دبي للبترول
Dubai Petroleum

هيئة دبي للتجهيزات
Dubai Supply Authority

DUSUP GUIDELINES
FOR PROTECTION OF HYDROCARBON PIPELINES

Approval

Note: This guideline was approved on 04-Oct-2021.

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1 INTRODUCTION

Dubai Supply Authority (DUSUP) provides energy supply (Natural Gas) to Emirate of Dubai to meet the needs of electricity generation and water desalination through its pipeline network. Through the production of natural gas (which is processed into gas and condensate products), the purchase of pipeline gas and LNG (and its regasification), gas storage and the operation of the pipeline network, DUSUP plays a key role in the growth and development of Dubai.

DUSUP has assigned Dubai Petroleum Establishment (DPE) the responsibility for operating DUSUP assets and authorized DPE to manage all emergency events occurring on its own operated facilities, pipelines and assets within pipeline corridors in liaison with other governmental entities.

DPE-DUSUP designs operates and maintains DUSUP's onshore pipelines and related facilities to International Standards in order to ensure an uninterrupted flow of gas and other hydrocarbons across Dubai. The onshore hydrocarbon pipeline network consists of approximately 700 kilometres of pipelines ranging from 48" high pressure gas pipelines down to 10" condensate lines. The gas pipelines operate at high-pressures up to 960-psig and transport highly explosive and flammable natural gas. A number of jet fuel and fuel oil pipelines share the corridors with the gas and condensate pipelines.

The majority of the onshore hydrocarbon pipeline network is laid-out in designated DUSUP corridors that are secured by fences and controlled access gates. Parts of the onshore pipeline network run in the Right of way, Public way and in unfenced corridors - due to the close proximity of road infrastructure.

2 PURPOSE

Provide procedural guidance regarding the minimum protection required for the construction of metallic pipeline and related asset within the DUSUP corridor.

DUSUP Guidelines for protection of non-metallic pipelines are covered under the separate document.

3 REFERENCES

a) DUSUP NOC Standard Conditions - DP-OPSON-0056
b) DUSUP Guidelines for Land Use Planning - DP-OPSON-0144
c) Gas Transmission and Distribution Piping Systems – ASME B31.8
d) Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids - ASME B31.4
e) Steel pipelines for high pressure gas transmission - IGEM/TD/1
f) Steel and PE pipelines for gas distribution - IGEM/TD/3

4 ABBREVIATIONS AND DEFINITIONS

4.1 Abbreviations

Abbreviation	Description
DEL	Dolphin Energy Limited
DEWA	Dubai Electricity and Water Authority
DPE	Dubai Petroleum Establishment
DUSUP	Dubai Supply Authority
EGA	Emirates Global Aluminium(DUBAL)
EMARAT	Emirates General Petroleum Corporation

EMDAD	EMARAT, Air BP and Shell Joint Venture
ENOC	Emirates National Oil Company
GCS	Gas Control Station
MOP	Maximum Operating Pressure
NOC	No Objection Certificate
PTW	Permit to Work
ROW	Right of Way
RTA	Roads and Transport Authority

4.2 Definitions

At Grade Crossing	For the purpose of pipeline protection, the carriageway at same level of adjacent ground or not more than 5'-0" (1.5meter) above adjacent ground/pipeline corridor to be considered as "At Grade Crossing".
DPE	DPE is the government entities that operates DUSUP assets as Onshore Operations Team and has authority to manage all emergency events occurring on its own operated facilities, pipelines and all crisis occurring within pipeline corridors in liaison with other governmental entities.
DUSUP	DUSUP is the legal commercial entity that own Margham Field, Margham Plant Facilities, Gas Control Station, LNG Platform and Onshore Pipelines within pipeline corridors and has given to DPE full operatorship of all its facilities.
DUSUP Corridor	DUSUP Corridor is the land allocated by Dubai Municipality or other statutory government authority to DUSUP for the construction, operation and maintenance of gas and fuel pipelines in the emirates of Dubai.
Onshore Hydrocarbon Pipelines Network	Approximately 700 kilometres of onshore hydrocarbon pipelines operating in Dubai. The network consist of gas, condensate, jet fuel and fuel oil pipelines. The gas pipelines operate at high-pressures up to 960-psig and transport highly explosive and flammable natural gas. The jet fuel and fuel oil pipelines operate at 653-psig share the same corridors. The condensate pipeline operate at 1000-psig and also share corridor with other pipeline.
Pipeline Owner	Owners or Owners designated Operator of the existing Gas / Liquid Fuel Pipelines in onshore hydrocarbon pipeline network (ENOC Group, EMDAD, DEL & DEWA).
No Go Zone	5.0 meters either sides of existing DUSUP/DPE pipelines.
No Objection Certificate (NOC)	A document issued by the Traffic and Roads Agency of RTA, authorizing the party to whom it has granted

	permission to implement works in the Right of Way or create Traffic Diversions.
Trenchless Crossing method /NDCM	Trenchless crossing method or Non-disruptive crossing method (NDCM) is a subsurface crossing method for the installation of utilities under the existing infrastructure such as road, buildings or other utilities that requires minimum excavation at the ends or no continuous trenches. E.g. Micro Tunnelling, Thrust boring, Horizontal directional drilling etc.,
Utility Owners	Owners of other utilities such as: drainage lines (DM), Electricity & Water(DEWA), ITS Services(RTA), Telephone(Etisalat, Du), Other communication cables(UAE Armed Forces), etc.,

5 UNDERGROUND PIPELINE PROTECTION

Hydrocarbon pipelines are important infrastructure elements as they transport natural gas, condensate, jet fuel and other liquid fuels over long distances. The pipelines are buried in soil due to safety, environmental and economic reasons. Minimum depth of burial varies as per the size, material and use.

5.1 Burial Depth

Buried pipelines shall be installed with minimum depth of soil cover in accordance with API RP 1102, ASME B31.4/B31.8 and minimum burial depth required from the ground level to the crown of the pipeline is 1.20 meter. Additional mitigations such as local berm or protection slab etc. shall be considered where the cover requirement cannot be met.

Note: Refer to “DUSUP Typical Road Crossing Arrangement” drawing reference: 900-08-03-01 (Attachment 1).

5.2 Minimum Separations between Existing and Proposed Pipeline

The separation distances between the pipelines mentioned below are based on the DUSUP/DPE past experience and IGEM/TD/1 recommendation for the Natural Gas pipelines of MOP ≤ 80 bar.

Any reduction of recommended separations mentioned below and where MOP for natural gas pipeline exceeds 80 bar, the designer must demonstrate (via modelling) that adjacent gas or liquefied pipelines are outside the ground crater generated.

The recommended separation distances are based on the assumption that both pipelines are at the same depth and that this depth is 1.20 meter.

5.2.1 Natural Gas Pipelines:

Minimum horizontal separation for the construction of new pipelines are:

Pipe Size (OD) in Inches	Horizontal Clearance (m)
<= 24	10.00
32	12.00
36	12.50
48	15.00

Note: Linear Interpolation can be done for the sizes in between those mentioned in the above table.

5.2.2 Liquid Fuel Pipelines:

Minimum horizontal separation between the liquid fuel pipelines is 10.0 meters.

5.2.3 Natural Gas & Liquid Fuel Pipelines:

Minimum horizontal separation requirement between the natural gas and liquid fuel pipelines are same as between the Natural gas pipelines mentioned under item 5.2.1.

6 CROSSINGS

New pipelines may require to cross existing hydrocarbon pipelines, road & railway infrastructures and utilities etc., the crossing requirements may vary as per the type of crossings:

6.1 Crossing Existing Roads

a) Where practicable, pipeline shall cross the road at approximately right angles thereto but preferably at not less than 45°.

b) Pipeline constructed by open cut excavation must cross the road at minimum 1.2 meter below road foundation layer or 2.0 meter below finished road level or comply with crossing requirements of existing utilities within the ROW; whichever is greater.

c) Where a pipeline is to cross a road by open cut excavation, the pipeline must be protected as per the protection design shown on “DUSUP Typical Road Crossing Arrangement” drawing reference: 900-08-03-01 (Attachment 1).

d) Pipeline protection must extend beyond the edge of the road shoulder (or toe of the embankment whichever is greater) as follows:

- At roundabouts, *elevated roads or bridge crossings - 20 meters.
- At straight road sections - 10 meters.

*Road raised 1.2 meter and above the grade level.

e) Crossing of existing major road is typically permitted by trenchless (non-Disruptive) methods only. As various utility corridors are located within the ROW, crossing requirements of both RTA and other existing utilities are applicable. DUSUP/DPE require minimum clear vertical separation of 2.0 meter or two times the diameter of trenchless crossing sleeve, whichever is more to the bottom of lowest utility.

f) Crossing sleeve / Casing of the proposed pipeline shall be extended minimum 5.0 meters beyond the edge of road or 1.5 m beyond the toe of the side slope or to where unrestricted maintenance access will be available in future.

g) New Cathodic Protection (CP) test posts for the pipeline(s) must be installed at the existing road crossing on the downstream side. For road crossings having a width of more than 10m, two monitoring test posts, and one at each side shall be provided. Test posts are preferably located within the fenced corridor. CP Test post in open area shall be protected with approved metal or concrete crash barriers.

h) Pipeline warning signs shall be installed on either side of road on approaching of corridor. The cumulative kilometre reading with pipeline identification code, the Road Crossing (RX) reference number will be shown on the bottom white strip of the signage panel as shown on the drawing reference : 900-08-004 (See Attachment 2).

Note: Refer to DUSUP Guidelines for Road & Rail Infrastructure Crossing for further details.

i) In case of crossing sleeve / casing, vents shall be provided on either end of the sleeve for escaping of contaminated gases. Vent shall always be vertical or shall have upward sloping.

j) Non-metallic centralizers shall be provided between the pipelines and casing; if required, casing shall be protected with sacrificial cathodic protection system.

6.2 Crossing Existing Railway/Metro:

Pipeline crossing “At Grade” or “Elevated” Railway/Metro lines shall be protected to the full width of railway protection zone or 30 meters either side of railway protection barrier or from the edge of Railway Bridge; whichever is greater and to comply with the Railway Agency requirements.

6.2.1 Pipeline Crossing under “At Grade” Railway

Pipeline crossing under “At Grade” railway must be constructed by trenchless method at minimum 3.0 meter below finish grade level at the railway track or at the level where vibration level from the railway operation to pipeline remain less than 40mm/sec or as per the Railway Agency vertical separation requirements; whichever is deeper to the approval of Pipeline Technical Authority (TA) of DUSUP/DPE.

Note: Refer to DUSUP Guidelines for Road & Rail Infrastructure Crossing for further details.

6.2.2 Pipeline Crossing under Railway on Soil Embankment

Pipeline crossing under the railway on soil embankment (elevated) must be constructed by trenchless method. The pipeline must cross at minimum 3.0 meter below finish grade level at the railway track or at the level where vibration level from railway operation remain less than 40mm/sec or as per the Railway Agency vertical separation requirements; whichever is deeper to the approval of Pipeline Technical Authority (TA) of DUSUP/DPE.

Note: Refer to DUSUP Guidelines for Road & Rail Infrastructure Crossing for further details.

6.3 Crossing Existing Utilities:

a) Existing utilities information must be obtained from the services authorities through e-NOC. Information provided by the utility companies may not be accurate therefore to be verified at site.

b) Various utilities are constructed outside ROW and cross DUSUP corridor to serve neighbouring communities. DUSUP as the custodian and primary user of the corridor, construct the pipeline within corridor by open cut excavation method. Therefore other utility crossing must be constructed below the lowest existing

hydrocarbon pipeline in the corridor complying with the DUSUP's vertical separation requirements and shall run at the same level throughout the width of corridor.

c) DUSUP requirements of clear vertical separation for the utility crossing below existing pipeline(s) are as follows:

- Minimum 1.0 meter for Open cut excavation.
- Minimum 2.0 meter or two times the diameter of crossing sleeve/duct whichever is more for trenchless crossing.

d) 100mm thick precast concrete slab(s) must be provided midway between the existing utility and proposed pipeline to serve as a warning/barrier during the future maintenance excavation of pipeline. The slab shall be minimum 400mm wider than the overall dimension of crossing utility and extended 1.0meter either side of pipeline. Concrete slab shall be reinforced with A193 mesh reinforcement and coated with minimum two coats of approved bitumen emulsion paint.

e) For crossing of existing hydrocarbon pipeline reinforced concrete slab of 2500 x 2000 x 100 mm must be installed between the new pipeline and the existing pipeline. Concrete slab can be in smaller sections and shall be reinforced with A193 mesh reinforcement and coated with minimum two coats of approved bitumen emulsion paint.

f) CP test post shall be provided at pipeline to pipeline crossings

g) All existing utilities including unforeseen utilities encountered during the construction must be accurately recorded with the description, elevation (DM datum) and location coordinates (DLTM) on the as built drawing for DUSUP record.

Note: Refer to DUSUP Guidelines for Utilities Crossings Existing Pipeline" for further details.

h) For pipeline parallel to or crossing under the existing High Voltage OHL an interference study must be conducted to determine the possible impact on hydrocarbon pipeline(s) and approved mitigation measure shall be implemented. DEWA's requirements for crossing of DEWA OHL are also applicable.

7 PIPELINE BERM

Where pipeline is not covered with the protection slab or other approved protection, pipeline shall be protected with approved soil berm as follows:

7.1 Pipeline Berm at Curved Road /Interchange Crossing

When pipeline crosses a curved road, i.e. within roundabouts and/or interchange loop sections - where slab or other approved protection is not available - pipeline shall be protected with the pipeline berm as shown on DUSUP drawing reference 900-08-055 (Attachment 3).

7.2 Pipeline Berm within Corridor

Pipeline berm inside the fenced corridor shall be constructed as per the DUSUP standard drawing reference: 900-08-011 (Attachment 4).

8 PIPELINE SIGNS

Pipeline signs shall be installed where it is considered necessary to indicate the presence of a pipeline, such as at road crossings, desert crossing points, along the pipeline, corridor fence & gates, and at pipeline facilities. Pipeline signs are also be installed to show the kilometre distances along the pipeline route.

8.1 Pipeline Warning Signs at Road and Desert Crossings:

To assist in the correct identification of the approved high way crossings or desert crossings (given that there are numerous crossings on each pipeline corridor), the crossings shall be preceded by a number that defines the pipeline corridor, and the pipeline corridors have been identified as set out in the table below:

Corridor Number	Corridor Location
Corridor 1	Margham Plant to JAFZA Pig trap
Corridor 2	Sharjah Border to Sheikh Zayed Road
Corridor 3	16” along Lehbab road Opposite Dubai Investment Park to Roundabout 3 in JAFZA
Corridor 4	Sheikh Zayed Road to Dewa End
Corridor 5	48” RM-2 Jebel Ali Industrial Area - DEWA JAPS
Corridor 6	Corridor -1 (Jebel Ali Industrial Area) - DEWA HASSYAN Power Plant
Corridor 7	Margham Plant to Khubai Well Pad

Thus road-crossing number 1 on the Margham Corridor would read RX101, and desert-crossing number 1 on the Margham Corridor would read DX101.

Similarly road-crossing number 1 on the Sharjah Corridor would read RX201 and desert-crossing number 1 on the Sharjah Corridor would read DX201.

Pipeline Warning Signs shall be installed at a height of six feet from finished ground level as shown on drawing reference 900-08-004-001 (See Attachment 2).

8.2 Pipeline Identification & Warning Signs

In order that members of the Emergency Services such as the Civil Defence and Police can identify the pipeline and pipeline location in the event of an emergency; all Pipeline Warning Signs shall have a Pipeline Identification reference included.

This identification reference can be quoted to the DUSUP Emergency Control Room thus identifying the pipeline. Pipeline identification shall be as described in the table below:

Pipeline	Start	End	Signage KP
16” Margham -DUGAS	Margham Plant	DUGAS	KPxxx 16HP

8.3 Pipeline Warning Signs along Pipeline Route

Pipeline Warning Signs shall be installed adjacent to the pipeline berm at 250 meter intervals, e.g. KM26+250, KM26+500, etc. The pipeline warning signs shall indicate cumulative kilometres from the reference station; cumulative Chainage zero starts from centre line of 1st valve at pig trap and usually going in the direction of product flow. The

cumulative kilometre reading with pipeline identification code shall be shown on the bottom white strip of the signage panel (see picture below).

The spacing of signs may be reduced to suit site conditions such as in JAFZA or to indicate a change of pipeline direction.

The signage foundation shall be installed at a 1.5 meter offset from the centre of the pipeline, except in heavily congested areas such as JAFZA, in which case the offset shall be determined after verification of site conditions.

In most cases more than one pipeline is running in parallel with another, with the starting kilometre point being slightly different. Where the pipelines are running in parallel, all warning signs shall be placed in line with the adjacent pipeline, perpendicular to the pipeline route.

Road Crossings (RX) - Pipeline Warning Signs shall be installed either side of highway crossings; they shall be set back slightly from the edge of the road shoulder or behind crash barriers and at the approaching edge of the corridor. The crossing identification (RX number) shall be included on the signage panel.

Road Crossing(RX) Sign


Desert Crossing (DX) - Pipeline Warning Signs shall be installed either side of desert crossing locations at the approaching edge of the corridor. The crossing identification (DX number) shall be included on the signage panel.

Desert Crossing(DX) Sign

8.4 Pipeline Warning Signs on Corridor Fence & Gates

Pipeline Warning Signs on the corridor fence shall be installed at intervals of every 500 meters along the corridor and on every double leaf gate installed at approved desert & road crossing locations. In areas of high density population such as in Jebel Ali Labour Camp Area or in sensitive areas such as Lussaili, the distance between signage on the fence shall be reduced in order to maximize the effect of the signage. Refer to drawing : 900-08-047-001(Attachment 5)

8.5 Restricted Area Signs

Restricted Area Sigs shall be installed on the facility fence of restricted areas such as Block Valve Stations, Pigging Stations and Dubal Corner Manifold Facility as shown in (Attachment 6)

8.6 Pipeline Markers

a) Pipeline Markers shall be installed on the pipeline berm mid-way between the Pipeline Warning Signs, i.e. every 125 meters. The result will be that there is an indication that a pipeline exists every 125 meters along the pipeline corridor. Also pipeline signs and markers shall be installed to show the kilometre distances along the pipeline route.

b) Parallel pipelines shall have these markers placed in line with the adjacent pipeline (perpendicular to the pipeline route). A typical Pipeline Marker is shown in (Attachment 7).

c) Where Dubai Municipality has allocated additional land for pipeline corridors, pipeline markers will be installed at the edge of the new pipeline corridor at 50 meter intervals and shall be maintained until such time the new corridor is fenced.

d) Where DUSUP corridor and RTA ROW intersects, pipeline markers shall be installed at 50 meter intervals between the edge of the pipeline corridor fence to the edge of

the carriageway hard shoulder or footpath to increase awareness that pipeline(s) are crossing.

8.7 Underground Utility Signs

The route of underground services such as water, drainage, electricity, telephone etc., are installed by the concerned utility owners such as DEWA, Dubai Municipality ETISALAT and Du and are generally installed upon completion of the utility crossing.

9 ABOVE GROUND PIPELINE/BLOCK VALVE STATION PROTECTION

Above ground pipeline facility such as Block Valve Stations (BVS) shall be provided with heavy duty crash protection in addition to chain-link fence with restricted area signs.

9.1 Crash Protection

Above ground Pipeline and BVS facility outside the plant boundary fence shall be provided with approved crash protection as shown in (Attachment 8).

9.2 Fencing

Above ground Pipeline and BVS facility outside the plant boundary fence shall be fenced with approved facility fence as shown in (Attachment 9).

9.3 Wind Socks

Wind Socks shall be provided for Block Valve Stations (BVS) and fenced Plant areas as shown on (Attachment 10).

9.4 Access Control

Access for non-routine operation activities to the above ground pipeline facility such as BVS area DUBAL Corner facility is managed with DPE Permit to Work System.

9.5 Lighting & CCTV for Fenced Facility

CCTV Camera and Lighting shall be provided for restricted areas such as Block Valve Stations, Pigging Stations and DUBAL Corner Manifold Facility as follows:

9.5.1 Lighting System:

All outdoor type lighting fixtures shall be LED type. The LED type Flood Light fixture with fully weatherproof, dustproof (IP66), corrosion resistant, suitable for environmental conditions shall be used for outdoor areas. Fittings installed in hazardous areas shall be Ex ‘d’, Gas Group IIB, T3.

All outdoor lighting shall be photocell and timer based control with selection arrangements. Indoor (building) lighting if any shall be manually controlled.

All outdoor lighting fixtures shall be suitable and certified for ambient temperature. Luminaries shall be as per IEC 60598.

All light fittings and associated junction boxes in outdoor area shall be fully weatherproof (min, IP-66), corrosion resistant and certified for use in the specified hazardous area classification.

Unless specified otherwise, following illumination level shall be maintained in different areas:

AREA	ILLUMNATION LEVEL(LUX)	ELEVATION
Process area, Valves, Manifold	50	Ground
Maintenance or Operation Platform	50	Floor

9.5.2 CCTV Camera:

CCTV Camera shall be provided with following minimum features:

a) 360° Pan-Tilt-Zoom (minimum 30X Optical zoom).

b) ONVIF compliant, IP based digital signal format with Ethernet based video encoder.

c) 2MP, Full HD resolution as minimum.

d) Multiple, individually configurable streams in H.264 and Motion JPEG.

e) PoE enabled cameras to use Power over Ethernet feature.

f) Day/Night functionality in indoor/outdoor environment with Wide Dynamic Range.

g) IR illuminator to assist in producing high quality video in low light and night-time conditions.

h) Production of colour image in low light & dark conditions as well

i) Range of reach 200 m (1300 ft) or more depending on the scene

j) Auto Iris lens to regulate light received by Outdoor cameras & protect sensor from sunlight.

k) Weatherproof to NEMA4X

l) Dome Type PTZ Explosion-proof cameras required at Re-injection Train Enclosures (2 nos.)

m) Weather proof and vandal proof housing

n) Comply with temperature, humidity, wind, etc. requirements.

o) Image stabilization due to vibration, Defogger, Image rotation, white-balance, and auto-focus.

p) Camera video and control shall be via the CCTV system at Control room.

q) Sun shields and self-cleaning window wiper, and where needed, 50 Hz hum eliminators.

r) Wash wiper kit with functional washing tank and accessories.

s) Video Motion Detection, Loitering Guard, Camera tampering alarm, etc.

t) Record video: Inbuilt memory, SD card and network share; Pre-and post-alarm video.

u) Support for SD card and encryption; recording to network-attached storage (NAS).

v) PTZ pre-set, start/stop guard tour, auto-tracking, etc.

w) Sturdy mounting equipment shall be used to avoid vibration caused by strong winds.

x) Camera mounts to mechanically couples the camera housing to supports (e.g. a tilt over mast)

CCTV Camera Installation Requirements:

a) Installation of cameras shall be on existing structures as far as possible.

b) In case existing structure is not suitable, a new hinged pole (10-12 meter) shall be provided with the tilting down till grade for ease of maintenance &suitable foundation fixed on Ground level.

c) Cameras can share tillable lighting pole as well; mounting accessories shall be provided.

d) Video cameras shall be mounted so that dead zone is minimized to the user requirements.

e) Cameras shall be mounted such that all effects of shudder due to camera vibration from wind or from vibrations due to the surrounding equipment are not visible on the image displayed.

10 PIPELINE SAFETY ZONE

Quantitative Risk Analyses are necessary to find a safe passage of gas pipeline and other hydrocarbon pipelines.

DUSUP and Dolphin Energy (DEL) independently carried out Quantitative Risk Assessment (QRA) studies to assess the risk from existing pipelines (for land use planning purposes) in the areas adjacent to hydrocarbon pipelines. Subsequently DUSUP and DEL issued guidelines to limit the use of the land adjacent to the pipeline corridor - based on their distance from the pipeline. Land Use Planning Zones may extend up to 500 meters beyond the Pipeline corridor limit and are divided into 4 and 5 Land Use Zones for DUSUP and DEL respectively, with corresponding restrictions for LUP. Refer to DUSUP Guidelines for Land Use Planning - DP-OPSON-0144 for further details.

11 PIPELINE CORRIDOR /CORRIDOR FENCE

11.1 Pipeline Corridor:

DUSUP corridors are reserved for the construction and operation of natural gas pipelines and other hydrocarbon pipelines such as condensate, jet fuel pipelines and Diesel Fuel Oil pipeline. The operational corridors are numbered for the identification and signage purposes as described in item 8.1.

For the total list of corridors allocated to DUSUP, refer to Attachment: 11

11.2 Corridor Fence:

Majority of DUSUP corridors are secured with 2.4 meter high chain-link fence with 2 (two) gates on each side of road or desert crossings. Refer to DUSUP Standard drawings for corridor Fence & Gates on Attachment 12 & 13.

12 PIPELINE SEGMENTATION

Long pipelines shall be divided into smaller segments that can be isolated in an emergency case or when needed to allow for operation, inspection and maintenance activities. Location of the valves provided for segmentation should be accessible to authorized personnel and protected from damage and tampering.

Valve spacing shall be determined based safety studies. In the absence of safety studies, the spacing of valves in the pipeline shall be:

- Class 1 location: 32 km
- Class 2 location: 24 km
- Class 3 location: 16 km
- Class 4 location: 8 km

The spacing may be adjusted by up to 25% based on operational, maintenance, access and system design factors.

If there is a risk of pipeline class change in the future, additional valves / segments may be required.

Isolation valve may be designed to operate from remote stations subjected to reaction time required to operate manually.

As a minimum, alternate valves shall be provided with depressurization system.

13 PIPELINE INTEGRITY MANAGEMENT

Pipeline integrity management strategy is designed to address the maintenance integrity stage, and covers the operational phase of the pipeline system from commissioning and up to and including abandonment.

The integrity management system is a long term and iterative process that involves planning, execution, evaluation and documentation of:

- Integrity control activities which cover inspection, monitoring, testing, and integrity assessments.
- Integrity improvement activities which cover internal mitigation, external intervention, and repair activities.

A brief description of operational practices considered as important to prevent or minimize integrity risks are:

- Representative integrity threat assessments, i.e. Susceptibility and identification.
- Validated Risk Assessments for prioritizing actions in a timely matter
- Appropriate, accurate and timely inspections such as Closed Visual Inspection (CVI), Non-Destructive Examinations (NDE), In-Line Inspections (ILI), Cathodic Protection (CP) surveys for applicable integrity threats.
- Mitigation via operational measures such as overpressure controls etc.

- Mitigation via maintenance practices such as inhibition, cleaning etc.
- Mitigation via integrity such as repairs, pressure reduction etc.
- Mitigation via design of system modification such as trap installation, variable frequency drive pumps etc.
- Effective cathodic protection and coating repairs minimizing corrosion initiation and growth.
- Smooth system operation minimizing both controller human factor effects, and material fatigue and upsets causing crack initiation and growth.
- Periodic monitoring of integrity hazards (i.e., threat susceptibility) and existing threats establishing growth and new emerging threats.
- Effective damage prevention measures such monitoring / controlling 3rd party activities through NOC and daily Patrolling.

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- Integrity improvement activities which cover internal mitigation, external intervention, and repair activities.

Note: For further details refer to "Pipeline Integrity Management Systems, Doc No: DP-ENG-GEN-A00001-PL-IMS-0001*"*

14 NON-METALLIC PIPELINE CONNECTION

Use of PE (Polyethylene) pipe/fittings for gas distribution network is permitted if design pressure is 125 psig or less and temperature is within the range of -29°C and 66°C. Pipe size shall not exceed 300mm and a design factor of 0.4 or less shall be used for establishing the required wall thickness.

PE Pipe shall comply with the testing requirements defined in ISO 4437-1.

PE material is not suitable for exposure to sunlight and shall be used only in the buried condition.

15 PIPELINE NOC MANAGEMENT

DUSUP-DPE operates a No Objection Certificate (NOC) system across the Emirate of Dubai through Government of Dubai e-NOC portal operated by Roads and Transport Authority (RTA). The NOC System is in place in Dubai to review and pre-approve any work on a Public Way or in the Right of Way or to create any Traffic Diversions. The same system is also used to review, approve and set conditions for monitoring and controlling third parties activities in the vicinity of onshore pipelines.

DUSUP Pipeline corridor is shared by ENOC Group, EMDAD, Dolphin Energy and DEWA. NOC for the pipelines are reviewed by respective pipeline Owners or Operators (ENOC Group, EMDAD & DEL) and processed through Government of Dubai e-NOC portal.

NOC for DEWA pipelines are processed directly by DEWA through e-NOC.

15.1 NOC Zone

DUSUP NOC is applicable for any restricted activity or other construction-related activities within the NOC Zones classified as follows:

a) 60m either side from the canter of pipelines or DUSUP Corridor limit, whichever is highest.

b) 10m either side of the pipeline for the pipelines located within DEWA or EGA (DUBAL) plot limits.

c) 5m either side from canter of 8” Shell pipeline (Abandoned, Positively Isolated).

d) Margham Field Safety Zone.

e) 10m radius buffer for all abandoned wells (Positively Isolated).

f) 500m buffer for LNG Terminal & Pipeline.

g) 500m buffer for all offshore Pipelines.

h) 500m from the pipeline for land use planning.

15.2 Minimum Requirements for Working within NOC Zone

a) Approved NOC and drawings and documents must be available at site.

b) Site Supervisor must attend DUSUP Pipeline Safety Training.

c) Any work within 10 meters of pipeline / within corridor must be carried out in the presence of DUSUP Pipeline Representative.

d) No Machine Excavation is permitted within 5.0 meters of pipeline.

Note: For further details refer to “DUSUP Guidelines for NOC Management and Work Supervision”

16 PIPELINE PATROLING

Pipeline patrols are a means to detect activities that may have a negative impact on the pipelines or facilities. The information on pipeline patrol reports is used to take proactive measures to protect people, property, and the environment.

The pipeline corridor patrol must be carried out with safety in mind.

Pipeline Patrol shall report accurately all patrol observations, including work locations observed during daily patrol, Liaise with Pipeline Representatives working on DUSUP owned or DUSUP administered pipelines and Stop any unauthorized work or activity.

The patrol frequencies shall be not less as stated in the ASME B31.4 and B31.8 codes. Currently the patrols are performed on a twice-daily basis, or more frequently if required.

Note: For further details refer to “DUSUP Guidelines for Hydrocarbon Pipeline Patrolling”

17 PIPELINE EMERGENCY MANAGEMENT

Control of Emergency

In the event of any emergency within the pipeline network, the affected pipelines owner shall be responsible for the coordination of the emergency response actions. It includes the following actions:

- Manage the emergency at the location,
- Coordinate the emergency response actions with government emergency departments,
- Inform DUSUP Gas Control Station.
- DUSUP GCS (Control room) will contact control rooms of pipelines owners having pipelines on the affected corridor and inform about the emergency situation.

For serious incident of any nature (medical, fire, gas release, spill, security, etc.) that requires personnel, equipment or resources to support the response from third party and government entities, DPE GCS (Control room) will contact control rooms of pipelines owners having pipelines on the affected corridor and inform about the emergency situation. The internal escalation shall be actioned according to each pipeline owner’s internal procedure.

Note: For further details refer to “DUSUP Guidelines for Hydrocarbon Pipeline Emergency Management”

18 DUSUP GUIDELINES

Various Guidelines for DUSUP/DPE Onshore pipelines are being developed for internal and external use. Reference is made to following of those Guidelines:

DUSUP Guidelines for Trial Pit

DUSUP Guidelines for Road & Rail Infrastructure Crossing

DUSUP Guidelines for Utilities Crossing Existing Pipeline

DUSUP Guidelines for Protection of Non-metallic Pipeline

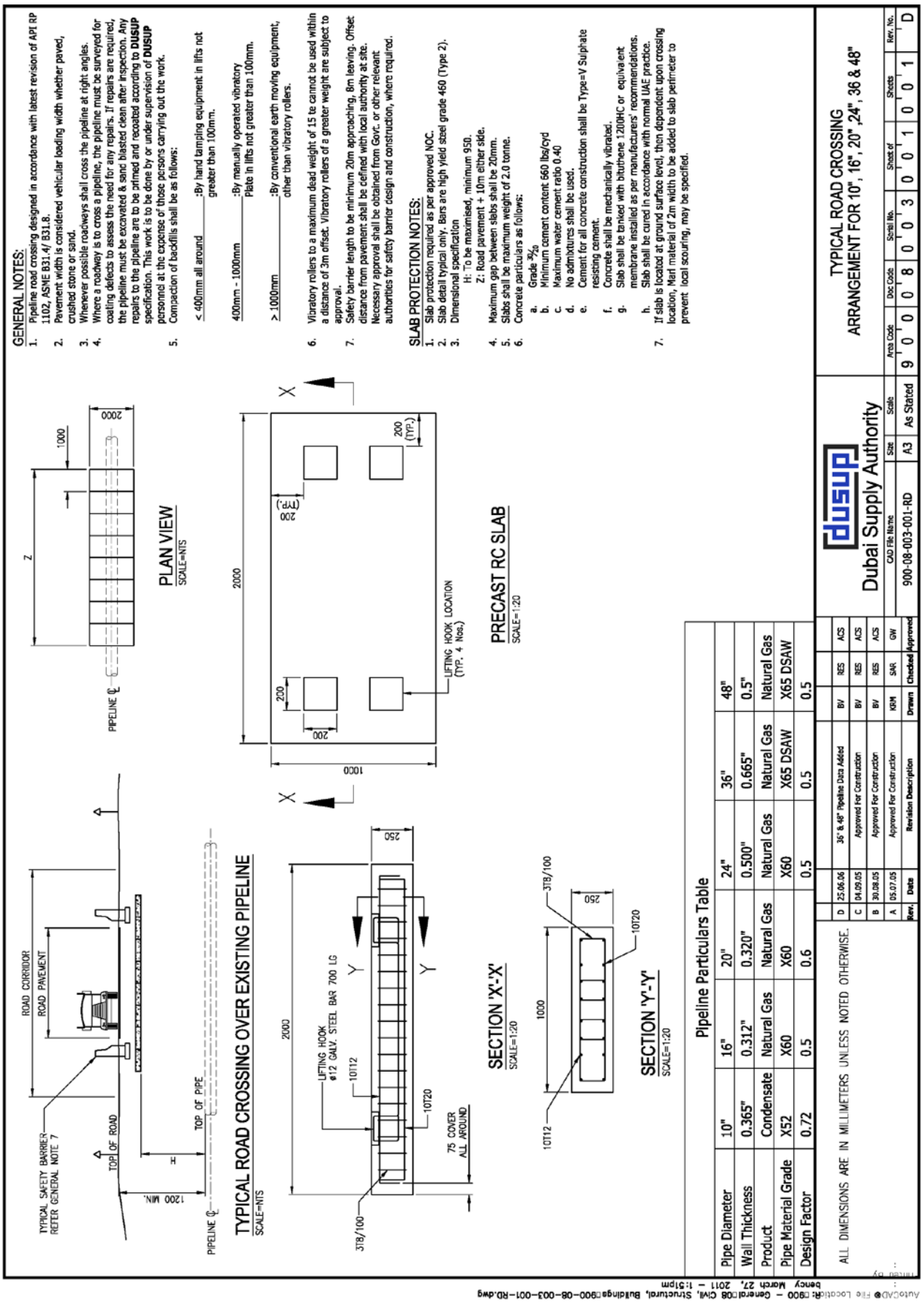
DUSUP Guidelines for Hydrocarbon Pipeline Integrity Management

DUSUP Guidelines for NOC Management and Work Supervision

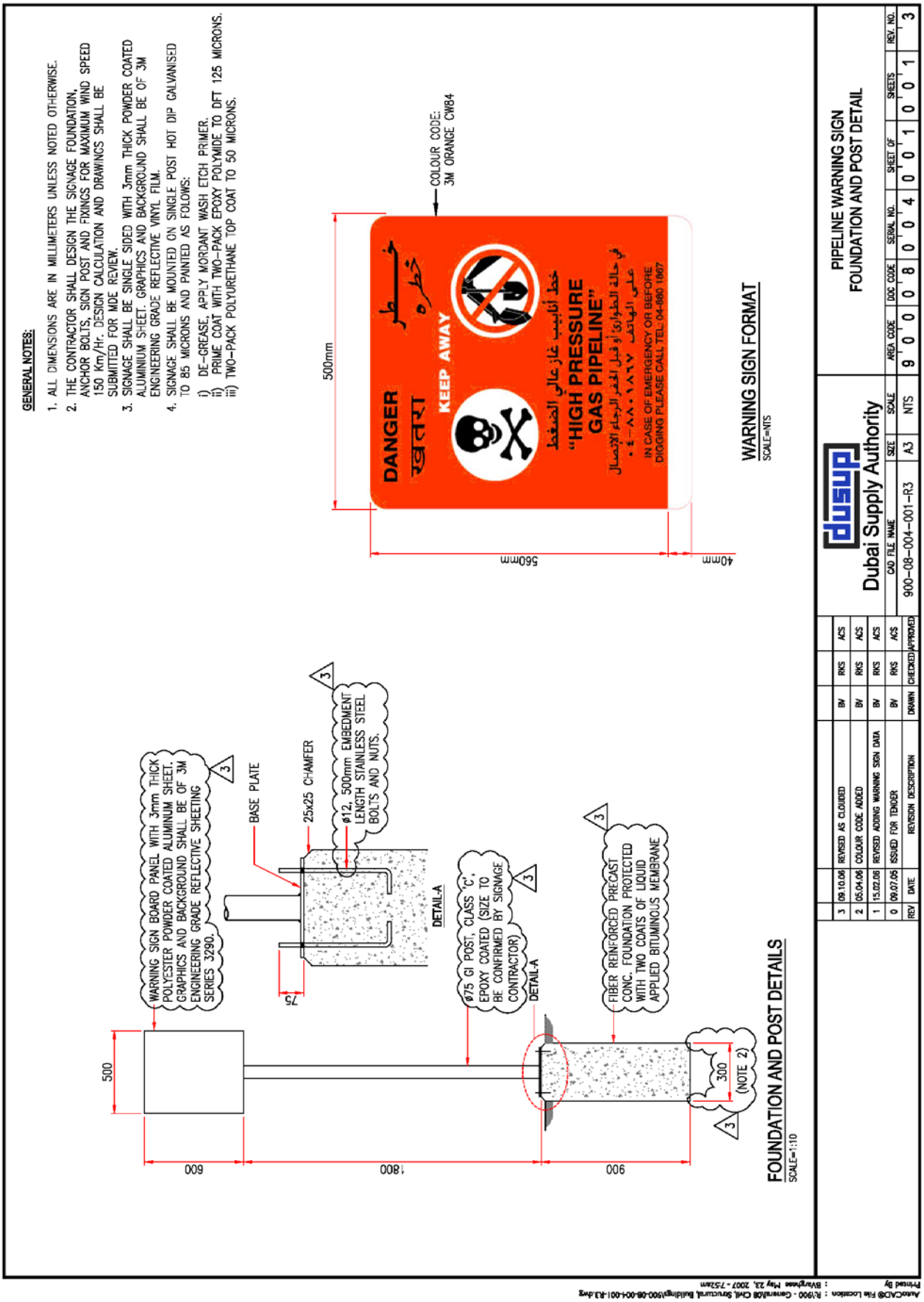
DUSUP Guidelines for Hydrocarbon Pipeline Patrolling

DUSUP Guidelines for Hydrocarbon Pipeline Emergency Management

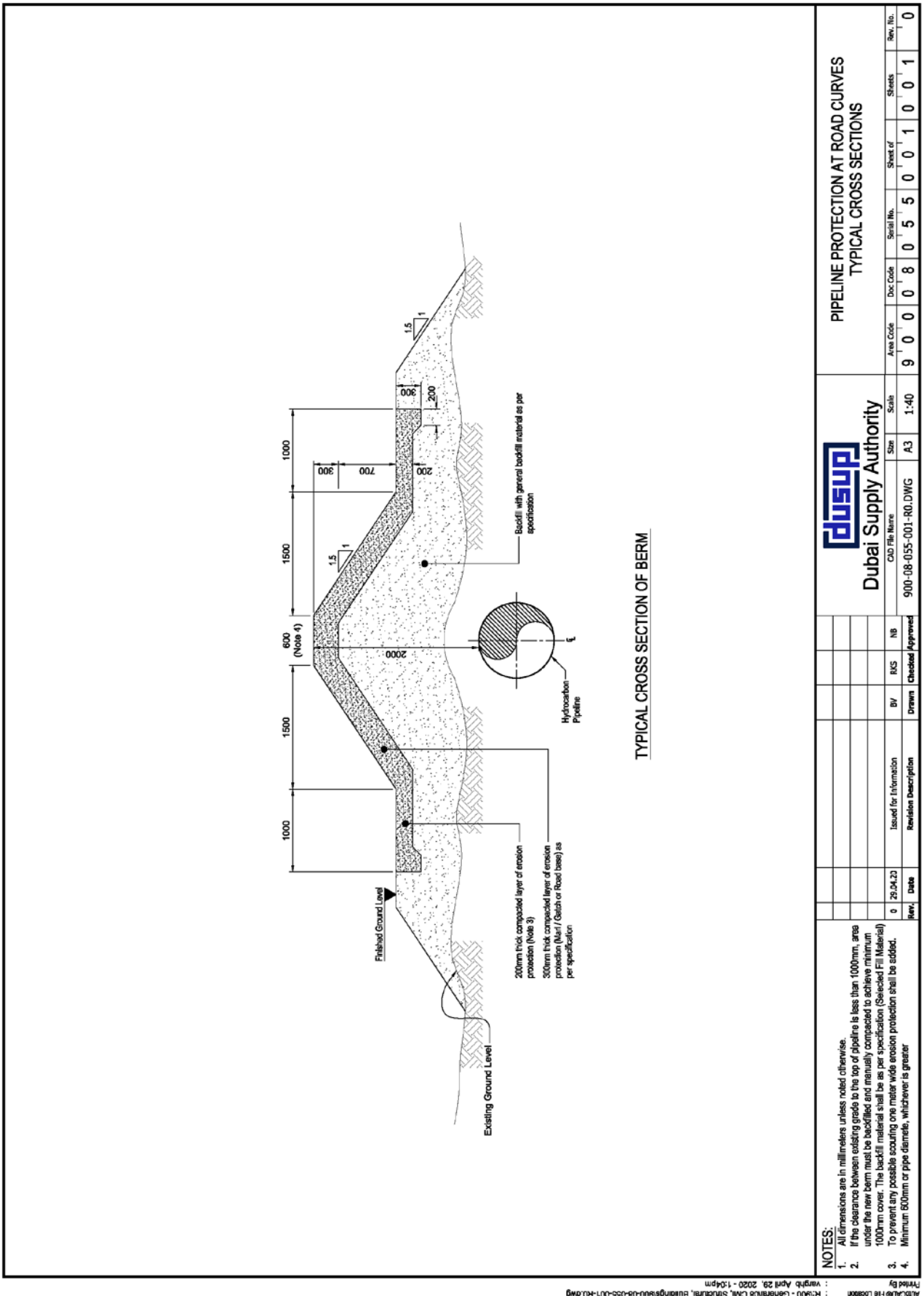
ATTACHMENT 1: SLAB PROTECTION DRAWING



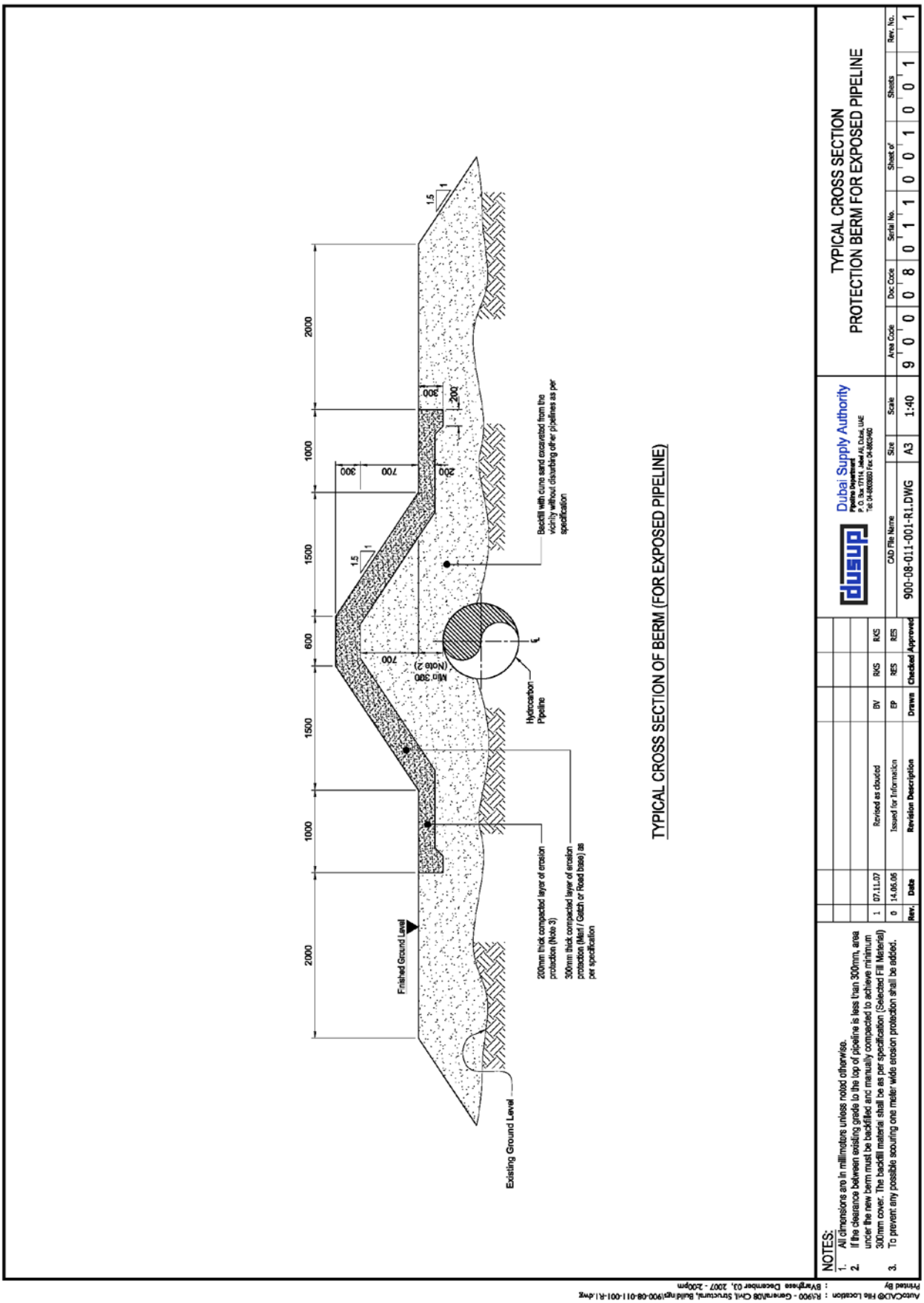
ATTACHMENT 2- PIPELINE WARNING SIGN



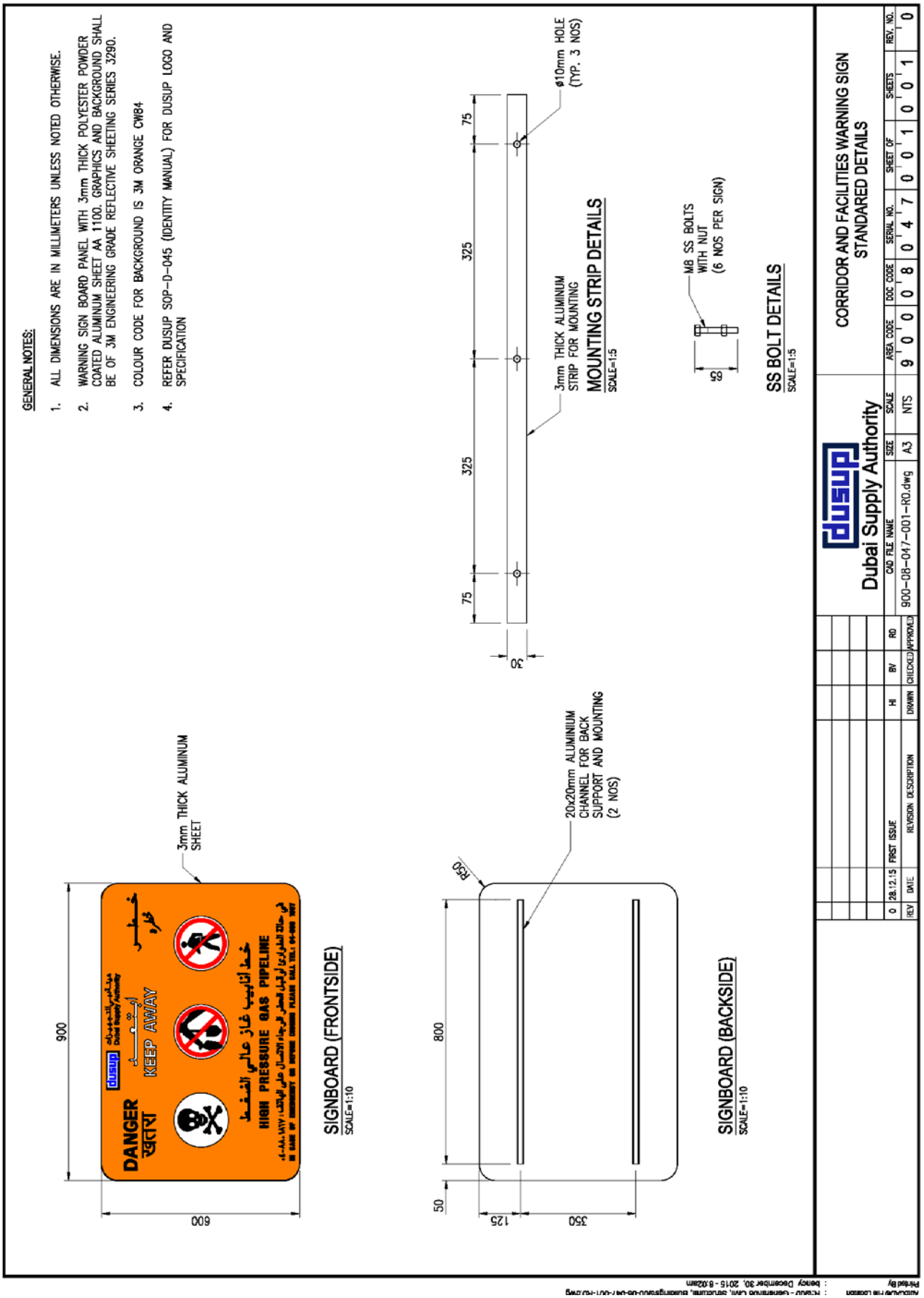
ATTACHMENT 3: BERM PROTECTION AT ROAD CURVES



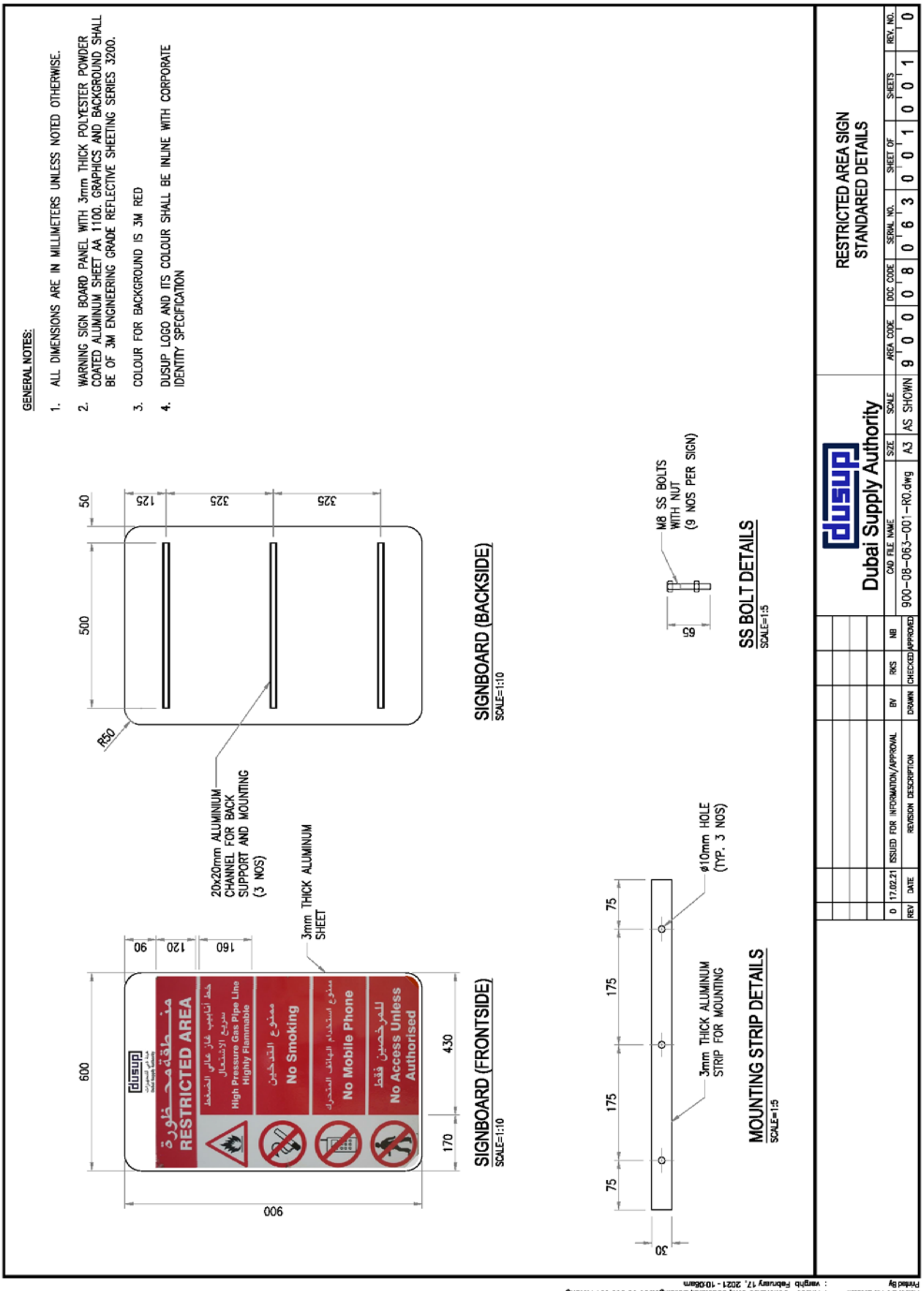
ATTACHMENT 4: BERM PROTECTION INSIDE CORRIDOR



ATTACHMENT 5: WARNING SIGN ON FENCE

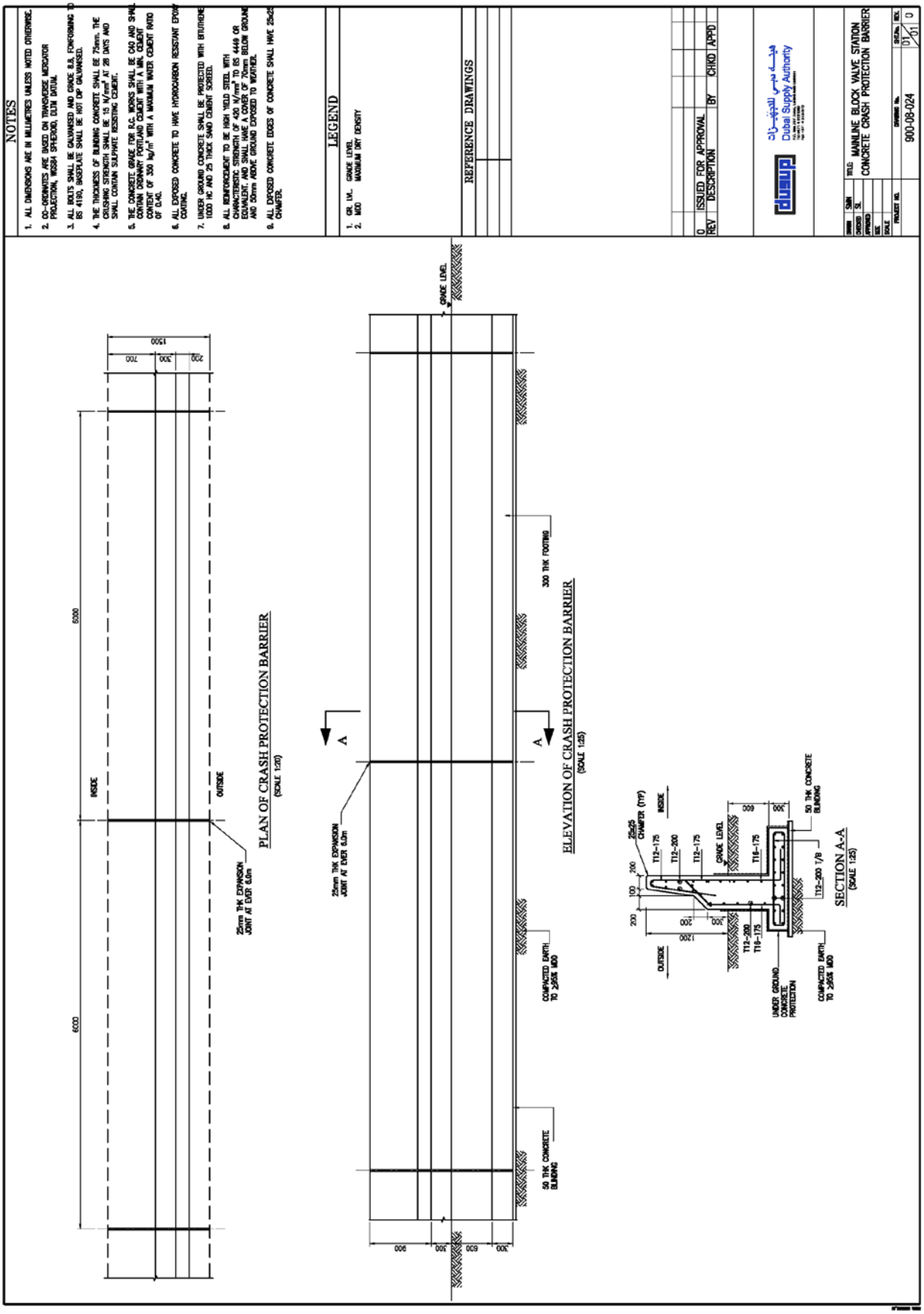


ATTACHMENT 6: RESTRICTED AREA SIGN DRAWING

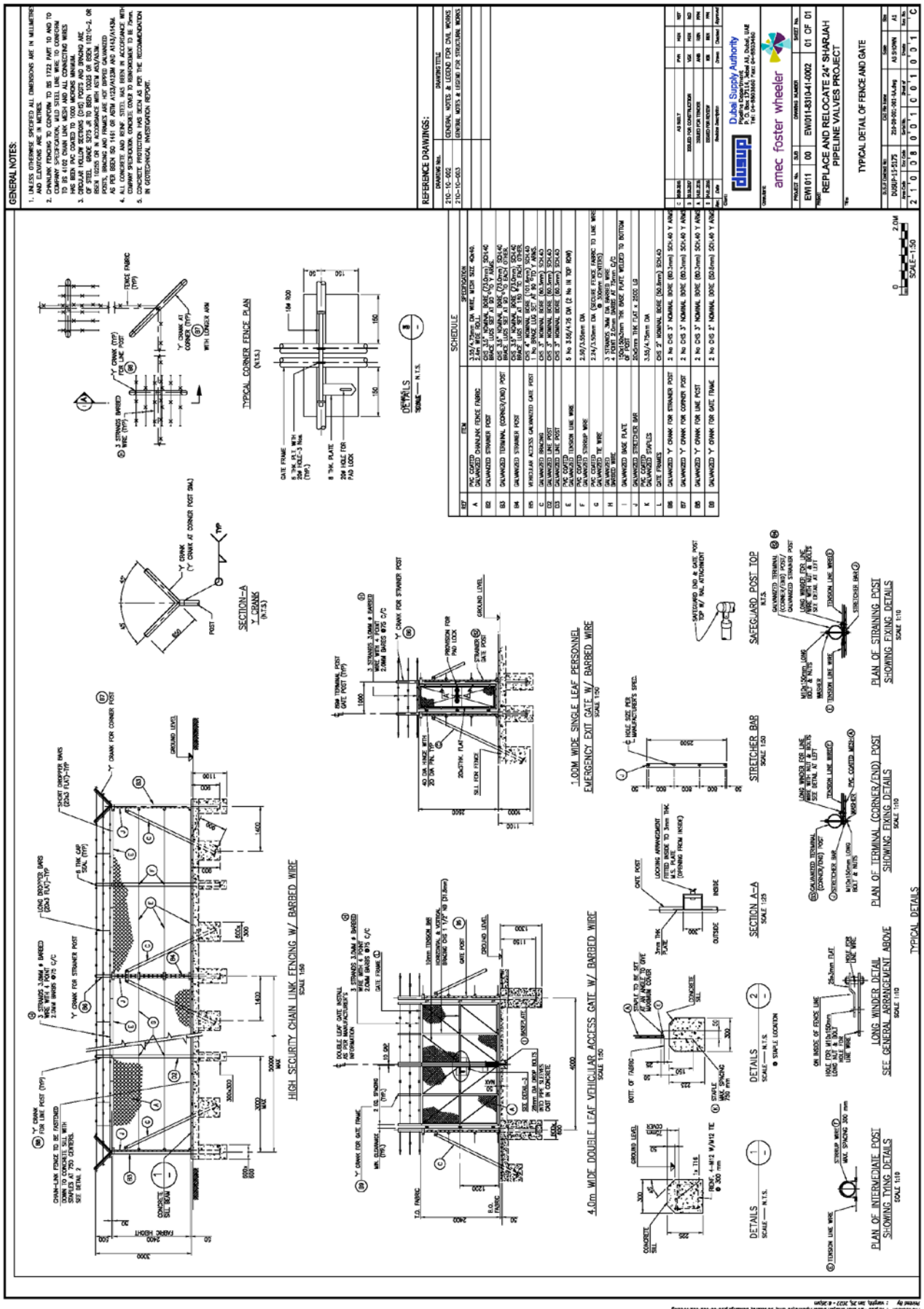


ATTACHMENT 7: PIPELINE MARKER

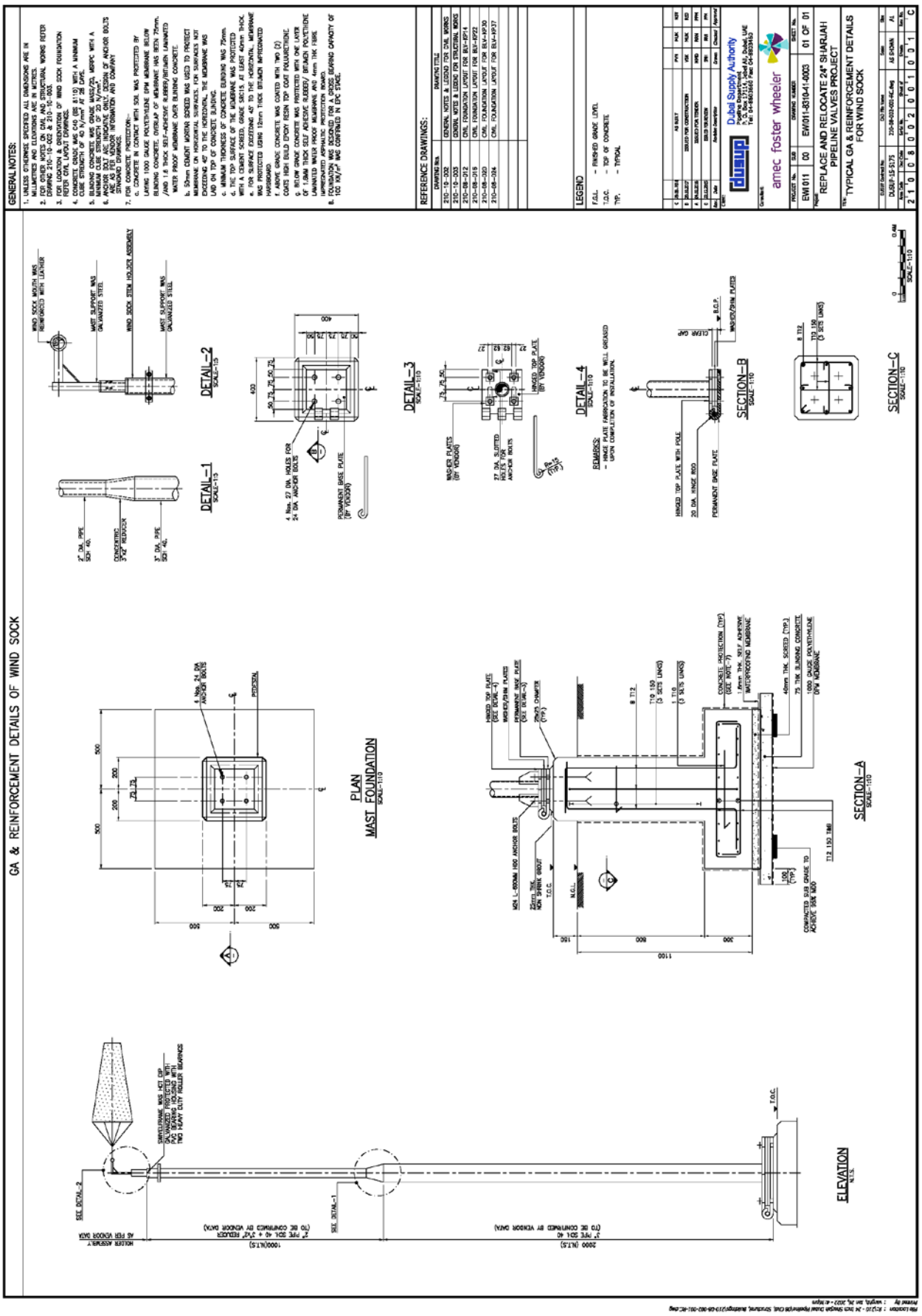
ATTACHMENT 8: CRASH BARRIERS AT BVS



ATTACHMENT 9: FACILITY AREA FENCE



ATTACHMENT 10: WIND SOCKS



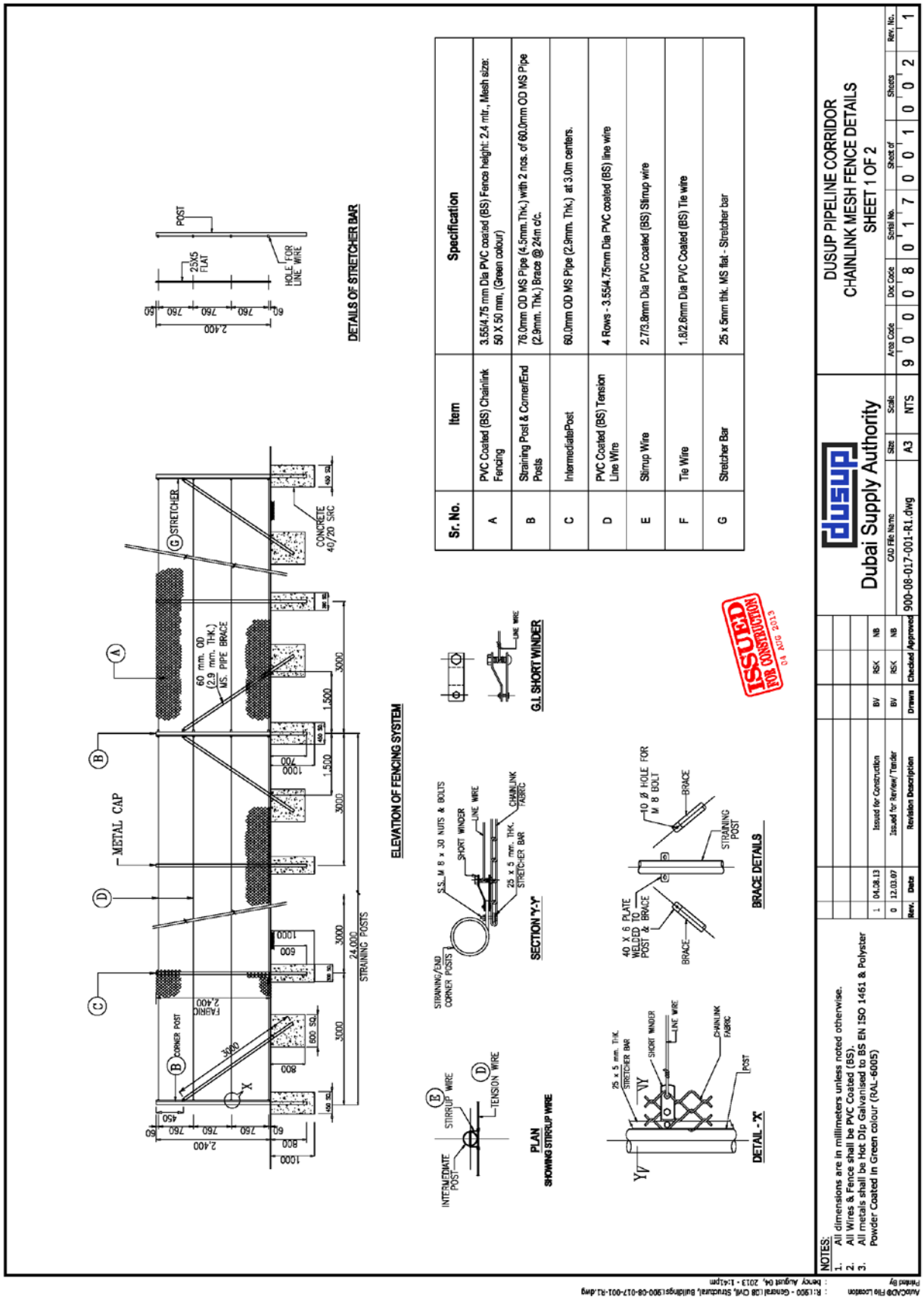
ATTACHMENT -11: CORRIDOR SUMMARY

DUSUP Corridor Summary

dusup هيئة دبي للتجهيزات Dubai Supply Authority — دبي للبترول Dubai Petroleum

No.	Corridor Name	Width (m)	Length KM (Approx.)	Location	Protection Method	Remarks
1	Margham	132m	22.27	Margham Plant - Lehbab Road	Fenced	DM Approved; Demarcation certificate obtained
2	Margham	100m	16.48	Along Lehbab Road upto Airport City	Fencing in 2019	DM Approved; No Demarcation
3	Margham	75m	4.39	Along Lehbab Road at Airport City	Fencing in 2019	Under Dubai Civil Aviation
4	Margham	106m	5.86	Lehbab Road to SMBZ Road (E311) thru DIP	Fenced	DM Approved; Demarcation certificate obtained
5	Margham	206m	2.34	SMBZ Road (E311) to GCS (H-I-J-K)	Fenced	DM Approved; Demarcation certificate obtained
6	Margham	106m	2.49	GCS to Sh. Zayed Road (E11)	Fenced	DM Approved; Demarcation certificate obtained
7	Lehbab	50m	2.74	Margham Corridor - Lehbab Power Plant	Not Fenced	DM Approved; Demarcation certificate obtained
8	Sharjah	120m	54.02	Sharjah Border - Sh. Zayed Road (E11)	Fenced	DM Approved; Demarcation certificate obtained
9	Sharjah	8m	0.07	CP Land (Behind Arabian Ranches)	Fenced	DM Approved; Demarcation certificate obtained
10	Sharjah	60m	0.34	DEWA-H Hot tap station - DEWA H	Fenced	DM Approved; Demarcation certificate obtained
11	-	-	1.65	DUBAL (EGA) Corner to LSV (Old Gas Metering Station)	One Side Fenced	With in DUBAL (EGA)
12	Ring Main	6M	1.28	Corridor between DUBAL (EGA) & DEWA	Fenced	DM Approved; No Demarcation
13	Airport City	-	5.30	16" Section along Lehbab Rd. at Airport City	Fence+Barrier	No corridor; Pipeline in RTA Corridor
14	Lehbab Road	-	5.12	16" Section along Lehbab Rd., between SMBZ Road (E311) & Sh. Zayed Road (E11)	Barrier on Road Edge	No corridor; Pipeline in RTA Corridor
15	JAFZA (16" Gas)	-	4.35	Sh. Zayed Road (E11) to DUGAS (16" Gas Pipeline Route)	Barrier on Road Edge	No corridor; Pipeline in RTA Corridor
16	JAFZA/DUGAS	-	1.28	DUBAL St. to JAFZA R/A 4 (Gate 1)	Barrier/Fence	No corridor; Pipeline in RTA Corridor
17	Ring Main	-	6.44	Dubai Corner to Dubai and DEWA R/M end	Fence+Barrier	No corridor; Pipelines in DUBAL/DEWA corridors
18	48 Ring Main-2	-	0.54	Route between E77 and Sh. Zayed Road (E11)	One Side Fenced	No corridor; Pipeline in DEWA Corridor
19	48 Ring Main-2	-	0.21	Route between Sh. Zayed Road (E11) and Old Sh. Zayed Road (E11)	Not Fenced	No corridor; Pipeline in RTA Corridor
20	48 Ring Main-2	-	3.30	Route within DEWA Plant	Not Fenced; within Plant area	No corridor; Pipeline in DEWA Corridor
21	Hassyan G	140m	2.53	Along SMBZ Road (E311), from Lehbab Road towards North	Fenced	DM Approved; Demarcation certificate obtained
22	Hassyan F	110M	6.73	Along SMBZ Road (E311), between Road 53 & Lehbab Road	Fenced	DM Approved; Demarcation certificate obtained
23	Hassyan E	110M	0.71	Along SMBZ Road (E311), between Road 53 & Technopark	Fenced	DM Approved; Demarcation certificate obtained
24	Hassyan D	110M	2.60	Along SMBZ Road (E311), Technopark	Fenced	DM Approved; Demarcation certificate obtained
25	Hassyan C	110M	4.05	Along SMBZ Road (E311), Nakheel Project	Fenced	DM Approved; Demarcation certificate obtained
26	Hassyan B	100M	8.48	Between SMBZ Road (E311) & Sh. Zayed Road (E11), at DXB-AUH border	Fenced	DM Approved; Demarcation certificate obtained
27	Hassyan A	79M	0.28	Between Sh. Zayed Road (E11) & DEWA Plant Rd, at DXB-AUH border	Fenced	DEWA Approved; within Hassyan Plant area
28	Hassyan A	63M	3.17	Within Hassyan Plant area, at DXB-AUH border	Fenced	DEWA Approved; within Hassyan Plant area
29	Hassyan Offshore	30M	0.56	Corridor from Hassyan Offshore Receiving Facility to DEWA plant	Not Fenced	DEWA Approved; within Hassyan Plant area
30	Khubai	40M	9.50	Margham Plant - Khubai Well	Not Fenced	DM Approved; Demarcation certificate obtained
31	TFP	100M	31.00	TFP BV-6 to Margham Plant	Not Fenced	DM Approved; Demarcation certificate obtained
32	JAFZA DISTRIBUTION	2m	0.52	JAFZA Distribution Corridor to Al Khaleej Sugar & Al Ghurair	Not Fenced	Trakhees Approved
	Total Corridor Length		**210.562**			

ATTACHMENT -12: CORRIDOR FENCE DRAWING



Sr. No.	Item	Specification
A	PVC Coated (BS) Chainlink Fencing	3.55/4.75 mm Dia PVC coated (BS) Fence height: 2.4 mtr., Mesh size: 50 X 50 mm. (Green colour)
B	Straining Post & Corner/End Posts	76.0mm OD MS Pipe (4.5mm.Thk.) with 2 nos. of 60.0mm OD MS Pipe (2.9mm. Thk.) Brace @ 24m c/c.
C	IntermediatePost	60.0mm OD MS Pipe (2.9mm. Thk.) at 3.0m centers.
D	PVC Coated (BS) Tension Line Wire	4 Rows - 3.55/4.75mm Dia PVC coated (BS) line wire
E	Stirrup Wire	2.7/3.6mm Dia PVC coated (BS) Stirrup wire
F	Tie Wire	1.8/2.6mm Dia PVC Coated (BS) Tie wire
G	Stretcher Bar	25 x 5mm thk. MS flat - Stretcher bar

ATTACHMENT -13: CORRIDOR GATE DRAWING