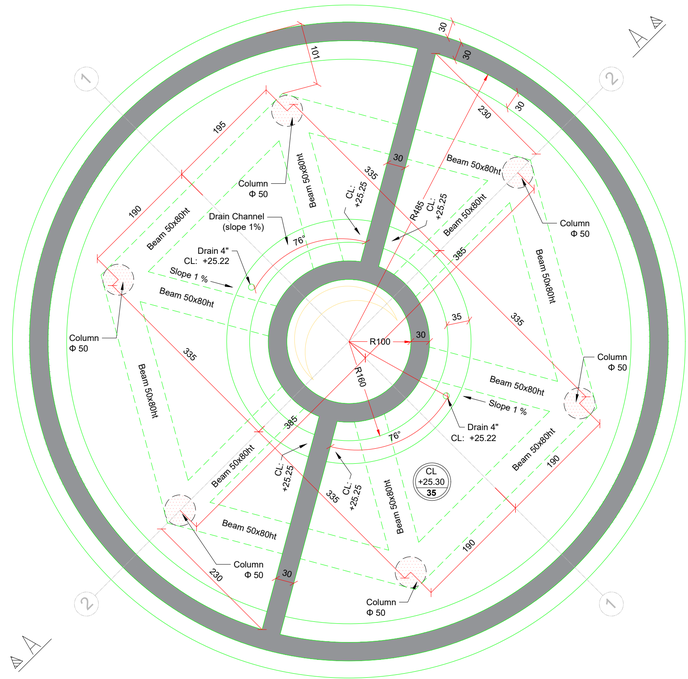
BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FORMWORK MECHANICAL ROOM AND FOUNDATIONS PLAN VIEWS

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	BTD	BTD	BTD

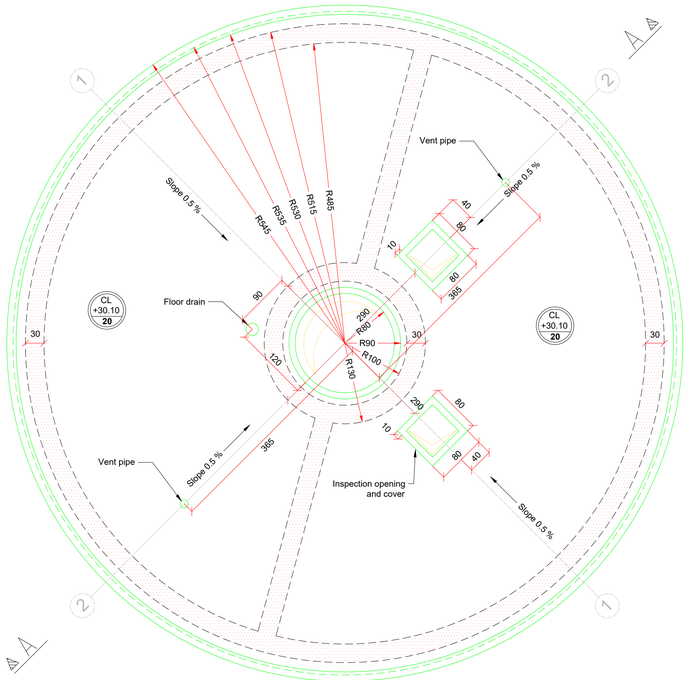
DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	2/5	477W-01RS-C02



TYPICAL BRACING PLAN VIEW
SCALE 1:50



RESERVOIR FLOOR PLAN VIEW
SCALE 1:50



RESERVOIR ROOF PLAN VIEW
SCALE 1:50

NOTES:

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COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY. (CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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WATERPROOFING:

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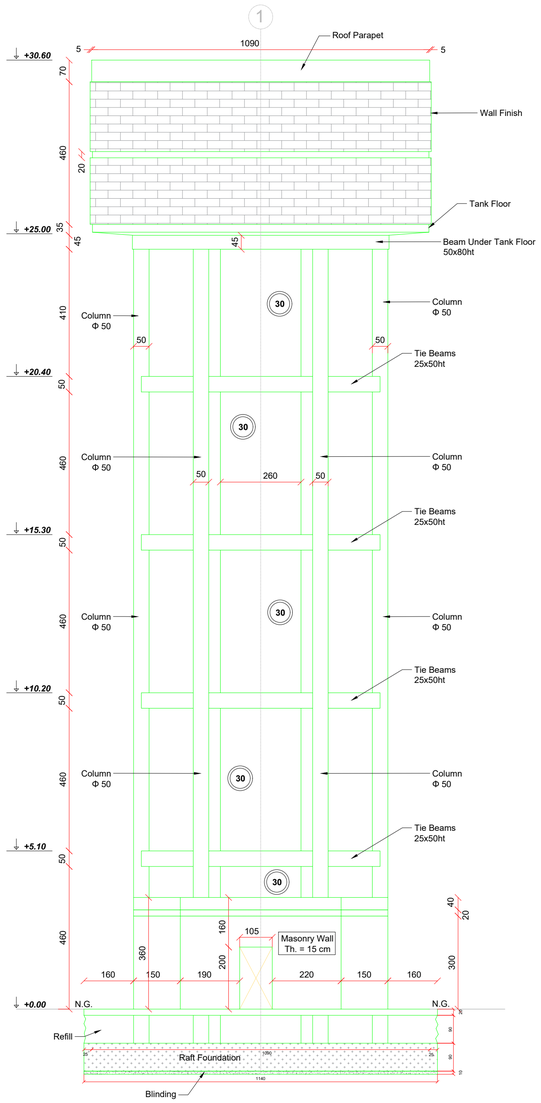
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)

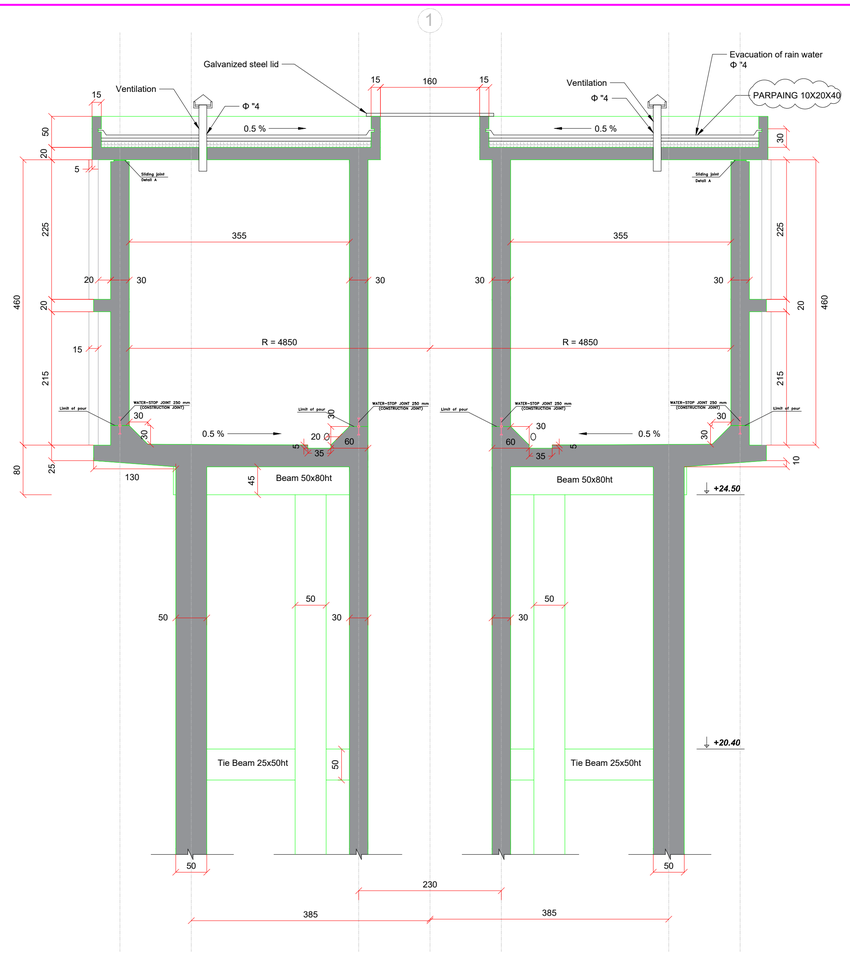
FORMWORK RESERVOIR AND BRACING PLAN VIEWS

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	BTD	BTD	BTD

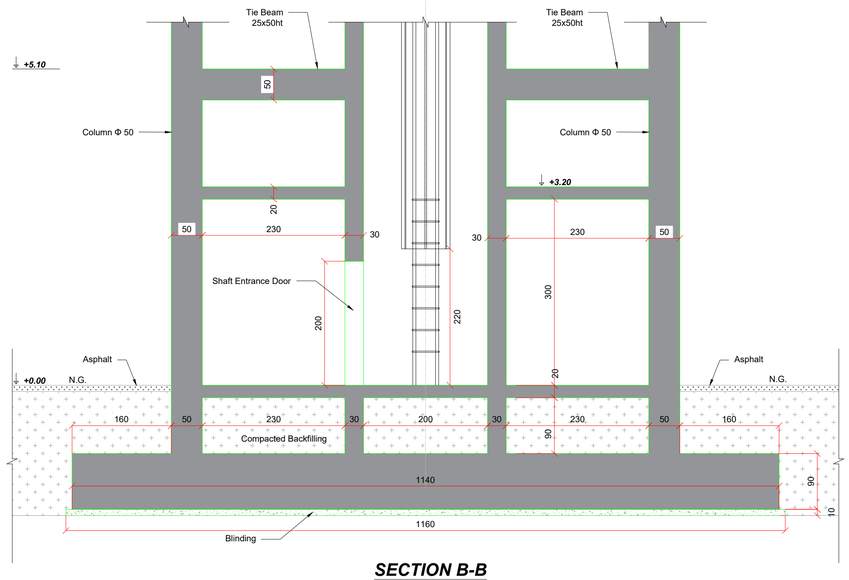
DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	3/5	477W-01RS-C03



ELEVATION VIEW
SCALE 1:100



SECTION A-A
SCALE 1:50



SECTION B-B
SCALE 1:50

NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

FORMWORK:

ALL EXECUTED CONCRETE SHALL BE FAIR FACED CONCRETE.

DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE–RODS.

THE USE OF ø6mm 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.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

N.B.

THE LEVEL +0.00 IS EQUIVALENT TO +657.10m

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
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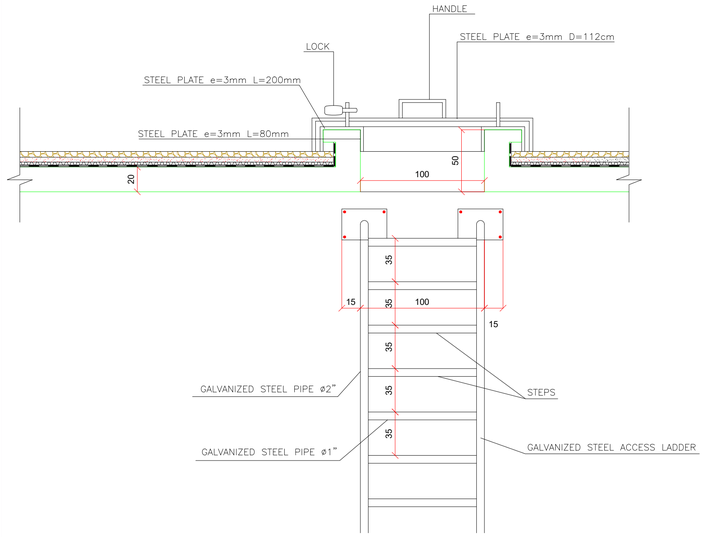
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

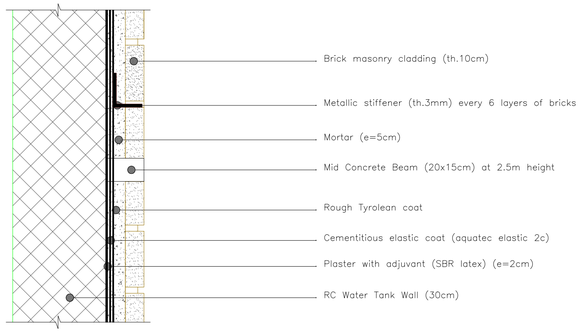
BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FORMWORK ELEVATION AND SECTIONS

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	4/5	477W-01RS-C04

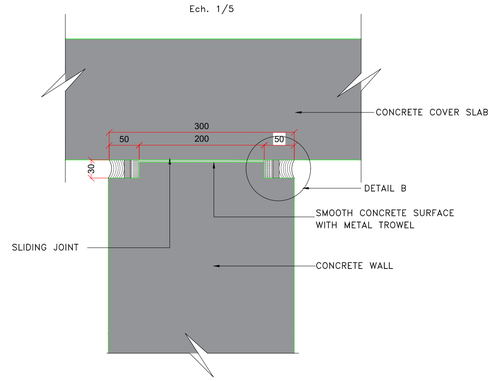


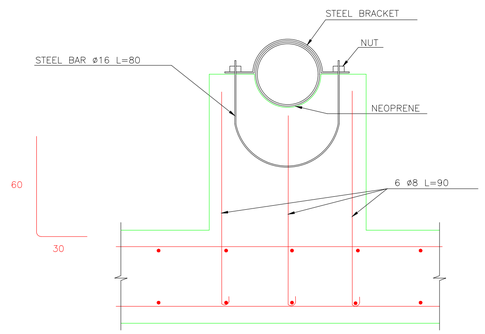
RESERVOIR ACCESS DETAILS
(FALL ARREST SYSTEM)
SCALE 1:25



BRICK MASONRY CLADDING DETAIL
SCALE 1:50

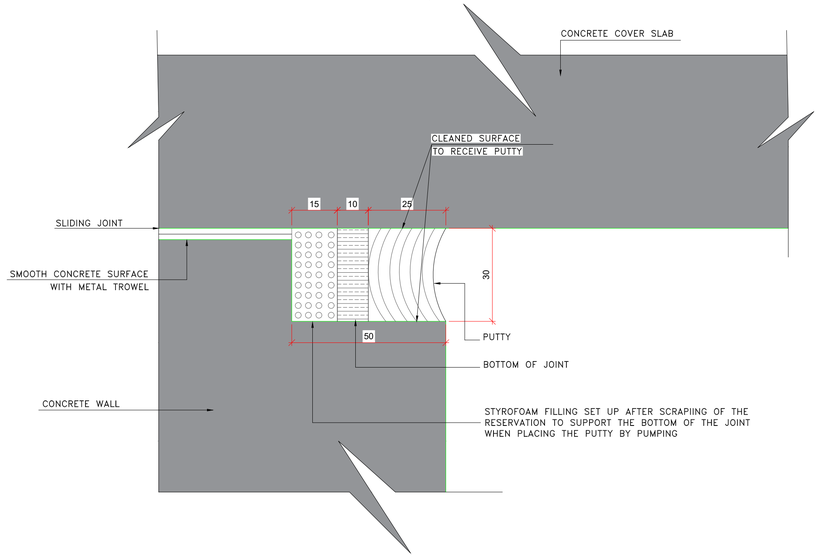
DETAIL A OF SLIDING JOINT
Ech. 1/5

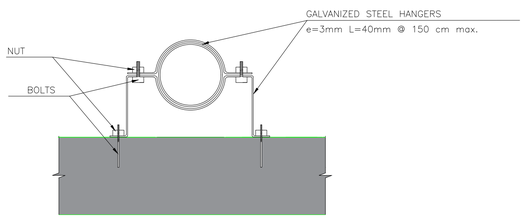




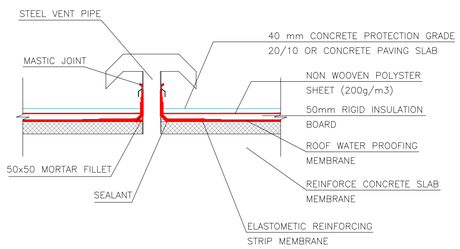
PIPE SUPPORT
SCALE 1:50

DETAIL B
Ech. 1/1

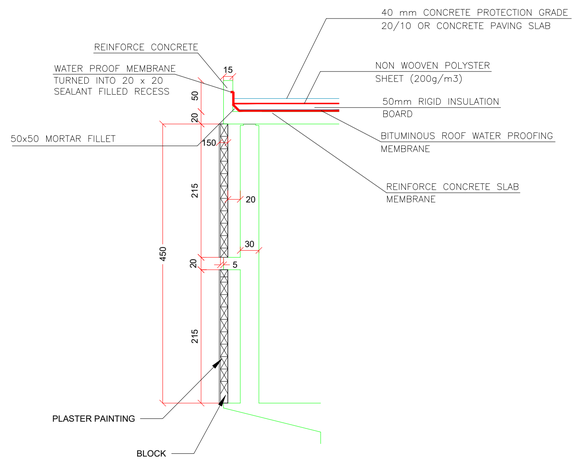




PIPE FIXATION
SCALE 1:50



RESERVOIR VENT PIPE INSTALLATION
AND ROOF WATERPROOFING
SCALE 1:50



WALL FINISH AND ROOF WATERPROOF DETAIL
SCALE 1:50

NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY. (CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

FORMWORK:

ALL EXECUTED CONCRETE SHALL BE FAIR FACED CONCRETE.

DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE–RODS.

THE USE OF ø6mm 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.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
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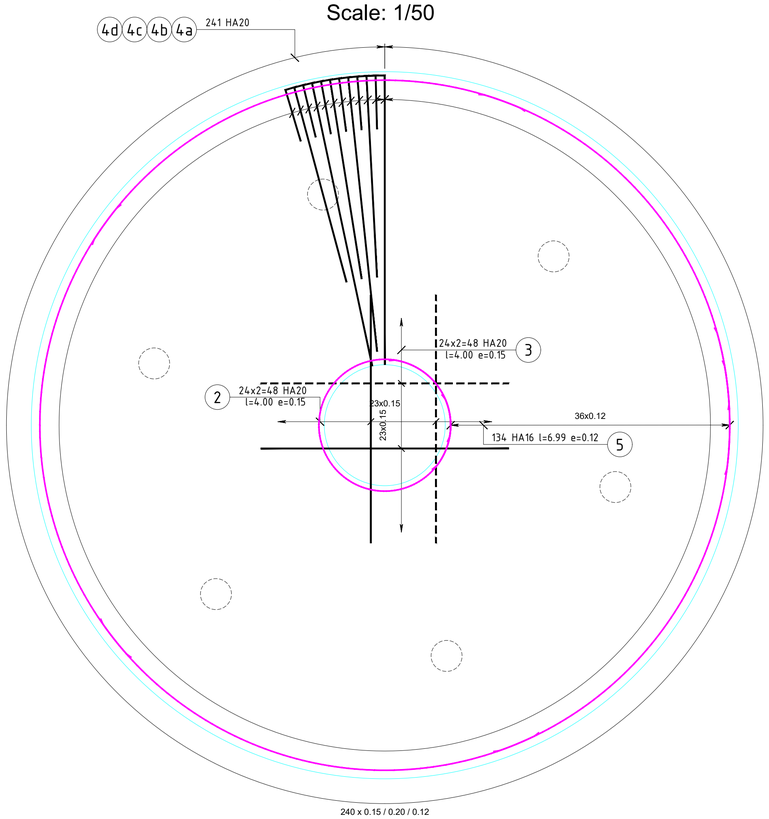
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	SLIDING JOINT, WATRERPROOFING, FIXING AND FINISHING DETAILS

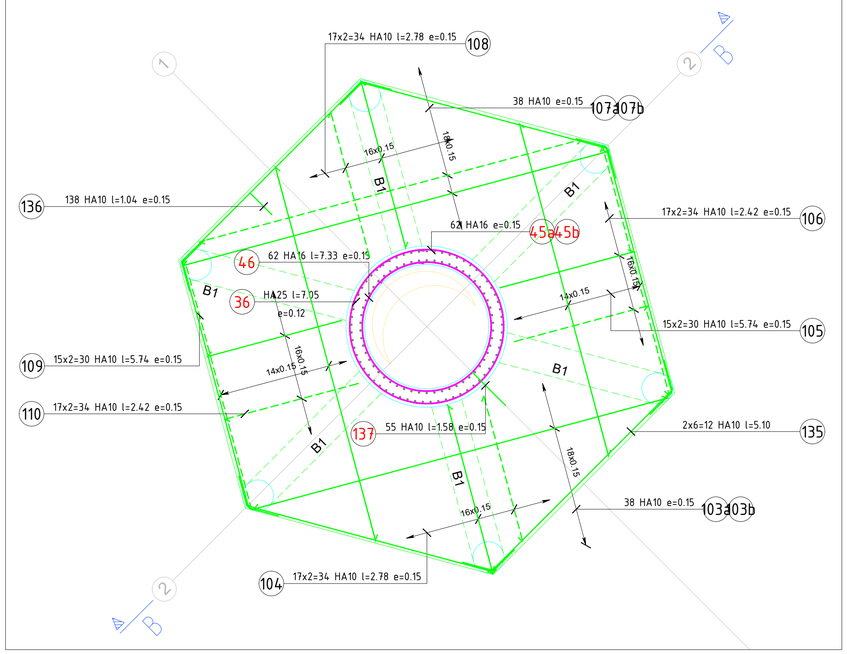
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	5/5	477W-01RS-C05

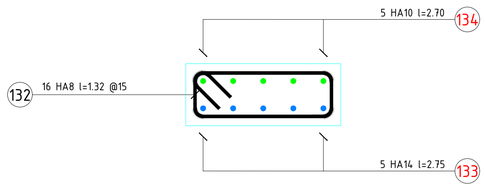
Raft Top and Bottom Reinforcement
Scale: 1/50



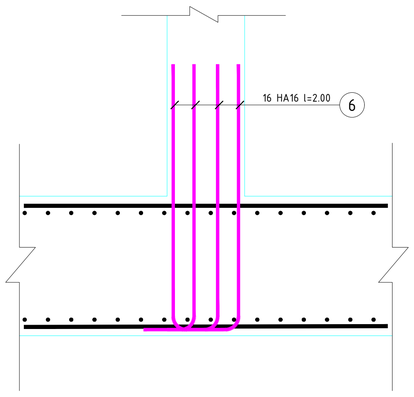
Mechanical Room upper slab Reinforcement
Scale: 1/50



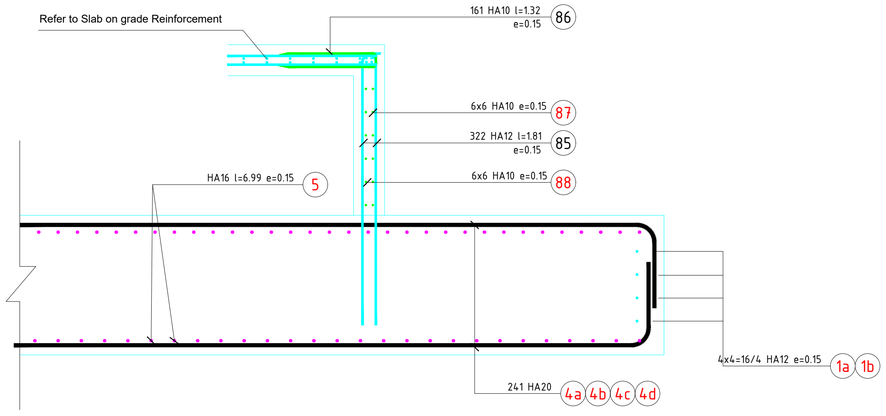
Beam Type B1 50x20ht Section Reinforcement
Scale: 1/10



Raft and Column Section
Scale: 1/20



Raft Section
Scale: 1/20



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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

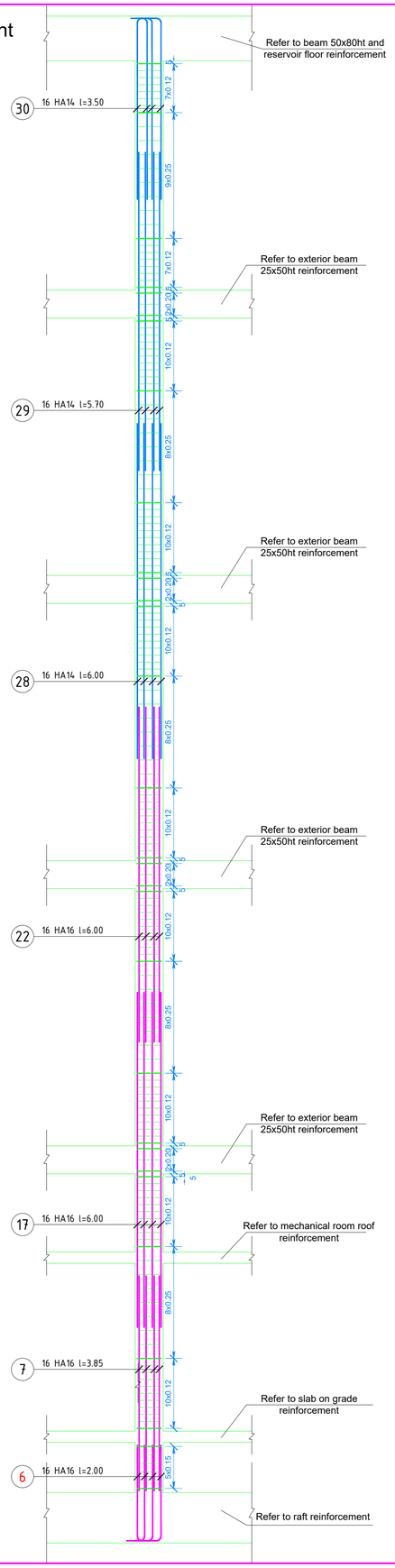
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	RAFT AND MECHANICAL ROOM UPPER SLAB REINFORCEMENT

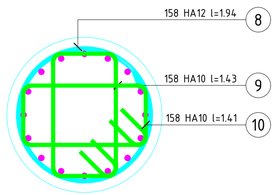
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	1/10	477W-01RS-C-F01

Column Section Reinforcement
Scale: 1/50



Column Section Reinforcement
Scale: 1/10



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

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

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

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

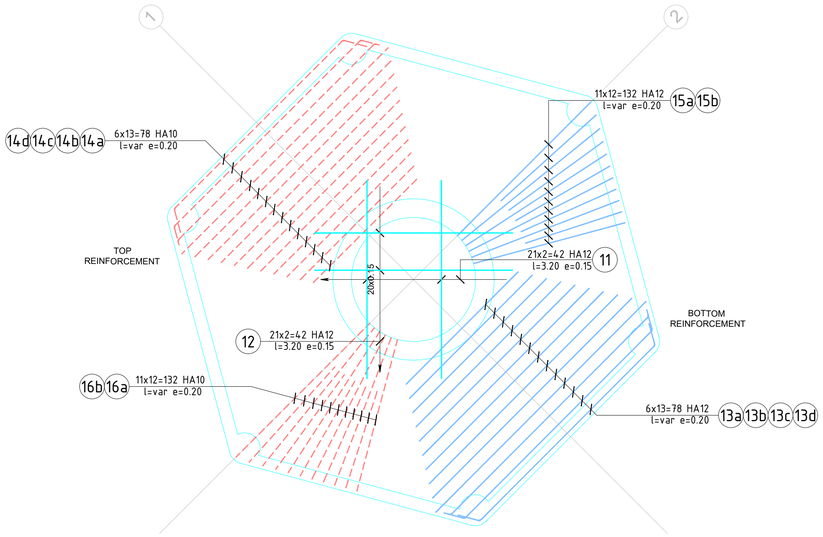
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	COLUMN REINFORCEMENT

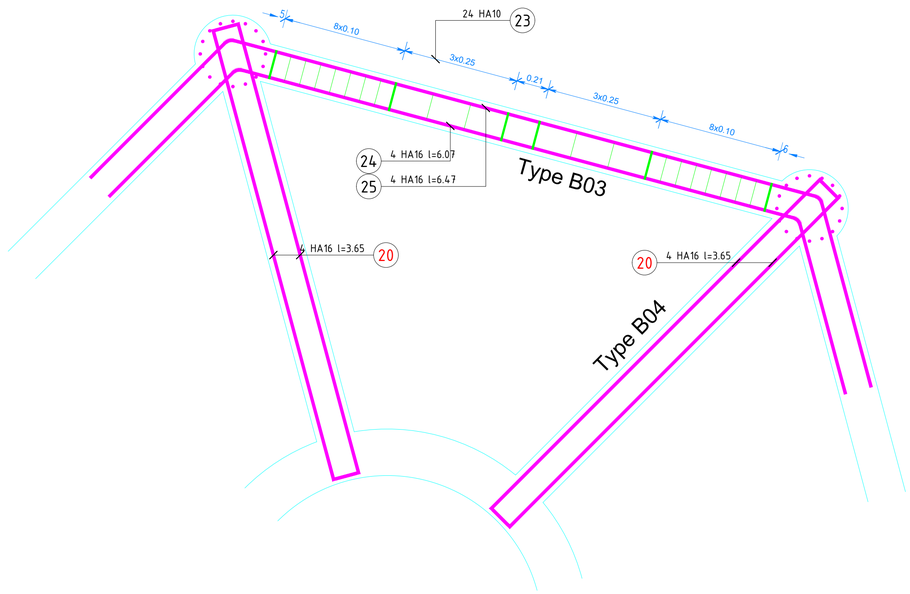
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	2/10	477W-01RS-C-F02

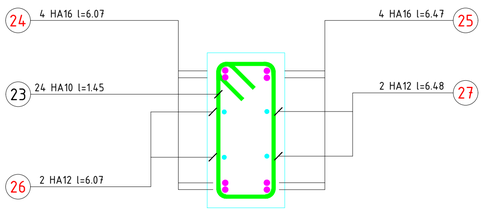
Slab on grade Reinforcement
Scale: 1/50



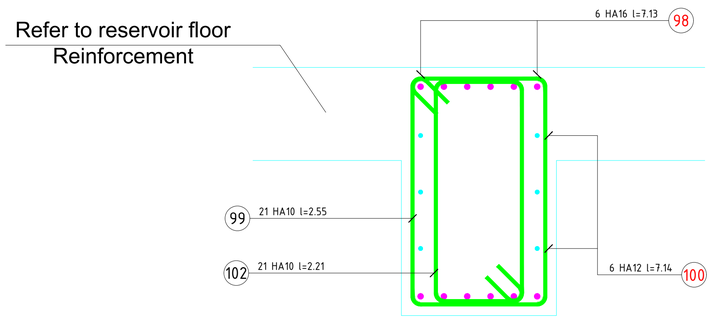
Exterior Beam 25x50ht Plan View Reinforcement
Scale: 1/20



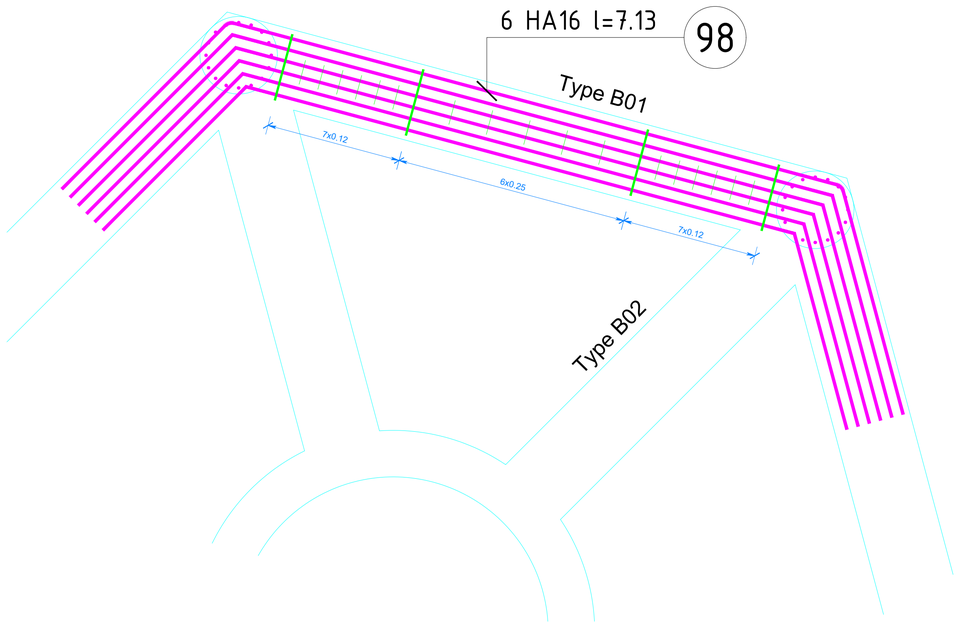
Exterior Beam Type "B03" 25x50ht Section Reinforcement
Scale: 1/10



Exterior Beam Type "B01" 50x80ht Section Reinforcement
Scale: 1/10



Exterior Beam 50x80ht Plan View Reinforcement
Scale: 1/20



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB – HAJAL Bldg
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TEL:(04) 712157 / 712158
FAX: (04) 712159

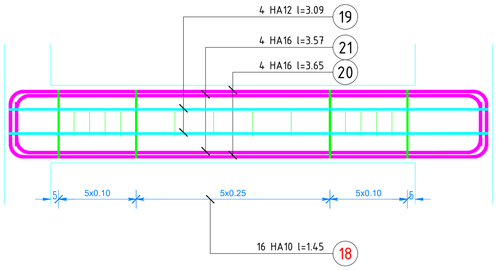
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	SLAB ON GRADE AND EXTERIOR BEAMS REINFORCEMENT

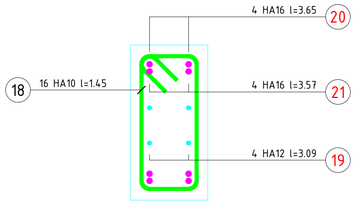
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	3/10	477W-01RS-C-F03

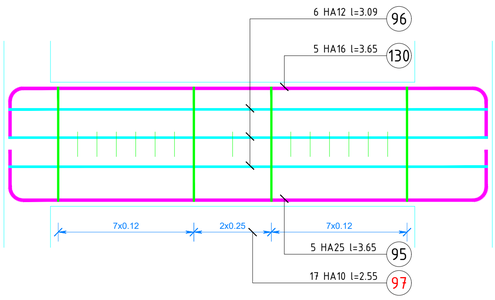
Interior Beam Type "B04" 25x50ht Elevation Reinforcement
Scale: 1/20



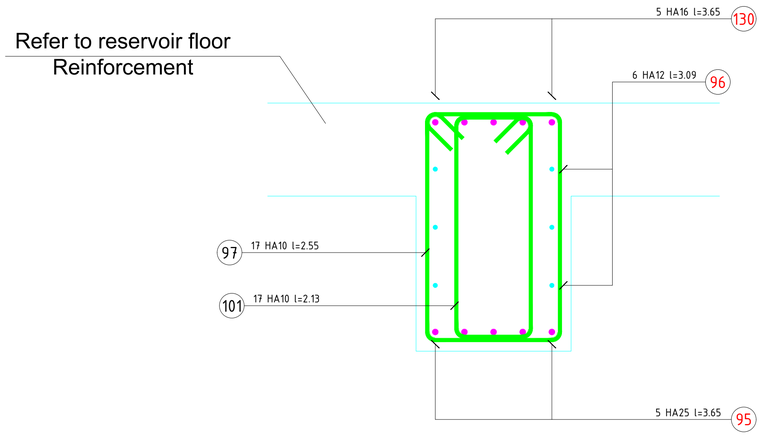
rior Beam Type "B04" 25x50ht Section Reinforcemen
Scale: 1/10



Interior Beam Type "B02" 50x80ht Elevation Reinforcement
Scale: 1/20



Interior Beam Type "B02" 50x80ht Section Reinforcement
Scale: 1/10



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

– FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2

– FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2

– FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2

– FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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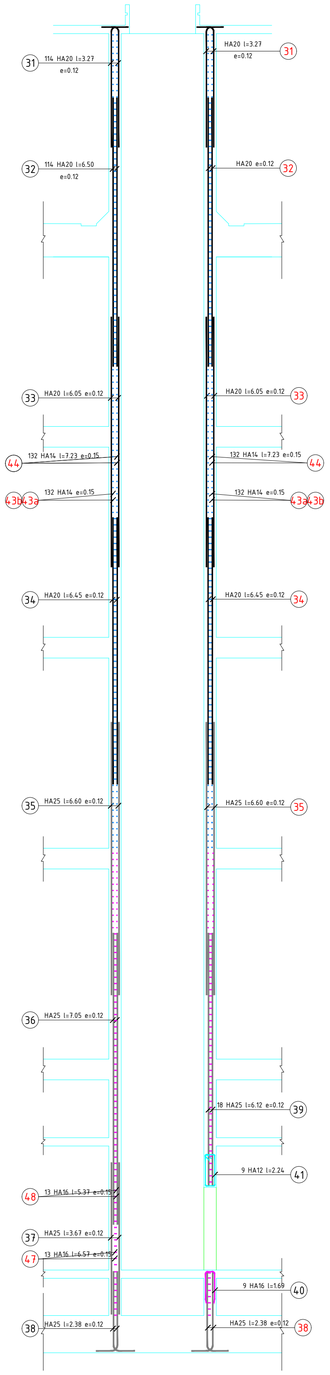
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	INTERIOR BEAMS REINFORCEMENT

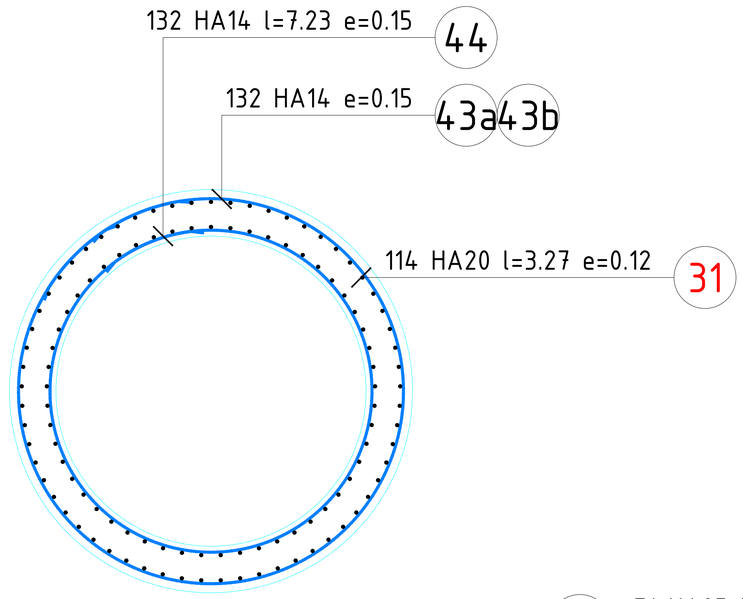
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W–01RS–C–F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	4/10	477W–01RS–C–F04

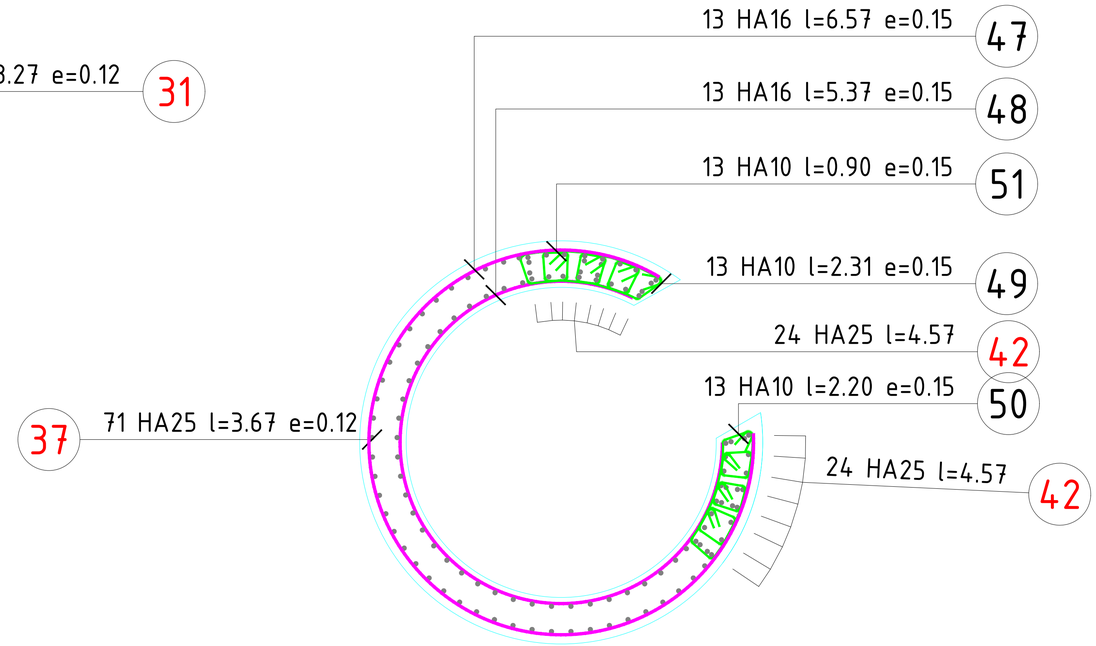
Core Wall Vertical Section Reinforcement
Scale: 1/75



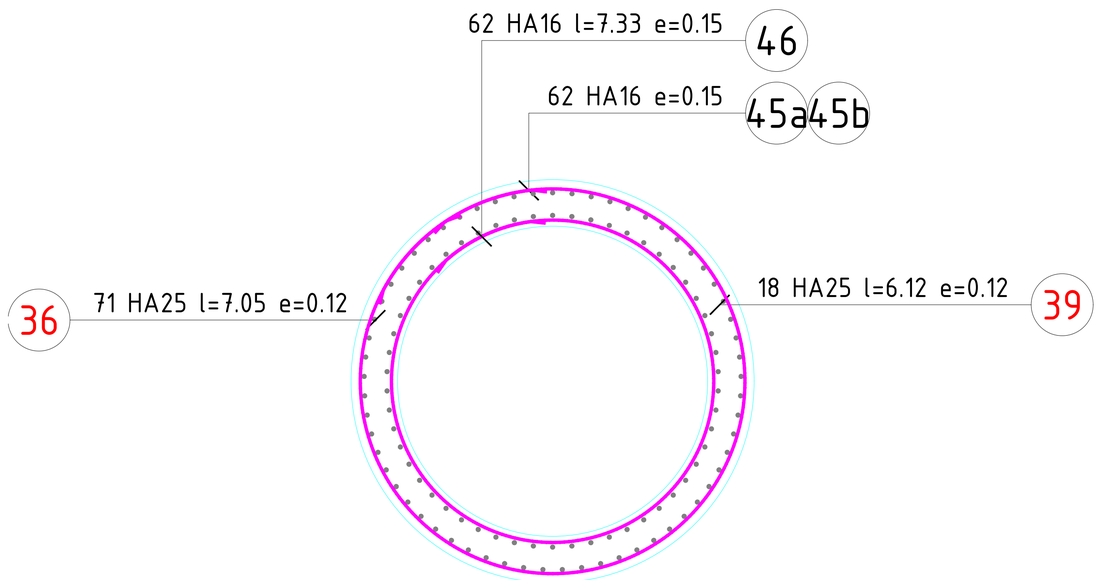
Core Wall Horizontal Section (From 10.20m to 30.10m)
Scale: 1/20



Core Wall Horizontal Section (From 0.00m to 2.00m)
Scale: 1/20



Core Wall Horizontal Section (From 2.00m to 10.20m)
Scale: 1/20



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.
MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:
40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL
30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
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TEL:(04) 712157 / 712158
FAX: (04) 712159

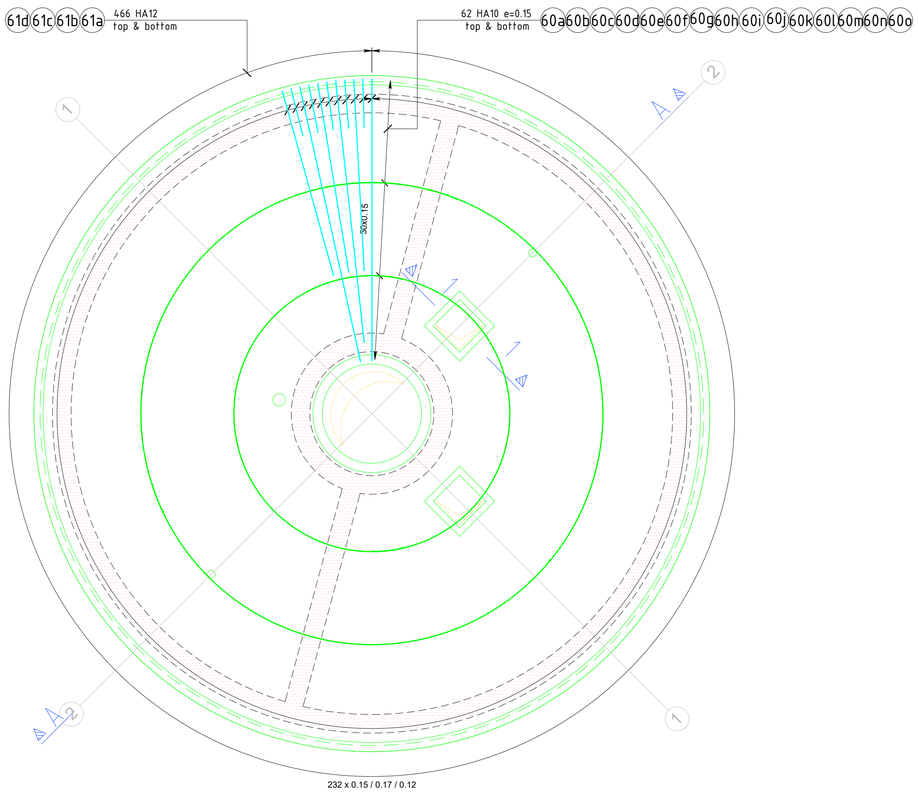
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	CORE WALL REINFORCEMENT

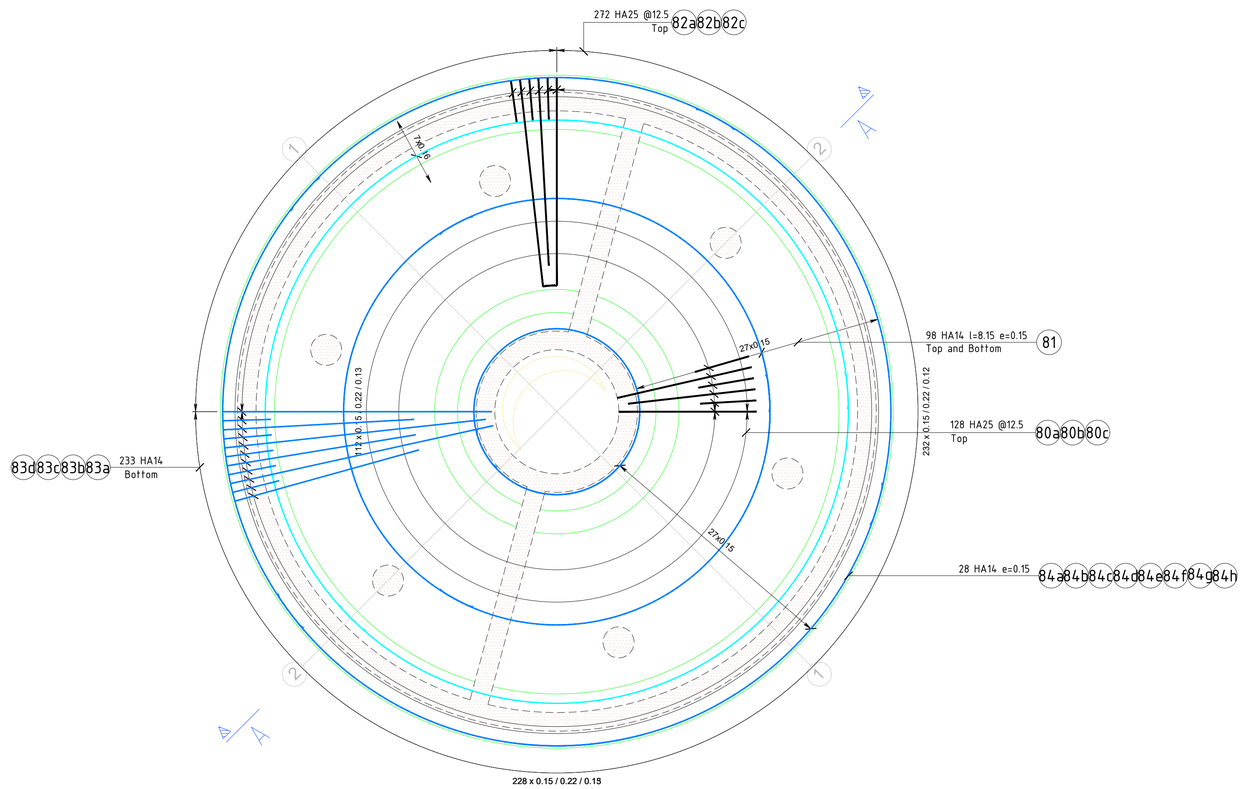
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	5/10	477W-01RS-C-F05

Reservoir Roof Reinforcement
Scale: 1/50



Reservoir Floor Reinforcement
Scale: 1/50



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

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

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

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FAX: (04) 712159

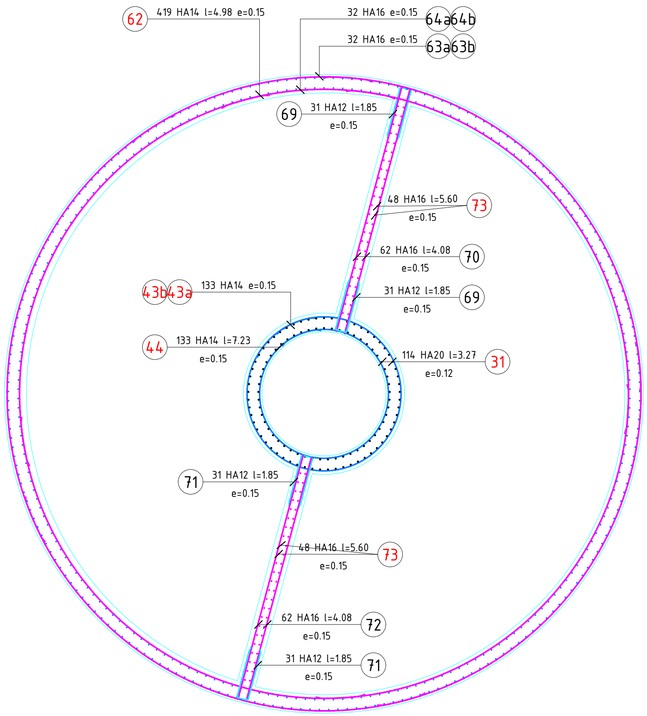
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	RESERVOIR ROOF AND FLOOR REINFORCEMENT

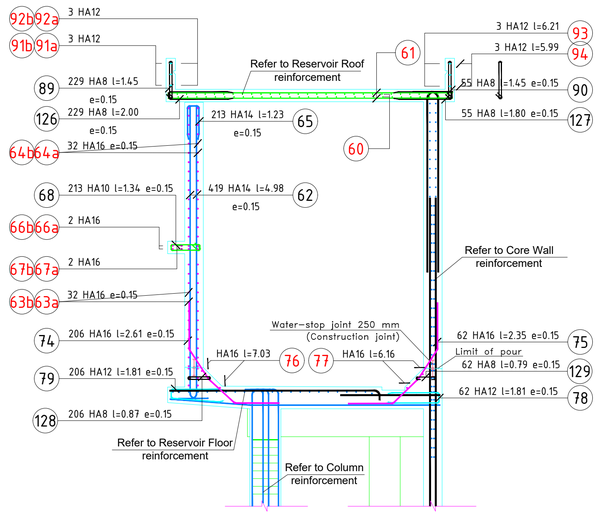
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	6/10	477W-01RS-C-F06

Reservoir Walls Reinforcement
Scale: 1/50



Reservoir Walls Section Reinforcement
Scale: 1/50



NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.
MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:
40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL
30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

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

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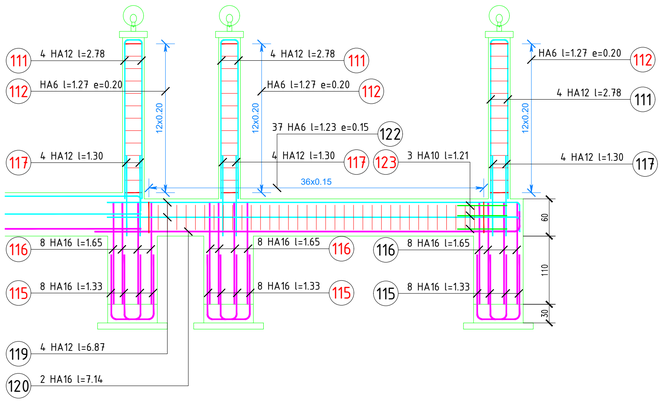
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	RESERVOIR WALLS REINFORCEMENT

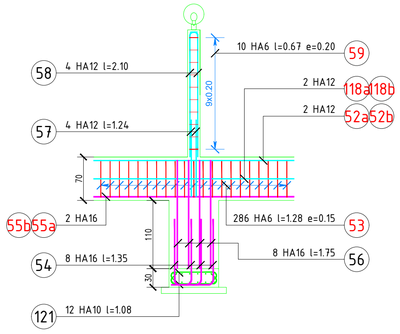
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	7/10	477W-01RS-C-F07

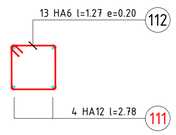
35x35 Column Elevation
Scale: 1/50



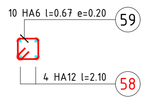
20x20 Column Elevation
Scale: 1/50



35x35 Column Section
Scale: 1/20

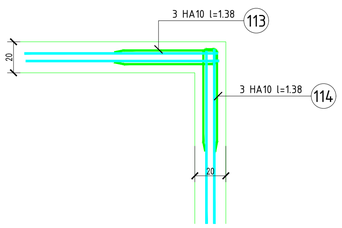


20x20 Column Section
Scale: 1/20

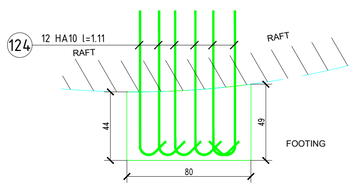


Detail 1 Beams of grade Intersection
Scale: 1/20

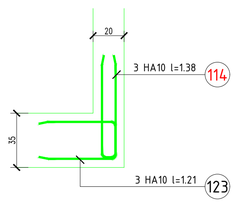
Detail 2 Footing and Raft intersection
Scale: 1/20

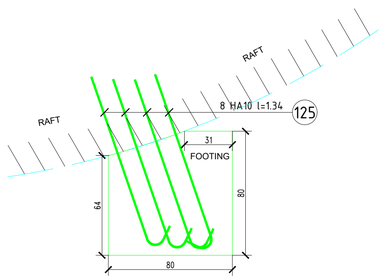


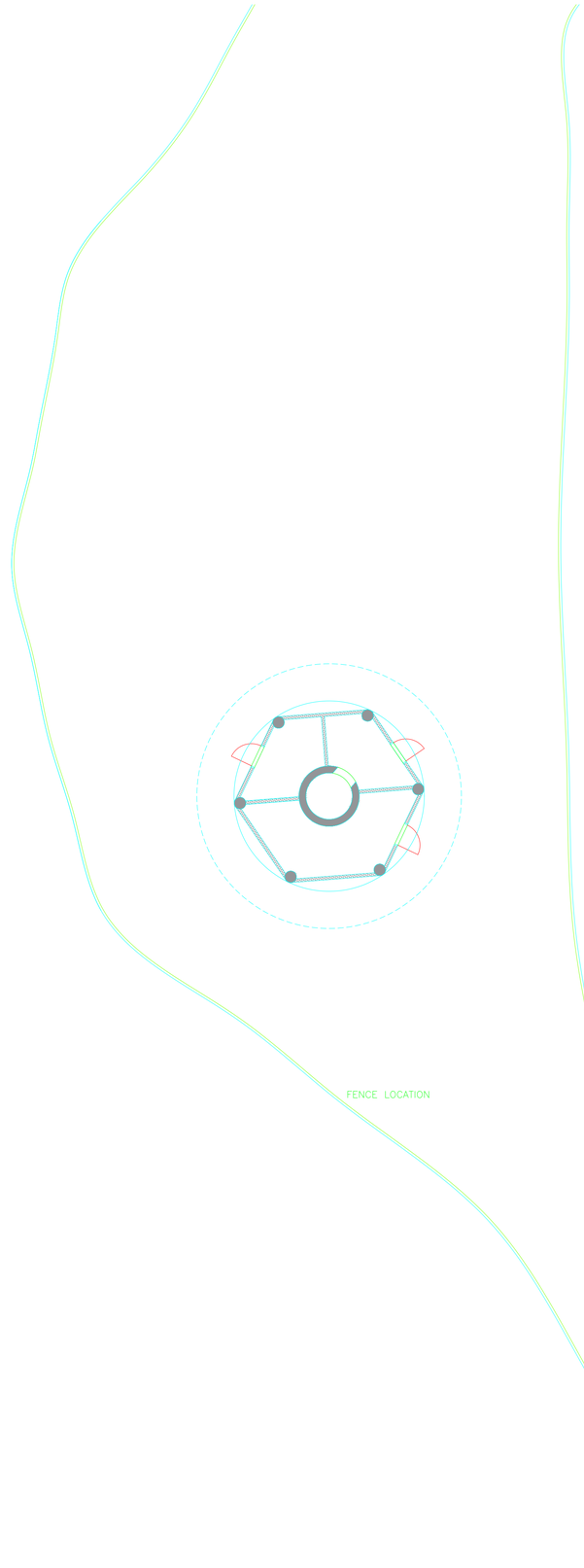
Detail 4 Beams on grade intersection
Scale: 1/20



Detail 3 Footing and Raft intersection
Scale: 1/20







NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

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

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FENCE DETAILS REINFORCEMENT

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	8/10	477W-01RS-C-F08

General nomenclature of steels

N°	Type	Ø	Member By Element	Member Of element	Member Total	Esp	Unit length	Shaping	Mandrel (cm)	TOTAL Length	Index
1a	HA	12	16	1	16		8.00	8.00 / 5.66		128.00	
1b	HA	12	4	1	4		6.58	6.58 / 5.66		26.32	
2	HA	20	48	1	48	0.15	4.00	4.00		192.00	
3	HA	20	48	1	48	0.15	4.00	4.00		192.00	
4a	HA	20	31	1	31		5.03	0.42 4.67	20.0	155.93	
4b	HA	20	30	1	30		4.81	0.42 4.46	20.0	144.30	
4c	HA	20	60	1	60		3.61	0.42 3.26	20.0	216.60	
4d	HA	20	120	1	120		1.23	0.42 0.88	20.0	147.60	
5	HA	16	134	1	134	0.12	6.99*	Var	15.0	936.66	
6	HA	16	16	6	96		2.00	0.33 1.72	15.0	192.00	
7	HA	16	16	6	96		3.85	3.85		369.60	
8	HA	12	158	1	158		1.94	0.21 Rec:0.60		306.52	
9	HA	10	158	1	158		1.43	0.41 0.21	4.0	225.94	
10	HA	10	158	1	158		1.41	0.00 0.41	4.0	222.78	
11	HA	12	42	1	42	0.15	3.20	3.20		134.40	
12	HA	12	42	1	42	0.15	3.20	3.20		134.40	
13a	HA	12	10	6	60	0.2	3.69*	Var		221.40	
13b	HA	12	1	6	6		4.72	0.23 90° 4.29 90° 0.23		28.32	
13c	HA	12	1	6	6		4.73	0.42 90° 4.52 90° 0.42		28.38	
13d	HA	12	1	6	6		4.72	0.37 90° 4.01 90° 0.37		28.32	
14a	HA	10	10	6	60	0.2	3.54*	Var		212.40	
14b	HA	10	1	6	6		4.62	0.08 90° 4.49 90° 0.08		27.72	
14c	HA	10	1	6	6		4.63	0.2 90° 4.26 90° 0.2		27.78	
14d	HA	10	1	6	6		4.63	0.4 90° 3.85 90° 0.4		27.78	
15a	HA	12	12	6	72	0.20	2.79*	Var		200.88	
15b	HA	12	12	5	60	0.20	1.86*	Var		111.60	
16a	HA	10	12	6	72	0.20	2.79*	Var		200.88	
16b	HA	10	12	5	60	0.20	1.86*	Var		111.60	
17	HA	16	16	6	96		6.00	6.00		576.00	
18	HA	10	16	24	384		1.45	0.44 0.79	4.0	556.80	
19	HA	12	4	24	96		3.09	3.09		296.64	
20	HA	16	4	24	96		3.65	0.33 3.09 0.33	15.0	350.40	
21	HA	16	4	24	96		3.57	0.33 3.01 0.33	15.0	342.72	
22	HA	16	16	6	96		6.00	6.00		576.00	
23	HA	10	24	24	576		1.45	0.44 0.79	4.0	835.2	
24	HA	16	4	24	96		6.07	3.76 135° 90° 135°	10.0	582.72	
25	HA	16	4	24	96		6.47	3.96 135° 90° 135°	10.0	621.12	
26	HA	12	2	24	48		6.07	3.76 135° 90° 135°	5.0	291.36	
27	HA	12	2	24	48		6.48	3.96 135° 90° 135°	5.0	311.04	
28	HA	14	16	6	96		6.00	6.00		576.00	
29	HA	14	16	6	96		5.70	5.70		547.20	
30	HA	14	16	1	16		3.50	0.30 3.25	15.0	56.00	
31	HA	20	114	1	114	0.12	3.27	0.42 2.92	20.0	372.78	
32	HA	20	114	1	114	0.12	6.50	6.50		741.00	
33	HA	20	114	1	114	0.12	6.05	6.05		689.70	
34	HA	20	114	1	114	0.12	6.45	6.45		735.30	
35	HA	25	114	1	114	0.12	6.60	6.60		752.40	
36	HA	25	71	1	71	0.12	7.05	7.05		500.55	
37	HA	25	71	1	71	0.12	3.67	3.67		260.57	
38	HA	25	114	1	114	0.12	2.38	0.53 1.94	25.0	271.32	
39	HA	25	18	1	18	0.12	6.12	6.12		110.16	
40	HA	16	9	1	9		1.69	0.24 0.73	10.0	15.21	
41	HA	12	9	1	9		2.24	0.73 0.24	5.0	20.16	
42	HA	25	24	1	24		4.57	4.57		109.68	
43a	HA	14	133	1	133	0.15	8.00	1.21 Rec:0.20		1064.00	
43b	HA	14	133	1	133	0.15	1.20	1.20 1.21		159.60	
44	HA	14	133	1	133	0.15	7.23	1.03 Rec:0.30		961.59	
45a	HA	16	62	1	62	0.15	8.00	1.21 Rec:0.21		496.00	
45b	HA	16	62	1	62	0.15	1.39	1.39 1.21		86.18	
46	HA	16	62	1	62	0.15	7.33	1.03 Rec:0.60		454.46	
47	HA	16	13	1	13	0.15	6.57	6.57 1.21		85.41	
48	HA	16	13	1	13	0.15	5.37	5.37 1.03		69.81	
49	HA	10	13	1	13	0.15	2.31	0.50 2.hx0.2hx0.22 0.50	4.0	30.03	
50	HA	10	13	1	13	0.15	2.20	0.50 2.hx0.2hx0.22 0.50	4.0	28.60	
51	HA	10	13	6	78	0.15	0.90	0.19 0.15 0.19 0.15	4.0	70.20	
52a	HA	12	6	1	6		12.00	12.00		72.00	
52b	HA	12	2	1	2		8.77	0.24 8.56		17.54	
53	HA	6	286	1	286	0.15	1.28	0.18 0.60	2.5	366.08	
54	HA	16	8	20	160		1.35	0.33 1.07	15.0	216.00	
55a	HA	16	6	1	6		12.00	12.00		72.00	
55b	HA	16	2	1	2		9.16	9.16		18.32	
56	HA	16	8	20	160		1.75	1.75		280.00	
57	HA	12	4	1	4		1.24	1.24		4.96	
58	HA	12	4	20	80		2.10	0.11 2.02	10.0	168.00	
59	HA	6	10	20	200	0.20	0.67	0.14 0.14	2.5	134.00	
60a	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60b	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60c	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60d	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60e	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60f	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60g	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60h	HA	10	6	1	6	0.15	8.00	8.00 1.0	10.0	48.00	
60i	HA	10	8	1	8	0.15	8.00	8.00 1.0	10.0	64.00	
60j	HA	10	8	1	8	0.15	8.00	8.00 1.0	10.0	64.00	
60k	HA	10	8	1	8	0.15	8.00	8.00 1.0	10.0	64.00	
60l	HA	10	8	1	8	0.15	8.00	8.00 1.0	10.0	64.00	
60m	HA	10	8	1	8	0.15	8.00	8.00 1.0	10.0	64.00	
60n	HA	10	8	1	8	0.15	8.00	8.00 1.0	10.0	64.00	
60o	HA	10	106	1	106	0.15	5.78*	Var	10.0	612.68	
61a	HA	12	60	1	60		4.55	4.55		273.00	
61b	HA	12	58	1	58		4.25	4.25		246.50	
61c	HA	12	116	1	116		3.09	3.09		358.44	
61d	HA	12	232	1	232		0.78	0.78		180.96	
62	HA	14	419	1	419	0.15	4.98	0.30 4.73	15.0	2086.62	
63a	HA	16	128	1	128	0.15	8.00	8.00 1.10		1024.00	
63b	HA	16	32	1	32	0.15	4.11	4.11 1.37		131.52	
64a	HA	16	128	1	128	0.15	8.00	8.00 1.10		1024.00	
64b	HA	16	32	1	32	0.15	2.85	2.85 1.30		91.20	
65	HA	14	213	1	213	0.15	1.23	0.20 0.55	7.0	261.99	

NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER–STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

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 DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	BAR BENDING (1)

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W–01RS–C–F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	9/10	477W–01RS–C–F09

66a	HA	16	8	1	8		8.00		64.00
66b	HA	16	2	1	2		5.72		11.44
67a	HA	16	8	1	8		8.00		64.00
67b	HA	16	2	1	2		4.74		9.48
68	HA	10	213	1	213	0.15	1.34	4.0	285.42
69	HA	12	31	1	31	0.15	1.85	5.0	57.35
70	HA	16	62	1	62	0.15	4.08		252.96
71	HA	12	31	1	31	0.15	1.85	5.0	57.35
72	HA	16	62	1	62	0.15	4.08		252.96
73	HA	16	48	2	96	0.15	5.60	15.0	537.60
74	HA	16	206	1	206	0.15	2.61	10.0	537.66
75	HA	16	62	1	62	0.15	2.61	10.0	145.70
76	HA	16	15	1	15	0.10	7.03*	15.0	105.45
77	HA	16	6	1	6	0.10	6.16*	15.0	36.96
78	HA	12	62	1	62	0.15	1.81	5.0	112.22
79	HA	12	206	1	206	0.15	1.81	5.0	372.86
80a	HA	25	33	1	33		2.22		73.26
80b	HA	25	32	1	32		2.06		65.92
80c	HA	25	63	1	63		0.9		56.7
81	HA	14	98	1	98	0.15	8.15*	10.0	798.70
82a	HA	25	68	1	68		3.02		205.36
82b	HA	25	135	1	135		0.66		89.1
82c	HA	25	69	1	69		3.71		255.99
83a	HA	14	30	1	30		4.32		129.60
83b	HA	14	29	1	29		4.22		122.38
83c	HA	14	58	1	58		3.07		178.06
83d	HA	14	116	1	116		0.76		88.16
84a	HA	14	3	1	3	0.15	8.00	15.0	24.00
84b	HA	14	3	1	3	0.15	8.00	15.0	24.00
84c	HA	14	3	1	3	0.15	8.00	15.0	24.00
84d	HA	14	3	1	3	0.15	8.00	15.0	24.00
84e	HA	14	3	1	3	0.15	8.00	15.0	24.00
84f	HA	14	3	1	3	0.15	8.00	15.0	24.00
84g	HA	14	3	1	3	0.15	8.00	15.0	24.00
84h	HA	14	79	1	79	0.15	6.74*	15.0	532.46
85	HA	12	322	1	322		1.81	10.0	582.82
86	HA	10	161	1	161		1.32	4.0	212.52
87	HA	10	6	6	36	0.15	5.25		189
88	HA	10	6	6	36	0.15	5.18		186.48
89	HA	8	229	1	229	0.15	1.45	3.0	332.05
90	HA	8	55	1	55	0.15	1.45	3.0	79.75
91a	HA	12	12	1	12	0.15	8.00		96.00
91b	HA	12	3	1	3	0.15	4.89		14.67
92a	HA	12	12	1	12	0.15	8.00		96.00
92b	HA	12	3	1	3	0.15	4.66		13.98
93	HA	12	3	1	3		6.21		18.63
94	HA	12	3	1	3		5.99		17.97
95	HA	25	5	6	30		3.65	15.0	109.5
96	HA	12	6	6	36		3.09		111.24
97	HA	10	17	6	102		2.55	4.0	260.10
98	HA	16	6	6	36		7.13	10.0	256.68
99	HA	10	21	6	126		2.55	4.0	321.30
100	HA	12	6	6	36		7.14	5.0	257.04

101	HA	10	17	6	102		2.13	4.0	217.26
102	HA	10	21	6	126		2.21	4.0	278.46
103a	HA	10	10	1	10	0.15	7.45	10.0	74.50
103b	HA	10	28	1	28	0.15	3.90*	10.0	109.20
104	HA	10	34	6	204	0.15	2.78*	10.0	567.12
105	HA	10	30	1	30	0.15	5.74*	10.0	172.20
106	HA	10	34	1	34	0.15	2.42	10.0	82.28
107a	HA	10	10	1	10	0.15	7.45	10.0	74.50
107b	HA	10	28	1	28	0.15	3.90*	10.0	109.20
108	HA	10	34	1	34	0.15	2.78*	10.0	94.52
109	HA	10	30	1	30	0.15	5.74*	10.0	172.20
110	HA	10	34	1	34	0.15	2.42	10.0	82.28
111	HA	12	4	3	12		2.78	10.0	33.36
112	HA	6	13	3	39	0.20	1.27	2.5	49.53
113	HA	10	3	3	9		1.38	4.0	12.42
114	HA	10	3	4	12		1.38	4.0	16.56
115	HA	16	8	3	24		1.33	15.0	31.92
116	HA	16	8	3	24		1.65		39.60
117	HA	12	4	3	12		1.30		15.60
118a	HA	12	6	1	6		12.00		72.00
118b	HA	12	2	1	2		8.56		17.12
119	HA	12	4	1	4		6.87	10.0	27.48
120	HA	16	2	1	2		7.14	15.0	14.28
121	HA	10	12	18	216		1.08	10.0	233.28
122	HA	6	37	1	37	0.15	1.23	2.5	45.51
123	HA	10	3	1	3		1.21	4.0	3.63
124	HA	10	12	1	12		1.11	10.0	13.32
125	HA	10	8	1	8		1.34	10.0	10.72
126	HA	8	229	1	229	0.15	2.00	3.0	458.00
127	HA	8	55	1	55	0.15	1.80	3.0	99.00
128	HA	8	206	1	206	0.15	0.87		179.22
129	HA	8	62	1	62	0.15	0.79		48.98
130	HA	16	5	6	30		3.65	17.0	109.5

131	HA	25	6	6	36		7.13	17.0	256.68
132	HA	8	16	6	96	0.15	1.32	3.0	126.72
133	HA	14	5	6	30		2.75	7.0	85.5
134	HA	10	5	6	30		2.70	4.0	81
135	HA	10	12	1	12		5.10	5.0	61.2
136	HA	10	138	1	138	0.15	1.04	5.0	143.52
137	HA	10	55	1	55	0.15	1.58	5.0	86.9

* : Average Length Average Diameter : 14.4 Average Length

Summary of steels

DIAMETER	HA6	HA8	HA10	HA12	HA14	HA16	HA20	HA25	HA32	HA40	HA-	D.MOY(mm)
MASS (kg/ml)	0.222	0.395	0.617	0.888	1.208	1.578	2.466	3.854	6.313	9.864	-	14.37
LONG. (m)	731.4	1187.5	8109.5	5562.9	7815.9	11097.8	3585.2	3117.2	-	-	-	TOTAL(kg)
MASS (Kg)	177.0	469.1	5003.6	4939.9	9441.6	17512.3	8841.1	12013.7	-	-	-	58398.3

Average diameter: 14.4 mm Total mass: 58398.3 kg

NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

REINFORCEMENT:

DEFORMED HIGH STRENGTH STEEL BARS: SYMBOL T YIELD STRESS: Fy=420 N/mm2.

MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/mm2.

MAXIMUM POURING HEIGHT :1500mm

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

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 = 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 ø8 SHALL BE USED ON EACH LAP.

BENDING:

ø>12mm MECHANICAL

ø<12mm MANUAL (POSSIBLY)

STRAIGHTENING OF BENDED BARS IS NOT ALLOWED.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

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 DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

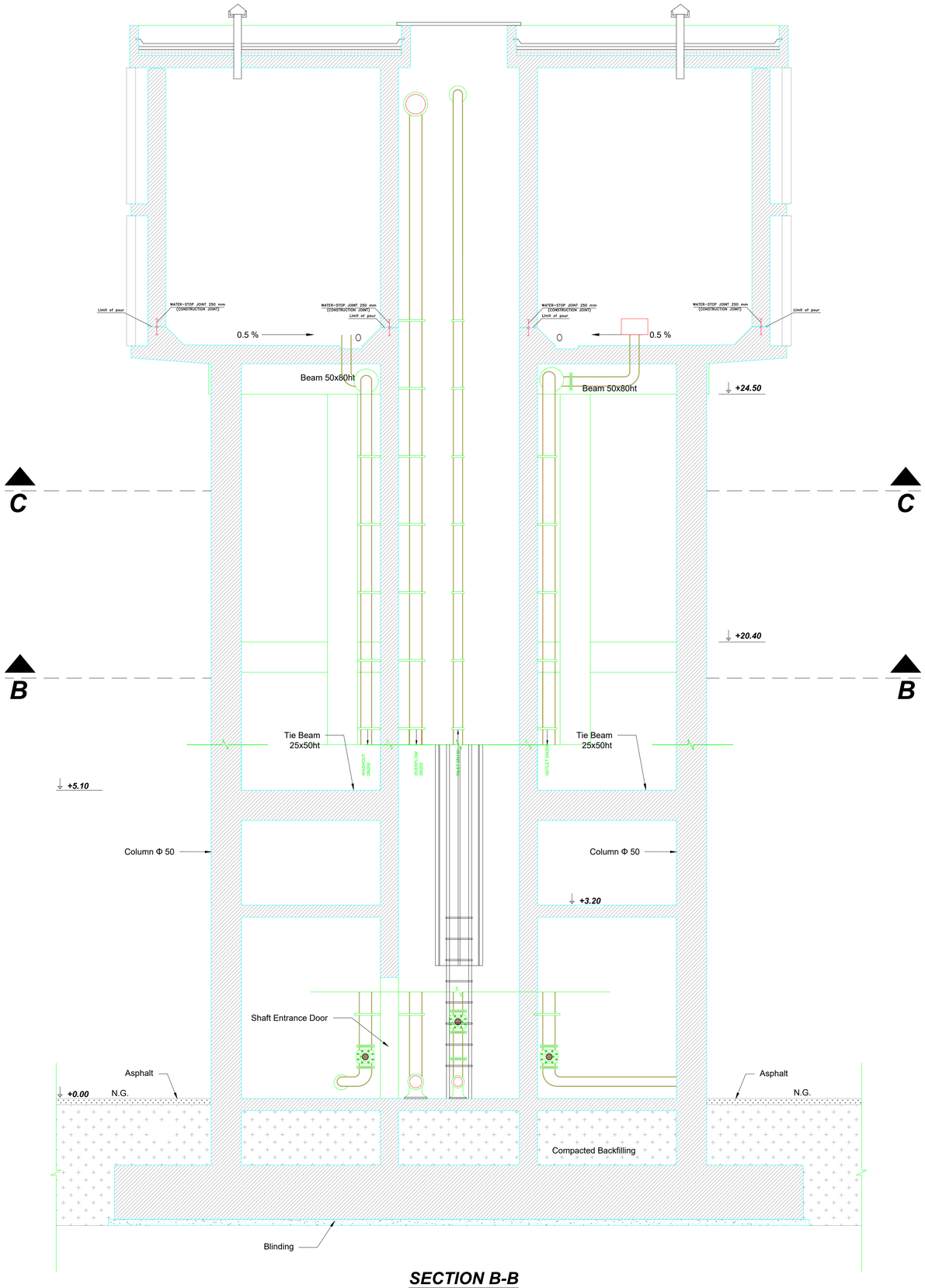
BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)

BAR BENDING (2)

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C-F	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	As Indicated	10/10	477W-01RS-C-F10

BEINO WATER TOWER VALVE CHAMBER



SECTION B-B

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

PIPES INSIDE VALVE CHAMBER SHOULD BE PAINTED AS FOLLOW:
- GREEN COLOR LINE Ral 6035 FOR FEEDING LINE/ INLET TO PROPOSED RESERVOIR
- RED COLOR LINE Ral 3013 FOR OVERFLOW PIPES
- BLUE COLOR LINE Ral 5013 or Ral 5014 FOR DISTRIBUTION PIPE
- BLACK COLOR FOR WASHOUT PIPE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

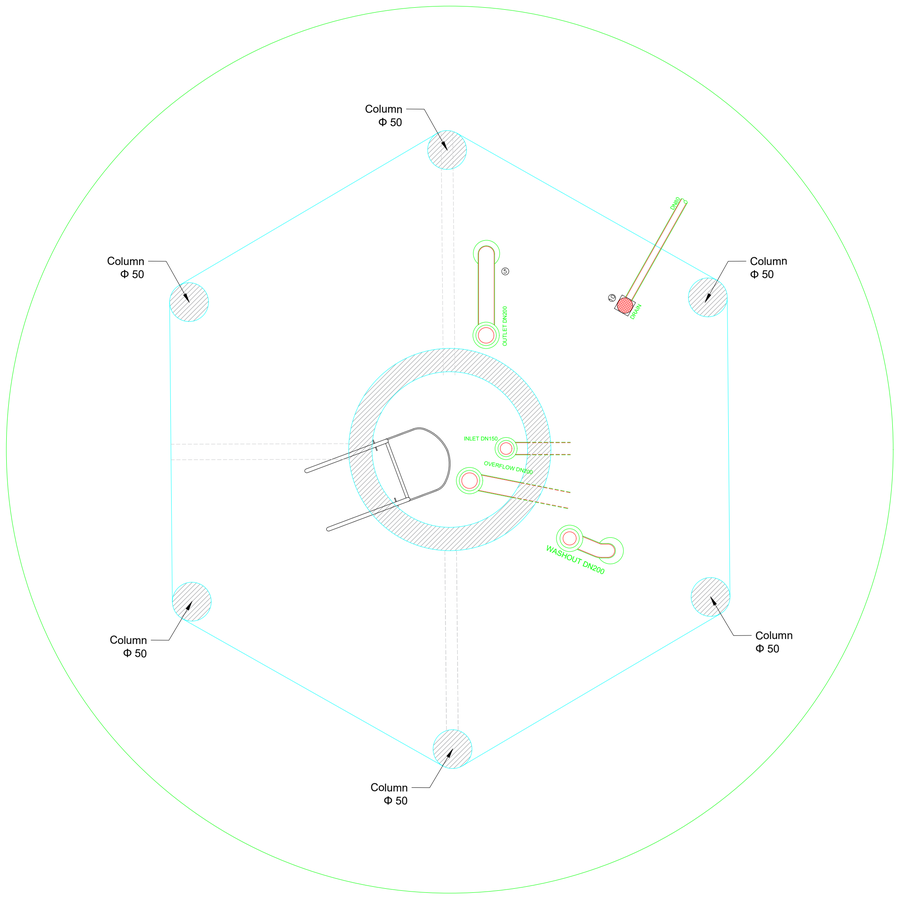
BEINO WATER TOWER
CAPACITY 300 m3
VALVE CHAMBER

HYDRAULIC ACCESSORIES

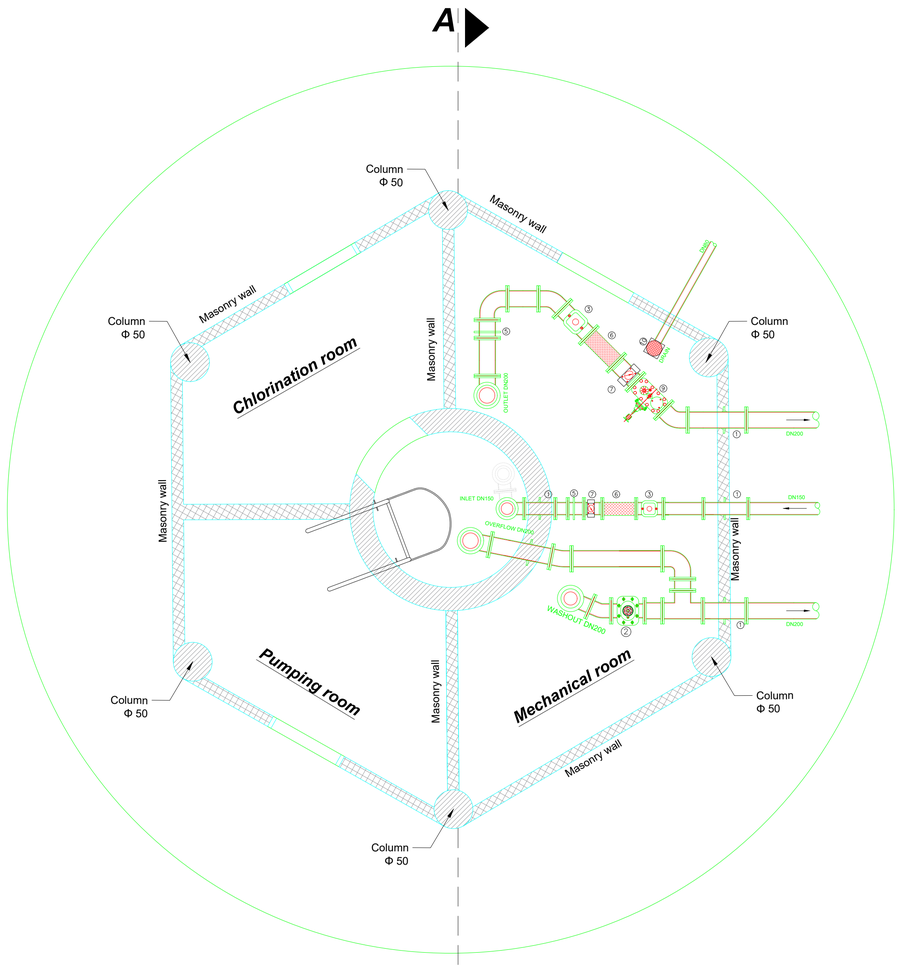
DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-VC	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	1 /2	477W-01RS-VC-01

BEINO WATER TOWER VALVE CHAMBER



SECTION C-C



Pumping station and Valve Chamber

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

PIPES INSIDE VALVE CHAMBER SHOULD BE PAINTED AS FOLLOW:
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- RED COLOR LINE Ral 3013 FOR OVERFLOW PIPES
- BLUE COLOR LINE Ral 5013 or Ral 5014 FOR DISTRIBUTION PIPE
- BLACK COLOR FOR WASHOUT PIPE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

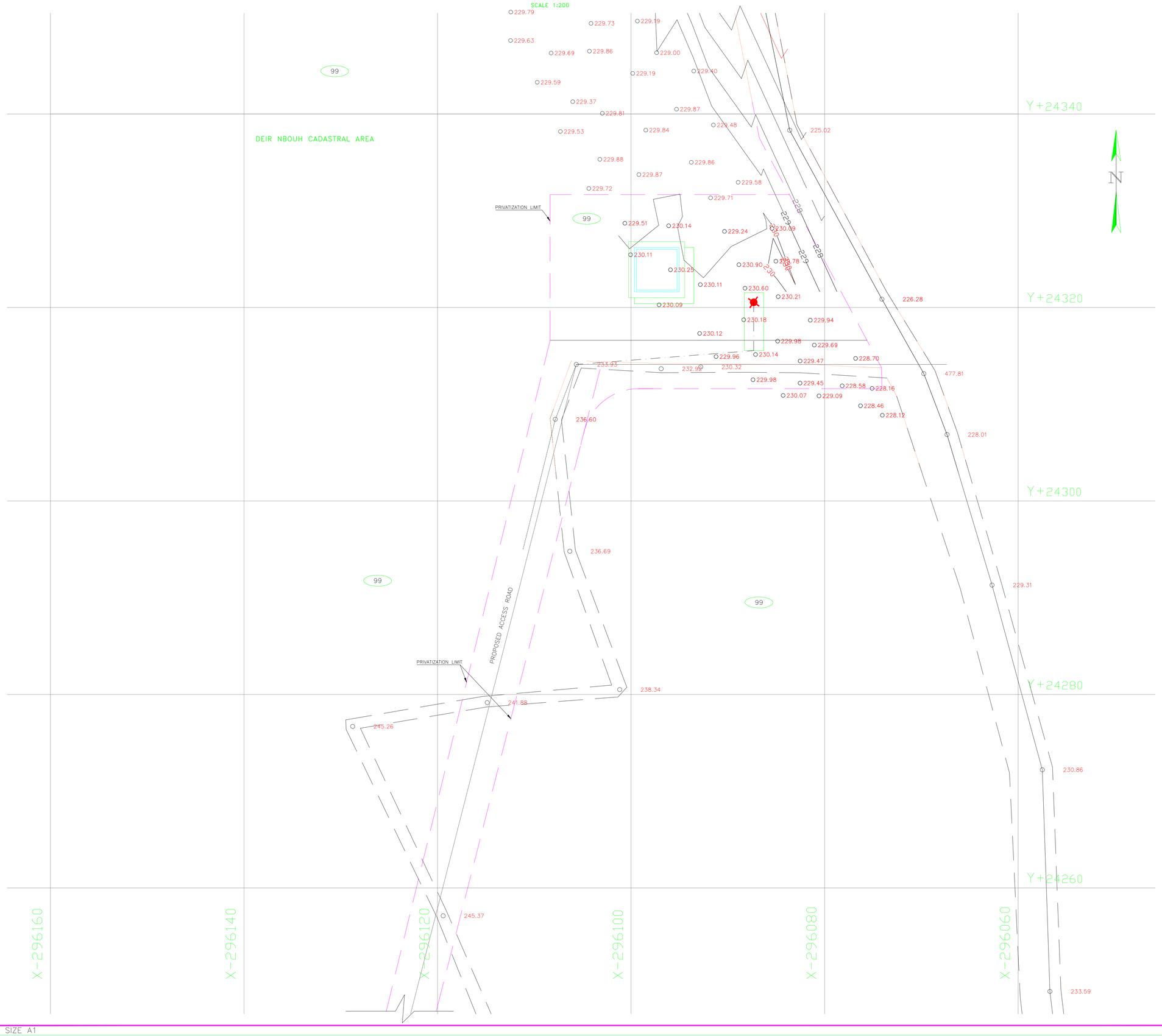
BEINO WATER TOWER CAPACITY 300 m3 VALVE CHAMBER	HYDRAULIC ACCESSORIES

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-VC	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	2/2	477W-01RS-VC-02

TOPOGRAPHICAL SURVEY
SITE LAYOUT

SCALE 1:200



NOTES:

- GROUND LEVEL OF PUMPING STATION BUILDING = +231.50m
- DO NOT SCALE FROM THIS DRAWING
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED
- ALL LEVELS ARE IN M UNLESS OTHERWISE SPECIFIED

TOPOGRAPHICAL LEGEND

	CULVERT/BRIDGE
Spr	SPRING
	WELL
	DECIDUOUS/PINE TREE
	ROCKS
	BUSHES
MH S	MANHOLE SEWER
MH W	MANHOLE WATER
MH T	MANHOLE TELEPHONE
MH NI	MANHOLE NOT IDENTIFIED
LP	LIGHTING POLE
	BUILDING
U/C	FOUNDATION/BUILDING UNDER CONSTRUCTION
	ROAD
	TRACK
	REFERENCE LINE
side walk	SIDE WALK
	RETAINING WALL
	RAILWAY
channel	CHANNEL
	TERRACE
	FENCE
	STREAM/RIVER
PYL	PYLON
EL.S.S	ELECTRIC SUB STATION
EP/TP	ELECTRIC POLE/TELEGRAPH POLE
	OVERGROUND WATER PIPE
	UNDERGROUND WATER PIPE
1160.12	SPOT HEIGHT
	TRAVERSING STATION
	TRIANGULATION POINT
	BENCH MARK
	ML
384	LOT No
	LOT LIMIT
	CIRCONSCRIPTION BOUNDARY
	PRIVATIZATION LIMIT

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH BOREHOLES AND PUMPING STATION

TOPOGRAPHICAL SURVEY SITE LAYOUT

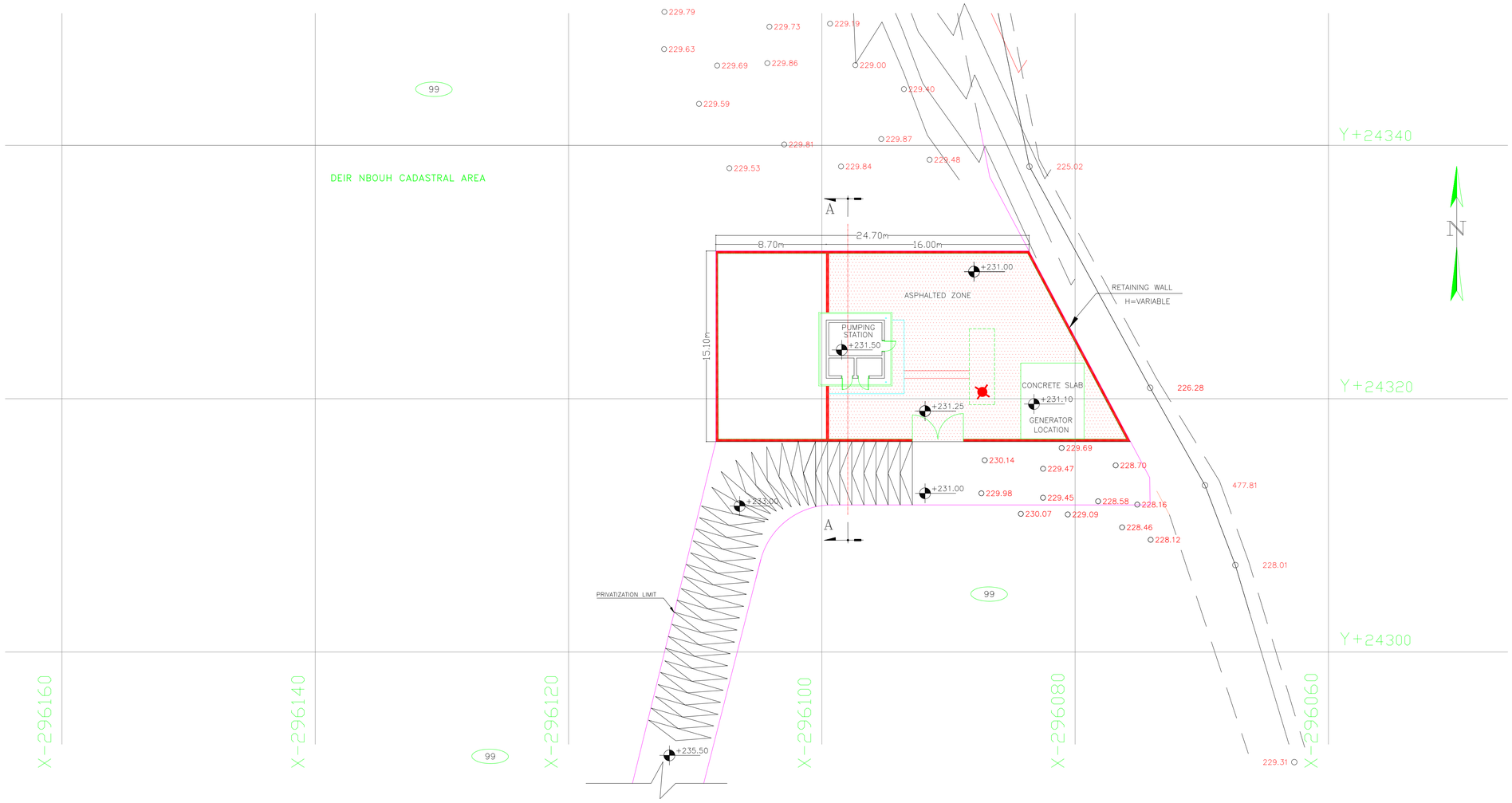
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	1:200	1/5	477W-02PS-C01

ORIGINAL SIZE A1

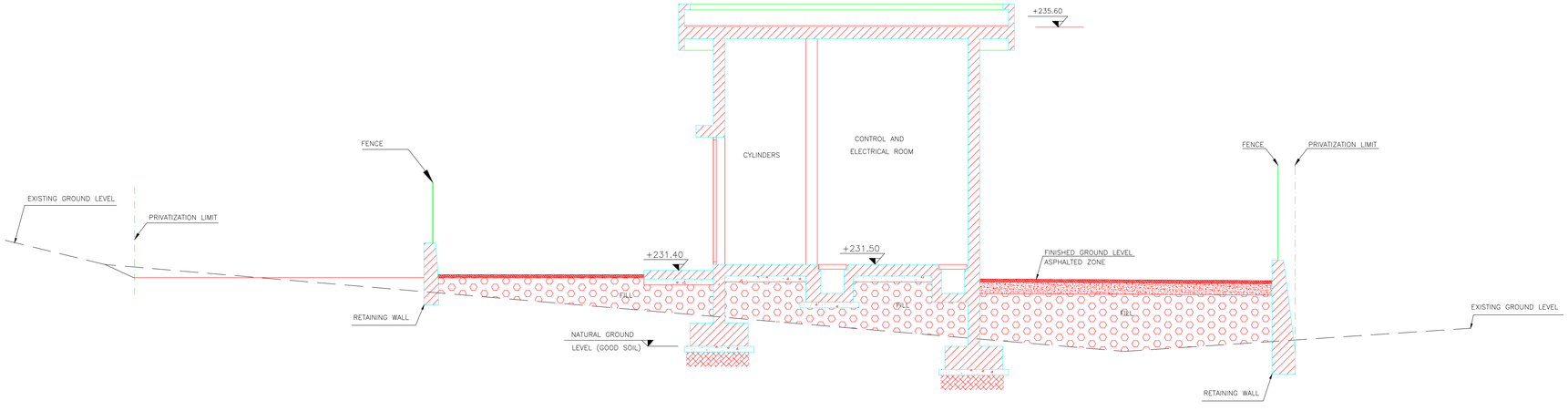
SITE PLAN

SCALE 1:200



SECTION A–A

SCALE 1:50



ORIGINAL SIZE A1

TOPOGRAPHICAL LEGEND

	CULVERT/BRIDGE
Spr	SPRING
	WELL
	DECIDUOUS/PINE TREE
	ROCKS
	BUSHES
MH S	MANHOLE SEWER
MH W	MANHOLE WATER
MH T	MANHOLE TELEPHONE
MH NI	MANHOLE NOT IDENTIFIED
LP	LIGHTING POLE
	BUILDING
U/C	FOUNDATION/BUILDING UNDER CONSTRUCTION
	ROAD
	TRACK
	REFERENCE LINE
side walk	SIDE WALK
	RETAINING WALL
	RAILWAY
channel	CHANNEL
	TERRACE
	FENCE
	STREAM/RIVER
PYL	PYLON
EL.S.S	ELECTRIC SUB STATION
EP/TP	ELECTRIC POLE/TELEGRAPH POLE
	OVERGROUND WATER PIPE
	UNDERGROUND WATER PIPE
1160.12	SPOT HEIGHT
	TRAVERSING STATION
	TRIANGULATION POINT
	BENCH MARK
	ML
384	LOT No
	BOUNDARY
	CIRCONSCRIPTION BOUNDARY
	PRIVATIZATION LIMIT

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER

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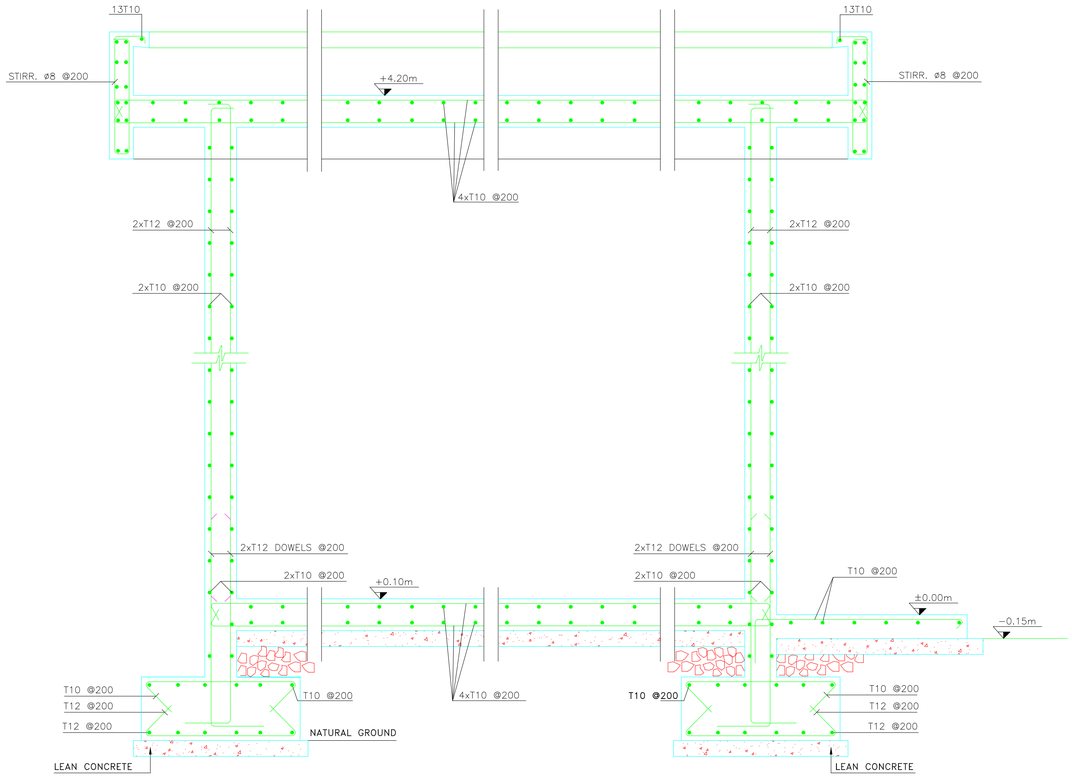
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH BOREHOLES AND PUMPING STATION	SITE PLAN SECTION A–A

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	W. SEIFEDDINE	W. SEIFEDDINE	W.SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	1/50-1/200	2/5	477W-02PS-C02

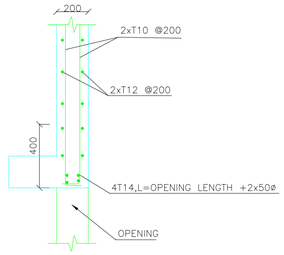


SECTION 4–4
SCALE 1:20

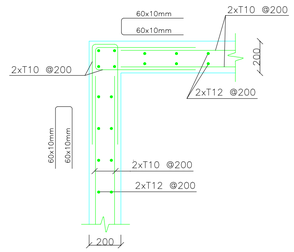
SECTION 3–3
SCALE 1:20

SECTION 2–2
SCALE 1:20

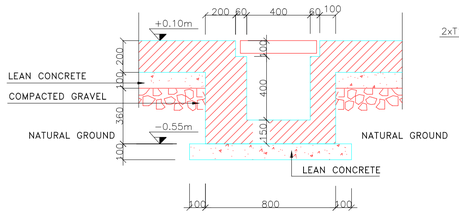
SECTION 1–1
SCALE 1:20



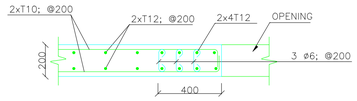
TYPICAL VERTICAL SECTION ON THE UPPER EDGE OF A WALL OPENING
SCALE 1:20



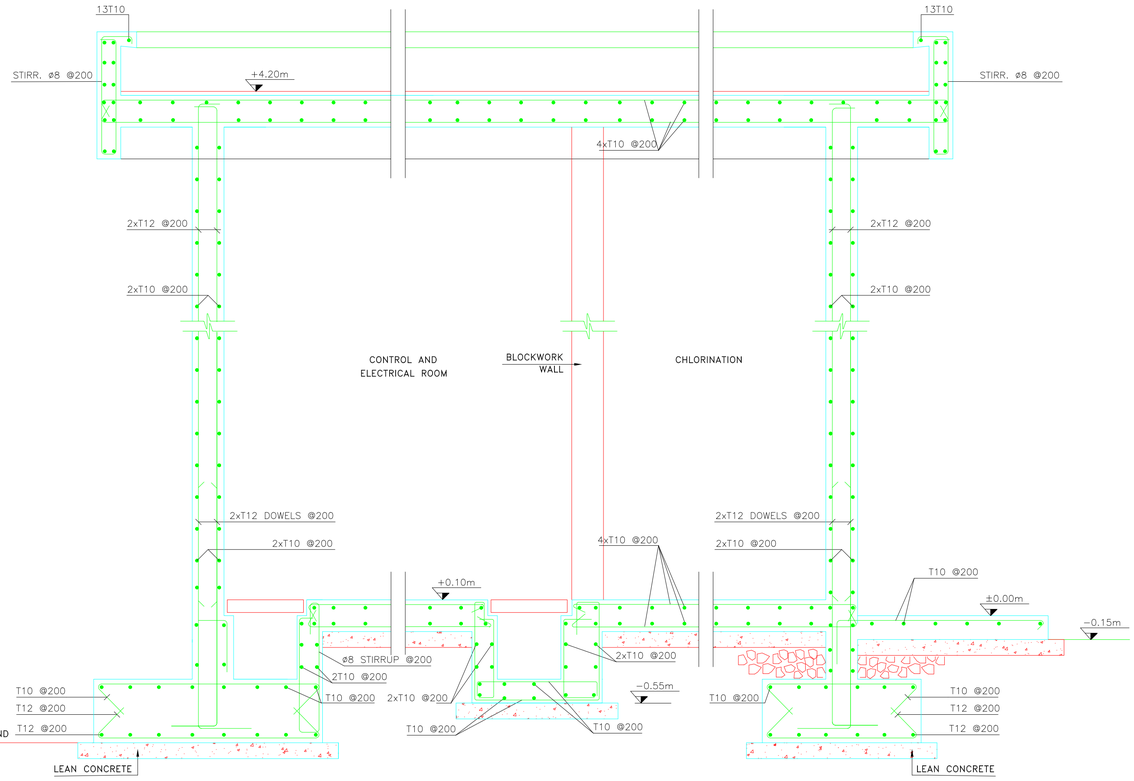
TYPICAL SECTION ON A WALL CORNER
SCALE 1:20



SECTION 6–6
SCALE 1:20



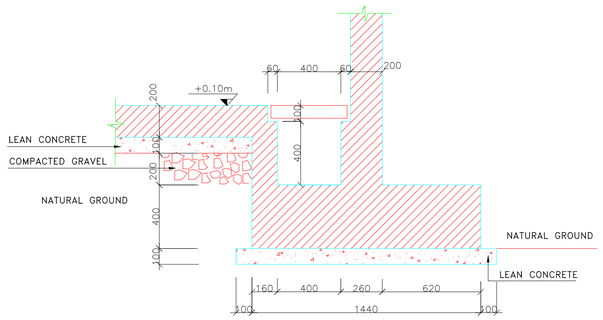
TYPICAL HORIZONTAL SECTION ON A WALL OPENING
SCALE 1:20



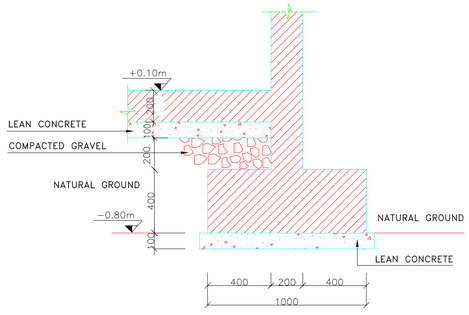
SECTION 7–7
SCALE 1:20

SECTION 6–6
SCALE 1:20

SECTION 5–5
SCALE 1:20



SECTION 7–7
SCALE 1:20



SECTION 4–4
SCALE 1:20

NOTES:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES

MIX ELEMENTS: ORDINARY PORTLAND CEMENT

STRESSES: CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
– ON A CUBE, a= 150mm : 30N/mm2
– ON A CYLINDER ø150mm, 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 (BLINDING) / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, 250Kg/m3.

REINFORCEMENT: DEFORMED HIGH STRENGTH STEEL BARS : SYMBOL : T
YIELD STRESS : Fy= 420N/mm2
MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/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 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 A SECTION.
PINS ø8 SHALL BE USED ON EACH LAP.

BENDING: ø> 12mm MECHANICALLY COMPULSONILY
ø≤ 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.

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

FORMWORK: ALL EXECUTED INTERIOR CONCRETE SHALL BE FAIR FACE CONCRETE.
TIE RODS 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 ø6mm 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 EQUIPEMENT TO BE INSTALLED.

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.

* THE LEVEL ±0.00 IS EQUIVALENT TO +231.40m

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

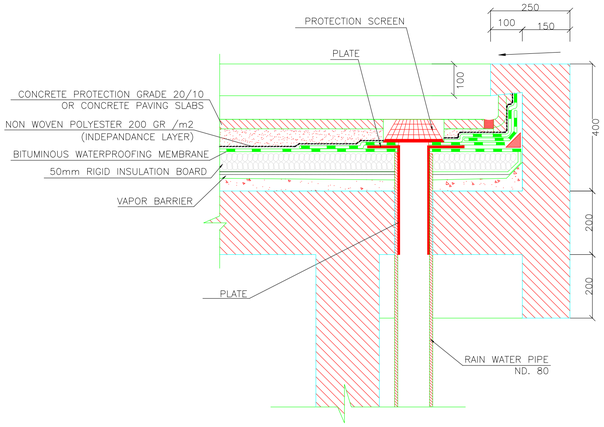
DEIR NBOUH BOREHOLES AND PUMPING STATION

STRUCTURAL DETAILS

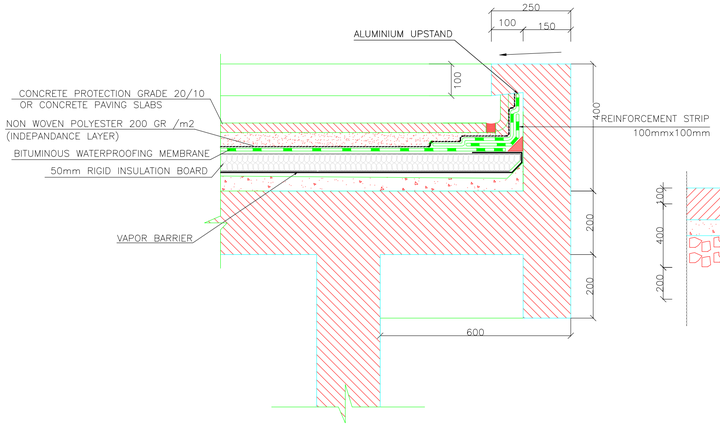
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	W. SEIFEDDINE	W. SEIFEDDINE	W. SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	1:20	3/5	477W-02PS-C03

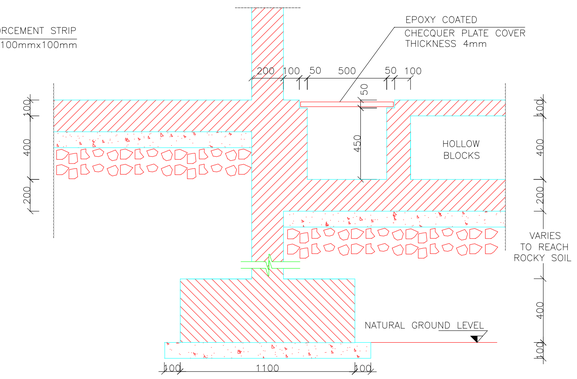
ORIGINAL SIZE A1



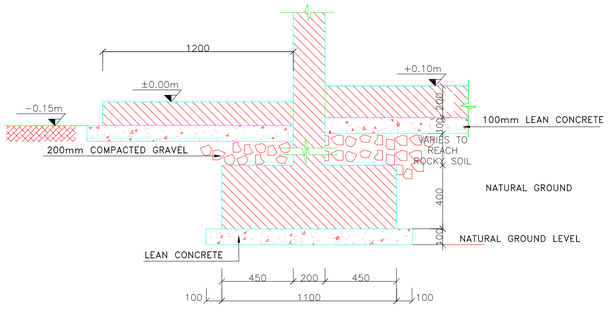
RAINWATER PIPE DETAIL
SCALE 1:10



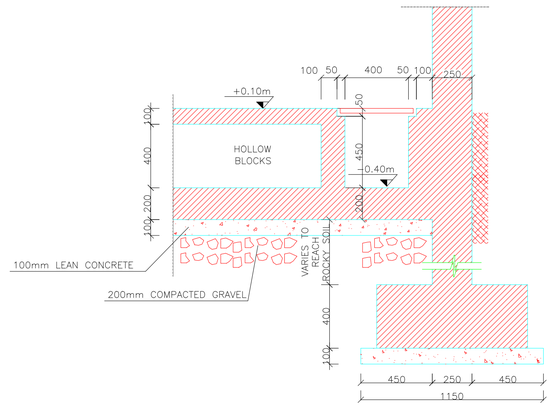
WATERPROOFING AND THERMAL INSULATION DETAIL
SCALE 1:10



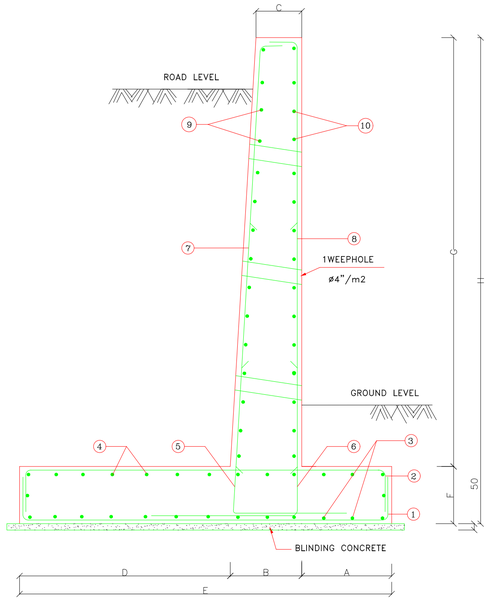
SECTION 3–3
SCALE 1:20



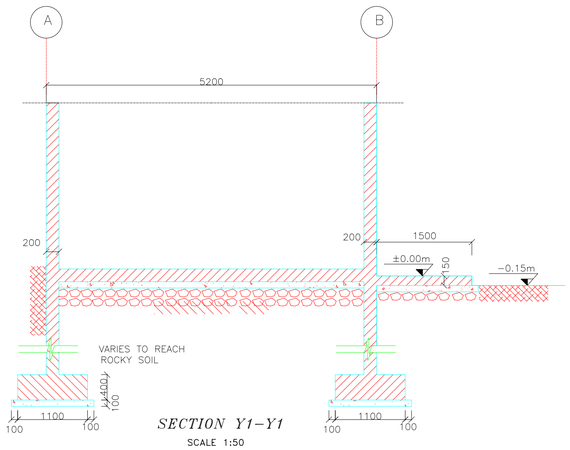
SECTION 4–4
SCALE 1:20



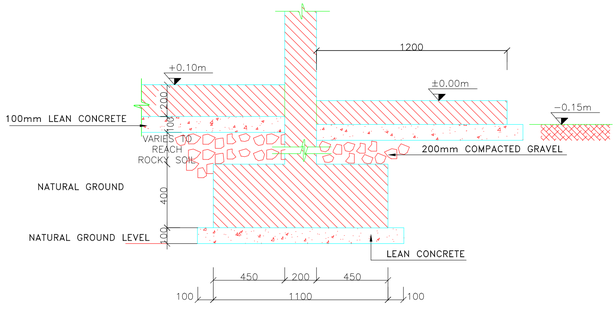
SECTION 6–6
SCALE 1:20



RETAINING WALL DETAILS
VARIABLE HEIGHT



SECTION Y1–Y1
SCALE 1:50



SECTION 1–1
SCALE 1:20

REINFORCEMENT DETAILS

REINFORCEMENT / HEIGHT (mm)	1	2	3	4	5	6	7	8	9	10
TYPE I (1000)	T12 @200 L=1000	T12 @20 L=1000	T12 @200 L=6000	T12 @200 L=6000	T12 @200 L=1500	T12 @200 L=1500			T12 @200 L=6000	T12 @200 L=6000
TYPE II (1500)	T12 @200 L=1250	T12 @200 L=1250	T12 @200 L=6000	T12 @200 L=6000	T12 @200 L=2000	T12 @200 L=2000			T12 @200 L=6000	T12 @200 L=6000
TYPE III (2000)	T12 @200 L=1750	T12 @200 L=1750	T12 @200 L=6000	T12 @200 L=6000	T12 @200 L=2500	T12 @200 L=2500			T12 @200 L=6000	T12 @200 L=6000
TYPE IV (2500)	T12 @200 L=2250	T14 @200 L=2250	T12 @200 L=6000	T12 @200 L=6000	T14 @200 L=2000	T12 @200 L=2000	T14 @200 L=2500	T12 @200 L=2500	T12 @200 L=6000	T12 @200 L=6000
TYPE V (3000)	T12 @165 L=2500	T14 @165 L=2500	T12 @200 L=6000	T12 @200 L=6000	T14 @165 L=2000	T12 @165 L=2000	T14 @165 L=3000	T12 @165 L=3000	T12 @200 L=6000	T12 @200 L=6000

DIMENSIONS DETAILS

DIMENSIONS / TYPE No	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

NOTES:

REINFORCED CONCRETE:
CONCRETE GRADE C30 FOR ALL STRUCTURES

MIX ELEMENTS: ORDINARY PORTLAND CEMENT

STRESSES: CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS:
– ON A CUBE, α= 150mm : 30N/mm2
– ON A CYLINDER ø150mm, 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 (BLINDING) / CYCLOPEAN CONCRETE:
MIX MADE WITH ORDINARY PORTLAND CEMENT, 250Kg/m3.

REINFORCEMENT: DEFORMED HIGH STRENGTH STEEL BARS : SYMBOL : T
YIELD STRESS : Fy= 420N/mm2
MILD STEEL BARS : SYMBOL ø YIELD STRESS: Fy=215 N/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 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 A SECTION.
PINS ø8 SHALL BE USED ON EACH LAP.

BENDING: ø> 12mm MECHANICALLY COMPULSONILY
ø≤ 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.

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

FORMWORK: ALL EXECUTED INTERIOR CONCRETE SHALL BE FAIR FACE CONCRETE.
TIE RODS 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 ø6mm 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 EQUIPEMENT TO BE INSTALLED.

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.
* THE LEVEL ±0.00 IS EQUIVALENT TO +231.40m

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB – HAJAL Bldg
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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

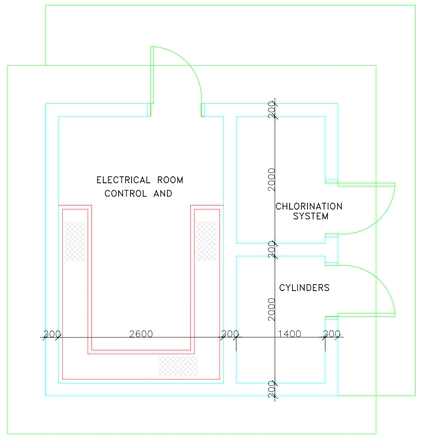
DEIR NBOUH BOREHOLES AND PUMPING STATION

FORMWORK DETAILS
RETAINING WALL

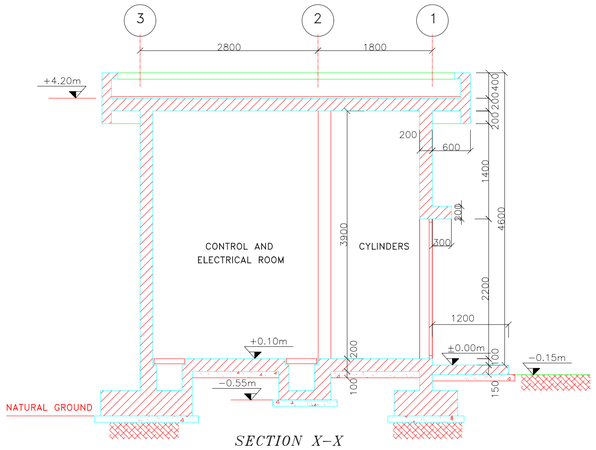
FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	BTD	BTD	BTD

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	1:50-1:20-1:10	4/5	477W-02PS-C04

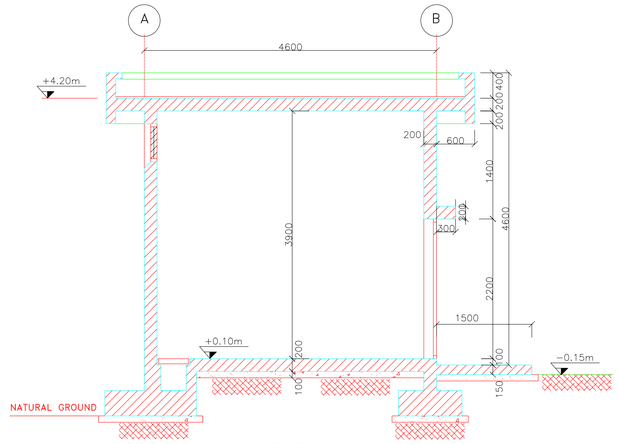
ORIGINAL SIZE A1



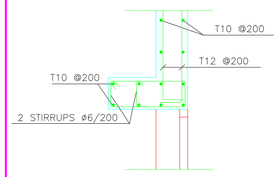
GROUND FLOOR PLAN
SCALE 1:50



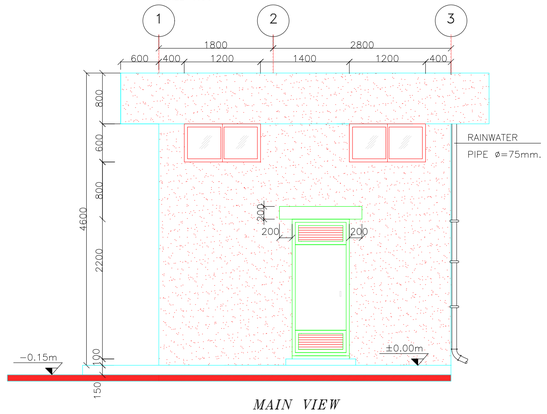
SECTION X–X
SCALE 1:50



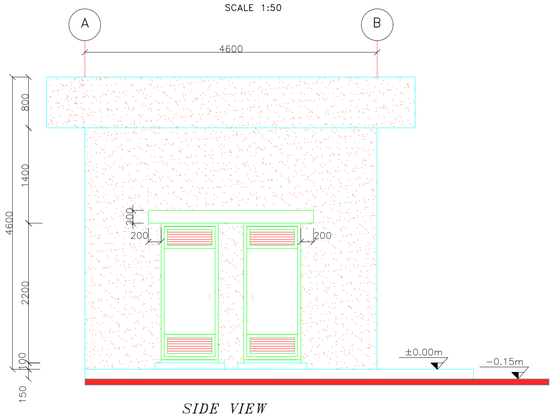
SECTION Y–Y
SCALE 1:50



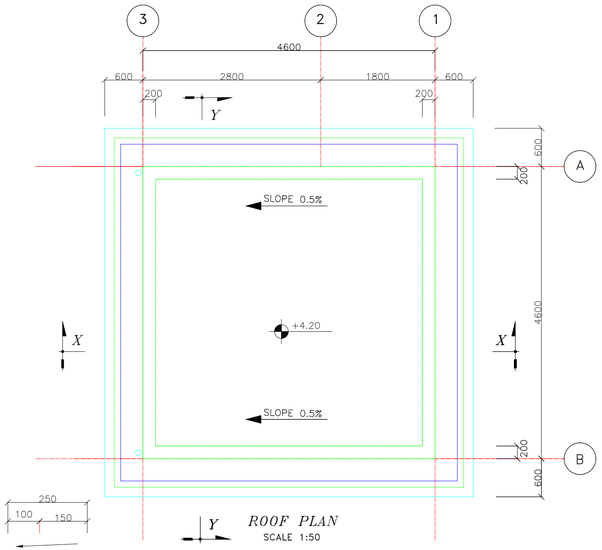
LINTEL DETAILS
SCALE 1:20



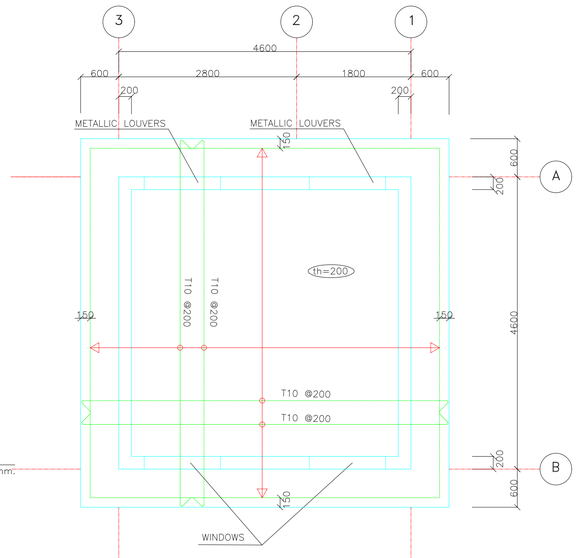
MAIN VIEW
SCALE 1:50



SIDE VIEW
SCALE 1:50

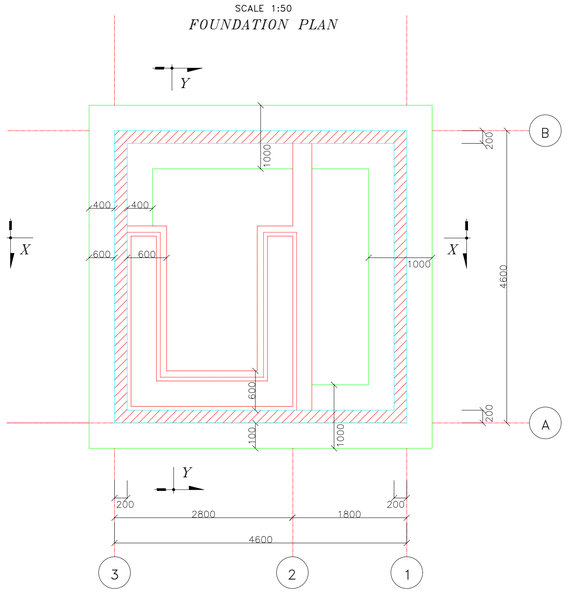


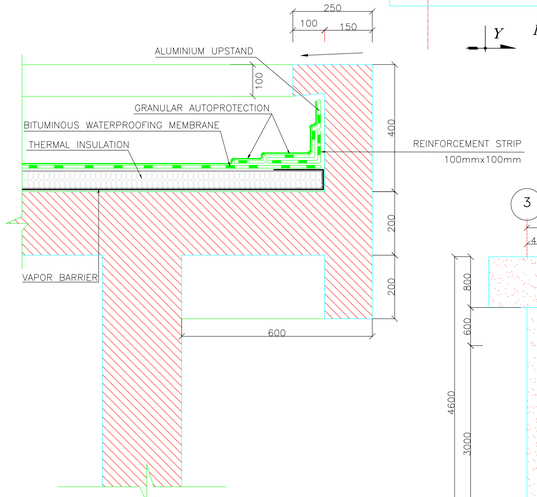
ROOF PLAN
SCALE 1:50



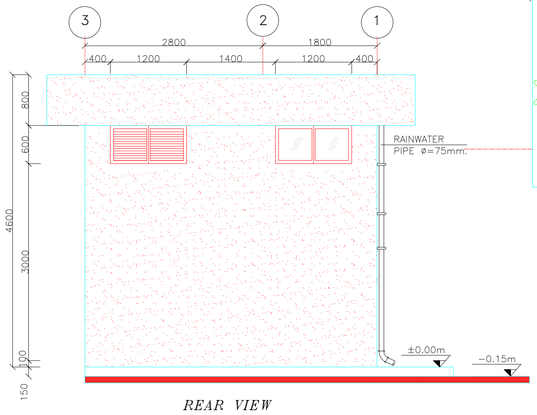
ROOF PLAN : R.C. DETAIL
SCALE 1:50

SCALE 1:50
FOUNDATION PLAN





WATERPROOFING AND
THERMAL INSULATION DETAIL
SCALE 1:10



REAR VIEW
SCALE 1:50

NOTES:

FINISHING SCHEDULE			
ROOM	FLOOR	WALLS	CEILING
CHLORINATION	INDUSTRIAL RESIN	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE
CYLINDERS	INDUSTRIAL RESIN	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE
CONTROL ROOM	INDUSTRIAL RESIN	INTERNAL USE COATING, WASHABLE	INTERNAL USE COATING, WASHABLE
EXTERNAL FACE OF EXTERIOR WALLS	COLORED BUSH–HAMMERED RENDER		

EXTERIOR DOORS	WINDOWS	PROTECTION BARS FOR EXTERIOR WINDOWS
STEEL PANELS 3mm THICK (ACCORDING TO DRAWINGS)	ALUMINIUM (ACCORDING TO DRAWINGS)	STEEL SQUARE BARS 10x10 (ACCORDIND 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 +231.40m.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

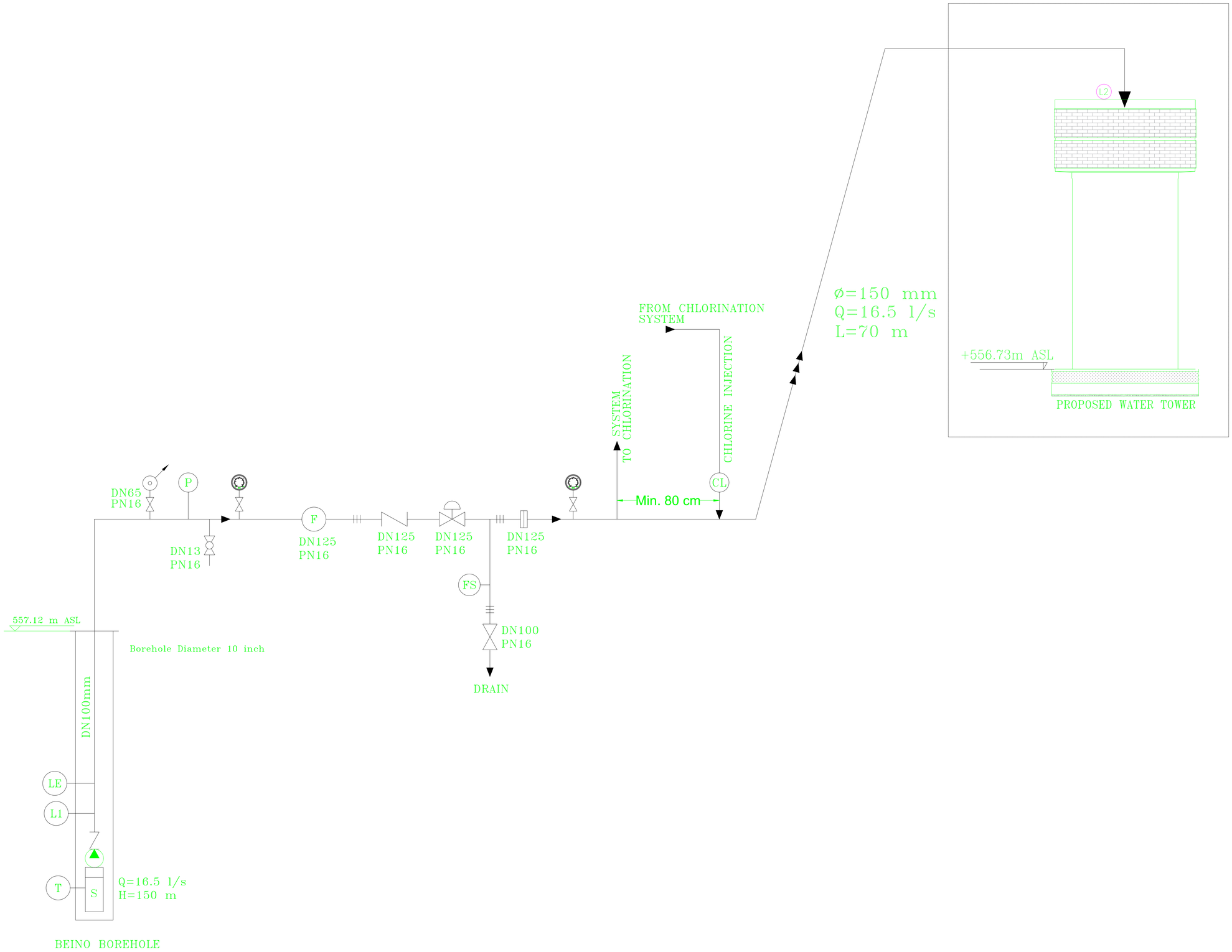
DEIR NBOUH BOREHOLES AND PUMPING STATION

ELEVATIONS – SECTIONS

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
477W-01RS-C	W. SEIFEDDINE	W. SEIFEDDINE	W.SEIFEDDINE

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2024	1:50	5/5	477W-02PS-C05

ORIGINAL SIZE A1



LEGEND:

- : SUBMERSIBLE PUMP
- DN : NOMINAL DIAMETER
- PN : NOMINAL PRESSURE
- (P) : PRESSURE MEASURMENT
- (FS) : FLOW SWITCH
- (T) : TEMPERATURE MEASURMENT
- (L) : LEVEL MEASURMENT
- (F) : FLOW MEASURMENT
- : GLYCERINE FILLED MANOMETER Ø100 WITH 3 WAY VALVE.
- (AWH) : SURGE SUPPRESSION EQUIPMENT.
- : PIPELINE
- : 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
- (CI) : CHLORINE INJECTION
- : STRAINER
- : RUBBER SPHERICAL FLEXIBLE JOINT.
- : STAINLESS STEEL FLEXIBLE JOINT.
- (PRV) : PRESSURE REDUCING VALVE
- : Y STRAINER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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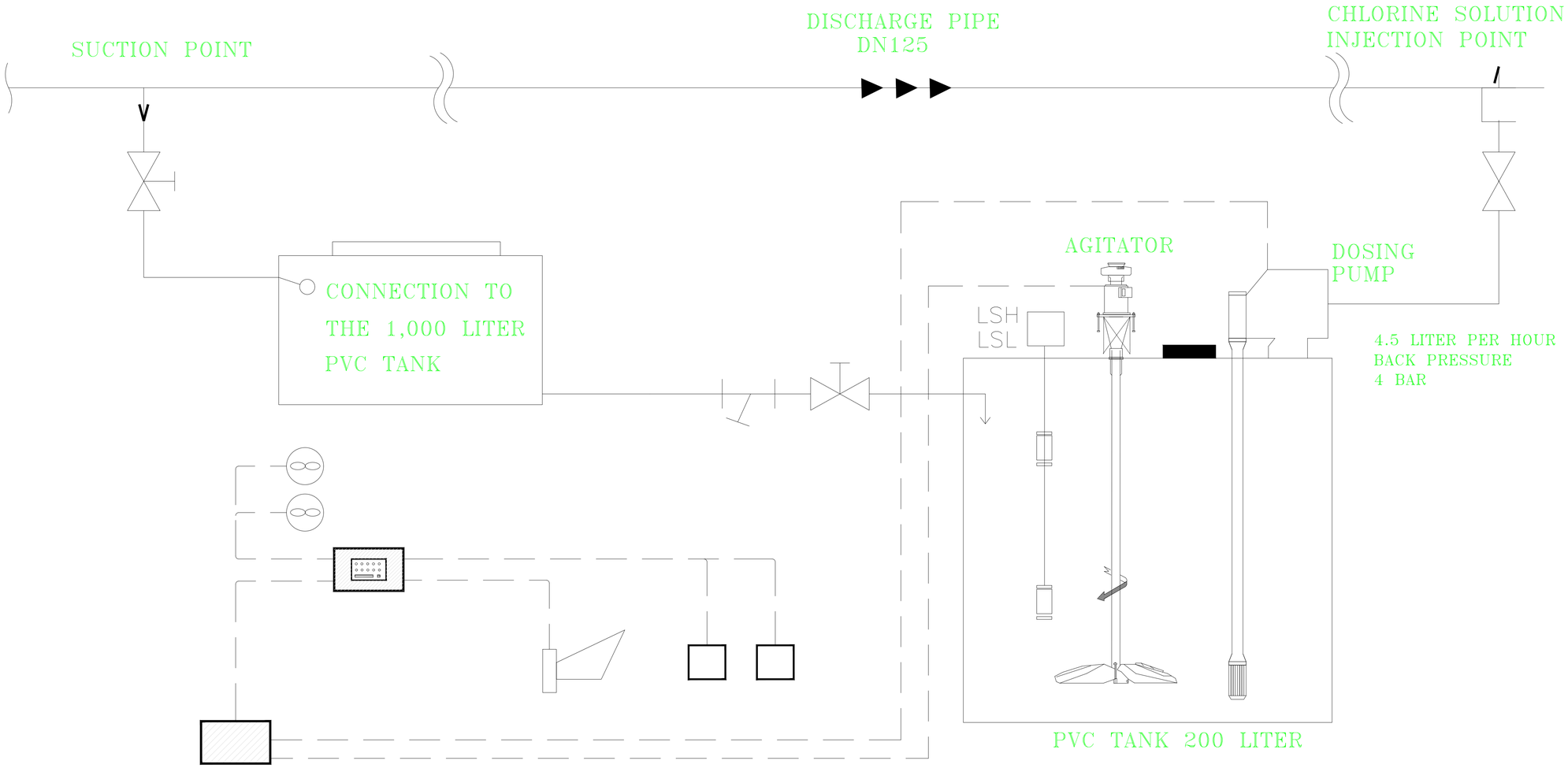
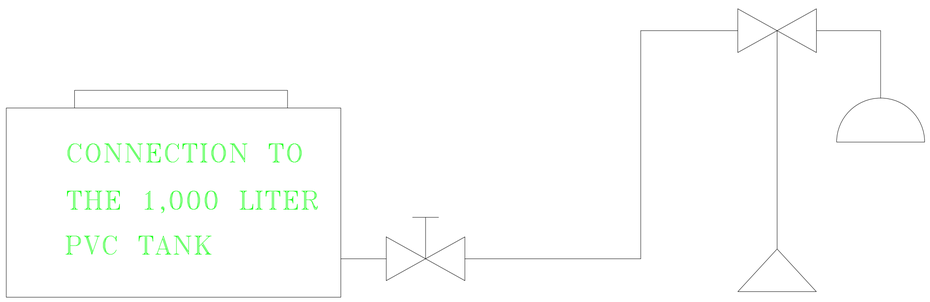
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION	WELL HEAD SCHEMATIC

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	1/8	477W-PS-01EM01





LEGEND:

- : POWER / CONTROL CABLE
- : PIPES
- PN : NOMINAL PRESSURE
- : BALL VALVE
- : Y STRAINER
- : EXTRACTOR FAN
- : HORN
- : CHAIN VALVE
- : EMERGENCY SHOWER
- : SENSOR
- : GAS MONITORING SYSTEM

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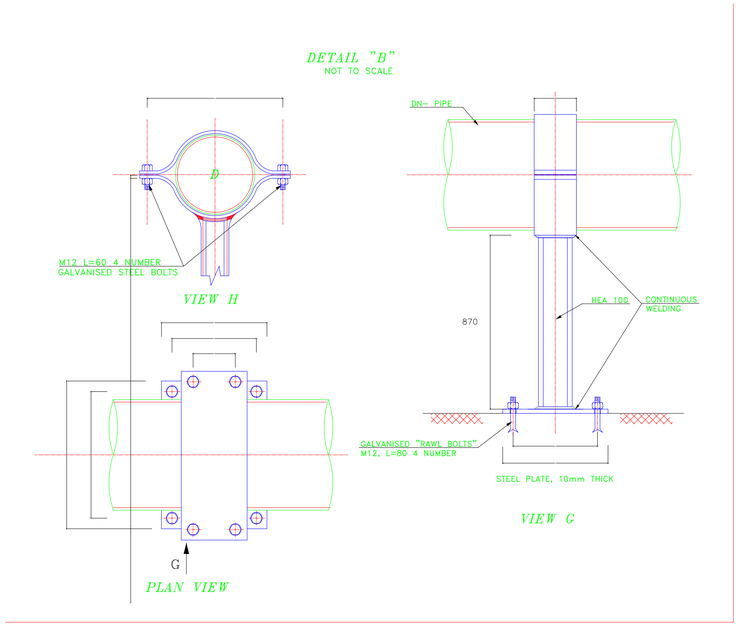
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

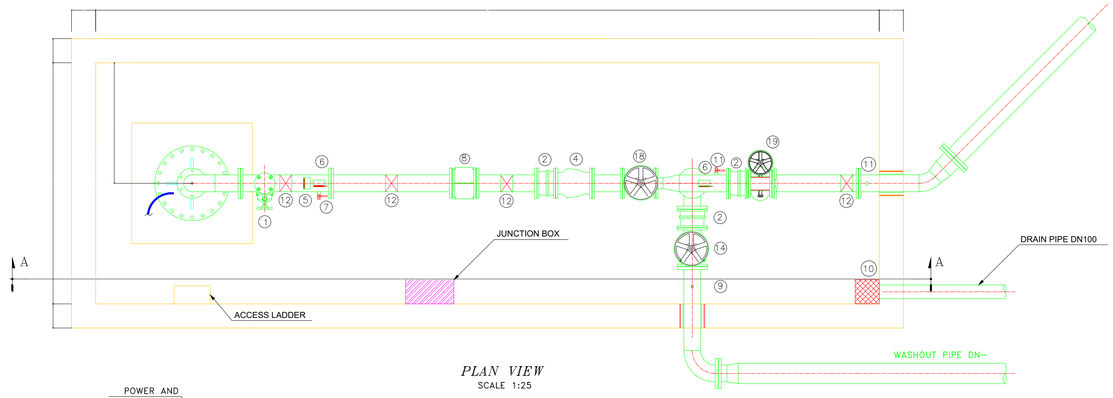
BEINO WELL PUMPING STATION

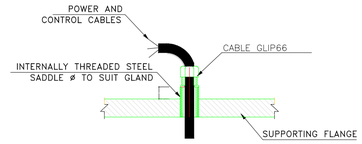
CHLORINATION SCHEMATIC

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

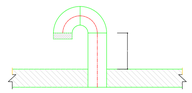
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	2/8	477W-PS-01EM02





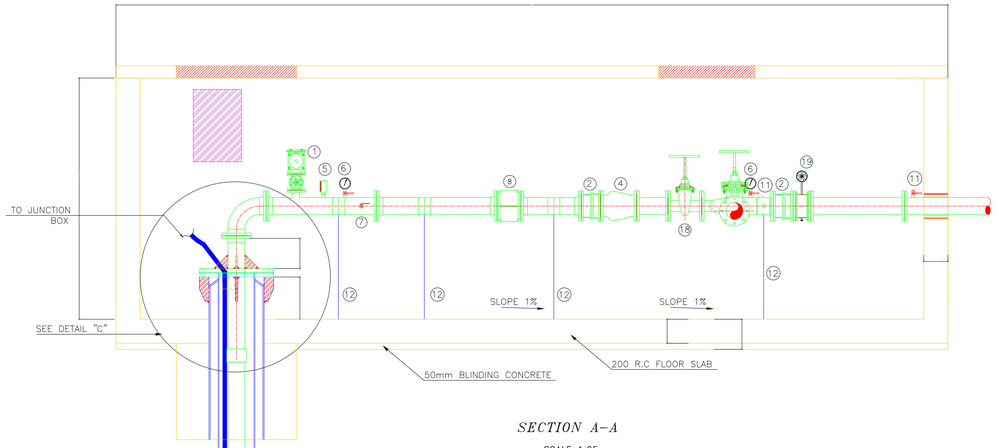


DETAIL D
N.T.S.

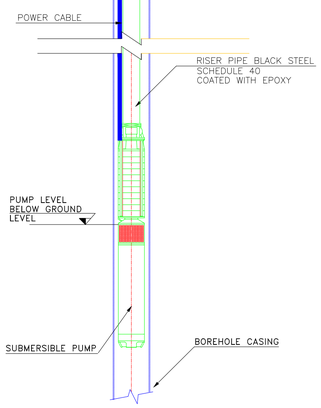


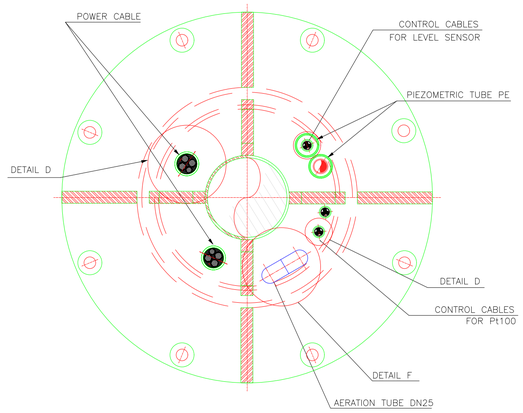
AERATION TUBE DN25 BLACK
STEEL PIPE, TERMINATED WITH
A SCREEN FOR INSECTS.

DETAIL F
SCALE 1:5

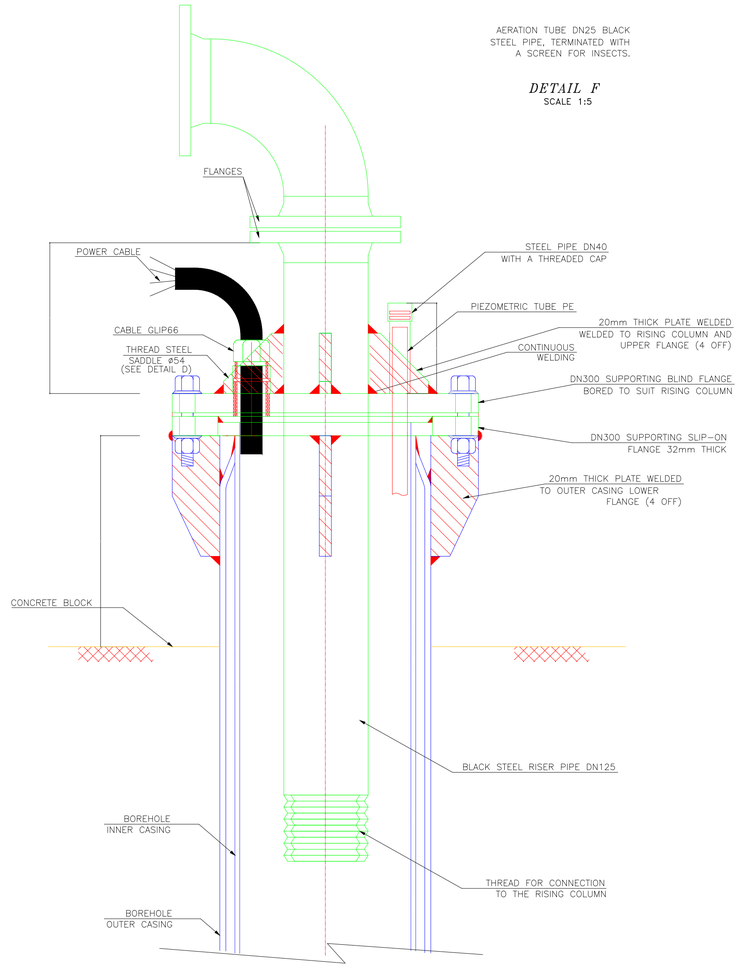


SECTION A-A
SCALE 1:25





DETAIL C
PLAN VIEW
SCALE 1:5



DETAIL C
SIDE VIEW
SCALE 1:5

LEGEND

1 : DOUBLE AIR RELEASE VALVE WITH ISOLATING VALVE
2 : DISMANTLING JOINT
3 : MOTORIZED 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 : GLOBE VALVE
19 : BUTTERFLY VALVE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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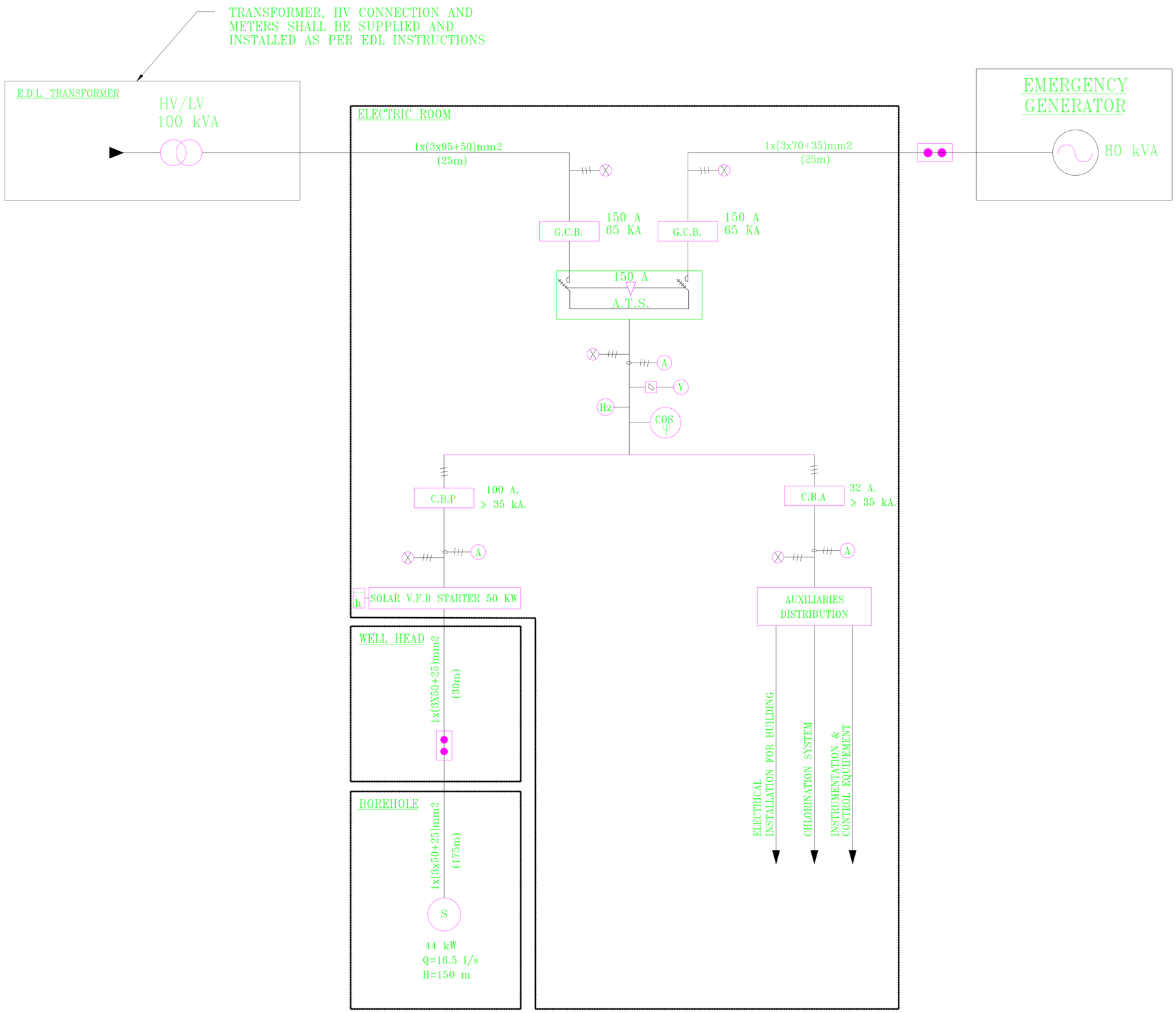
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION

MECHANICAL DRAWING FOR WELL HEAD

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	3/8	477W-PS-01EM03



LEGEND

- COS φ : POWER FACTOR MEASURMENT
- : INDICATING LAMP
- : SELECTOR SWITCH
- Hz : FREQUENCY METER
- V : VOLTMETER
- A : AMPERMETER
- h : HOURMETER
- C.B. : CIRCUIT BREAKER
- : JUNCTION BOX IP67
- : TRANSFORMER HV/LV
- S : SUBMERSIBLE MOTOPUMPSET
- B : SURFACE MOTOPUMPSET
- A.T.S. : AUTOMATIC TRANSFER SWITCH (A.T.S.)
- : EMERGENCY GENERATOR
- C.B.B : GENERAL CIRCUIT BREAKER
- C.B.P : CIRCUIT BREAKER FOR PUMPSET
- C.B.A : CIRCUIT BREAKER FOR AUXILIARIES

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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

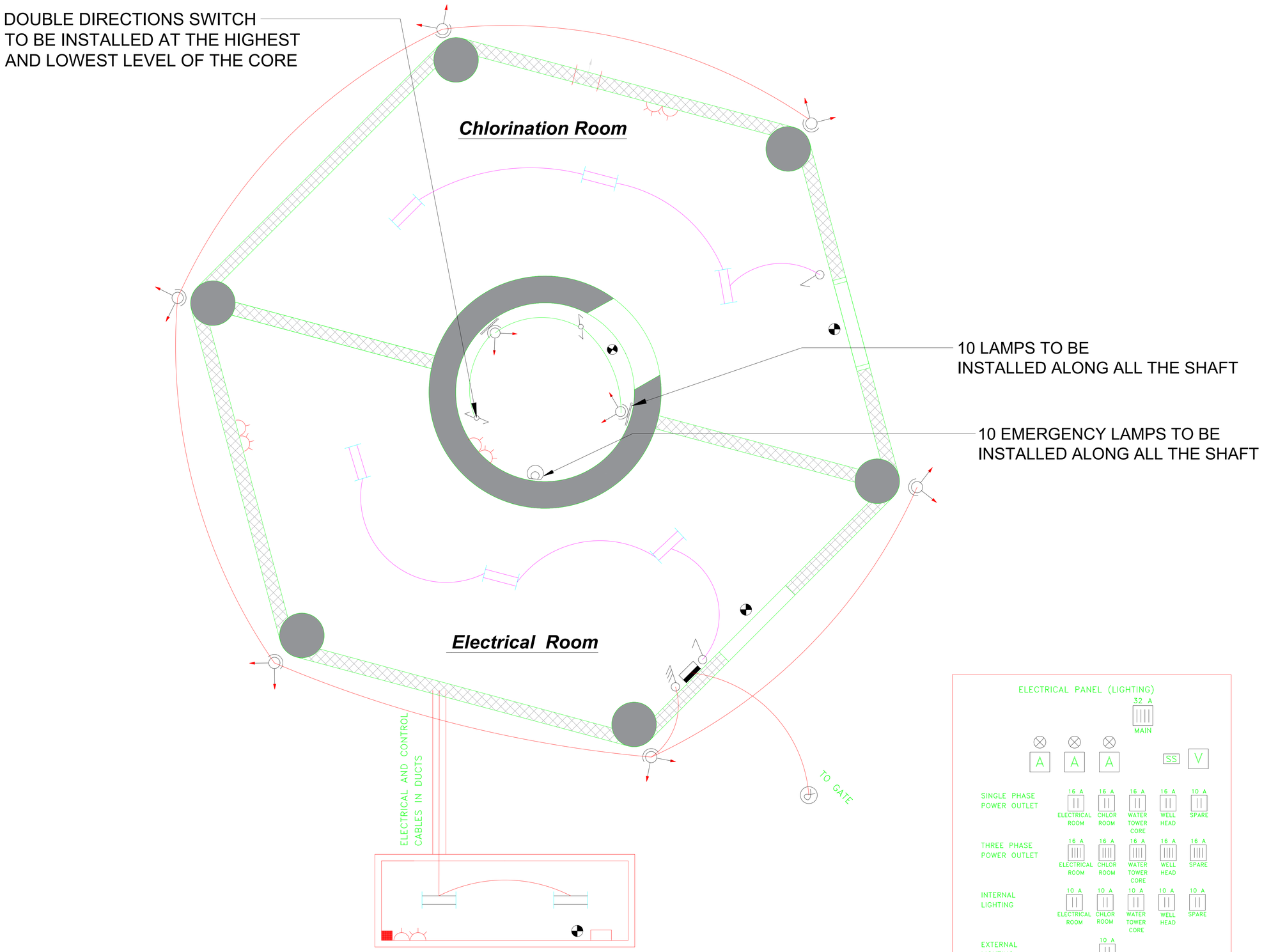
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

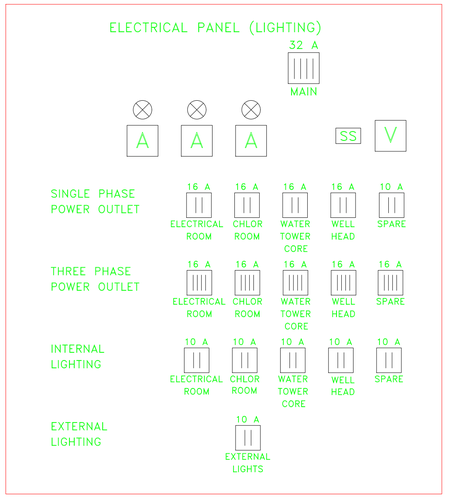
BEINO WELL PUMPING STATION

ELECTRICAL SCHEMATIC

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	4/8	477W-PS-01EM04





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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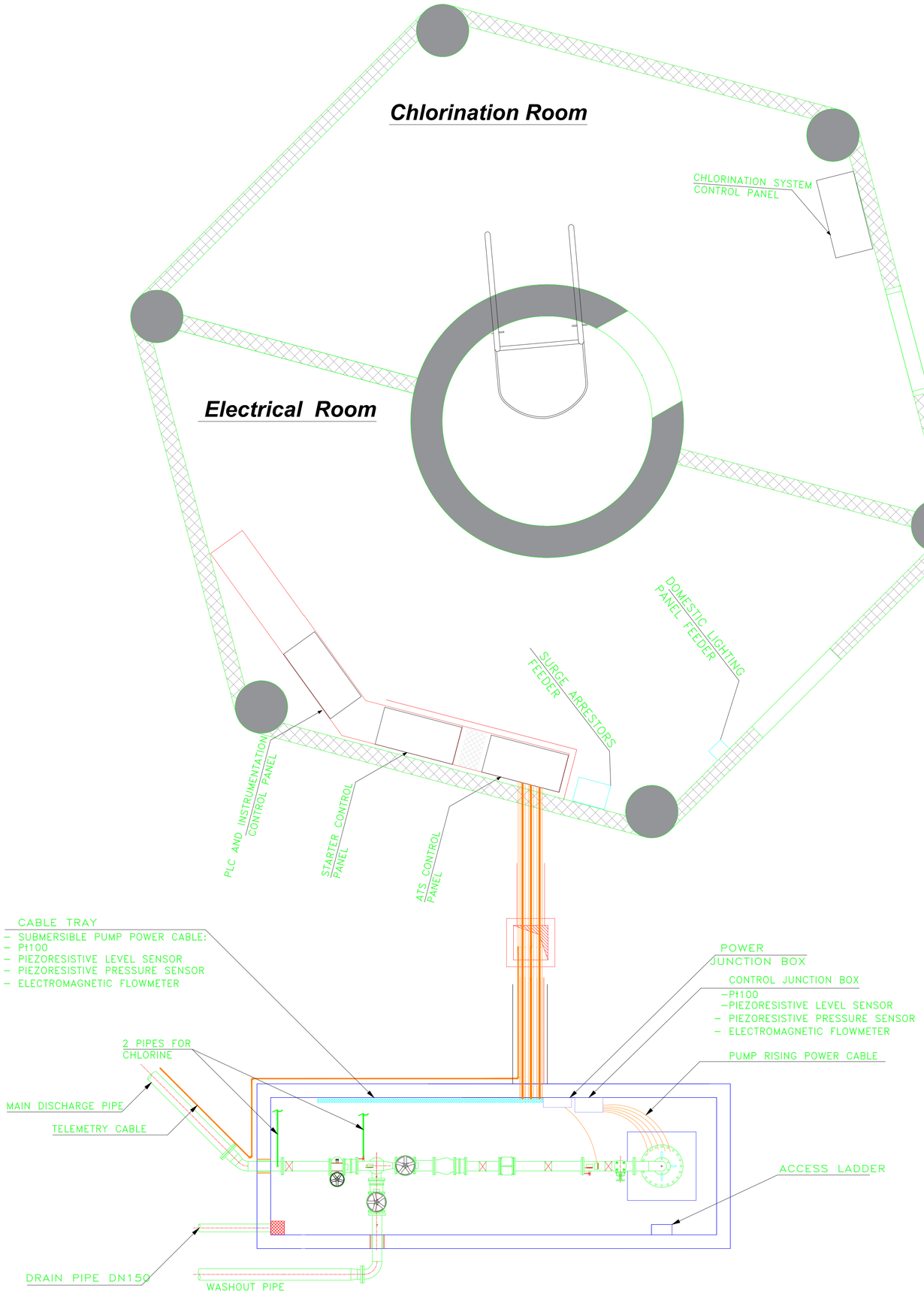
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION

DOMESTIC ELECTRICAL INSTALLATION SCHEMATIC

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	5/8	477W–PS–01EM05



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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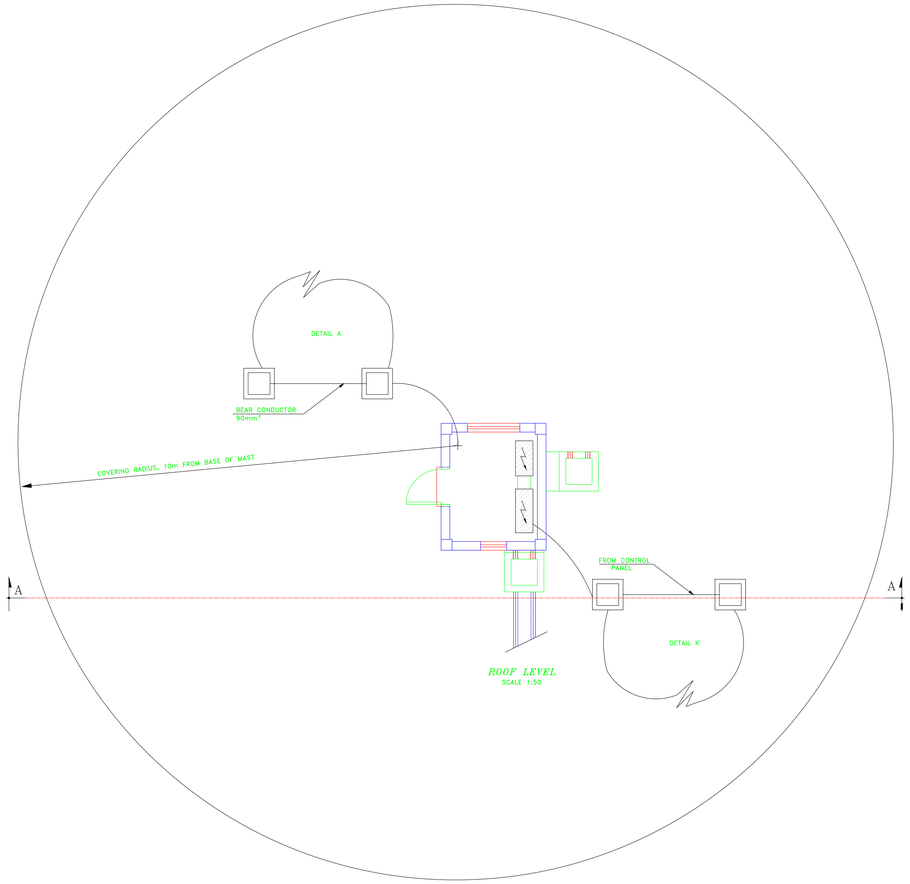
FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION	ELECTRICAL DETAILS DRAWING

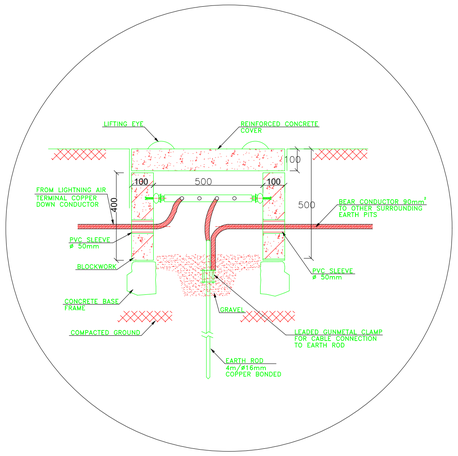
DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	6/8	477W-PS-01EM06

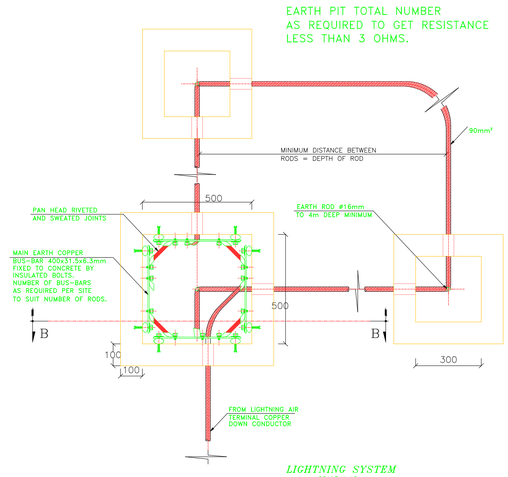


ROOF LEVEL
SCALE 1:50

DETAIL A

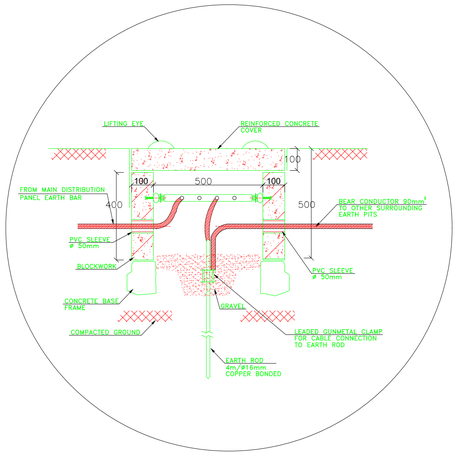


SECTION B-B
SCALE 1:10

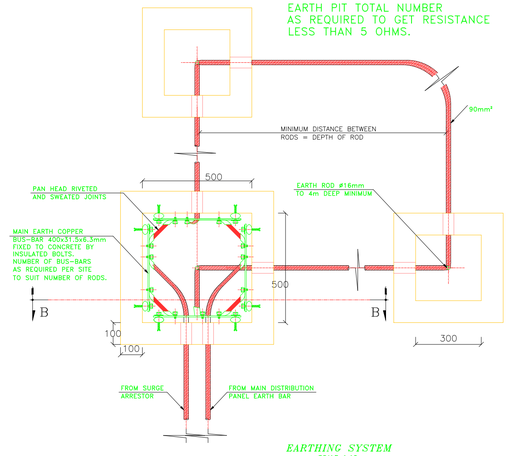


LIGHTNING SYSTEM
SCALE 1:10

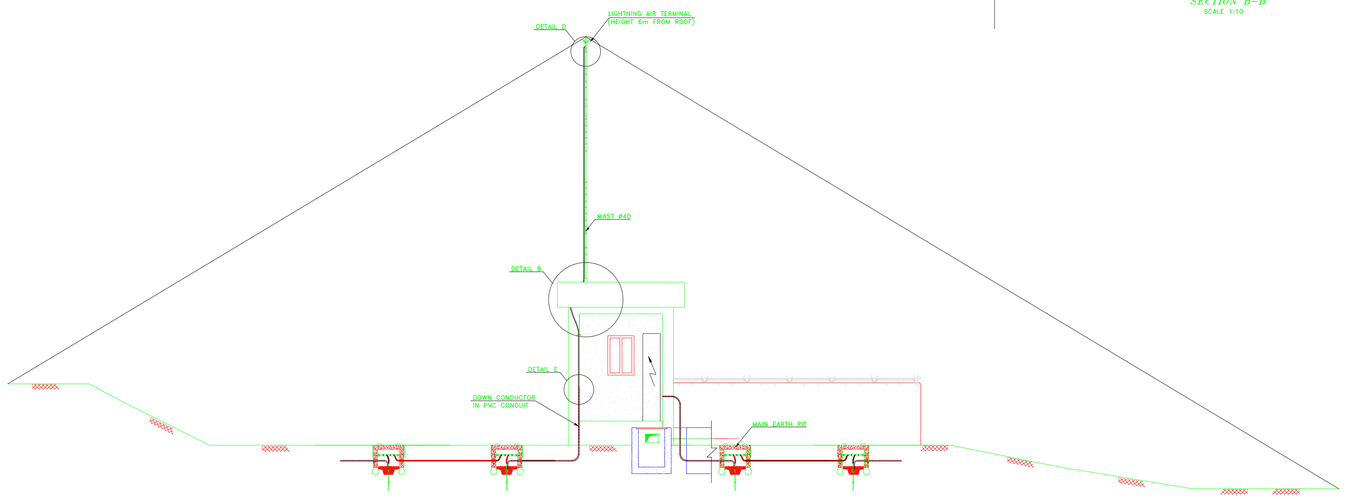
DETAIL K



SECTION B-B
SCALE 1:10

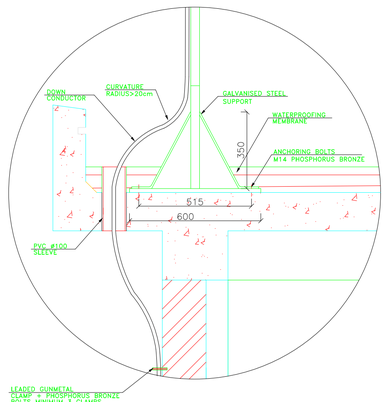


EARTHING SYSTEM
SCALE 1:10

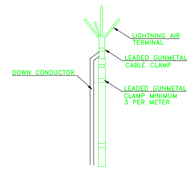


NOTE: ALL EXTERNAL METALLIC MASSES SITUATED AT LESS THAN 1 METER FROM THE DOWN CONDUCTOR SHOULD BE CONNECTED TO IT THROUGH CONDUCTORS HAVING THE SAME SECTION OF THE STRIP ITSELF.

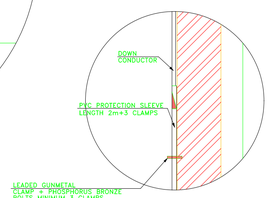
SECTION A-A
SCALE 1:50



DETAIL B
SCALE 1:10



DETAIL D
SCALE 1:10



DETAIL E
SCALE 1:10

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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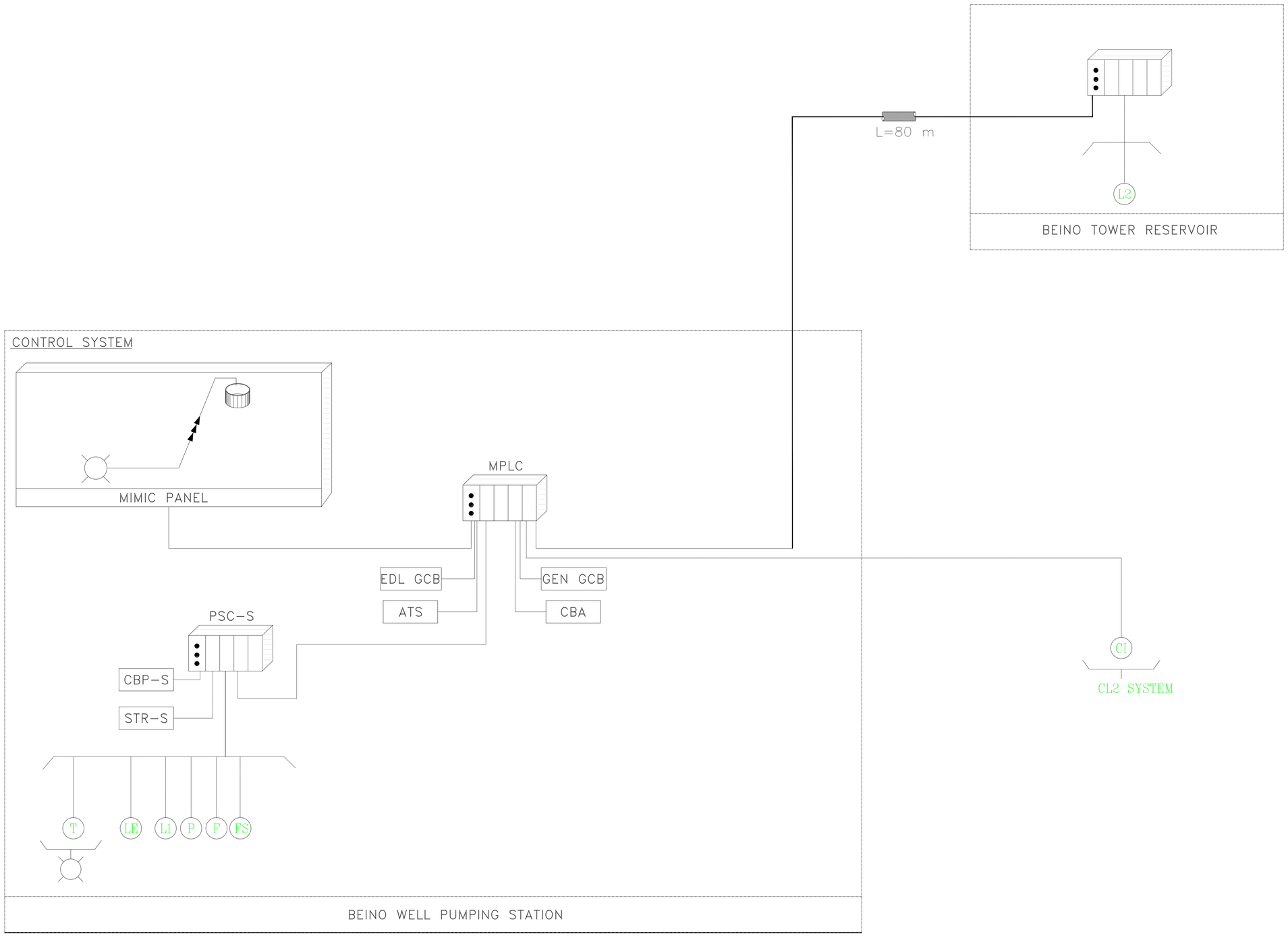
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION

STANDARD DRAWING FOR THE EARTHING AND LIGHTNING PROTECTION SYSTEM

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	7/8	477W-PS-01EM07



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
- F : FLOW MEASUREMENT
- L : LEVEL MEASUREMENT
- P : PRESSURE MEASUREMENT
- T : TEMPERATURE MEASUREMENT
- CI : CHLORINE
- STR : STARTER
- CBP : CIRCUIT BREAKER FOR PUMPSET
- CBA : CIRCUIT BREAKER FOR AUXILIARIES
- GCB : GENERAL CIRCUIT BREAKER
- : SURFACE MOTOPUMPSET
- : ELECTRIC ACTUATOR
- AWH : ANTI WATER HAMMER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

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COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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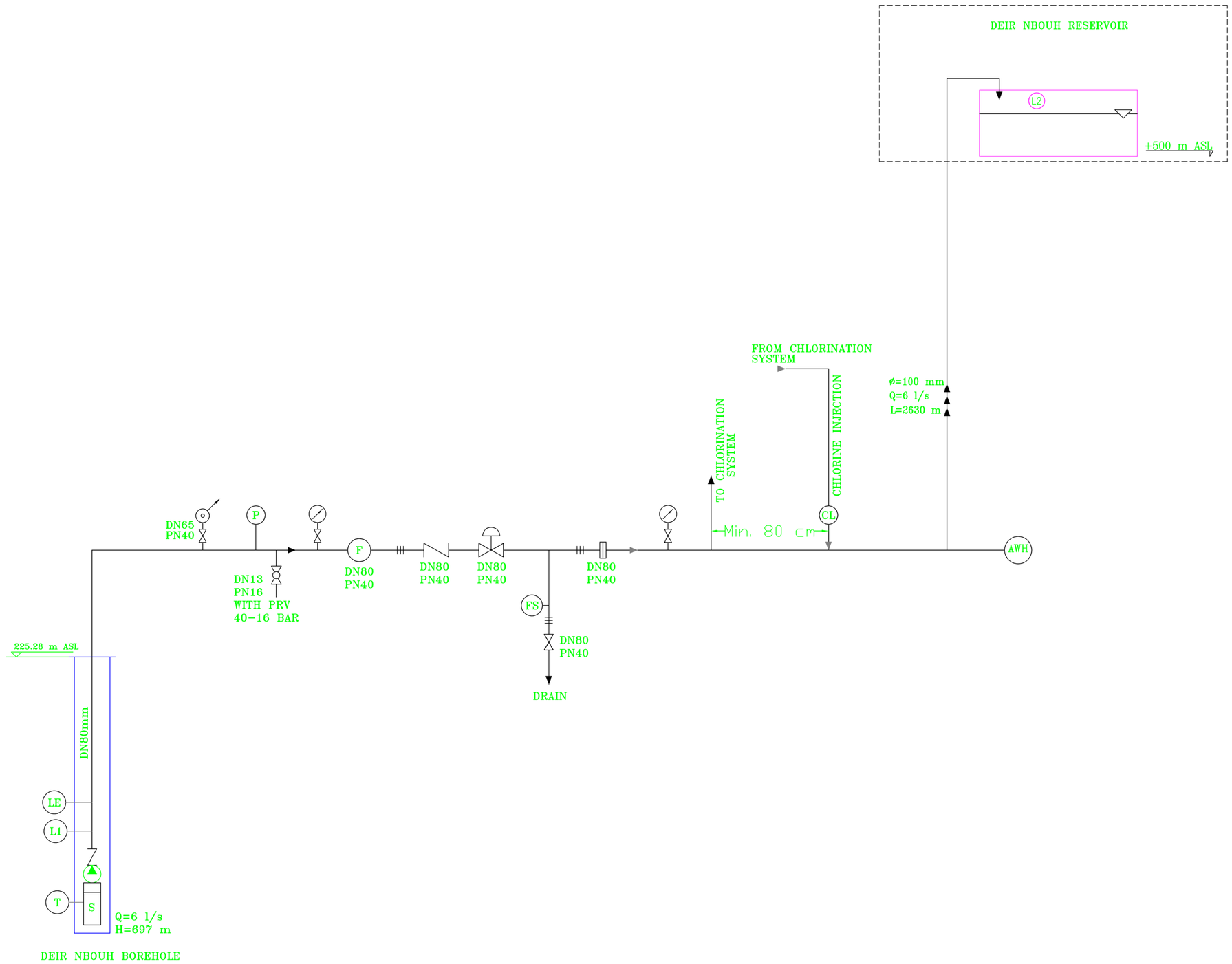
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION	CONTROL SCHEMATIC

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	8/8	477W-PS-01EM08



LEGEND:

- : SUBMERSIBLE PUMP
- DN : NOMINAL DIAMETER
- PN : NOMINAL PRESSURE
- (P) : PRESSURE MEASURMENT
- (FS) : FLOW SWITCH
- (T) : TEMPERATURE MEASURMENT
- (L) : LEVEL MEASURMENT
- (F) : FLOW MEASURMENT
- : GLYCERINE FILLED MANOMETER ø100 WITH 3 WAY VALVE.
- (AWH) : SURGE SUPPRESSION EQUIPMENT.
- : PIPELINE
- : DOUBLE AIR RELEASE VALVE WITH ISOLATING VALVE.
- : ELECTRIC ACTUATOR
- : GATE VALVE
- : SPRING LOADED CHECK VALVE, NOZZLE TYPE WITH SPRING CLASS 2
- : SAMPLING VALVE
- : PERFORATED CHECK VALVE
- : DEMOUNTABLE JOINT
- : SURGE ANTICIPATION VALVE
- : GLOBE VALVE
- : BUTTERFLY VALVE
- : PUMPING LINE
- : GRAVITY LINE
- : REGULATING VALVE
- : FLEXIBLE JOINT
- (CL) : CHLORINE INJECTION
- : STRAINER
- : RUBBER SPHERICAL FLEXIBLE JOINT.
- : STAINLESS STEEL FLEXIBLE JOINT.
- (PRV) : PRESSURE REDUCING VALVE
- : Y STRAINER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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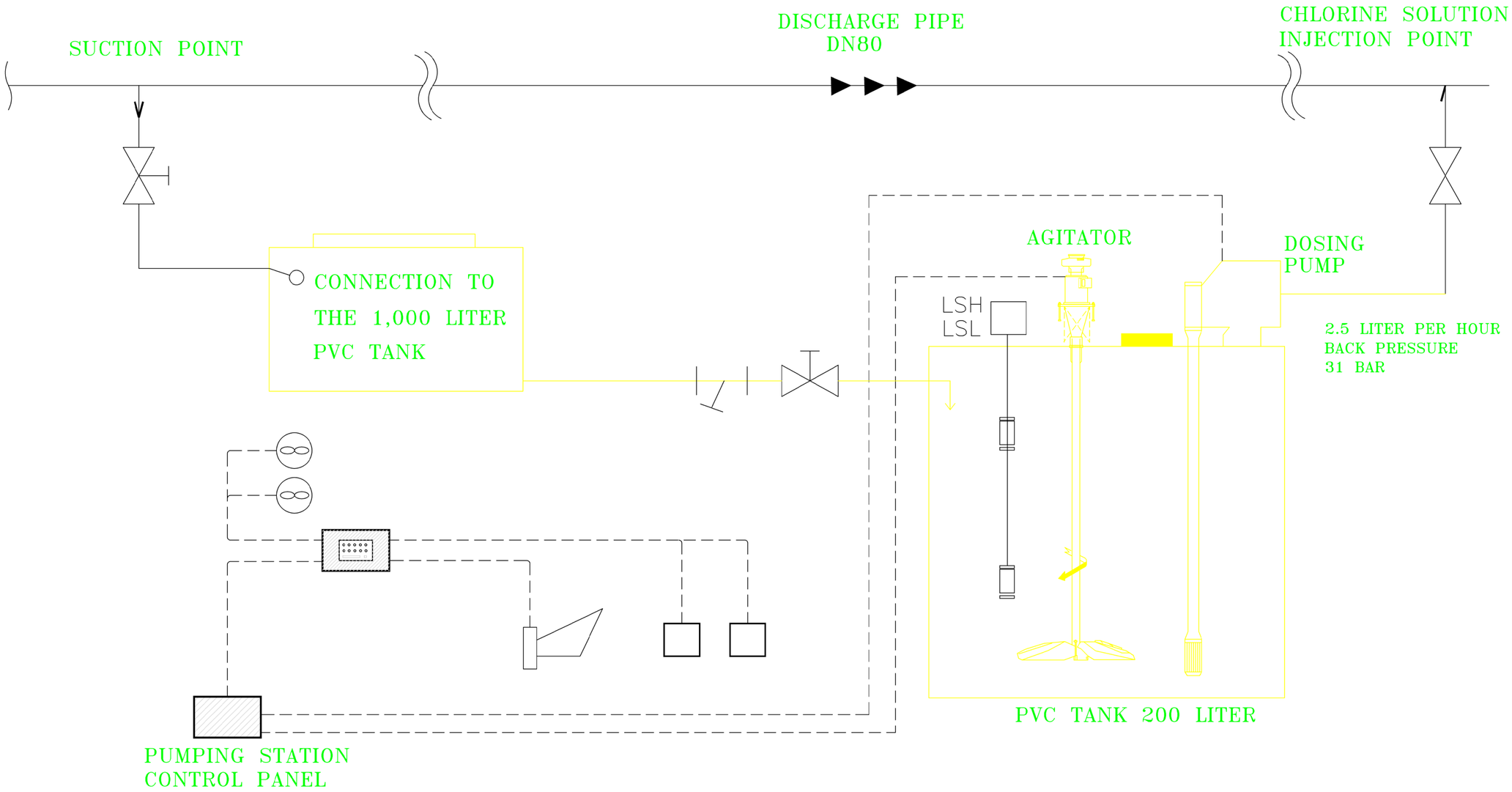
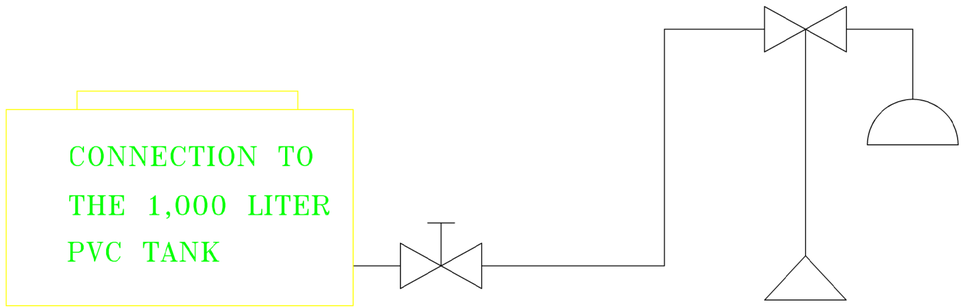
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	WELL HEAD SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	1/8	477W-PS-02EM01





Note: Pipes, valves and fittings
of the chlorination system should be PN40

LEGEND:

- : POWER / CONTROL CABLE
- : PIPES
- PN : NOMINAL PRESSURE
- : BALL VALVE
- : Y STRAINER
- : EXTRACTOR FAN
- : HORN
- : CHAIN VALVE
- : EMERGENCY SHOWER
- : SENSOR
- : GAS MONITORING SYSTEM

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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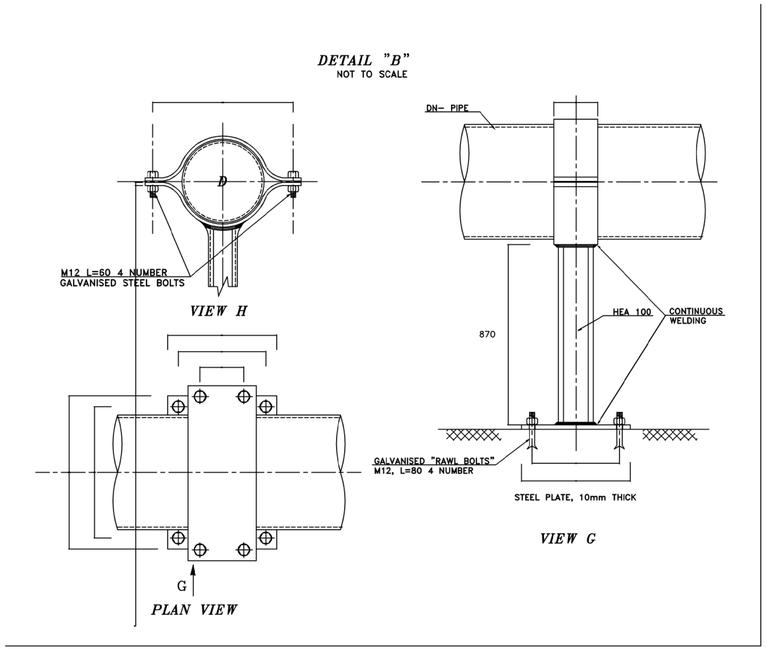
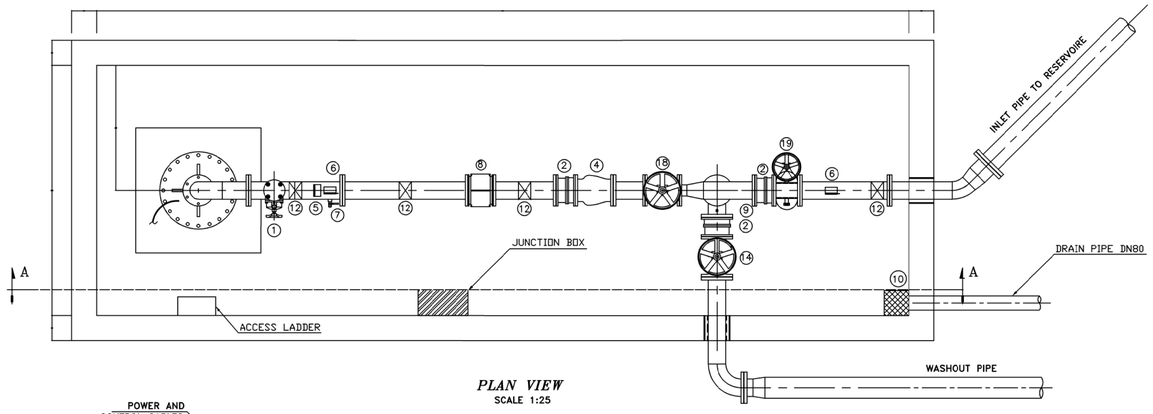
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

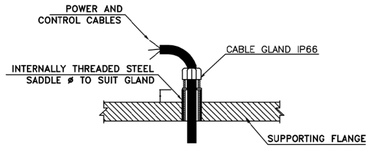
DEIR NBOUH PUMPING STATION	CHLORINATION SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-02EM	T.RMEITY	A.CHREIM	T.RMEITY

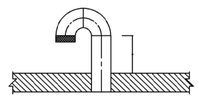
DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	2/8	477W-PS-02EM02





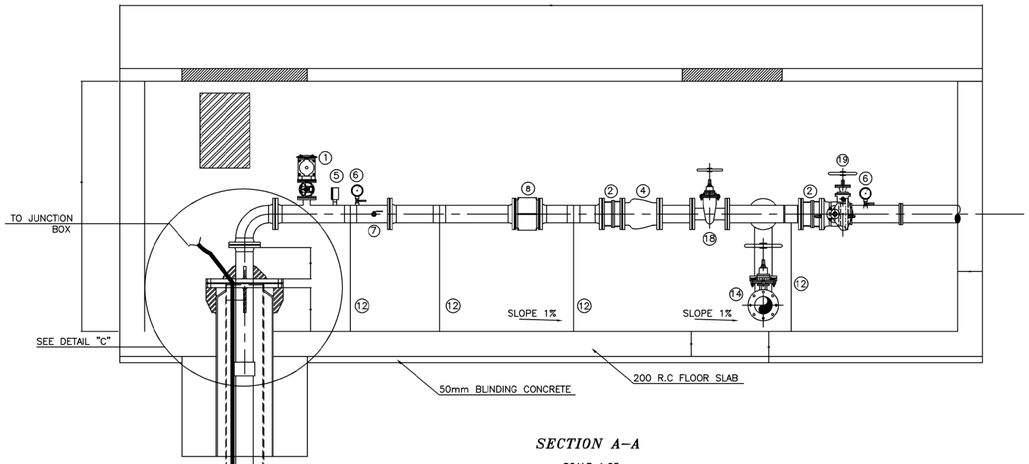


DETAIL D
N.T.S.

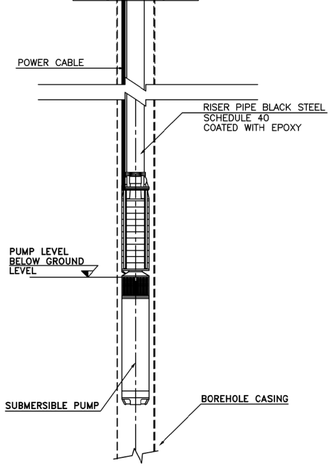


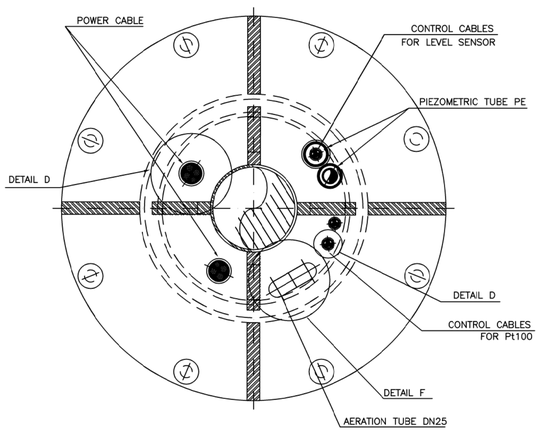
AERATION TUBE DN25 BLACK STEEL PIPE, TERMINATED WITH A SCREEN FOR INSECTS.

DETAIL F
SCALE 1:5

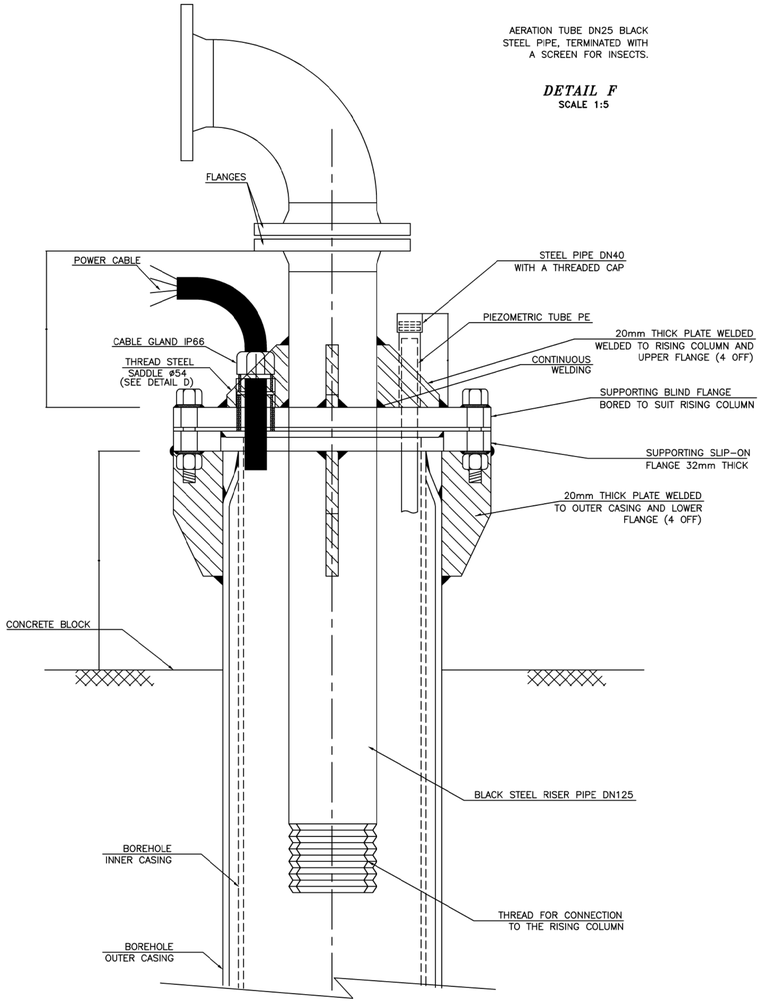


SECTION A–A
SCALE 1:25





DETAIL C
PLAN VIEW



DETAIL C
SIDE VIEW
SCALE 1:5

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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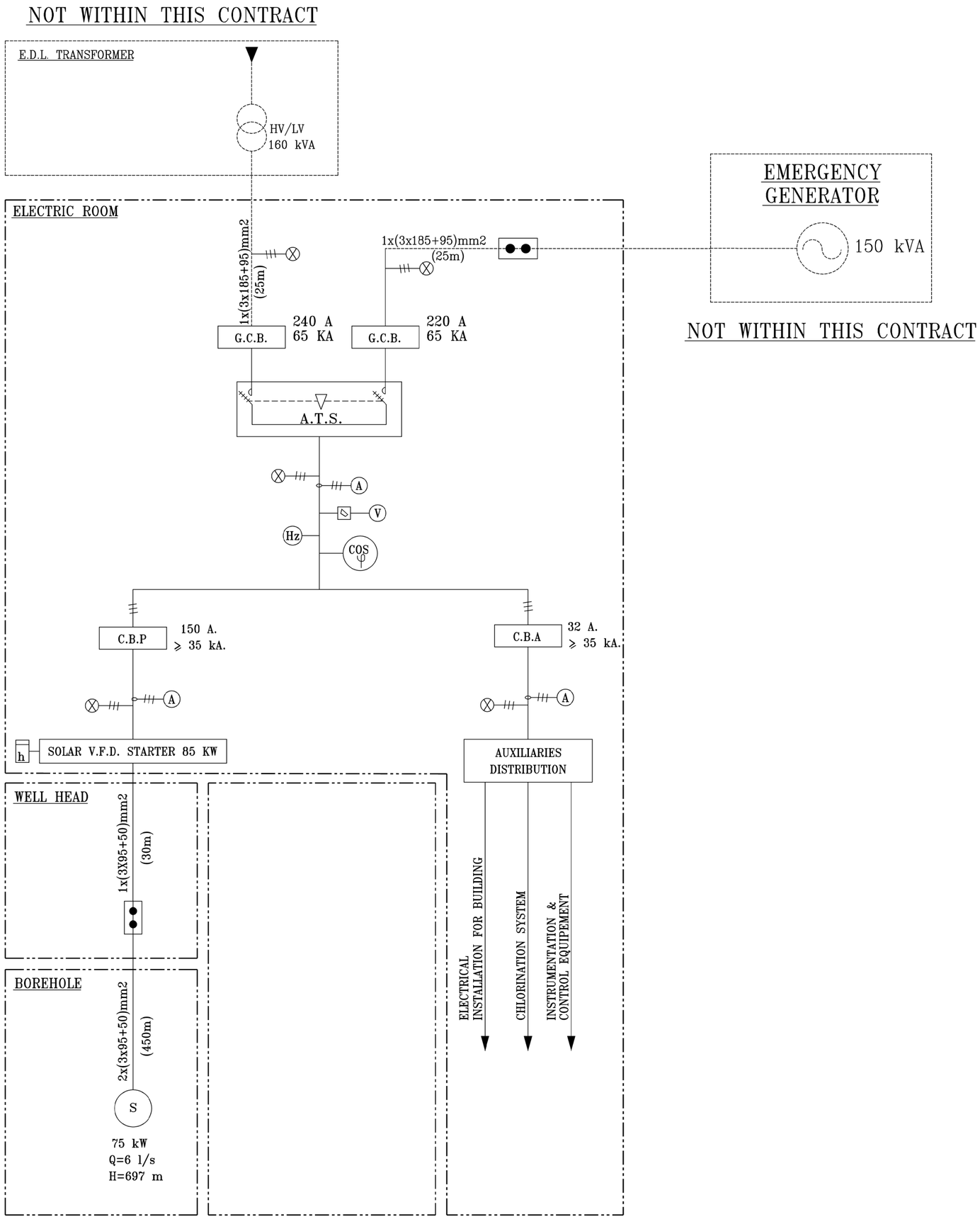
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	MECHANICAL DRAWING FOR WELL HEAD

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W–PS–02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	3/8	477W–PS–02EM03



LEGEND

- COS φ : POWER FACTOR MEASURMENT
- : INDICATING LAMP
- : SELECTOR SWITCH
- Hz : FREQUENCY METER
- V : VOLTMETER
- A : AMPERMETER
- h : HOURMETER
- C.B. : CIRCUIT BREAKER
- : JUNCTION BOX IP67
- : TRANSFORMER HV/LV
- S : SUBMERSIBLE MOTOPUMPSET
- B : SURFACE MOTOPUMPSET
- A.T.S. : AUTOMATIC TRANSFER SWITCH (A.T.S.)
- : EMERGENCY GENERATOR
- C.B.B : GENERAL CIRCUIT BREAKER
- C.B.P : CIRCUIT BREAKER FOR PUMPSET
- C.B.A : CIRCUIT BREAKER FOR AUXILIARIES

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

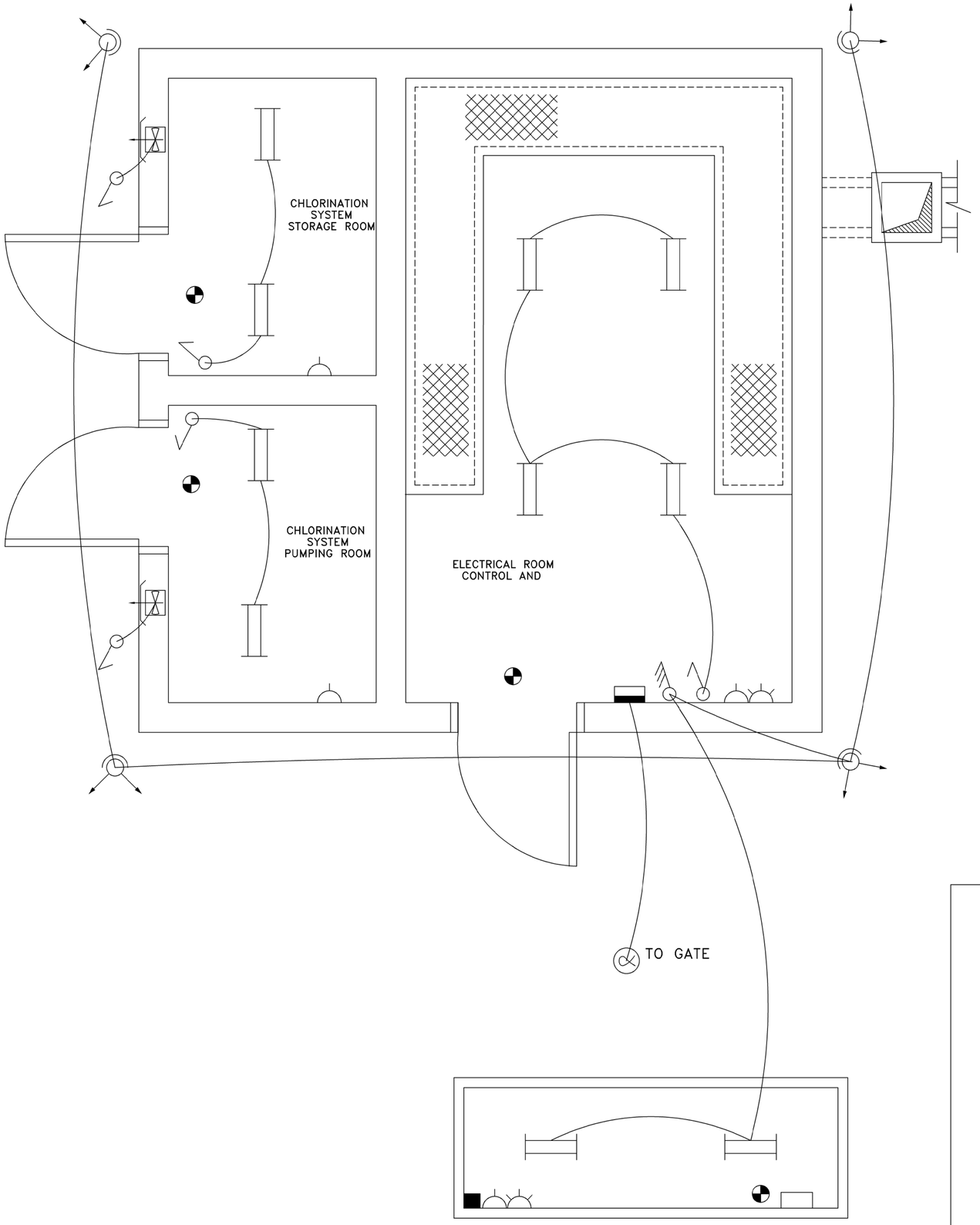
BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB – HAJAL Bldg
P.O.BOX:70492 – ANTELIAS
TEL:(04) 712157 / 712158
FAX: (04) 712159

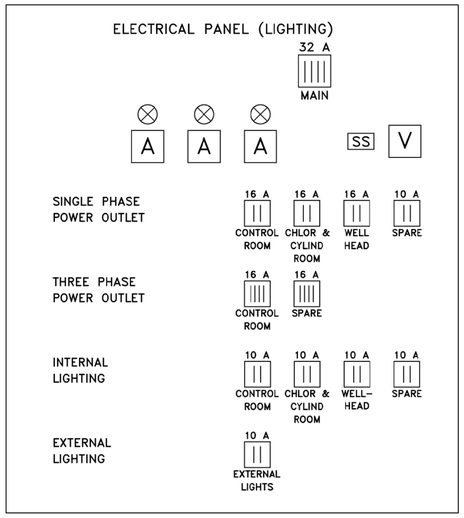
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	ELECTRICAL SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W–PS–02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	4/8	477W–PS–02EM04





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)
- V VOLTMETER
- A AMMETER
- 4–POLE CIRCUIT BREAKER (4P–C.B.)
- 3–POLE CIRCUIT BREAKER (3P–C.B.)
- 2–POLE CIRCUIT BREAKER (2P–C.B.)
- SS SELECTOR SWITCH
- VENTILATION

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

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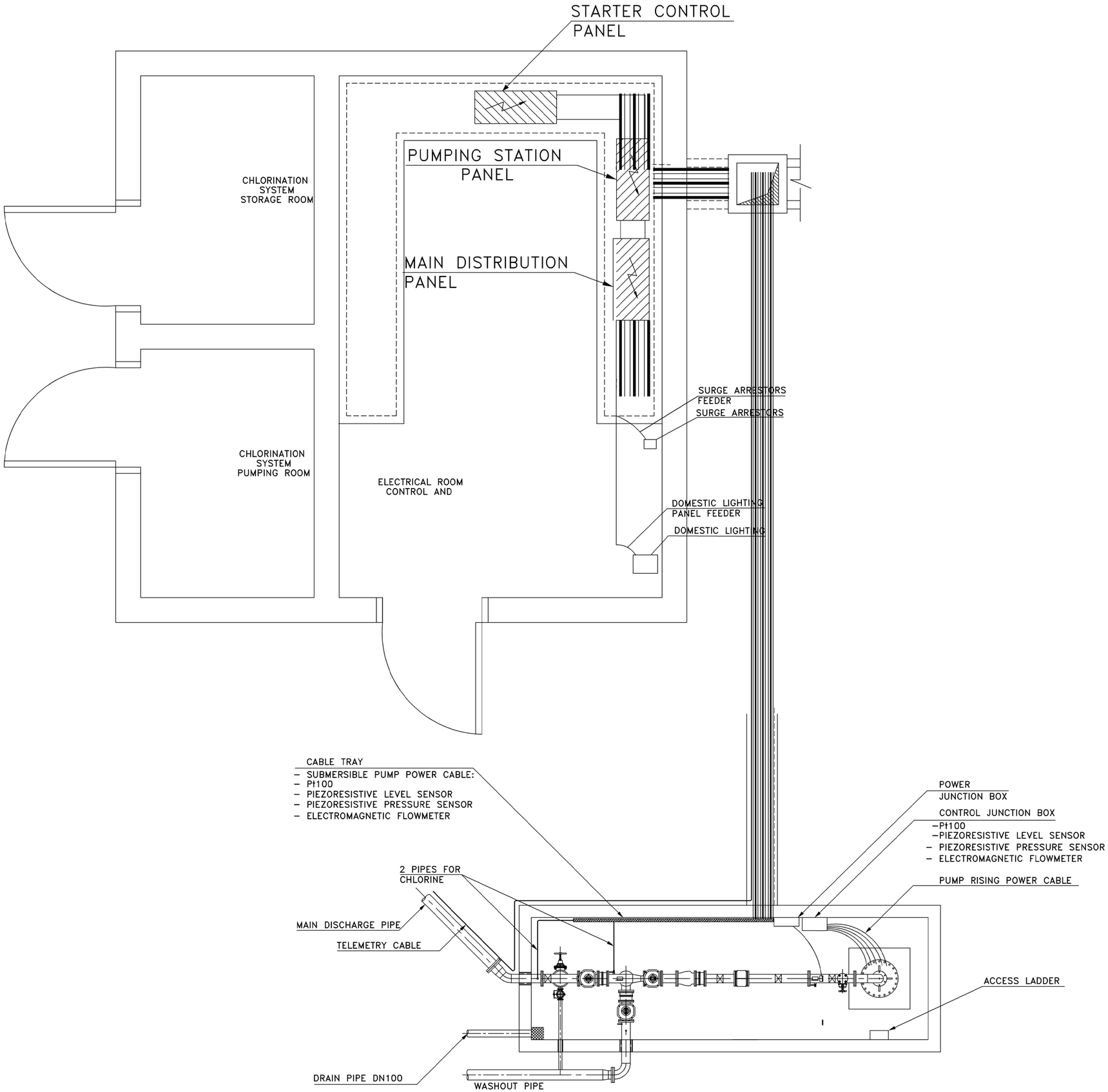
FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	DOMESTIC ELECTRICAL INSTALLATION SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W–PS–02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	5/8	477W–PS–02EM05



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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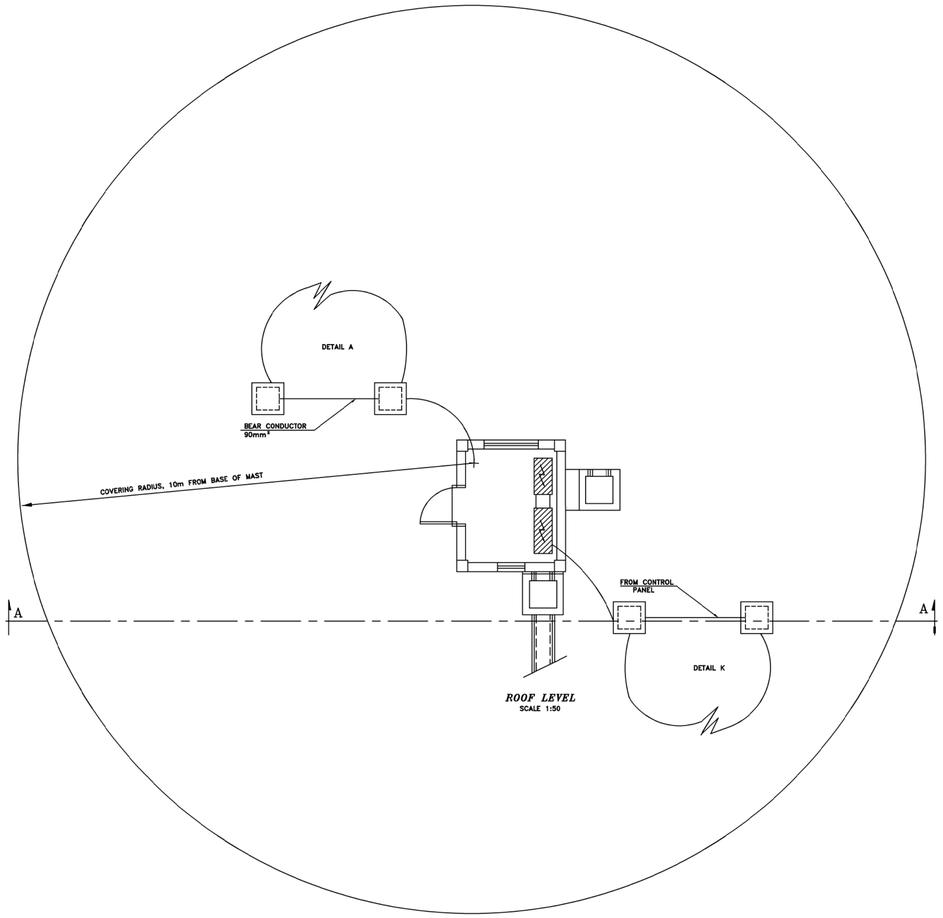
TEL:(04) 712157 / 712158
FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	ELECTRICAL DETAILS DRAWING

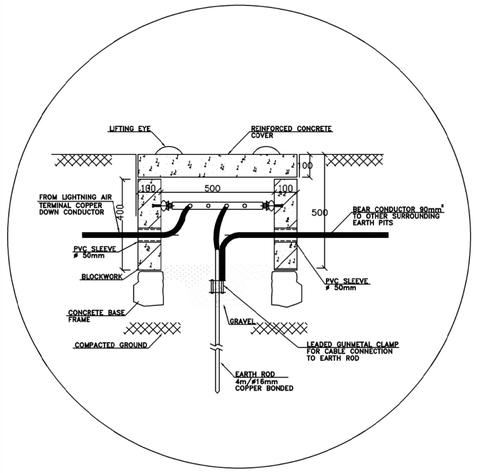
DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W–PS–02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	6/8	477W–PS–02EM06

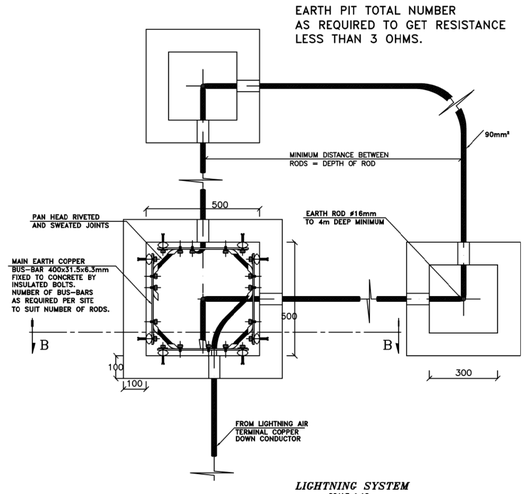


ROOF LEVEL
SCALE 1:50

DETAIL A

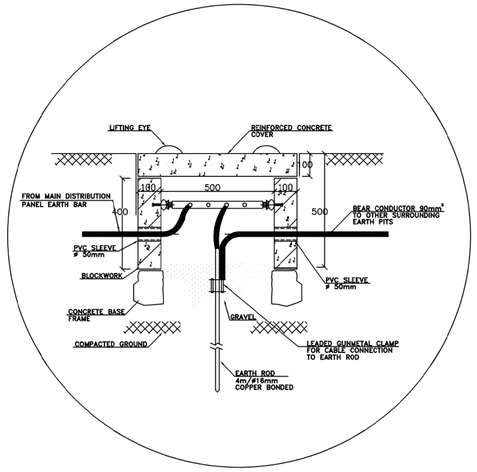


SECTION B–B
SCALE 1:10

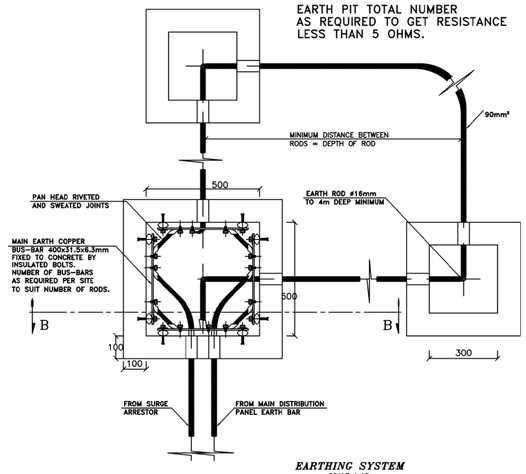


LIGHTNING SYSTEM
SCALE 1:10

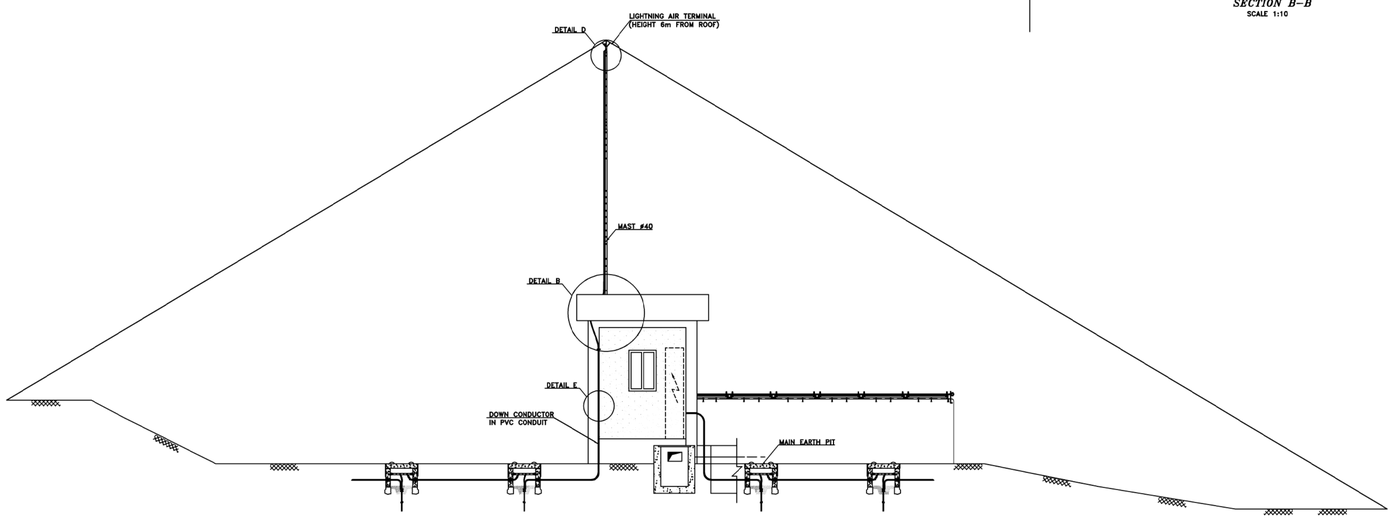
DETAIL K



SECTION B–B
SCALE 1:10

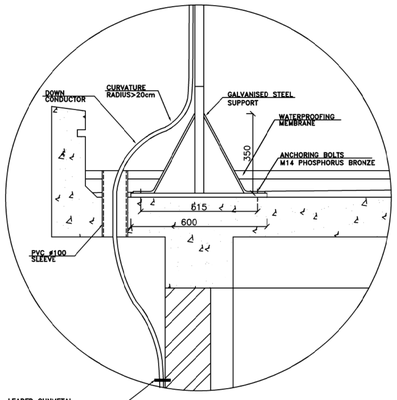


EARTHING SYSTEM
SCALE 1:10

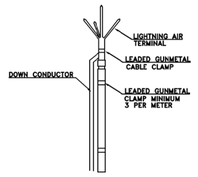


NOTE: ALL EXTERNAL METALLIC MASSES SITUATED AT LESS THAN 1 METER FROM THE DOWN CONDUCTOR SHOULD BE CONNECTED TO IT THROUGH CONDUCTORS HAVING THE SAME SECTION OF THE STRIP ITSELF.

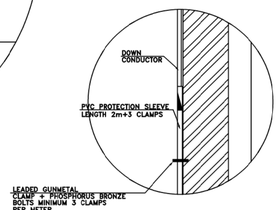
SECTION A–A
SCALE 1:50



DETAIL B
SCALE 1:10



DETAIL D
SCALE 1:10



DETAIL E
SCALE 1:10

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER
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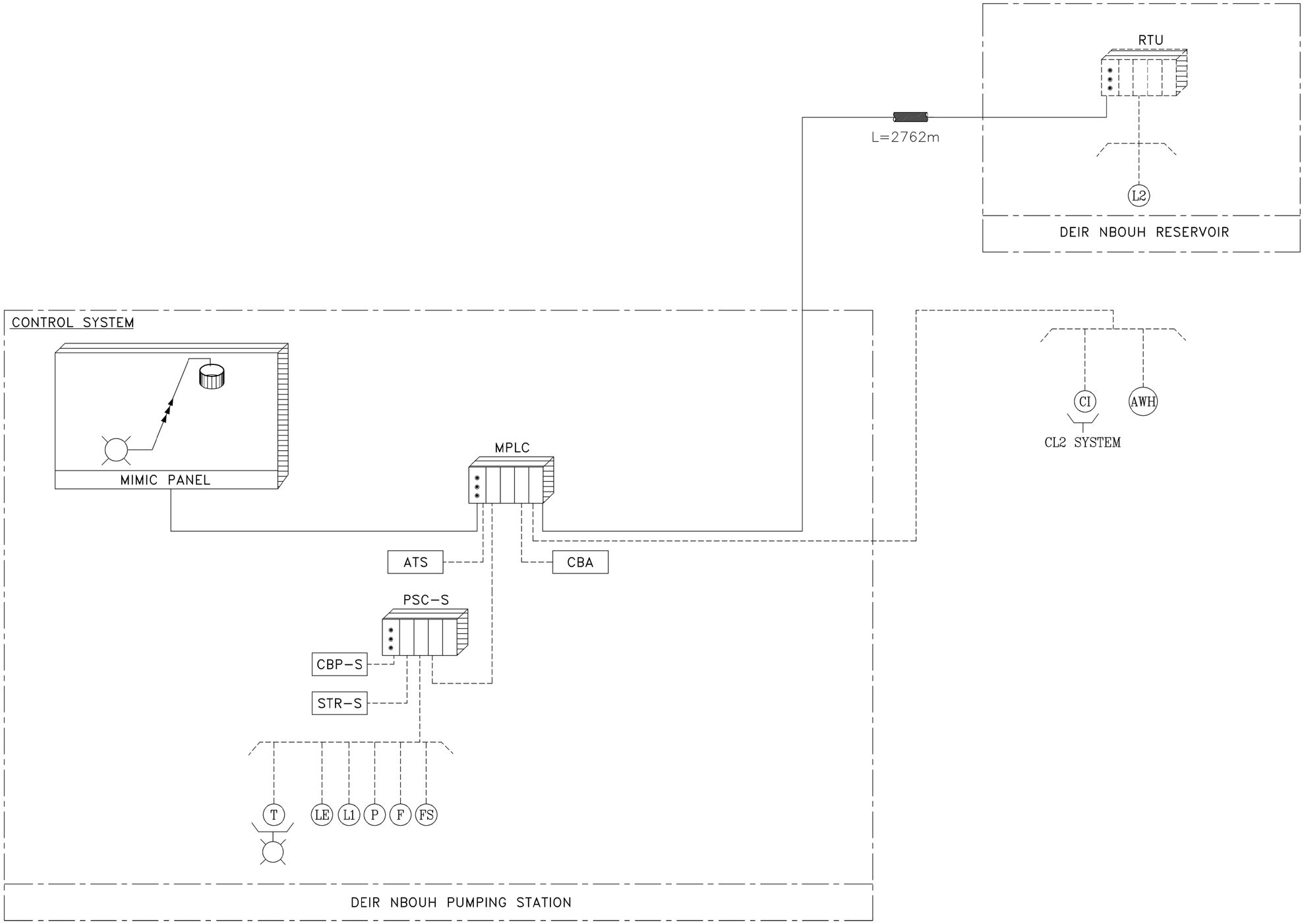
TEL:(04) 712157 / 712158
FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	STANDARD DRAWING FOR THE EARTHING AND LIGHTNING PROTECTION SYSTEM

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W–PS–02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	7/8	477W–PS–02EM07



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
- F : FLOW MEASUREMENT
- L : LEVEL MEASUREMENT
- P : PRESSURE MEASUREMENT
- T : TEMPERATURE MEASUREMENT
- CI : CHLORINE
- STR : STARTER
- CBP : CIRCUIT BREAKER FOR PUMPSET
- CBA : CIRCUIT BREAKER FOR AUXILIARIES
- GCB : GENERAL CIRCUIT BREAKER
- : SURFACE MOTOPUMPSET
- : ELECTRIC ACTUATOR
- AWH : ANTI WATER HAMMER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
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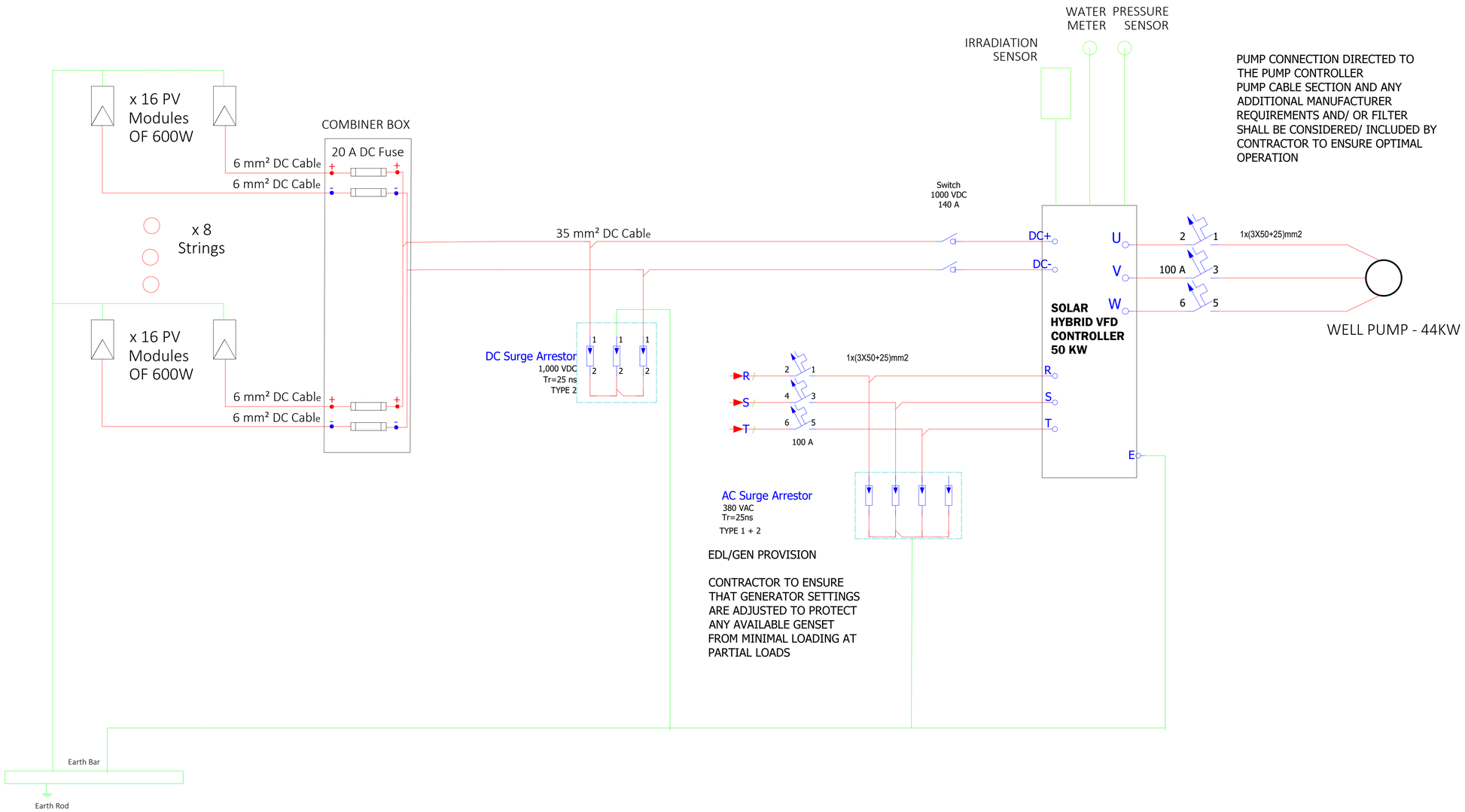
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH PUMPING STATION	CONTROL SCHEMATIC

DRAWING No:	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-02EM	T.RMEITY	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. No
APRIL 2024	N.T.S.	8/8	477W-PS-02EM08



PV MODULES

INVERTER

GENSET

CIRCUIT BREAKER

SPD

EXISTING TOPOLOGY

DC WIRE

AC - PHASE 1

AC - PHASE 2

AC - PHASE 3

NEUTRAL

GROUND

CONTROL WIRES

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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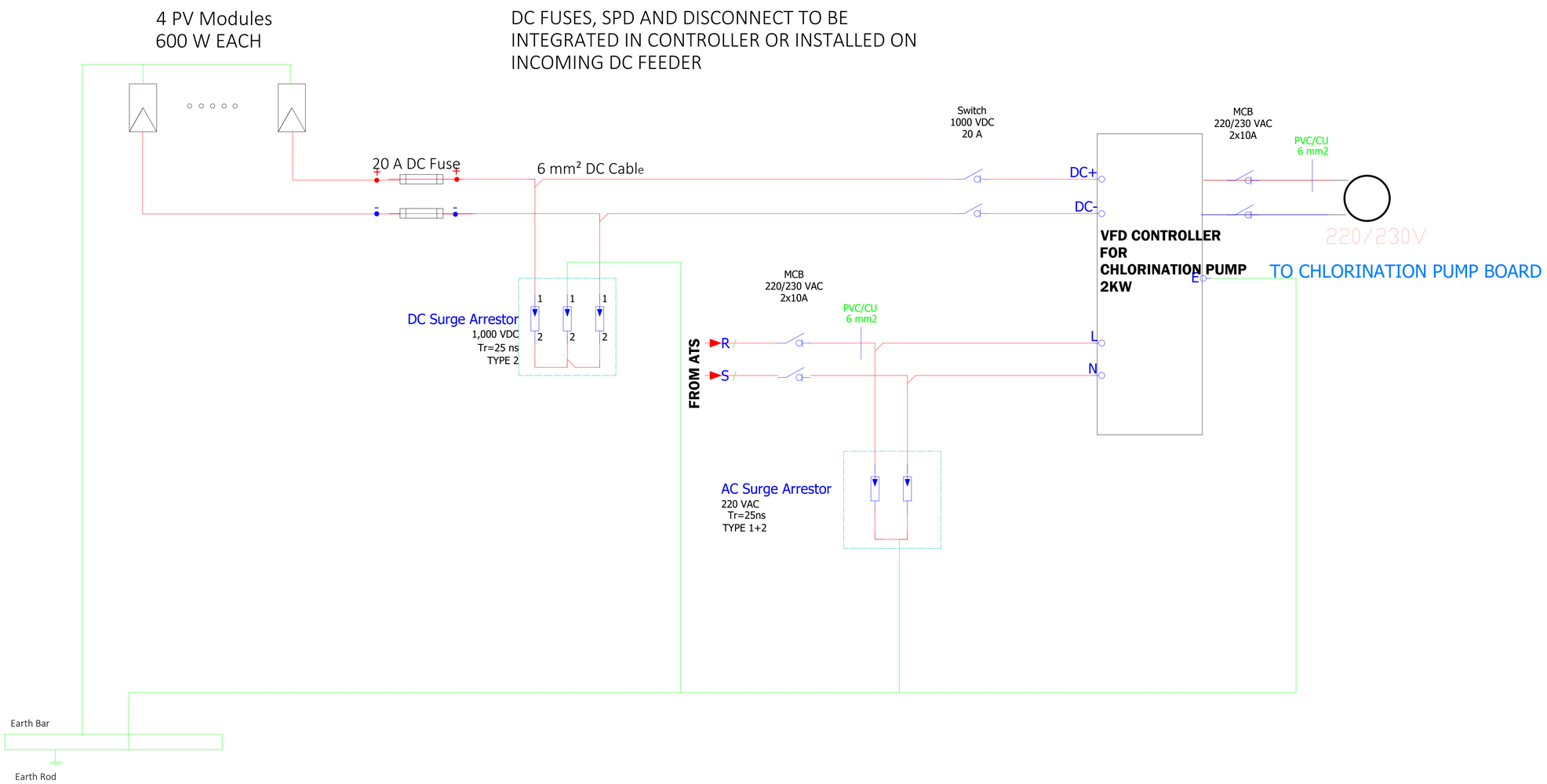
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION	SLD DRAWING WELL SYSTEM

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01SE	A.CHREIM	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	1/3	477W-PS-01SE01



PV MODULES

INVERTER

GENSET

CIRCUIT BREAKER

SPD

EXISTING TOPOLOGY

DC WIRE

AC - PHASE 1

AC - PHASE 2

AC - PHASE 3

NEUTRAL

GROUND

CONTROL WIRES

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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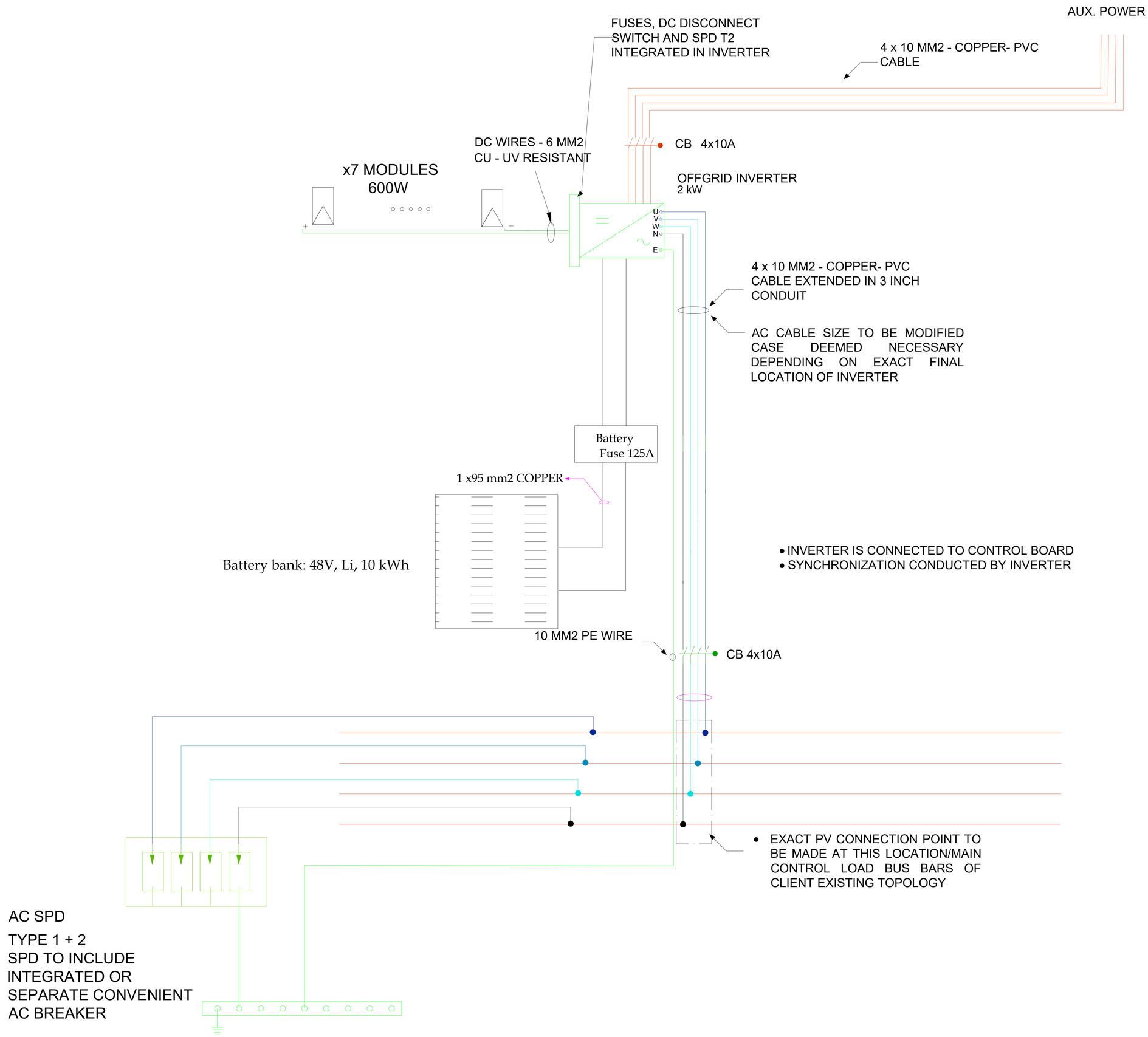
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION

SLD DRAWING
CHLORINATION SYSTEM

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01SE	A.CHREIM	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	2/3	477W–PS–01SE02



PV MODULES

INVERTER

GENSET

CIRCUIT BREAKER

SPD

EXISTING TOPOLOGY

DC WIRE

AC - PHASE 1

AC - PHASE 2

AC - PHASE 3

NEUTRAL

GROUND

CONTROL WIRES

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

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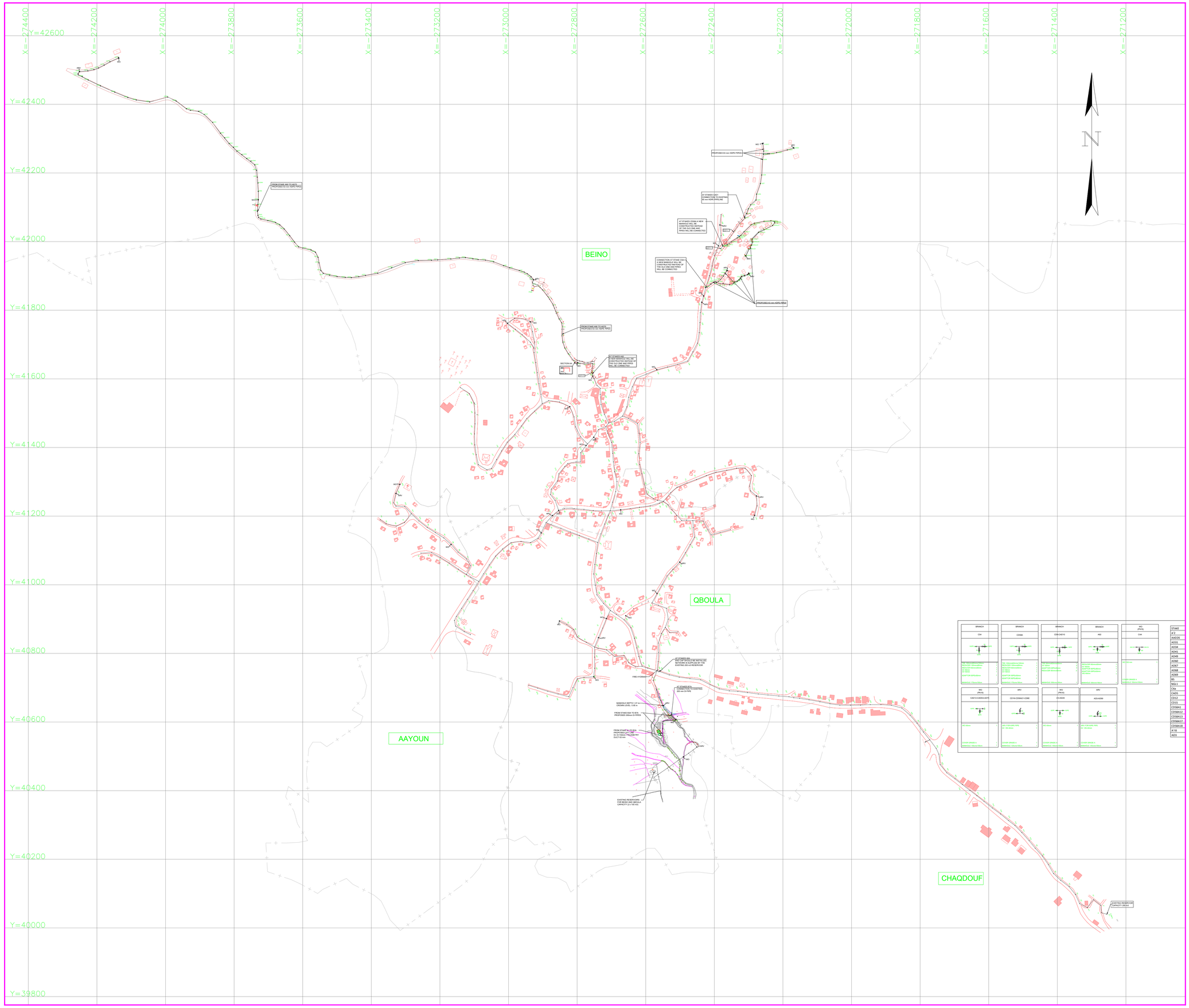
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL PUMPING STATION

SLD DRAWING – HYBRID SYSTEM

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-PS-01SE	A.CHREIM	A.CHREIM	T.RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S.	3/3	477W-PS-01SE03



HYDRAULIC LEGEND

PIPELINE	BEND 1/8 (C1/8)
FLOW DIRECTION	ARV (SINGLE AIR VALVE - SAV)
GATE VALVE	W.O (WASHOUT)
TEE	EXISTING PIPE
REDUCER	WATER METER W.M.
EXISTING WELL	S.M.D. ## — SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
FLANGED ADAPTER	FIRE HYDRANT
END CAPS	

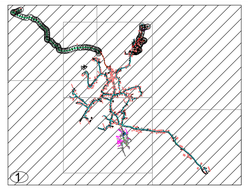
NOTES

- 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=0.2 mm FOR HDPE PIPES
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP05
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP010 & 477W-DS-STDP11
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG 477W-DS-STDP12
- PIPE MATERIAL : DUCTILE IRON
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED ROADS
- BETWEEN STAKES "A'4& A'5" AND STAKES "AD43 & AD44" BRIDGE CROSSING. FOR BRIDGE CROSSING DETAILS REFER TO STANDARD DWG 477W-DS-STD06

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 STAKE POINT
SPRING	SPOT HEIGHT
WELL	PLOT No
DECIDUOUS/PINE TREE	BOUNDARY
ROCKS	MAIN ROAD
DownHill	CIRCONSCRIPTION BOUNDARY
High-Hill	RESERVOIR

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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FAX: (04) 712159

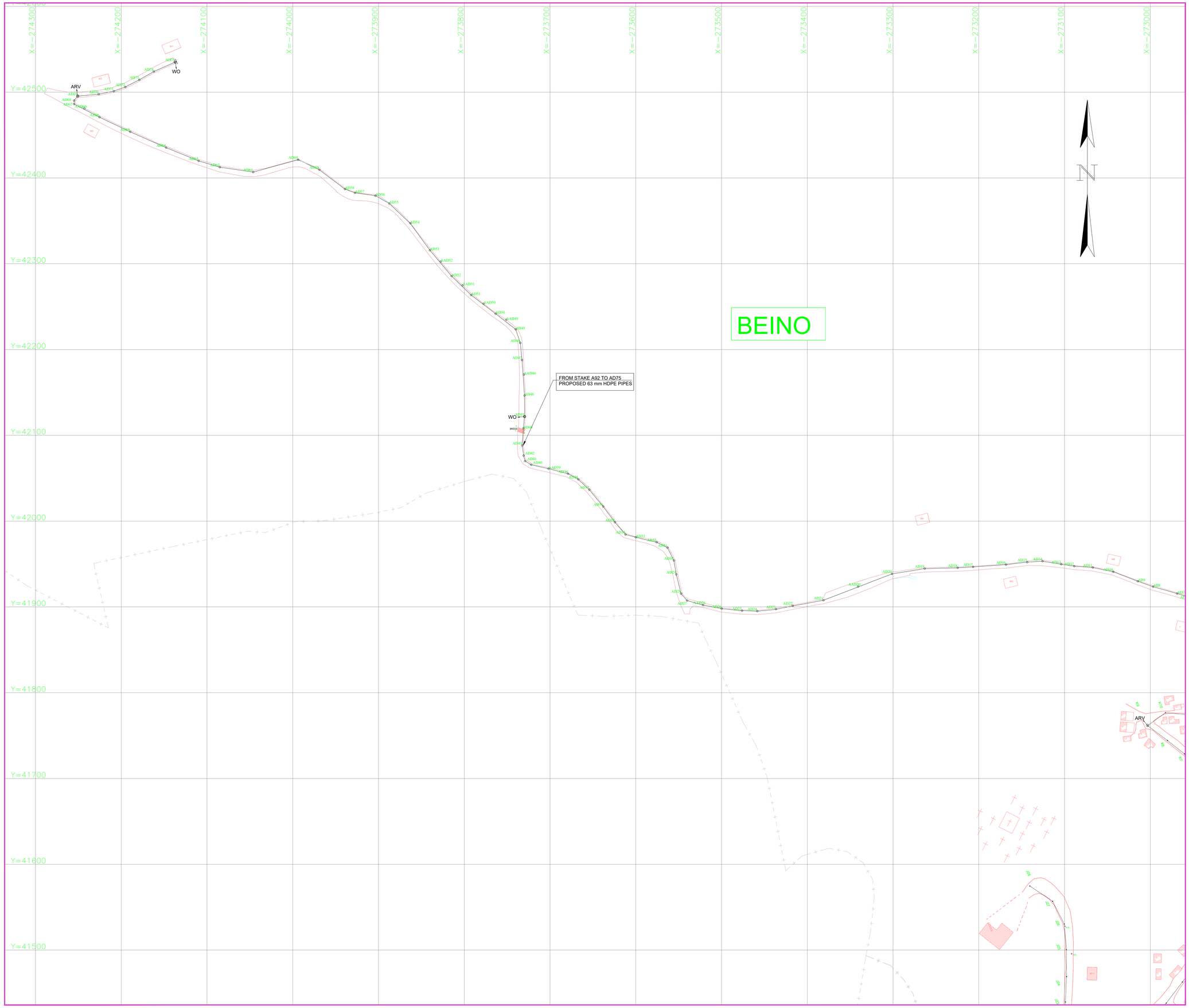
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO AND QBOULA DISTRIBUTION NETWORK

GENERAL LAYOUT

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-01PL	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	1/5000	1/5	477W-DS-01PL-01



HYDRAULIC LEGEND

PIPELINE	BEND 1/8 C1/8
FLOW DIRECTION	ARV (SINGLE AIR VALVE - SAV)
GATE VALVE	W.O (WASHOUT)
TEE	EXISTING PIPE
REDUCER	WATER METER W.M.
EXISTING WELL	S.M.D. ## — SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
FLANGED ADAPTER	FIRE HYDRANT
END CAPS	

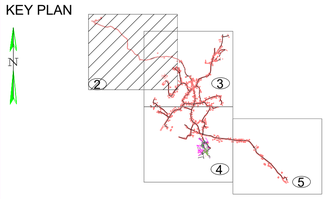
NOTES

- 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=0.2 mm FOR HDPE PIPES
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP05
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP010 & 477W-DS-STDP11
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG 477W-DS-STDP12
- PIPE MATERIAL : DUCTILE IRON
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED ROADS
- BETWEEN STAKES "A'4& A'5" AND STAKES "AD43 & AD44" BRIDGE CROSSING. FOR BRIDGE CROSSING DETAILS REFER TO STANDARD DWG 477W-DS-STD06

TOPOGRAPHICAL LEGEND

BUILDING	MANHOLE SEWER
PAVED ROAD	MANHOLE WATER
CONCRETE ROAD	MANHOLE TELEPHONE
TRACK	MH — MANHOLE NOT IDENTIFIED
REFERENCE LINE	LIGHTING POLE
channel — CHANNEL	TP — TELEPHONE POLE
TERRACE	TRIANGULATION STATION
FENCE	EL.S.S — ELECTRIC SUB STATION
STREAM/RIVER	ELECTRIC POLE/TELEGRAPH POLE
CULVERT/BRIDGE	Num — STAKE NUMBER STAKE POINT
SPRING	1160.12 — SPOT HEIGHT
WELL	1262 — PLOT No
DECIDUOUS/PINE TREE	BOUNDARY
ROCKS	MAIN ROAD
DownHill	CIRCONSCRIPTION BOUNDARY
High-Hill	RESERVOIR

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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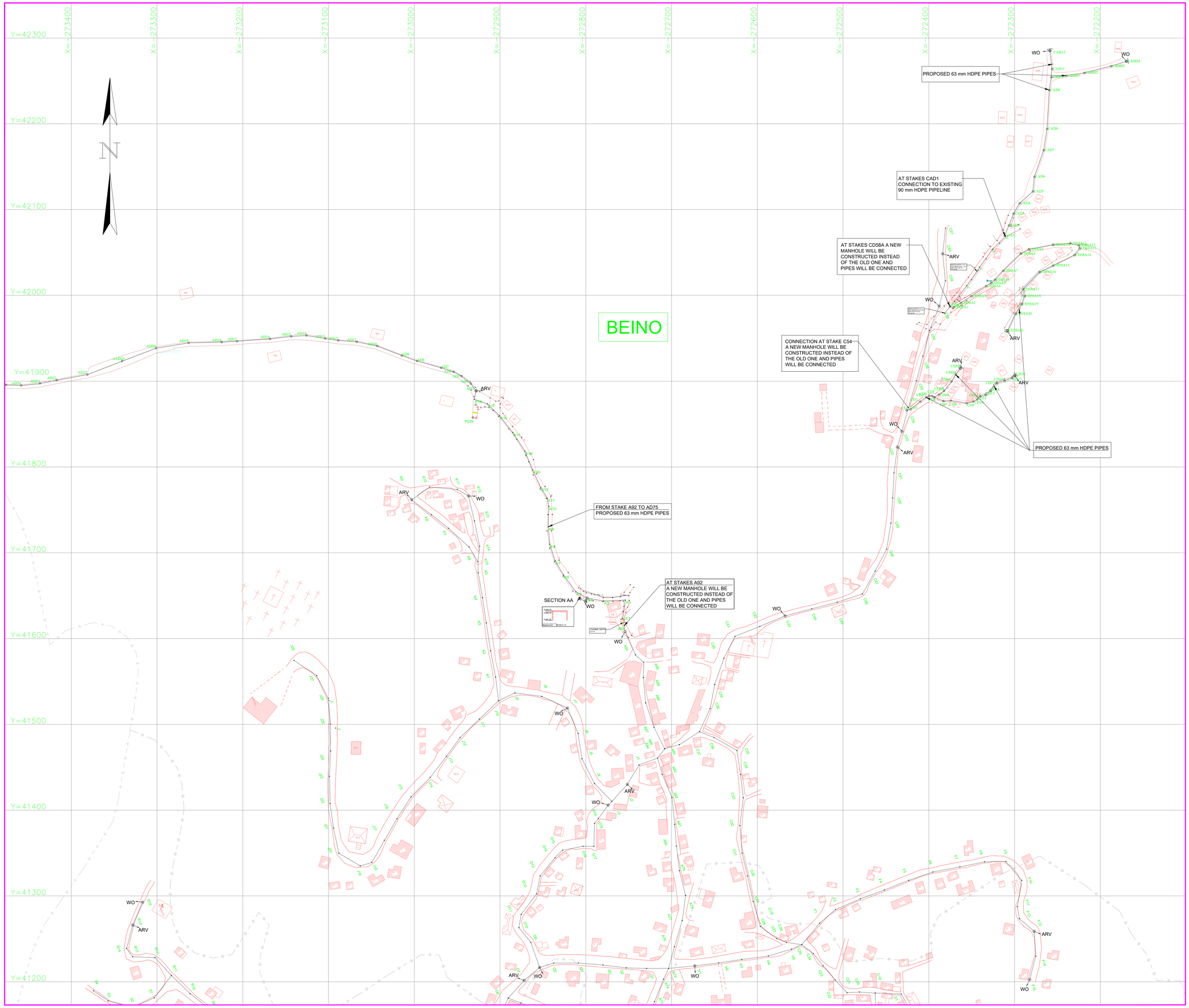
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO AND QBOULA DISTRIBUTION NETWORK	PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-01PL	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	1/2000	2/5	477W-DS-01PL-02



HYDRAULIC LEGEND

PIPELINE	BEND 1/8 C1/8
FLOW DIRECTION	ARV (SINGLE AIR VALVE - SAV)
GATE VALVE	W.O (WASHOUT)
TEE	EXISTING PIPE
REDUCER	WATER METER W.M.
EXISTING WELL	S.M.D. ## — SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
FLANGED ADAPTER	FIRE HYDRANT
END CAPS	

NOTES

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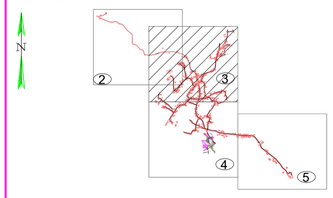
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP010 & 477W-DS-STDP11
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG 477W-DS-STDP12
- PIPE MATERIAL : DUCTILE IRON
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED ROADS
- BETWEEN STAKES "A'4& A'5" AND STAKES "AD43 & AD44" BRIDGE CROSSING. FOR BRIDGE CROSSING DETAILS REFER TO STANDARD DWG 477W-DS-STD06

TOPOGRAPHICAL LEGEND

BUILDING	MANHOLE SEWER
PAVED ROAD	MANHOLE WATER
CONCRETE ROAD	MANHOLE TELEPHONE
TRACK	MH — MANHOLE NOT IDENTIFIED
REFERENCE LINE	LIGHTING POLE
CHANNEL — channel	TP — TELEPHONE POLE
TERRACE	TRIANGULATION STATION
FENCE	EL.S.S — ELECTRIC SUB STATION
STREAM/RIVER	ELECTRIC POLE/TELEGRAPH POLE
CULVERT/BRIDGE	Num — STAKE NUMBER STAKE POINT
SPRING	1160.12 — SPOT HEIGHT
WELL	1262 — PLOT No
DECIDUOUS/PINE TREE	BOUNDARY
ROCKS	MAIN ROAD
DownHill	CIRCONSCRIPTION BOUNDARY
High-Hill	RESERVOIR

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB – HAJAL Bldg
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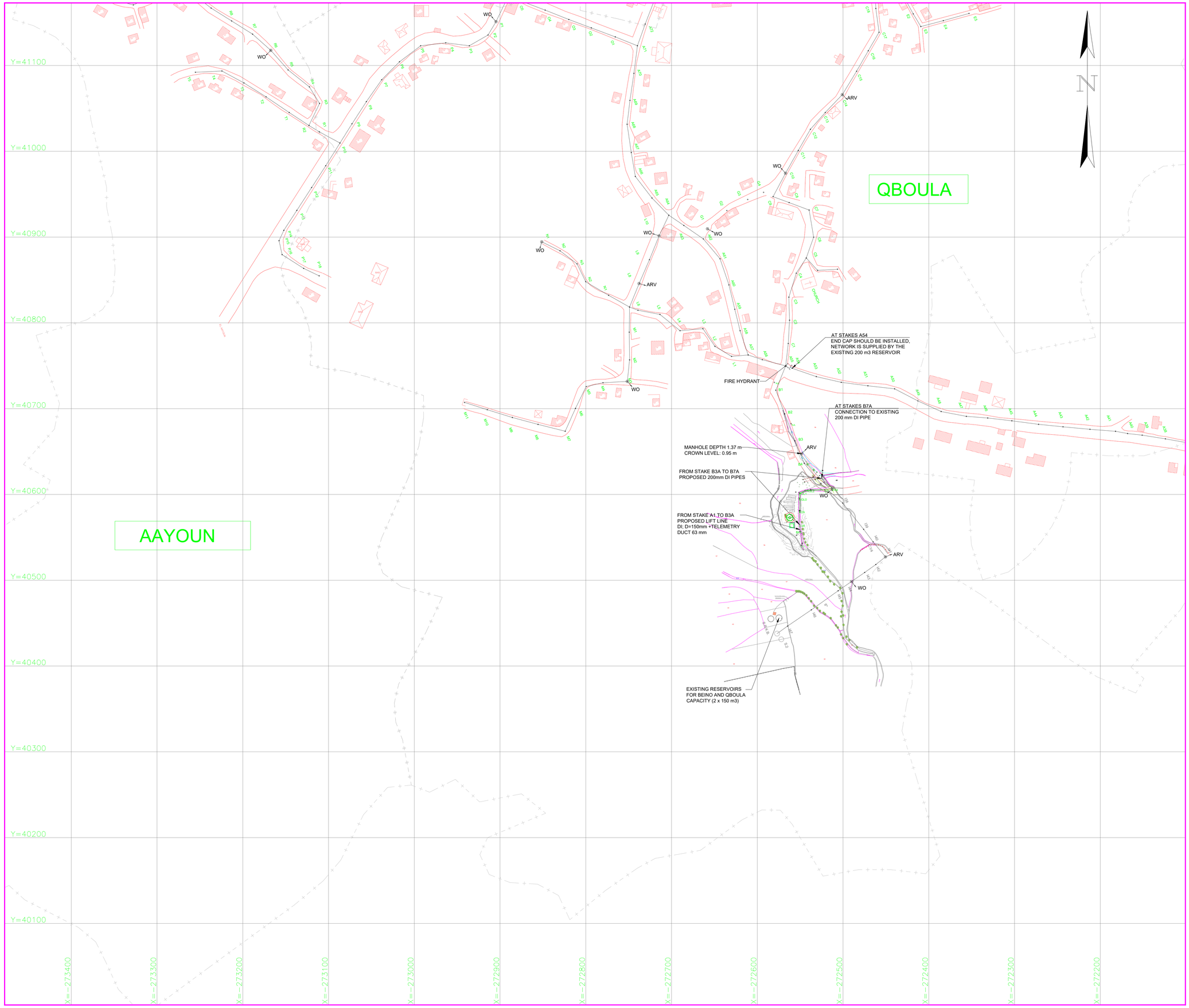
FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO AND QBOULA DISTRIBUTION NETWORK	PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-01PL	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	1/2000	3/5	477W-DS-01PL-03



HYDRAULIC LEGEND

PIPELINE		BEND 1/8	C1/8
FLOW DIRECTION		ARV (SINGLE AIR VALVE - SAV)	
GATE VALVE		W.O (WASHOUT)	
TEE		EXISTING PIPE	
REDUCER		WATER METER W.M.	
EXISTING WELL		S.M.D. ##	SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
FLANGED ADAPTER		FIRE HYDRANT	
END CAPS			

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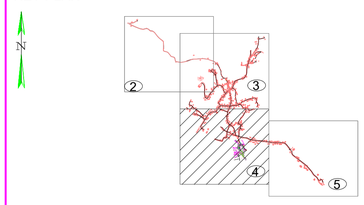
TOPOGRAPHICAL LEGEND

	BUILDING		MANHOLE SEWER
	PAVED ROAD		MANHOLE WATER
	CONCRETE ROAD		MANHOLE TELEPHONE
	TRACK	MH	MANHOLE NOT IDENTIFIED
	REFERENCE LINE		LIGHTING POLE
channel	CHANNEL	TP	TELEPHONE POLE
	TERRACE		TRIANGULATION STATION
	FENCE	EL.S.S	ELECTRIC SUB STATION
	STREAM/RIVER		ELECTRIC POLE/TELEGRAPH POLE
	CULVERT/BRIDGE	Num	STAKE NUMBER STAKE POINT
Spr	SPRING	1160.12	SPOT HEIGHT
	WELL	1262	PLOT No
	DECIDUOUS/PINE TREE		BOUNDARY
	ROCKS		MAIN ROAD
	DownHill		CIRCONSCRIPTION BOUNDARY
	High-Hill		RESERVOIR

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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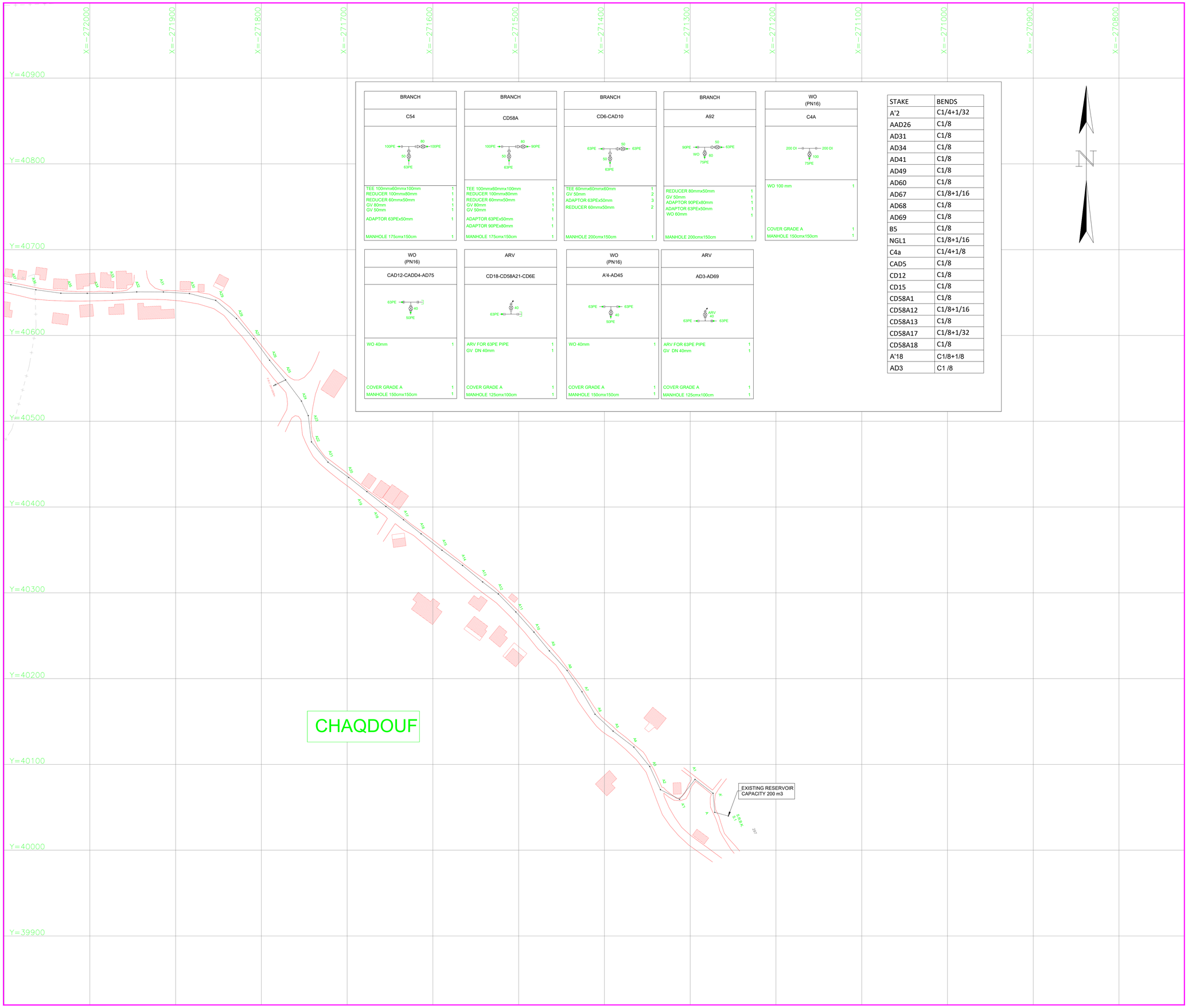
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO AND QBOULA DISTRIBUTION NETWORK	PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-01PL	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	1/2000	4/5	477W-DS-01PL-04



BRANCH	BRANCH	BRANCH	BRANCH	WO (PN16)
C54	CD58A	CD6-CAD10	A92	C4A
100PE — 80 — 100PE; 50 — 63PE	100PE — 80 — 90PE; 50 — 63PE	63PE — 50 — 63PE; 50 — 63PE	90PE — 50 — 63PE; WO — 60 — 75PE	200 DI — 200 DI; 100 — 75PE
TEE 100mmx60mmx100mm 1	TEE 100mmx60mmx100mm 1	TEE 60mmx60mmx60mm 1	REDUCER 80mmx50mm 1	WO 100 mm 1
REDUCER 100mmx80mm 1	REDUCER 100mmx80mm 1	GV 50mm 2	GV 50mm 1	
REDUCER 60mmx50mm 1	REDUCER 60mmx50mm 1	ADAPTOR 63PEx50mm 3	ADAPTOR 90PEx80mm 1	
GV 80mm 1	GV 80mm 1	REDUCER 60mmx50mm 2	ADAPTOR 63PEx50mm 1	
GV 50mm 1	GV 50mm 1		WO 60mm 1	
ADAPTOR 63PEx50mm 1	ADAPTOR 63PEx50mm 1			
	ADAPTOR 90PEx80mm 1			
MANHOLE 175cmx150cm 1	MANHOLE 175cmx150cm 1	MANHOLE 200cmx150cm 1	MANHOLE 200cmx150cm 1	COVER GRADE A 1
				MANHOLE 150cmx150cm 1

WO (PN16)	ARV	WO (PN16)	ARV
CAD12-CADD4-AD75	CD18-CD58A21-CD6E	A'4-AD45	AD3-AD69
63PE — 40 — 50PE	40 — 63PE	63PE — 63PE; 40 — 50PE	ARV 40 — 63PE — 63PE
WO 40mm 1	ARV FOR 63PE PIPE 1	WO 40mm 1	ARV FOR 63PE PIPE 1
	GV DN 40mm 1		GV DN 40mm 1
COVER GRADE A 1	COVER GRADE A 1	COVER GRADE A 1	COVER GRADE A 1
MANHOLE 150cmx150cm 1	MANHOLE 125cmx100cm 1	MANHOLE 150cmx150cm 1	MANHOLE 125cmx100cm 1

STAKE	BENDS
A'2	C1/4+1/32
AAD26	C1/8
AD31	C1/8
AD34	C1/8
AD41	C1/8
AD49	C1/8
AD60	C1/8
AD67	C1/8+1/16
AD68	C1/8
AD69	C1/8
B5	C1/8
NGL1	C1/8+1/16
C4a	C1/4+1/8
CAD5	C1/8
CD12	C1/8
CD15	C1/8
CD58A1	C1/8
CD58A12	C1/8+1/16
CD58A13	C1/8
CD58A17	C1/8+1/32
CD58A18	C1/8
A'18	C1/8+1/8
AD3	C1 /8

HYDRAULIC LEGEND

PIPELINE	BEND 1/8 C1/8
FLOW DIRECTION	ARV (SINGLE AIR VALVE - SAV)
GATE VALVE	W.O (WASHOUT)
TEE	EXISTING PIPE
REDUCER	WATER METER W.M.
EXISTING WELL	S.M.D. ## — SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
FLANGED ADAPTER	FIRE HYDRANT
END CAPS	

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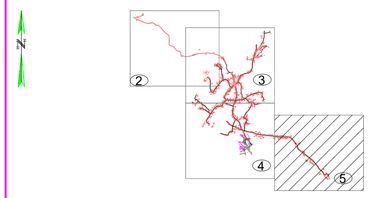
TOPOGRAPHICAL LEGEND

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 STAKE POINT
SPRING	SPOT HEIGHT
WELL	PLOT No
DECIDUOUS/PINE TREE	BOUNDARY
ROCKS	MAIN ROAD
DownHill	CIRCONSCRIPTION BOUNDARY
High-Hill	RESERVOIR

KEY PLAN



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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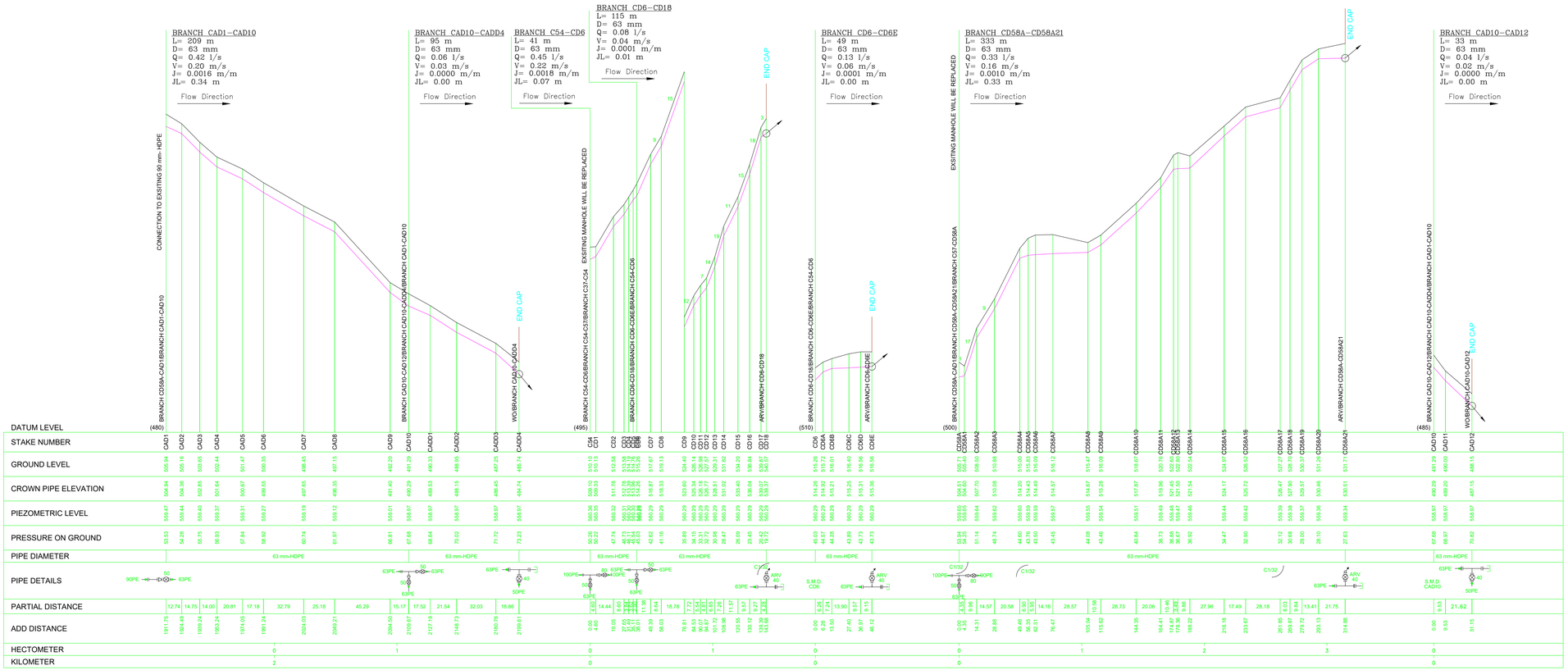
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

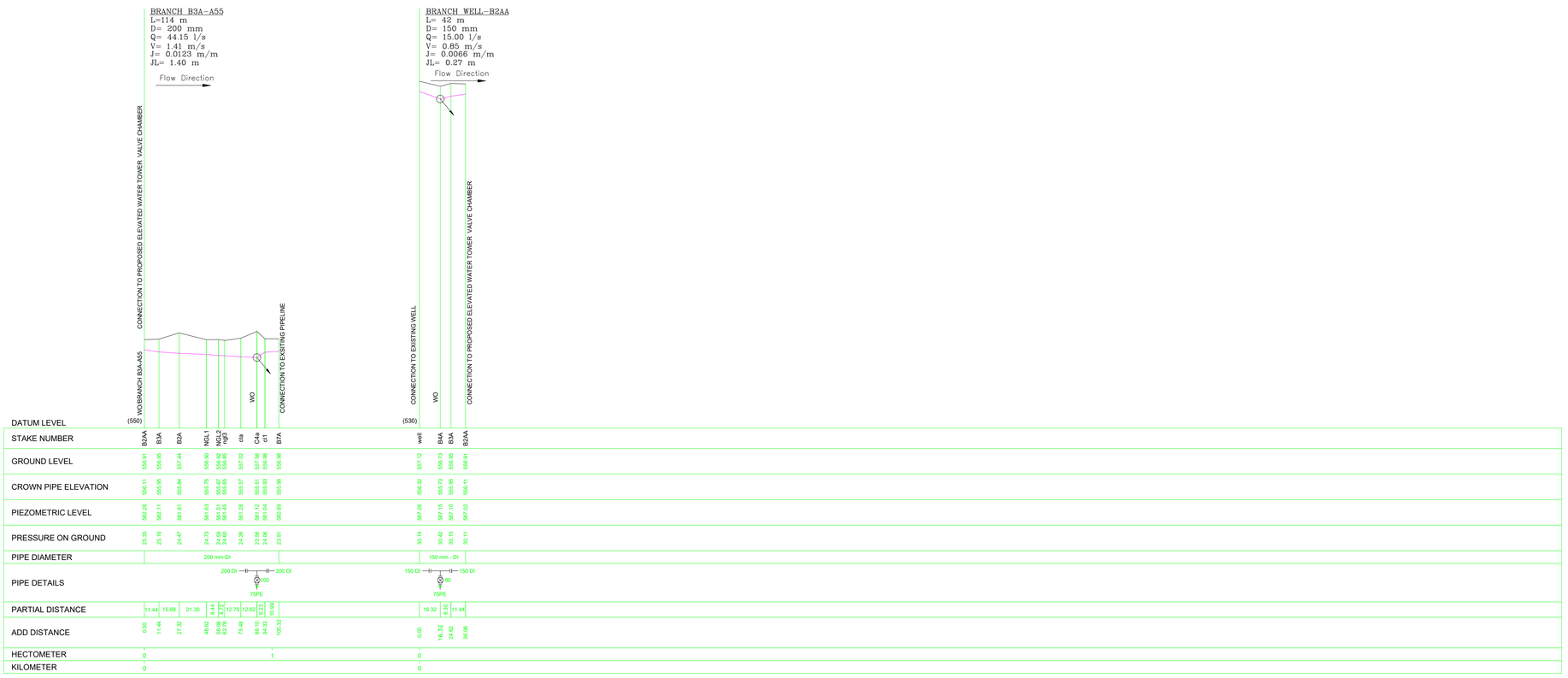
BEINO AND QBOULA DISTRIBUTION NETWORK

PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-01PL	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	1/2000	5/5	477W-DS-01PL-05





HYDRAULIC LEGEND

PIPELINE	BEND 1/8 (C1/8)
FLOW DIRECTION	ARV (SINGLE AIR VALVE - SAV)
GATE VALVE	W.O (WASHOUT)
TEE	EXISTING PIPE
REDUCER	WATER METER W.M.
EXISTING WELL	S.M.D. ## — SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
FLANGED ADAPTER	FIRE HYDRANT
END CAPS	

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

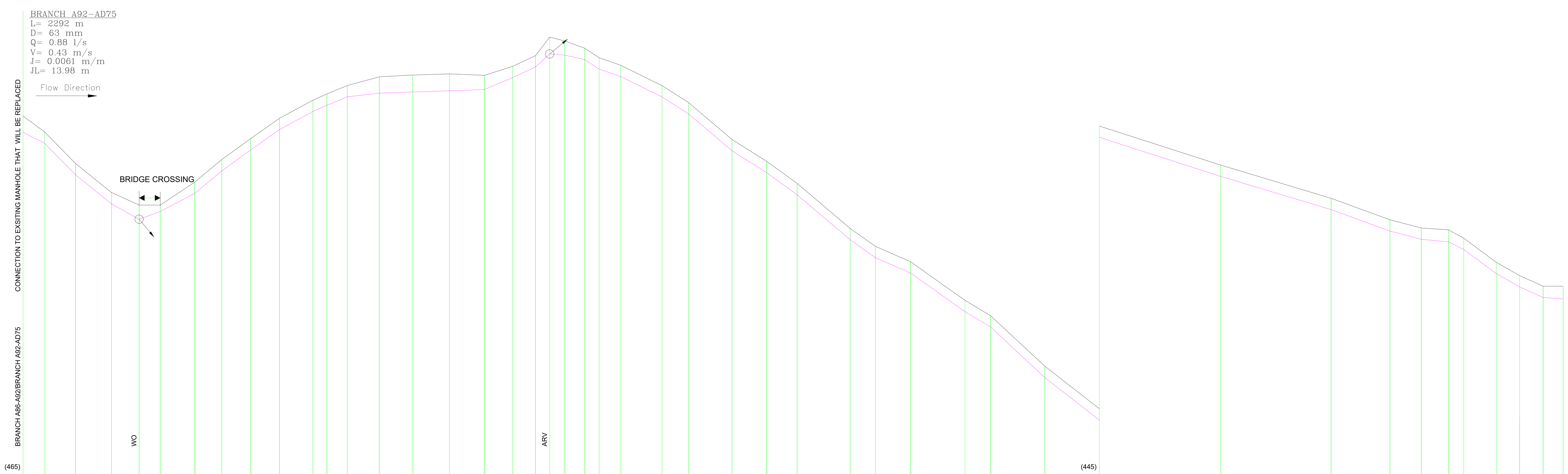
BEINO AND QBOULA DISTRIBUTION NETWORK

PROFILE

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477-DS-01PR	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	H= 1/2000 V= 1/200	1/2	477-DS-01PR01

BRANCH A92–AD75 — Profile (1/2)



DATUM LEVEL: (465) / (445)

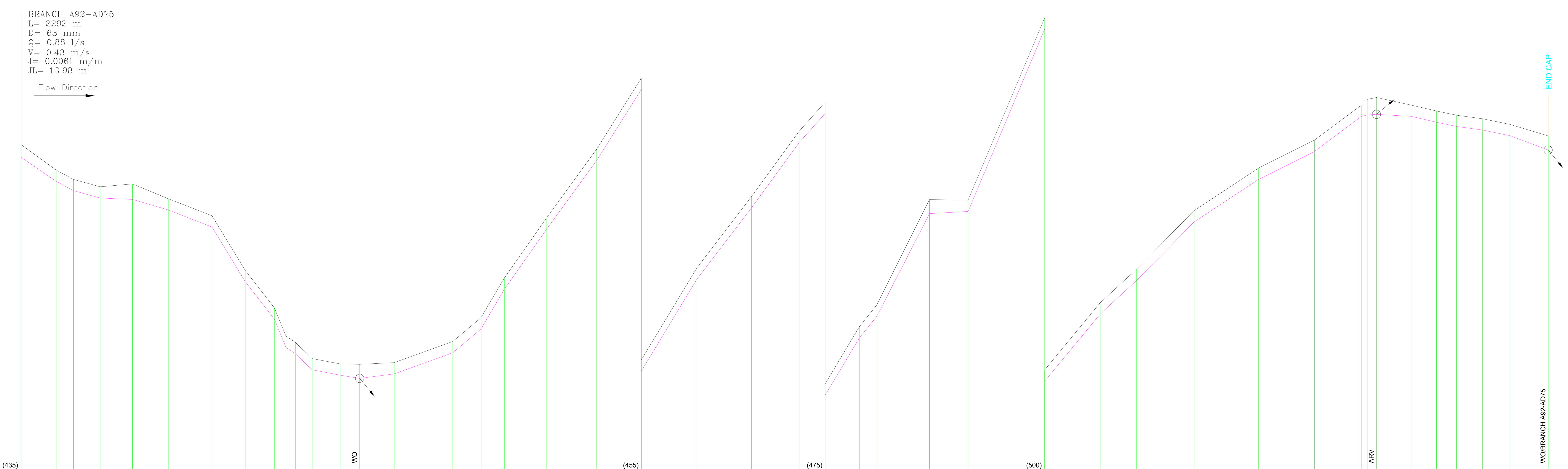
PIPE DIAMETER: 63 mm-HDPE

PIPE DETAILS: A92: 90PE, 50, 63PE, WO 60, 75PE; A'4: 63PE, 63PE, 40, 50PE; AD3: ARV 40, 63PE, 63PE

STAKE NUMBER	GROUND LEVEL	CROWN PIPE ELEVATION	PIEZOMETRIC LEVEL	PRESSURE ON GROUND	PARTIAL DISTANCE (to next stake)	ADD DISTANCE
A92	490.36	489.21	560.91	70.55	15.17	193.84
A'1	489.25	488.45	560.82	71.57	21.97	209.00
A'2	487.01	486.21	560.68	73.67	25.35	230.97
A'3	484.96	484.16	560.53	75.57	19.64	256.32
A'4	484.07	483.07	560.41	76.34	14.92	275.96
A'5	484.07	483.62	560.32	76.25	24.34	290.88
A'6	485.69	484.89	560.17	74.48	19.21	315.22
A'7	487.29	486.49	560.05	72.76	20.40	334.43
A'8	488.77	487.97	559.92	71.15	20.41	354.82
A'9	490.21	489.41	559.80	69.59	23.65	375.24
A'10	491.49	490.69	559.65	68.16	9.86	398.88
A'11	491.93	491.13	559.59	67.66	14.44	408.74
A'12	492.53	491.73	559.50	66.97	22.68	423.17
A'13	493.14	491.99	559.37	66.23	23.54	445.85
A'14	493.27	492.07	559.22	65.95	25.98	469.39
A'15	493.35	492.15	559.06	65.71	24.87	495.37
A'16	493.25	492.25	558.91	65.66	19.85	520.25
A'17	493.88	493.08	558.79	64.91	16.18	540.09
A'18	494.64	493.84	558.69	64.05	10.13	556.27
AD3	495.96	494.76	558.63	62.67	10.52	566.40
AD4	495.68	494.68	558.56	62.88	14.09	576.92
AD5	495.17	494.37	558.48	63.31	10.34	591.00
AD6	494.49	493.69	558.41	63.92	15.17	601.35
AD7	493.96	493.16	558.32	64.36	29.27	616.52
AD8	492.52	491.72	558.14	65.62	18.83	645.79
AD9	491.32	490.52	558.02	66.70	30.68	664.62
AD10	488.71	487.91	557.84	69.13	24.42	695.30
AD11	487.17	486.37	557.69	70.52	21.67	719.72
AD12	485.60	484.80	557.55	71.95	37.47	741.38
AD14	482.42	481.62	557.32	74.90	17.89	778.85
AD15	481.15	480.35	557.22	76.07	24.86	796.74
AD16	480.06	479.26	557.06	77.00	38.48	821.60
AD17	477.33	476.53	556.83	79.50	18.03	860.08
AD18	476.25	475.45	556.72	80.47	38.49	878.11
AD19	472.67	471.87	556.48	83.81	38.55	916.60
AD20	469.66	468.86	556.24	86.58	85.77	955.15
AD21	466.90	466.10	555.72	88.82	78.15	1040.92
AD23	464.55	463.75	555.24	90.69	41.63	1119.07
AD25	463.03	462.23	554.98	91.95	22.17	1160.70
AD26	462.45	461.65	554.85	92.40	19.24	1182.87
AAD26	462.32	461.47	554.73	92.41	10.79	1202.10
AD28	461.73	460.93	554.66	92.93	23.03	1212.90
AD29	460.02	459.22	554.52	94.50	16.49	1235.93
AD30	459.08	458.28	554.42	95.34	16.64	1252.42
AD31	458.33	457.53	554.32	95.99	14.19	1269.06
AD32	458.33	457.43	554.23	95.90	24.96	1283.25

HECTOMETER: 2, 3, 4, 5, 6, 7, 8, 9, 0, 1, 2
KILOMETER: 1

BRANCH A92–AD75 — Profile (2/2)



DATUM LEVEL: (435) / (455) / (475) / (500)

PIPE DIAMETER: 63 mm-HDPE

PIPE DETAILS: C1/32; AD45: 63PE, 63PE, 40, 50PE; C1/32 C1/32; AD69: ARV 40, 63PE, 63PE; AD75: 63PE, 40, 50PE

STAKE NUMBER	GROUND LEVEL	CROWN PIPE ELEVATION	PIEZOMETRIC LEVEL	PRESSURE ON GROUND	PARTIAL DISTANCE (to next stake)	ADD DISTANCE
AD32	458.33	457.43	554.23	95.90	24.96	1283.25
AD33	456.52	455.72	554.08	97.56	12.41	1308.22
AD34	455.85	455.05	554.00	98.15	18.83	1320.63
AD35	455.33	454.53	553.89	98.56	23.00	1339.45
AD36	455.53	454.43	553.75	98.22	25.42	1362.46
AD37	454.48	453.68	553.59	99.11	31.00	1387.87
AD38	453.27	452.47	553.40	100.13	23.48	1418.87
AAD39	449.41	448.61	553.26	103.85	20.75	1442.36
AD40	446.74	445.94	553.13	106.39	8.29	1463.11
AD41	444.72	443.92	553.08	108.36	6.62	1471.40
AD42	444.28	443.48	553.04	108.76	11.89	1478.02
AD43	443.13	442.33	552.97	109.84	19.92	1489.90
AD44	442.75	441.95	552.84	110.09	13.84	1509.83
AD45	442.72	441.72	552.76	110.04	24.52	1523.67
AD46	442.84	442.04	552.61	109.77	41.58	1548.19
AD47	444.34	443.54	552.35	108.01	20.03	1589.77
AD48	446.03	445.23	552.23	106.20	16.59	1609.79
AD49	448.85	448.05	552.13	103.28	29.66	1626.39
AD50	453.07	452.27	551.95	98.88	35.86	1656.05
AD51	458.00	457.20	551.73	93.73	31.81	1691.91
AD52	463.06	462.26	551.53	88.47	39.36	1723.72
AD53	469.57	468.77	551.29	81.72	38.79	1763.08
AD54	474.64	473.84	551.05	76.41	33.80	1801.87
AD55	479.28	478.48	550.85	71.57	18.47	1835.67
AD56	481.34	480.54	550.73	69.39	24.13	1854.14
AD57	485.38	484.58	550.59	65.21	12.52	1878.27
AD58	486.94	486.14	550.51	63.57	37.34	1890.79
AD59	494.42	493.42	550.28	55.86	27.40	1928.13
AD60	494.38	493.58	550.11	55.73	54.33	1955.53
AD61	507.32	506.52	549.78	42.46	39.33	2009.86
AD62	512.08	511.28	549.54	37.46	25.72	2049.19
AD63	514.46	513.66	549.38	34.92	40.97	2074.91
AD64	518.63	517.83	549.13	30.50	45.89	2115.88
AD65	521.66	520.86	548.85	27.19	39.59	2161.77
AD66	523.64	522.84	548.61	24.97	33.25	2201.36
AD67	526.12	525.32	548.40	22.28	4.15	2234.62
AD68	526.53	525.43	548.38	21.85	6.61	2238.77
AD69	526.67	525.47	548.34	21.67	24.61	2245.37
AD70	526.13	525.33	548.19	22.06	18.04	2269.98
AD71	525.71	524.91	548.08	22.37	14.24	2288.02
AD72	525.41	524.61	547.99	22.58	18.31	2302.26
AD73	525.16	524.36	547.88	22.72	19.48	2320.57
AD74	524.76	523.96	547.76	23.00	27.21	2340.05
AD75	523.94	522.94	547.59	23.65		2367.25

HECTOMETER: 3, 4, 5, 6, 7, 8, 9, 0, 1, 2, 3
KILOMETER: 2

HYDRAULIC LEGEND

- PIPELINE
- FLOW DIRECTION
- GATE VALVE
- TEE
- REDUCER
- EXISTING WELL
- FLANGED ADAPTER
- END CAPS
- BEND 1/8 (C1/8)
- ARV (SINGLE AIR VALVE - SAV)
- W.O (WASHOUT)
- EXISTING PIPE
- WATER METER W.M.
- S.M.D. ## — SEE MANHOLE DETAILS OF STAKE ## ON NETWORK PLANS
- FIRE HYDRANT

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=0.2 mm FOR HDPE PIPES
- FOR PIPELINE TRENCH DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP05
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 477W-DS-STDP010 & 477W-DS-STDP11
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG 477W-DS-STDP12
- PIPE MATERIAL : DUCTILE IRON
- ALL PIPE FITTINGS AND ACCESSORIES ARE PN16, UNLESS OTHERWISE SPECIFIED
- ALL PIPES SHOULD BE EXECUTED IN PUBLIC OR EXPROPRIATED ROADS
- BETWEEN STAKES "A'4& A'5" AND STAKES "AD43 & AD44" BRIDGE CROSSING. FOR BRIDGE CROSSING DETAILS REFER TO STANDARD DWG 477W-DS-STD06

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB – HAJAL Bldg
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FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO AND QBOULA DISTRIBUTION NETWORK

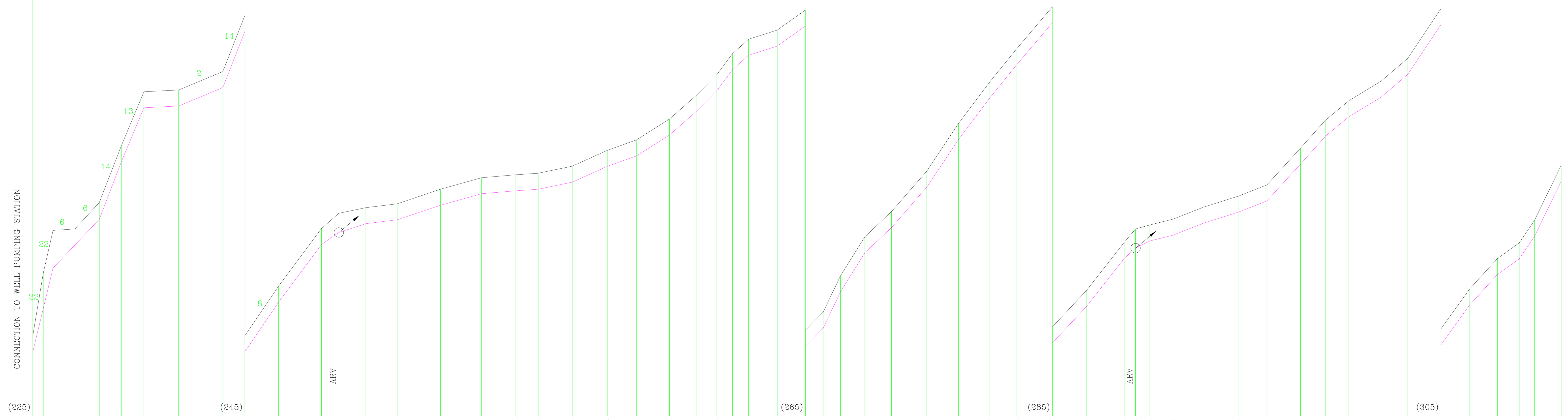
PROFILE

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477-DS-01PR	C.ELIAS	M.HAHMOUD	W.SEIFEDDINE

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	H= 1/2000 V= 1/200	2/2	477-DS-01PR02

BRANCH P.S.-L1
L= 2622 m
D= 100 mm
Q= 9.60 l/s
V= 1.22 m/s
J= 0.0225 m/m
JL= 59.00 m

FLOW DIRECTION



DATUM LEVEL: (225) P.S.–M9; (245) M8–L117; (265) L116–L108; (285) L107–L94; (305) L93–L88

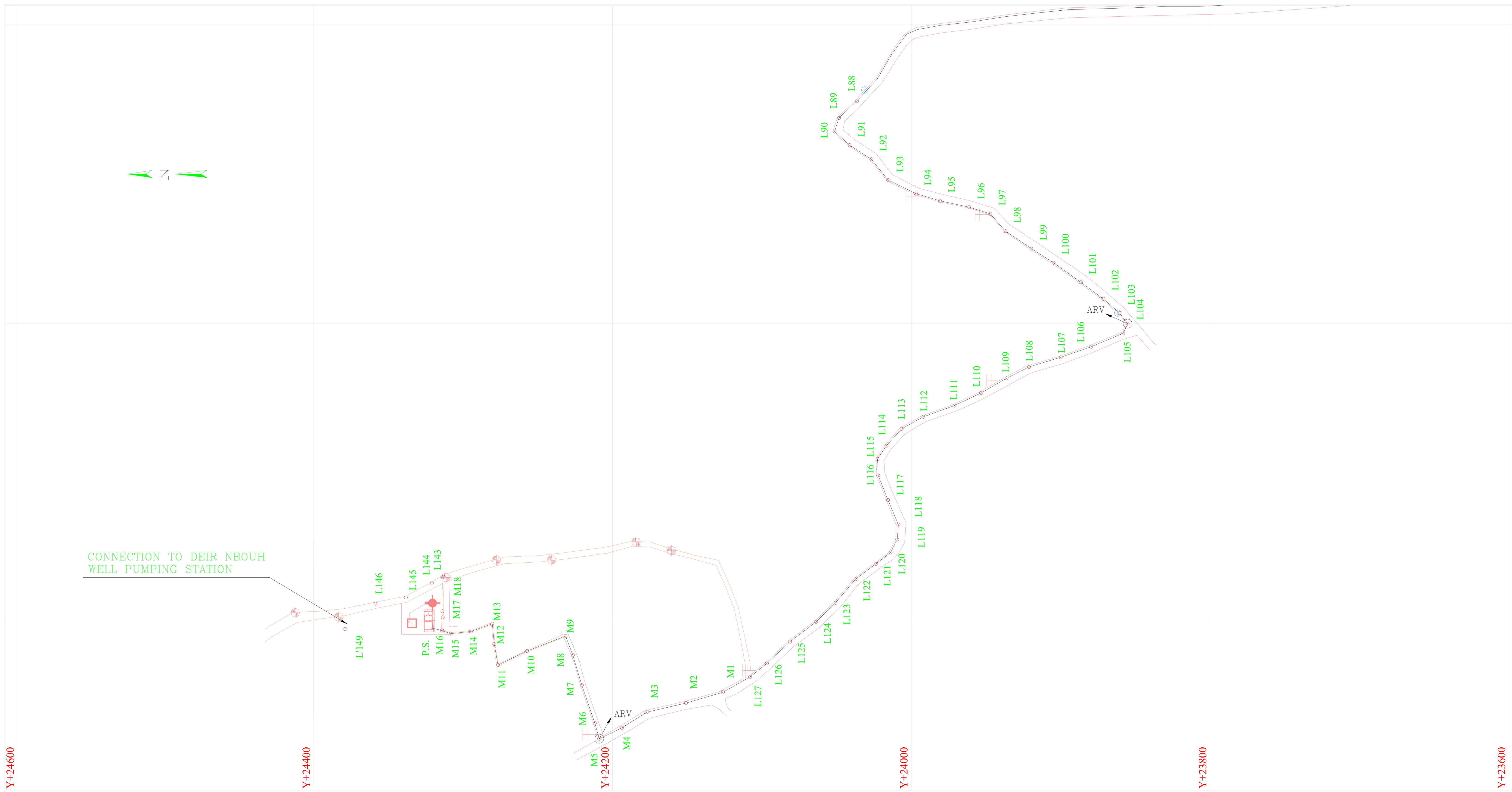
STAKE NUMBER	GROUND LEVEL	CROWN PIPE ELEVATION	PIEZOMETRIC LEVEL	PRESSURE ON GROUND	PARTIAL DISTANCE	ADD DISTANCE
P.S.	230.00	229.00	572.00	342.00		0.00
M16	233.93	231.72	571.83	337.90	6.57	6.57
M15	236.60	234.25	571.68	335.08	6.08	12.65
M14	236.69	235.69	571.37	334.68	13.70	26.36
M13	238.34	237.29	571.03	332.69	15.20	41.56
M12	241.88	240.88	570.71	328.83	13.76	55.32
M11	245.26	244.26	570.38	325.12	14.12	69.44
M10	245.37	244.37	569.89	324.52	21.69	91.13
M9	246.52	245.52	569.27	322.75	27.59	118.73
M8	250.02	249.02	568.95	318.93	13.76	132.49
M7	253.10	252.10	568.47	315.37	20.96	153.45
M6	256.72	255.72	567.86	311.14	26.93	180.38
M5	257.67	256.47	567.62	309.95	10.83	191.21
M4	258.02	257.02	567.24	309.22	16.84	208.05
M3	258.26	257.26	566.80	308.54	19.61	227.67
M2	259.17	258.17	566.19	307.02	26.98	254.64
M1	259.89	258.89	565.61	305.72	25.72	280.37
L127	260.07	259.07	565.14	305.07	20.95	301.32
L126	260.17	259.17	564.82	304.65	14.42	315.74
L125	260.61	259.61	564.34	303.73	21.24	336.98
L124	261.60	260.60	563.84	302.24	21.88	358.86
L123	262.25	261.25	563.43	301.18	18.19	377.05
L122	263.56	262.56	562.97	299.41	20.73	397.77
L121	265.06	264.06	562.58	297.52	17.02	414.79
L120	266.33	265.33	562.30	295.97	12.53	427.32
L119	267.64	266.64	562.08	294.44	9.77	437.09
L118	268.54	267.54	561.85	293.31	10.03	447.12
L117	269.11	268.11	561.45	292.34	17.89	465.01
L116	270.37	269.37	561.05	290.68	17.67	482.68
L115	271.50	270.50	560.80	289.30	11.06	493.74
L114	273.76	272.76	560.55	286.79	10.78	504.52
L113	276.20	275.20	560.21	284.01	15.20	519.72
L112	277.77	276.77	559.83	282.06	16.63	536.35
L111	280.30	279.30	559.33	279.03	22.06	558.41
L110	283.27	282.27	558.88	275.61	19.77	578.17
L109	285.88	284.88	558.43	272.55	19.67	597.85
L108	287.96	286.96	558.05	270.09	16.87	614.71
L107	290.57	289.57	557.55	266.98	22.16	636.87
L106	292.87	291.87	557.06	264.19	21.50	658.37
L105	295.85	294.85	556.53	260.68	23.36	681.74
L104	296.69	295.49	556.37	259.68	7.09	688.82
L103	296.94	295.94	556.17	259.23	8.90	697.73
L102	297.30	296.30	555.85	258.55	14.47	712.19
L101	298.04	297.04	555.42	257.38	18.77	730.96
L100	298.75	297.75	554.92	256.17	22.36	753.32
L99	299.44	298.44	554.53	255.09	17.54	770.86
L98	301.74	300.74	554.05	252.31	21.01	791.87
L97	303.47	302.47	553.70	250.23	15.44	807.32
L96	304.70	303.70	553.37	248.67	14.73	822.05
L95	305.92	304.92	552.91	246.99	20.11	842.16
L94	307.35	306.35	552.54	245.19	16.73	858.90
L93	310.45	309.45	552.07	241.62	20.68	879.57
L92	312.95	311.95	551.66	238.71	17.99	897.57
L91	314.85	313.85	551.26	236.41	17.38	914.95
L90	315.82	314.82	550.96	235.14	13.54	928.49
L89	317.23	316.23	550.74	233.51	9.53	938.02
L88	320.67	319.67	550.36	229.69	16.71	954.73

PIPE DIAMETER: 100 mm – DI

PIPE DETAILS: C1/32, C1/32, C1/32, C1/32; 60, 100DI, 100DI (at M5); 60, 100DI, 100DI (at L104)

HECTOMETER: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

KILOMETER: 0



DAV (PN40)	
M5–L104	
60, 100DI, 100DI	
TEE 100mm x 60mm x 100mm	1
DAV + G.V. 60mm	1
MANHOLE 125 x 100 cm	1

STAKE	HORIZONTAL BEND(S)
M16	C1/32
M15	C1/16
M14	C1/32
M13	C1/4+1/32
M11	C1/4+1/32
M9	C1/4
M5	C1/4+1/32
M3	C1/16
M1	C1/32
L127	C1/32
L122	C1/32
L120	C1/16
L119	C1/16
L118	C1/16
L116	C1/16
L115	C1/16+1/32
L114	C1/32
L113	C1/16
L112	C1/32
L108	C1/32
L105	C1/8
L104	C1/8+1/32
L103	C1/32
L98	C1/32
L97	C1/16+1/32
L94	C1/32
L93	C1/16
L92	C1/16
L91	C1/32
L90	C1/8+1/16
L89	C1/16

HYDRAULIC LEGEND

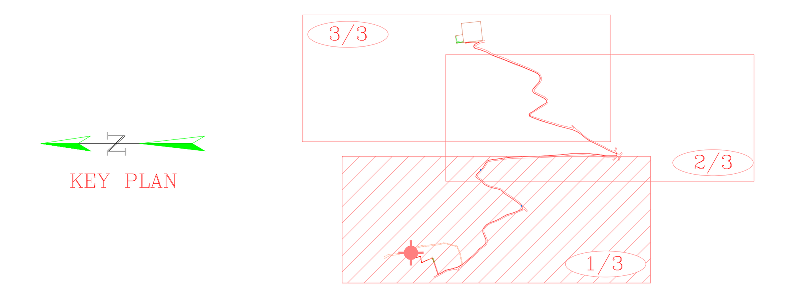
GROUND LEVEL
CROWN PIPE ELEVATION
FLOW DIRECTION
GATE VALVE
CHECK VALVE
TEE
TAPER
PRESSURE REGULATING VALVE (P.R.V)
BEND 1/8 (C1/8)
ARV (DOUBLE AIR VALVE - DAV)
W.O (WASHOUT)
FLANGED ADAPTER
END CAPS

TOPOGRAPHICAL LEGEND

BUILDING
PAVED ROAD
CONCRETE ROAD
TRACK
REFERENCE LINE
CHANNEL (channel)
TERRACE
FENCE
STREAM/RIVER
CULVERT/BRIDGE
SPRING (Spr)
WELL
DECIDUOUS/PINE TREE
TREE
ROCKS
DownHill
High-Hill
MANHOLE SEWER (mh-s)
MANHOLE WATER (mh-w)
MANHOLE TELEPHONE (mh-t)
MANHOLE NOT IDENTIFIED (MH)
LIGHTING POLE
ELECTRICAL / TELEPHONE POLE (EP/TP)
TOPOGRAPHICAL STATION (s1)
ELECTRIC SUB STATION (EL.S.S)
ELECTRIC POLE/TELEGRAPH POLE
STAKE POINT + STAKE NAME (A1)
SPOT HEIGHT (1160.12)
PLOT No (1262)
PLOT BOUNDARY
CIRCONSCRIPTION BOUNDARY
WELL
RESERVOIR

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.
- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 476STDP10.
- FOR PIPELINE TRENCH DETAILS AND CONCRETE SURROUND REFER TO STANDARD DWGS Nb 476STDP03 , 476STDP04, 476STDP05 AND 476STDP06.
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWGS Nb 476STDP07 AND 476STDP08.
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 476STDP09.
- 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 ROADS.
- THE PROPOSED PIPES SHOULD BE LAID TAKING INTO CONSIDERATION THE PRESENCE OF THE EXISTING PIPES AND UTILITIES.
- BETWEEN STAKES P.S.-M15, M13-M12 AND M9-M8 AN ANCHOR BLOCK SHOULD BE EXECUTED FOR EACH OF THE PIPES .
- 63mm HDPE PIPES FOR TELEMETRY CABLES SHOULD BE LAID PARALLEL TO THE LIFT LINE.



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

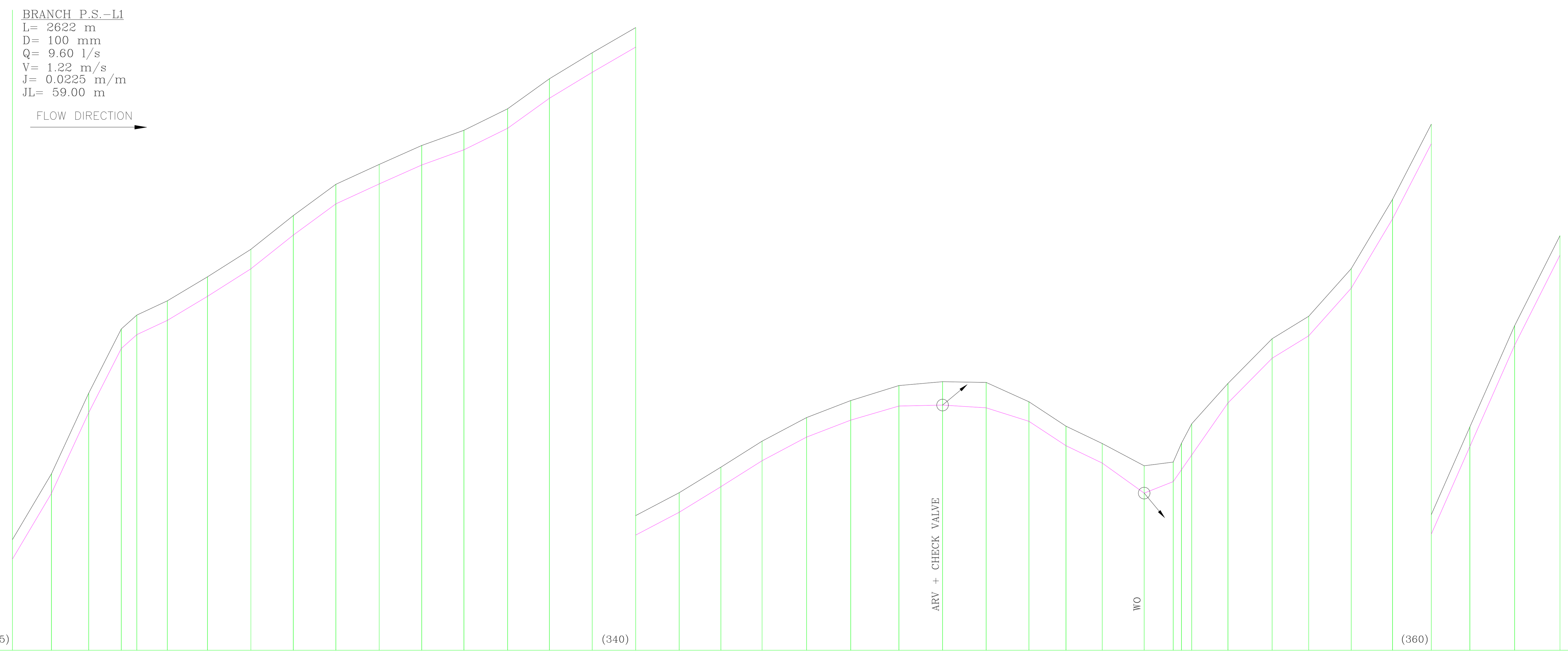
BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
JALL ED DIB – HAJAL Bldg TEL:(04) 712157 / 712158
P.O.BOX:70492 – ANTELIAS FAX: (04) 712159

CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH LIFT LINE | PROFILE AND PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-02DS-PR	C. SAWAYA	C. SAWAYA	T. RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	H: 1/2000 V: 1/200	1/3	477W-02DS-PR01



DATUM LEVEL (315) (340) (360)

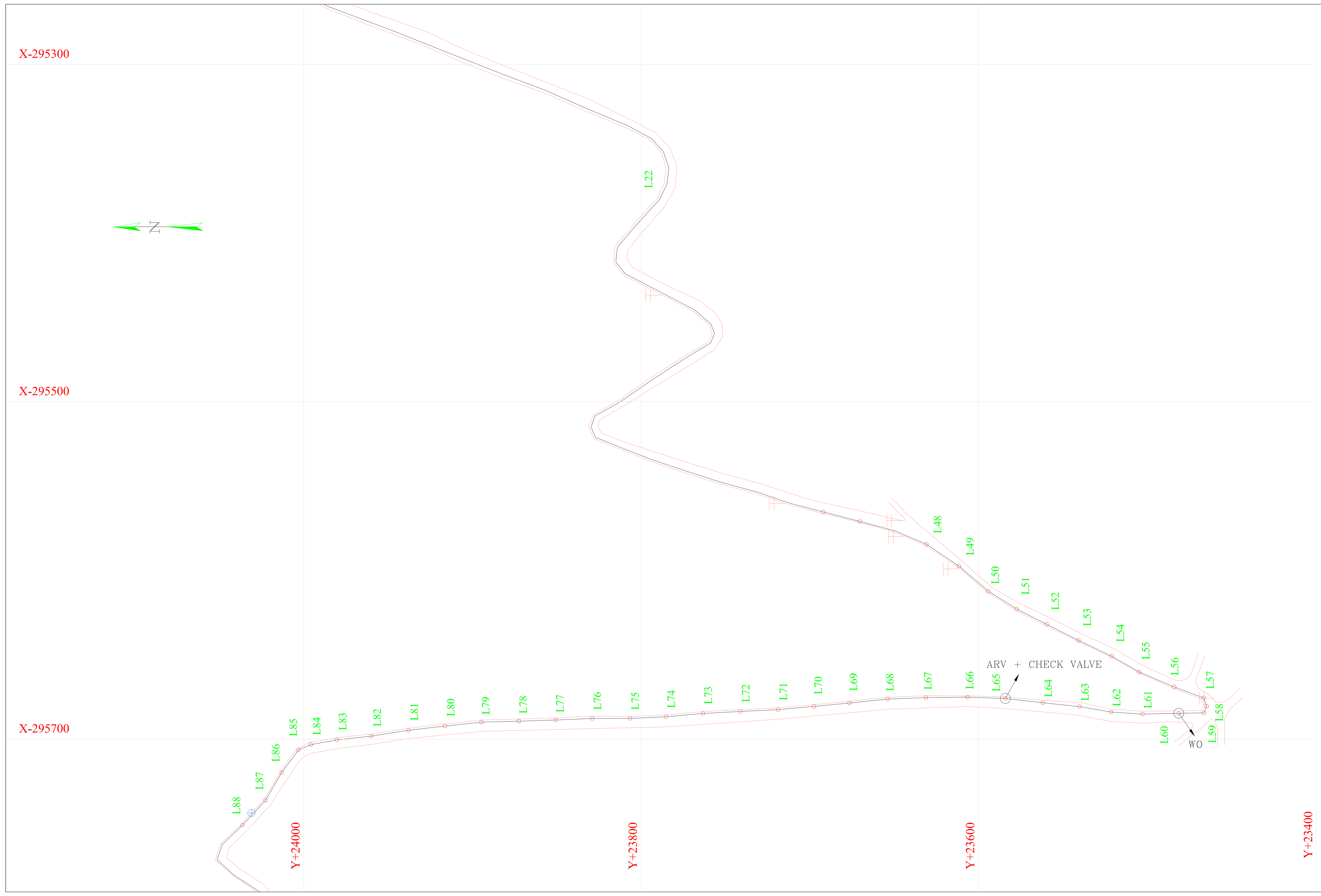
STAKE NUMBER	GROUND LEVEL	CROWN PIPE ELEVATION	PIEZOMETRIC LEVEL	PRESSURE ON GROUND	PARTIAL DISTANCE	ADD DISTANCE
L88	320.67	319.67	550.36	229.69		954.73
L87	324.04	323.04	549.90	225.86	20.01	974.74
L86	328.17	327.17	549.46	221.29	19.10	993.84
L85	331.46	330.46	549.08	217.62	16.72	1010.56
L84	332.17	331.17	548.90	216.73	7.96	1018.53
L83	332.90	331.90	548.55	215.65	15.63	1034.16
L82	334.13	333.13	548.08	213.95	20.61	1054.77
L81	335.54	334.54	547.58	212.04	22.24	1077.01
L80	337.27	336.27	547.09	209.82	21.78	1098.79
L79	338.87	337.87	546.60	207.73	21.81	1120.59
L78	339.89	338.89	546.10	206.21	22.21	1142.80
L77	340.86	339.86	545.61	204.75	21.82	1164.62
L76	341.64	340.64	545.12	203.48	21.65	1186.27
L75	342.74	341.74	544.61	201.87	22.40	1208.68
L74	344.28	343.28	544.13	199.85	21.44	1230.12
L73	345.61	344.61	543.63	198.02	21.94	1252.05
L72	346.90	345.90	543.13	196.23	22.30	1274.35
L71	348.07	347.07	542.63	194.56	22.30	1296.66
L70	349.38	348.38	542.15	192.77	21.39	1318.05
L69	350.71	349.71	541.67	190.96	21.11	1339.16
L68	351.92	350.92	541.16	189.24	22.83	1361.99
L67	352.79	351.79	540.65	187.86	22.62	1384.61
L66	353.56	352.51	540.09	186.53	24.73	1409.34
L65	353.76	352.56	539.59	185.83	22.38	1431.72
L64	353.72	352.42	539.08	185.36	22.37	1454.09
L63	352.73	351.73	538.59	185.86	21.91	1476.00
L62	351.48	350.48	538.16	186.68	19.00	1495.00
L61	350.59	349.59	537.74	187.15	18.59	1513.58
L60	349.45	348.05	537.26	187.81	21.52	1535.10
L59	349.64	348.64	536.92	187.28	14.89	1550.00
L58	350.61	349.25	536.83	186.22	4.24	1554.24
L57	351.60	350.00	536.71	185.11	5.24	1559.48
L56	353.67	352.67	536.28	182.61	18.60	1578.07
L55	355.96	354.96	535.77	179.81	22.63	1600.71
L54	357.11	356.11	535.35	178.24	18.77	1619.47
L53	359.55	358.55	534.86	175.31	21.80	1641.28
L52	363.10	362.10	534.37	171.27	21.18	1662.46
L51	366.95	365.95	533.92	166.97	19.89	1682.35
L50	371.44	370.44	533.46	162.02	19.77	1702.12
L49	376.63	375.63	532.93	156.30	22.96	1725.08
L48	381.24	380.24	532.40	151.16	23.25	1748.33

PIPE DIAMETER: 100 mm - DI

PIPE DETAILS: 100DI — 100DI (L65); 100DI — 100DI, 80 (L60)

HECTOMETER: 0 1 2 3 4 5 6 7

KILOMETER: 1



ARV + CHECK VALVE (PN25)	
L65	
100DI — FLOW DIRECTION — 100DI	
TEE 100mm x 50mm x 100mm	1
3F ANTI-SHOCK AIR VALVE DN50*6 (ANTI-HAMMER 6mm (max.) ORIFICE)	1
CHECK VALVE PN25 DN100	1
OPEN BYPASS DN20	1
VENTED MANHOLE 225 x 150 cm	1

WO (PN25)	
L60	
100DI — 100DI, 80, 90PE	
WO 80mm	1
MANHOLE 150 x 150 cm	1

ADDITIONAL NOTES:

1- 3F ANTI-SHOCK AIR RELEASE VALVE PN25 DN50*6, ANTI-HAMMER ORIFICE FACTORY CALIBRATED TO A MAXIMUM OF 6mm, DESIGN SIMILAR TO CSA OR VENTOMAT.

2- CHECK VALVE (BACKFLOW RESTRICTOR): INLINE NON RETURN VALVE DN100 PN25, TILTED OR NOZZLE TYPE FITTED WITH INTEGRATED OR EXTERNAL OPEN BYPASS DN20mm, EUROPEAN MADE PRODUCT OF HIGH QUALITY.

STAKE	HORIZONTAL BEND(S)
L87	C1/32
L85	C1/16
L84	C1/32
L59	C1/8+1/16
L58	C1/8
L57	C1/8
L50	C1/32
L48	C1/32

HYDRAULIC LEGEND

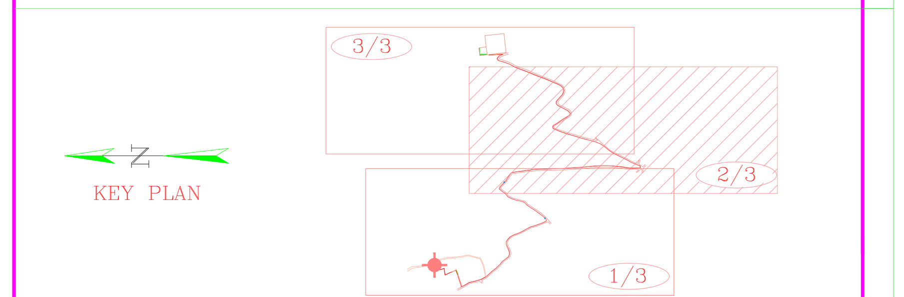
GROUND LEVEL
CROWN PIPE ELEVATION
FLOW DIRECTION
GATE VALVE
CHECK VALVE
TEE
TAPER
PRESSURE REGULATING VALVE (P.R.V)
BEND 1/8 (C1/8)
ARV (DOUBLE AIR VALVE - DAV)
W.O (WASHOUT)
FLANGED ADAPTER
END CAPS

TOPOGRAPHICAL LEGEND

BUILDING
PAVED ROAD
CONCRETE ROAD
TRACK
REFERENCE LINE
CHANNEL (channel)
TERRACE
FENCE
STREAM/RIVER
CULVERT/BRIDGE
SPRING (Spr)
WELL
DECIDUOUS/PINE TREE
TREE
ROCKS
DownHill
High-Hill
MANHOLE SEWER (mh-s)
MANHOLE WATER (mh-w)
MANHOLE TELEPHONE (mh-t)
MANHOLE NOT IDENTIFIED (MH)
LIGHTING POLE
ELECTRICAL / TELEPHONE POLE (EP/TP)
TOPOGRAPHICAL STATION (s1)
ELECTRIC SUB STATION (EL.S.S)
ELECTRIC POLE/TELEGRAPH POLE
STAKE POINT + STAKE NAME (A1)
SPOT HEIGHT (1160.12)
PLOT No (1262)
PLOT BOUNDARY
CIRCONSCRIPTION BOUNDARY
WELL
RESERVOIR

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.
- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 476STDP10.
- FOR PIPELINE TRENCH DETAILS AND CONCRETE SURROUND REFER TO STANDARD DWGS Nb 476STDP03 , 476STDP04, 476STDP05 AND 476STDP06.
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWGS Nb 476STDP07 AND 476STDP08.
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 476STDP09.
- 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 ROADS.
- THE PROPOSED PIPES SHOULD BE LAID TAKING INTO CONSIDERATION THE PRESENCE OF THE EXISTING PIPES AND UTILITIES.
- BETWEEN STAKES P.S.-M15, M13-M12 AND M9-M8 AN ANCHOR BLOCK SHOULD BE EXECUTED FOR EACH OF THE PIPES .
- 63mm HDPE PIPES FOR TELEMETRY CABLES SHOULD BE LAID PARALLEL TO THE LIFT LINE.



KEY PLAN

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
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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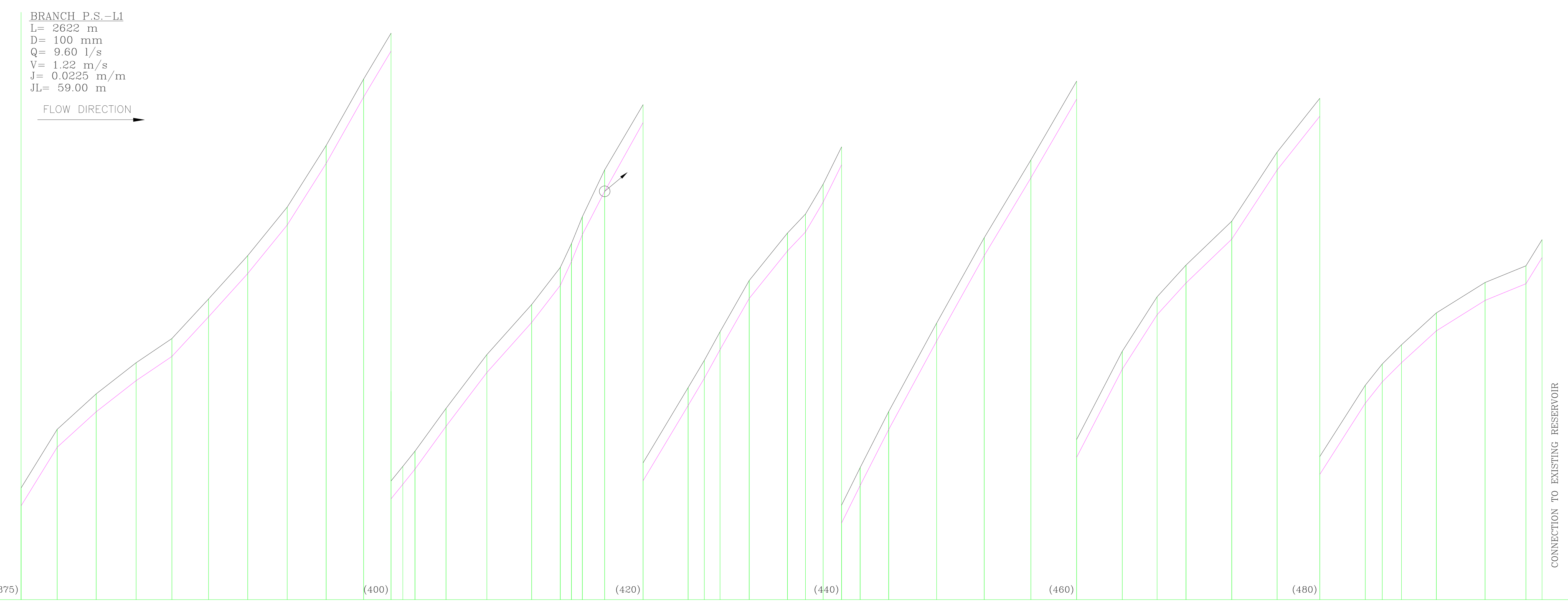
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

DEIR NBOUH LIFT LINE | PROFILE AND PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-02DS-PR	C. SAWAYA	C. SAWAYA	T. RMEITY

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	H: 1/2000 V: 1/200	2/3	477W-02DS-PR02



DATUM LEVEL: (375) (400) (420) (440) (460) (480)

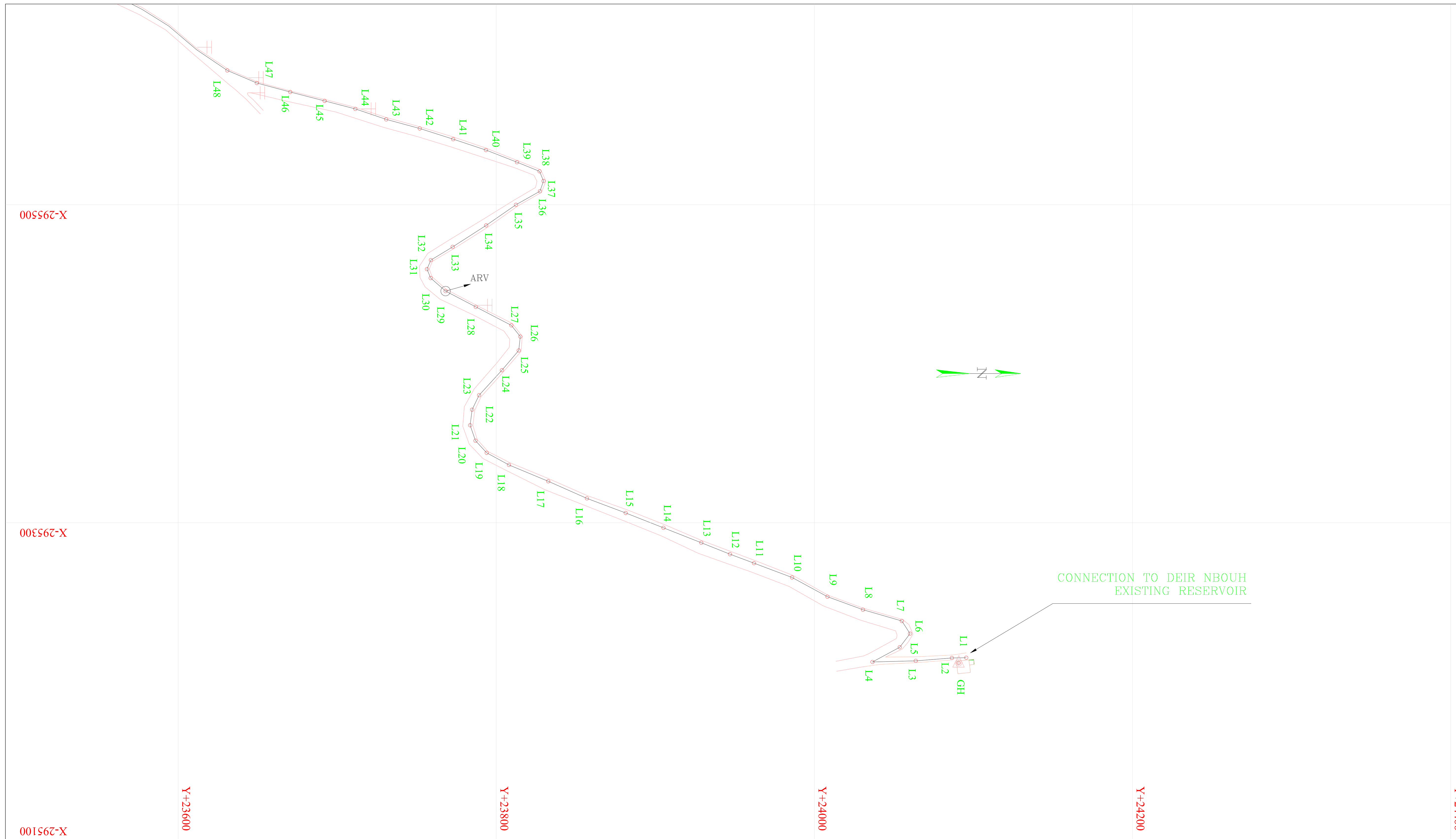
STAKE NUMBER	GROUND LEVEL	CROWN PIPE ELEVATION	PIEZOMETRIC LEVEL	PRESSURE ON GROUND	PARTIAL DISTANCE	ADD DISTANCE
L48	381.24	380.24	532.40	151.16	20.16	1748.33
L47	384.51	383.51	531.94	147.43	21.77	1768.49
L46	386.49	385.49	531.45	144.96	22.32	1790.26
L45	388.23	387.23	530.94	142.71	19.97	1812.58
L44	389.58	388.58	530.49	140.91	20.48	1832.55
L43	391.79	390.79	530.03	138.24	21.87	1853.04
L42	394.21	393.21	529.53	135.32	22.04	1874.91
L41	396.92	395.92	529.03	132.11	21.75	1896.95
L40	400.36	399.36	528.54	128.18	20.93	1918.69
L39	404.07	403.07	528.06	123.99	15.31	1939.63
L38	406.63	405.63	527.71	121.08	6.57	1954.94
L37	407.44	406.44	527.56	120.12	6.81	1961.50
L36	408.29	407.29	527.41	119.12	17.33	1968.31
L35	410.68	409.68	527.01	116.33	22.78	1985.64
L34	413.68	412.68	526.50	112.82	25.04	2008.42
L33	416.48	415.48	525.93	109.45	15.99	2033.46
L32	418.55	417.55	525.57	107.02	6.22	2049.46
L31	419.88	418.88	525.42	105.54	6.08	2055.67
L30	421.38	420.38	525.28	103.90	12.47	2061.75
L29	424.00	422.80	525.00	101.00	21.45	2074.22
L28	427.64	426.64	524.51	96.87	25.16	2095.68
L27	431.84	430.84	523.93	92.09	9.03	2120.84
L26	433.36	432.36	523.73	90.37	8.80	2129.87
L25	434.96	433.96	523.53	88.57	16.27	2138.67
L24	437.82	436.82	523.15	85.33	21.37	2154.94
L23	440.47	439.47	522.67	82.20	10.06	2176.30
L22	441.53	440.53	522.44	80.91	9.87	2186.37
L21	443.20	442.20	522.22	79.02	10.29	2196.24
L20	445.28	444.28	521.98	76.70	10.36	2206.54
L19	447.37	446.37	521.74	74.37	15.94	2216.90
L18	450.50	449.50	521.38	70.88	26.78	2232.84
L17	455.44	454.44	520.76	65.32	26.58	2259.62
L16	460.21	459.21	520.16	59.95	26.06	2286.20
L15	464.55	463.55	519.56	55.01	25.54	2312.25
L14	468.95	467.95	518.98	50.03	25.51	2337.79
L13	473.87	472.87	518.40	44.53	19.43	2363.31
L12	476.91	475.91	517.95	41.04	16.14	2382.74
L11	478.68	477.68	517.59	38.91	25.54	2398.88
L10	481.13	480.13	517.01	35.88	25.34	2424.41
L9	484.99	483.99	516.43	31.44	23.81	2449.75
L8	487.99	486.99	515.89	27.90	25.43	2473.57
L7	491.97	490.97	515.31	23.34	9.48	2498.99
L6	493.16	492.16	515.10	21.94	10.74	2508.47
L5	494.23	493.23	514.86	20.63	19.47	2519.21
L4	496.01	495.01	514.42	18.41	27.20	2538.68
L3	497.71	496.71	513.80	16.09	22.81	2565.89
L2	498.64	497.64	513.29	14.65	9.00	2588.70
L1	500.10	499.10	513.08	12.98		2597.70

PIPE DIAMETER: 100 mm - DI

PIPE DETAILS: 100DI (tee with air valve at L29) 100DI

HECTOMETER: 8 9 0 1 2 3 4 5

KILOMETER: 2



DAV (PN16)	
L29	
100DI — 100DI	
TEE 100mm x 50mm x 100mm	1
3F ANTI-SHOCK AIR VALVE DN50*9 (ANTI-HAMMER 9mm (max.) ORIFICE)	1
MANHOLE 125 x 100 cm	1

ADDITIONAL NOTE:

3F ANTI-SHOCK AIR RELEASE VALVE PN16 DN50*9, ANTI-HAMMER ORIFICE FACTORY CALIBRATED TO A MAXIMUM OF 9mm, DESIGN SIMILAR TO CSA OR VENTOMAT.

STAKE	HORIZONTAL BEND(S)
L38	C1/8
L37	C1/8
L36	C1/8
L32	C1/16+1/32
L31	C1/8
L30	C1/16
L29	C1/32
L27	C1/16
L26	C1/8
L25	C1/16+1/32
L23	C1/32
L22	C1/16
L21	C1/16
L20	C1/16
L19	C1/16
L9	C1/32
L7	C1/8
L6	C1/8+1/16
L5	C1/16
L4	C1/4+1/8+1/16

STATION	X	Y	Z
GH	-295,211.79	24,090.70	504.93

HYDRAULIC LEGEND

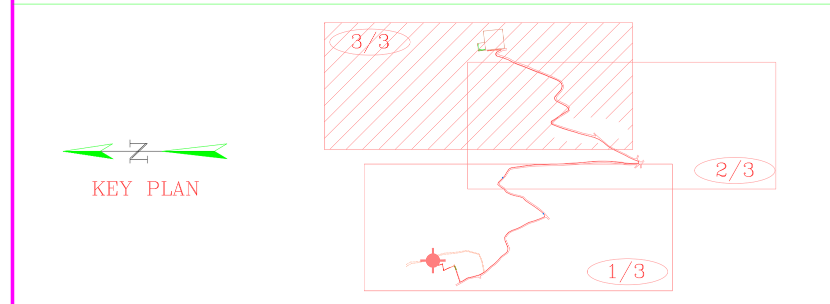
GROUND LEVEL
CROWN PIPE ELEVATION
FLOW DIRECTION
GATE VALVE
CHECK VALVE
TEE
TAPER
PRESSURE REGULATING VALVE (P.R.V)
BEND 1/8 (C1/8)
ARV (DOUBLE AIR VALVE - DAV)
W.O (WASHOUT)
FLANGED ADAPTER
END CAPS

TOPOGRAPHICAL LEGEND

BUILDING
PAVED ROAD
CONCRETE ROAD
TRACK
REFERENCE LINE
CHANNEL (channel)
TERRACE
FENCE
STREAM/RIVER
CULVERT/BRIDGE
SPRING (Spr)
WELL
DECIDUOUS/PINE TREE
TREE
ROCKS
DownHill
High-Hill
MANHOLE SEWER (mh-s)
MANHOLE WATER (mh-w)
MANHOLE TELEPHONE (mh-t)
MANHOLE NOT IDENTIFIED (MH)
LIGHTING POLE
ELECTRICAL / TELEPHONE POLE (EP/TP)
TOPOGRAPHICAL STATION (s1)
ELECTRIC SUB STATION (EL.S.S)
ELECTRIC POLE/TELEGRAPH POLE
STAKE POINT + STAKE NAME (A1)
SPOT HEIGHT (1160.12)
PLOT No (1262)
PLOT BOUNDARY
CIRCONSCRIPTION BOUNDARY
WELL
RESERVOIR

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.
- FOR PIPELINE ANCHORS AND SUPPORT DETAILS REFER TO STANDARD DWG Nb 476STDP10.
- FOR PIPELINE TRENCH DETAILS AND CONCRETE SURROUND REFER TO STANDARD DWGS Nb 476STDP03 , 476STDP04, 476STDP05 AND 476STDP06.
- FOR HORIZONTAL BENDS THRUST BLOCKS DETAILS REFER TO STANDARD DWGS Nb 476STDP07 AND 476STDP08.
- FOR VERTICAL BENDS AND TAPERS THRUST BLOCKS DETAILS REFER TO STANDARD DWG Nb 476STDP09.
- 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 ROADS.
- THE PROPOSED PIPES SHOULD BE LAID TAKING INTO CONSIDERATION THE PRESENCE OF THE EXISTING PIPES AND UTILITIES.
- BETWEEN STAKES P.S.-M15, M13-M12 AND M9-M8 AN ANCHOR BLOCK SHOULD BE EXECUTED FOR EACH OF THE PIPES .
- 63mm HDPE PIPES FOR TELEMETRY CABLES SHOULD BE LAID PARALLEL TO THE LIFT LINE.



Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

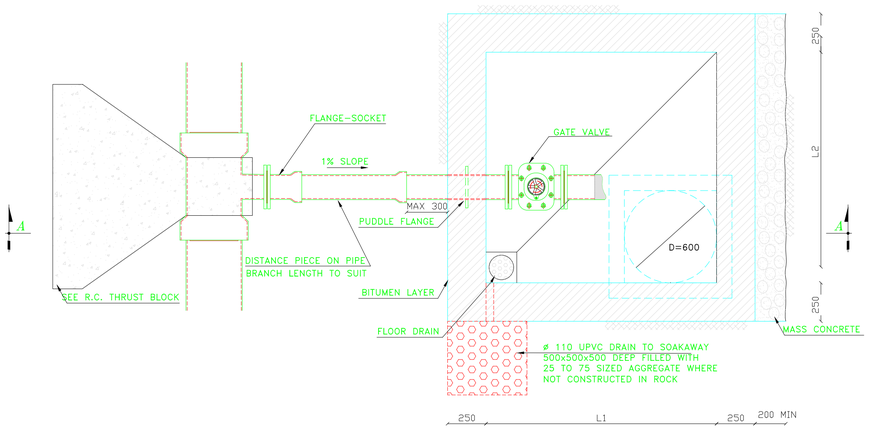
DEIR NBOUH LIFT LINE

PROFILE AND PLAN

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-02DS-PR	C. SAWAYA	C. SAWAYA	T. RMEITY

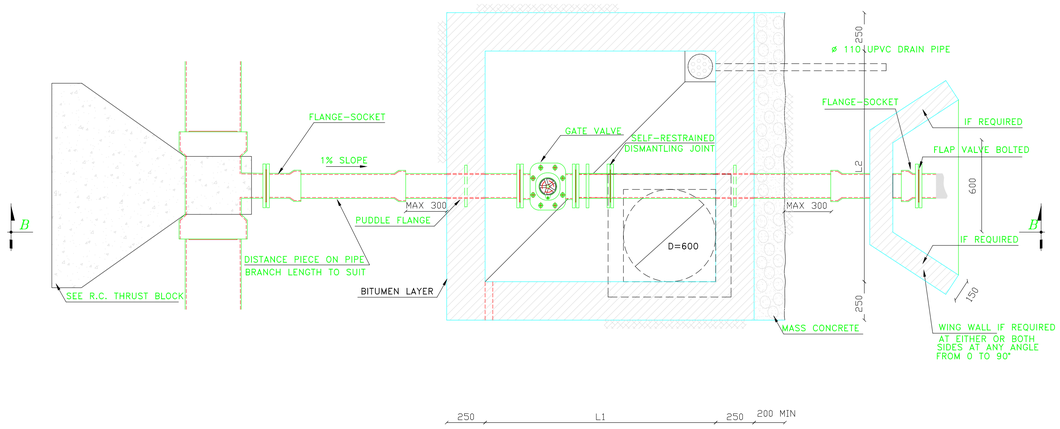
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	H: 1/2000 V: 1/200	3/3	477W-02DS-PR03

TYPICAL WASHOUT CHAMBER DETAIL
TYPE I

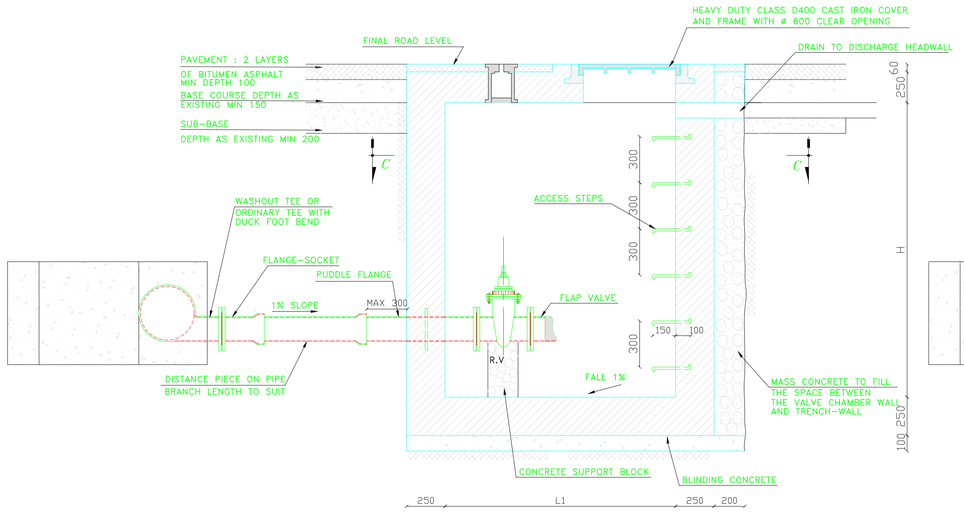


SECTION C-C

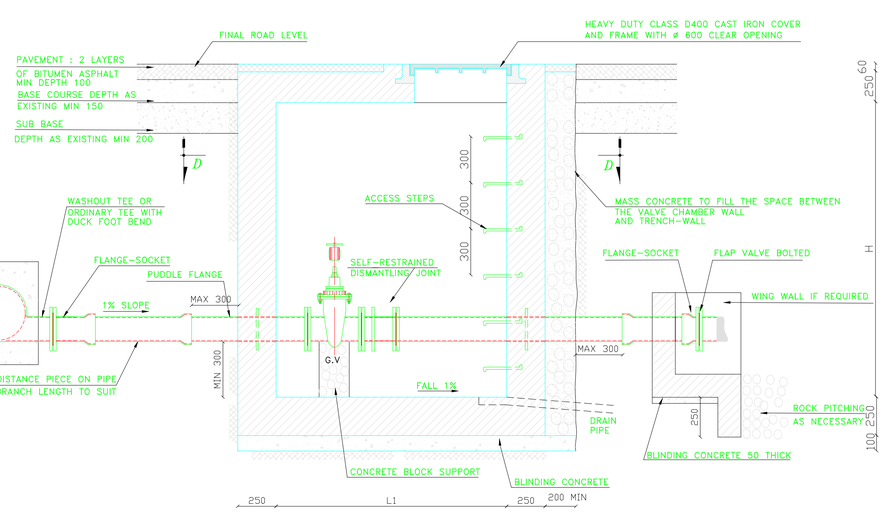
TYPICAL WASHOUT CHAMBER DETAIL
TYPE II



SECTION D-D

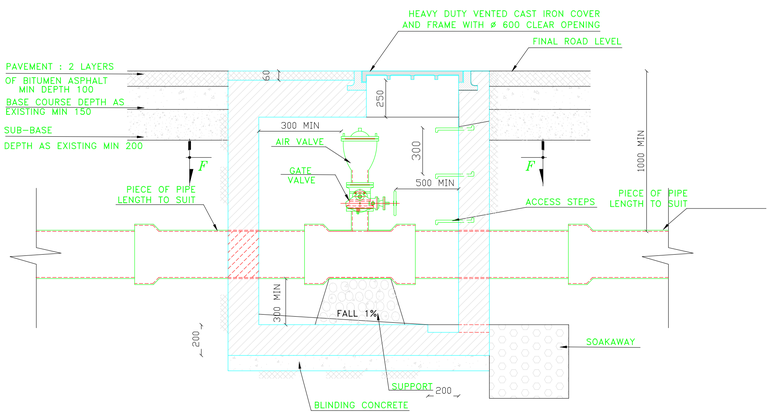


SECTION A-A

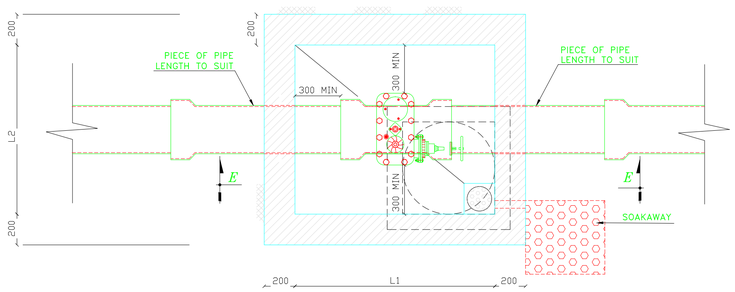


SECTION B-B

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: 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.

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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MINISTRY OF ENERGY AND WATER
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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

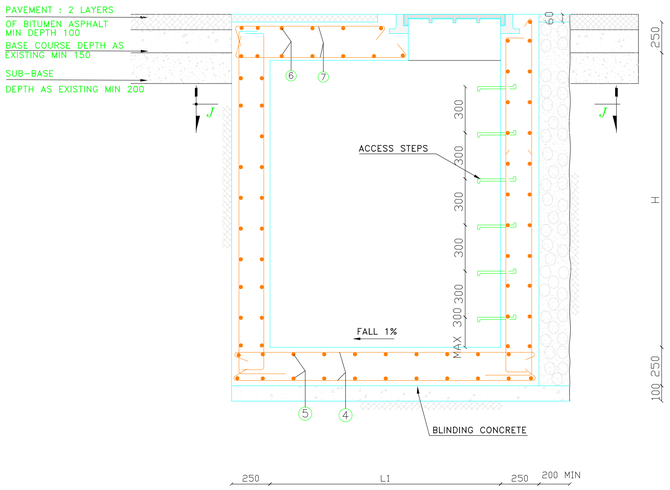
TRANSMISSION AND DISTRIBUTION SYSTEMS

WASHOUT AND AIR VALVE CHAMBER DETAILS

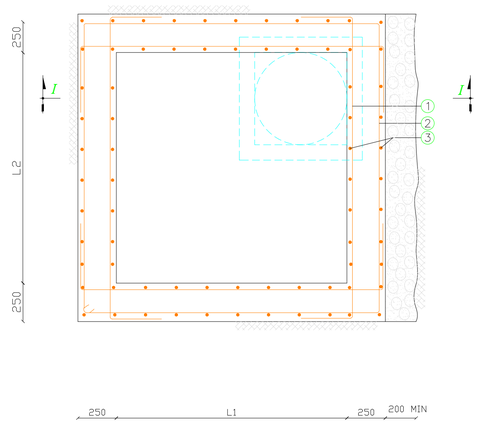
DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	1/23	477W-DS-STD01

TYPICAL REINFORCEMENT DETAIL FOR WASHOUT CHAMBER
NOT TO SCALE

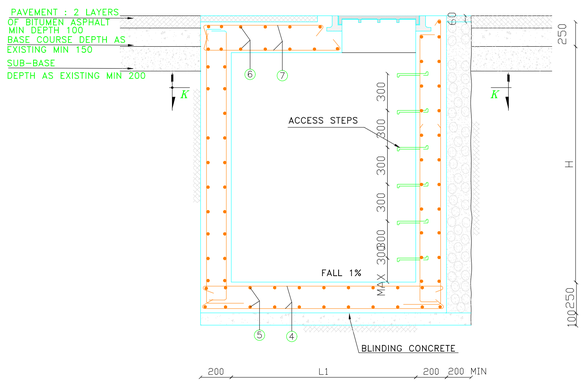


SECTION I-I

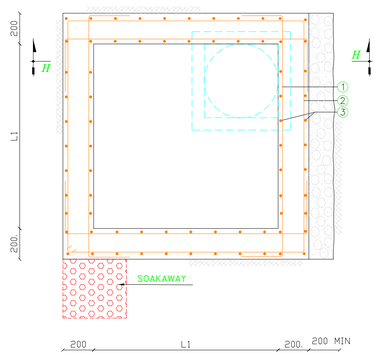


SECTION J-J

TYPICAL REINFORCEMENT DETAIL FOR AIR VALVE CHAMBER
NOT TO SCALE



SECTION H-H



SECTION K-K

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 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
200-250	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
300-400	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
450-600	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
700-800	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
900-1000	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200

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	L2	H
mm	mm	mm	mm	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		
		L1	L2	L1	L2	H
mm	mm	mm	mm	mm	mm	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 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
200	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
250	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
300-350	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200

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 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
500	T14 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
600<D<900	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200

TYPICAL WASHOUT CHAMBER DETAIL FOR DISTRIBUTION PIPELINES

DIMENSIONS TABLE

MAIN PIPE DIAMETER	WASHOUT DIAMETER	DIMENSIONS		
		L1	L2	H
mm	mm	mm	mm	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 @200	T12 @200	T10 @200	T12 @200	T12 @200	T14 @200	T14 @200
150	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T14 @200	T14 @200
200	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T14 @200	T14 @200
250	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T14 @200	T14 @200
300 ≤ ø ≤ 600	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T14 @200	T14 @200

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: ft =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.

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
MINISTRY OF ENERGY AND WATER
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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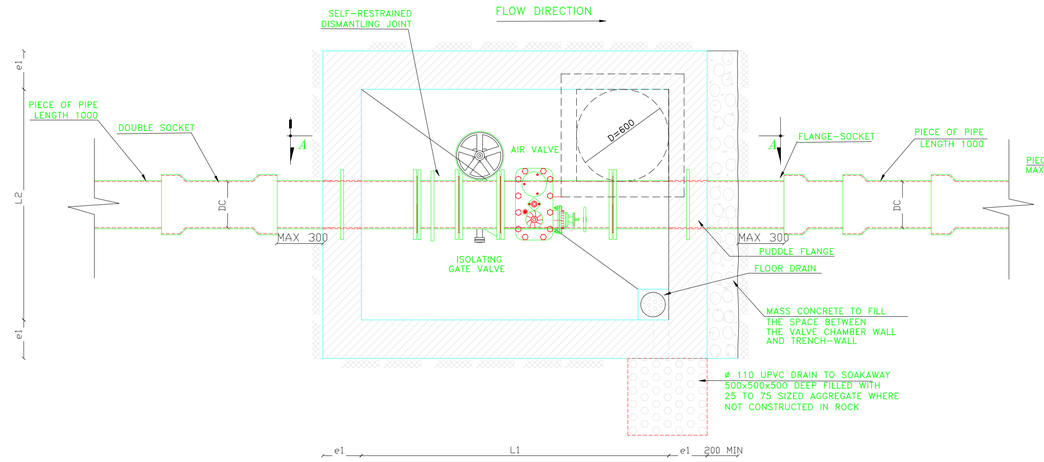
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

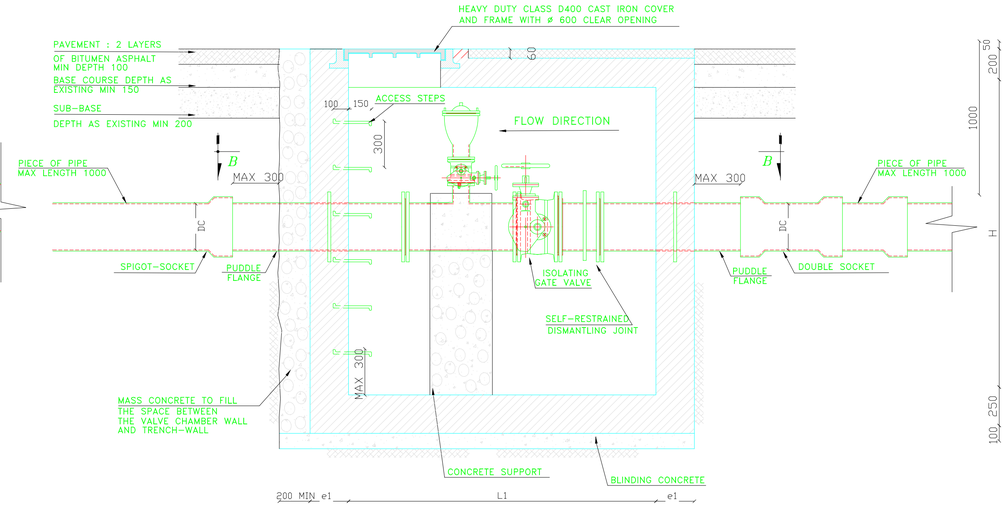
WASHOUT AND AIR VALVE CHAMBER DETAILS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

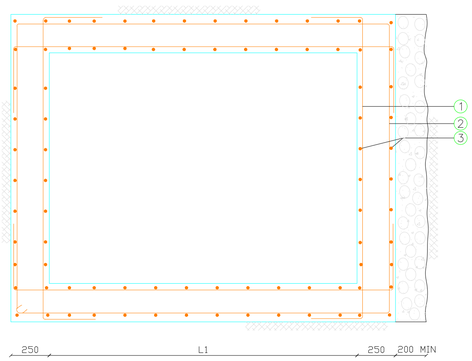
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	1:50 - 1:20	2/23	477W-DS-STD02



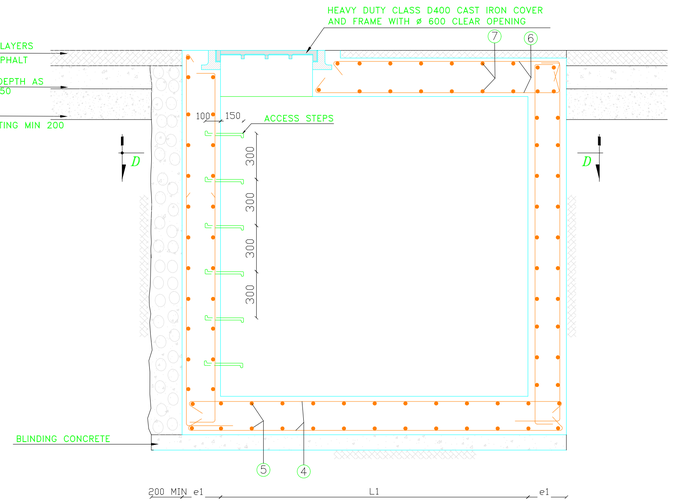
SECTION B–B
TYPICAL STOP VALVE CHAMBER DETAIL



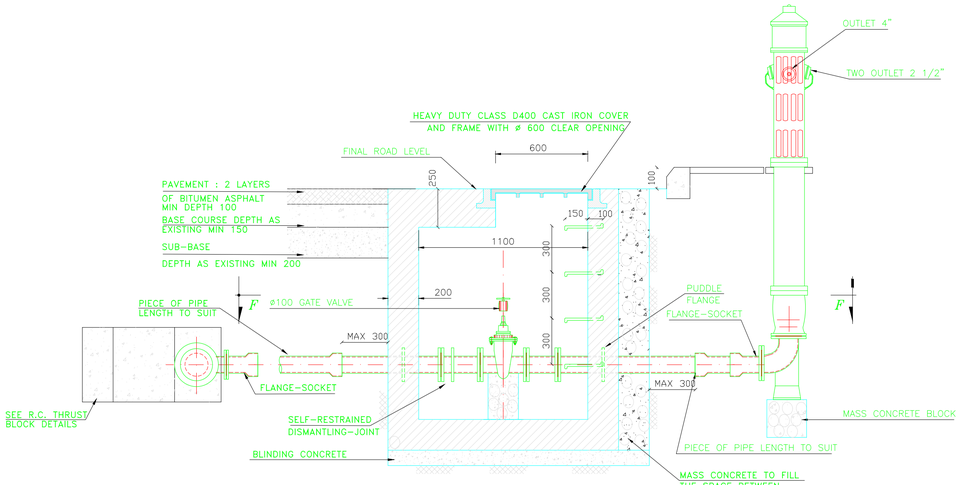
SECTION A–A
TYPICAL STOP VALVE CHAMBER DETAIL



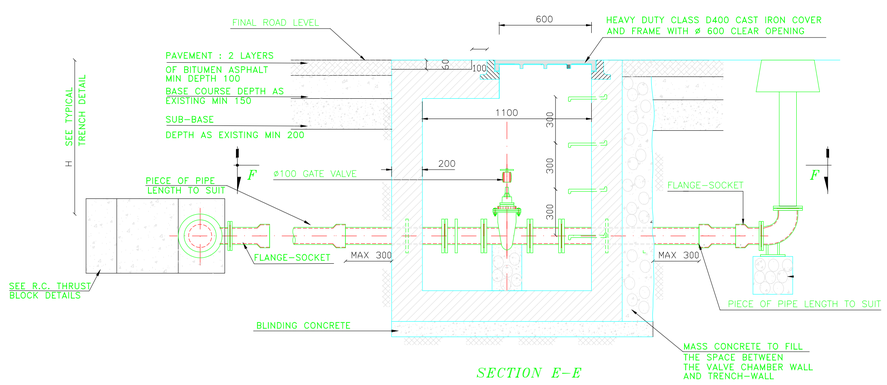
SECTION D–D
TYPICAL AIR VALVE CHAMBER REINFORCEMENT DETAILS



SECTION A–A
TYPICAL VALVE CHAMBER REINFORCEMENT DETAILS



SECTION E–E
PILLAR TYPE



SECTION E–E
POST TYPE FIRE HYDRANT

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.

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

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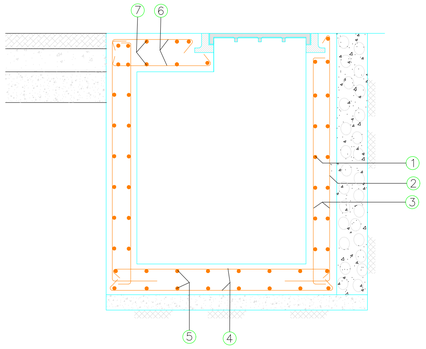
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

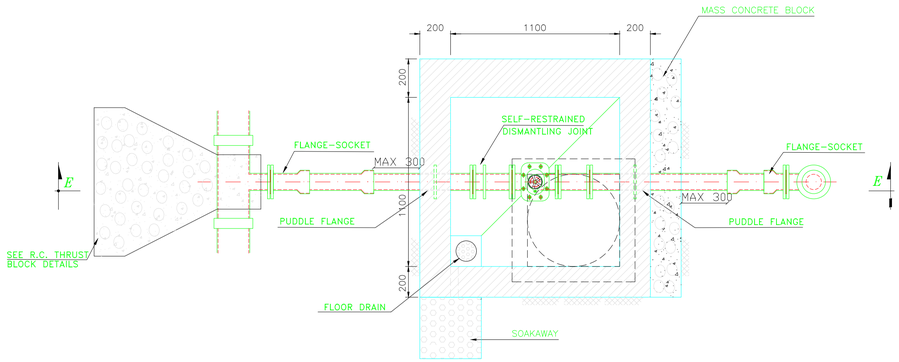
STOP VALVE AND FIRE HYDRANT TYPICAL VALVE CHAMBER DETAILS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	3/23	477W-DS-STD03



SECTION E–E
TYPICAL FIRE HYDRANT VALVE CHAMBER



SECTION F–F
POST TYPE & PILLAR TYPE FIRE HYDRANT

TYPICAL STOP VALVE CHAMBER DIMENSIONS

MAIN PIPE DIAMETER	DIMENSIONS				
	WALL & LOWER SLAB THICKNESS	COVER SLAB THICKNESS	LENGTH	WIDTH	HEIGHT
DC mm	e1 mm	e2 mm	L1 mm	L2 mm	H mm
80–150	200	250	1500	1250	1450
200–250	250	250	1750	1500	1550
300–350	250	250	2000	2000	2100
400–450	300	300	2500	2250	2500
500–600	350	300	3000	3000	3000
700–800	400	300	3500	3000	3300
900–1000	500	400	3500	3000	4300

TYPICAL FIRE HYDRANT VALVE CHAMBER

TYPICAL STOP VALVE CHAMBER REINFORCEMENT

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
80–150	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
200–250	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200
300–350	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200
400–450	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200
500–600	T16 @200	T16 @200	T16 @200	T16 @200	T16 @200	T14 @200	T14 @200
700–800	T16 @200	T16 @200	T16 @165	T16 @200	T16 @200	T14 @165	T14 @165
900–1000	T16 @200	T16 @200	T20 @200	T16 @200	T16 @200	T16 @200	T16 @200

REINFORCEMENT STEEL TABLE

PIPE DIAMETER	REINFORCEMENT						
D mm	1 mm	2 mm	3 mm	4 mm	5 mm	6 mm	7 mm
80–1000	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T14 @200	T14 @200

NOTES:

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DOSING 350 Kg/m3

BLINDING AND MASS CONCRETE:
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BENDING:
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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 :
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* 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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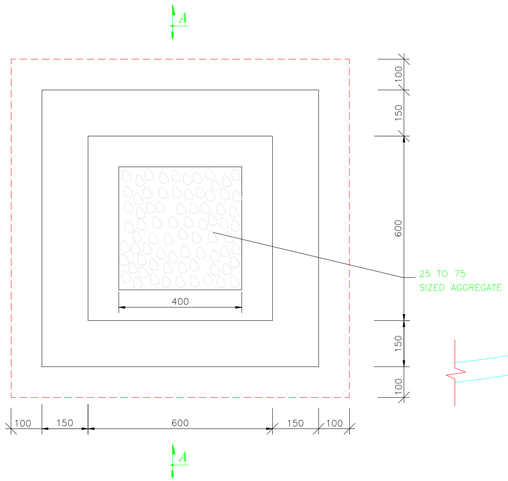
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

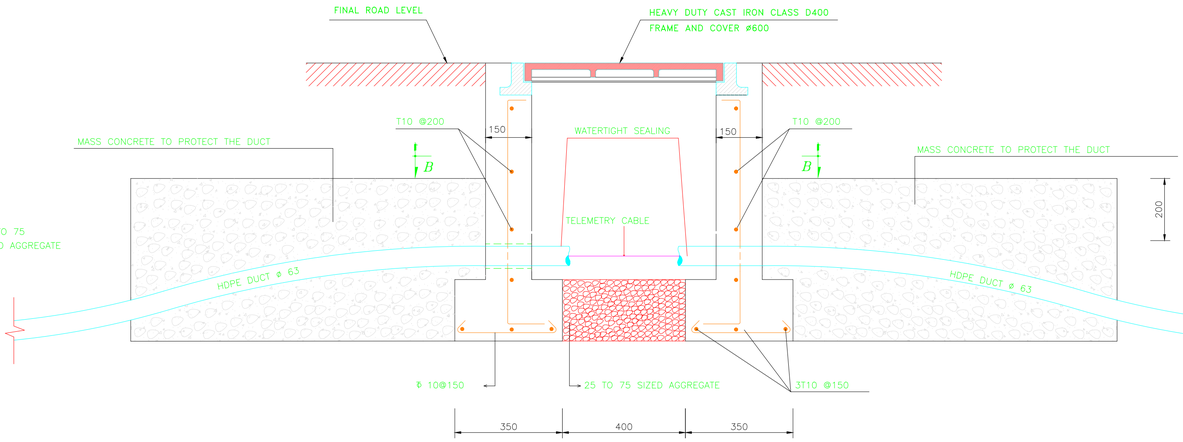
STOP VALVE AND FIRE HYDRANT TYPICAL VALVE CHAMBER DETAILS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

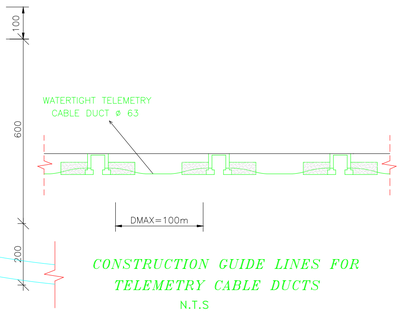
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	4/23	477W-DS-STD04



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

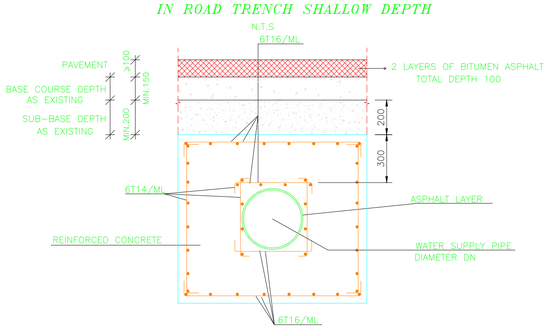


SECTION A–A
TYPICAL TELEMETRY CABLE DRAW PIT
SCALE 1:10

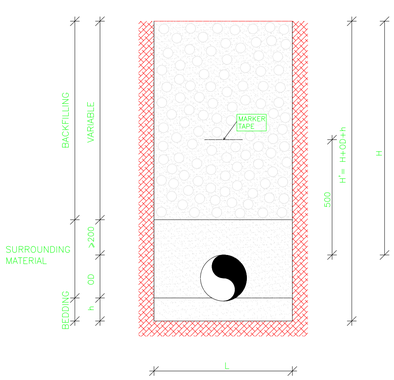


CONSTRUCTION GUIDE LINES FOR
TELEMETRY CABLE DUCTS
N.T.S

IN ROAD TRENCH SHALLOW DEPTH

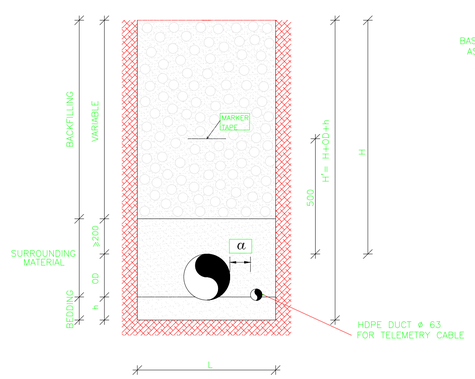


NOMINAL PIPE DIAMETER DN mm	PIPELINE COVER H mm	
	DISTRIBUTION	TRANSMISSION
80–150	800	1000
200–350	1000	1000
400–450	1100	1200
>500	1200	1300



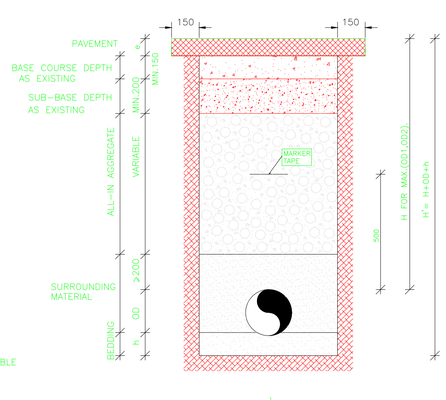
L: TRENCH WIDTH L= 4/3 OD+450(L>600)
h: BEDDING DEPTH
h:=100+DN/10

TRENCH OFF ROAD FOR ONE PIPE
NOT TO SCALE



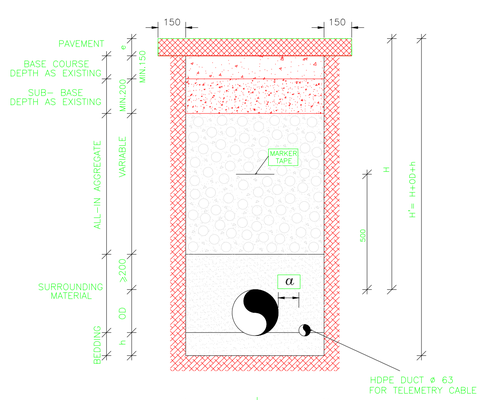
L: TRENCH WIDTH L=4/3 OD+600
h: BEDDING DEPTH h= 100+DN/10
a≥200

TRENCH OFF ROAD WITH HDPE DUCT ø 63
FOR TELEMETRY CABLE
NOT TO SCALE



L: TRENCH WIDTH L= 4/3 OD+450(L>600)
h: BEDDING DEPTH h= 100+DN/10 mm

TRENCH IN ROAD FOR ONE PIPE
NOT TO SCALE



L: TRENCH WIDTH L= 4/3 OD+600
h: BEDDING DEPTH h= 100+DN/10
a≥200

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

NOTES:

–ALL DIMENSIONS ARE IN MILLIMETERS.

–OD : OUTER PIPE DIAMETER

–DN : NOMINAL PIPE DIAMETER

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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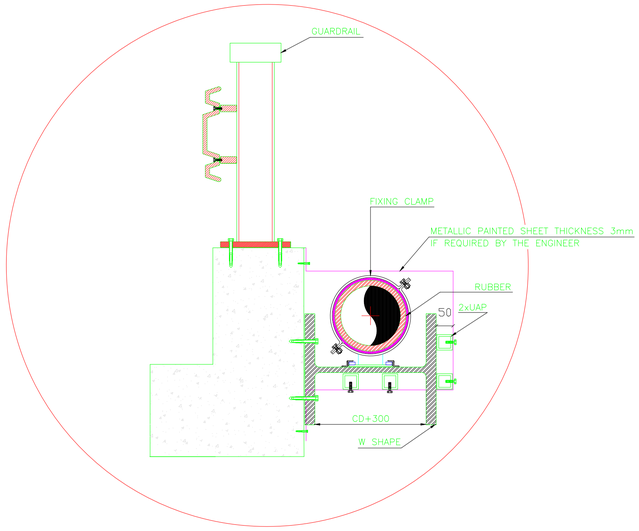
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

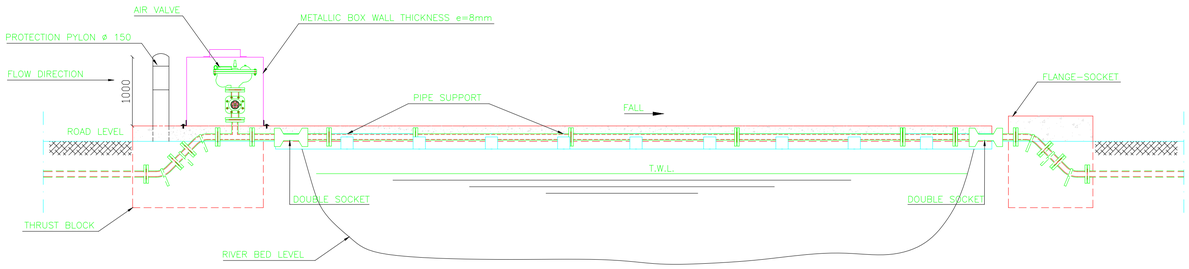
TYPICAL TRENCH DETAILS AND TELEMETRY CABLE DRAWPIT

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

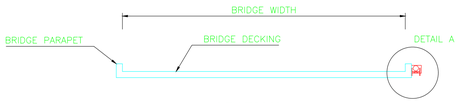
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	5/23	477W-DS-STD05



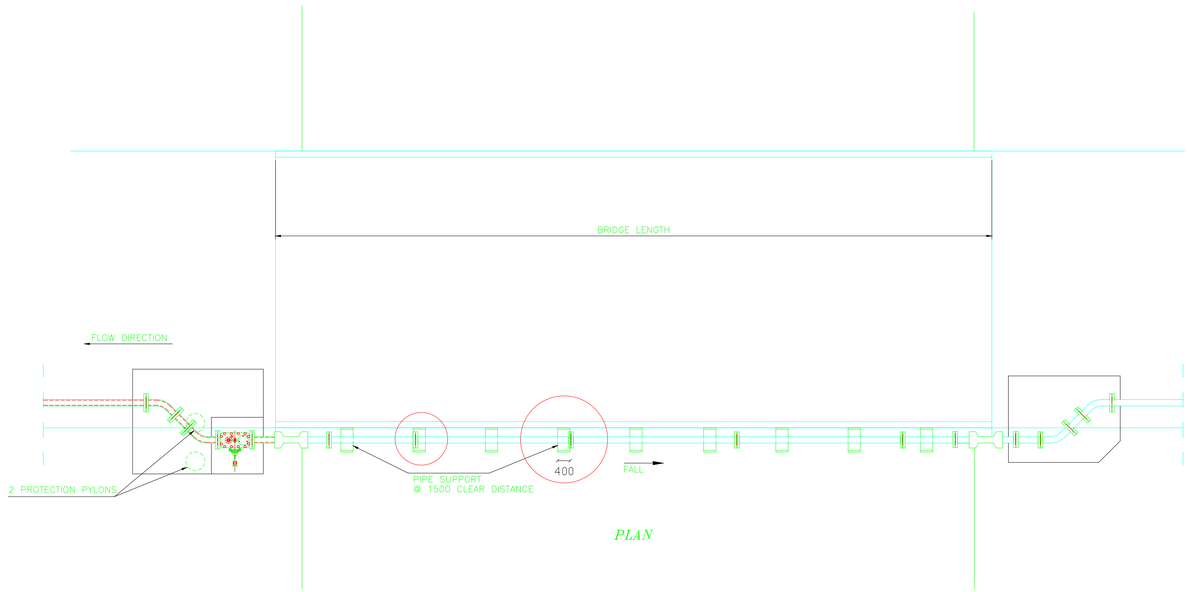
DETAIL A
TYPICAL PIPE SUPPORT ON
ROAD BRIDGE HIGHWAY CROSSING



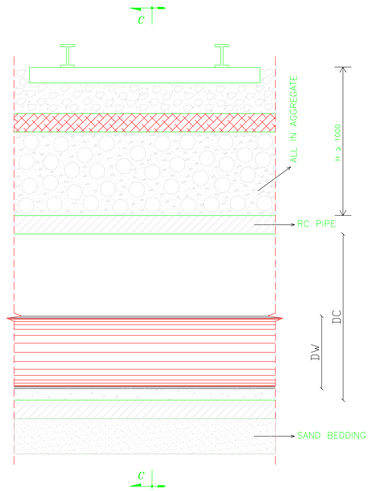
ELEVATION



SECTION A-A

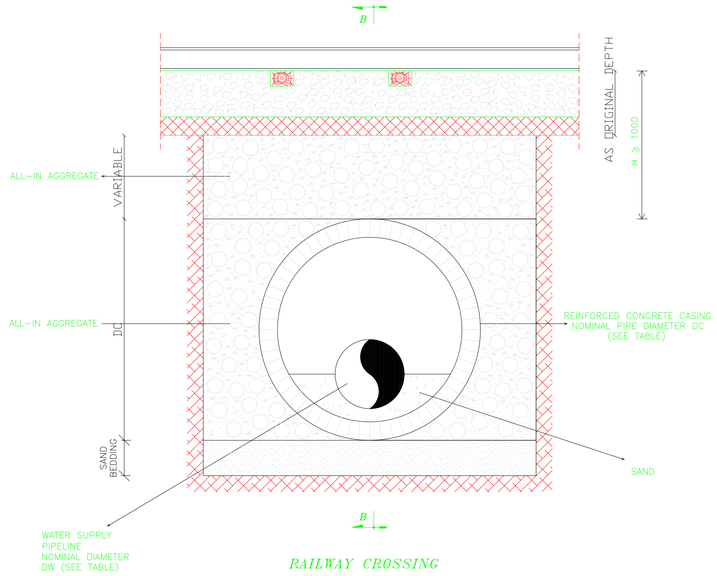


PLAN



RAILWAY CROSSING
SECTION B-B

WATER SUPPLY PIPE	CONCRETE CASING PIPE
DW MM	DC MM
80-100	400
150	600
200-300	800
350-400	1000
450-600	1200



RAILWAY CROSSING
SECTION C-C

NOTES:

-ALL DIMENSIONS ARE IN MILLIMETERS.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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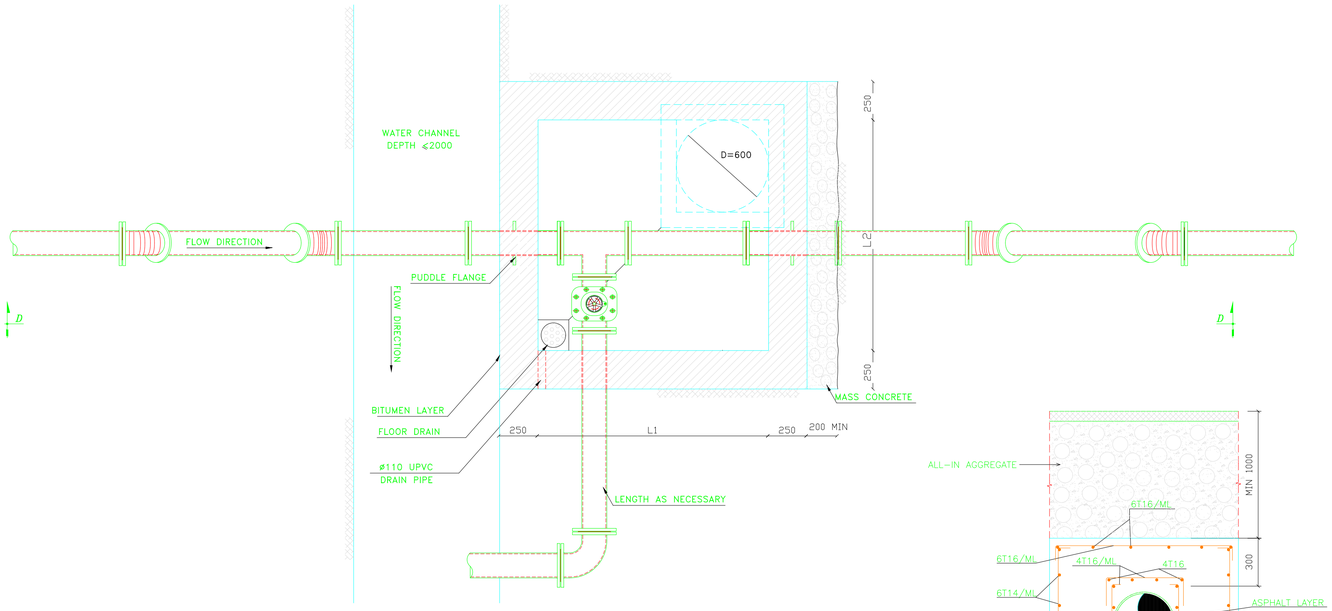
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

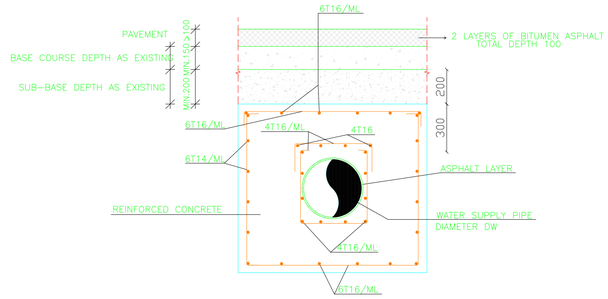
PIPING UNDER SPECIAL CONDITIONS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

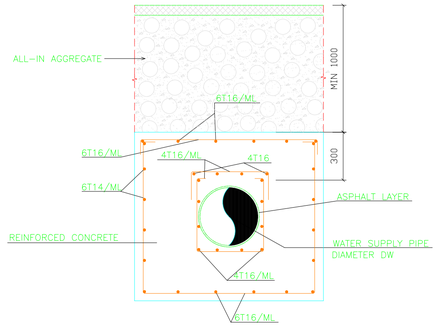
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	6/23	477W-DS-STD06



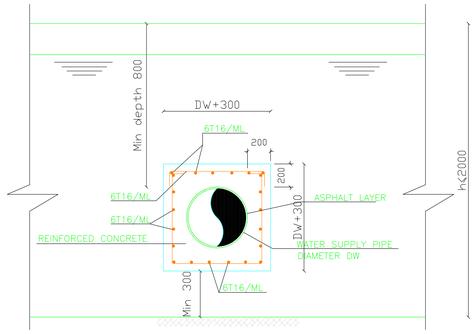
WATER CHANNEL CROSSING (TYPE I)
PLAN



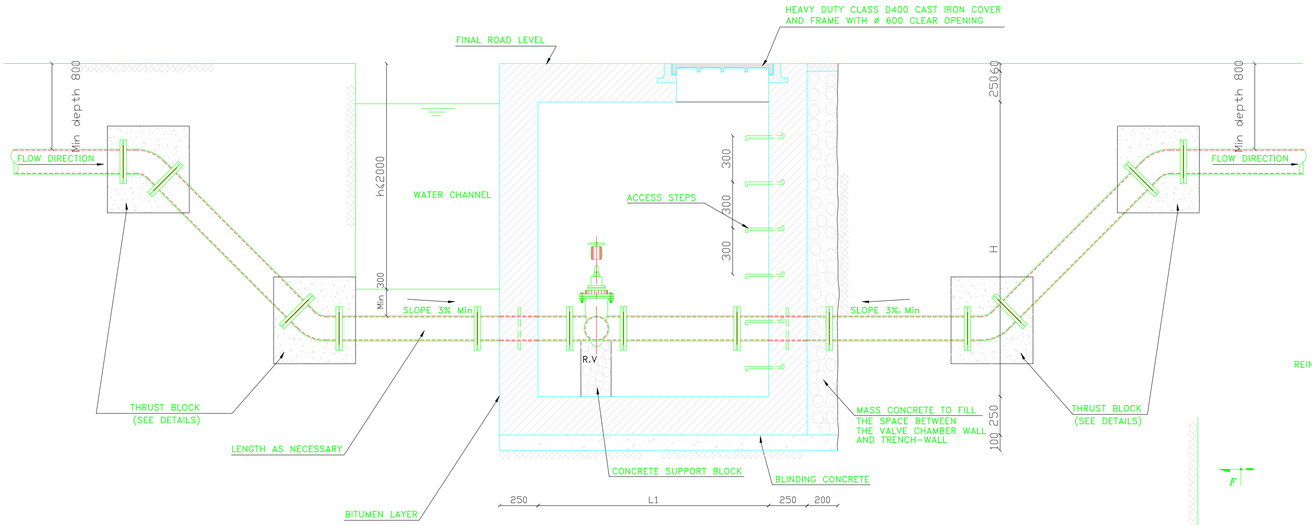
IN ROAD TRENCH SHALLOW DEPTH



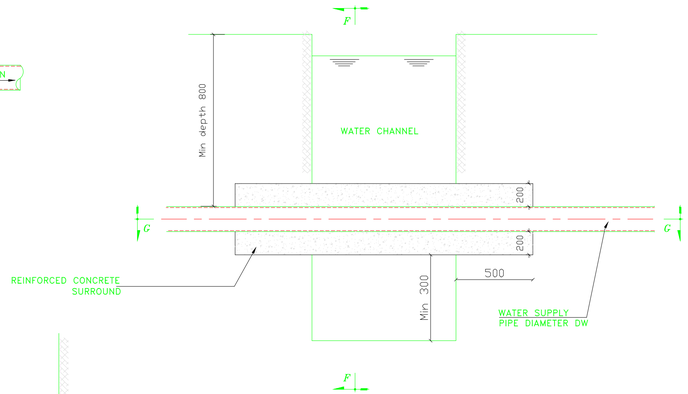
ALONG WATER COURSES
N.T.S



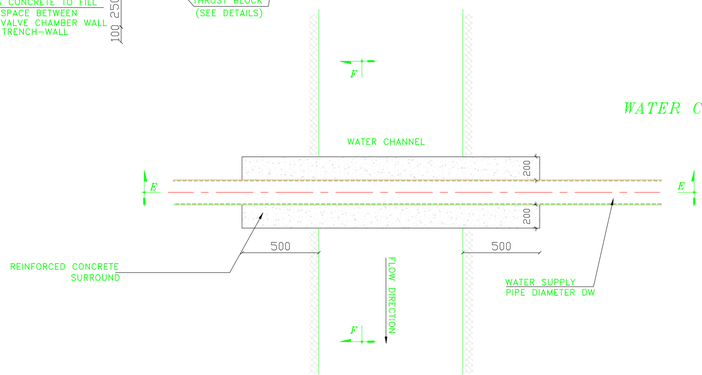
WATER CHANNEL CROSSING (TYPE II)
SECTION F-F



WATER CHANNEL CROSSING (TYPE I)
SECTION D-D



WATER CHANNEL CROSSING (TYPE II)
SECTION E-E



WATER CHANNEL CROSSING (TYPE II)
SECTION G-G

NOTES:

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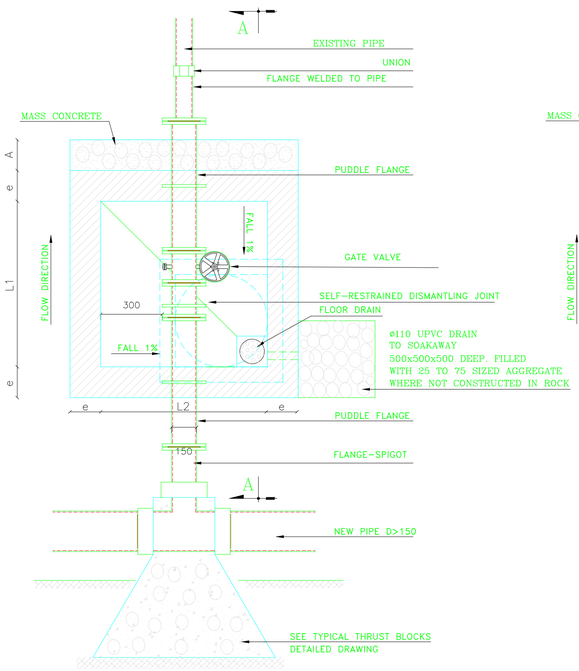
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS	PIPING UNDER SPECIAL CONDITIONS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

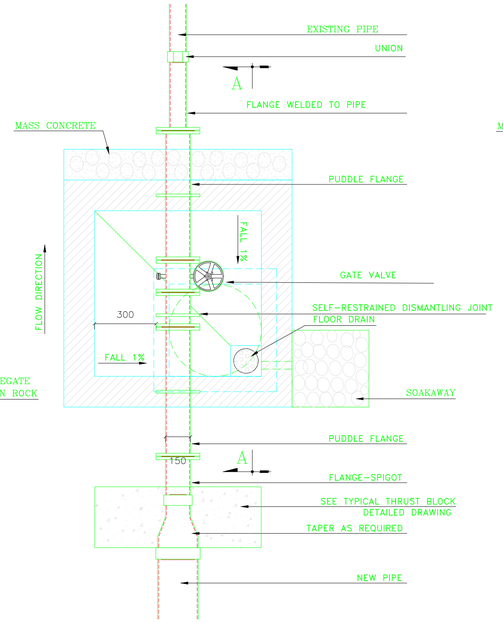
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	7/23	477W-DS-STD07

TYPE 1
SECTION C–C



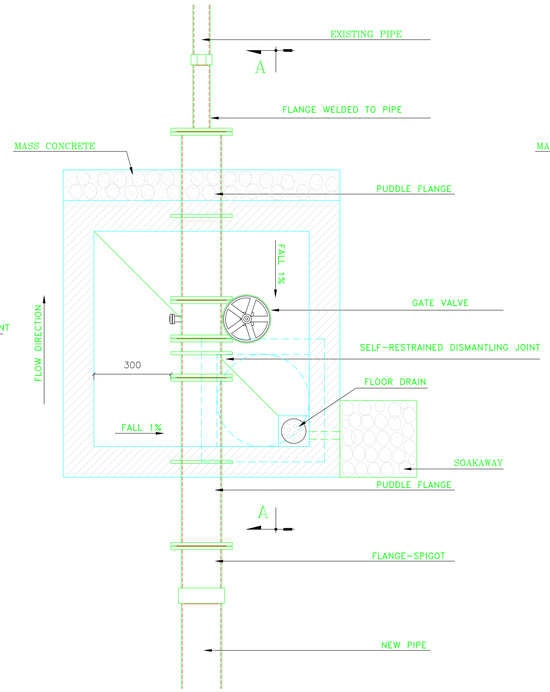
TYPE 1–A

TYPE 2
SECTION C–C



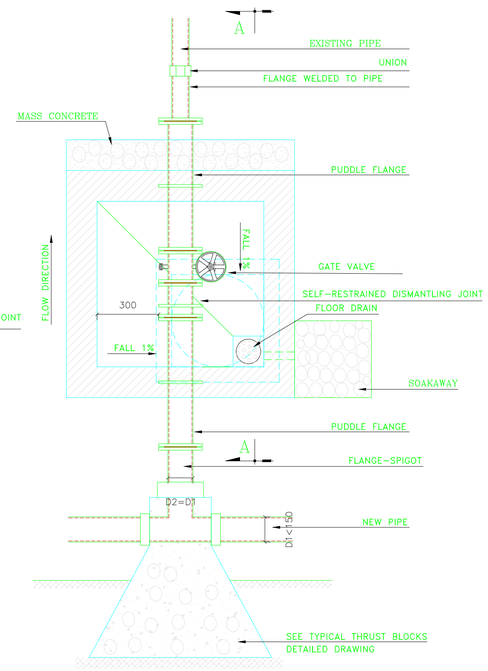
TYPE 2–A

TYPE 3
SECTION C–C

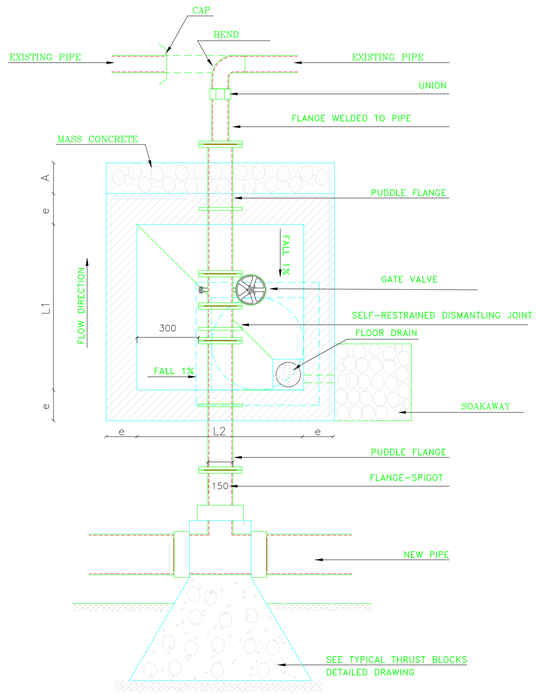


TYPE 3–A

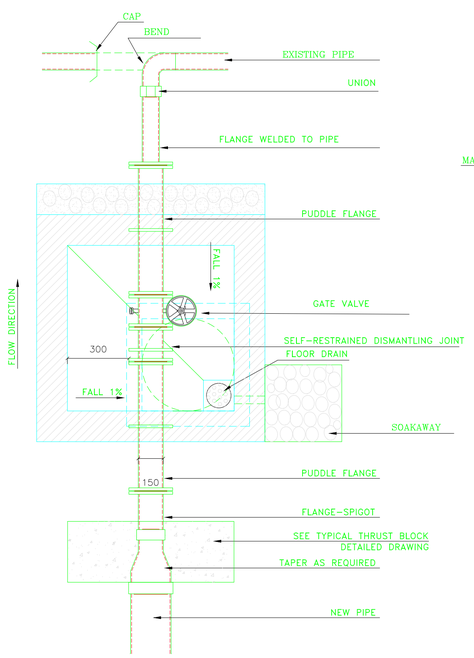
TYPE 4
SECTION C–C



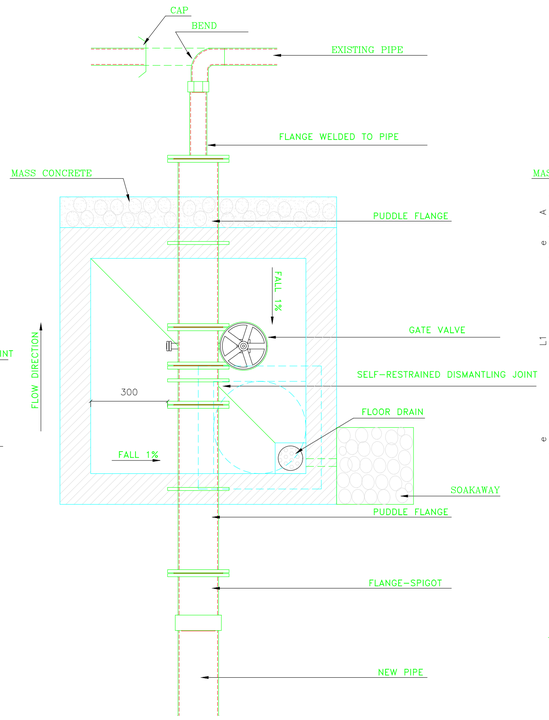
TYPE 4–A



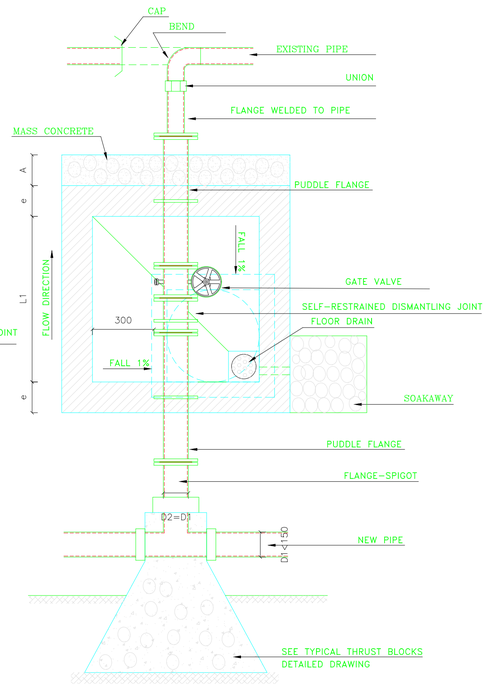
TYPE 1–B



TYPE 2–B



TYPE 3–B



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: 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.

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. CONSEQUETLY, 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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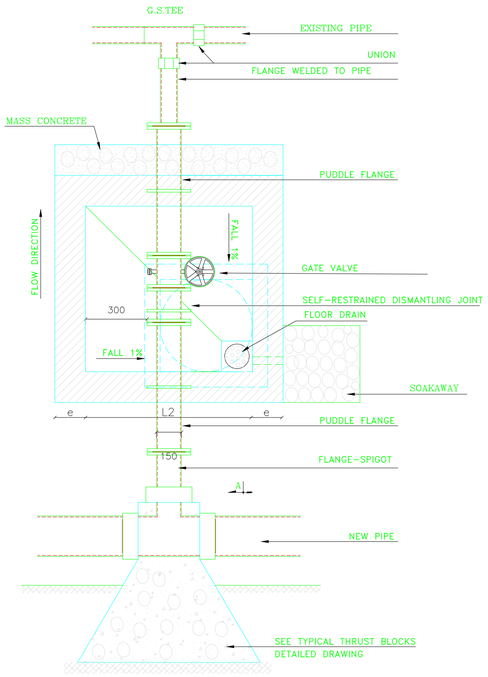
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

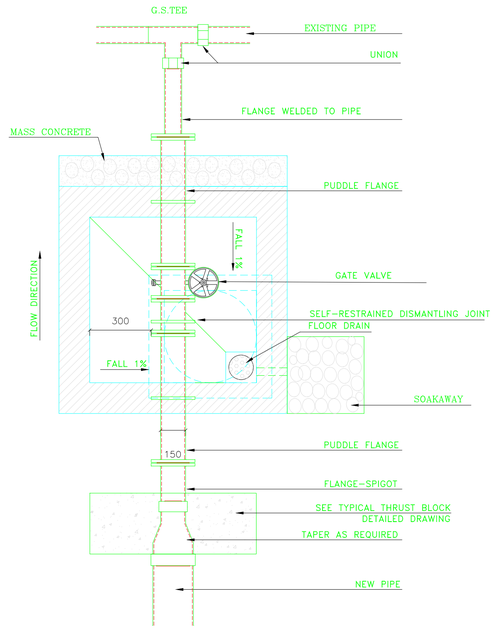
TYPICAL CONNECTIONS OF NEW PIPES TO EXISTING PIPES

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

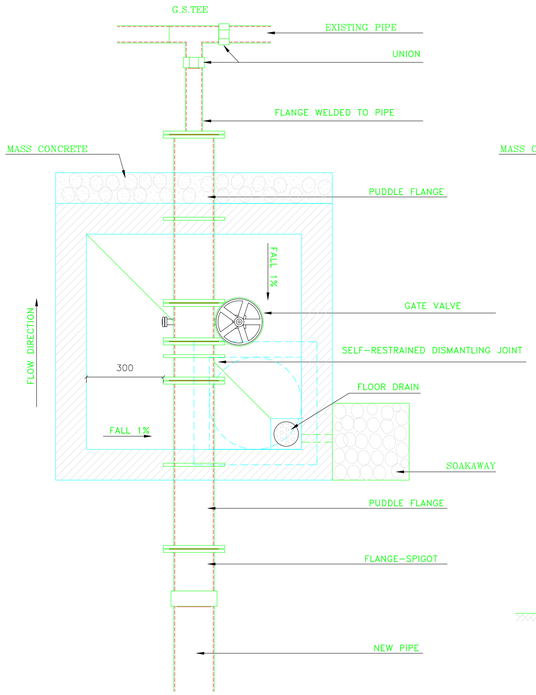
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	8/23	477W-DS-STD08



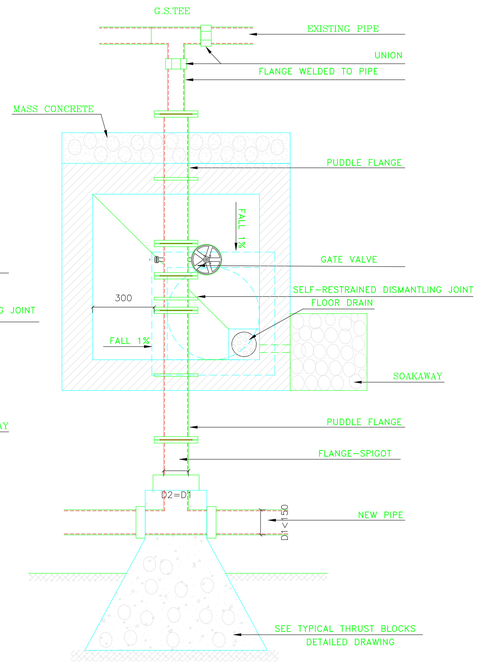
TYPE 1-C



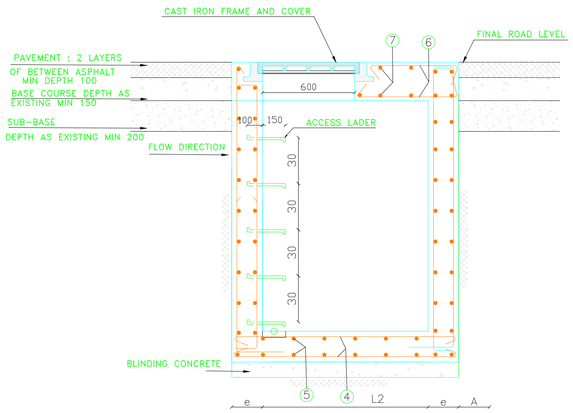
TYPE 2-C



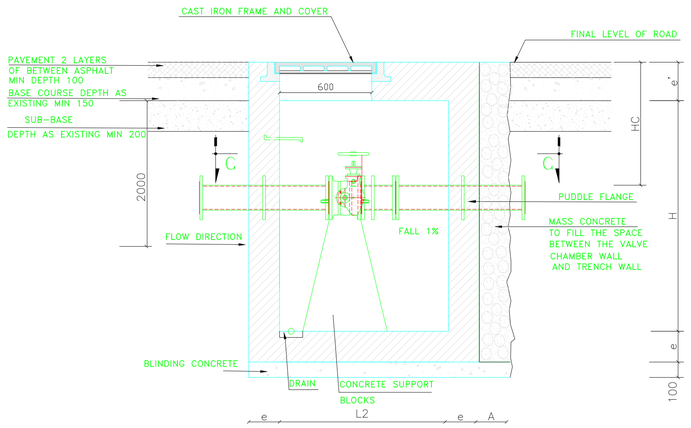
TYPE 3-C



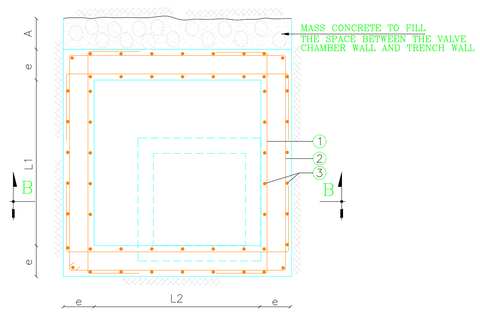
TYPE 4-C



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 @200	T12 @200	T10 @200	T12 @200	T12 @200	T12 @200	T12 @200
200	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T12 @200	T12 @200
250	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T12 @200	T12 @200
300	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T12 @200	T12 @200
350	T12 @200	T12 @200	T10 @200	T12 @200	T12 @200	T12 @200	T12 @200
400	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200
450	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200	T12 @200
500	T14 @200	T14 @200	T12 @200	T14 @200	T14 @200	T12 @200	T12 @200
600	T14 @200	T14 @200	T14 @200	T14 @200	T14 @200	T12 @200	T12 @200

NOTES:

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DOSING 350 Kg/m3

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SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f'c =25 MPa.
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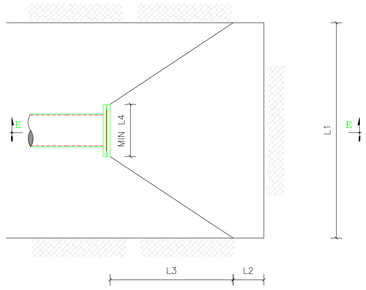
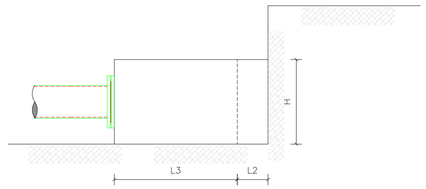
477W-DS-STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	9/23	477W-DS-STD09

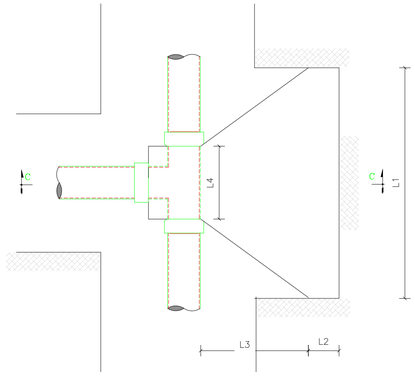
TYPICAL THRUST BLOCKS FOR TEES – HORIZONTAL BENDS – END CAPS



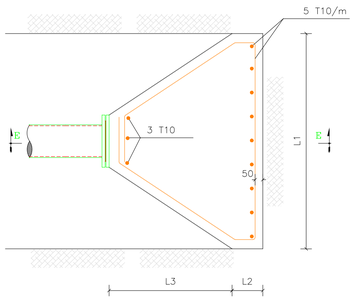
PLAN
END-CAP THRUST BLOCK



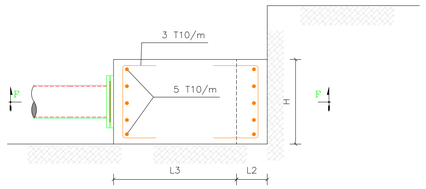
SECTION E-E
END-CAP THRUST BLOCK



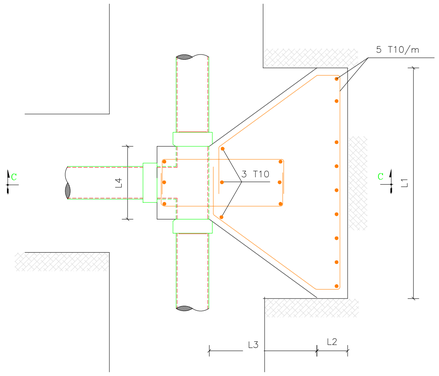
PLAN
TEE THRUST BLOCK



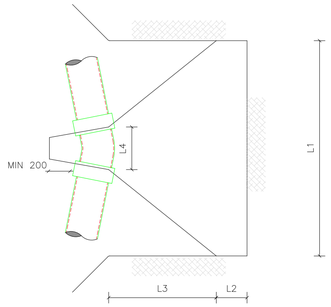
SECTION F-F
END-CAP THRUST BLOCK
TYPICAL REINFORCEMENT



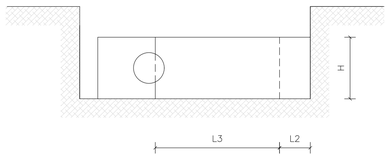
SECTION E-E
END-CAP THRUST BLOCK
TYPICAL REINFORCEMENT



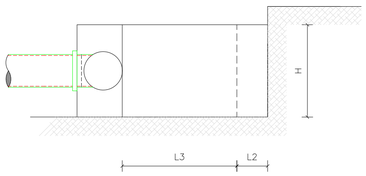
SECTION D-D
TEE THRUST BLOCK
TYPICAL REINFORCEMENT



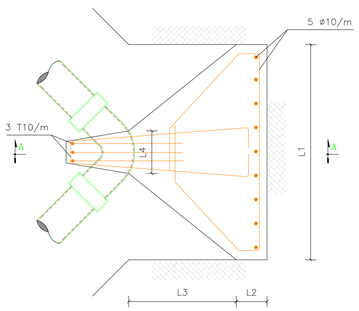
PLAN
TYPICAL HORIZONTAL BEND
THRUST BLOCK



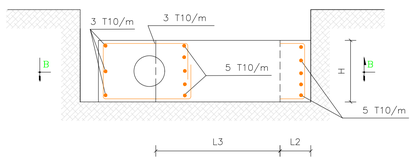
SECTION A-A
TYPICAL HORIZONTAL BEND
THRUST BLOCK



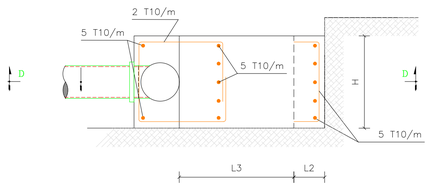
SECTION C-C
TEE THRUST BLOCK



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	ø °	
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm2
SOIL-CONCRETE FRICTION ANGLE	2/3 * ø °	

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
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 DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

PIPELINE THRUST BLOCKS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	10/23	477W-DS-STD10

TYPICAL THRUST BLOCKS FOR TEES – HORIZONTAL BENDS – END CAPS

TABLE NO. 1 : THRUST BLOCKS TYPES

Pressure (bars) / Soil Internal Friction Angle (ø°)

Diam. (mm)	Theta BEND ANGLE (°)	Soil Cover (m)	1				5				10				15			
			20	25	30	35	20	25	30	35	20	25	30	35	20	25	30	35
1000	T or E–C	1.2	15	15	15	15	–	–	–	–	–	–	–	–	–	–	–	–
1000	90	1.2	15	15	15	15	–	–	–	–	–	–	–	–	–	–	–	–
1000	45	1.2	15	15	15	15	–	–	–	16	–	–	–	–	–	–	–	–
1000	22.5	1.2	15	15	15	15	15	15	15	15	–	–	–	16	–	–	–	–
1000	11.25	1.2	15	15	15	15	15	15	15	15	15	15	15	15	–	–	15	15
900	T or E–C	1.2	14	14	14	14	–	–	–	–	–	–	–	–	–	–	–	–
900	90	1.2	14	14	14	14	–	–	–	–	–	–	–	–	–	–	–	–
900	45	1.2	14	14	14	14	–	–	16	15	–	–	–	–	–	–	–	–
900	22.5	1.2	14	14	14	14	14	14	14	14	–	–	16	15	–	–	–	–
900	11.25	1.2	14	14	14	14	14	14	14	14	14	14	14	14	16	15	14	14
800	T or E–C	1.2	13	13	13	13	–	–	16	15	–	–	–	–	–	–	–	–
800	90	1.2	13	13	13	13	–	–	–	–	–	–	–	–	–	–	–	–
800	45	1.2	13	13	13	13	–	15	14	13	–	–	–	–	–	–	–	–
800	22.5	1.2	13	13	13	13	13	13	13	13	–	16	14	13	–	–	–	–
800	11.25	1.2	13	13	13	13	13	13	13	13	13	13	13	13	15	14	13	13
700	T or E–C	1.2	10	10	10	10	–	16	14	14	–	–	–	–	–	–	–	–
700	90	1.2	10	10	10	10	–	–	–	16	–	–	–	–	–	–	–	–
700	45	1.2	10	10	10	10	15	14	13	12	–	–	–	–	–	–	–	–
700	22.5	1.2	10	10	10	10	10	10	10	10	15	14	13	12	–	–	16	15
700	11.25	1.2	10	10	10	10	10	10	10	10	10	10	10	10	13	12	11	10
600	T or E–C	1.2	9	9	9	9	15	14	13	12	–	–	–	–	–	–	–	–
600	90	1.2	9	9	9	9	–	16	15	14	–	–	–	–	–	–	–	–
600	45	1.2	9	9	9	9	13	12	11	10	–	–	16	15	–	–	–	–
600	22.5	1.2	9	9	9	9	9	9	9	9	13	12	11	10	16	15	14	13
600	11.25	1.2	9	9	9	9	9	9	9	9	9	9	9	9	12	10	9	9
500	T or E–C	1.2	7	7	7	7	13	12	10	10	–	16	15	14	–	–	–	–
500	90	1.2	7	7	7	7	15	14	13	12	–	–	–	–	–	–	–	–
500	45	1.2	7	7	7	7	11	10	9	8	15	14	13	12	–	–	16	15
500	22.5	1.2	7	7	7	7	7	7	7	7	11	10	9	8	14	13	12	10
500	11.25	1.2	7	7	7	7	7	7	7	7	7	7	7	7	9	9	8	7
450	T or E–C	1.1	6	6	6	6	12	10	10	9	–	15	14	13	–	–	–	16
450	90	1.1	6	6	6	6	14	13	12	11	–	–	–	16	–	–	–	–
450	45	1.1	6	6	6	6	10	9	8	8	15	13	12	12	–	16	15	14
450	22.5	1.1	6	6	6	6	7	6	6	6	10	9	9	8	13	12	10	10
450	11.25	1.1	6	6	6	6	6	6	6	6	7	6	6	6	9	8	7	7
400	T or E–C	1.1	5	5	5	5	10	9	9	8	15	14	13	12	–	–	15	14
400	90	1.1	5	5	5	5	13	12	10	10	–	16	15	14	–	–	–	–
400	45	1.1	5	5	5	5	9	8	7	7	13	12	11	10	16	15	14	13
400	22.5	1.1	5	5	5	5	6	5	5	5	9	8	7	7	12	10	9	9
400	11.25	1.1	5	5	5	5	5	5	5	5	6	5	5	5	8	7	6	6
350	T or E–C	1.0	4	4	4	4	9	9	8	7	14	13	12	10	–	15	14	13
350	90	1.0	4	4	4	4	12	10	9	9	16	15	14	13	–	–	–	16
350	45	1.0	4	4	4	4	8	7	7	6	12	11	10	9	15	13	13	12
350	22.5	1.0	4	4	4	4	5	5	4	4	8	7	7	6	10	9	9	8
350	11.25	1.0	4	4	4	4	4	4	4	4	5	5	4	4	7	6	6	5
300	T or E–C	1.0	4	4	4	4	8	7	7	6	12	10	10	9	14	13	12	12
300	90	1.0	4	4	4	4	10	9	8	7	14	13	12	11	–	16	15	14
300	45	1.0	4	4	4	4	7	6	5	5	10	9	9	8	13	12	10	10
300	22.5	1.0	4	4	4	4	4	4	4	4	7	6	6	5	9	8	7	7
300	11.25	1.0	4	4	4	4	4	4	4	4	4	4	4	4	6	5	5	4
250	T or E–C	1.0	2	2	2	2	6	6	5	5	10	9	8	7	12	11	10	9
250	90	1.0	3	2	2	2	8	7	7	6	12	11	10	9	14	13	12	12
250	45	1.0	2	2	2	2	5	5	4	4	8	7	7	6	10	9	9	8
250	22.5	1.0	2	2	2	2	4	3	3	2	5	5	5	4	7	6	6	5
250	11.25	1.0	2	2	2	2	2	2	2	2	4	3	3	2	5	4	4	3
200	T or E–C	1.0	2	2	2	2	5	4	4	4	7	7	6	6	9	9	8	7
200	90	1.0	2	2	2	2	6	5	5	5	9	8	8	7	12	10	10	9
200	45	1.0	2	2	2	2	4	4	3	3	6	6	5	5	8	7	7	6
200	22.5	1.0	2	2	2	2	2	2	2	2	4	4	3	3	5	5	4	4
200	11.25	1.0	2	2	2	2	2	2	2	2	2	2	2	2	4	3	3	2
150	T or E–C	1.0	2	2	2	2	4	3	3	2	5	5	4	4	7	6	6	5
150	90	1.0	2	2	2	2	4	4	4	3	7	6	5	5	9	8	7	7
150	45	1.0	2	2	2	2	3	2	2	2	5	4	4	3	6	5	5	4
150	22.5	1.0	2	2	2	2	2	2	2	2	3	2	2	2	4	4	3	3
150	11.25	1.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
125	T or E–C	1.0	1	1	1	1	3	2	2	2	4	4	4	3	5	5	5	4
125	90	1.0	1	1	1	1	3	3	3	2	5	5	4	4	7	6	6	5
125	45	1.0	1	1	1	1	2	2	2	2	4	3	3	2	5	4	4	4
125	22.5	1.0	1	1	1	1	2	1	1	1	2	2	2	2	3	3	2	2
125	11.25	1.0	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2
100	T or E–C	1.0	1	1	1	1	2	2	2	2	3	3	2	2	4	4	4	3
100	90	1.0	1	1	1	1	2	2	2	2	4	4	3	3	5	5	4	4
100	45	1.0	1	1	1	1	2	2	2	1	3	2	2	2	4	3	3	2
100	22.5	1.0	1	1	1	1	1	1	1	1	2	2	2	1	2	2	2	2
100	11.25	1.0	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
80	T or E–C	1.0	1	1	1	1	2	2	1	1	2	2	2	2	3	3	2	2
80	90	1.0	1	1	1	1	2	2	2	2	3	3	2	2	4	4	3	3
80	45	1.0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
80	22.5	1.0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1
80	11.25	1.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Diam. (mm)	Theta BEND ANGLE (°)	Soil Cover (m)	20				25				30				35			
			20	25	30	35	20	25	30	35	20	25	30	35	20	25	30	35
1000	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	11.25	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	11.25	1.2	–	–	16	15	–	–	–	–	–	–	–	–	–	–	–	–
800	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	11.25	1.2	–	16	14	14	–	–	16	15	–	–	–	–	–	–	–	–
700	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	11.25	1.2	15	14	13	12	–	15	14	13	–	–	16	15	–	–	–	16
600	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	22.5	1.2	–	–	16	15	–	–	–	–	–	–	–	–	–	–	–	–
600	11.25	1.2	13	12	11	10	15	14	13	12	16	15	14	13	–	16	15	14
500	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	22.5	1.2	16	14	13	13	–	16	15	14	–	–	16	15	–	–	–	–
500	11.25	1.2	11	10	9	9	13	12	10	10	14	13	12	10	15	14	13	12
450	T or E–C	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
450	90	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
450	45	1.1	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–
450	22.5	1.1	15	14	13	12	–	15	14	13	–	–	15	14	–	–	–	15
450	11.25	1.1	10	9	9	8	12	10	10	9	13	12	11	10	14	13	12	11
400	T or E–C	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
400	90	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
400	45	1.1	–	–	16	15	–	–	–	16	–	–	–	–	–	–	–	–
400	22.5	1.1	13	12	11	10	15	14	13	12	16	15	14	13	–	16	15	14
400	11.25	1.1	9	8	7	7	10	9	9	8	12	10	9	9	12	12	10	9
350	T or E–C	1.0	–	–	16	15	–	–	–	–	–	–	–	–	–	–	–	–
350	90	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
350	45	1.0	–	15	14	13	–	–	16	15	–	–	–	16	–	–	–	–
350	22.5	1.0	12	11	10	9	13	12	12	10	15	14	13	12	16	15	14	13
350	11.25	1.0	8	7	7	6	9	9	8	7	10	9	9	8	11	10	9	9
300	T or E–C	1.0	–	15	14	13	–	–	16	15	–	–	–	16	–	–	–	–
300	90	1.0	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–
300	45	1.0	15	13	13	12	16	15	14	13	–	16	15	14	–	–	16	15
300	22.5	1.0	10	9	9	8	12	10	10	9	13	12	11	10	14	13	12	11
300	11.25	1.0	7	6	6	5	8	7	7	6	9	8	7	7	9	9	8	7
250	T or E–C	1.0	14	13	12	11	16	14	13	12	–	16	15	14	–	–	16	15
250	90	1.0	–	15	14	13	–	–	16	15	–	–	–	16	–	–	–	–
250	45	1.0	12	11	10	9	14	13	12	11	15	14	13	12	16	15	14	13
250	22.5	1.0	8	8	7	6	9	9	8	7	10	10	9	8	12	10	10	9
250	11.25	1.0	5	5	5	4	6	6	5	5	7	7	6	5	8	7	7	6
200	T or E–C	1.0	11	10	9	9	13	12	10	10	14	13	12	11	15	14	13	12
200	90	1.0	13	12	12	10	15	14	13	12	–	15	14	13	–	16	15	14
200	45	1.0	10	9	8	7	11	10	9	9	12	11	10	9	13	12	11	10
200	22.5	1.0	7	6	5	5	7	7	6	6	8	7	7	6	9	8	7	7
200	11.25	1.0	4	4	4	3	5	4	4	4	5	5	4	4	6	5	5	5
150	T or E–C	1.0	8	7	7	6	9	9	8	7	10	9	9	8	12	10	9	9
150	90	1.0	10	9	8	8	12	10	9	9	13	12	10	10	14	13	12	10
150	45	1.0	7	6	6	5	8	7	7	6	9	8	7	7	10	9	8	7
150	22.5	1.0	5	4	4	3	5	5	4	4	6	5	5	4	7	6	5	5
150	11.25	1.0	3	2	2	2	3	3	3	2	4	4	3	3	4	4	4	3
125	T or E–C	1.0	7	6	5	5	8	7	6	6	9	8	7	6	9	8	8	7
125	90	1.0	8	7	7	6	9	9	8	7	10	9	9	8	11	10	9	9
125	45	1.0	6	5	5	4	7	6	5	5	7	7	6	5	8	7	7	6
125	22.5	1.0	4	3	3	3	4	4	4	3	5	4	4	4	5	5	4	4
125	11.25	1.0	2	2	2	2	2	2	2	2	3	3	2	2	3	3	3	2
100	T or E–C	1.0	5	5	4	4	6	5	5	4	7	6	5	5	7	7	6	5
100	90	1.0	6	6	5	5	7	7	6	5	8	7	7	6	9	8	7	7
100	45	1.0	4	4	4	3	5	4	4	4	5	5	5	4	6	5	5	5
100	22.5	1.0	3	2	2	2	3	3	2	2	4	3	3	2	4	4	3	3
100	11.25	1.0	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
80	T or E–C	1.0	4	4	3	3	4	4	4	3	5	4	4	4	5	5	4	4
80	90	1.0	5	4	4	4	5	5	5	4	6	5	5	5	7	6	5	5
80	45	1.0	3	3	2	2	4	3	3	3	4	4	3	3	5	4	4	3
80	22.5	1.0	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2
80	11.25	1.0	1	1	1	1	2	2	1	1	2	2	2	1	2	2	2	2

Diam. (mm)	Theta BEND ANGLE (°)	Soil Cover (m)	40				45				50				55				60			
			20	25	30	35	20	25	30	35	20	25	30	35	20	25	30	35	20	25	30	35
1000	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	11.25	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
900	11.25	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
800	11.25	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
700	11.25	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	11.25	1.2	–	–	16	15	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–
500	T or E–C	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	90	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	45	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	22.5	1.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	11.25	1.2	16	14	13	13	–	15	14	13	–	16	15	14	–	–	16	15	–	–	–	15
450	T or E–C	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
450	90	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
450	45	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
450	22.5	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
450	11.25	1.1	15	14	13	12	16	14	13	12	–	15	14	13	–	16	15	14	–	–	15	14
400	T or E–C	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
400	90	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
400	45	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
400	22.5	1.1	–	–	16	15	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–
400	11.25	1.1	13	12	11	10	14	13	12	11	15	14	13	12	15	14	13	12	16	15	14	13
350	T or E–C	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
350	90	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
350	45	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
350	22.5	1.0	–	16	14	13	–	–	15	14	–	–	16	15	–	–	–	16	–	–	–	–
350	11.25	1.0	12	11	10	9	13	12	11	10	14	13	12	10	14	13	12	11	15	14	13	12
300	T or E–C	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
300	90	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
300	45	1.0	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
300	22.5	1.0	15	14	13	12	15	14	13	12	–	15	14	13	–	16	15	14	–	–	15	14
300	11.25	1.0	10	9	9	8	11	10	9	8	12	10	10	9	12	11	10	9	13	12	11	10
250	T or E–C	1.0	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
250	90	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
250	45	1.0	–	16	15	14	–	–	16	14	–	–	–	15	–	–	–	16	–	–	–	–
250	22.5	1.0	12	12	10	9	13	12	11	10	14	13	12	11	14	13	12	12	15	14	13	12
250	11.25	1.0	9	8	7	6	9	8	7	7	10	9	8	7	10	9	9	8	10	10	9	8
200	T or E–C	1.0	16	15	14	13	–	15	14	13	–	–	15	14	–	–	16	15	–	–	–	15
200	90	1.0	–	–	16	15	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	–
200	45	1.0	14	13	12	11	15	14	13	12	16	14	13	12	16	15	14	13	–	16	15	14
200	22.5	1.0	10	9	8	7	10	9	9	8	11	10	9	9	12	10	10	9	12	11	10	9
200	11.25	1.0	7	6	5	5	7	6	6	5	7	7	6	6	8	7	7	6	8	7	7	6
150	T or E–C	1.0	12	11	10	9	13	12	11	10	14	13	12	10	14	13	12	11	15	14	13	12
150	90	1.0	14	13	12	12	15	14	13	12	16	15	14	13	–	15	14	13	–	16	15	14
150	45	1.0	10	9	9	8	11	10	9	9	12	11	10	9	13	12	10	10	13	12	11	10
150	22.5	1.0	7	6	6	5	8	7	6	6	8	7	7	6	9	8	7	7	9	8	7	7
150	11.25	1.0	5	4	4	3	5	4	4	4	5	5	4	4	6	5	5	4	6	5	5	4
125	T or E–C	1.0	10	9	8	8	10	10	9	8	12	10	9	9	12	11	10	9	13	12	10	10
125	90	1.0	12	11	10	9	13	12	11	10	14	13	12	10	14	13	12	11	15	14	13	12
125	45	1.0	9	8	7	7	9	8	8	7	10	9	8	7	10	9	9	8	11	10	9	8
125	22.5	1.0	6	5	5	4	6	5	5	5	7	6	5	5	7	6	6	5	7	7	6	5
125	11.25	1.0	4	3	3	3	4	4	3	3	4	4	4	3	5	4	4	3	5	4	4	4
100	T or E–C	1.0	8	7	6	6	8	7	7	6	9	8	7	7	9	9	8	7	10	9	8	7
100	90	1.0	9	9	8	7	10	9	9	8	11	10	9	8	12	10	9	9	12	11	10	9
100	45	1.0	7	6	5	5	7	6	6	5	7	7	6	6	8	7	7	6	8	8	7	6
100	22.5	1.0	4	4	4	3	5	4	4	4	5	5	4	4	5	5	4	4	5	5	5	4
100	11.25	1.0	3	2	2	2	3	2	2	2	3	3	2	2	3	3	3	2	4	3	3	2
80	T or E–C	1.0	6	5	5	4	6	6	5	5	7	6	6	5	7	7	6	5	8	7	6	6
80	90	1.0	7	7	6	5	8	7	7	6	8	8	7	6	9	8	7	7	9	9	8	7
80	45	1.0	5	5	4	4	5	5	4	4	6	5	5	4	6	5	5	5	7	6	5	5
80	22.5	1.0	3	3	2	2	4	3	3	2	4	3	3	3	4	4	3	3	4	4	4	3
80	11.25	1.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2

TE : TEE
E–C : END CUP

*N.B.: * WHERE " – " EXIST REFER TO THE TABLE No. 2 (SELF ANCHORED PIPES)*
** FOR TEES " DIAM" IN THE FIRST COLUMN OF TABLE No. 1 REPRESENT THE BRANCH DIAM OF THE TEE*

LENGTH (IN METER) OF PIPE TO BE SELF ANCHORED AT EACH SIDE OF BENDS WHERE THRUST BLOCKS ARE NOT USED (TEST PRESSURE=10 BARS)

TABLE No. 2

DIAM (mm)	Bend 90°			Bend 45°			Bend 22.5°			Bend 11.25°			Blank flange		
Soil cover(m)	1	1.5	2	1	1.5	2	1	1.5	2	1	1.5	2	1	1.5	2
1000	36.9	27.2	21.6	22.9	16.9	13.4	12.8	9.5	7.5	6.8	5.0	4.0	46.9	34.7	27.5
900	34.1	25.0	19.8	21.2	15.6	12.3	11.9	8.7	6.9	6.3	4.6	3.7	43.4	31.9	25.2
800	31.2	22.8	17.9	19.4	14.4	11.1	10.9	7.9	6.2	5.8	4.2	3.3	39.8	29.0	22.8
700	28.2	20.4	16.0	17.5	12.7	9.9	9.8	7.1	5.6	5.2	3.8	2.9	25.8	25.9	20.3
600	25.0	17.9	14.0	15.5	11.1	8.7	8.7	6.2	4.9	4.6	3.3	2.6	31.8	22.8	17.8
500	21.5	15.3	11.9	13.4	9.5	7.4	7.5	5.3	4.1	4.0	2.8	2.2	27.4	19.5	15.1
450	19.7	14.0	10.8	12.3	8.7	6.7	6.9	4.9	3.8	3.6	2.6	2.0	25.1	17.8	13.8
400	17.9	12.6	9.7	11.1	7.8	6.0	6.2	4.4	3.4	3.3	2.3	1.8	22.8	16.0	12.4
350	16.0	11.2	8.6	9.9	7.0	5.4	5.6	3.9	3.0	2.9	2.1	1.6	20.3	14.3	11.0
300	14.1	9.8	7.5	8.7	6.1	4.7	4.9	3.4	2.6	2.6	1.8	1.4	17.9	12.5	9.6
250	12.0	8.3	6.4	7.5	5.2	4.0	4.2	2.9	2.2	2.2	1.5	1.2	15.3	10.6	8.1
200	9.9	6.8	5.2	6.1	4.2	3.2	3.4	2.4	1.8	1.8	1.3	1.0	12.6	8.7	6.6
150	7.7	5.3	4.0	4.8	3.3	2.5	2.7	1.8	1.4	1.4	1.0	0.7	9.8	6.7	5.1
125	6.6	4.5	3.4	4.1	2.8	2.1	2.3	1.6	1.2	1.2	0.8	0.6	8.4	5.7	4.4
100	5.4	3.7	2.8	3.4	2.3	1.8	1.9	1.3	1.0	1.0	0.7	0.5	6.9	4.7	3.6
80	4.5	3.1	2.3	2.8	1.9	1.5	1.6	1.1	0.8	0.8	0.6	0.5	5.7	3.9	3.0

WHERE TEST PRESSURE P ≠ 10 BARS, ANCHORING LENGTHS SHALL BE MULTIPLIED BY P/10
WHERE P.E SLEEVING IS USED, MULTIPLY BY 2.

TABLE No. 3 : THRUST BLOCKS DIMENSIONS

Type	L1 (m)	L2 (m)	L3 (m)	L4 (m)	H (m)	Volume(m3)
1	0.50	0.1	0.20	0.15	0.20	0.023
2	0.80	0.15	0.30	0.20	0.35	0.095
3	1.00	0.15	0.40	0.25	0.40	0.160
4	1.20	0.15	0.45	0.30	0.50	0.259
5	1.40	0.15	0.55	0.30	0.60	0.406
6	1.60	0.15	0.65	0.30	0.65	0.557
7	1.80	0.15	0.75	0.30	0.75	0.793
8	2.00	0.15	0.85	0.30	0.80	1.022
9	2.20	0.15	0.95	0.30	0.90	1.366
10	2.40	0.15	1.05	0.30	1.00	1.778
11	2.60	0.15	1.15	0.30	1.00	2.058
12	2.80	0.15	1.25	0.30	1.10	2.593
13	3.00	0.15	1.35	0.30	1.20	3.213
14	3.20	0.15	1.45	0.30	1.30	3.923
15	3.40	0.15	1.55	0.30	1.40	4.729
16	3.60	0.15	1.65	0.30	1.45	5.448
–	SEE TABLE " LENGTH OF PIPE TO BE SELF ANCHORED "					

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	ø °	
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm2
SOIL–CONCRETE FRICTION ANGLE	2/3 * ø °	

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS | PIPELINE THRUST BLOCKS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	11/23	477W-DS-STD11

TYPICAL THRUST BLOCKS FOR VERTICAL BENDS

DOWNWARD DIRECTION TYPES

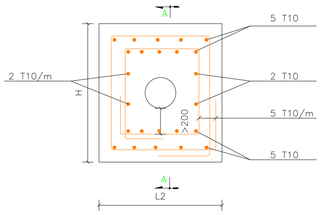
Diam (mm)	Theta Bend angle(°)	cover depth (m)	Test pressure 1	5	10	15	20	25	30	35	40	45	50	55	60
1000	90	1.20	12	–	–	–	–	–	–	–	–	–	–	–	–
1000	45	1.20	12	12	12	12	–	–	–	–	–	–	–	–	–
1000	22.5	1.20	12	12	12	12	12	12	12	–	–	–	–	–	–
1000	11.25	1.20	12	12	12	12	12	12	12	12	12	12	12	12	12
900	90	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
900	45	1.20	11	11	11	11	12	–	–	–	–	–	–	–	–
900	22.5	1.20	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
800	90	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
800	45	1.20	11	11	11	11	11	12	–	–	–	–	–	–	–
800	22.5	1.20	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
700	90	1.20	10	12	–	–	–	–	–	–	–	–	–	–	–
700	45	1.20	10	10	10	10	11	11	12	–	–	–	–	–	–
700	22.5	1.20	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
600	90	1.20	10	11	–	–	–	–	–	–	–	–	–	–	–
600	45	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	11	11
600	11.25	1.20	10	10	10	10	10	10	10	10	10	10	10	10	10
500	90	1.20	9	10	12	–	–	–	–	–	–	–	–	–	–
500	45	1.20	9	9	9	9	9	10	10	10	11	11	12	12	12
500	22.5	1.20	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
450	90	1.10	8	10	12	–	–	–	–	–	–	–	–	–	–
450	45	1.10	8	8	8	8	8	9	10	10	10	11	11	11	12
450	22.5	1.10	8	8	8	8	8	8	8	8	8	8	8	9	9
450	11.25	1.10	8	8	8	8	8	8	8	8	8	8	8	8	8
400	90	1.10	8	9	11	–	–	–	–	–	–	–	–	–	–
400	45	1.10	8	8	8	8	8	8	9	10	10	10	10	11	11
400	22.5	1.10	8	8	8	8	8	8	8	8	8	8	8	8	8
400	11.25	1.10	8	8	8	8	8	8	8	8	8	8	8	8	8
350	90	1.00	7	8	11	12	–	–	–	–	–	–	–	–	–
350	45	1.00	7	7	7	7	7	7	8	9	9	10	10	10	10
350	22.5	1.00	7	7	7	7	7	7	7	7	7	7	7	7	7
350	11.25	1.00	7	7	7	7	7	7	7	7	7	7	7	7	7
300	90	1.00	7	7	10	11	12	–	–	–	–	–	–	–	–
300	45	1.00	7	7	7	7	7	7	7	8	8	9	9	10	10
300	22.5	1.00	7	7	7	7	7	7	7	7	7	7	7	7	7
300	11.25	1.00	7	7	7	7	7	7	7	7	7	7	7	7	7
250	90	1.00	6	6	9	10	11	12	12	–	–	–	–	–	–
250	45	1.00	6	6	6	6	6	6	6	6	7	7	8	8	8
250	22.5	1.00	6	6	6	6	6	6	6	6	6	6	6	6	6
250	11.25	1.00	6	6	6	6	6	6	6	6	6	6	6	6	6
200	90	1.00	6	6	7	9	10	10	11	11	12	12	12	–	–
200	45	1.00	6	6	6	6	6	6	6	6	6	6	6	6	7
200	22.5	1.00	6	6	6	6	6	6	6	6	6	6	6	6	6
200	11.25	1.00	6	6	6	6	6	6	6	6	6	6	6	6	6
150	90	0.80	5	5	6	7	8	9	10	10	10	11	11	11	12
150	45	0.80	5	5	5	5	5	5	5	5	5	5	5	5	6
150	22.5	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
150	11.25	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
125	90	0.80	5	5	5	6	7	8	8	9	10	10	10	10	11
125	45	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
125	22.5	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
125	11.25	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
100	90	0.80	5	5	5	5	6	6	7	7	8	8	9	9	10
100	45	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
100	22.5	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
100	11.25	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
80	90	0.80	4	4	4	4	4	5	5	6	6	7	7	7	8
80	45	0.80	4	4	4	4	4	4	4	4	4	4	4	4	4
80	22.5	0.80	4	4	4	4	4	4	4	4	4	4	4	4	4
80	11.25	0.80	4	4	4	4	4	4	4	4	4	4	4	4	4

DIMENSIONS OF THRUST BLOCKS FOR VERTICAL BENDS

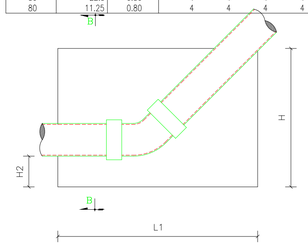
Type	L2(m)	L1(m)	H(m)	Volume (m3)
1	0.20	0.30	0.24	0.01
2	0.30	0.45	0.36	0.05
3	0.40	0.60	0.48	0.12
4	0.50	0.75	0.60	0.23
5	0.60	0.90	0.72	0.39
6	0.70	1.05	0.84	0.62
7	0.80	1.20	0.96	0.92
8	0.90	1.35	1.08	1.31
9	1.00	1.50	1.20	1.80
10	1.20	1.80	1.44	3.11
11	1.40	2.10	1.68	4.94
12	1.60	2.40	1.92	7.37

UPWARD DIRECTION TYPES

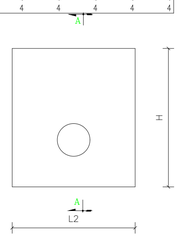
Diam (mm)	Theta Bend angle(°)	cover depth (m)	Test pressure 1	5	10	15	20	25	30	35	40	45	50	55	60
1000	90	1.20	–	–	–	–	–	–	–	–	–	–	–	–	–
1000	45	1.20	12	–	–	–	–	–	–	–	–	–	–	–	–
1000	22.5	1.20	12	–	–	–	–	–	–	–	–	–	–	–	–
1000	11.25	1.20	12	12	–	–	–	–	–	–	–	–	–	–	–
900	90	1.20	–	–	–	–	–	–	–	–	–	–	–	–	–
900	45	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
900	22.5	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
900	11.25	1.20	11	11	12	–	–	–	–	–	–	–	–	–	–
800	90	1.20	–	–	–	–	–	–	–	–	–	–	–	–	–
800	45	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
800	22.5	1.20	11	12	–	–	–	–	–	–	–	–	–	–	–
800	11.25	1.20	11	11	11	–	–	–	–	–	–	–	–	–	–
700	90	1.20	12	–	–	–	–	–	–	–	–	–	–	–	–
700	45	1.20	10	–	–	–	–	–	–	–	–	–	–	–	–
700	22.5	1.20	10	11	–	–	–	–	–	–	–	–	–	–	–
700	11.25	1.20	10	10	11	12	–	–	–	–	–	–	–	–	–
600	90	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
600	45	1.20	10	–	–	–	–	–	–	–	–	–	–	–	–
600	22.5	1.20	10	11	12	–	–	–	–	–	–	–	–	–	–
600	11.25	1.20	10	10	10	11	12	12	–	–	–	–	–	–	–
500	90	1.20	11	–	–	–	–	–	–	–	–	–	–	–	–
500	45	1.20	9	12	–	–	–	–	–	–	–	–	–	–	–
500	22.5	1.20	9	10	11	–	–	–	–	–	–	–	–	–	–
500	11.25	1.20	9	9	9	10	11	11	12	12	–	–	–	–	–
450	90	1.10	10	–	–	–	–	–	–	–	–	–	–	–	–
450	45	1.10	8	12	–	–	–	–	–	–	–	–	–	–	–
450	22.5	1.10	8	9	11	12	–	–	–	–	–	–	–	–	–
450	11.25	1.10	8	8	8	10	10	11	11	12	12	–	–	–	–
400	90	1.10	10	–	–	–	–	–	–	–	–	–	–	–	–
400	45	1.10	8	11	–	–	–	–	–	–	–	–	–	–	–
400	22.5	1.10	8	8	10	11	12	–	–	–	–	–	–	–	–
400	11.25	1.10	8	8	8	9	10	10	11	11	12	12	12	12	–
350	90	1.00	9	–	–	–	–	–	–	–	–	–	–	–	–
350	45	1.00	7	11	12	–	–	–	–	–	–	–	–	–	–
350	22.5	1.00	7	8	10	11	12	12	–	–	–	–	–	–	–
350	11.25	1.00	7	7	7	8	9	10	10	11	11	11	12	12	12
300	90	1.00	8	12	–	–	–	–	–	–	–	–	–	–	–
300	45	1.00	7	10	12	–	–	–	–	–	–	–	–	–	–
300	22.5	1.00	7	7	9	10	11	11	12	12	–	–	–	–	–
300	11.25	1.00	7	7	7	7	8	9	10	10	10	10	11	11	11
250	90	1.00	7	11	–	–	–	–	–	–	–	–	–	–	–
250	45	1.00	6	9	11	12	–	–	–	–	–	–	–	–	–
250	22.5	1.00	6	6	8	9	10	10	11	11	12	12	12	–	–
250	11.25	1.00	6	6	6	6	7	8	8	9	9	10	10	10	10
200	90	1.00	6	10	12	–	–	–	–	–	–	–	–	–	–
200	45	1.00	6	7	10	11	11	12	12	–	–	–	–	–	–
200	22.5	1.00	6	6	6	8	9	9	10	10	11	11	11	11	12
200	11.25	1.00	6	6	6	6	6	6	7	7	8	8	9	9	9
150	90	0.80	5	9	11	12	–	–	–	–	–	–	–	–	–
150	45	0.80	5	6	8	10	10	11	11	12	12	12	12	–	–
150	22.5	0.80	5	5	5	6	7	8	8	9	9	10	10	10	10
150	11.25	0.80	5	5	5	5	5	5	6	6	6	7	7	7	8
125	90	0.80	5	8	10	11	12	12	–	–	–	–	–	–	–
125	45	0.80	5	5	7	8	9	10	10	11	11	11	12	12	12
125	22.5	0.80	5	5	5	5	6	7	7	8	8	9	9	9	10
125	11.25	0.80	5	5	5	5	5	5	5	5	5	6	6	6	6
100	90	0.80	5	6	9	10	11	11	12	12	12	–	–	–	–
100	45	0.80	5	5	6	7	8	8	9	10	10	10	10	11	11
100	22.5	0.80	5	5	5	5	5	5	6	6	7	7	7	8	8
100	11.25	0.80	5	5	5	5	5	5	5	5	5	5	5	5	5
80	90	0.80	4	5	7	9	10	10	10	11	11	11	12	12	12
80	45	0.80	4	4	5	6	6	7	8	8	9	9	9	10	10
80	22.5	0.80	4	4	4	4	4	4	5	5	6	6	6	6	7
80	11.25	0.80	4	4	4	4	4	4	4	4	4	4	4	4	4



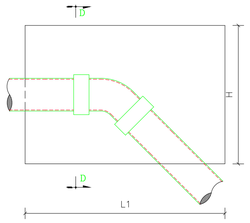
SECTION B–B
VERTICAL BEND ANCHOR BLOCK
TYPICAL REINFORCEMENT DETAIL



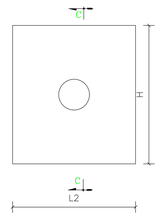
SECTION A–A
UPWARD FLOW DIRECTION



SECTION B–B
VERTICAL BEND ANCHOR BLOCK
UPWARD FLOW DIRECTION



SECTION C–C
DOWNWARD FLOW DIRECTION

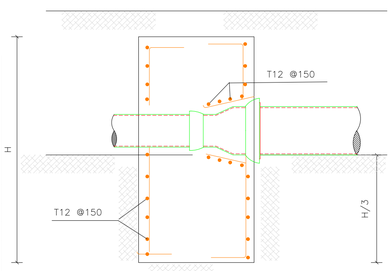


SECTION D–D
VERTICAL BEND ANCHOR BLOCK
DOWNWARD FLOW DIRECTION

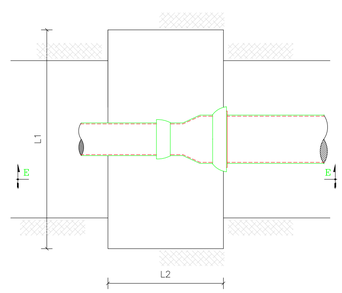
TYPICAL THRUST BLOCKS FOR TAPERS

THRUST BLOCK DIMENSIONS

Type	L1 (m)	L2 (m)	H (m)	Volume (m3)
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

THRUST BLOCKS TYPE

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

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	25°	
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm2
SOIL–CONCRETE FRICTION ANGLE	2/3 * 25°	

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
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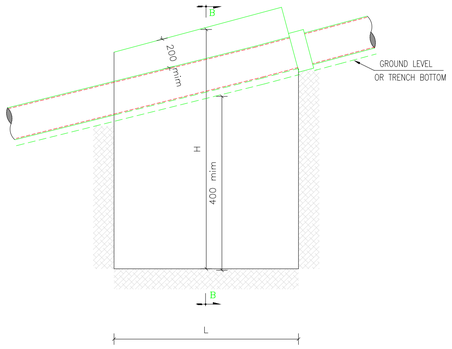
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

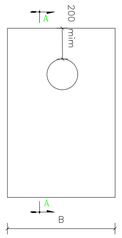
PIPELINE THRUST BLOCKS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

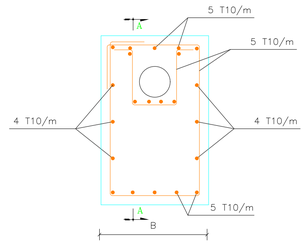
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	12/23	477W-DS-STD12



SECTION A–A
ANCHOR BLOCK FOR BURIED
OR UNCOVERED PIPES (ONE BLOCK PER PIPE)
SLOPE ≤ 50%



SECTION B–B
ANCHOR BLOCK FOR BURIED
OR UNCOVERED PIPES
SLOPE ≤ 50%

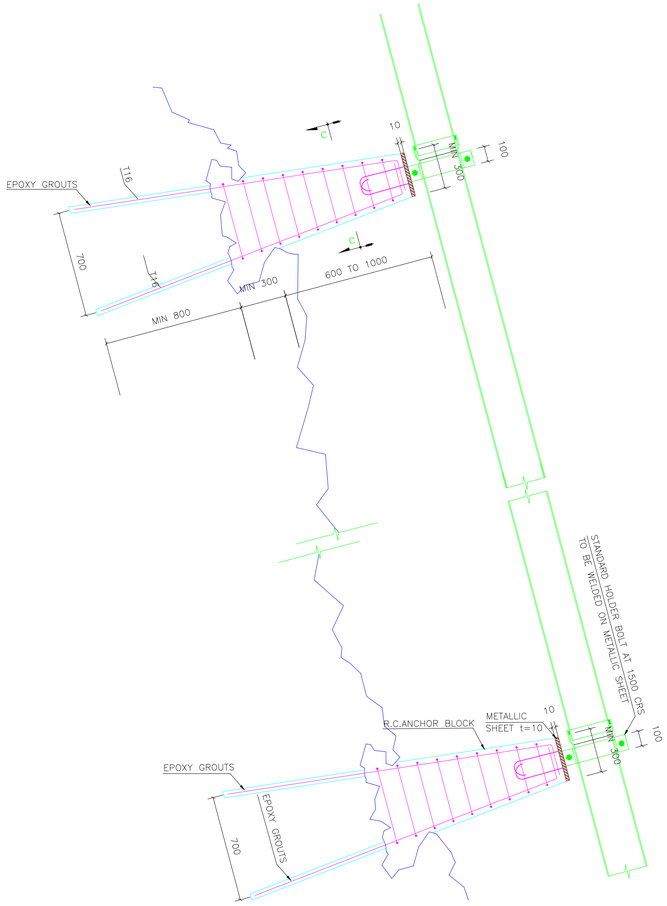


SECTION B–B
ANCHOR BLOCK FOR BURIED OR UNCOVERED PIPES
TYPICAL REINFORCEMENT DETAIL
SLOPE ≤ 50%

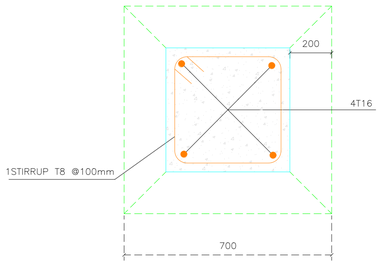
ANCHOR BLOCKS FOR BURIED SLOPED PIPES

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	0.700	1.850	1.750
800	0.300	1.450	1.600	0.300	1.500	1.600	0.300	1.550	1.600	0.450	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

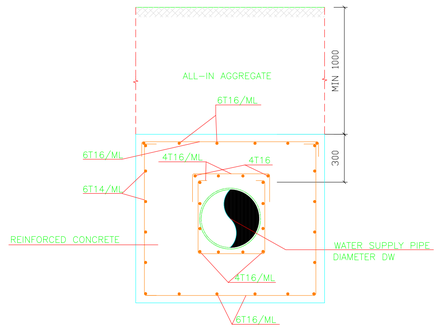
* FOR SLOPE > 50% SEE NOTE



ANCHORS ON ROCK
FOR SLOPE > 50 % AND FOR UNCOVERED PIPES



SECTION C–C
N.T.S



REINFORCED CONCRETE SURROUND
N.T.S

ANCHOR BLOCKS FOR UNCOVERED SLOPED PIPES.

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	1.600	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

NOTES:

WHEN THE SLOPE IS GREATER THAN 50 % ALL THE PIPELINE TRENCH SHALL BE FILLED BY MASS CONCRETE

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	25°	
SECURITY FACTOR	1.2	
SOIL BEARING CAPACITY	3	kg/cm2
SOIL–CONCRETE FRICTION ANGLE	2/3 * 25°	

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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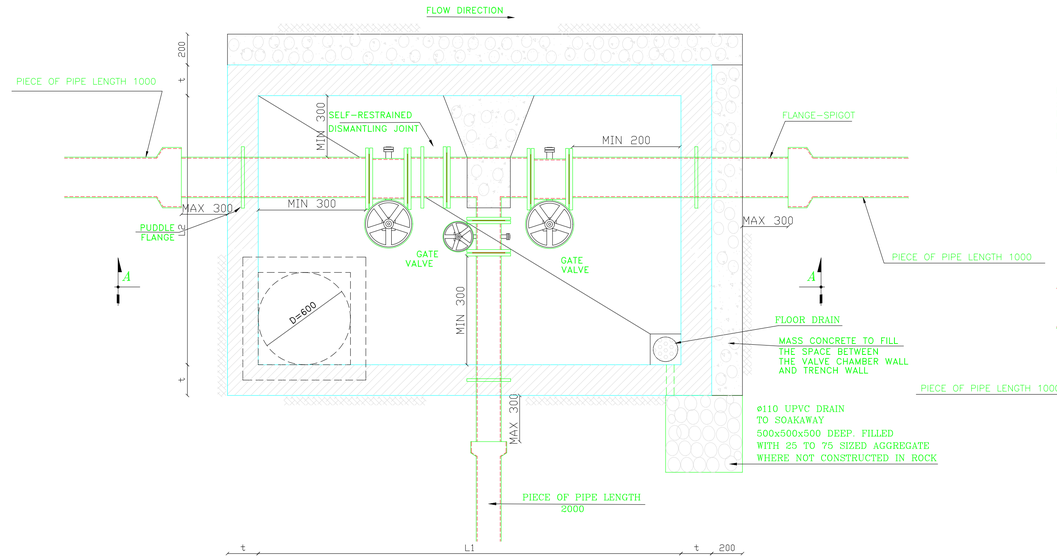
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

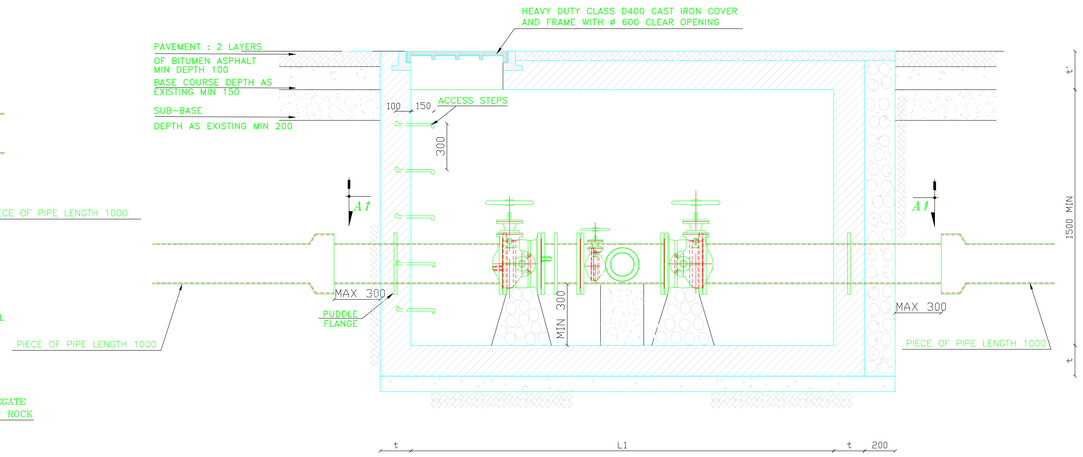
PIPELINE ANCHOR BLOCKS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

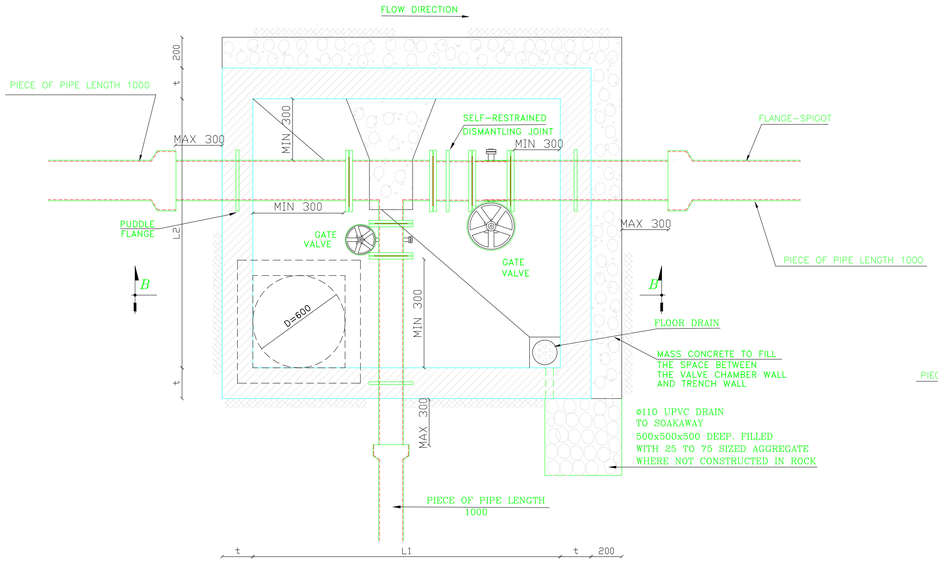
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	13/23	477W-DS-STD13



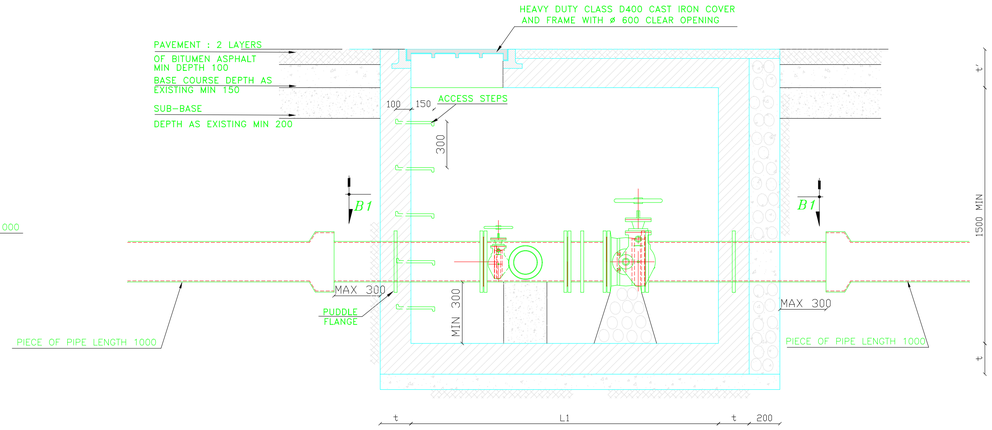
SECTION A1-A1



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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MINISTRY OF ENERGY AND WATER
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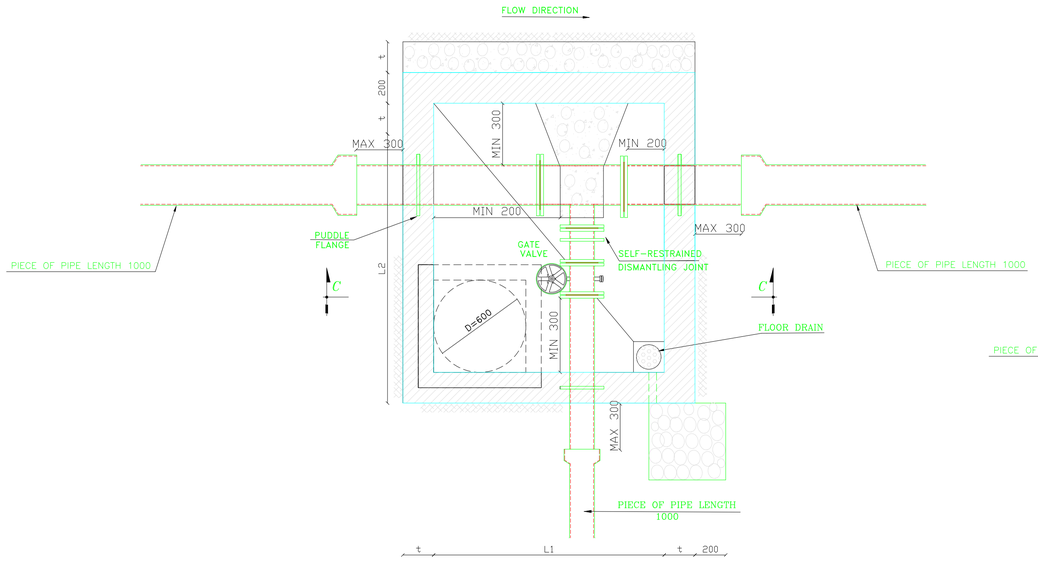
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

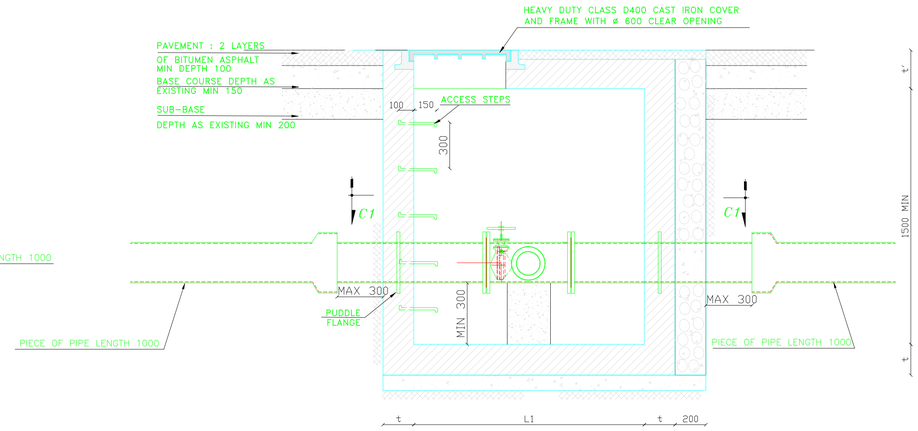
TRANSMISSION AND DISTRIBUTION SYSTEMS	TYPICAL VALVE CHAMBER DETAILS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

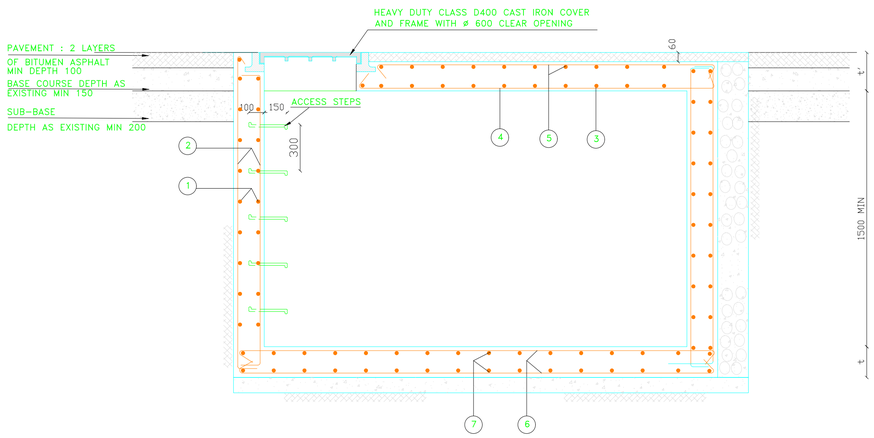
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	14/23	477W-DS-STD14

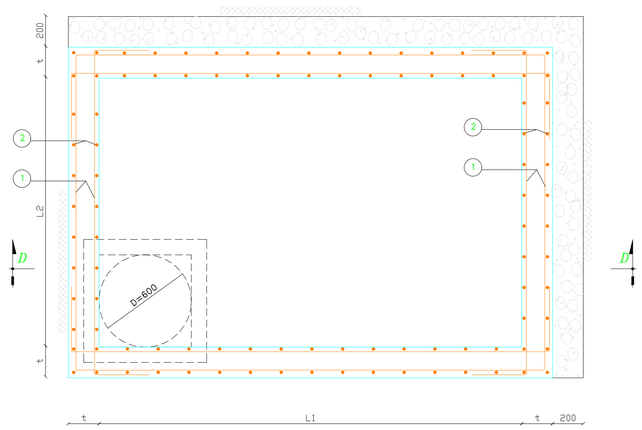


SECTION C1–C1



SECTION C–C





VALVE CHAMBER TYPE

BRANCH DIAM	60			80			100			125			150			200			250			300			350			400			450			500			600		
NBR OF VALVES / MAIN PIPE	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	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	–	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	R42

REINFORCEMENT STEEL TABLE

VALVE CHAMBER	THICKNESS		REINFORCEMENT						
TYPE	t mm	t' mm	1	2	3	4	5	6	7
R1–R5	200	250	T14 @200	T14 @200	T16 @200	T14 @200	2xT12 @200	T14 @200	T14 @200
R6–R11	200	250	T14 @165	T14 @165	T16 @165	T14 @165	2xT12 @165	T14 @165	T14 @165
R11–R23	200	250	T14 @150	T14 @150	T14 @150	T14 @150	2xT12 @150	T14 @150	T14 @150
R23–R38	250	300	T16 @200	T16 @200	T20 @200	T14 @200	2xT12 @200	T16 @200	T16 @200
R39–R42	300	300	T16 @165	T16 @165	T20 @165	T14 @165	2xT12 @165	T16 @165	T16 @165

VALVE CHAMBER DIMENSIONS	
TYPE	LixL2
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	LixL2
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

NOTES:

REINFORCED CONCRETE:
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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.

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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

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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

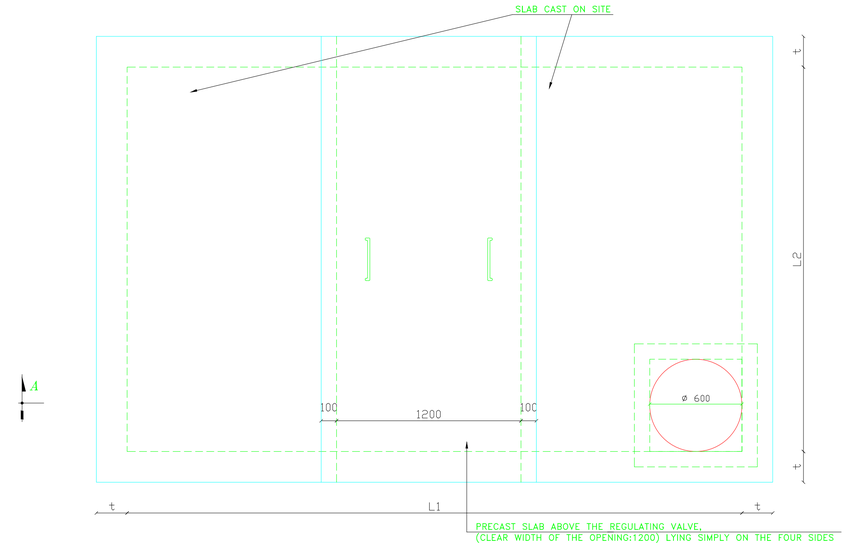
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

TYPICAL VALVE CHAMBER DETAILS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

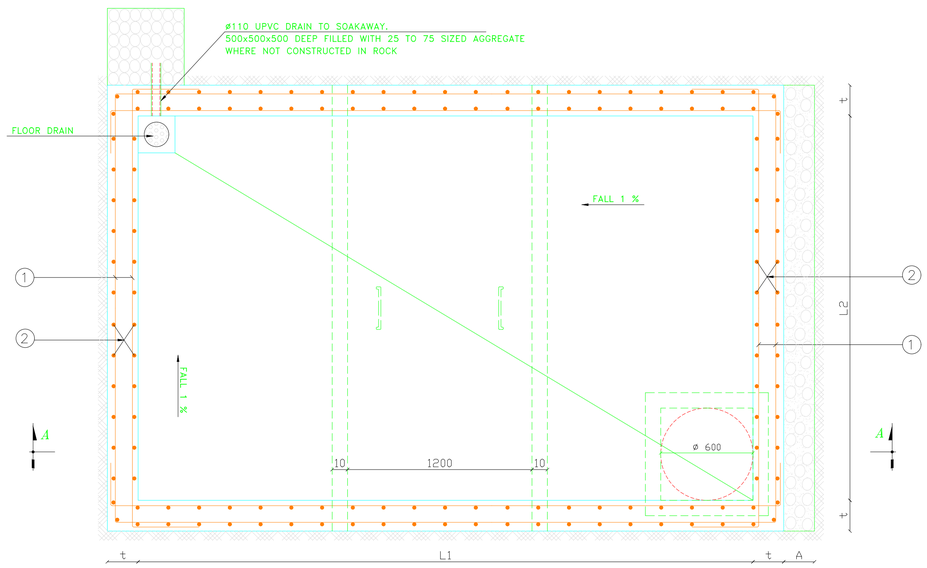
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	15/23	477W-DS-STD15



PLAN VIEW

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

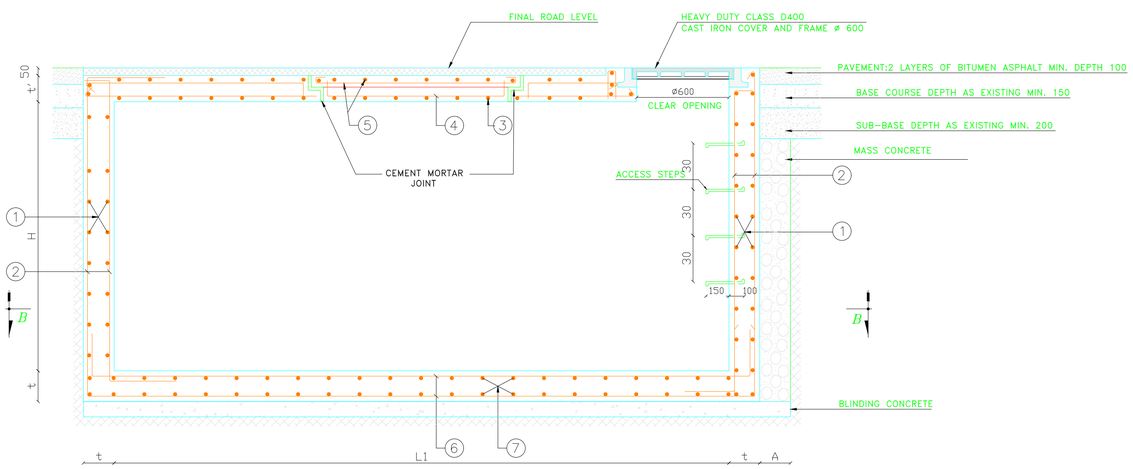
* UPSTREAM PRESSURE – DOWNSTREAM PRESSURE ≤ 16 BARS.



SECTION B–B

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	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250
100	80	80	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250
150	100	80	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250
200	150	100	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250
250	200	150	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250
300	250	200	T14@165	T14@165	T16@165	T12@165	2xT12@165	T14@165	T14@165	200	250	T16@200	T16@200	T16@165	T12@165	2xT12@165	T16@200	T16@200	250	250
350	300	250	T16@200	T16@200	T20@200	T12@200	2xT12@200	T16@200	T16@200	250	300	T16@165	T16@165	T20@165	T12@165	2xT12@165	T16@165	T16@165	300	300
400	300	250	T16@200	T16@200	T20@200	T12@200	2xT12@200	T16@200	T16@200	250	300	T16@165	T16@165	T20@165	T12@165	2xT12@165	T16@165	T16@165	300	300
450	350	250	T16@200	T16@200	T20@200	T12@200	2xT12@200	T16@200	T16@200	250	300	T16@165	T16@165	T20@165	T12@165	2xT12@165	T16@165	T16@165	300	300
500	400	300	T16@165	T16@165	T20@165	T12@165	2xT12@165	T16@165	T16@165	300	300	T16@165	T16@165	T20@165	T12@165	2xT12@165	T16@165	T16@165	350	300
600	500	400	T14@200	T14@200	T20@165	T12@165	2xT12@165	T14@200	T14@200	350	300									
700	500	400	T14@200	T14@200	T20@165	T12@165	2xT12@165	T14@200	T14@200	400	300									
800*	600	400	T16@200	T16@200	T20@165	T12@165	2xT12@165	T16@200	T16@200	400	300									

* UPSTREAM PRESSURE – DOWNSTREAM PRESSURE ≤ 16 BARS.



SECTION A–A

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 # 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 #8 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

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 OR 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

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT
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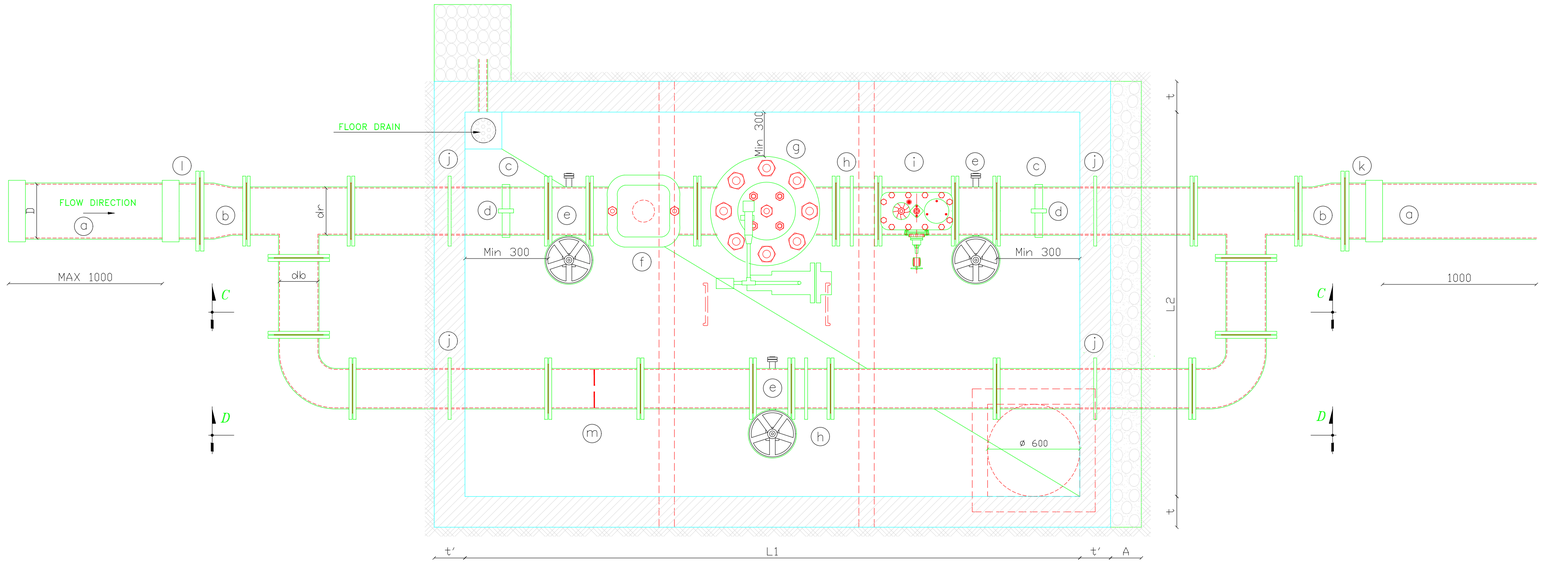
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

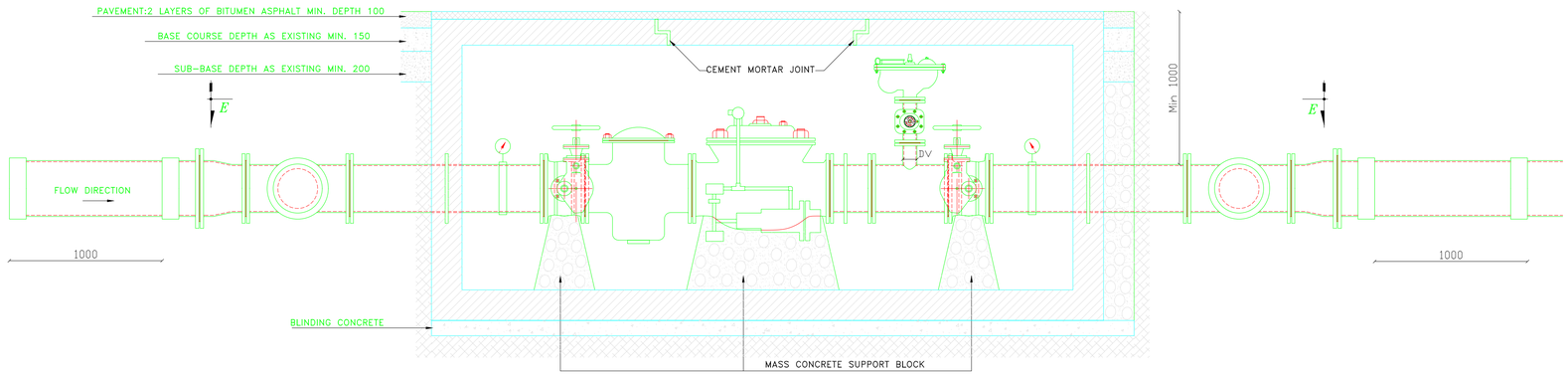
PRESSURE REGULATING VALVE DETAILS OF INSTALLATION AND PROTECTION CHAMBER

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

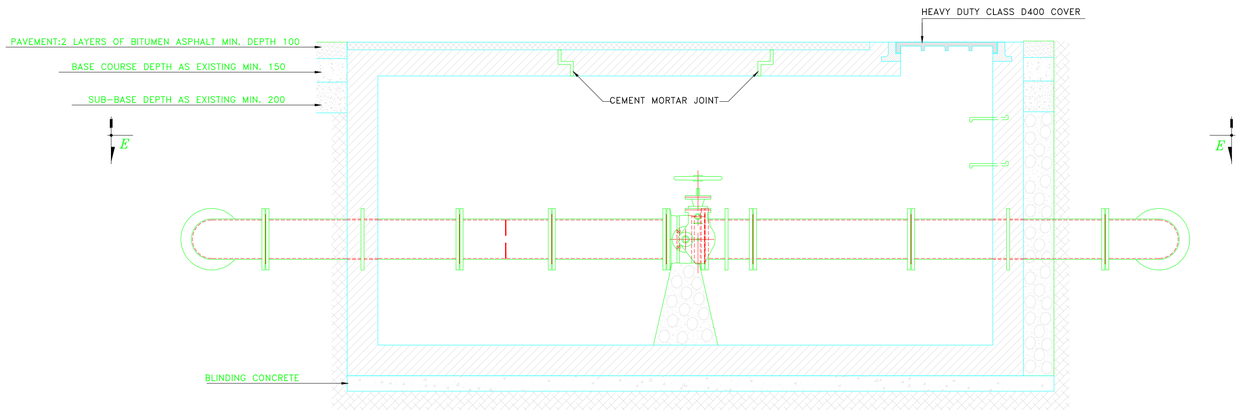
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	16/23	477W-DS-STD16



SECTION E-E



SECTION C-C



SECTION D-D

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.
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STRESSES:
SEVERE CONTROL.
CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS: f'c =25 MPa.
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CLEARANCE BETWEEN THE EXTERNAL GENERATRIX OF BARS AND THE FACINGS SHALL BE 30 mm

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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:
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.
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* 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 STABLITY 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

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 OR 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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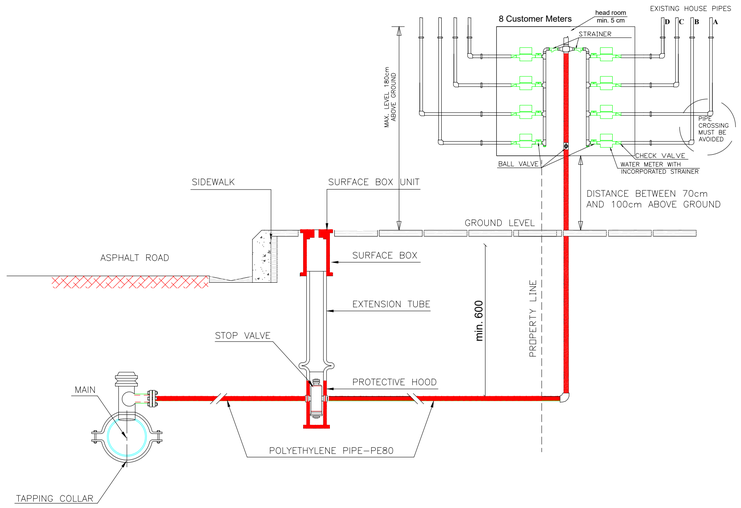
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

PRESSURE REGULATING VALVE DETAILS OF INSTALLATION AND PROTECTION CHAMBER

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	17/23	477W-DS-STD17

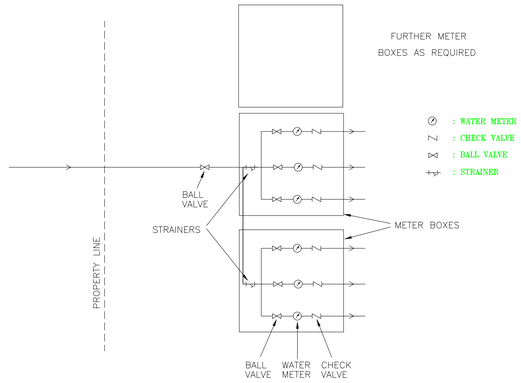


SERVICE CONNECTION WITHOUT INSULATION

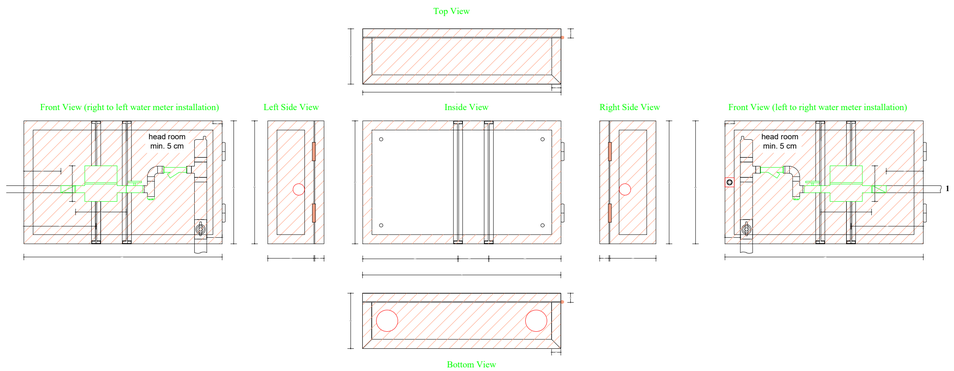
NUMBER OF CONSUMERS	SERVICE PIPE OUTER DIAMETER
1-6	20 mm
7-16	25 mm
17-26	32 mm
>27 OR BIG CONSUMERS	40 mm

Note:

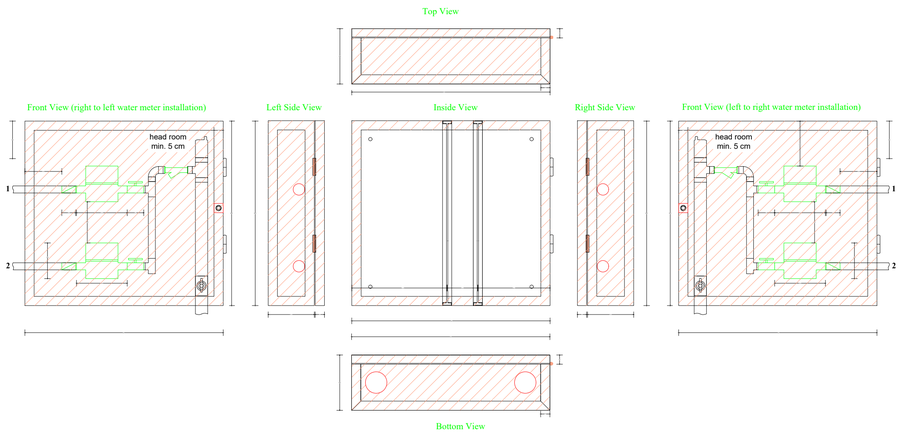
- Protection box shall be installed at a level that allows easy reading and opening for maintenance reasons.
- Minimum level above ground shall be not less than 70 cm.
- Maximum level above ground shall not be more than 180 cm.
- Pipe crossings as shown for connections A and B must to be avoided.
- Pipes must be installed in a straight alignment (vertical or horizontal). Adequate fittings must be provided by Contractor.



MULTIPLE SERVICE CONNECTION DETAIL



TYPICAL PROTECTION BOX FOR 1 WATER METER



TYPICAL PROTECTION BOX FOR 2 WATER METERS

NOTES:

1- MULTIPLE HOUSE CONNECTIONS MAY INVOLVE SEVERAL WATER METER BOXES OF TYPICAL SIZE

2- ALL DIMENSIONS ARE IN CENTIMETERS UNLESS OTHERWISE INDICATED

3- ALL EXPOSED PIPING SHALL BE GALVANIZED IRON AND SHALL BE TAMPER PROOF

4- ALL WATER METER BOXES SHALL BE MADE OF COLORED, RUST-PROOF, AND ELECTRO-PLATED STEEL OR THE EQUIVALENT, UP TO THE APPROVAL OF THE ENGINEER

5- PRIOR TO MANUFACTURING THE BOXES, THE CONTRACTOR SHALL SUBMIT FOR APPROVAL A COMPLETE SAMPLE OF EACH BOX SIZE WITH ALL PIPING, FITTINGS, WATER METERS, LOCKS, KEYS, AS WELL AS EXTERNAL FINISH AND WALL FIXING SCREWS

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

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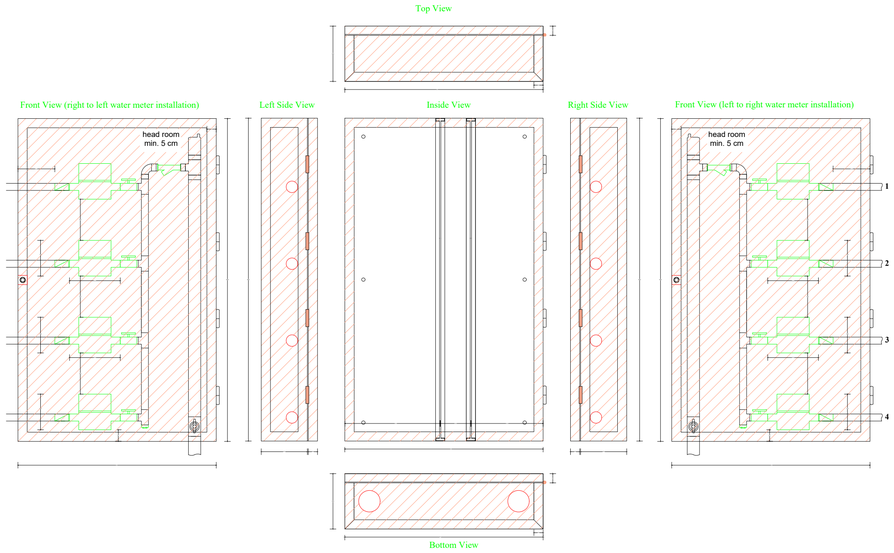
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

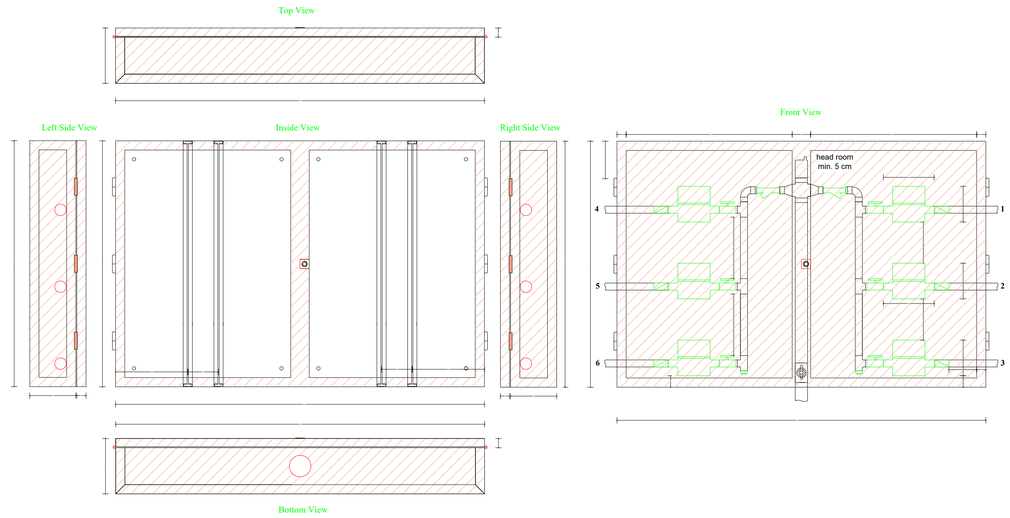
TYPICAL SERVICE AND HOUSE CONNECTIONS
TYPICAL WATER METER PROTECTION BOXES FOR 1 & 2 WATER METERS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

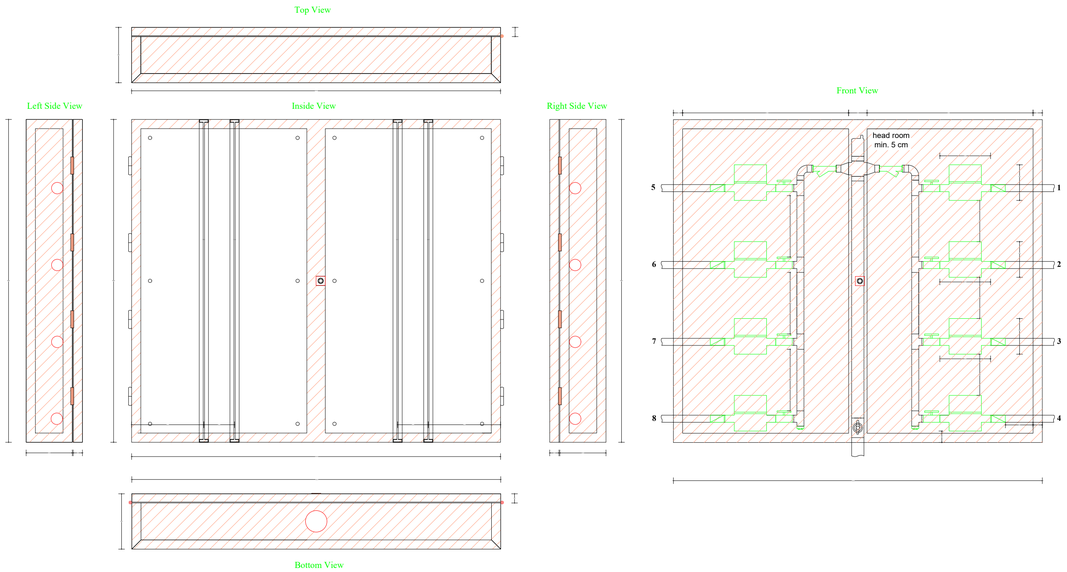
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	18/23	477W-DS-STD18



TYPICAL PROTECTION BOX FOR 4 WATER METERS



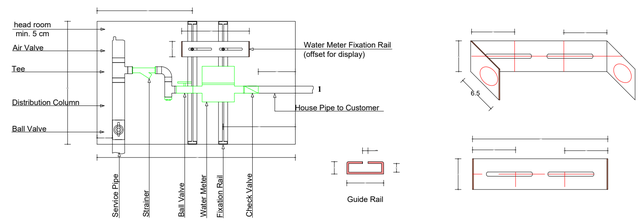
TYPICAL PROTECTION BOX FOR 6 WATER METERS



TYPICAL PROTECTION BOX FOR 8 WATER METERS

		Width	Height	Depth
Water Meters	1	65cm	40cm	18cm
	2	65cm	60cm	18cm
	4	65cm	105cm	18cm
	6	120cm	80cm	18cm
	8	120cm	105cm	18cm

WATER METER BOX



PROTECTION BOX GEOMETRY

NOTES:

1- MULTIPLE HOUSE CONNECTIONS MAY INVOLVE SEVERAL WATER METER BOXES OF TYPICAL SIZE

2- ALL DIMENSIONS ARE IN CENTIMETERS UNLESS OTHERWISE INDICATED

3- ALL EXPOSED PIPING SHALL BE GALVANIZED IRON AND SHALL BE TAMPER PROOF

4- ALL WATER METER BOXES SHALL BE MADE OF COLORED, RUST-PROOF, AND ELECTRO-PLATED STEEL OR THE EQUIVALENT, UP TO THE APPROVAL OF THE ENGINEER

5- PRIOR TO MANUFACTURING THE BOXES, THE CONTRACTOR SHALL SUBMIT FOR APPROVAL A COMPLETE SAMPLE OF EACH BOX SIZE WITH ALL PIPING, FITTINGS, WATER METERS, LOCKS, KEYS, AS WELL AS EXTERNAL FINISH AND WALL FIXING SCREWS

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

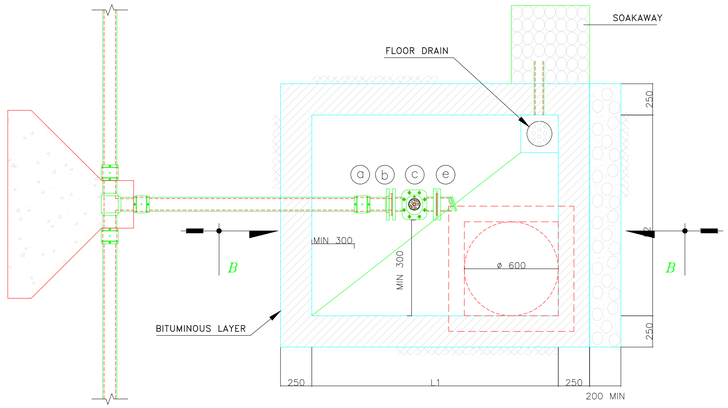
TRANSMISSION AND DISTRIBUTION SYSTEMS

TYPICAL WATER METER PROTECTION BOXES FOR 4 - 6 & 8 WATER METERS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

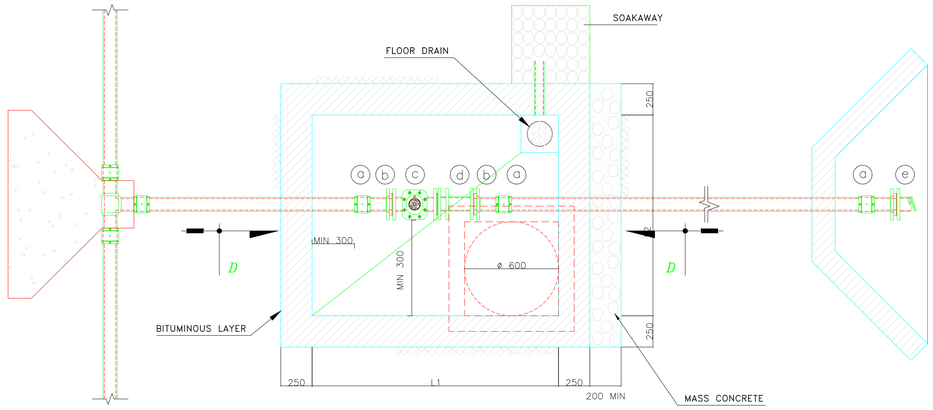
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	19/23	477W-DS-STD19

TYPICAL WASHOUT CHAMBER DETAIL
TYPE I

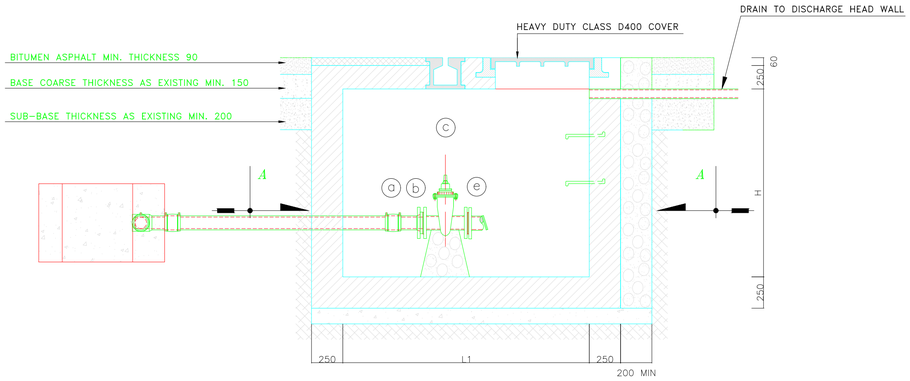


SECTION A–A

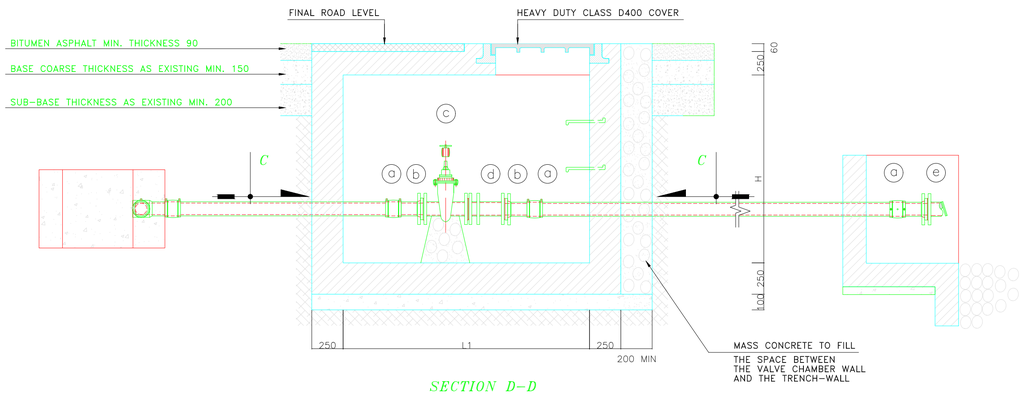
TYPICAL WASHOUT CHAMBER DETAIL
TYPE II



SECTION C–C

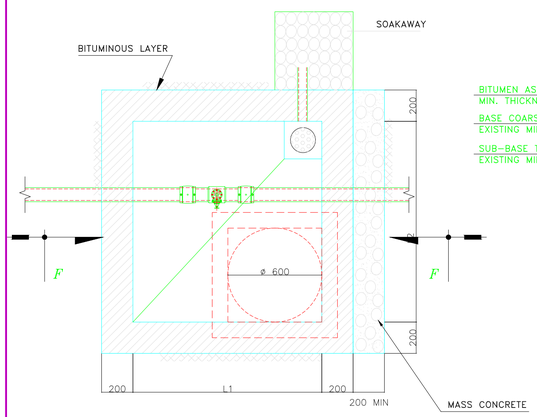


SECTION B–B

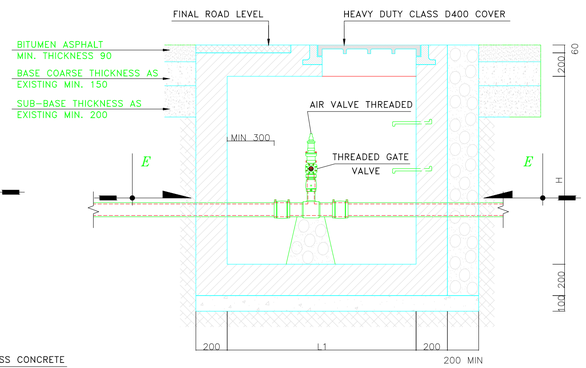


SECTION D–D

TYPICAL AIR VALVE CHAMBER DETAIL
TYPE I

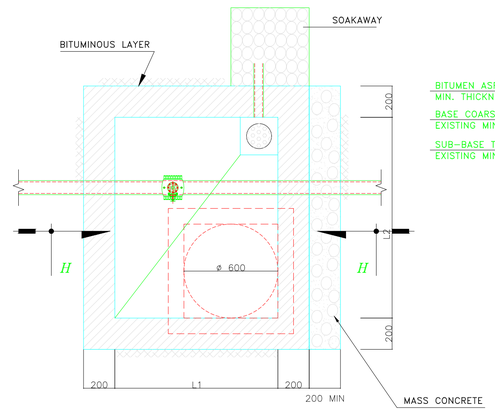


SECTION E–E

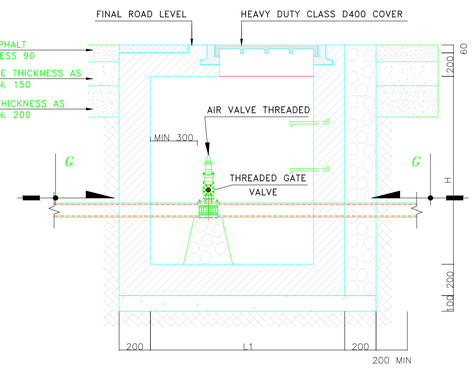


SECTION F–F

TYPICAL AIR VALVE CHAMBER DETAIL
TYPE II



SECTION G–G



SECTION H–H

NOTES:

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

BUNDING 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

LEGEND:
- a ELECTROFUSION COUPLING
- b PE-FLANGE ADAPTOR WITH BACKING FLANGE
- c GATE VALVE
- d SELF-RESTRAINED DISMANTLING JOINT
- e FLANGED FLAP VALVE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON
MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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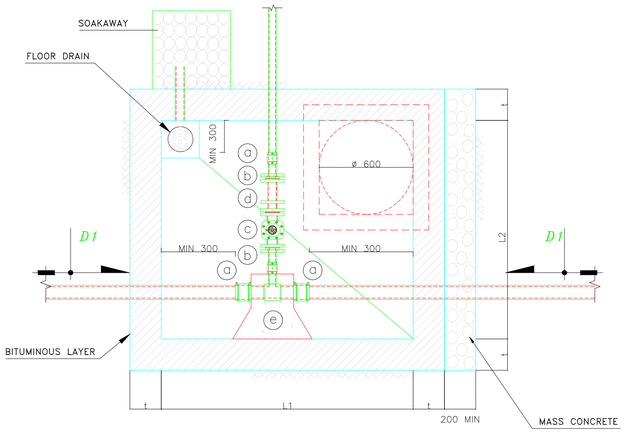
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

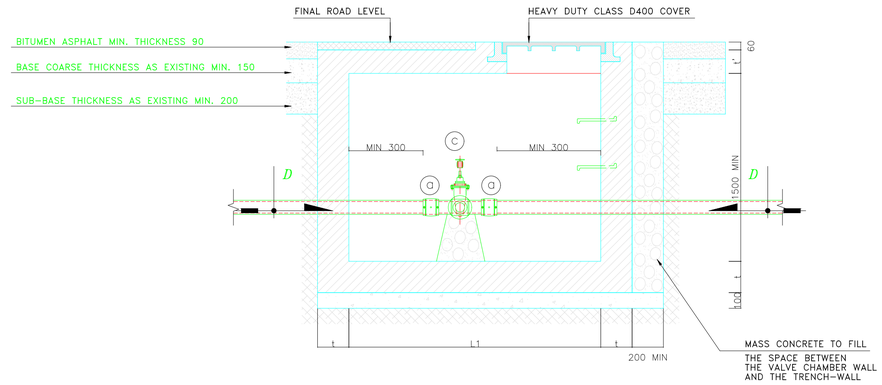
WASHOUT AND AIR VALVE CHAMBER DETAILS FOR HDPE PIPES

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

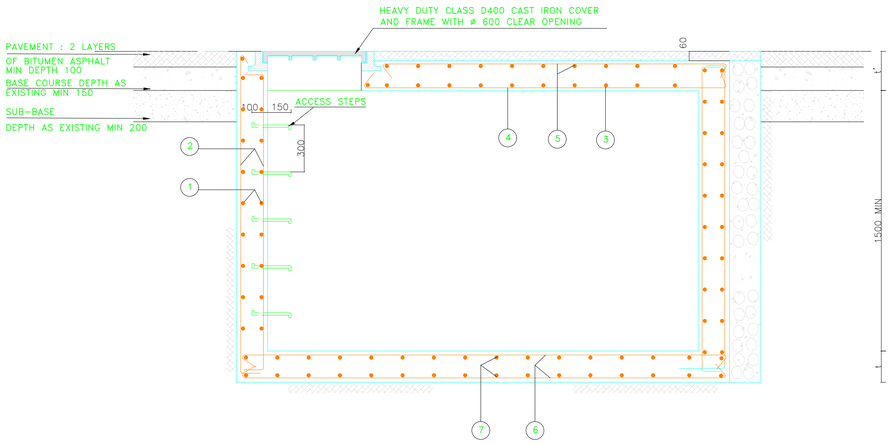
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	20/23	477W-DS-STD20

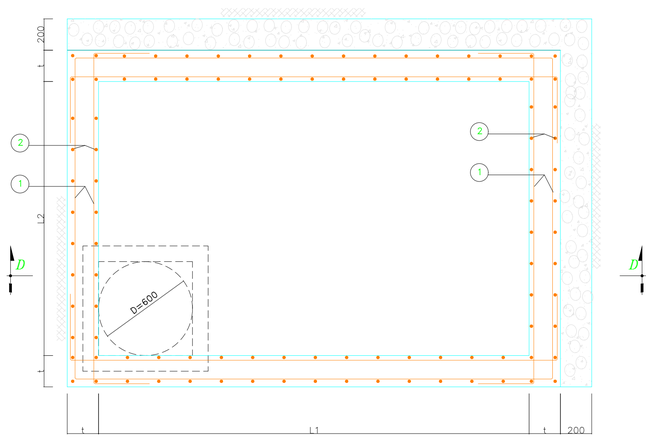


SECTION D–D



SECTION D1–D1





VALVE CHAMBER TYPE

BRANCH DIAM	63			75			90			110			125			140		
NBR OF VALVES / MAIN PIPE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
63	–	R8	R12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
75	R4	R8	R12	–	R8	R12	–	–	–	–	–	–	–	–	–	–	–	–
90	R4	R8	R12	R4	R8	R12	–	R8	R12	–	–	–	–	–	–	–	–	–
110	R4	R12	R14	R4	R12	R14	R4	R12	R14	–	R12	R14	–	–	–	–	–	–
125	R4	R12	R14	R4	R12	R14	R4	R12	R14	R4	R12	R14	–	R12	R14	–	–	–
140	R4	R12	R14	R4	R12	R14	R4	R12	R14	R4	R12	R14	R4	R12	R14	–	R12	R14

VALVE CHAMBER DIMENSIONS	
TYPE	LixL2
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	LixL2
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

REINFORCEMENT STEEL TABLE

VALVE CHAMBER	THICKNESS		REINFORCEMENT						
TYPE	t mm	t' mm	1	2	3	4	5	6	7
R1–R5	200	250	T14 @200	T14 @200	T16 @200	T14 @200	2xT12 @200	T14 @200	T14 @200
R6–R11	200	250	T14 @165	T14 @165	T16 @165	T14 @165	2xT12 @165	T14 @165	T14 @165
R11–R23	200	250	T14 @150	T14 @150	T14 @150	T14 @150	2xT12 @150	T14 @150	T14 @150
R23–R38	250	300	T16 @200	T16 @200	T20 @200	T14 @200	2xT12 @200	T16 @200	T16 @200
R39–R42	300	300	T16 @165	T16 @165	T20 @165	T14 @165	2xT12 @165	T16 @165	T16 @165

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: ft =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.
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* SCALING FROM THESE DRAWINGS IS NOT ALLOWED.
* SOIL FRICTION ANGLE SHALL BE 25°
* GROUND/ MANHOLE FRICTION COEFFICIENT SHALL BE 2/3 tg ø
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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) ELECTROFUSION COUPLING
(b) PE–FLANGE ADAPTOR WITH BACKING FLANGE
(c) GATE VALVE
(d) SELF–RESTRAINED DISMANTLING JOINT
(e) REDUCED PE TEE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER
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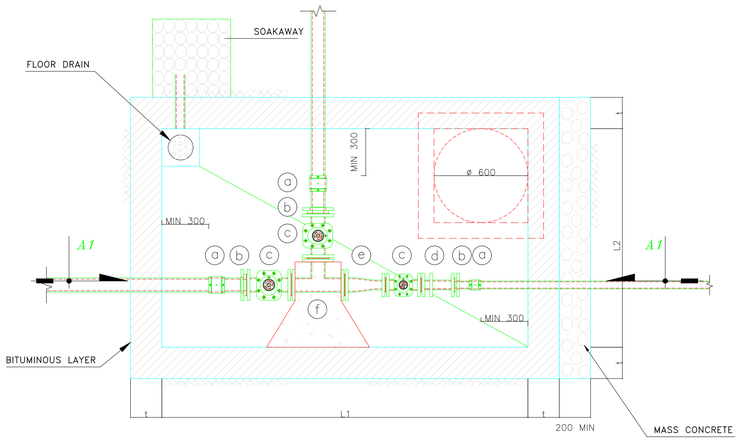
CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

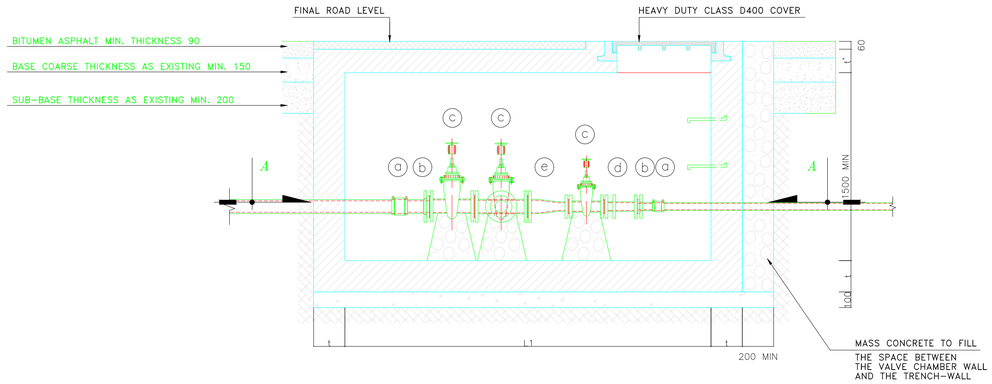
TYPICAL VALVE CHAMBER DETAILS FOR HDPE PIPES

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

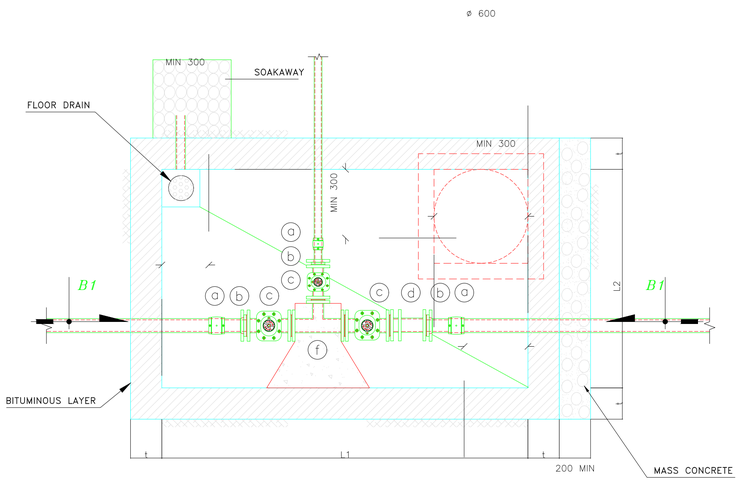
DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	21/23	477W-DS-STD21



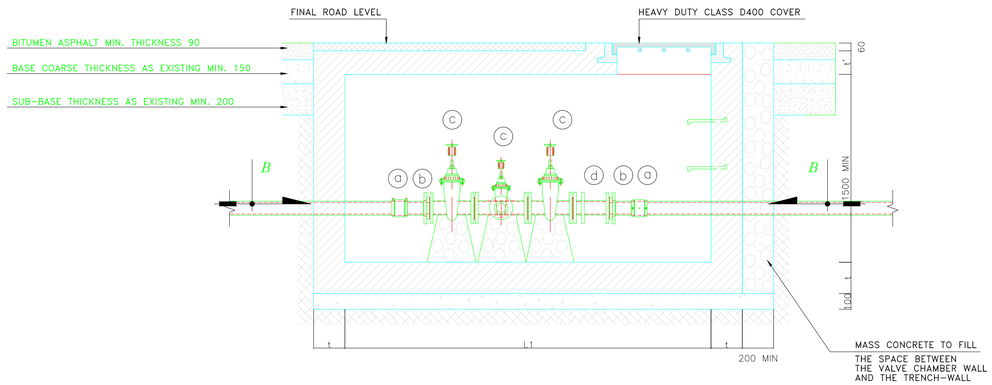
SECTION A–A



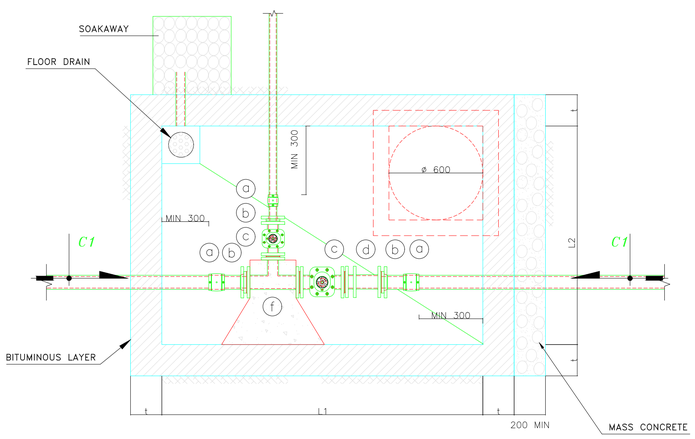
SECTION A1–A1



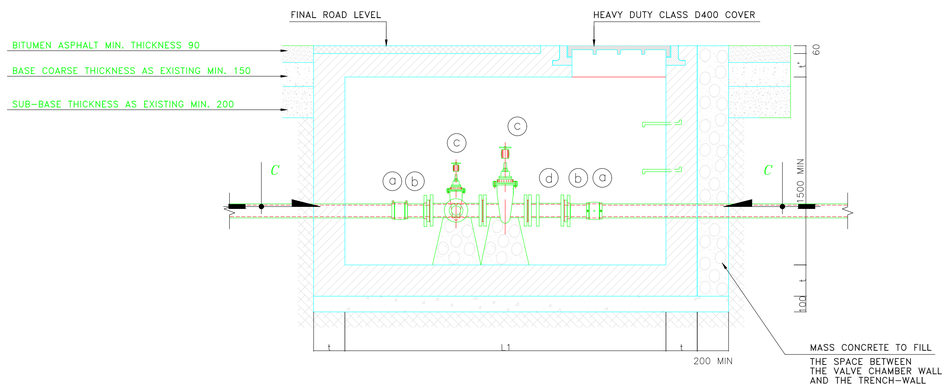
SECTION B–B



SECTION B1–B1



SECTION C–C



SECTION C1–C1

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: $f_c^{\prime}$ =25 MPa.
CONCRETE TENSILE STRENGTH AT 28 DAYS: $f_t^{\prime}$ =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.
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* 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

LEGEND:
- (a) ELECTROFUSION COUPLING
- (b) PE–FLANGE ADAPTOR WITH BACKING FLANGE
- (c) GATE VALVE
- (d) SELF–RESTRAINED DISMANTLING JOINT
- (e) REDUCER
- (f) ALL FLANGED TEE

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER
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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

TRANSMISSION AND DISTRIBUTION SYSTEMS

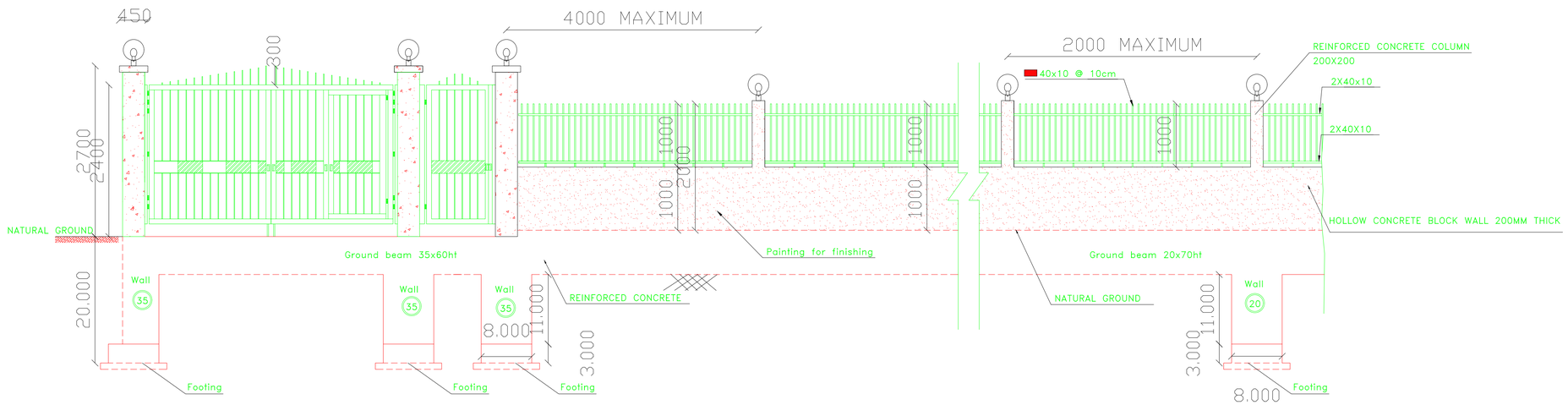
TYPICAL VALVE CHAMBER DETAILS FOR HDPE PIPES

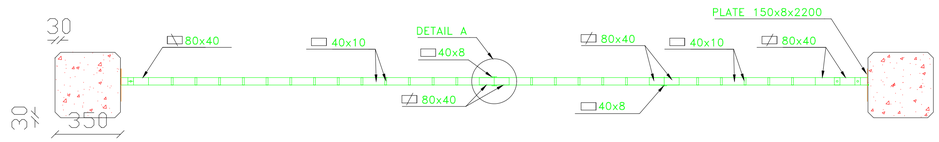
DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS- STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	22/23	477W-DS-STD22

GATEs 4 m and 1.2m (ELEVATION)

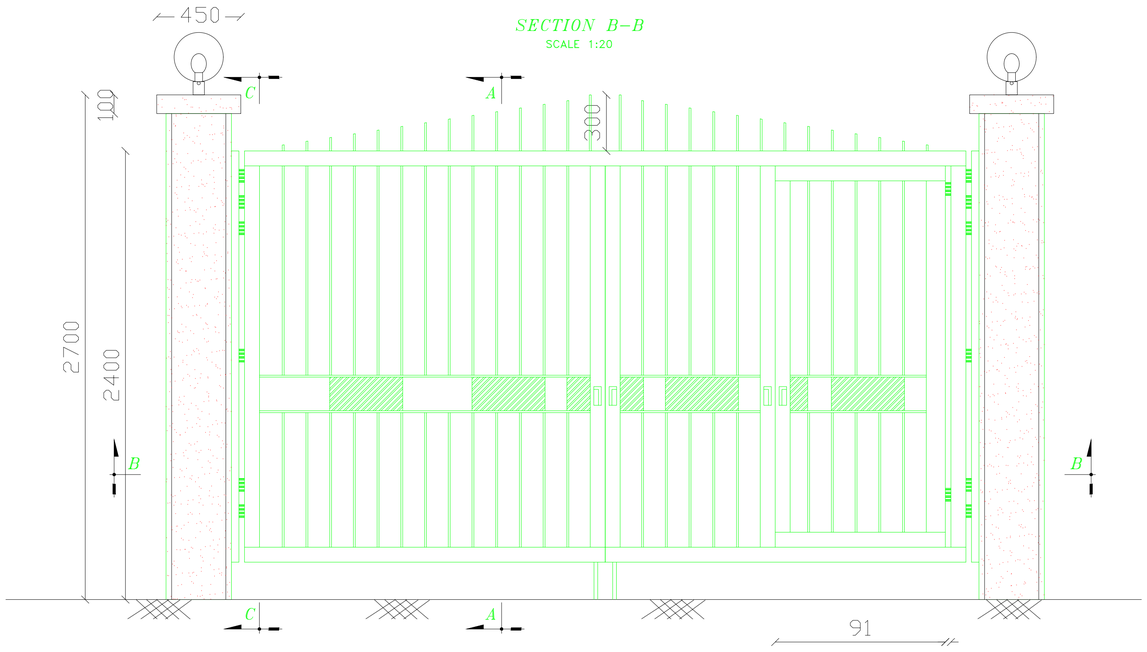
SCALE 1:50





SECTION B–B

SCALE 1:20



GATE 4 m ELEVATION

SCALE 1:20

NOTES:

REINFORCED CONCRETE:

ORDINARY PORTLAND CEMENT.

Grade C30 : DOSING 400 Kg/m3 FOR RESERVOIR.

Grade C30 : DOSING 350 Kg/m3 FOR BUILDINGS AND OTHER STRUCTURES.

Grade C25 : 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:

- FOR RESERVOIR : ON A CUBE, a= 150mm :37N/mm2
- FOR RESERVOIR : ON A CYLINDER ø=150mm, h=300mm :30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CUBE, a= 150mm: 30N/mm2
- FOR OTHER BUILDINGS AND STRUCTURE : ON A CYLINDER ø=150mm, h=300mm: 25N/mm2

COVER:

THE CONCRETE COVER FOR ALL STEEL BARS INCLUDING STIRRUPS SHALL NOT BE LESS THAN:

40MM: RESERVOIR WALL AND RAFT – AND ALL CONCRETE SURFACES IN CONTACT WITH SOIL

30MM: FOR EXTERNAL SURFACES OF STRUCTURES AND ALL ELEMENTS OF BUILDINGS

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.

WATER-STOP JOINTS SHALL BE USED IN EACH CONSTRUCTION JOINT CONTINUOUSLY.

(CONFORMING TO THE PRODUCT'S TECHNICAL SHEET).

FORMWORK:

ALL EXECUTED CONCRETE SHALL BE FAIR FACED CONCRETE.

DOUBLE THREADED WATERPROOF CONNECTION SLEEVES SHALL BE USED FOR RESERVOIR FORMWORKS TIE-RODS.

THE USE OF ø6mm 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.

WATERPROOFING:

SURFACE WATERPROOFING TREATMENT OF RESERVOIR FLOOR SLAB, WALLS AND ROOF FROM THE INTERIOR SIDE.

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

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MINISTRY OF ENERGY AND WATER

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CONSTRUCTION OF DRILLING WATER WELLS, PUMPING STATIONS AND LIFT LINES IN BEINO AND DEIR NBOUH AREAS

BEINO WELL, PUMPING STATION AND WATER TOWER (CAPACITY 300 m3)	FENCE DETAILS PLAN VIEWS AND ELEVATIONS

DRAWING NO.	DESIGNED BY	DRAWN BY	CHECKED BY
477W-DS-STD	BTD	BTD	BTD

DATE	SCALE	SHEET No.	SEQ. NO
APRIL 2024	N.T.S	23/23	477W-DS-STD23