

## Owner of the declaration, manufacturer

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## Product name and number

Polystyrene drainage board products (FSDrain 25; FSDrain 25 Free; FSDrain 25 Slow; FSDrain 40; FSDrain 40 Free; FSDrain 40 Slow; FSDrain 60; FSDrain 60 Free)

## Manufacturing plant

Pest County, Hungary

## Description of the Product group

The members of FSDrain product family are drainage and water storing boards made of recycled polystyrene (HIPS) for extensive and intensive green roof application. The three product versions satisfy all the needs in relation to the drainage system on green roofs.

### FSDrain 25 / FSDrain 40 / FSDrain 60 Drainage, water storing drainage boards:

The drainage system has two key functions: to manage the drainage of excess water from the surface to provide efficient water flow capacity (measured in l/m x s), but at the same time to retain sufficient water to supply the vegetation (l/m<sup>2</sup>). The strength of the drainage board and its capacity to store a high volume of water are key characteristics of the product, ensuring a stable layer and the ability to protect the vegetation through drier periods. The higher storage capacity of these drainage boards also means that they can be equally effective with a thinner layer, which can reduce costs. The physical stability of the drainage board is measured by its compressive strength (kN/m<sup>2</sup>), determined by the material used and its unique design, which includes diffusion perforations in the material to ensure effective ventilation and drainage.

### FSDrain 25 Free / FSDrain 40 Free / FSDrain 60 Free Drainage boards:

A drainage system designed specifically for paved surfaces on top of slabs, which manages the drainage of water from the pavement through perforations that control water flow effectively. Due to its function, this system has no need for water storage capacity. The required compressive strength is provided by filling the drainage plate with grit. The height of the fill depends on the load requirements of the surface. The installation of two movement layers under the drainage plate maintains the stability of the pavement by balancing the forces on the structure. The backfilled drainage board also functions as an important layer of insulation protection. The distance between the RWOs (water channel length) determines the height of the drainage board that needs to be used.

## FSDrain 25 Slow / FSDrain 40 Slow Drainage, water storage, retention boards:

The stormwater management system is a critical component in the control of urban flash floods. It slows the release of water from the roof so that the standard drainage infrastructure can cope with sudden large volumes, and at the same time it has the capacity to hold and store large quantities of rainwater run-off that can be used by plants. This significantly reduces the burden on the urban sewerage network. It is characterised by a run-off coefficient or "C-value" (%), which indicates the percentage of rainfall reaching the roof surface that is discharged into the wastewater system. The C-value can be adjusted through the use of drainage plates. The higher the drainage plate (25/40), the greater improvement in both the runoff coefficient and water retention capacity.

## Product Category Rules and the scope of the declaration

The declaration has been prepared in accordance with EN 15804:2012+A2:2019 and ISO 14025 and 14040/44 standards and the additional requirements stated in the RTS PCR (English version, 18.6.2018) (SFS-EN 15804:2012+A2:2019).

EPD of construction products may not be comparable if they do not comply with EN 15804 and seen in a building context.

## Author of the life-cycle assessment and declaration

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## Verification

This EPD has been verified according to the requirements of EN 15804+A2 and RTS PCR by a third party. The verification has been carried out by:

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## Declaration issue date and validity

Declaration issue date is 28.08.2023 The declaration is valid for 5 years.

## Product description

The declaration has been conducted for polystyrene drainage boards (FSDrain 25, FSDrain 25 Free, FSDrain 25 Slow, FSDrain 40, FSDrain 40 Free, FSDrain 40 Slow, FSDrain 60, and FSDrain 60 Free) manufactured in Hungary.

## Technical specifications, physical properties, and environmental/hazardous properties

Technical specifications	FSDrain 25, FSDrain 25 Free, FSDrain 25 Slow	FSDrain 40, FSDrain 40 Free, FSDrain 40 Slow	FSDrain 60, FSDrain 60 Free
Dimension (mm)	1995 x 1003	1995 x 1003	1940 x 940
Height (mm)	25	40	60
Weight (kg/m <sup>2</sup> )	1,36	1,92	2,22
Material	Polystyrene	Polystyrene	Polystyrene
Building material class	F (Standard: EN 13501-1)	F (Standard: EN 13501-1)	F (Standard: EN 13501-1)

### Technical data sheet

Technical data		Unit	Standard
Physical state at 23°C	Solid (pellets)		
Density at 23°C	1,04	g/cm <sup>3</sup>	ASTM D-792
Melt flow rate 200°C / 5kg	5	g/10min	ASTM D-1238
Glass transition temperature	105 - 135	°C	
Decomposition temperature	>300	°C	
Auto-flammability	>427	°C	
Flexular modulus 23°C	1800	Mpa	ASTM D-790
IZOD impact strength, notched 23°C	70	J/m	ASTM D-256

### Environmental/hazardous properties

The products do not contain substances listed in the Candidate List of Substances of Very High Concern for authorisation under the REACH Regulation.

The final products are not expected to produce significant adverse health effects when the recommended instruction for use is followed.

## Raw-materials of the product and product information

Product structure / composition / raw-material	Material	quantity p%*	Usability			Origin of the raw materials
			Renewable	Non-renewable	Recycled	
Plastic	Polystyrene	97%		x	x	EU
Additive - Black masterbatch	70% low-density polyethylene 30% carbon black	3%		x		EU

\*Order of magnitude, not exact composition

Product main composition, at least metals, stone materials, fossil materials, bio-based materials

Product structure / composition / raw-material	quantity p%*	Origin of the raw materials
Metals	0%	
Stone-based materials (minerals)	0%	
Fossil materials	100%	EU
Bio-based materials	0%	

\*Order of magnitude, not exact composition

Mass inputs for the packaging materials for the drainage board products:

Packaging materials	Weight, kg (per functional unit)
FSDrain 25	
EUR pallet	0,041536
Stretch foil	0,000830
FSDrain 40	
EUR pallet	0,057689
Stretch foil	0,001153
FSDrain 60	
EUR pallet	0,078667
Stretch foil	0,001572

## Functional / declared unit

Indicators are for one m<sup>2</sup>. The values can be converted to kg by using the following conversion factors:

Name of the product	kg/m <sup>2</sup>
FSDrain 25	1,36
FSDrain 25 Free	1,36
FSDrain 25 Slow	1,36
FSDrain 40	1,92
FSDrain 40 Free	1,92
FSDrain 40 Slow	1,92
FSDrain 60	2,22
FSDrain 60 Free	2,22

## System boundary

This EPD covers the following modules: Cradle-to-gate with modules C1–C4 and module D (A1–A3 + C + D).

The scenarios included are currently in use and are representative for one of the most likely scenario alternatives.

Product stage			Construction process stage	Use stage								End of life stage				Resource recovery stage
Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
x	x	x	ND <sup>1</sup>	ND	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x

	Mandatory modules
	Mandatory as per the RTS PCR section 6.2.1 rules and terms
	Optional modules based on scenarios

<sup>1</sup> The RTS PCR Guideline outlines that the environmental impacts of the A4 module must be declared if their GWP (global warming potential) is over 20% of the GWP of modules A1–A3; as per calculated during the LCA and displayed in the LCA background report, it is below 20% thus A4 does not need to be declared

## Cut-off criteria

A1 raw material supply, A2 transportation, A3 manufacturing. All used materials, energy, packaging, and transportation until the end-of-waste state have been included. The information from transportation A4 is included in the LCA-calculation, but is excluded from the present EPD, because the A4 module's GWP (global warming potential) is below 20% of the GWP of modules A1–A3. Information from B-module has not been calculated nor included in the LCA-calculations. Modules C1 – C4 have been included. Module D is also included.

## Normalization and weighing

According to the RTS EPD Guideline, if the GWP value differs by 10% (the highest compared to the lowest), the values must be reported separately in the same report as tables using multiple factors or as their own values. Given that the difference between the GWP is less than 10% between the various products, they can be declared in one table per product group: FSDrain 25, FSDrain 40, and FSDrain 60.

Product	GWP in kg CO <sub>2</sub> -eq. (A1-A3) per functional unit	Difference in % (lowest to highest)	Name of product (group)
FSDrain 25	1,70E+00	3%	FSDrain 25
FSDrain 25 Free	1,74E+00	2%	
FSDrain 25 Slow	1,75E+00	3%	
FSDrain 40	2,30E+00	8%	FSDrain 40
FSDrain 40 Free	2,44E+00	6%	
FSDrain 40 Slow	2,51E+00	8%	
FSDrain 60	2,71E+00	1%	FSDrain 60
FSDrain 60 Free	2,72E+00	1%	

According to ISO 14044, normalization is the calculation of the magnitude of the category indicator results relative to some reference information. The aim of the normalization is to understand better the relative magnitude for each indicator result of the product system under study. It is an optional element that may be helpful in, for example, preparing for additional procedures, such as grouping, weighting or life cycle interpretation.

According to ISO 14044, weighting is the process of converting indicator results of different impact categories by using numerical factors based on value-choices. It may include aggregation of the weighted indicator results.

In order to provide an overall aggregate and average picture about the environmental performance of the various product groups, normalization and weighting are conducted in accordance with the annual production volume in m<sup>2</sup>.

Product	Share of market output	Name of product (group)
FSDrain 25	95%	FSDrain 25
FSDrain 25 Free	3%	
FSDrain 25 Slow	2%	
<b>Total:</b>	<b>100%</b>	
FSDrain 40	94%	FSDrain 40
FSDrain 40 Free	4%	
FSDrain 40 Slow	2%	
<b>Total:</b>	<b>100%</b>	
FSDrain 60	81%	FSDrain 60
FSDrain 60 Free	19%	
<b>Total:</b>	<b>100%</b>	

Overall, the following environmental performance for GWP is resulted upon averaging the environmental performance of each product based on share of market output within the product group:

Product	GWP in kg CO <sub>2</sub> -eq. (A1-A3)
FSDrain 25	1,70E+00
FSDrain 40	2,31E+00
FSDrain 60	2,71E+00

The same process is applied for all the other environmental performance indicators amongst the products.

## Environmental impacts

### FSDrain 25 (including FSDrain 25, FSDrain 25 Free, and FSDrain 25 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot. A1-A3	C1	C2	C3	C4	D
GWP-fossil	kg CO <sub>2</sub> eq.	1,47E+00	9,28E-02	9,54E-03	1,57E+00	0,00E+00	1,14E-01	1,66E-02	2,78E+00	3,49E+00
GWP-biogenic	kg CO <sub>2</sub> eq.	7,43E-03	8,02E-05	3,62E-05	7,55E-03	0,00E+00	9,40E-05	2,31E-04	1,70E-04	2,84E-02
GWP-luluc	kg CO <sub>2</sub> eq.	1,46E-03	4,54E-05	2,61E-06	1,51E-03	0,00E+00	6,66E-05	2,99E-06	8,97E-06	-1,42E-03
GWP-total	kg CO <sub>2</sub> eq.	1,48E+00	9,29E-02	9,58E-03	1,58E+00	0,00E+00	1,14E-01	1,69E-02	2,78E+00	3,52E+00
ODP	kg CFC 11 eq.	2,79E-08	2,03E-09	3,10E-10	3,02E-08	0,00E+00	2,50E-09	3,62E-10	1,19E-09	-1,36E-08
AP	mol H <sup>+</sup> eq.	6,71E-03	3,84E-04	4,90E-05	7,14E-03	0,00E+00	6,03E-04	8,31E-05	3,36E-04	1,23E-02
EP-freshwater	kg P eq.	7,10E-04	6,53E-06	2,74E-06	7,19E-04	0,00E+00	9,63E-06	1,01E-06	3,17E-06	-5,36E-04
EP-marine	kg N eq.	1,37E-03	1,47E-04	8,58E-06	1,53E-03	0,00E+00	2,46E-04	3,48E-05	4,45E-04	1,58E-03
EP-terrestrial	mol N eq.	1,38E-02	1,56E-03	9,09E-05	1,55E-02	0,00E+00	2,64E-03	3,75E-04	1,72E-03	1,79E-02
POCP	kg NMVOC eq.	4,65E-03	5,62E-04	3,13E-05	5,25E-03	0,00E+00	8,65E-04	1,40E-04	4,85E-04	8,59E-03
ADP-minerals&metals <sup>1</sup>	kg Sb eq.	9,12E-06	3,06E-07	1,14E-07	9,54E-06	0,00E+00	5,09E-07	4,44E-08	6,45E-08	-2,64E-06
ADP-fossil <sup>1</sup>	MJ	2,86E+01	1,33E+00	2,60E-01	3,02E+01	0,00E+00	1,63E+00	2,96E-01	2,21E-01	8,72E+01
WDP	m <sup>3</sup>	3,99E-01	6,54E-03	2,61E-03	4,08E-01	0,00E+00	9,18E-03	4,51E-03	1,96E-02	2,51E+00
Acronyms	GWP-total = Global Warming Potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential									
Disclaimer	<sup>1</sup> The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									



FSDrain 40 (including FSDrain 40, FSDrain 40 Free, and FSDrain 40 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
GWP-fossil	kg CO <sub>2</sub> eq.	1,98E+00	1,31E-01	1,35E-02	2,12E+00	0,00E+00	1,61E-01	2,35E-02	3,93E+00	4,93E+00
GWP-biogenic	kg CO <sub>2</sub> eq.	1,01E-02	1,13E-04	5,11E-05	1,03E-02	0,00E+00	1,33E-04	3,26E-04	2,41E-04	4,01E-02
GWP-luluc	kg CO <sub>2</sub> eq.	2,03E-03	6,40E-05	3,68E-06	2,10E-03	0,00E+00	9,40E-05	4,22E-06	1,27E-05	-2,00E-03
GWP-total	kg CO <sub>2</sub> eq.	1,99E+00	1,31E-01	1,35E-02	2,13E+00	0,00E+00	1,61E-01	2,38E-02	3,93E+00	4,97E+00
ODP	kg CFC 11 eq.	3,63E-08	2,87E-09	4,38E-10	3,96E-08	0,00E+00	3,53E-09	5,12E-10	1,68E-09	-1,92E-08
AP	mol H <sup>+</sup> eq.	8,98E-03	5,42E-04	6,91E-05	9,59E-03	0,00E+00	8,51E-04	1,17E-04	4,75E-04	1,73E-02
EP-freshwater	kg P eq.	9,75E-04	9,23E-06	3,87E-06	9,88E-04	0,00E+00	1,36E-05	1,42E-06	4,48E-06	-7,57E-04
EP-marine	kg N eq.	1,85E-03	2,07E-04	1,21E-05	2,07E-03	0,00E+00	3,47E-04	4,92E-05	6,28E-04	2,23E-03
EP-terrestrial	mol N eq.	1,86E-02	2,21E-03	1,28E-04	2,10E-02	0,00E+00	3,73E-03	5,30E-04	2,43E-03	2,52E-02
POCP	kg NMVO C eq.	6,26E-03	7,94E-04	4,41E-05	7,10E-03	0,00E+00	1,22E-03	1,98E-04	6,85E-04	1,21E-02
ADP-minerals&metals <sup>1</sup>	kg Sb eq.	1,18E-05	4,33E-07	1,61E-07	1,23E-05	0,00E+00	7,18E-07	6,27E-08	9,11E-08	-3,72E-06
ADP-fossil <sup>1</sup>	MJ	3,79E+01	1,88E+00	3,67E-01	4,01E+01	0,00E+00	2,30E+00	4,19E-01	3,12E-01	1,23E+02
WDP	m <sup>3</sup>	5,37E-01	9,24E-03	3,68E-03	5,50E-01	0,00E+00	1,30E-02	6,36E-03	2,76E-02	3,54E+00
Acronyms	GWP-total = Global Warming Potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential									
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FSDrain 60 (including FSDrain 60 and FSDrain 60 Free)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
GWP-fossil	kg CO <sub>2</sub> eq.	2,34E+00	1,51E-01	1,56E-02	2,51E+00	0,00E+00	1,86E-01	2,72E-02	4,54E+00	5,70E+00
GWP-biogenic	kg CO <sub>2</sub> eq.	1,19E-02	1,31E-04	5,91E-05	1,21E-02	0,00E+00	1,53E-04	3,77E-04	2,78E-04	4,64E-02
GWP-luluc	kg CO <sub>2</sub> eq.	2,38E-03	7,40E-05	4,26E-06	2,46E-03	0,00E+00	1,09E-04	4,88E-06	1,46E-05	-2,32E-03
GWP-total	kg CO <sub>2</sub> eq.	2,36E+00	1,52E-01	1,56E-02	2,52E+00	0,00E+00	1,87E-01	2,75E-02	4,54E+00	5,74E+00
ODP	kg CFC 11 eq.	4,38E-08	3,32E-09	5,06E-10	4,76E-08	0,00E+00	4,08E-09	5,91E-10	1,94E-09	-2,22E-08
AP	mol H <sup>+</sup> eq.	1,07E-02	6,27E-04	7,99E-05	1,14E-02	0,00E+00	9,84E-04	1,36E-04	5,49E-04	2,00E-02
EP-freshwater	kg P eq.	1,14E-03	1,07E-05	4,48E-06	1,16E-03	0,00E+00	1,57E-05	1,65E-06	5,18E-06	-8,75E-04
EP-marine	kg N eq.	2,19E-03	2,39E-04	1,40E-05	2,44E-03	0,00E+00	4,01E-04	5,69E-05	7,26E-04	2,58E-03
EP-terrestrial	mol N eq.	2,21E-02	2,55E-03	1,48E-04	2,48E-02	0,00E+00	4,32E-03	6,12E-04	2,81E-03	2,91E-02
POCP	kg NMVOC eq.	7,44E-03	9,18E-04	5,10E-05	8,41E-03	0,00E+00	1,41E-03	2,28E-04	7,92E-04	1,40E-02
ADP-minerals&metals <sup>1</sup>	kg Sb eq.	1,42E-05	5,00E-07	1,86E-07	1,49E-05	0,00E+00	8,30E-07	7,25E-08	1,05E-07	-4,31E-06
ADP-fossil <sup>1</sup>	MJ	4,53E+01	2,18E+00	4,25E-01	4,79E+01	0,00E+00	2,66E+00	4,84E-01	3,61E-01	1,42E+02
WDP	m <sup>3</sup>	6,39E-01	1,07E-02	4,26E-03	6,53E-01	0,00E+00	1,50E-02	7,36E-03	3,19E-02	4,09E+00
Acronyms	GWP-total = Global Warming Potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential									
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## Use of natural resources

### FSDrain 25 (including FSDrain 25, FSDrain 25 Free, and FSDrain 25 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
PERE	MJ	2,65E+00	2,05E-02	2,97E-02	2,70E+00	0,00E+00	3,48E-02	2,71E-02	8,53E-03	-2,15E-01
PERM	MJ	0,00E+00	0,00E+00	6,29E-01	6,29E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,28E+00	2,05E-02	2,97E-02	3,33E+00	0,00E+00	3,48E-02	2,71E-02	8,53E-03	-2,15E-01
PENRE	MJ	-1,91E+01	1,33E+00	2,60E-01	-1,75E+01	0,00E+00	1,63E+00	-2,20E+01	-4,91E+01	1,25E+02
PENRM	MJ	4,74E+01	0,00E+00	7,14E-02	4,75E+01	0,00E+00	0,00E+00	0,00E+00	4,74E+01	-3,82E+01
PENRT	MJ	2,86E+01	1,33E+00	2,60E-01	3,00E+01	0,00E+00	1,63E+00	2,96E-01	2,21E-01	8,72E+01
SM	kg	1,33E+00	0,00E+00	-6,90E-03	1,32E+00	0,00E+00	0,00E+00	0,00E+00	-1,23E+00	8,79E-02
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m <sup>3</sup>	1,00E-02	1,59E-04	7,47E-05	1,03E-02	0,00E+00	2,26E-04	3,75E-04	5,58E-04	5,78E-02
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

FSDrain 40 (including FSDrain 40, FSDrain 40 Free, and FSDrain 40 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
PERE	MJ	3,44E+00	2,90E-02	4,19E-02	3,51E+00	0,00E+00	4,91E-02	3,83E-02	1,20E-02	-3,03E-01
PERM	MJ	0,00E+00	0,00E+00	8,73E-01	8,73E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	4,32E+00	2,90E-02	4,19E-02	4,39E+00	0,00E+00	4,91E-02	3,83E-02	1,20E-02	-3,03E-01
PENRE	MJ	-2,95E+01	1,88E+00	3,67E-01	-2,73E+01	0,00E+00	2,30E+00	-3,10E+01	-6,93E+01	1,77E+02
PENRM	MJ.	6,69E+01	0,00E+00	9,91E-02	6,70E+01	0,00E+00	0,00E+00	0,00E+00	6,69E+01	-5,40E+01
PENRT	MJ	3,79E+01	1,88E+00	3,67E-01	3,98E+01	0,00E+00	2,30E+00	4,19E-01	3,12E-01	1,23E+02
SM	kg	1,87E+00	0,00E+00	-9,74E-03	1,86E+00	0,00E+00	0,00E+00	0,00E+00	-1,74E+00	1,24E-01
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m <sup>3</sup>	1,34E-02	2,25E-04	1,06E-04	1,37E-02	0,00E+00	3,20E-04	5,29E-04	7,88E-04	8,17E-02
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

FSDrain 60 (including FSDrain 60 and FSDrain 60 Free)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
PERE	MJ	4,27E+00	3,35E-02	4,85E-02	4,35E+00	0,00E+00	5,67E-02	4,43E-02	1,39E-02	-3,51E-01
PERM	MJ	0,00E+00	0,00E+00	1,19E+00	1,19E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	5,46E+00	3,35E-02	4,85E-02	5,54E+00	0,00E+00	5,67E-02	4,43E-02	1,39E-02	-3,51E-01
PENRE	MJ	-3,26E+01	2,18E+00	4,25E-01	-3,00E+01	0,00E+00	2,66E+00	-3,58E+01	-8,01E+01	2,05E+02
PENRM	MJ	7,74E+01	0,00E+00	1,35E-01	7,75E+01	0,00E+00	0,00E+00	0,00E+00	7,74E+01	-6,24E+01
PENRT	MJ	4,53E+01	2,18E+00	4,25E-01	4,75E+01	0,00E+00	2,66E+00	4,84E-01	3,61E-01	1,42E+02
SM	kg	2,16E+00	0,00E+00	-1,13E-02	2,15E+00	0,00E+00	0,00E+00	0,00E+00	-2,01E+00	1,44E-01
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m <sup>3</sup>	1,60E-02	2,60E-04	1,22E-04	1,63E-02	0,00E+00	3,70E-04	6,12E-04	9,11E-04	9,44E-02
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

## End-of-life – Waste

### FSDrain 25 (including FSDrain 25, FSDrain 25 Free, and FSDrain 25 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	4,19E-02	8,95E-04	4,68E-04	4,33E-02	0,00E+00	1,21E-03	1,74E-04	1,34E-02	2,68E-02
Non-hazardous waste disposed	kg	3,30E+00	2,72E-02	1,23E-02	3,34E+00	0,00E+00	4,27E-02	1,16E+00	8,87E-01	-2,67E+00
Radioactive waste disposed	kg	1,11E-04	4,30E-07	1,86E-06	1,13E-04	0,00E+00	7,87E-07	3,65E-07	1,47E-07	-8,25E-06

### FSDrain 40 (including FSDrain 40, FSDrain 40 Free, and FSDrain 40 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	5,46E-02	1,26E-03	6,60E-04	5,65E-02	0,00E+00	1,71E-03	2,46E-04	1,89E-02	3,78E-02
Non-hazardous waste disposed	kg	4,54E+00	3,84E-02	1,74E-02	4,60E+00	0,00E+00	6,03E-02	1,64E+00	1,25E+00	-3,77E+00
Radioactive waste disposed	kg	1,38E-04	6,07E-07	2,63E-06	1,41E-04	0,00E+00	1,11E-06	5,16E-07	2,07E-07	-1,16E-05

### FSDrain 60 (including FSDrain 60 and FSDrain 60 Free)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	6,58E-02	1,46E-03	7,63E-04	6,80E-02	0,00E+00	1,98E-03	2,85E-04	2,19E-02	4,37E-02
Non-hazardous waste disposed	kg	5,33E+00	4,44E-02	2,01E-02	5,39E+00	0,00E+00	6,97E-02	1,89E+00	1,45E+00	-4,36E+00
Radioactive waste disposed	kg	1,70E-04	7,02E-07	3,04E-06	1,74E-04	0,00E+00	1,28E-06	5,96E-07	2,39E-07	-1,35E-05

## End-of-life – Output flow

### FSDrain 25 (including FSDrain 25, FSDrain 25 Free, and FSDrain 25 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,07E-02	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,61E-01	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,13E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,23E+01	0,00E+00

### FSDrain 40 (including FSDrain 40, FSDrain 40 Free, and FSDrain 40 Slow)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,28E-01	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,22E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,66E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,74E+01	0,00E+00

### FSDrain 60 (including FSDrain 60 and FSDrain 60 Free)

Results per functional or declared unit										
Indicator	Unit	A1	A2	A3	Tot.A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,48E-01	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,41E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+01	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,01E+01	0,00E+00

## Key information table

**FSDrain 25: Key information table (RTS) - Key information per 1 kg of product**

Indicator	Unit	A1	A2	A3	Tot. A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	1,09E+00	6,83E-02	7,04E-03	1,16E+00	0,00E+00	8,41E-02	1,24E-02	2,04E+00	2,59E+00
ADP-minerals & metals	kg Sb eq.	6,71E-06	2,25E-07	8,37E-08	7,02E-06	0,00E+00	3,74E-07	3,27E-08	4,75E-08	-1,94E-06
ADP-fossil	MJ	2,11E+01	9,81E-01	1,91E-01	2,22E+01	0,00E+00	1,20E+00	2,18E-01	1,62E-01	6,41E+01
WDP	m3	2,93E-01	4,81E-03	1,92E-03	3,00E-01	0,00E+00	6,75E-03	3,32E-03	1,44E-02	1,84E+00
SM	kg	9,75E-01	0,00E+00	-5,07E-03	9,70E-01	0,00E+00	0,00E+00	0,00E+00	-9,05E-01	6,47E-02
Biogenic carbon content in product	kg C	N/A	N/A	0,00E+00	0,00E+00	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in accompanying packaging	kg C	N/A	N/A	1,44E-02	1,44E-02	N/A	N/A	N/A	N/A	N/A
Acronyms	GWP-total = Global Warming Potential total; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption; SM = Use of secondary material									

**FSDrain 40: Key information table (RTS) - Key information per 1 kg of product**

Indicator	Unit	A1	A2	A3	Tot. A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	1,04E+00	6,83E-02	7,04E-03	1,11E+00	0,00E+00	8,41E-02	1,24E-02	2,04E+00	2,59E+00
ADP-minerals & metals	kg Sb eq.	6,12E-06	2,25E-07	8,37E-08	6,43E-06	0,00E+00	3,74E-07	3,27E-08	4,75E-08	-1,94E-06
ADP-fossil	MJ	1,97E+01	9,81E-01	1,91E-01	2,09E+01	0,00E+00	1,20E+00	2,18E-01	1,62E-01	6,41E+01
WDP	m3	2,80E-01	4,81E-03	1,92E-03	2,87E-01	0,00E+00	6,75E-03	3,32E-03	1,44E-02	1,84E+00
SM	kg	9,75E-01	0,00E+00	-5,07E-03	9,70E-01	0,00E+00	0,00E+00	0,00E+00	-9,05E-01	6,47E-02
Biogenic carbon content in product	kg C	N/A	N/A	0,00E+00	0,00E+00	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in accompanying packaging	kg C	N/A	N/A	1,42E-02	1,42E-02	N/A	N/A	N/A	N/A	N/A
Acronyms	GWP-total = Global Warming Potential total; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption; SM = Use of secondary material									



### FSDrain 60: Key information table (RTS) - Key information per 1 kg of product

Indicator	Unit	A1	A2	A3	Tot. A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO <sub>2</sub> eq.	1,06E+00	6,83E-02	7,04E-03	1,14E+00	0,00E+00	8,41E-02	1,24E-02	2,04E+00	2,59E+00
ADP-minerals & metals	kg Sb eq.	6,41E-06	2,25E-07	8,37E-08	6,72E-06	0,00E+00	3,74E-07	3,27E-08	4,75E-08	-1,94E-06
ADP-fossil	MJ	2,04E+01	9,81E-01	1,91E-01	2,16E+01	0,00E+00	1,20E+00	2,18E-01	1,62E-01	6,41E+01
WDP	m <sup>3</sup>	2,88E-01	4,81E-03	1,92E-03	2,94E-01	0,00E+00	6,75E-03	3,32E-03	1,44E-02	1,84E+00
SM	kg	9,75E-01	0,00E+00	-5,07E-03	9,70E-01	0,00E+00	0,00E+00	0,00E+00	-9,05E-01	6,47E-02
Biogenic carbon content in product	kg C	N/A	N/A	0,00E+00	0,00E+00	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in accompanying packaging	kg C	N/A	N/A	1,67E-02	1,67E-02	N/A	N/A	N/A	N/A	N/A
Acronyms	GWP-total = Global Warming Potential total; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption; SM = Use of secondary material									

### Energy in the manufacturing phase

A3 Electricity information and CO <sub>2</sub> emission kg CO <sub>2</sub> -eq./kWh	electricity, low voltage, residual mix // HU, electricity, low voltage	0,39 kg CO <sub>2</sub> -eq./kWh
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### Additional technical information, transport to the building site (module A4)

Parameter	Quantity	Comments
Fuel type and consumption of vehicle or vehicle type used for transport	0,56 kg CO <sub>2</sub> -eq./metric ton*km	transport, freight, lorry 3.5-7.5 metric ton, EURO3
Distance (average distance of the transportation)	200 km	N/A

## End-of-life process description

C1: since only manual dismantling is required for the deconstruction of the drainage boards at the end of their life cycles, there is no emission assumed at this life cycle stage.

C2: the following distances are assumed for the respective waste destinations:

- To the sorting facility – 100 km;
- To landfill – 50 km;
- To the recycling facility – 50 km;
- To the incineration plant – 50 km.

C3 and C4: the Polystyrene drainage board products are sold over many European markets with varying levels of waste treatment services. One waste treatment scenario is modelled – for broad European context (100% market share). Detailed presentation of this assumption based on the Overview of Plastic Waste from Building and Construction by Polymer and by Recycling, Energy Recovery and Disposal<sup>2</sup> is shown below. The table below summarises the total share of the polystyrene drainage board by waste treatment options (the EUR-pallets are considered with multiple reuses, so they are not considered in C-modules).

- Collection rate: 100%;
- Incineration with energy recovery: 63%;
- Recycling: 7%;
- Sanitary landfill: 30%.

The incineration process produces 4.51 MJ/kg electricity and 9.05 MJ/kg heat energy, while the LHV of the polystyrene waste is 38.67 MJ/kg, thus the efficiency of the incineration 35%.

D: for the calculation of module D, the benefits/loads from recycling are accounted. The recyclable fraction of the products at the end of their life cycles (6.67%) can be re-used as secondary raw materials, thus reducing the need for virgin polystyrene granules (module D).

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<sup>2</sup> Source: <https://plasticseurope.org/sustainability/sustainable-use/sustainable-building-construction/>

Processes	Unit (expressed per functional unit)
Collection process specified by type	FSDrain 25: 1,36 kg collected separately FSDrain 40: 1,92 kg collected separately FSDrain 60: 2,22 kg collected separately
	FSDrain 25: 0 kg collected with mixed construction waste FSDrain 40: 0 kg collected with mixed construction waste FSDrain 60: 0 kg collected with mixed construction waste
Recovery system specified by type	FSDrain 25: 0,095 kg for recycling FSDrain 40: 0,134 kg for recycling FSDrain 60: 0,155 for recycling
	FSDrain 25: 0,857 kg for energy recovery FSDrain 40: 1,210 kg for energy recovery FSDrain 60: 1,399 kg for energy recovery
Disposal specified by type	FSDrain 25: 0,408 kg for sanitary landfill FSDrain 40: 0,576 kg for sanitary landfill FSDrain 60: 0,666 kg for sanitary landfill
Assumptions for scenario development, e.g., transportation	The following distances are assumed for the respective waste destinations: <ul style="list-style-type: none"> <li>- To the sorting facility – 100 km;</li> <li>- To the recycling facility – 50 km;</li> <li>- To landfill – 50 km;</li> <li>- To the incineration plant – 50 km.</li> </ul>



Product	Reuse of components	Recycling of material		Recovery of energy content	Disposal of product or material, including losses
		Recycling method	System boundaries (module D)		
Drainage board (97% polystyrene)	Reused if meeting the requirements of the new application	Used as a raw material for new polystyrene-based products	Recycled plastics replace virgin plastics	Energy recovery by incineration	To landfill

### Additional information

- a) emissions to soil  
The information is not available.
- b) emissions to water  
The information is not available.
- c) emissions to indoor air  
The information is not available.

### Product declaration

The information is available at the web pages, please see link.

### Information on biogenic carbon content

#### FSDrain 25

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	Unit	QUANTITY
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	1,96E-02

#### FSDrain 40

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	Unit	QUANTITY
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	2,72E-02

#### FSDrain 60

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	Unit	QUANTITY
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	3,71E-02

## References

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