LEGEND:

Access Road + Bridge (Phase 1)

Existing Dirt / Gravel Road

Unpaved Shoulders

LP: 0+211.13

Walls Foundations

Dyke

R.C Water Canal with Heavy Duty Grating. Where needed, the final closure of the Landfill Cell 2 / Cell 3 shall be applied to the canal, the geomembrane shall be attached to the canal according to ASTM D6497/D6497M,

Open Canal Crossing

U-Shaped Retaining Walls

Open Canal

Concrete Wall

Slope

Unpaved Shoulder

Bridge Crossing

Khalde Highway

Ouazai Highway

Precast Concrete Gutter

Manhole

Workshop & Storage

EDL Room (NIC)

Guard House

Paved Road

Parking

New Fuel Tanks

Generators Room

Transformers Room

Transformers & Generators Building

Uncovered Storage Yard

Paved Road

Unpaved Shoulders

Primary Sedimentation Tanks

Primary Sedimentation T

Primary Sludge 2x DN150

Unpaved Shoulders

LP: 0+529.78

Upstand Wall 25*60 cm

Precast Concrete Gutter

Unpaved Shoulder

Old Concrete Beam

GRAVITY THICKENER PRIMARY SLUDGE

GRAVITY THICKENER PRIMARY SLUDGE

THKND SLDG PMP & SCRN

STORM BOX CULVERT 2 CELLS (3.75x2.25m)

Guest Room

LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH NAZIH TALEB & PARTNERS Founded 1956

ARTELIA

Connection Between Existing & New Sites

Access Road Plan View

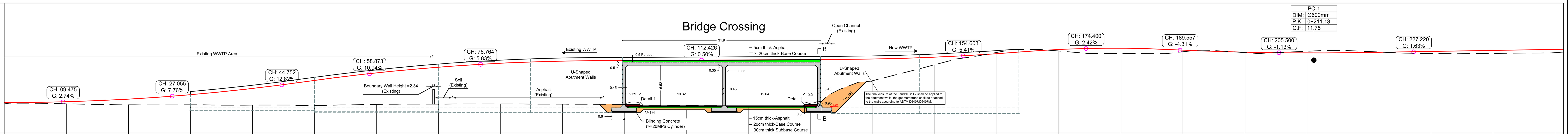
DRAWN :	H.J
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:400
FILE NAME	Con-ARPV-01

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	ARPV	01	0

LEGEND:

- Natural Ground Level (dashed line)
- New Road Vertical Alignment (red line)

Scale H: 1/400
Scale V: 1/400



DATUM LEVEL 0.00

Cumulative Distance	Natural Ground Level	Project Level
0.00	4.70	4.90
10.00	4.72	5.05
20.00	4.55	5.48
30.00	4.55	6.20
40.00	4.52	7.20
50.00	4.43	8.49
60.00	4.63	9.69
70.00	4.68	10.61
80.00	4.69	11.24
90.00	4.67	11.59
100.00	4.62	11.68
110.00	4.43	11.73
120.00	4.39	11.78
130.00	4.86	11.83
140.00	8.44	11.92
150.00	11.01	12.23
160.00	12.99	12.78
170.00	13.21	13.46
180.00	12.83	13.67
190.00	13.09	13.35
200.00	12.95	13.02
210.00	13.17	12.90
220.00	13.13	12.98
230.00	12.82	13.14
240.00	12.84	13.30
250.00	12.95	13.47

Cumulative Distance (Vertical Alignment): 48.53, 95.30, 134.51, 164.63, 187.32, 219.27

Vertical Alignment: R =350.00 L =48.53; R =350.00 L =46.78; P =0.50% L =39.21; R =410.00 L =30.12; R =180.00 L =22.69; R =500.00 L =31.94

Cumulative Distance (Horizontal Alignment): 3.42, 23.25, 30.77, 35.77, 49.22, 69.22, 129.03, 149.03, 155.15, 162.35, 169.29, 179.29

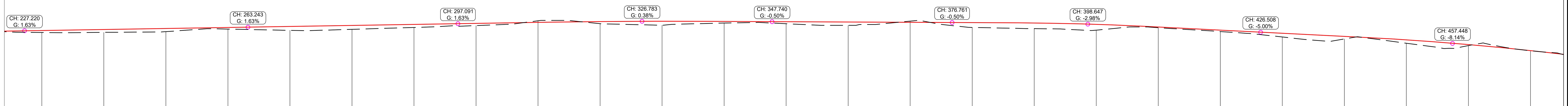
Horizontal Alignment: L =3.42; R: 17.00 L: 19.83; R: 38.87 L: 7.52; R: 94.42 L: 18.45; L =99.81; R: 25.00 L: 6.12; R: 6.89 L: 7.20; R: 25.00 L: 6.94

Cross Slope / Superelevation Left *: 2%; 2%; 2%; 2.5%; 2.5%

Cross Slope / Superelevation Right *: 4%; 3%; 2%; 2%; 4%

* Occasionally regardless than horizontal profile, to minimize the cost of surface runoff water drainage system.

Scale H: 1/400
Scale V: 1/400



DATUM LEVEL 0.00

Cumulative Distance	Natural Ground Level	Project Level
230.00	12.82	13.14
240.00	12.84	13.30
250.00	12.95	13.47
260.00	13.36	13.63
270.00	13.16	13.79
280.00	13.33	13.95
290.00	13.63	14.12
300.00	13.93	14.28
310.00	14.70	14.44
320.00	14.24	14.58
330.00	13.98	14.63
340.00	14.34	14.60
350.00	14.23	14.55
360.00	13.96	14.50
370.00	14.65	14.45
380.00	13.63	14.40
390.00	13.43	14.35
400.00	13.19	14.13
410.00	13.59	13.70
420.00	12.97	13.20
430.00	12.10	12.70
440.00	11.78	12.20
450.00	11.09	11.63
460.00	10.72	10.86
470.00	9.88	9.90

Cumulative Distance (Vertical Alignment): 311.83, 337.38, 387.49, 407.71, 442.08

Vertical Alignment: P =1.63% L =92.57; R =1200.00 L =25.55; P =0.50% L =50.11; R =450.00 L =20.22; P =5.00% L =34.37; R =500.00 L =53.29

Cumulative Distance (Horizontal Alignment): 397.74, 416.15, 433.68, 442.51, 452.12, 457.51, 468.75, 473.58

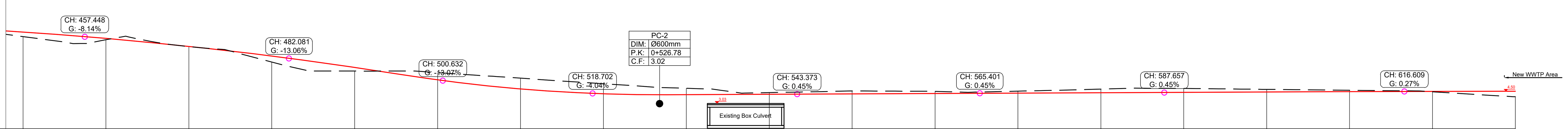
Horizontal Alignment: L =228.45; R: 25.00 L: 18.41; R: 25.00 L: 17.53; L =18.44; R: 25.00 L: 5.39; R: 10.73 L: 11.24; R: 25.00 L: 4.83

Cross Slope / Superelevation Left *: 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%

Cross Slope / Superelevation Right *: 4%

* Occasionally regardless than horizontal profile, to minimize the cost of surface runoff water drainage system.

Scale H: 1/400
Scale V: 1/400



DATUM LEVEL 0.00

Cumulative Distance	Natural Ground Level	Project Level
450.00	11.09	11.63
460.00	10.72	10.86
470.00	9.88	9.90
480.00	8.02	8.73
490.00	6.94	7.37
500.00	6.75	5.88
510.00	6.08	4.79
520.00	5.41	4.20
530.00	4.86	4.10
540.00	4.34	4.15
550.00	4.54	4.19
560.00	4.49	4.24
570.00	4.51	4.28
580.00	4.76	4.33
590.00	4.84	4.37
600.00	4.73	4.41
610.00	4.62	4.46
620.00	4.44	4.49
630.00	3.84	4.50

Cumulative Distance (Vertical Alignment): 495.38, 527.58, 608.86, 629.27, 630.00

Vertical Alignment: R =500.00 L =53.29; R =200.00 L =32.20; P =0.45% L =81.28; R =4540.00 L =20.41; P =0.00% L =0.73

Cumulative Distance (Horizontal Alignment): 452.12, 457.51, 468.75, 473.58, 484.61, 488.58, 506.62, 531.50, 542.53, 552.81, 558.82, 588.84, 604.87, 630.00

Horizontal Alignment: R: 25.00 L: 5.39; R: 10.73 L: 11.24; R: 25.00 L: 4.83; R: 100.31 L: 11.03; R: 15.38 L: 22.01; L =24.88; R: 30.00 L: 11.03; R: 23.00 L: 10.29; R: 23.95 L: 6.01; R: 120.24 L: 30.02; R: 25.00 L: 16.03; L =25.13

Cross Slope / Superelevation Left *:

Cross Slope / Superelevation Right *: 4%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%; 2.5%

* Occasionally regardless than horizontal profile, to minimize the cost of surface runoff water drainage system.

LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH NAZIH TALEB & PARTNERS Founded 1956
ARTELIA

Connection Between Existing & New Sites

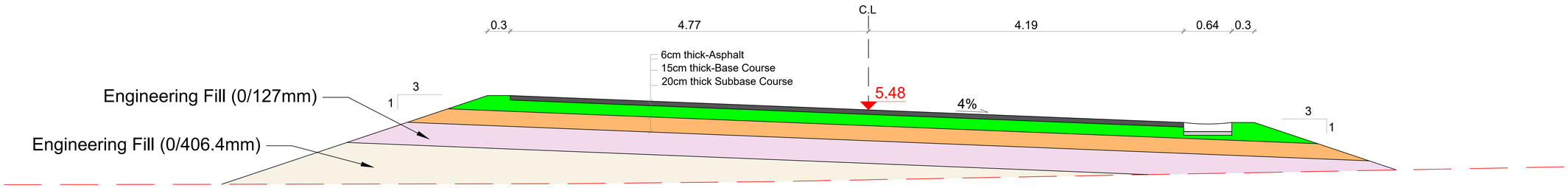
Access Road Profile

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:400
FILE NAME	Con-ARPr-02

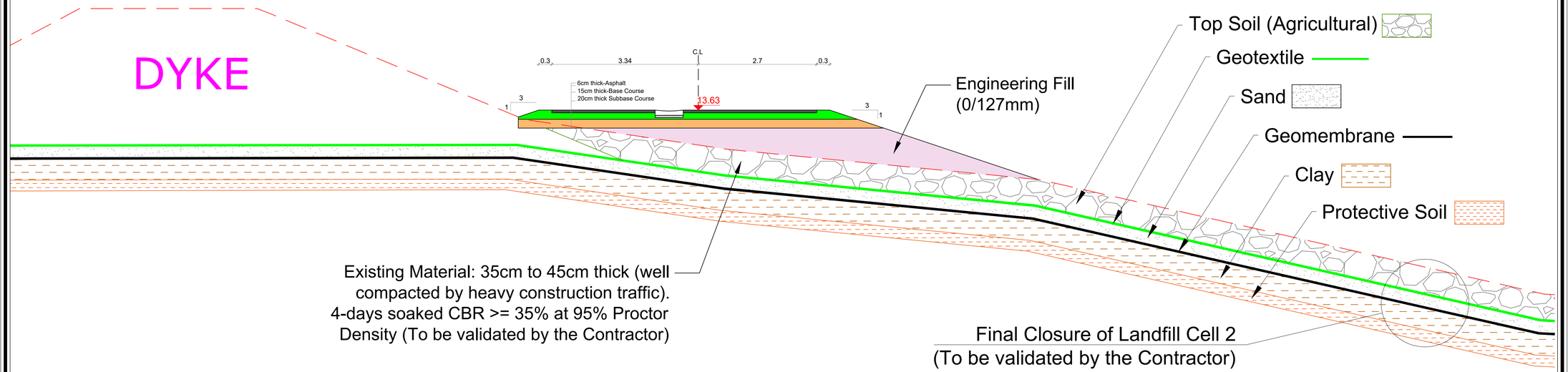
PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	ARPr	02	0

A1 Size

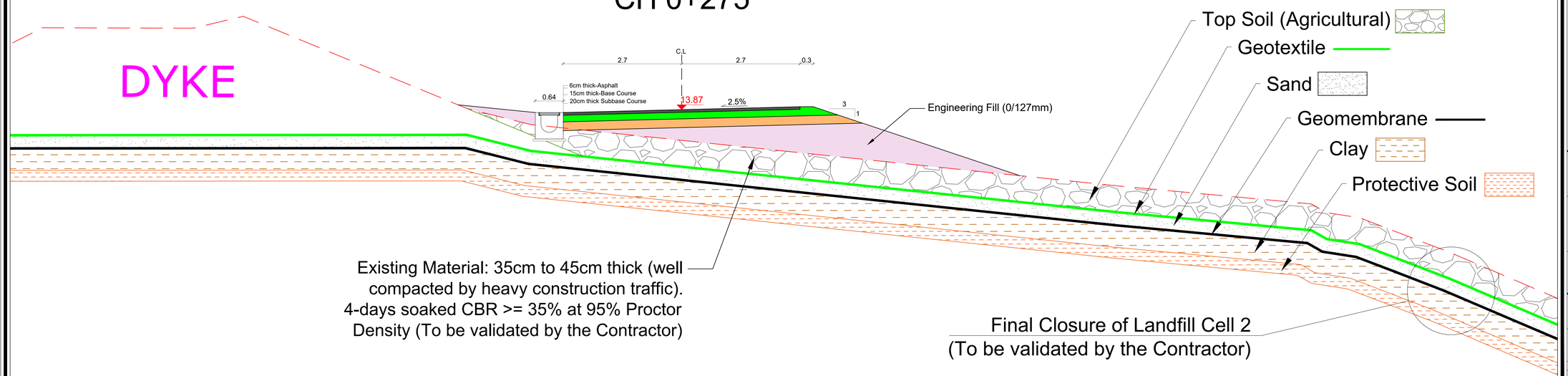
CH 0+020



CH 0+175



CH 0+275



LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH
NAZIH TALEB & PARTNERS
Founded 1956

ARTELIA

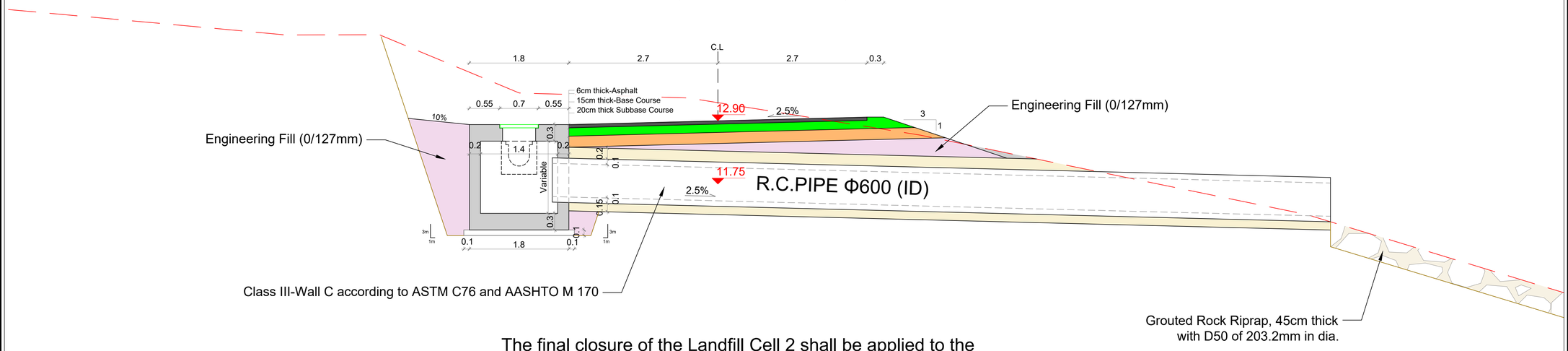
Connection Between Existing & New Sites

Access Road Sections (1 of 2)

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:30; 1:50
FILE NAME	Con–ARS1–03

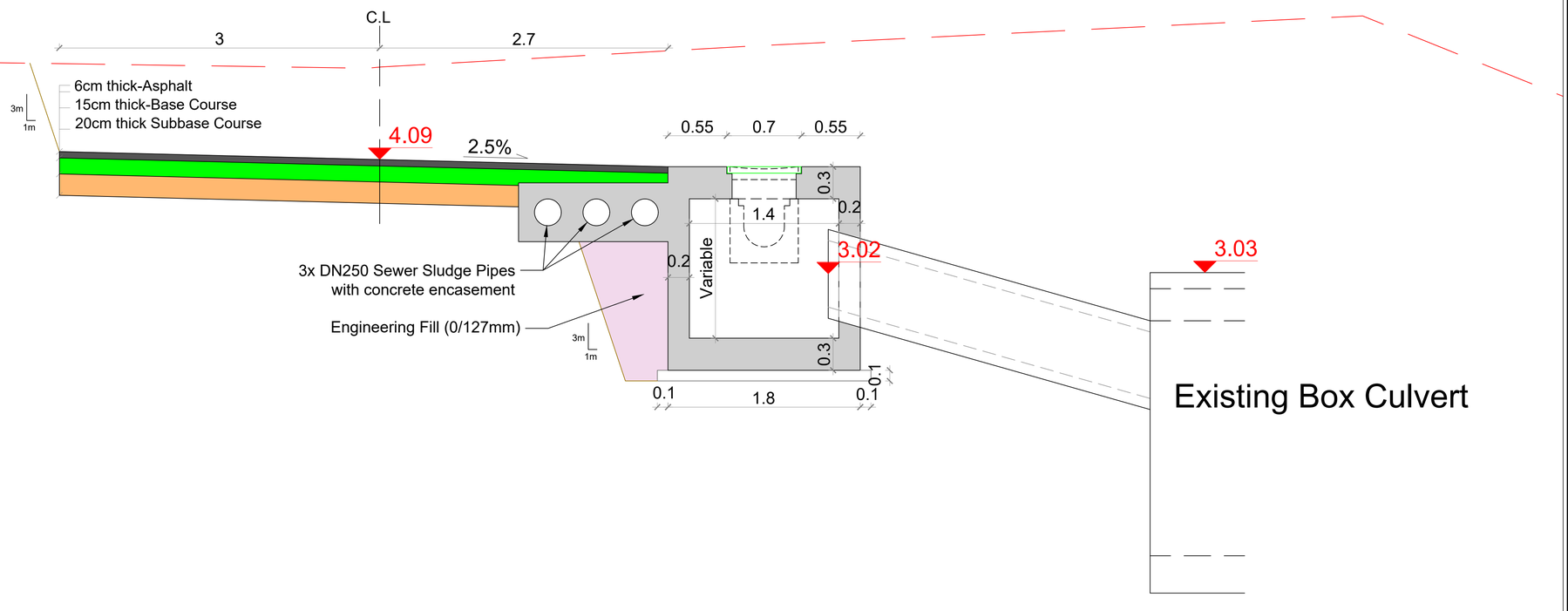
PROJECT	DIVISION	SUB–DIVISION	SHEET	REVISION
L2401DS	Con	ARS1	03	0

PC-1 (CH 0+211.13)



The final closure of the Landfill Cell 2 shall be applied to the Pipe Culvert, the geomembrane shall be attached to the Manhole and the Pipe according to ASTM D6497/D6497M,

PC-2 (CH 0+526.78)



LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

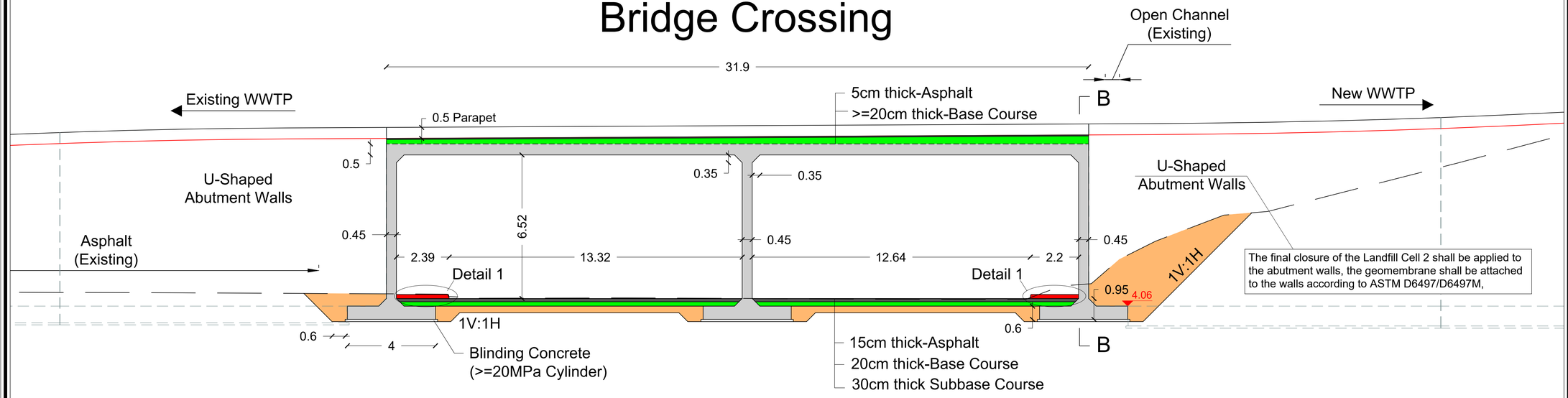
DAR AL HANDASAH NAZIH TALEB & PARTNERS Founded 1956

ARTELIA

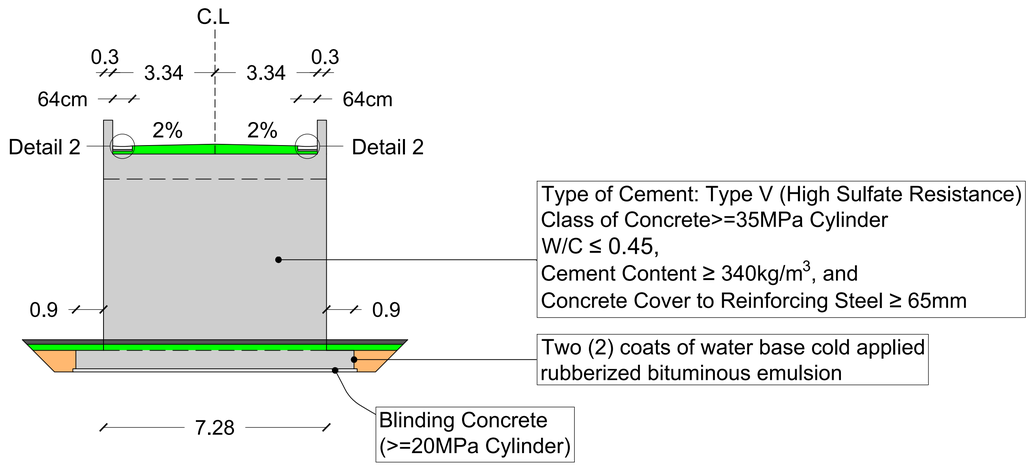
Connection Between Existing & New Sites	DRAWN : H.
	CHECKED : S.H
	APPROVED : F.L
	DATE : 05 March 2025
	SCALE : 1:40; 1:25
Access Road Sections (2 of 2)	FILE NAME
	Con-ARS2-04

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	ARS2	04	0

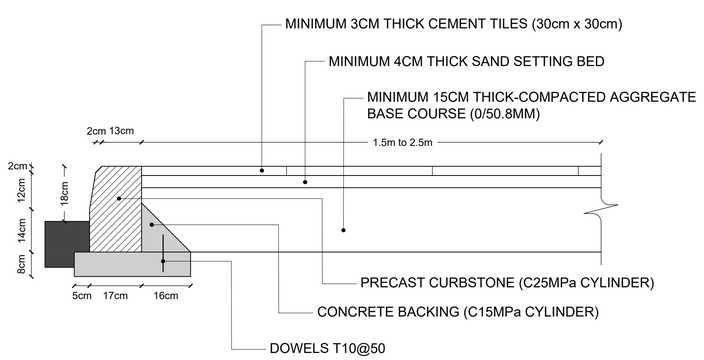
Bridge Crossing



Section B-B

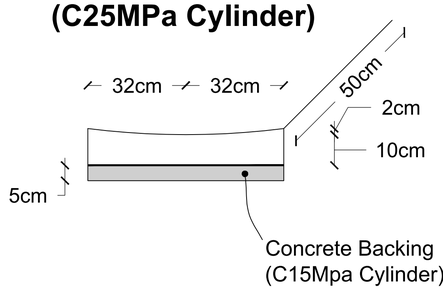


Sidewalk



Detail 1

Precast Concrete Gutter (C25MPa Cylinder)



Detail 2

LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH
NAZIH TALEB & PARTNERS
Founded 1956

ARTELIA

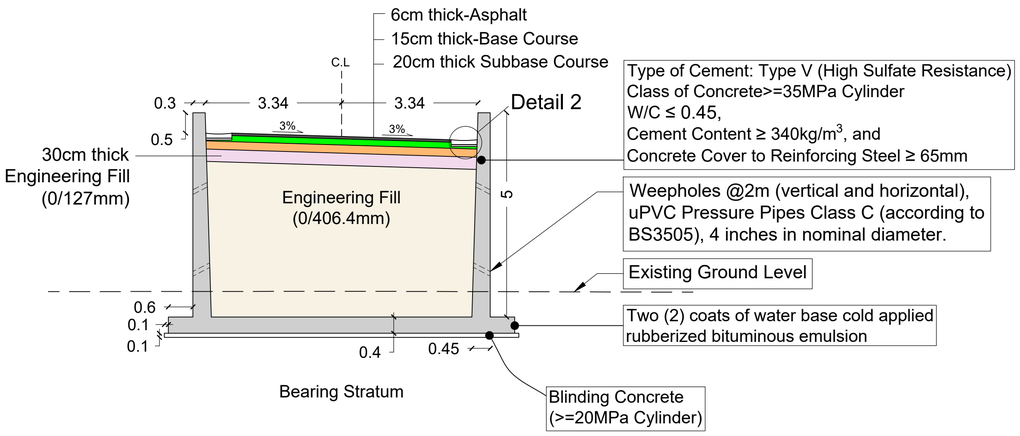
Connection Between Existing & New Sites

Bridge Crossing Details

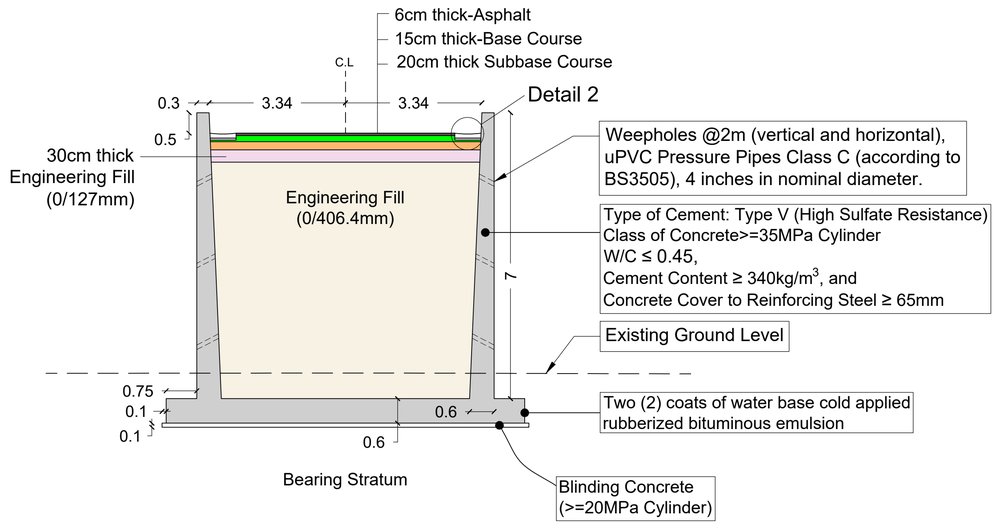
DRAWN :	H.J
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:100
FILE NAME	Con-BCD-05

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	BCD	05	0

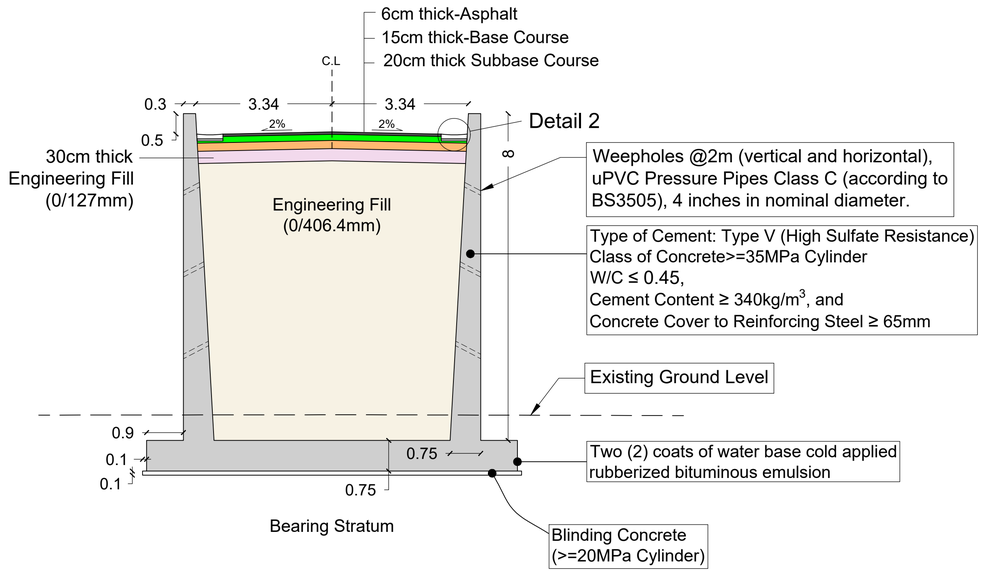
U-Shaped RWs (3m to 5m high)
0+030 to 0+050



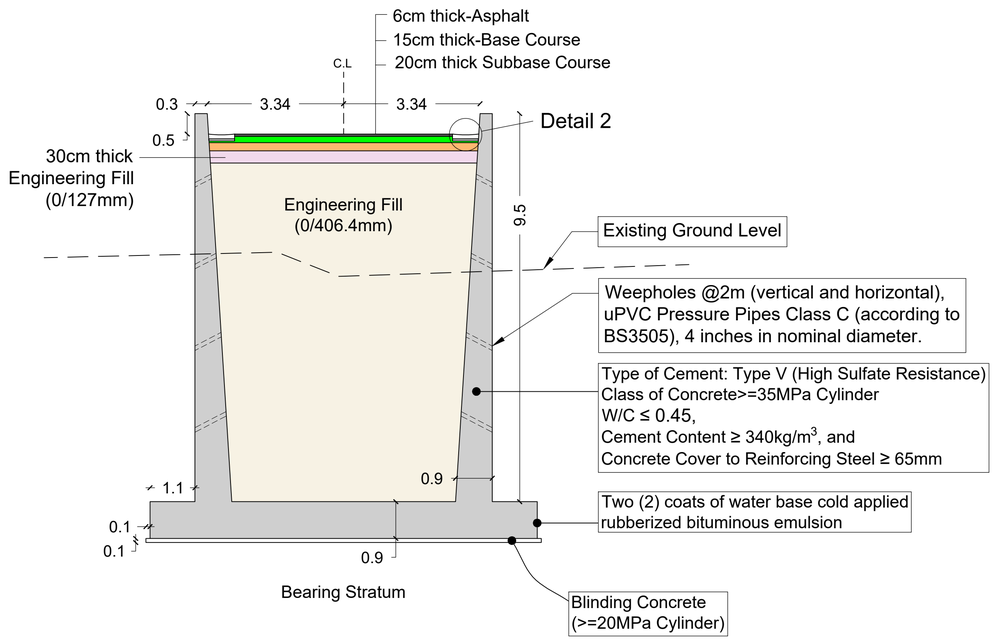
U-Shaped RWs (5m to 7m high)
0+050 to 0+070



U-Shaped RWs (7m to 8m high)
0+070 to 0+100



U-Shaped RWs (8.5m to 9.5m high)
0+131 to 0+163



LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH
NAZIH TALEB & PARTNERS
Founded 1956

ARTELIA

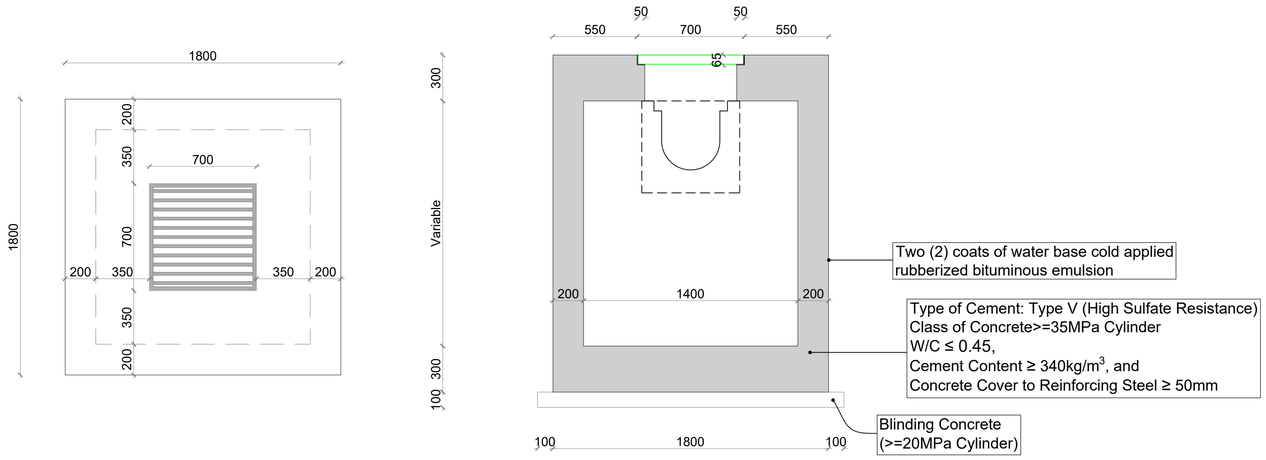
Connection Between Existing & New Sites

U-Shaped Retaining Walls Details

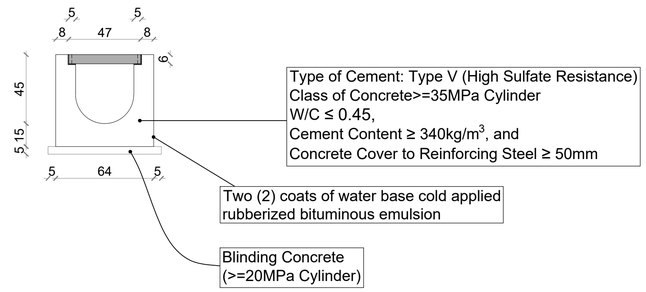
DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:75
FILE NAME	Con-URW-06

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	URW	06	0

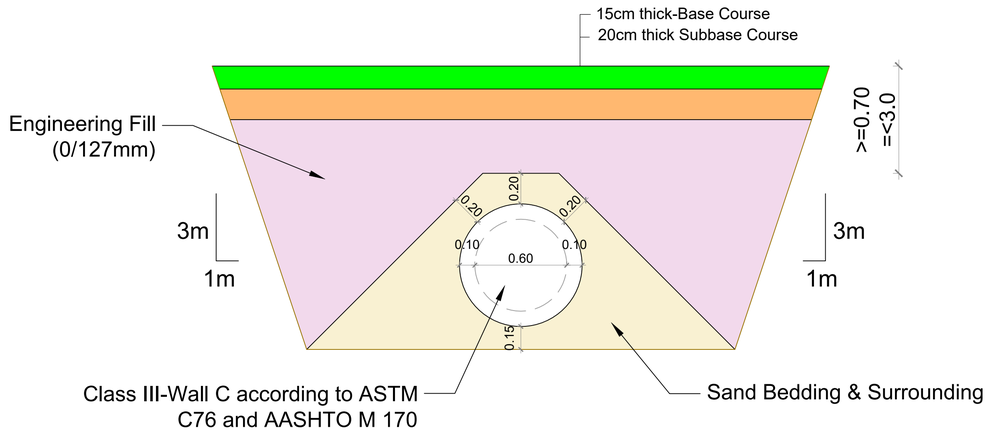
Reinforced Concrete Manhole



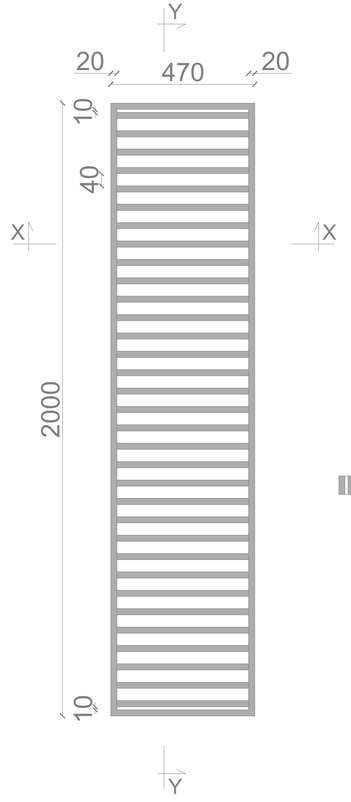
Reinforced Concrete Water Canal with Heavy Duty Grating



Reinforced Concrete Pipe Trench



Heavy Duty Grating for AASHTO H-20 Truck Traffic 47 x 200cm (Yield Strength of not less than 500 N/mm2) Anti-corrosive bituminous painting conforms to BS 3416 / 1991 Type-II



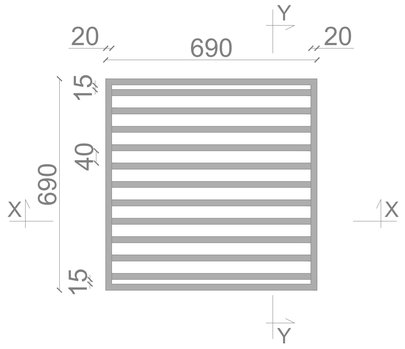
Section X-X



Section Y-Y



Heavy Duty Grating for AASHTO H-20 Truck Traffic 69 x 69cm (Yield Strength of not less than 500 N/mm2) Anti-corrosive bituminous painting conforms to BS 3416 / 1991 Type-II



Section X-X



Section Y-Y



Steel Frame



LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH NAZIH TALEB & PARTNERS Founded 1956

ARTELIA

Connection Between Existing & New Sites

Typical Details

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:20; 1:10
FILE NAME	Con-TD-07

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	TD	07	0

NOTES

Engineering Fill (0/406.4mm):
The engineering fill (A-1-b with fines up to 25%) shall be well graded (coefficient of curvature between 1 and 3) and shall have a minimum 4 days soaked CBR of 35% at 95% proctor compaction. The engineering fill shall be placed in compacted (at least 95%) layers of 45cm to 50cm thick each with respect to its maximum and nominal maximum aggregate sizes 406.4mm (up to 10%) and 304.8mm.

Engineering Fill (0/127mm):
The engineering fill (A-1-a with fines up to 15%) shall be well graded (coefficient of curvature between 1 and 3) and shall have a minimum 4 days soaked CBR of 45% at 95% proctor compaction. The engineering fill shall be placed in compacted (at least 95%) layers of 25cm to 30cm thick each with respect to its maximum and nominal maximum aggregate sizes 127mm (up to 10%) and 101.6mm.

Aggregate Subbase Course (0/101.6mm):
The quarry runs aggregate subbase course (A-1-a with fines up to 10%) shall be well graded (coefficient of curvature between 1 and 3) and shall have a minimum 4 days soaked CBR of 60% at 96% proctor compaction. The aggregate subbase course shall be placed in compacted (at least 96%) layers of 20cm to 25cm thick each with respect to its maximum and nominal maximum aggregate sizes 101.6mm (up to 10%) and 76.2mm, respectively.

Aggregate Base Course (0/76.2mm):
The quarry runs aggregate base course (A-1-a with fines up to 7%) shall be well graded (coefficient of curvature between 1 and 3) and shall have a minimum 4 days soaked CBR of 80% at 98% proctor compaction. The aggregate base course shall be placed in compacted (at least 98%) layers of 15cm to 20cm thick each with respect to its maximum and nominal maximum aggregate sizes 76.2mm (up to 10%) and 50.8mm, respectively.

The engineering fills (0/406.4mm and 0/127mm), subbase & base courses shall be tested as follows and approved by the Engineer (prior to start execution), the Contractor to provide the Engineer with Material Submittals for Approval.

- Organic impurities,
- Clay Lumps and Friable Particles,
- Flakiness and Elongation Index,
- Liquid Limit (LL),
- Plasticity Index (PI),
- Sand Equivalent (ES %),
- Specific Gravity (Saturated Surface Dry) and Water Absorption,
- Proctor Density & Optimum Water Content,
- 4 days Soaked CBR at 95% (0/406.4mm and 0/127mm), 96% (0/101.6mm) and 98% (0/76.2mm) proctor compaction,
- LA (500 revolutions),
- Soundness, and
- Compressive Strength and/or PLI.

The engineering fills (0/406.4mm and 0/127mm), subbase & base courses shall also be tested for quality during the execution as directed by the Engineer.

The engineering fills (0/406.4mm and 0/127mm), subbase & base courses shall be compacted by using at least 12-ton-static class single-drum vibratory smooth roller, and shall be tested for Field Density after compaction (layer by layer), all as directed by the Engineer, and the lab test results shall be submitted to the Engineer for his approval.

The subgrade soil / bearing stratum to a depth of 20cm shall be compacted (>=95%) to a dense and stable course, and shall be tested for Field Density after compaction, all as directed by the Engineer. Accordingly, the subgrade soil / bearing stratum shall be tested for Gradation, Atterberg Limits, 4-days soaked CBR at 95% proctor compaction and Proctor Density (as directed by the Engineer) prior to start compaction, and the lab test results shall be submitted to the Engineer for his approval.

If needed/where needed and/or as directed by the Engineer, the subgrade soil / bearing stratum (excavated ground level and/or natural ground level after removing the top soil and/or clearing and grabbing) shall be removed and replaced with Engineering Fill and/or subbase & base course to a depth that will be determined by the Engineer.

Wearing course of asphalt-concrete (Maximum and Nominal Maximum Aggregate Sizes are 19.05mm and 12.7mm, respectively).

- Bitumen Grade = 60-70,
- Marshall Stability at 60^{o}C >= 950Kg and Flow: 2 - 3.5mm,
- Percent Air Voids (Pa) = 3 - 5%,
- Percent Voids in the Mineral Aggregate (VMA) > 14,
- Percent of Voids Filled with Asphalt (VFA) = 65 - 75,
- Optimum Bitumen Content in Total Mix (Pb) = 4.5 - 5.5%,
- Bulk Specific Gravity of Compacted Mix (Gmb) >= 2.3gr/cm3, and
- Mineral Filler to Bitumen Ratio = 0.8 - 1.2.

Binder course of asphalt-concrete (Maximum and Nominal Maximum Aggregate Sizes are 25.4mm and 19.05mm, respectively).

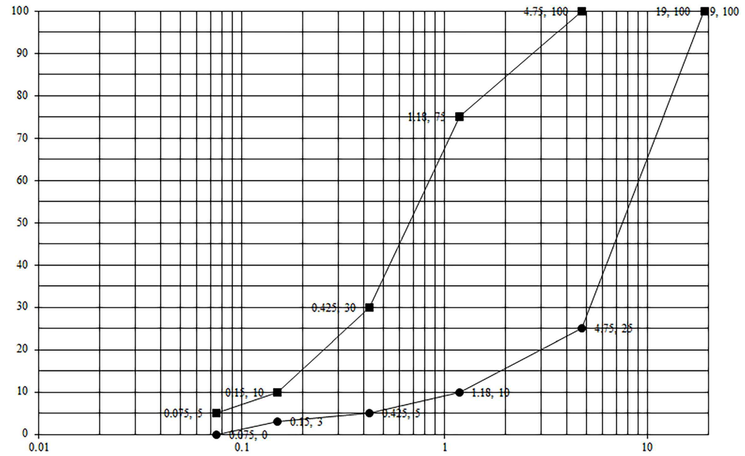
- Bitumen Grade = 60-70,
- Marshall Stability at 60oC >= 800Kg and Flow: 2 - 3.5mm,
- Percent Air Voids (Pa) = 4 - 7%,
- Percent Voids in the Mineral Aggregate (VMA) > 13,
- Percent of Voids Filled with Asphalt (VFA) = 60 - 70,
- Optimum Bitumen Content in Total Mix (Pb) = 4 - 5%,
- Bulk Specific Gravity of Compacted Mix (Gmb) >= 2.25gr/cm3, and
- Mineral Filler to Bitumen Ratio = 0.8 - 1.2.

Prime coating: Liquid asphalt MC-30, 1.2Kg/m2,

Tack coating: Liquid asphalt RC-70, 0.4Kg/m2,

Sand Bedding and Surrounding Material
Sand bedding and surrounding material (natural and/or crushed) shall be uniform and well graded with plasticity index of max 4%. Sand bedding and surrounding material shall be capable of being compacted (min. 92% at optimum water content) to a dense and stable course. Sand bedding and surrounding material shall be placed in compacted layers of 10 to 20cm thick each.
Coefficients of uniformity (Cu):
D60 / D10 = Cu > 6
Curvature (Cc):
1 < (D30^2 / D60*D10) < 3

Gradation:



The sand bedding and surrounding material shall be tested for:

- Gradation,
- Organic impurities,
- Clay Lumps and Friable Particles,
- Liquid Limit (LL),
- Plasticity Index (PI),
- Sand Equivalent (ES %),
- Specific Gravity (Saturated Surface Dry) and Water Absorption,
- Micro-Deval (or equivalent) Abrasion, and
- Proctor Density & Optimum Water Content.

Sand bedding and surrounding material (natural and/or crushed) shall be tested at quarry / source and approved by the Engineer before being delivered to site (Material Submittal for Approval), to ensure its overall quality and quantity. Sampling should be done in presence of the Engineer at quarry / source.

The sand bedding and surrounding material shall also be tested for quality during the execution as directed by the Engineer.

Grouted Rock Riprap
The grouted riprap shall be composed of dense (Specific Gravity >= 2.56 ton/m3), strong, sound and durable angular / broken rock fragments with near cubical shape as possible (D50 = 203.2mm in diameter, flat rock fragments should not be used for riprap). The largest rock fragment shall not exceed 1.5 times the D50, and, the least dimension shall not be less than one-third of the largest rock fragment. The grouted rock riprap shall be placed without segregation and in as dense / interlocked state as possible, the voids in rock riprap shall be filled with spalls (smaller rock fragments in size).

The grouted rock riprap shall be installed to its full thickness (45cm) in one operation with minimum penetration of grout (25MPa-Cylinder@28 days) 15cm.

In addition to weepholes, the U-shaped retaining walls shall be provided with back-subsurface-drainage-system consists of Geocomposite Strip Drains (50cm wide each) at 2 meters horizontal spacing, Perforated (according to AASHTO M252-Class 1) HDPE Pipes (HDPE 80 - SDR 13.6 (PN10) - OD 180mm, black with 4 blue strips), Gravel Size Number 5 (according to ASTM C33) and Geotextile PP-350gr/m2 (according to GRI - GT12), detailed drawings (including material submittals) shall be provided by the Contractor for the approval of the Engineer.

The allowable bearing capacity for U-shaped RWs, Bridge Crossing and other reinforced concrete structures shall be validated by the Contractor through geotechnical investigations (including Test Pits and Plate Load Tests, but not limited to) as directed by the Engineer.

The reinforced concrete structures shall be provided with construction and expansion joints, detailed drawings (including Backing Rod according to ASTM D5249, bituminous type joint filler/board and putty according to AASHTO M33/ASTM D994) shall be provided by the Contractor for the approval of the Engineer.

Laboratory submittal for approval shall be done by the Contractor prior to Material Submittal for Approval.

The laboratory test results shall be up-to-date and shall refer to the Project, Client, Engineer and Contractor.

Quarry / Borrow Pit / Source shall be identified / indicated in all laboratory test results, and the samples shall be taken and tested by the approved laboratory.
The Contractor is reminded that all legal issues pertaining to Quarry / Borrow Pit / Source are under his scope and responsibility.

The Contractor confirms that Quarry / Borrow Pit / Source are capable and/or large enough to supply the required material (s) at the rate and quantity necessary to complete the road works on time.

Any change of Quarry / Borrow Pit / Source will have to be approved by the Engineer, furthermore; the Engineer has the right during the execution, to ask for a change of Quarry / Borrow Pit / Source in the event the quality / quantity is not in compliance with the specifications / lab test results presented during the Material Submittal for Approval and project needs.

LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion and Upgrade of Al-Ghadir Wastewater Treatment Plant Project – Phase I: Design, Build and Operate, Including Sea Outfalls

DAR AL HANDASAH
NAZIH TALEB & PARTNERS
Founded 1956

ARTELIA

Connection Between Existing & New Sites

Notes for U-Shaped Retaining Walls & Bridge Crossing

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	-
FILE NAME	Con-WBN-08

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Con	WBN	08	0