DRENING®

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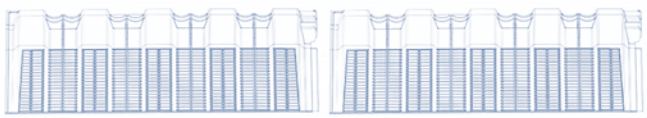
DRENING® Specifications / History / Technical characteristics Uses / Installation / Cost analysis

DRENING® drainage basins without capacity limits
The advantages of using DRENING®
Extremely simple and functional stacking and moving of the units
Financial savings when compared to traditional methods
Savings in time laying
Drainage of water even in poorly permeable soils
Consolidation of poor terrain
Possibility to accumulate up to 310 lt./sq.mt.



DRENING®

HISTORY

Until now, the methods used to disperse and regulate the flow of water were limited to recharging basins in cement with gravel filling, linked to existing sewage systems and channels with direct link-ups to drainage canals.
These systems often showed to be insufficient or in any case unsuitable in given situations, and sometimes even impossible to implement.
In Italy, the number of asphalted surfaces has increased greatly over the past ten years because of a considerable industrial and consequent civil expansion, which has led to the urbanisation of many parcels of land that previously could help in draining water.
In current conditions, it is often impossible to build new sewage systems or enlarge existing ones. We must therefore opt for a system that can provide a release of water suited to the type of soil beneath and that offers above all an extremely high capacity of accumulation.
For this reason, large cement tubes with lateral holes are often laid and filled with gravel to effect the drainage and accumulation required.
Laying these large tubes, however, is expensive and impractical because of the large quantities of gravel to be transported to the site and shifted by crane or any other machine with mechanical arm for lifting and laying the material.

Hence the reason for "DRENING®",a more convenient and cheaper system than today's cement tubes. DRENING® has been specially designed to eliminate all the difficulties of the drainage and accumulation of excess water.
DRENING® is the solution of all problems of water drainage where no sewage system exists or can be built, or where the distribution network is insufficient and where it can therefore serve as an accumulation basin as well.
The arrival of DRENING® on the market will certainly benefit companies using it as it requires very little room in shipping and storage on site, and laying can be undertaken manually as the weight is negligible and so the subsequent filling with gravel will be reduced to the minimum time necessary.
DRENING® is therefore the perfect solution.

The advantages of using **DRENING®**

Extremely simple and functional stacking and moving of the units

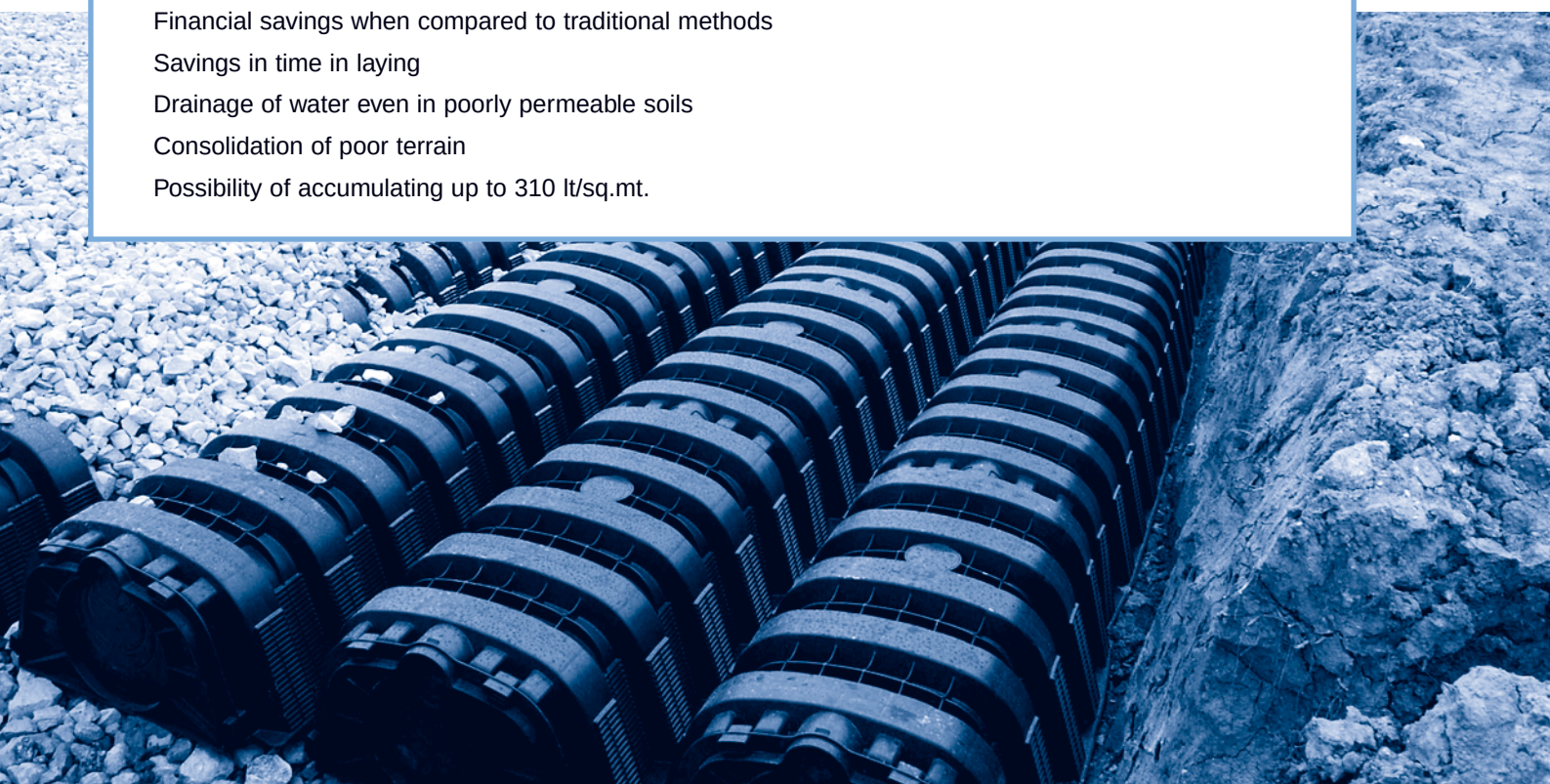
Financial savings when compared to traditional methods

Savings in time in laying

Drainage of water even in poorly permeable soils

Consolidation of poor terrain

Possibility of accumulating up to 310 lt/sq.mt.



RESOLUTION OF THE REGIONAL COUNCIL 13 December 2002, no.3637

In recent years the succession of hydrogeological disasters such as the flood of 1994, the events at Sarno, the autumn floods in 1998 and 2000 and the tragedy of Soverato, have drawn the attention of public opinion to the fragility of the Italian territory in the link between its physical characteristics and the phenomena associated with human settlement.
Consequently, law no. 267 of 03.08.98 contemplates the River Basin Authorities and Regions should adopt provisional basin Plans for the Hydrogeological layout (P.A.I.) which contain in particular the identification of areas at hydrogeological risk and the definition of the perimeter of the areas to be subjected to protection measures, as well as the measures themselves.
The P.A.I. assumes the role of a territorial sector plan which, by means of criteria, directions and standards, must allow a reduction of the hydrogeological disaster and of the related risk, and which, as a "provisional plan", must harmonise organically and functionally with the process of forming the Basin Plan. This was introduced into the Italian regulations by law no. 183 of 18.05.89 and is the main tool of a complex planning and programming system which aims to preserve, defend and utilize the soil while ensuring the correct use of the waters.
The PAI is therefore an important part of this programming process aimed at ensuring the defence of the territory against disasters due to phenomena of geological and hydraulic decline and at defining and programming the necessary action so that further conditions of risk do not occur. It therefore appears fundamental that, besides allowing the identification of the operations that will lessen the hydrogeological risk, the analysis of the territory will also have the purpose of dictating standards for the use of the territory in such a way as to guarantee an adequate level of safety and prevent the aggravation of the situation of unbalance. To achieve and, above all, to continue to ensure an adequate level of safety in the territory, it is not sufficient to carry out only repairs, but it is also essential to seek a use of the soil that is compatible with the basin's hydrographic system.

www.regione.veneto.it/NR/rdonlyres/27AA4BF7-B3D0-45B4-802F-D45962085AE4/ 0/DGR3637_02.PDF

TECHNICAL CHARACTERISTICS

DRENING®, is made from high-density regenerated PE HD polyethylene, a material which offers considerable mechanical qualities and is able to resist any chemical product or attack by micro-organisms.
This system is self-supporting in that, on top of being made from a highly resistant material, it has been designed with ribbing to reinforce each unit. Made in this way, DRENING® is able to stand a load of 8 tonnes per wheel, equivalent to a total of 150 tonnes per sq.mt. beneath a well-compacted layer of gravel of 15 cm.
Its design has taken into account not only the loads, but also the surface of percolation, with DRENING® equipped with 2800 cm^2 of slotted surface per unit, so that water can run beneath it. It is thus able to offer an accumulation capacity of 310 lt./sq.mt.
The main advantage of the article is its practical nature, thanks to the piling system facilitating transport and storage on site. Its non-excessive weight makes it possible for a single person to install it. Fitting with joints, DRENING® is very simple to lay and very stable when the gravel is added.

TECHNICAL SPECIFICATIONS **DRENING®**

Dimensions	120 x 80 x h40 cm.
Material	HD PE (Regenerated high-density polyethylene)
Weight of a single unit	11 Kg
Capacity	310 lt/sq.mt. (300 lt. per unit)
Resistance to compression with a 15 cm layer of gravel on the DRENING®.	8 tonnes per wheel (150 ton/sq.mt.)
Lateral infiltration surface area	2800 cm^2 per unit
Packing	50 pieces.
Size of packing	80 x 120 x h260 cm.

USES

DRENING® can be used for small, medium or large-sized basins, on any sort of terrain and in a series of applications that have very few limitations.
Its use can range from a simple family house which must dispose of rainwater, to car parks or industrial areas, as well as sports fields, the improvement of ditches for the enlargement of roadsides and of sewage systems operating as an overflow if necessary.
All these applications must nevertheless be studied case by case, as there is no such thing as a standard application.
Every time we use DRENING®, we must analyse the zone in all its aspects: if the area is particularly prone to rainfall, we must take into account the figures recorded at the nearest meteorological station; if the area has springs, a study of the soil beneath will be needed together with the study of the output of the springs; moreover, if the terrain in which the DRENING® is to be placed is more or less permeable, the size of the basin to be realised must be measured (eg. $K=10^{-6}$ m/s for muddy areas, , $K=10^{-7}$ m/s for shale-based terrain, $K<10^{-9}$ for clay-based terrain, where K indicates the permeability), etc.
The use of the DRENING® system makes it possible to include shafts of various sorts, whether for simple inspection, for decantation or de-oiling in the case of industries and car parks, or a shaft with bypass and capacity regulator, etc.

INSTALLATION

As mentioned above, the strong points of DRENING® are its simplicity, precision and – above all – the speed with which it can be laid in place.
In order to lay it correctly, one only needs to follow the indications below:

- Dig into the terrain to the required depth, this being given from earlier calculations effected by a competent technical consultant or geologist;
- Lay a lower layer of gravel of the depth needed to give a good degree of stability, as specified for the type of terrain beneath;
- Lay the DRENING® in such quantities as required for the development of the basin and resulting from the morphological study of the area;
- Cover the DRENING® with gravel: from a minimum of 40 cm to a maximum of 250 cm, on the basis of the filling requirements;
- Insert a layer of geotextile within the layer of gravel above, this being necessary to stop any form of impurity which could block the lateral slots during drainage;
- Cover the work completely;
- Asphalt if required.

Fundamental accessories for this system are the caps used to join tributary tubes for the plant and to close the sides of the basin, thereby enabling the terrain beneath not to diminish as a result of refills caused by subsidence.
It is also important to bear in mind slopes. It is necessary that the slope of the asphalt or other layer above is orientated towards the various collection shafts; likewise, the network of tubes linking to the basin beneath must be perfectly sloped and clear of obstructions to prevent the formation of puddles above the plant.
We also wish to point out that, in case it is used as overfill system for the sewage system, the plant must be completely above the level of the sewage system itself.

TECHNICAL DATA

Following all the calculations cited above, a number of formulae are given here to apply to the design and realisation, and to take into account the various considerations that vary from case to case.

Calculation of retention time

Which is to say, the time it takes for the water to percolate into the subsoil when the water is eliminated by sub-dispersion:

$$T = \frac{V}{n.S_i.K.Vi}$$

WHERE:

T= time of discharge (sec.)

V= volume of water in the basin (c.m.)

n= number of pieces of DRENING® (no.)

S_i= surface area of a DRENING® (sq.mt.)

V_i= speed of infiltration into the subsoil (mt./sec.)

K= corrective permeability coefficient (0.2)

Calculation of the volume to collect and of the catchment basin

At the same time as calculating the time it takes the water to flow away, we will need to determine the volume to be collected, as well as the volume of the catchment basin. The first analysis will be affected by:

- Surface area of the area rendered impermeable;
- Discharge that can be borne in the sewage system in a given unit of time;
- Discharge that can be filtered by the terrain in the period of maximum intensity of rain;
- Frequency of rain with indication of the quantity that falls.

It must be borne in mind that in areas in which permeability (K) is less than 10^{-6}, it is advisable to connect the plant to a sewage system or, where this is not possible, make the plant over-size.

TYPE OF TERRAIN	Permeability **V_i = (m/s)**
Clay	10^{-9}
Shale	10^{-8} / 10^{-7}
Mud	10^{-6}
Fine sand	10^{-5}
Coarse sand	10^{-4}
Fissured rock	10^{-3}

The second analysis, however, is as follows:

V_{basin} = **V** volume of water - **$V_{delivered\ to\ sewage\ system}$** - **$V_{filtering\ into\ the\ terrain}$**

Knowing that the **V**delivered to sewage system is a value established by law.
$V_{delivered}$ = **Q** brought by rainfall x **$T_{volume\ of\ water}$**

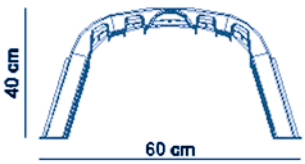
Where **Q** brought by rainfall is a value affected by other factors such as the area in question, the surface of the catchment basin and the terrain permeability coefficient.

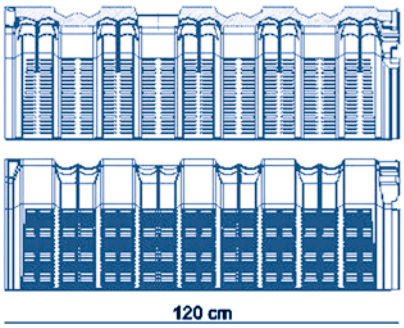
Example of calculating size for a drainage basin using the DRENING® system

With an exceptional meteorological phenomenon such as strong thunderstorms or floods, an average of 25-30 mm of rain can fall in 15-30 minutes.
For example, for a surface area of 5000 sq.mt., let us suppose we need to channel a volume of water resulting from an exceptional event, bearing in mind that in recent years Italy has suffered a series of floods caused by peaks of 80 mm of rain falling in 30 minutes.

Impermeable surface (asphalt, cement, etc.)	5000 sq.mt.
Rainfall in 30’	60 mm. (60 lt./sq.mt.)
Volume of water over 5000 sq.mt.	300000 lt. (300 c.m.)
Basic surface area of DRENING®	0,96 sq.mt.
Volume of DRENING®	0,3 c.m.
Thickness of gravel over the chambers	15 cm.
Thickness of gravel under the chambers	10 cm.
Thickness of gravel around the perimeter of the chambers	30 cm.
Volume of 20/40 gravel around each single DRENING®	0,084 c.m.

Volume of water between the pebbles of 20/40 gravel (30% of the volume of gravel around the DRENING®)	0,0252 c.m.
Volume of water gathered by each single DRENING®	0,3252 c.m.





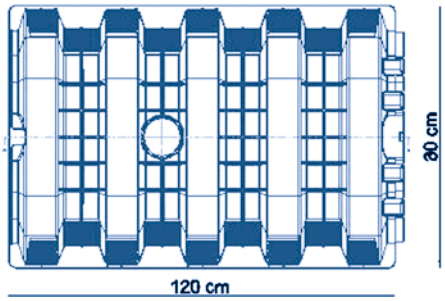


TABLE **CALCULATING THE SIZE OF THE BASIN**

Number of DRENING®	300 / 0,3252 = 922	930
Total volume of basin	930 X 0,3	279 c.m.
Surface covered by the basin	930 X 0,96	892,8 sq.mt.
Number rows	$\sqrt{892,8}$ / 0,80	37 rows
Number DRENING® per row	930 / 37	25

TABLE **CALCULATING THE SIZE OF THE EXCAVATION**

Width of excavation	(37 rows X 0,8) + 0,3 + 0,3	30,20 mt.
Length of excavation	(25 DRENING® per row X 1,2) + 0,3 + 0,3	30,6 mt.
Total surface area of excavation	30,2 X 30,6	924,12 sq.mt.
Total volume of excavation	924,12 X (0,1 + 0,4 + 0,15 + 0,3)[1]	877,92 sq.mt.

1.In the hypothesis of 10 cm. of gravel beneath the basin, 40 cm. DRENING® in height, 15 cm. of gravel above the DRENING® and 30 cm. infill.

TABLE **GRAVEL**

Volume of gravel for filling	(924,12 X 0,65) - 279 volume of basin	321,68 sq.mt.
Weight of the gravel	321,68 X 1,66	534 ton.

COST ANALYSIS

Diagram for estimate of cost of works (sum contracted) for realisation of a draining basin calculated for an impermeable surface area of ..... m²

TABLE **COST ANALYSIS**

DESCRIPTION	MU	Quantity	Price per unit	Total
1) DRENING® in PE HD with rib reinforcements needed to increase load capacity as resulting from backfill and passage of vehicles	no.			
2) DRENING® closure caps	no.			
3) open-air excavation effected with help of machinery in the area in question	c.m.			
4) Class 6 geotextile spread 40 cm apart to be inserted between gravel and soil	sq.mt.			
5) Laying of a level of well-bedded 20-40 gravel to act as bed, flank and covering of DRENING®	c.m.			
6) Realisation of the water distribution grid with insertion of the various collectors in PVC				
6bis) Realisation of inspection slots with insertion of PVC tubes serving also for ventilation				
7) Labour: laying of DRENING®, assembly of tubes, laying of geotextile, laying and compacting of gravel, filling of excavation, finishing off surface above...				

TOTAL

TABLE FOR **CALCULATING GENERAL ESTIMATE**

1	Determination of the basin's storage volume **V** $_{\text{brought by rainfall}}$ = Impermeable surface x 40mm (copious rainfall lasting 20 - 30 min.) Calculation of the number of DRENING® units to use . Number of units = $\frac{\mathbf{V}_{\text{basin}}}{\mathbf{V}_{\text{DRENING®}}}$ Production of the design of the system with eventual requantification of the number of units needed and calculation of the closure caps necessary.
2	The excavation must be dug at least 1 mt wider than needed in order for the person responsible to be able to lay the units. Likewise, its depth will be conditioned by the presence or absence of a sewage system.
3	If the excavation is in terrain which is not very permeable, the geotextile layer must be laid with particular care.
4	Calculation of quantity of gravel required **V** $_{\text{gravel}}$ = Surface area of excavation x h adopted - **V** $_{\text{of DRENING®}}$
5	Evaluation of the design of the tubes and catchment and distribution shafts.

DRENING® VALUES

TABLE OF **DRENING® DIMENSIONS AND FIGURES**

DETAILS OF DRENING®	Figures
Height (H)	40 cm.
Base (B)	80 cm.
Length (L)	120 cm.
Weight (Kg)	11 kg
Area of base (sq.mt.)	0,96 sq.mt.
Volume (c.m.)	0,30 sq.mt.
Capacity 1 (lt./sq.mt.)	310 lt./sq.mt.
Capacity 2 (lt./unit)	300 lt./unit

SPECIFICATIONS

Excavation, supply and laying of buried basin with retention capacity as per design, realised with a series of HD PE units, with size 120 x 80 x h 40 cm: DRENING® GEOPLAST, without base and with lateral slots to allow infiltration, shaped and reinforced with ribs.

- **L**aying of 8-10 cm base of washed 20/40 gravel.
- **P**ositioning of the Geoplast type DRENING® drainage chambers at a depth with respect to finished surface as per project. Every start and end of row to be closed off with the closure caps into which will subsequently be inserted the water collection tubes with a maximum diameter of 200 mm.
- **L**aying of 30 cm on the sides and a minimum of 15 cm over this plant of washed gravel, 20/40 mm in diameter, the whole compacted with a vibrator.
- **L**aying of a layer of class 6 geotextile over the whole of the surface between gravel and native terrain, realised with rolls 5 metres wide and a length equal to that of the plant, and placed at least 40 cm the one above the other.
- **R**ealisation of the distribution system with insertion of catchment shafts and inspection and ventilation shafts, the whole using tubes that are in accordance with pr EN 13476-1 type A 1 of a diameter as indicated in the project phase.
- **I**nfill with compacted earth.
- **A** further layer of geotextile and infill beneath any road-base that may go above.

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Socio UNI - Membro ASTM - Sportello Tecnologico SITEB - Associato AICQ e ALPI

RAPPORTO DI PROVA
CERTIFICATO N. 000212/4/01 pag. 01 di 01 Vicenza: 19-03-04

DATA DELLA RICHIESTA: 10-03-04 DATA DI ACCETTAZIONE: 10-03-04
IL RICHIEDENTE: GEOPLAST SRL - 35010 GRANTORTO (PD)

PROVA DI COMPRESSIONE

INDICAZIONI DEL RICHIEDENTE:

N° 3 CAMPIONI DI ELEMENTI POLIETILENE PER BACINI DRENANTI E DI ACCUMULO DENOMINATI "DRENING"

PROVA DI COMPRESSIONE

Provino	Dimensioni mm			Carico massimo
	largh	alt.	lung.	daN
A1	810	410	1190	884.5
A2	810	410	1190	915.0
A3	810	410	1190	915.0

Attrezzatura : Martinetto idraulico da 20 t n° int. 149
Manometro da 600 kg/cm² n° int. 401
Tipo di carico : verticale applicato sulla costola centrale
Dimensioni impronta del carico: 100x100 mm
Data di prova : 15-03-2004

Nota: i provini sono stati caricati in condizioni di spinta eliminata, vincolando la base all'interno di un apposito telaio (vedi documentazione fotografica)

IL RESPONSABILE TECNICO
Ing. Vigilante m

IL DIRETTORE DEL LABORATORIO
Ing. Alfio Luca Vigilante

I RISULTATI SI RIFERISCONO ESCLUSIVAMENTE AI CAMPIONI SOTTOPOSTI A PROVA
È VIETATA LA RIPRODUZIONE ANCHE PARZIALE DEL PRESENTE DOCUMENTO SENZA L'AUTORIZZAZIONE DI TECHNOPROVE

TECHNOPROVE Srl

Prove di laboratorio e in sito - servizi per l'industria delle costruzioni - Laboratorio geotecnico e chimico

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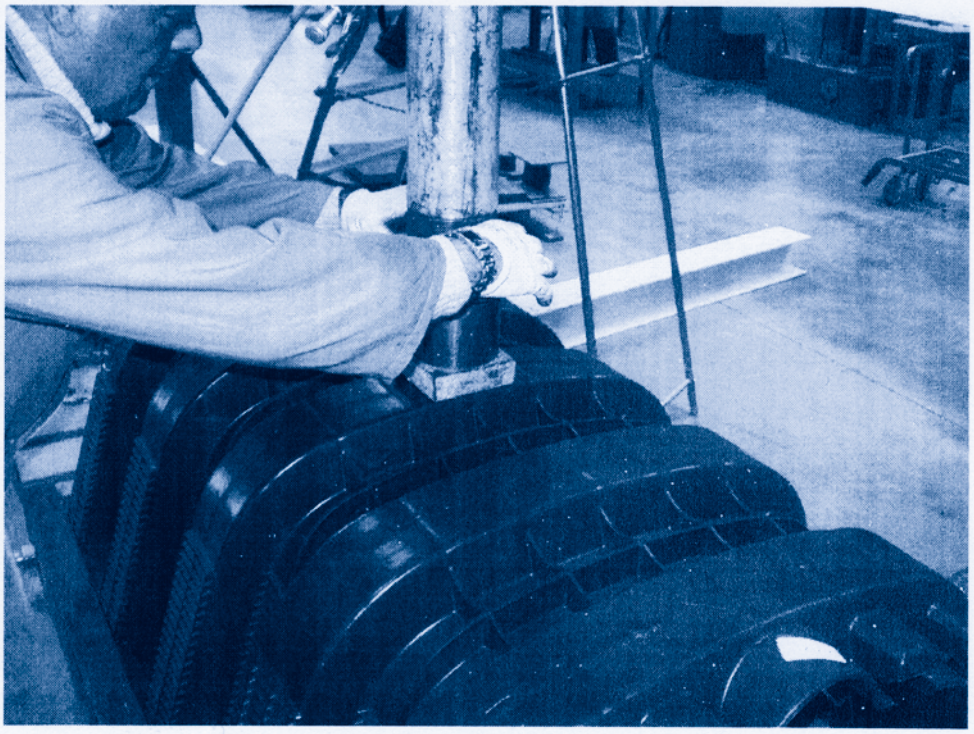
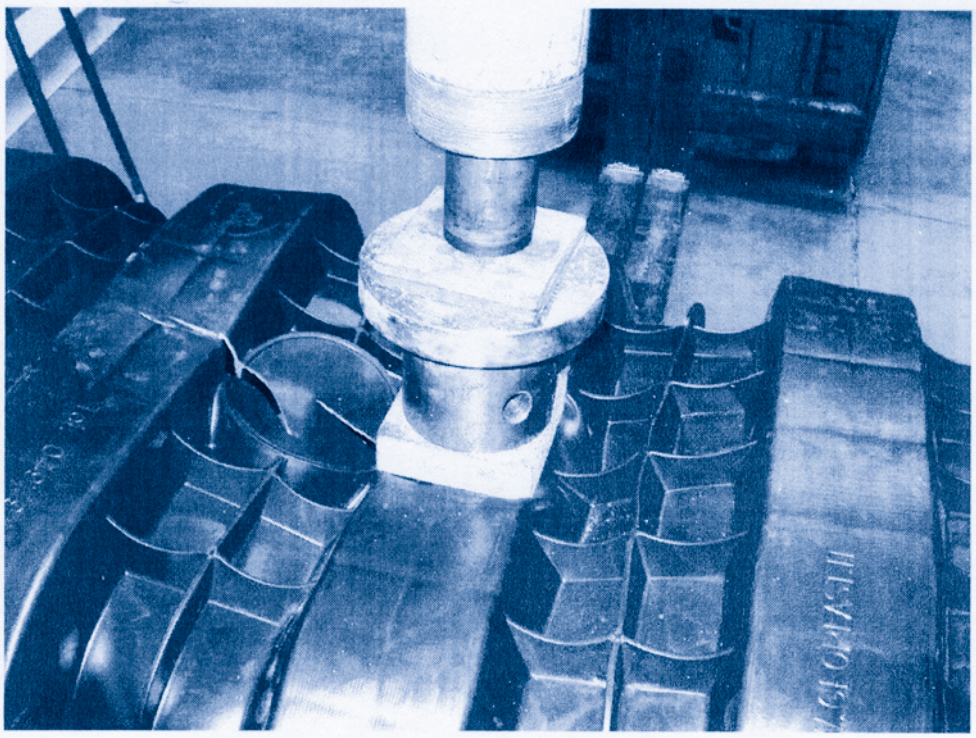
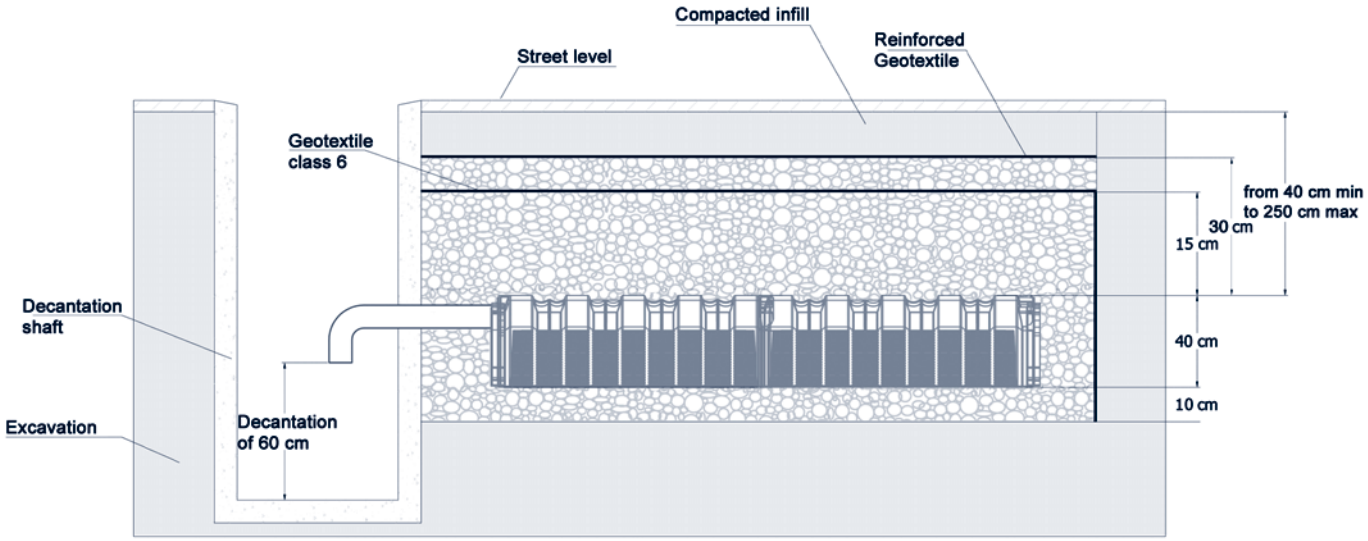
Allegato al certificato n. 212/4/01

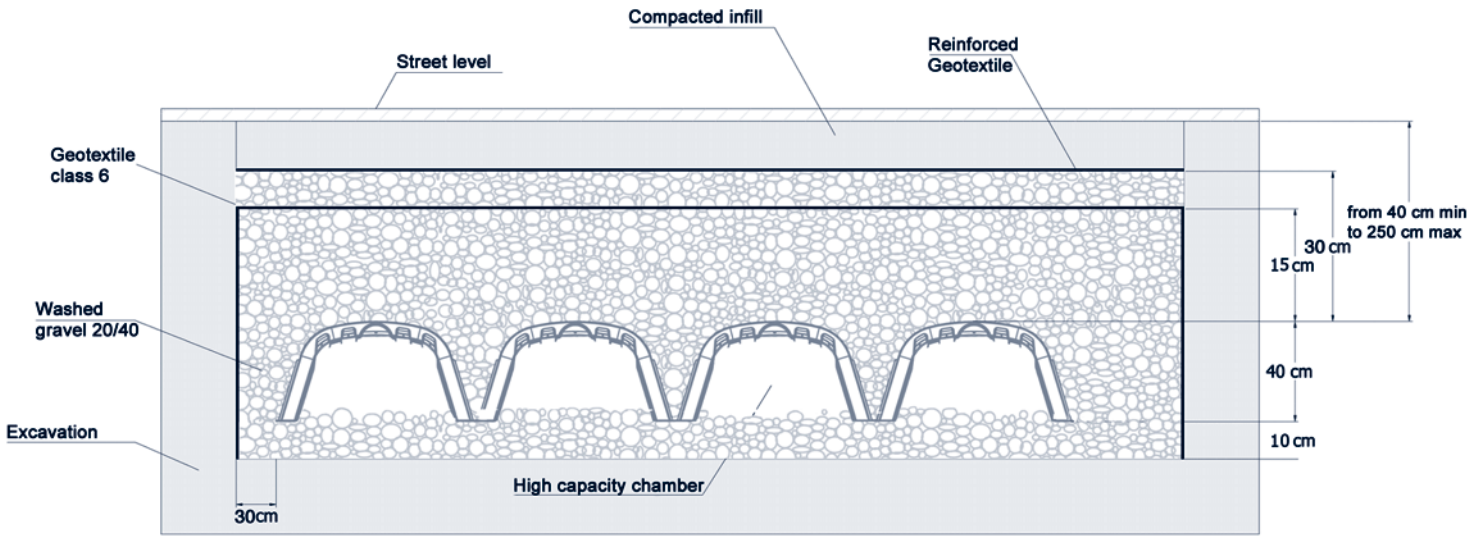


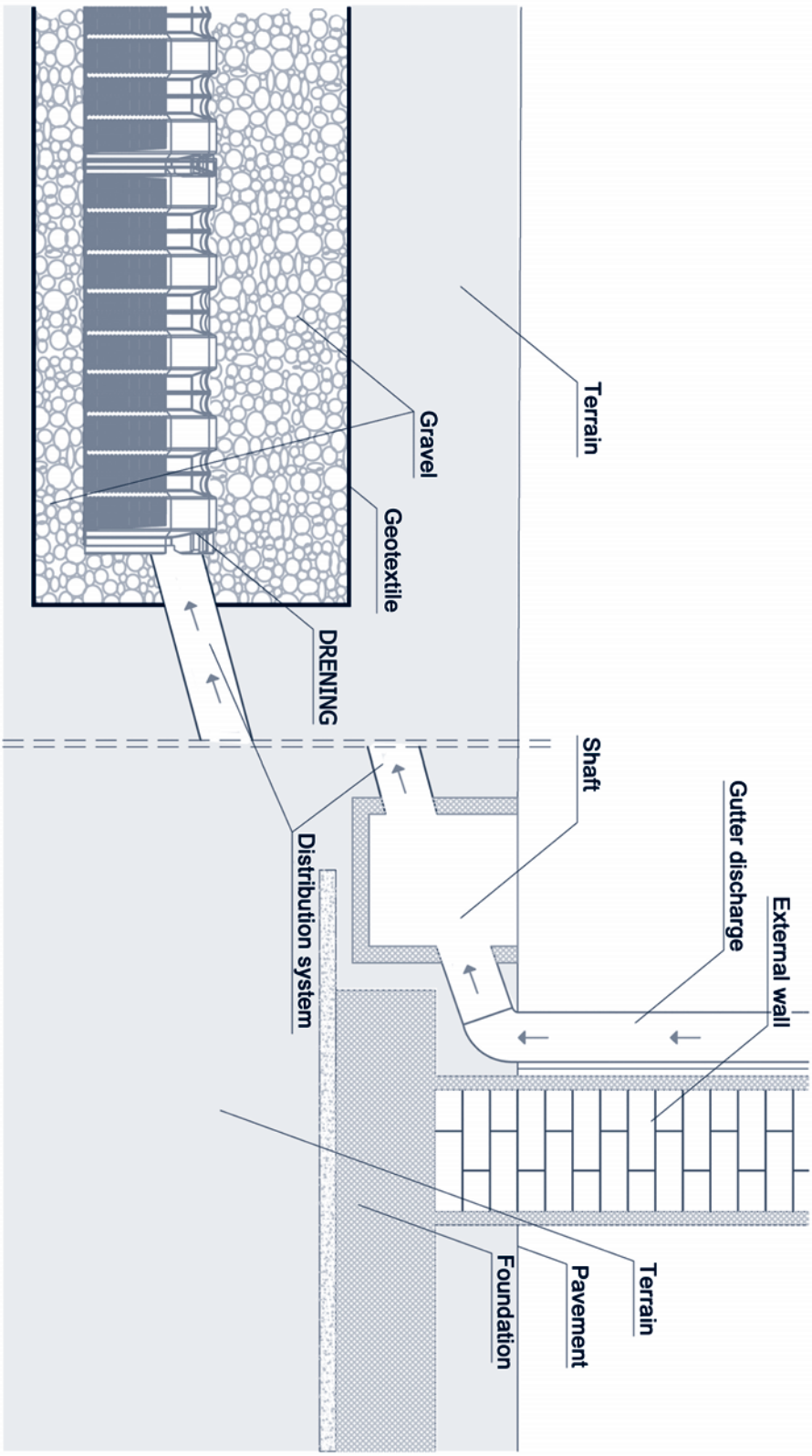
Sistemazione dell'impronta di carico di punzonamento



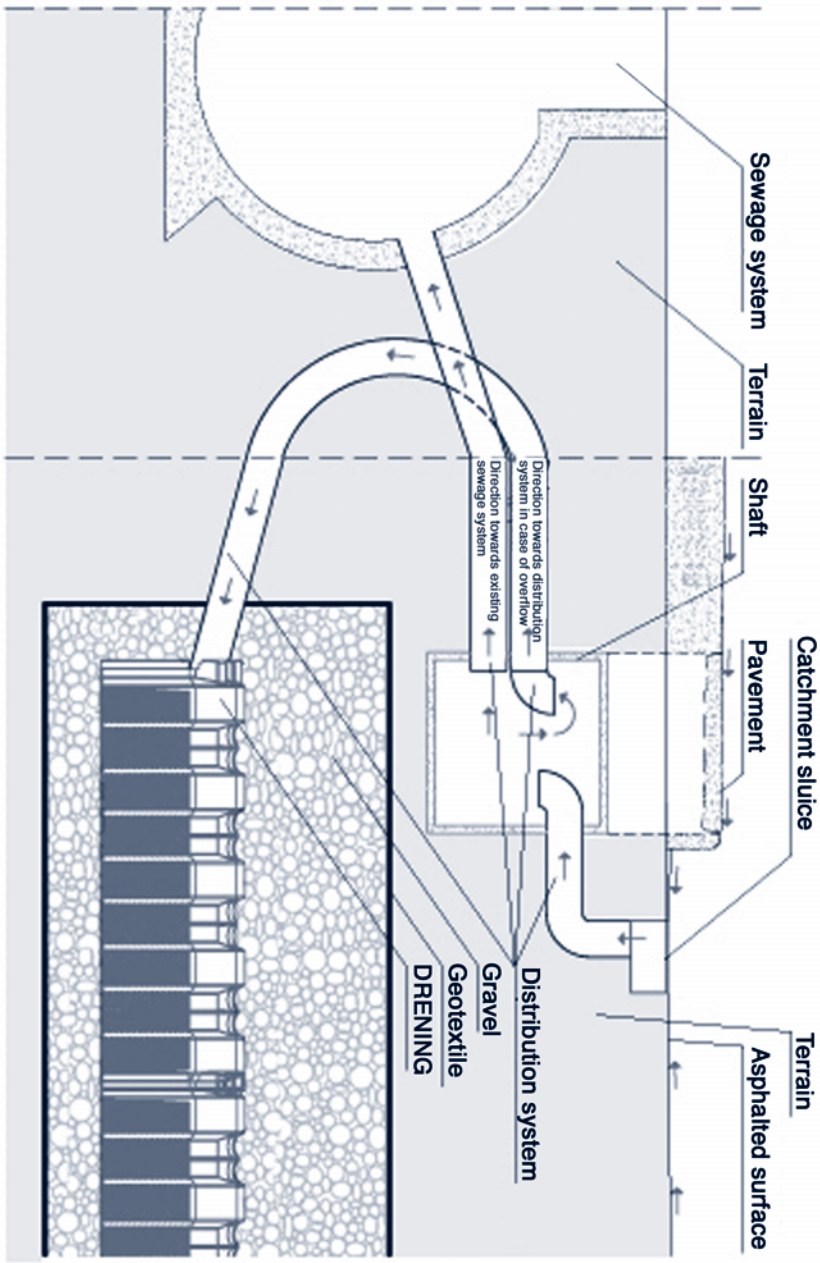
Particolare dell'impronta di carico di punzonamento


Compacted infill
Reinforced Geotextile
Street level
Geotextile class 6
from 40 cm min to 250 cm max
30 cm
15 cm
Decantation shaft
40 cm
10 cm
Excavation
Decantation of 60 cm

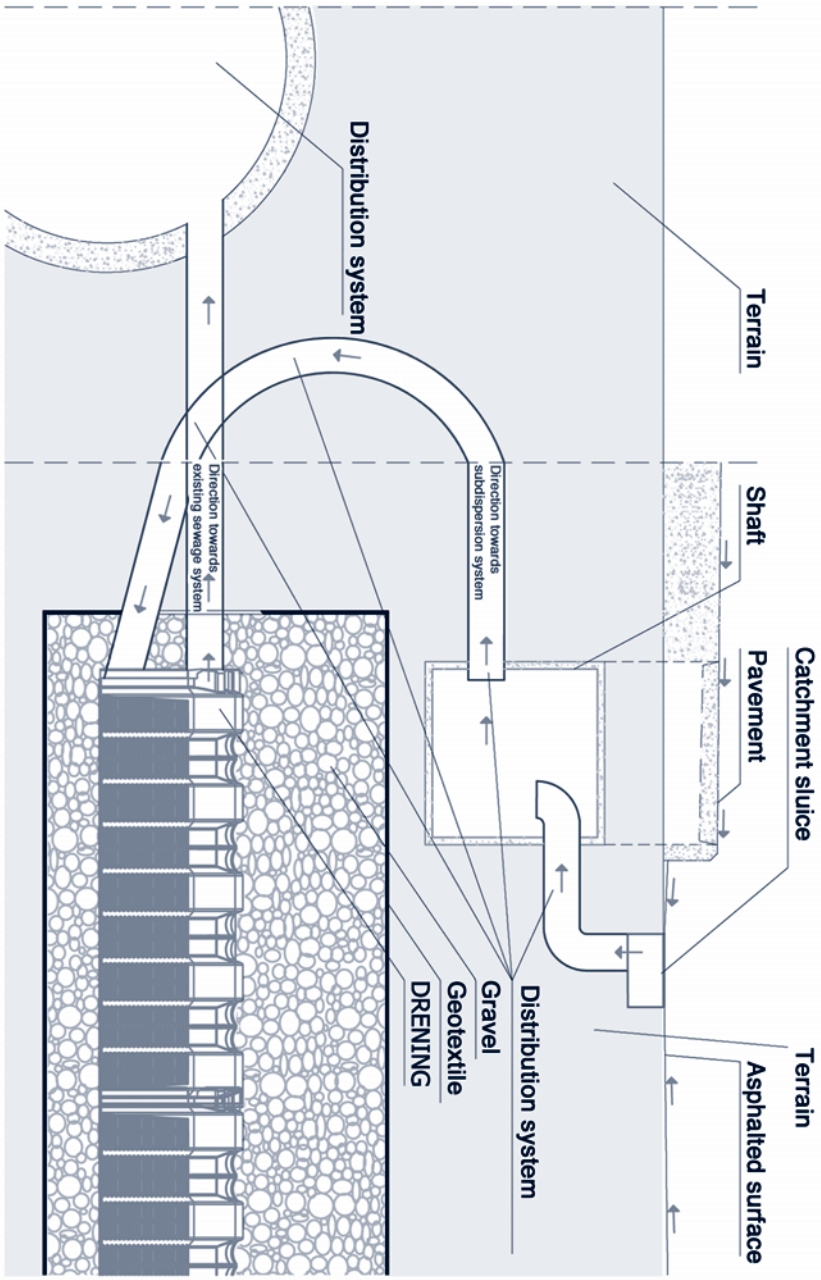

Compacted infill
Reinforced Geotextile
Street level
Geotextile class 6
from 40 cm min to 250 cm max
30 cm
15 cm
Washed gravel 20/40
40 cm
10 cm
Excavation
High capacity chamber
30cm


Terrain
Gravel
Geotextile
DRENING
Shaft
Distribution system
Gutter discharge
External wall
Terrain
Pavement
Foundation

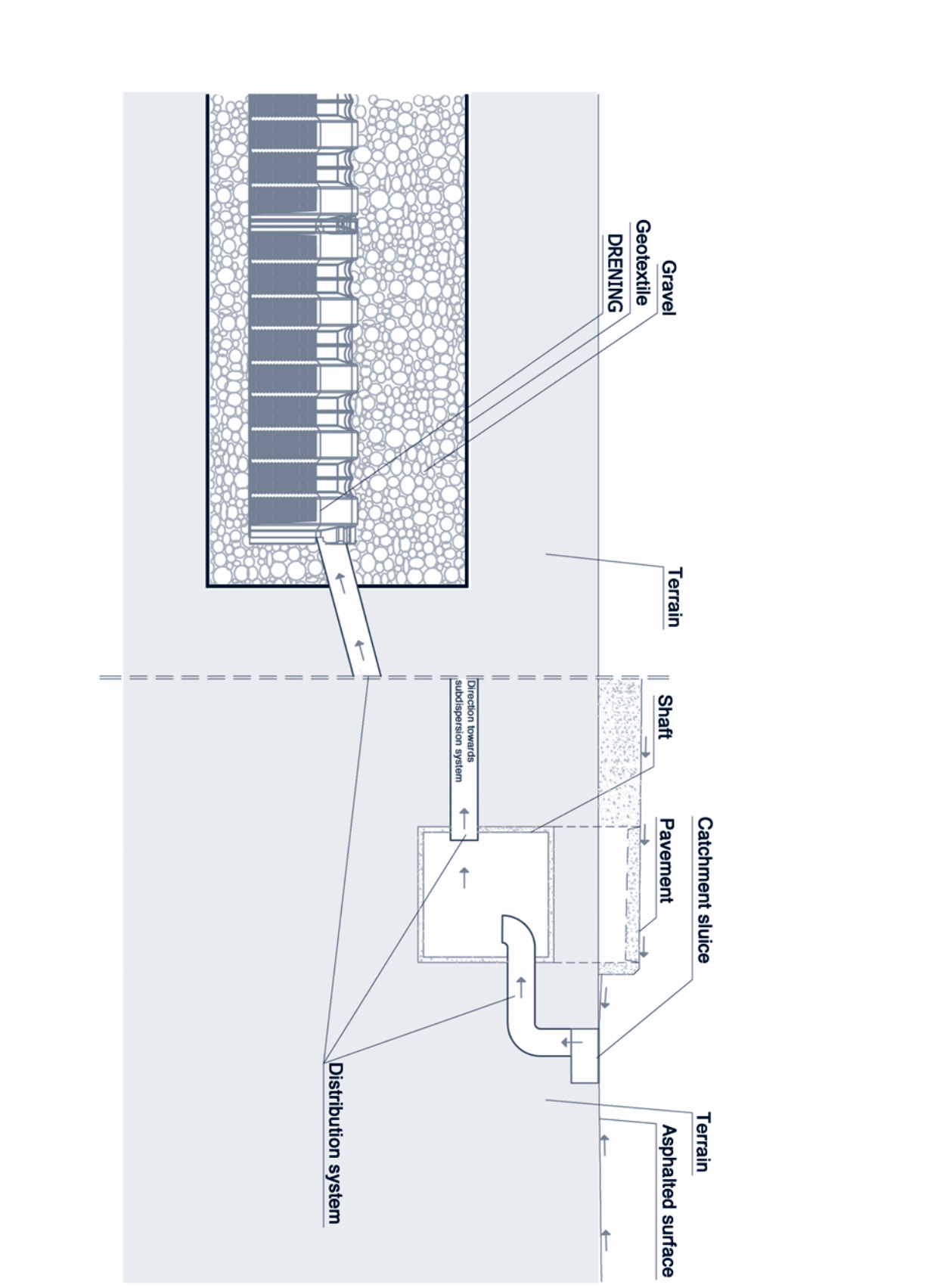
3° CASE _ APPLICATION FOR CAR PARK WITH DISCHARGE INTO BASINS IN CASE OF OVERFLOW



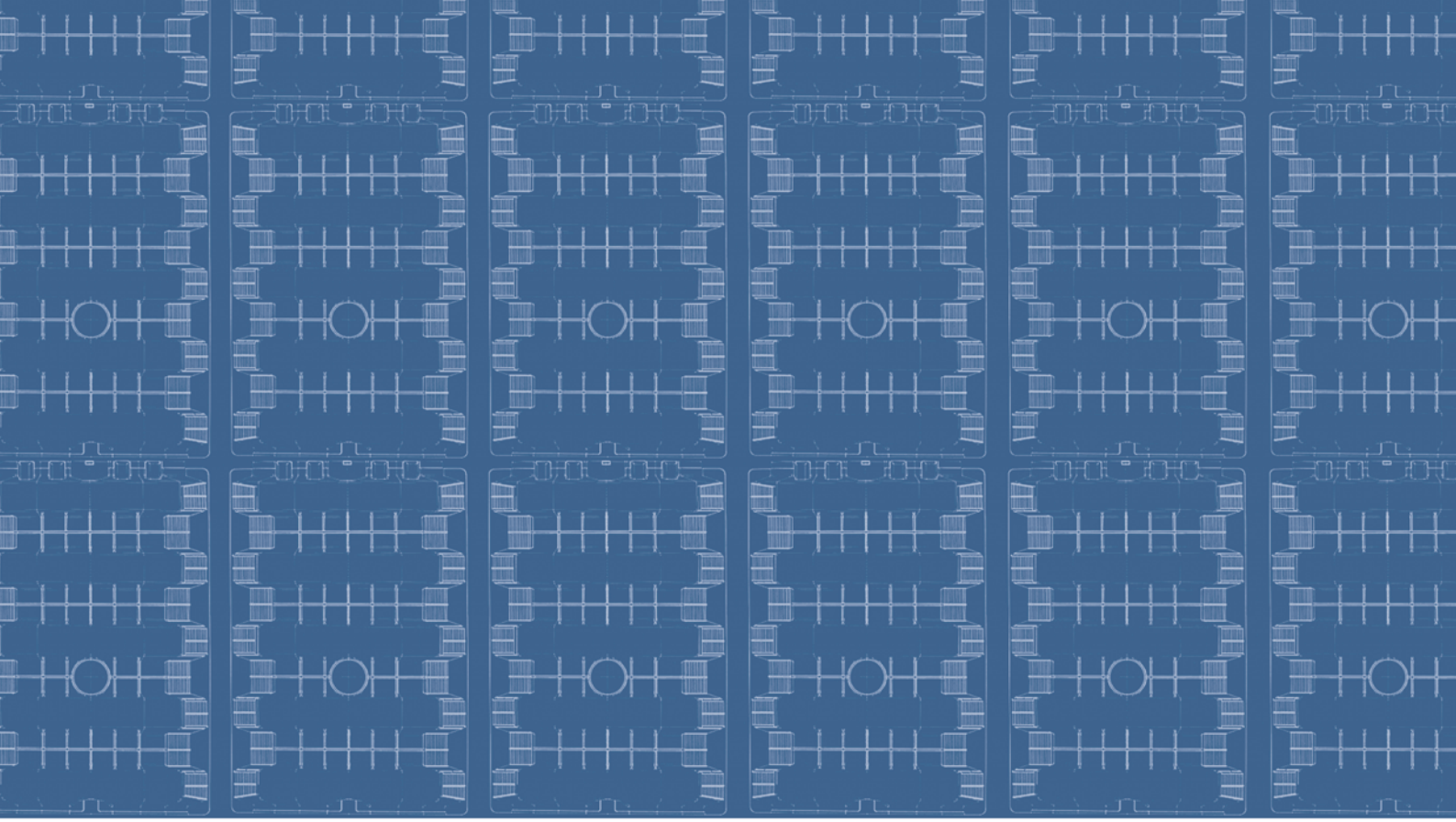
4° CASE _ **APPLICATION FOR CAR PARK WITH SEWAGE SYSTEM**



5° CASE _ **APPLICATION FOR CAR PARK WITHOUT SEWAGE SYSTEM**



DRENING®



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