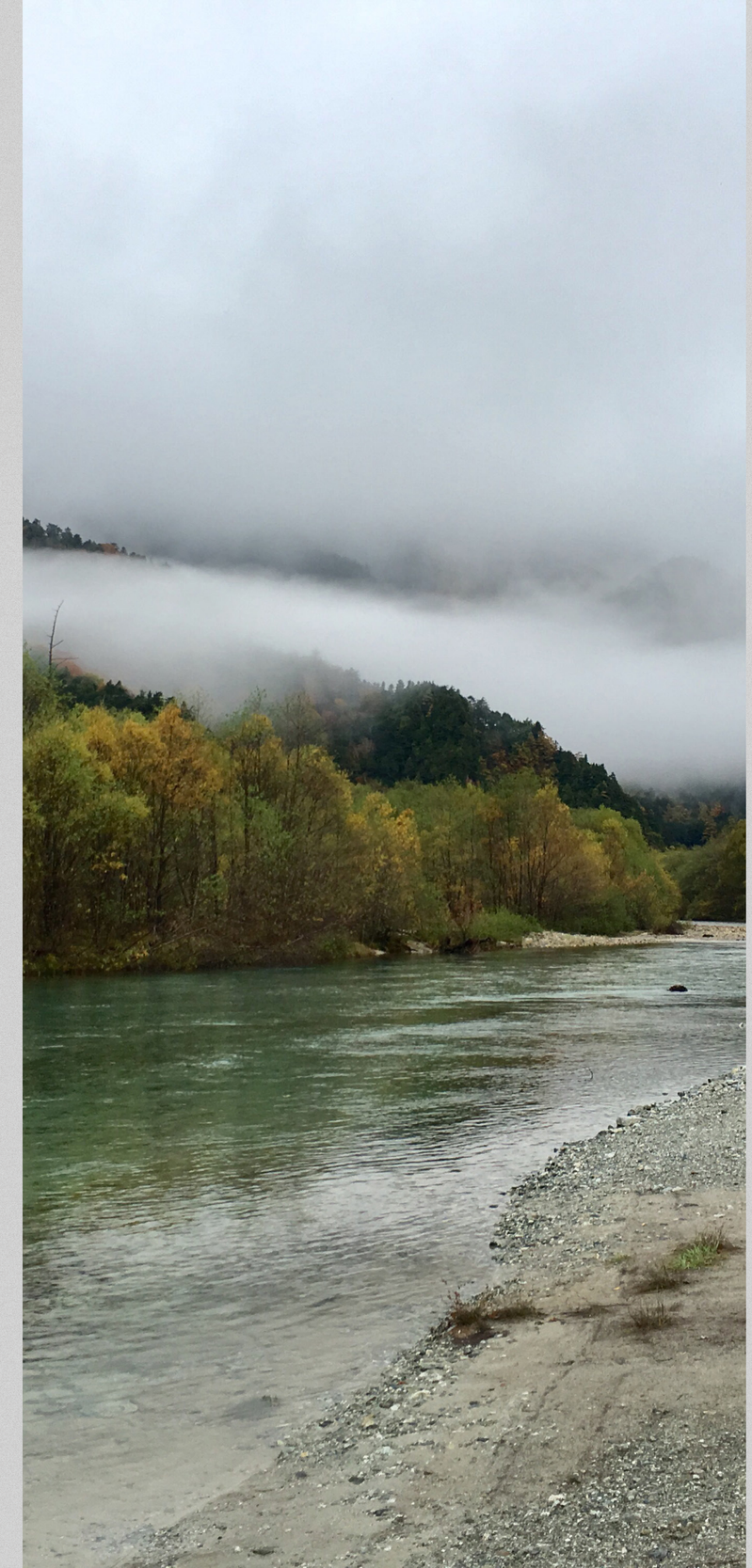
水 引 國 際



MCPC
水 引 管

大地治水　涵養更勝於疏導
大禹治水　疏導重於圍堵

從古至今，人類文明在土地上的刻畫與沉積，在在顯現了與自然的共生與相搏。隨著人類活動的加劇，水土工程更趨向於複雜龐大的工程建設，且對於治水方案始終無法超越疏導或圍堵的思考方式。面對困境甚至是災難，反璞歸真、師法自然，是人類謙卑的起頭。仿效植物與大地的調節共生，運用水在特殊條件下的各種現象，例如毛細作用、虹吸效應，啟發了水引管的誕生。

Throughout history, civilization has marked footprints on earth that serve as testimonies of not just our coexistence but also our struggle with nature. As we continuously reach new heights in our ability to builder bigger, stronger, and more complex structures to meet our ever growing needs, the way we manage water drainage for these developments, however, remains at an age-old “divert or block” mindset. If we could approach water drainage from a different angle, build an intrinsic drainage system into the land to fundamentally transform the land’s condition rather than employing an interfering system to straightforwardly deal with the problems caused by water, we would have avoided many drainage problems after all. This is the concept behind the breakthrough design of the MCPC (Micro Channel Passive Capillary) pipes, innovative drainage pipes that act according to natural hydraulic principles.

Product Overview

產品簡介

在長期淤積或短期暴雨的土壤中，水引管上的微渠溝槽，產生了自飽和的土壤中快速吸水、導水的作用，並透過重力以及虹吸效應，連動吸水與排水的雙重作用，產生快速排水的效果。水引管適應範圍廣大且極適合因土壤、人為活動或低窪地形所造成的水土淤積區域採用。由於水引管能根本地改善土壤條件，從而可避免水泥化的常規排水工程，擴大自然植被範圍，讓植物根系的水土保持作用與人工的排水系統彼此間互為表裡、效應相乘。

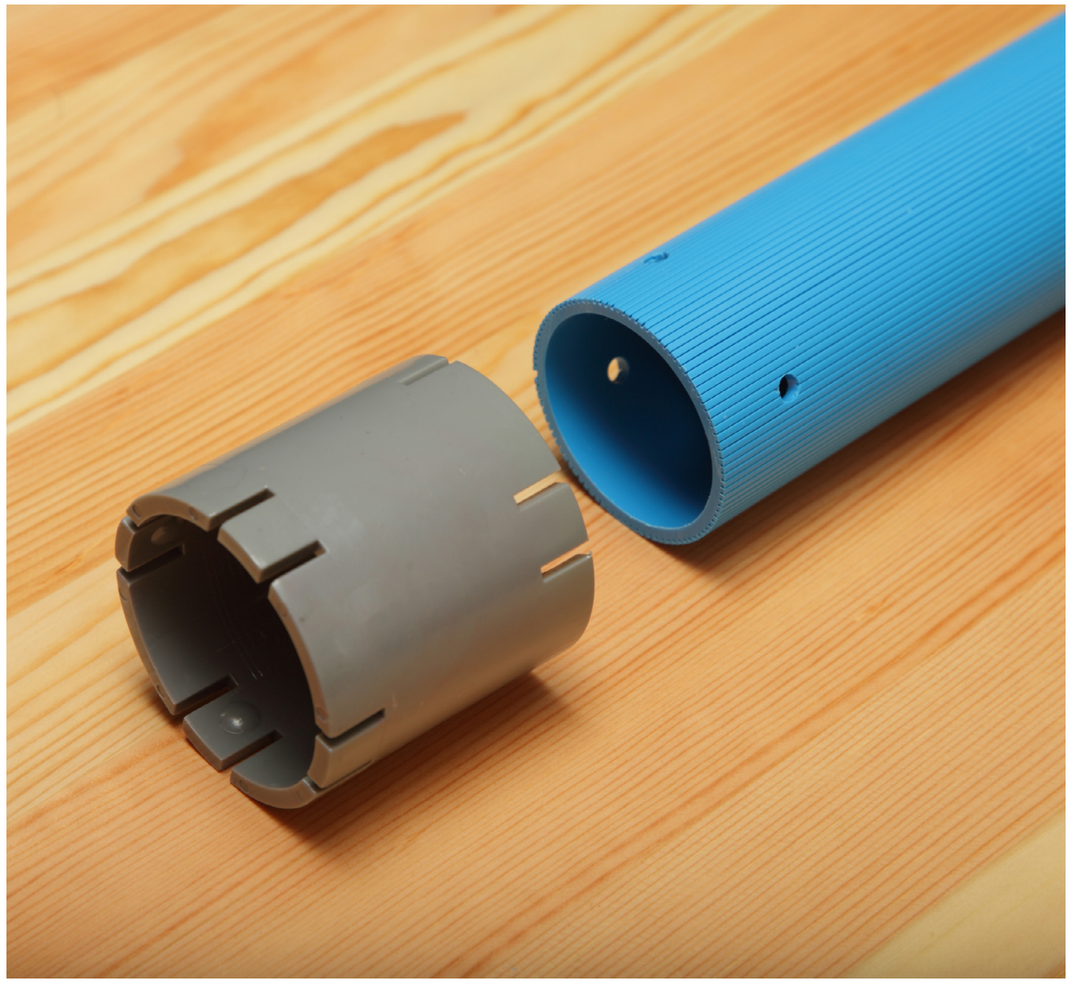
MCPC pipes are new and one-of-a-kind drainage pipes that remove water from oversaturated soil using capillary action conducted through the numerous micro channels on the surfaces of the pipes. They are especially useful in underground applications where naturally oversaturated soil hinders healthy plant growth, as well as in urban settings where heavy rainfall could lead to surface runoff, pooling, and flooding. Not only do the MCPC pipes perform with exceptional efficiency, but they also help enhance the natural vegetation vibrancy of the environment that could often be otherwise compromised by conventional plastic and concrete draining methods.

Product Feature

產品構造

水引管為一體成形押製出的PVC管，外壁佈滿全管長之極窄排水溝槽。每根水引管為一米長，以卡榫接頭緊密連接。

MCPC pipes are extrusion molded PVC pipes with an innovative and patented design feature: tightly spaced micro channels that run in the longitudinal direction across the entire length of the pipe. Each pipe tube is fabricated into one meter standard length and connectable to one another via a PVC latch joint.



Design Principles

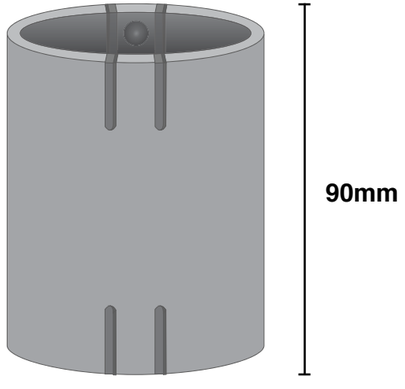
設計原理

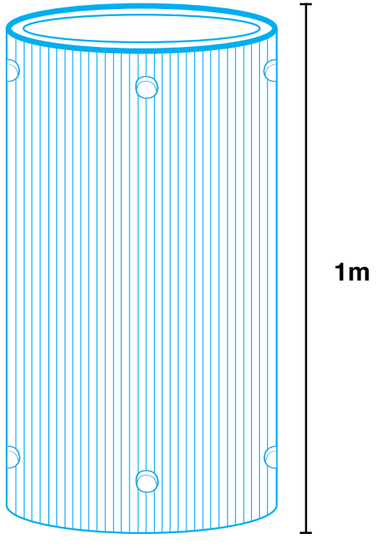
運用自然作用力的主動式排水系統

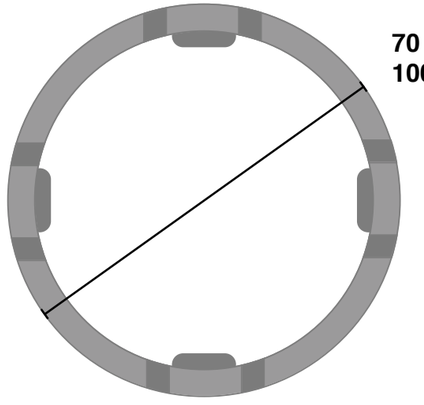
土壤中的飽和水分經由毛細作用被水引管外壁的微管快速吸收再由卡式接榫處流入主水引管，以重力自然排放。由於微管縫隙狹小以及水的表面張力作用，微管管壁內的水並不會被釋回土壤。微管內充滿水分後形成滿管流，細窄管壁內的水流速度加快以保持進入口徑巨大的水引管內後能維持兩者一致的排水量洩入終端出水口，其所產生的虹吸排水效應繼續促使水引管自土壤中快速地吸水。水引管是不需借助抽水裝置的主動排水系統，實現了同步且強力的吸水與排水功效。

PASSIVE DRAINAGE SYSTEM BASED ON NATURAL SCIENCE PRINCIPLES

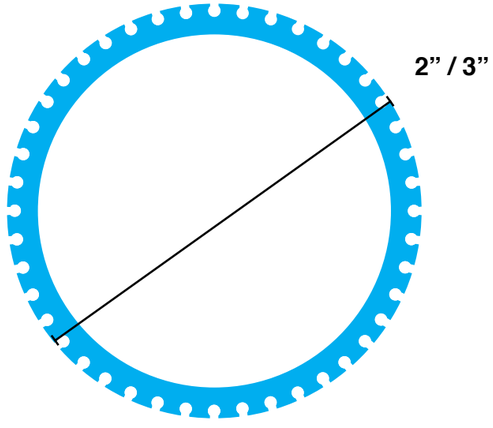
The exterior of the MCPC pipe is densely lined with micro channels that act like suctions. When the soil is saturated, capillary action causes the narrow micro channels to absorb water into the channels. Because the diameter of the micro channels is sufficiently small, the combination of surface tension and adhesive forces prevents the captured water from escaping back into the soil. As water accumulates in the micro channels, gravity pulls the water toward the lower end of the pipe, forming a flow that enters through a latch joint into the interior of the pipe system. On the one hand, water continues to fill up the the extremely narrow micro channels; on the other hand, water exits into the larger and lower pressured pipe hollow. This simultaneous suction and discharge generate a siphon effect that maintains fast water absorption from the soil and steady water flow in the pipes. The result is a passive capillary and gravity drainage system that consumes no energy, requires no human or mechanical intervention (such as a pump), and continues to function as long as excess water is present in the soil.







卡準式接頭
Latch Joint



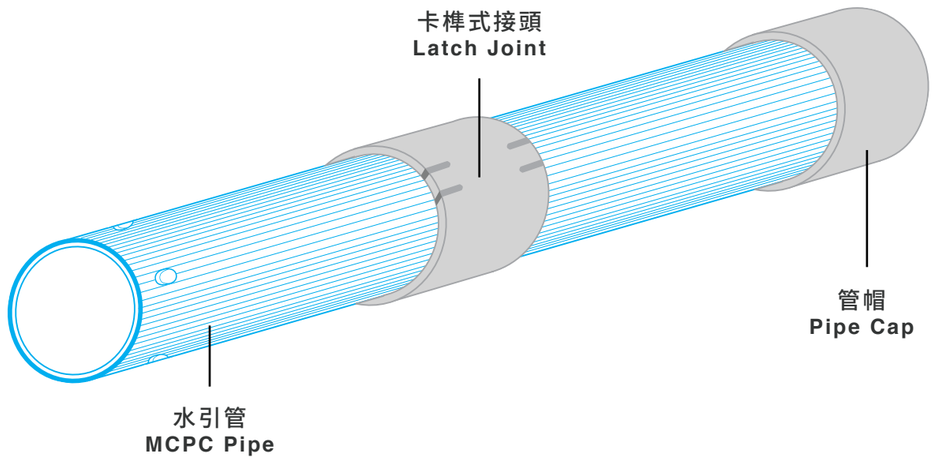
水引管
MCPC Pipe

自淨反阻塞設計

即使土壤中有級細小的顆粒被帶入微管中，他們會再游移回土壤或是被微管中因虹吸效應產生的快速水流夾帶進入水引管，而不會沉積在管壁或阻塞管口。

SELF-CLEANING AND ANTI-CLOG

The ultra narrow slit opening of the micro channels act as a filter to block out sands and debris in the soil. When fine particles penetrate, they would either migrate out of the channel opening as water pushes through the channels, or flush along with the water into the pipe interior towards an ultimate draining outlet. The siphon effect generated in the MCPC drainage system produces a high water velocity that forbids particles from settling at any point in the system, rendering the system effectively sediment and clog free.



水引管組合示意圖
MCPC Pipe Connection

Product Advantages

產品優勢

外柔內剛、身段多變

外有全覆且廣延的毛細吸水表面，內有快速導水的光滑管壁，特殊的設計達成自主連動式排水，排水效率大且不易阻塞。水引管結構強、抗承重，可因應場地條件及排水需求而有各種安裝方式 。

RESILIENT AND ADAPTABLE

For optimal structural integrity, only virgin materials are used to manufacture the MCPC pipes. The pipes are lightweight, strong, high pressure tolerant, anti-corrosion, and chemical resistant. The large number of micro channels on the surface of the MCPC pipe increases the capillary surface to maximize water suction capacity, while the inner wall of the pipe is made smooth to accelerate flow velocity. Via simple yet secure latching mechanism, pipes can be connected and configured to adapt to various landscape profiles and to drain to specified degrees.

施工簡單、工期快速

雖然水引管需要完全掩埋在土層中，但因其獨特的設計，水引管不需要任何透水層的輔助，亦不用土工布(不織布)的包覆，可以相當的減少人工以及其它配合材料的費用支出，同時也縮短工期，對基地以及整體工程只造成最低影響。因此，水引管不僅適用於新建工程，亦是已建工程排水系統中代替傳統盲管的最佳選擇。

QUICK AND EASY INSTALLATION

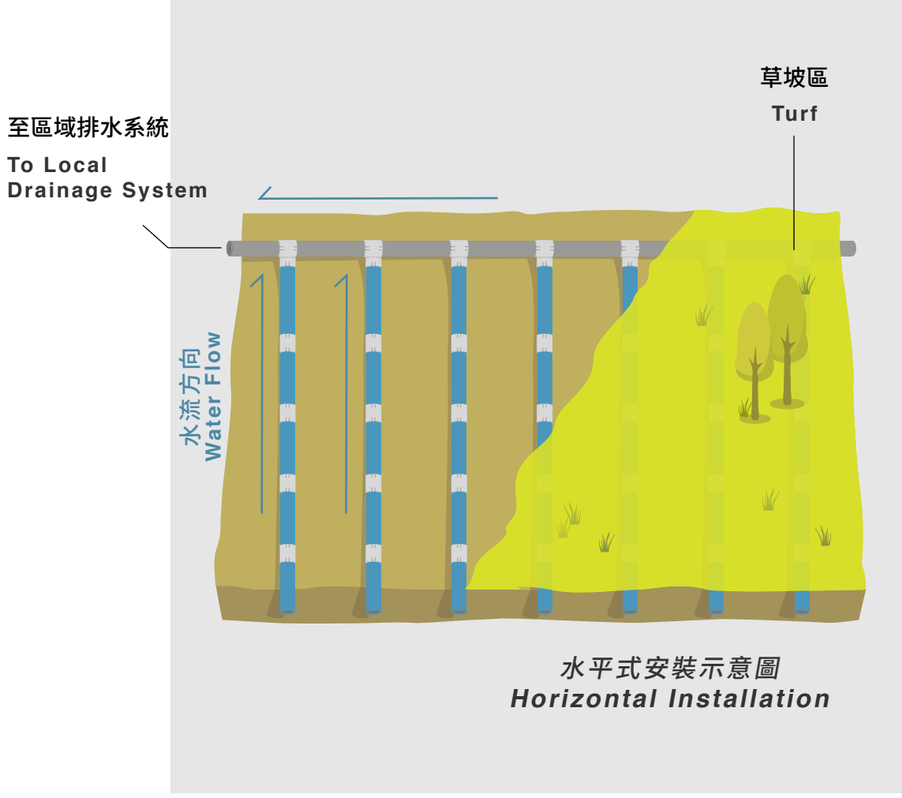
Because the MCPC pipe system is buried underground, no disfiguring component will be seen to disrupt the aesthetic of the project above ground. Thanks to the ingenious design of the micro channels, the MCPC pipes require less backfill materials and no geotextile lining at all when they are laid in the excavated trenches. This makes the MCPC drainage system immensely cost effective, as now labor intensity and installation time are both significantly reduced and disruption caused to the surrounding is minimized. Bearing all these advantages, MCPC pipes are an excellent choice not just for new projects but also as partial or full replacement to existing systems that use conventional drainage equipment.

長期工程效應及環境友善效應明顯

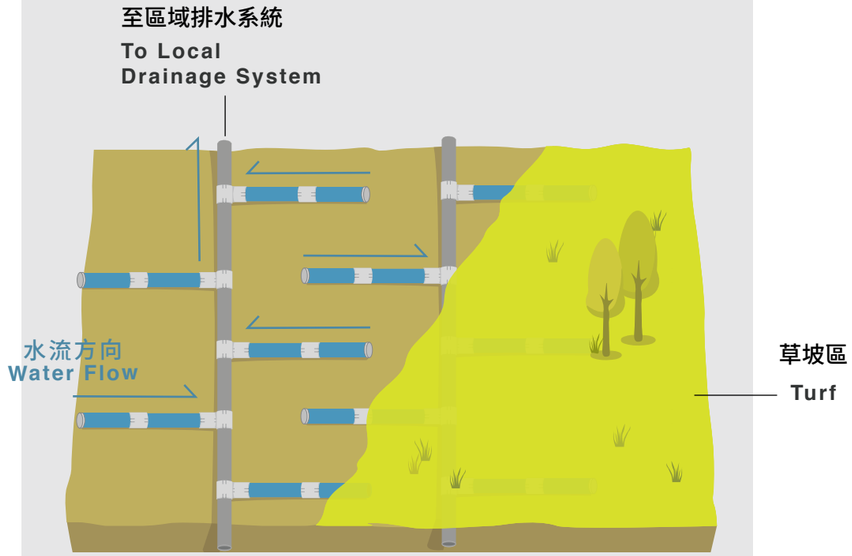
水引管排水系統能維持表土及土壤內的空氣及微生態處於健康、平衡、穩定的狀態，創造理想的植被成長或生態復育條件。結合水引管與低衝擊開發項目或綠色基礎設施將大幅提高整體水土涵養的功效，延長水土工程以及綠色基礎設施的生命週期，符合海綿城市、LID低衝擊開發以及LEED綠色建築理念。期望藉此環保產品鼓勵工程捨棄傳統的水泥化排水工程，回歸自然植被地面。

ENVIRONMENTALLY FRIENDLY DESIGN WITH LASTING IMPACT

A well-designed MCPC drainage system not only effectively prevents flooding but also cultivates a favourable soil environment. The system removes excess water from the soil so that aeration in the root zone is improved to stimulate better plant growth. Bringing the saturation level of the soil to normal also enhances the soil's resistance to erosion and helps stabilize subterranean microbiology and mineral composition. The long term effect is a healthy landscape where natural greenery thrives alongside human activities. Because the MCPC pipes are durably designed to deliver outstanding draining performance, once correctly installed they can last many decades with barely any need of maintenance at all. Not only does this eliminate waste produced from having to repair or replace parts, but it also contributes to the long term economic vitality of the project as a whole. Moreover, water drained from the MCPC pipes can be collected, treated, and redistributed for other uses such as cleaning and irrigating, thus further resonating with environmental conservation objectives. MCPC drainage systems are highly recommended for sponge city development, LID low impact development and LEED green building construction. They are truly the green drainage solution for today and tomorrow.



水平式安裝示意圖
Horizontal Installation



魚骨式安裝示意圖
Fishbone Installation

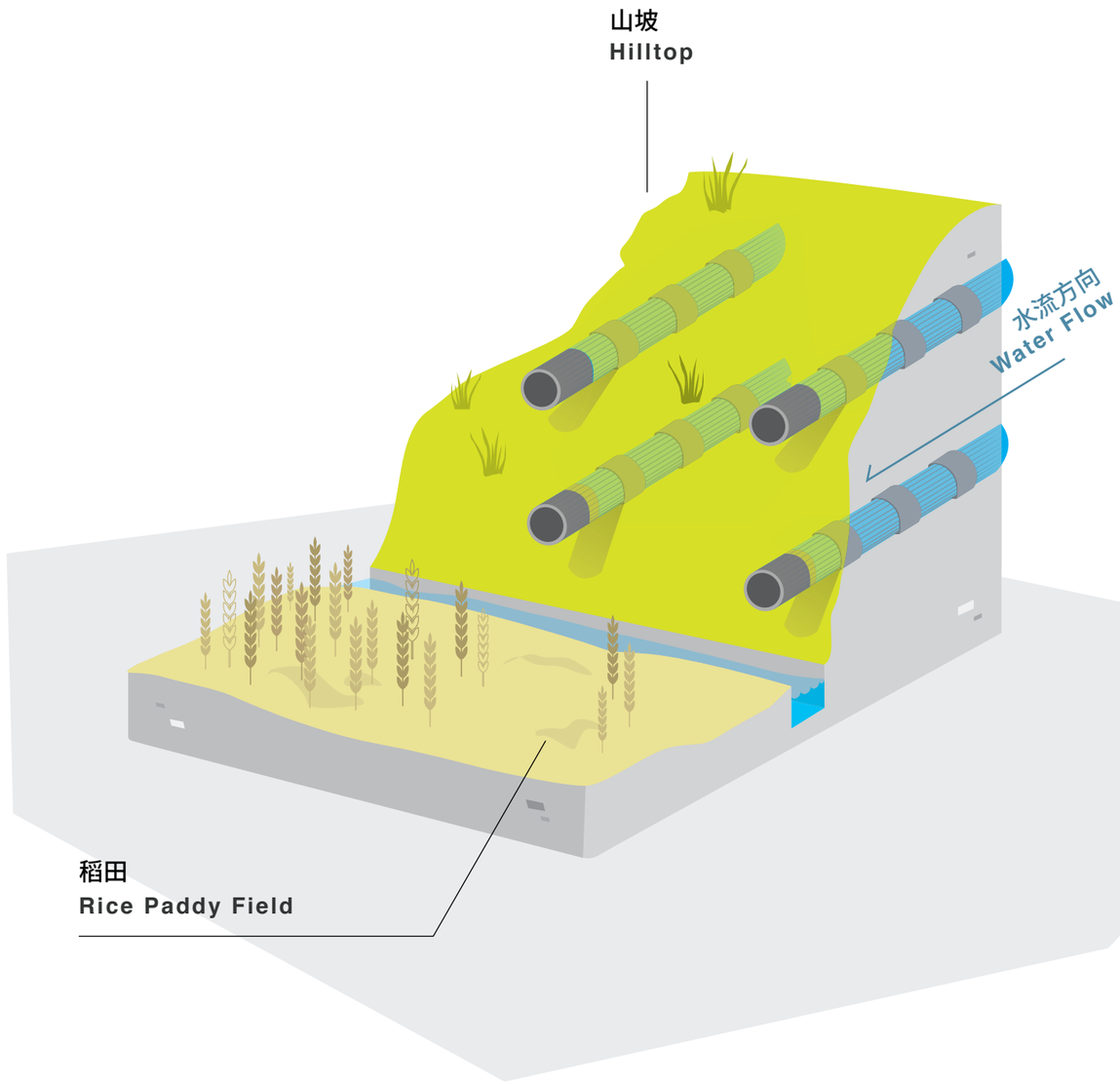
Scope of Application

適應範圍

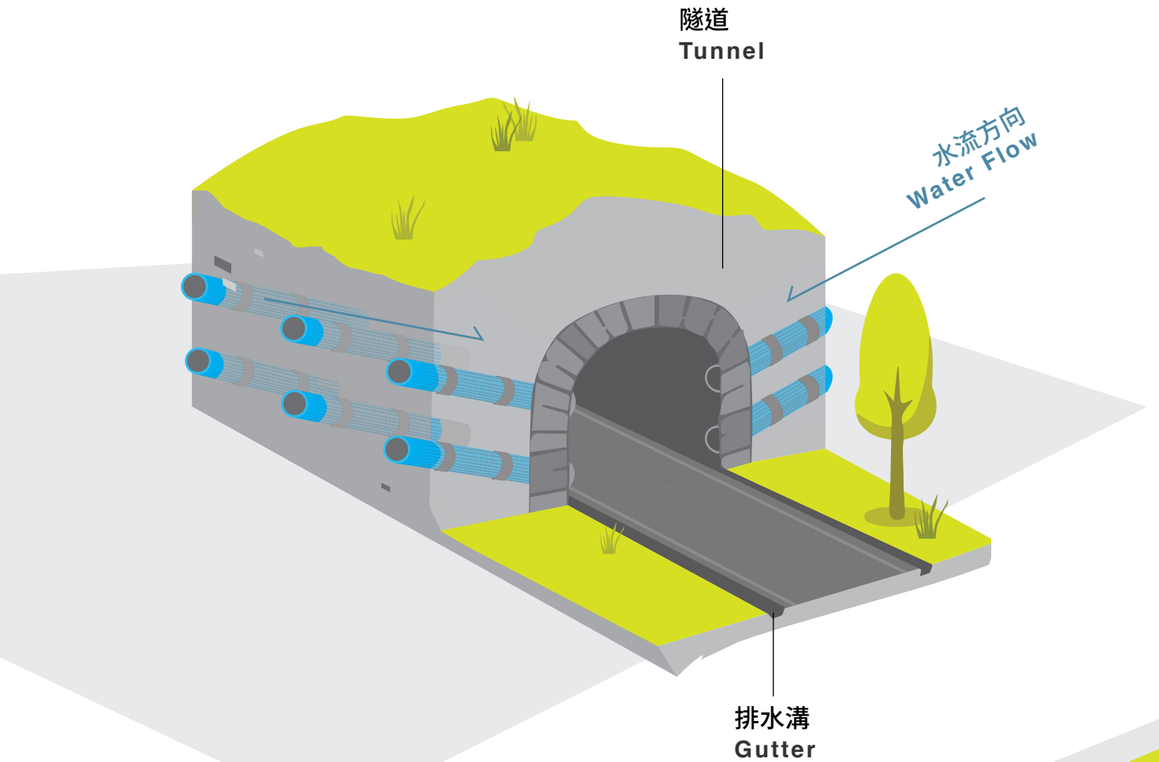
高爾夫球場/運動球場/公園綠地排水工程	Golf Course / Sports Field / Park and Recreation
工廠/垃圾掩埋場排水工程	Factory and Land Fill Site
擋土牆排水工程/搶修工程	Retaining Wall and Failed Retaining Wall Emergency Reconstruction
人行道鋪面下排水工程	Pedestrian Sidewalk Subsurface Drainage
道路地下湧水穩定工程	Roadway Underground Water Inrush Mitigation
雨水回收再利用工程	Rain Harvest System
集水井工程/水溝渠道工程	Storm Gutter / Storm Drain / Retention Basin / Natural Swale
水土保持工程及各項排水工程等	Soil and Water Conservation Engineering
山坡邊坡穩定工程/搶修工程	Slope Stabilization and Landslide Mitigation
農業灌溉溝渠截水工程	Agricultural Ditch and Dike Engineering
隧道排水工程	Tunnel Drainage
新生土地或軟弱地區之預壓排水	Preloading and Vertical Drains on Gained Land from River Diversion or Vulnerable Land
鐵、公路路基及路肩排水	Railway / Road Subgrade Drainage

例1: 山坡邊坡穩定工程

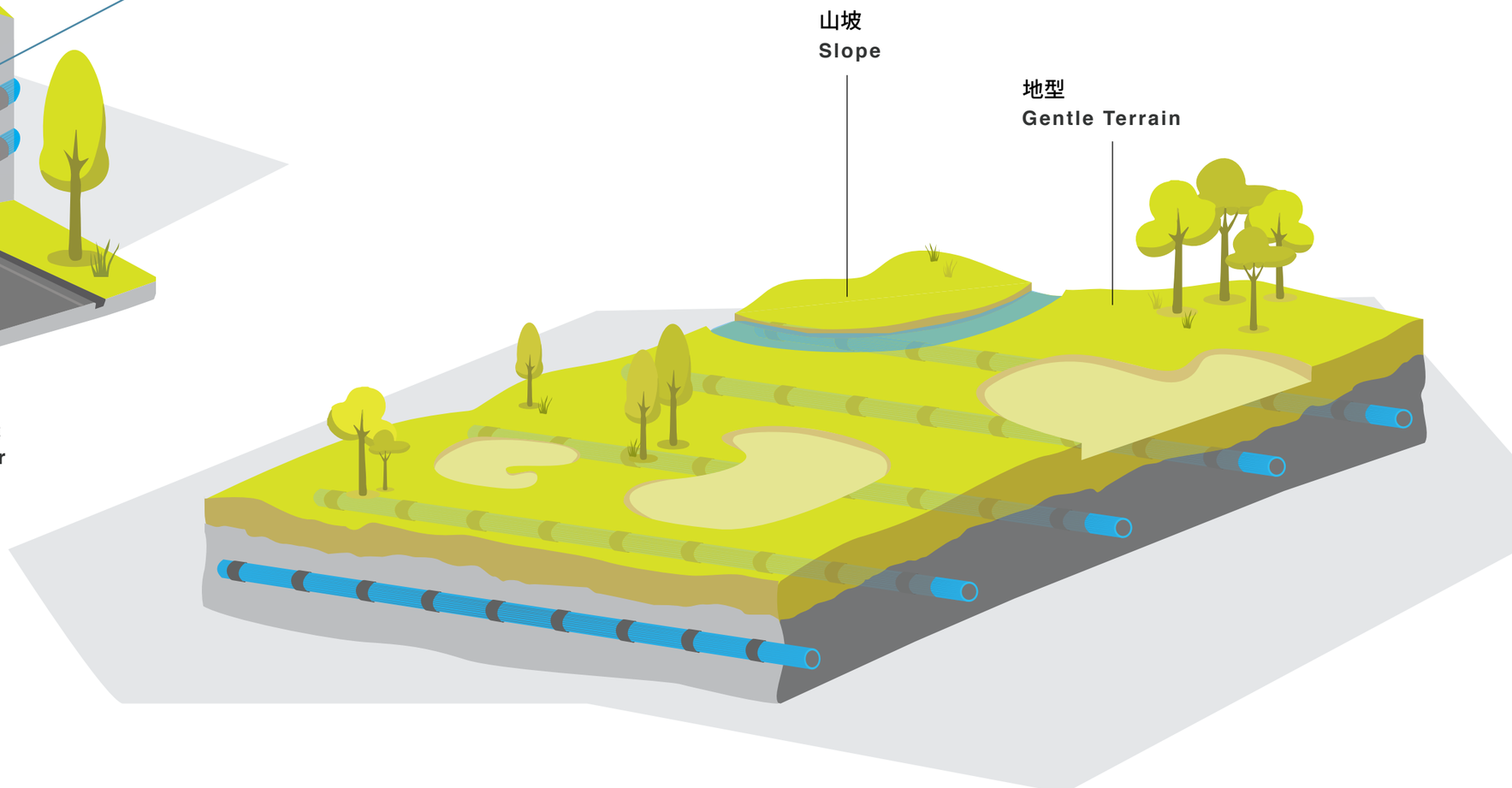
Application 1: Slope Stabilization



例2: 隧道排水工程
Application 2: Tunnel Drainage

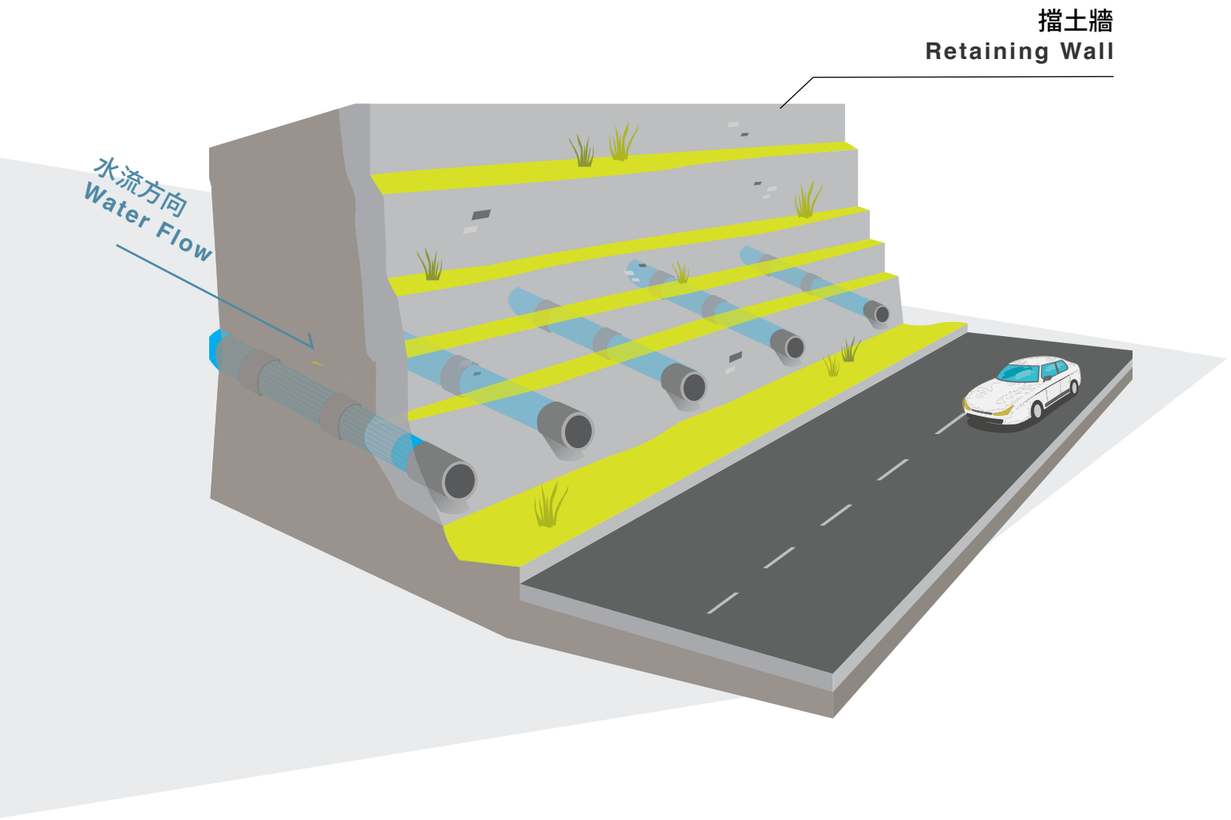


例3: 綠地排水工程
Application 3: Field Drainage



例4: 擋土牆排水工程

Application 4: Retaining Wall Drainage



各類管材比較表 Comparison of Different Drainage Pipes

比較項目 Comparison Parameters	水引管 MCPC	PVC 有孔集水管 PVC Perforated	HDPE網管 HDPE Net Pipe	軟式透水管 Geotextile Corrugated
包裹不織布 Geotextile Wrap	不需要 Not Required	需要 Required	需要 Required	需要 Required
過濾材料清碎石 Filter Material	不需要 Not Required	需要 Required	需要 Required	需要 Required
抗壓強度 Compression Strength	大 High	小 Low	中 Medium	小 Low
排水能力 Water Capacity	大 High	大 High	中 Medium	大 High
使用壽命 Lifetime	長 Long	短 Short	短 Short	中 Medium
透水效果 Permeability (透水量 = l/sec)	優 (> 0.1) Good	中 Mediocre	中 Mediocre	中 Mediocre
阻塞狀況 Clog Probability	不阻塞 Never (360 °进水)	易阻塞 Easy	易阻塞 Easy	易阻塞 Easy
搭接狀況 Joint Design	卡準式接頭 Latch Joint	一般接头 Glued-on Joint	一般接头 Glued-on Joint	接搭不易 Hard to Join
施工 / 工時 Installation Intensity / Hours	易/短 Easy / Short	難/長 Complicated / Long	難/長 Complicated / Long	中/長 Mediocre / Long

流量參考表 Flow Comparison

測試條件 Test Condition	埋設長度 Buried Length = 100m; 土壤滲透系數 Ks = $1x10^{-6}$ m^3/sec; 水力坡度 I = 1			
產品名稱 Product	管徑 (mm) d	開孔率 (%) Ar	開孔面積 = 管徑 x π x 開孔率 (m^2) As = d x π x Ar	集水量 = 土壤滲透系數 x 水力坡度 x 開孔面積 (m^3/sec) Qc = Ks x I x As
2” 水引管 2” MCPC	60	20	3.77	$3.77x10^{-6}$
3” 水引管 3” MCPC	89	20	5.59	$5.59x10^{-6}$
4” PVC有孔集水管 4” PVC Perforated	100	1.5	0.47	$0.47x10^{-6}$
4” HDPE網管 4” HDPE Net Pipe	100	6.3	1.98**	$1.98x10^{-6}$
計算結果 Calculated Results	2”水引管的集水量約為PVC有孔集水管的8倍		Qc (2” MCPC) ≈ 8 x Qc (PVC Perforated)	
	3”水引管的集水量約為PVC有孔集水管的12倍		Qc (3” MCPC) ≈ 12 x Qc (PVC Perforated)	
	2”水引管的集水量約為HDPE網管的2倍		Qc (2” MCPC) ≈ 2 x Qc (HDPE Net Pipe)	
	3”水引管的集水量約為HDPE網管的3倍		Qc (3” MCPC) ≈ 3 x Qc (HDPE Net Pipe)	

** 經測量出的吸水面積 *Measured water absorption area*