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CONCENTRATED SOLAR POWER REDSTONE

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ACWA POWER SOLARRESERVE®

CONSORTIUM / CONSORCIO:

acciona Industrial

ORIGINATOR / EMISOR:

EMPRESARIOS AGRUPADOS

TITLE / TÍTULO:

STORMWATER MANAGEMENT PLAN

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STORMWATER MANAGEMENT PLAN

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CLASSIFICATION

Contains information for the design of structures, systems or components: Yes ☐ No ☒

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Issue	Modifications
1	Not applicable, first issue

PRELIMINARY OR PENDING INFORMATION

Issue	Paragraphs	Subject	Status

DISTRIBUTION

External	Internal	No. copies/Format

Table of Contents

Page No.

1. GENERAL

The purpose of this document is to describe the management of the storm water drainage system for the 100 MWe Net Concentrated Solar Power (“CSP”) REDSTONE Project located on the remainder of the Farm 469, the Hay District (Administration District), approximately 5 km southeast of the Groenwater community and 30 km east of Postmasburg, in South Africa.

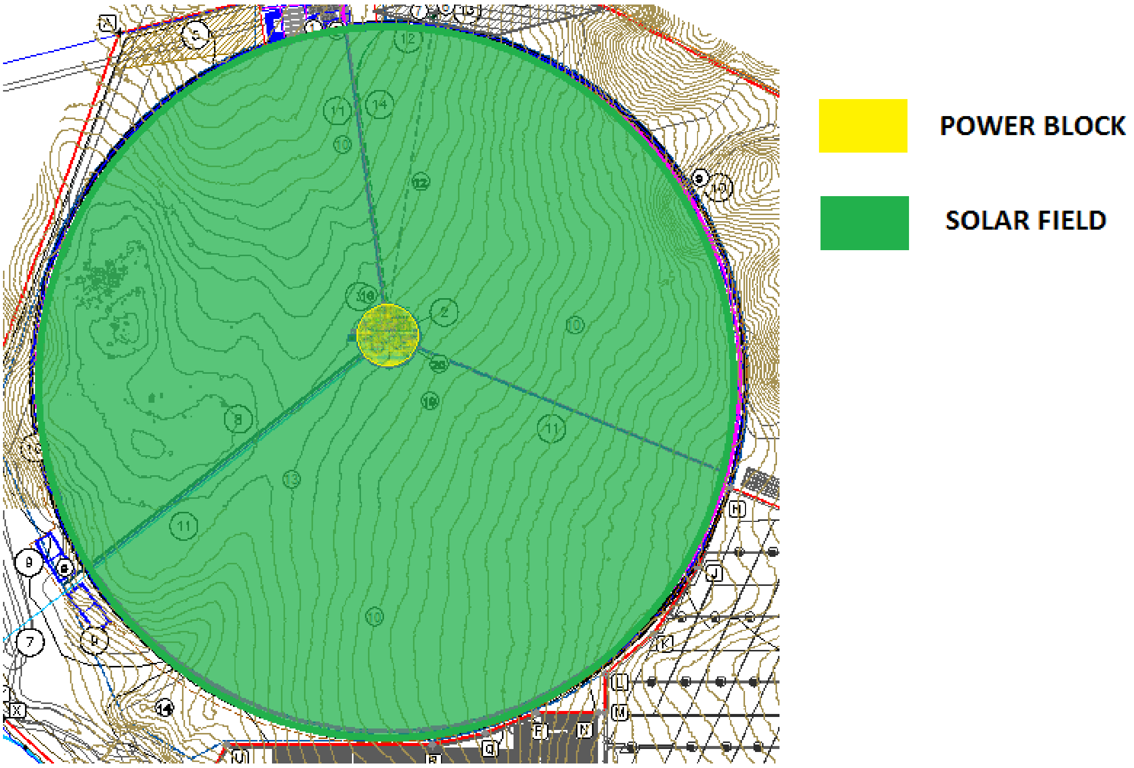
2. DESIGN CONCEPT

The basic purpose of the storm water drainage system is to collect storm water and dispose of it in a suitable discharge location.

The plant area is divided into 2 areas:

- Solar Field
- Power Block

These two areas are indicated in the image below.



Redstone Solar Power Plant will discharge its liquid effluents into the main following systems:

- Storm water drainage
- Oily water drainage
- Non-Oily water drainage
- Sewage water

Storm water will be conducted to the plant boundary. Terminal points will be selected taking into consideration the natural surface run-off of the plant surroundings.

2.1 SOLAR FIELD

In this area there will be only storm water drainage system. The Project Site, which lies in a shallow valley between two ridgelines at a height of approximately 1500 metres above the sea level (masl), is generally flat. The site slopes gently in a south-westerly direction from 1533 m to 1500 m at a very flat grade of approximately 1 %.

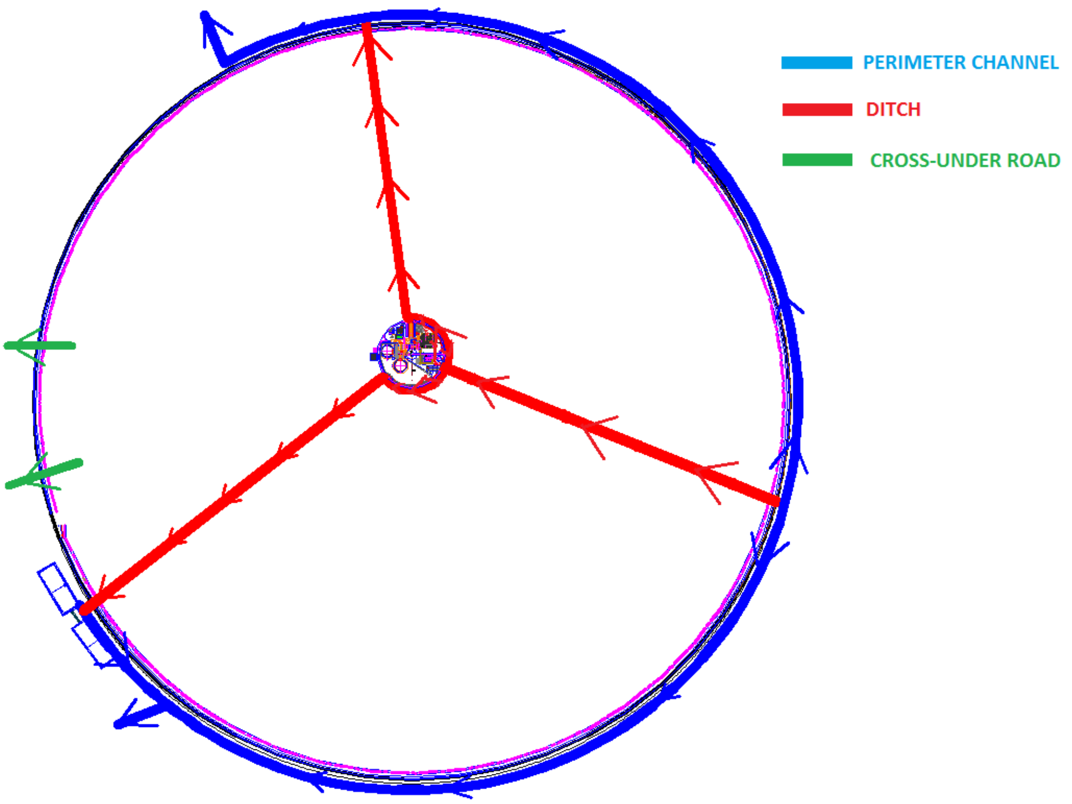
2.1.1 Storm water drainage

Storm water falling outside the solar field will be intercepted and routed to a perimeter channel (see Figure 1 for reference of typical detail). This channel is sloped towards low points, to subsequently discharge superficially outside the parcel trying to follow the natural surface run-off.

According to Environmental Impact Report, the use of heavy machinery for construction of the heliostats will cause soil compaction and result in loss of infiltration capacity. This is likely to generate excess surface water through sheet flow during intense storms. As a result, run-off coefficient inside the solar field will be different from the one considered outside the solar field.

Storm water falling inside the solar field which has not been filtered will be collected in the road ditches or will be discharged outside the parcel through crosses under the perimeter road. The road ditches will be sloped towards low points and they will discharge to the perimeter channel (see Figures 2 to 4 for reference of typical details).

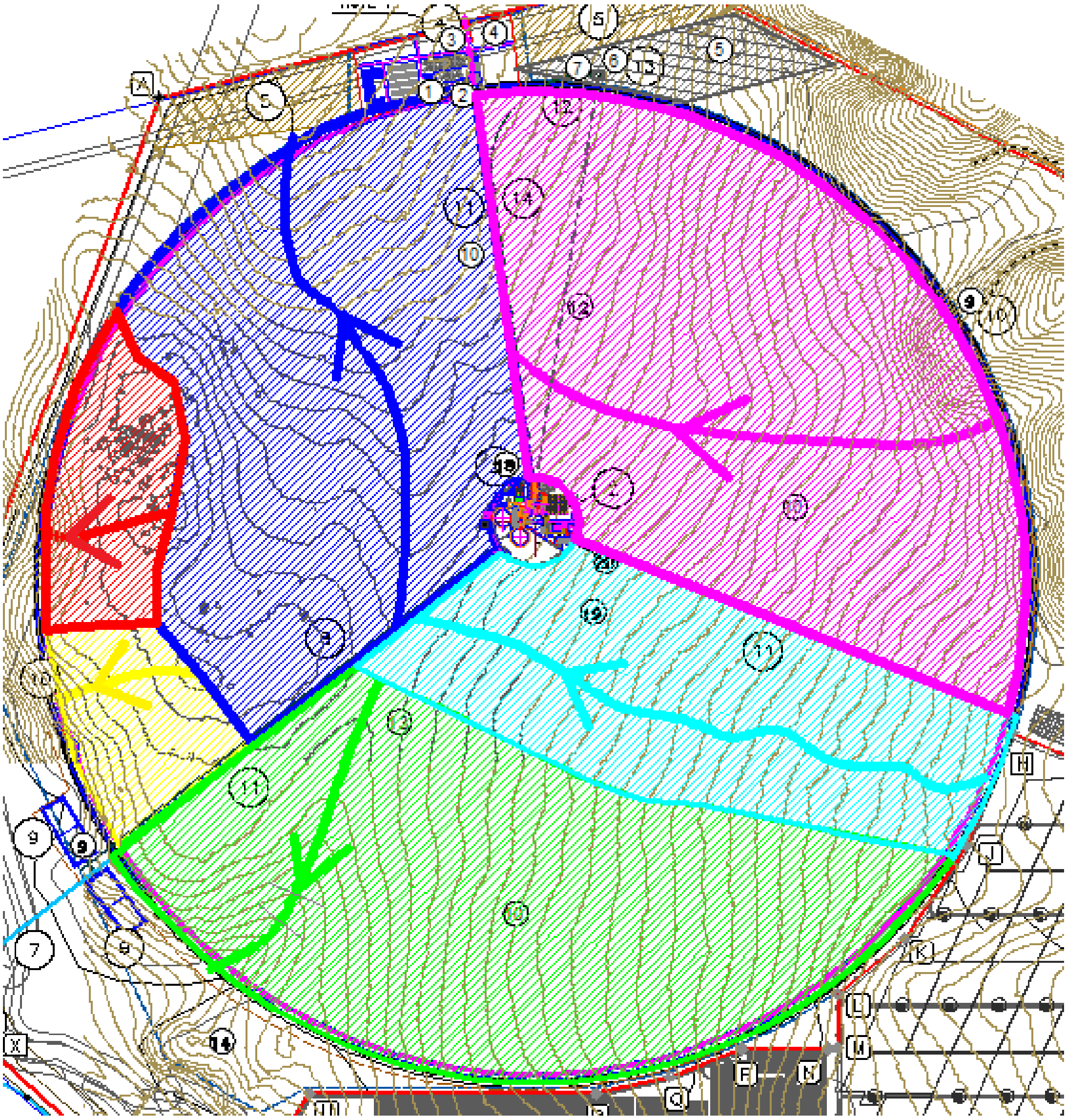
In the next image, perimeter channel and ditches of the roads are shown.



Discharge points must be protected from erosion with some type of energy dissipater. The dissipater may be a designed structure or may be constructed of rock riprap capable of withstanding the velocity of flow from the chute. Rock riprap protects soil from erosion due to concentrated runoff (see Figure 5 to 8 for reference of typical details).

The formation of natural waterways and its slope will be analyzed in the inner regions of the solar field. In these areas water speed will be analyzed and these erosion practices will be established if necessary.

The next image represents all the basins inside the solar field with their principal flows.



2.2 POWER BLOCK

The following drainages systems will be present in Power Block area:

- Sewage water drainage
- Oily water drainage
- Non-oily water drainage
- Storm water drainage

2.2.1 Sewage water drainage

Sanitary water produced will be conveyed to a sewage treatment plant.

2.2.2 Oily water drainage

There will be a specific drainage network for oily spills in areas where oil, polish or hydrocarbons might be discharged. Equipments which are likely to produce oil spilling will also discharge to oily water drainage network.

Slopes will be formed on the foundation surface in order to convey the spill to the oily water drainage network. Also, these substances are carried away by hosedowns or rainwater towards the provided sinks.

An example of this kind of areas within the Power Block is:

- Transformers containment area
- Inside parking lot, etc.

These oily waters are conducted to a pit (oil/water separator - lamellar decanter). The obtained oil is periodically collected by a certified authority. Additionally, the water collected is led through the non-oily water drainage network to the effluent collection basin.

2.2.3 Non-oily water drainage

Non oily water drainage network will collect the effluent process water and the water collected after oil/water separator – lamellar decanter process.

Non-oily effluent will be treated and then recovered as much as possible into the makeup water system. The effluent which cannot be recovered will be driven to the evaporation pond.

The evaporation pond will be placed in south-west part of the farm, outside the solar field. It will be connected to the perimeter road. The evaporation pond will consist of an embankment dam. The main object of the embankment dam is to guarantee the stability, integrity and water tightness of the evaporation pond.

2.2.4 Power block storm water drainage

Clean and dirty storm water should at all times be kept separate. No dirty storm water may be discharged directly to the ground.

Clean storm water is the rainwater which falls in the power block except in the transformers containment area, inside parking lot and chemical containment bunds. Storm water fallen in molten salt containment area will be considered as clean storm water.

Rainwater shall not penetrate enclosed buildings even in extreme conditions or if a system blockage should occur. Runoff from roofs will be diverted to the rainwater system by means of downspouts. The design and routing of gutters and down-pipes shall be integrated into the architectural and structural design of facilities and shall ensure a durable, leak-free system, while being readily maintainable. Provision shall be made for the easy maintenance and clearing of blockages to all parts of the system with manholes.

The rainwater systems shall be designed and specified for the maximum expected rainfall intensity of a major storm. The rain water run-off system shall consider the surface water of the entire catchment area and the existing run-off ditches and creeks, in the boundary limits.

The network is sloped towards low points, to subsequently discharge superficially to the solar field. The discharge point must be protected from erosion hazards caused by increases in runoff volume and velocity.

ANNEX 1

TYPICAL DRAINAGE DETAILS

Note:

Annex 1 contains typical details for reference.

FIG. 1: TYPICAL CHANNEL (OFF SITE)

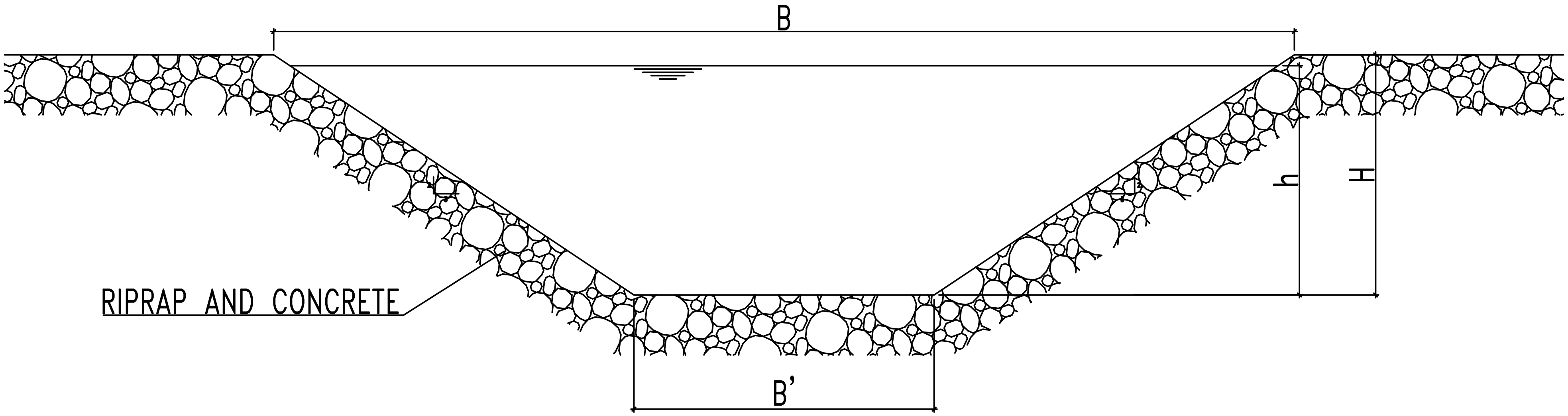


FIG. 2: TYPICAL DITCH

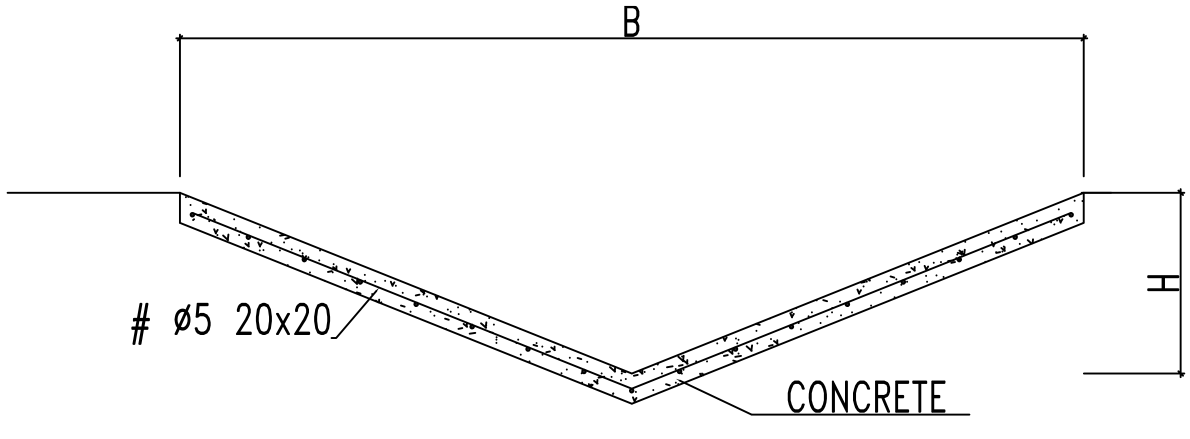


FIG. 3: TYPICAL GUTTER

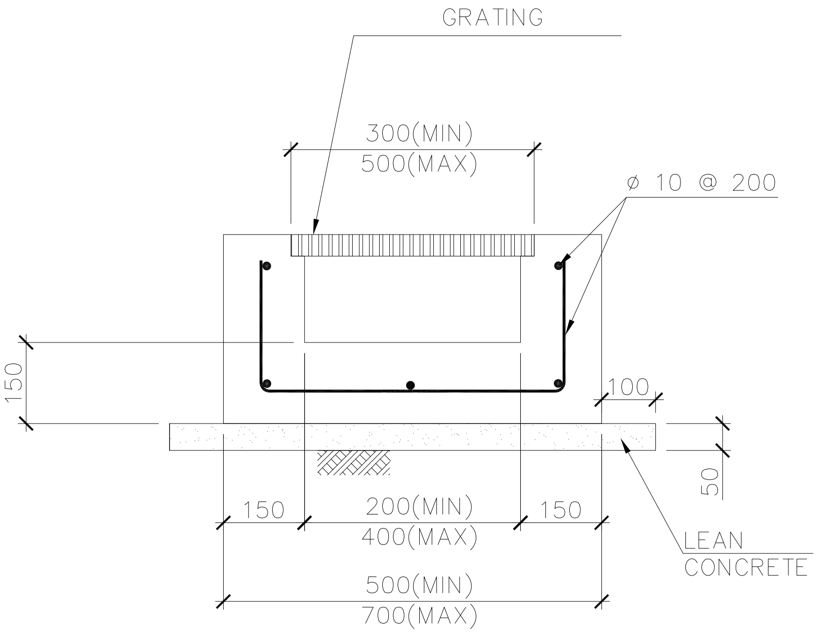


FIG. 4: TYPICAL CHANNEL

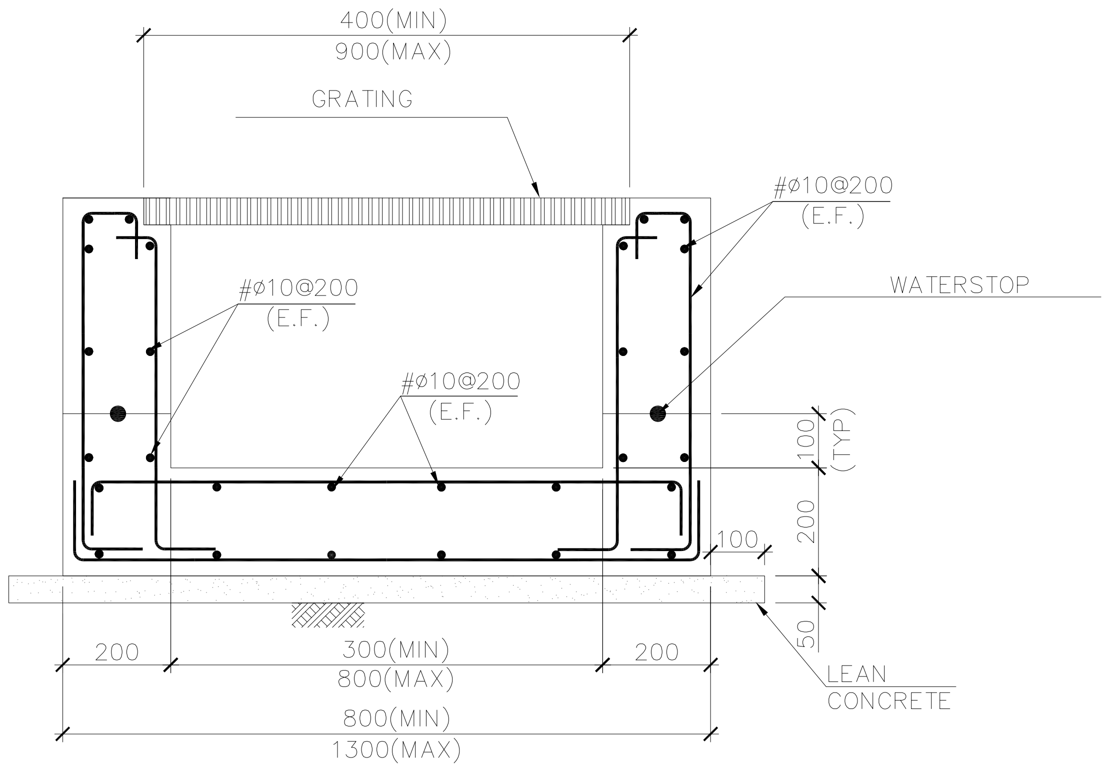
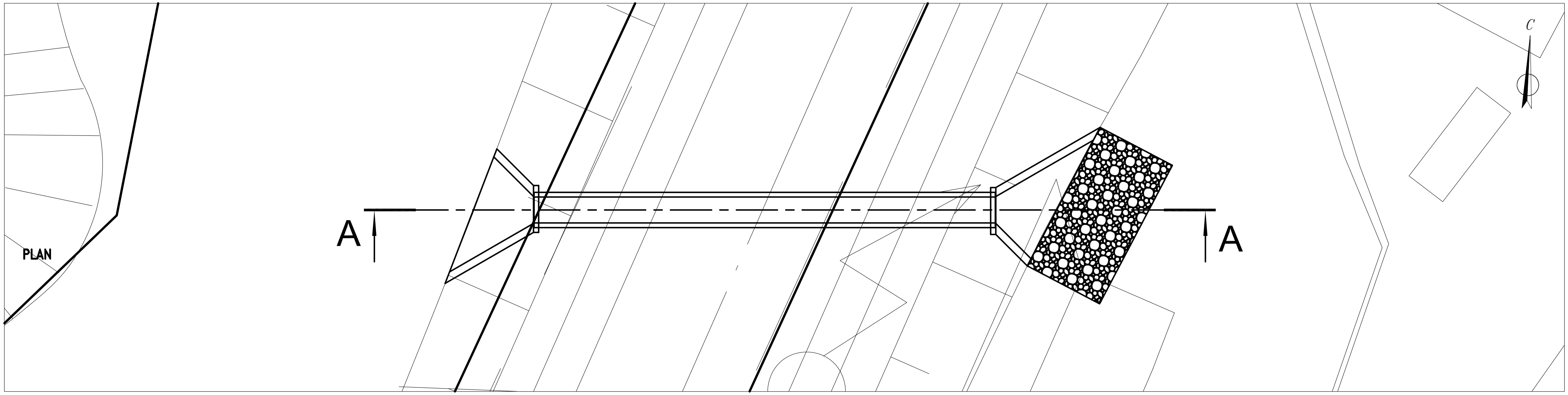


FIG. 5: CROSS DRAINAGE TYPE 1



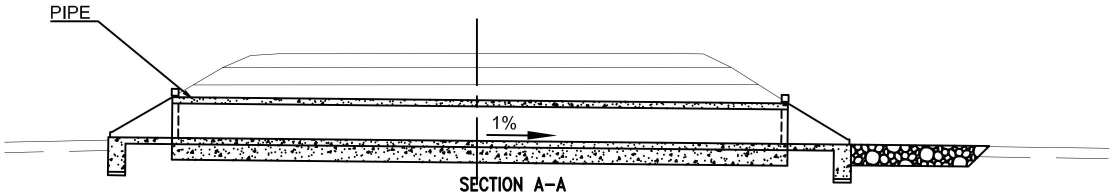
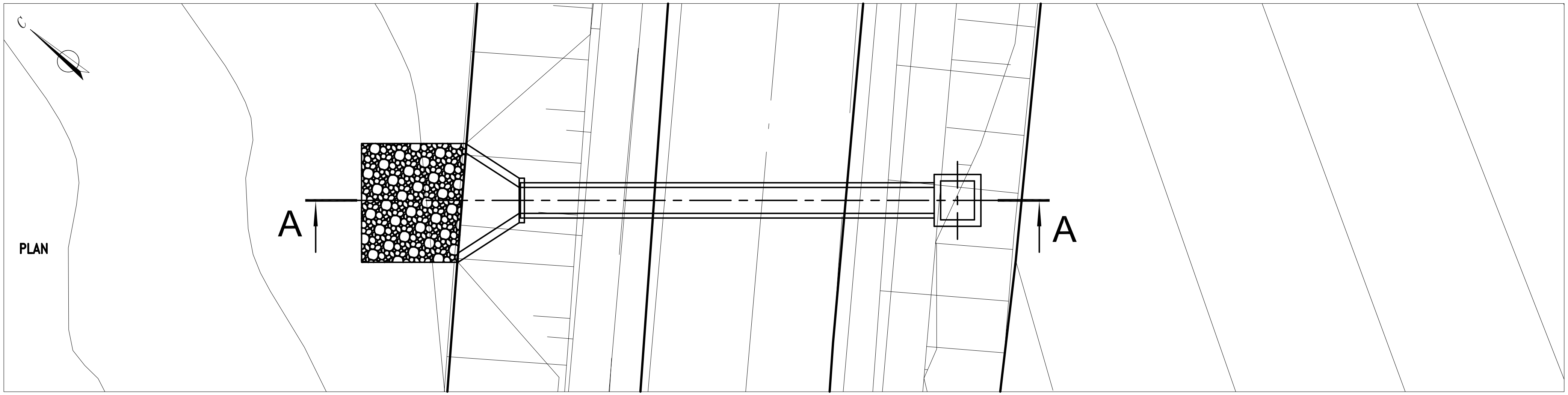
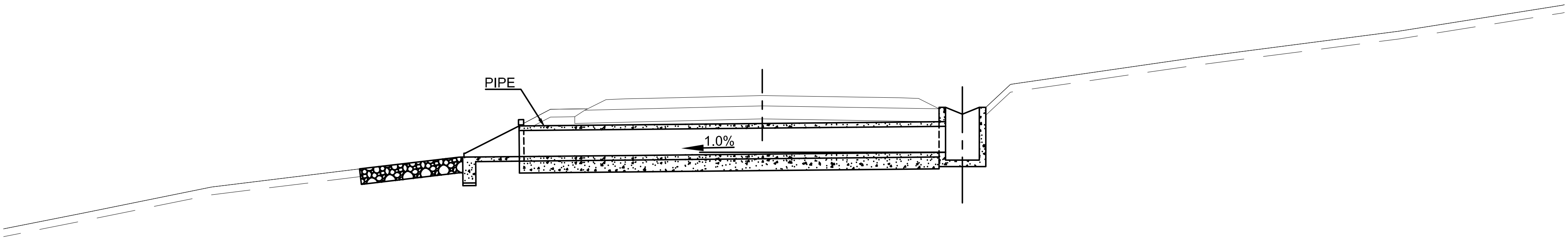


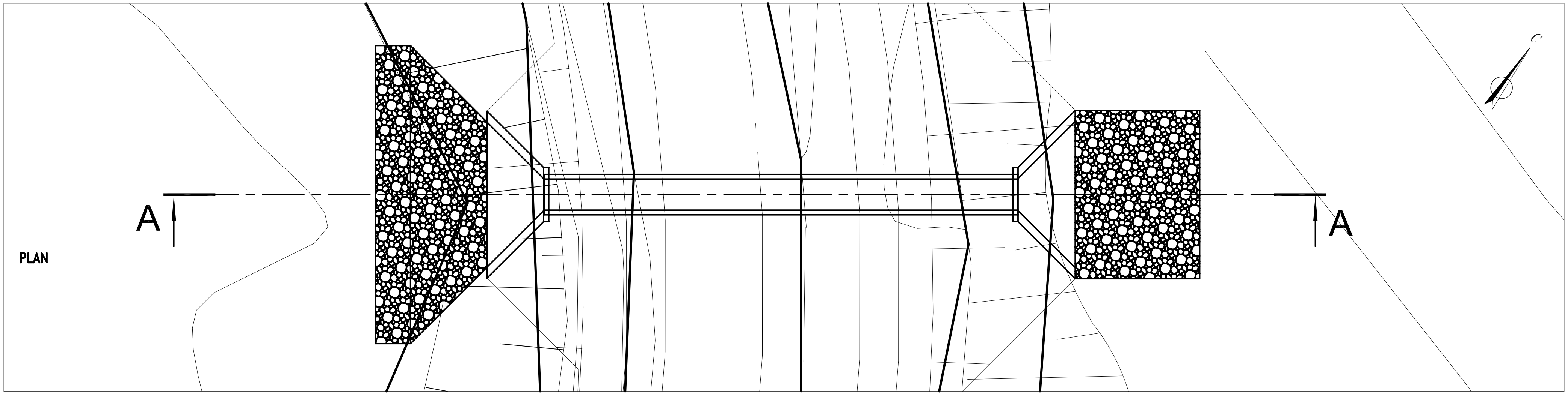
FIG. 6: CROSS DRAINAGE TYPE 2

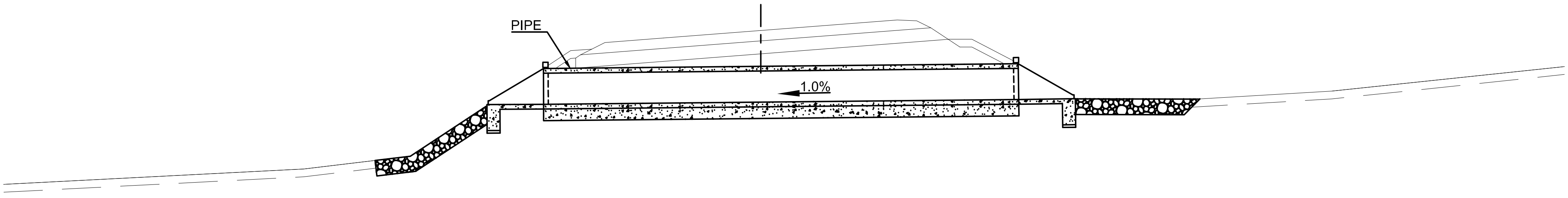




SECTION A–A

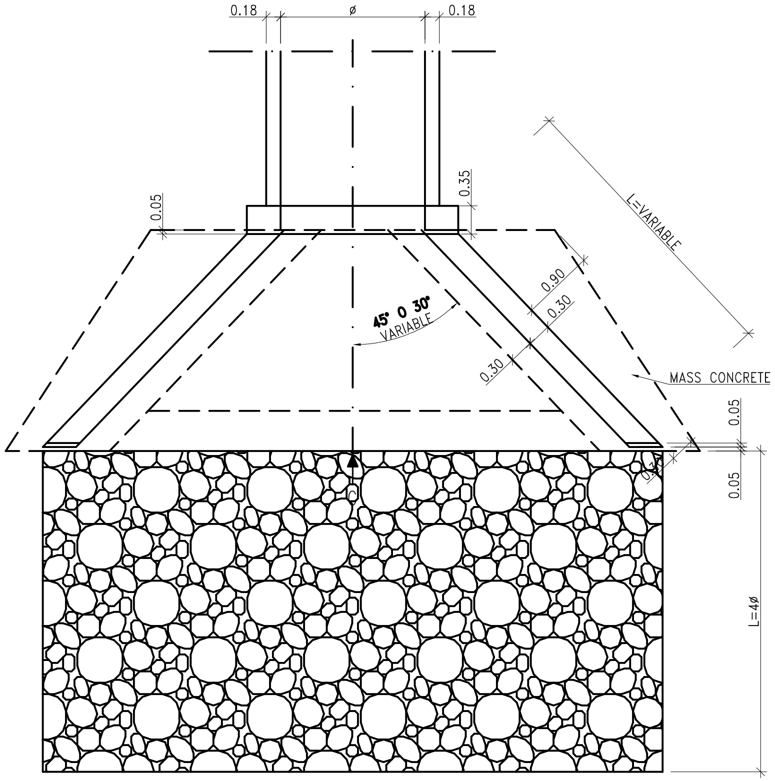
FIG. 7: CROSS DRAINAGE TYPE 3



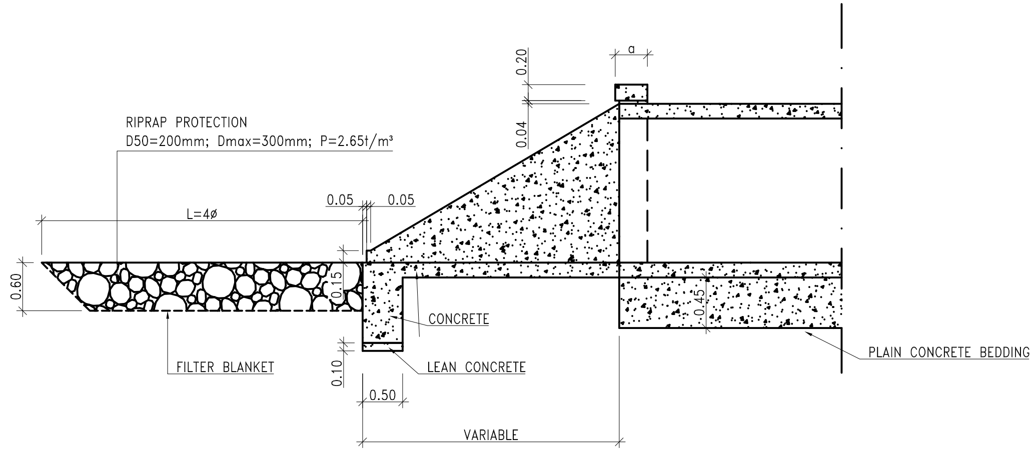


SECTION A–A

FIG. 8: CROSS DRAINAGE DETAIL



PLAN VIEW



LONGITUDINAL SECTION