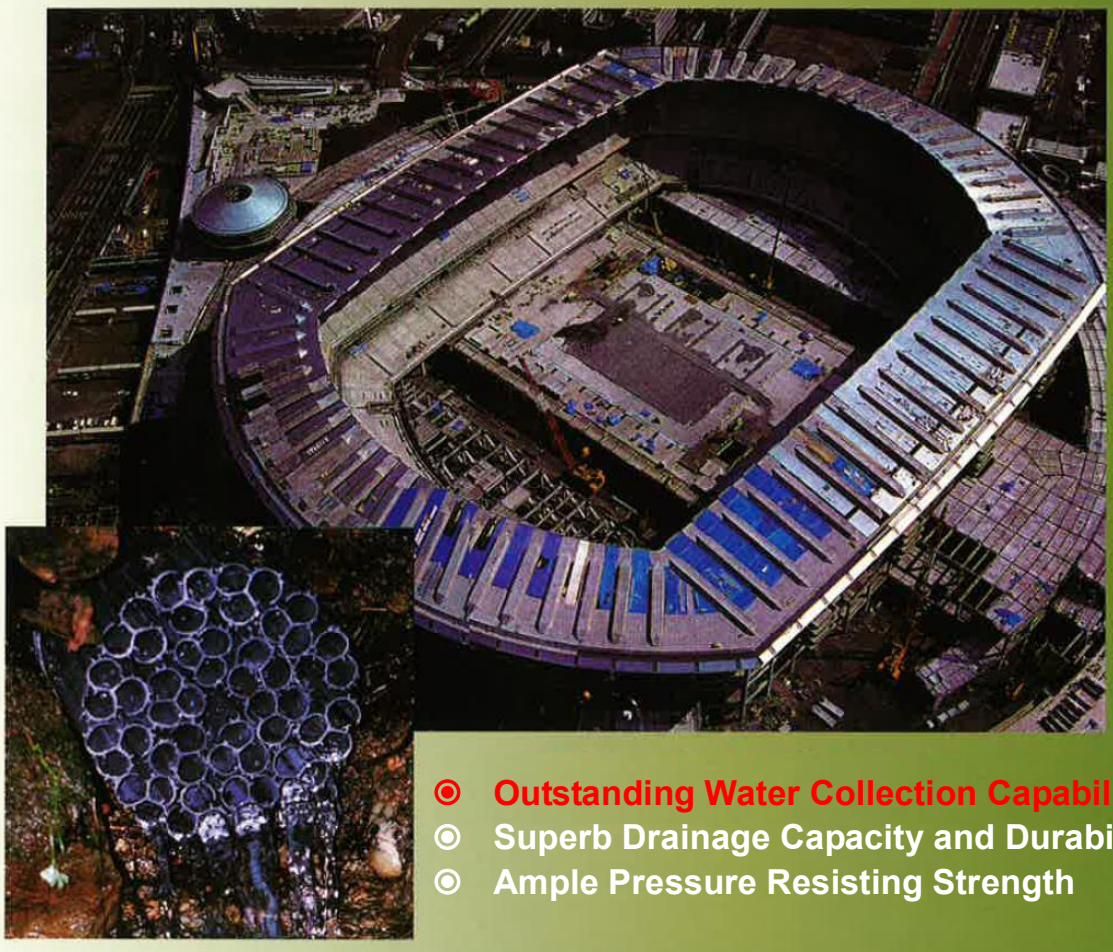
Cluster Pipe (slit-guided water collection)

Mitsuba Drain®

Environment-Friendly unplasticized PVC (cut length: 4.0 m)

NETIS Registration No.: KK-120072-A

Highly Reliable Cluster Pipe for Culverts Designed as an Upgrade
to the Time-tested S-configuration Cluster Pipe for Greater Efficiency



- **Outstanding Water Collection Capability**
- **Superb Drainage Capacity and Durability**
- **Ample Pressure Resisting Strength**

Be it in design or execution, our expertise in the field of drainage works is top of the line. Call on us for all your drainage needs from installation of pipes in culverts at athletic fields, parks, or reclaimed land to implementation of measures against spring water.

NIHON DRAIN CO., LTD.

4-12-1 Shoji-cho, Fukui-shi, Fukui tel: (0776) 41-3725
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Features of the Mitsuba Drain

Configuration

- Tubes (Water Channels) with a Trefoil Cross Section Assembled in a Honeycomb Arrangement
- Aggregate of Constituent Drainage Tubes (Water Channels)

Water Collection Capability

- A bundle of uniquely configured tubes creates a good many continuous open lines (slits) along and around the bundle.
- The direction of water collection is in keeping with the direction of discharge to allow smooth inflow of water.
- With its slits providing the largest total area of intake, the Mitsuba Drain excels all other pipes of the same dimensions in terms of water collection efficiency.

Drainage Capacity

- The smooth inner surface of the Mitsuba Drain ensures undisturbed passage of water.
- By reason of directionality, a bundle of bamboo stems is known to adequately drain water in the absence of “water channels.” The Mitsuba Drain, meanwhile, adds to the drainage capacity of its natural counterpart by virtue of the presence of water channels across its length.

Workability

- Being orientation-free, the Mitsuba Drain may be installed without regard to direction (up/down or left/right). In other words, despite its distinctive configuration, the drain may be handled just as easily as any round pipe.

Resistance to Clogging

- Water flows into the Mitsuba Drain smoothly so that there is little, if any, transfer of fine soil.
- The openings form continuous lines and accordingly provide a relatively larger area of contact with water, bringing about greater resistance to a buildup of water stains.
- The Mitsuba Drain consists of multiple tubes (water channels) interconnected in an ideal arrangement; as such, irregularities or clogging, unless significantly pronounced, will not likely affect its overall function, making it remarkably long-lasting.

Resistance to Pressure

- The cluster arrangement makes the Mitsuba Drain exceptionally resistant to pressure, thanks to its honeycombed cross section chock-a-block with trefoil-shaped tubes.
- The engagement between the projections on the outside and the protrusions on the inside of the trefoil tubes boosts the characteristic flexibility of the Mitsuba Drain (i.e., flexible pipe), so that it may provide added resistance to pressure (as under earth fills of appreciable depth).

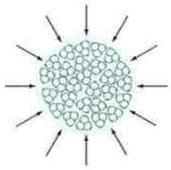
Why does water so readily flow into the Mitsuba Drain?

Because ...

- its water inlets are found all around its entire circumference in large numbers;
- its water inlets are overwhelmingly large in total area;
- its water inlets are not individual openings but form continuous lines;

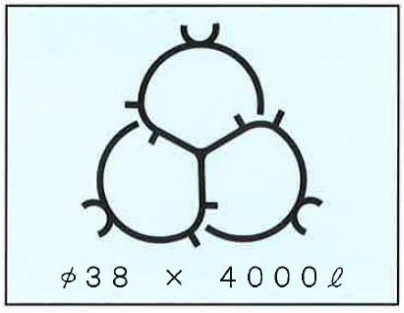
thus, it draws

- seepage water from ABOVE.
- spring water from BELOW.
- migration water from the SIDE.



The Mitsuba Drain catches free-flowing water from all directions.

Configuration/Dimensions of the Mitsuba Drain and Standards



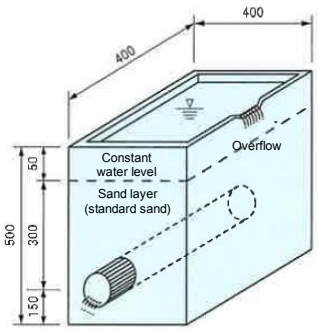
Cut length: L = 4.0 m
Material: unplasticized polyvinyl chloride
Attachment: socket (direct-mount; 1 pc per cut-length)

Nominal diameter (mm)	Number of tubes
75	5
100	8
125	12
150	18
200	30
250	50
300	70
May be sized to order.	

Drainage Tests and Results

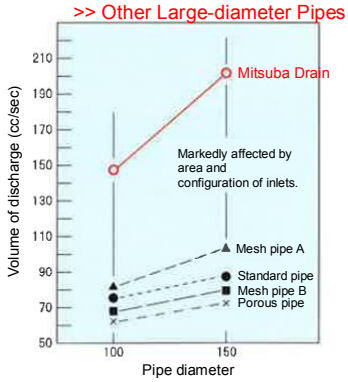
Water Being Drained
(Mitsuba Drain)

Testing Equipment



As per methods recommended by National Research Institute of Agricultural Engineering

Volume of Flow
Small-diameter Mitsuba Drain
>> Other Large-diameter Pipes



The standard pipe used is a 150-mesh metal pipe.

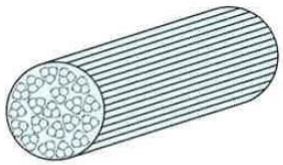
Comparison between Mitsuba Drain and Mesh Pipe

Enlargement

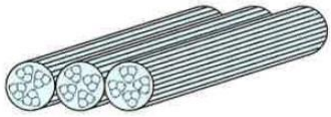
Water Being Collected Regardless of Direction of Inflow

Water Collected from Below Only (spring water)

Multiple-row Drainage and Water Collection Capability of the Mitsuba Drain



Nominal diameter: ϕ 300
Number of tubes: 70
Number of bundles used: 1
Total number of tubes used: 70
S_1 = area of water collection: 300 $\pi \approx 0.9$ m^2/m



Nominal diameter: ϕ 150
Number of tubes: 18
Number of bundles used: 3
Total number of tubes used: 54
S_1 = area of water collection: 150 π x 3 $\approx$ 1.35 m^2/m

$S_1 < S_2$

- Areas particularly marked by the presence of spring/subsoil water benefit more from multiple-row drainage (i.e., installation of multiple Mitsuba Drains arranged in a row) in terms of water collection capability.
- In multiple-row drainage, the use of small-diameter drains results in improved workability (as in the transportation of drains and materials).
- In multiple-row drainage, fewer tubes are bundled into each cluster so that cost-related benefits may also be expected.

Soil-and-Water Conservation Works with Multiple-row Drainage (Nagano; presence of culverts indicated by red dashed lines)

Photos of Works (in progress and upon completion)

Drainage System for Rooftop Gardening
(greening project)

Coupling Joint Designed and Made to Meet Specific
Needs of a Particular Site

Shipped Securely Bound with P.P. Bands
(ready for on-site installation "as is")

Multiple-row Installation

Mitsuba Drain Installed for Underground
Drainage

Drainage along the Back of a Structure

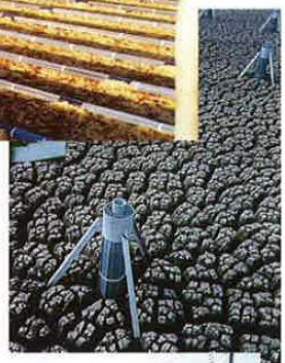
Consolidation of a Piste (ski run)

Subsurface Drainage through Culverts under School Grounds

Providing Site-specific Solutions with the Mitsuba Drain

Drainage through Culverts
(J-VILLAGE National Training Center Ground, Fukushima)

Sun-drying Bed
vertical drain (PAT)



Railroads (demonstrating resistance to heavy loads imposed by train movement)

Disposal Site (demonstrating universal applicability)

Soil-and-Water Conservation Works

Problem-free Direct Placement on Concrete Surfaces
(International Stadium Yokohama)

Solution to Clogging (photo showing clogging of non-continuous water collection openings by organic and other elements brought on as a result of worsening water contamination of recent years)

Land Reclamation Works (Kasai Rinkai Park)

Solution to Clogging (photo showing clogging by inadequate resistance to pressure)

Standard Installation Workload

(per 10 m)

Nominal diameter (mm)	Number of tubes	Weight (kg/4 m CLTH)	Installation (workers)	Segment-based transport (workers)
75	5	3.4	0.018	0.010
100	8	5.4	0.022	0.013
125	12	8.1	0.026	0.016
150	18	12.2	0.033	0.020
200	30	20.4	0.040	0.030
250	50	34.0	0.048	0.040
300	70	47.6	0.060	0.055

[1] The workload associated with installation (laying of the drain) does not include excavation, backfilling, and surplus soil disposal.
[2] Likewise, the workload associated with installation (laying of the drain) is subject to adjustment as necessitated by ground conditions (i.e., soft ground, steep terrain).
[3] The term “segment-based transport” refers to movement on flat ground over a distance of 100 m or less within a single site.
[4] The tubes are delivered bound into bundles by means of P.P. bands and may be handled as easily as commonly found round pipes.

Standard Installation (cross-sectional view)

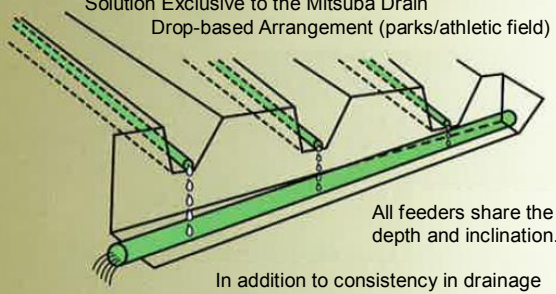
Nominal diameter (mm)	A (mm)	B (mm)
75	300	250
100	350	300
125	350	300
150	400	350
200	400	350
250	500	400
300	600	450

[1] The width and depth of excavation vary according to the quality of soil (good or poor), terrain inclination, and other factors.
[2] The intermediary layer is laid for installation at athletic fields, parks, and the like.
[3] The gravel bed (50 mm deep, approx.) laid under the pipe is useful in countering the possible concentration of silt occurring during the initial phase of work as well as in adjusting the inclination.

Applications of the Mitsuba Drain

Grounds Multi-purpose open space Park	Feeder	φ100~125	Intercept culvert works	φ200~300
	Trunk	φ150~200	Intermountain region (landslide)	φ150~300
Road shoulder	bottom	φ125~150	Reclaimed land ground	φ150~300
Road bed	bottom	φ 75~125	Retaining wall bottom	φ125~200
Railroad bed, Cemetery		φ 75~125	Spring water control	
Golf course		φ100~200	Subsoil water collection	
Market garden/Farming field (consolidation)		φ 75~100	Slope spring water control	

Solution Exclusive to the Mitsuba Drain
Drop-based Arrangement (parks/athletic field)



All feeders share the same depth and inclination.

In addition to consistency in drainage efficiency, economic benefits may also be expected.

Drainage Capacity of the Mitsuba Drain

(m³/Hr)

Inclination	φ75	100	125	150	200	250	300
1/100	4.61	7.38	11.08	16.62	27.70	46.16	64.63
1/200	3.26	5.22	7.83	11.75	19.58	32.64	45.70
1/300	2.66	4.26	6.39	9.59	15.99	26.65	37.31
1/400	2.30	3.69	5.54	8.31	13.85	23.08	32.31
1/500	2.06	3.30	4.95	7.43	12.38	20.64	28.90
1/1000	1.46	2.33	3.50	5.25	8.76	14.60	20.44

(coefficient of grain size: 0.01)

The volume of flow is calculated using the Manning formula.

Inclination Variations ex. where φ 100 and I = i/1000, Q = 2.33√i
where φ 100 and I = 3/1000, Q = 2.33√3
≈ 4.03 m³/Hr

ex. where φ 200 and I = i/1000, Q = 8.76√i
where φ 200 and I = 3/1000, Q = 8.76√3
≈ 15.17 m³/Hr

(In parks, athletic fields, and the like, the inclination (i) should preferably be at least 3/1000.)

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