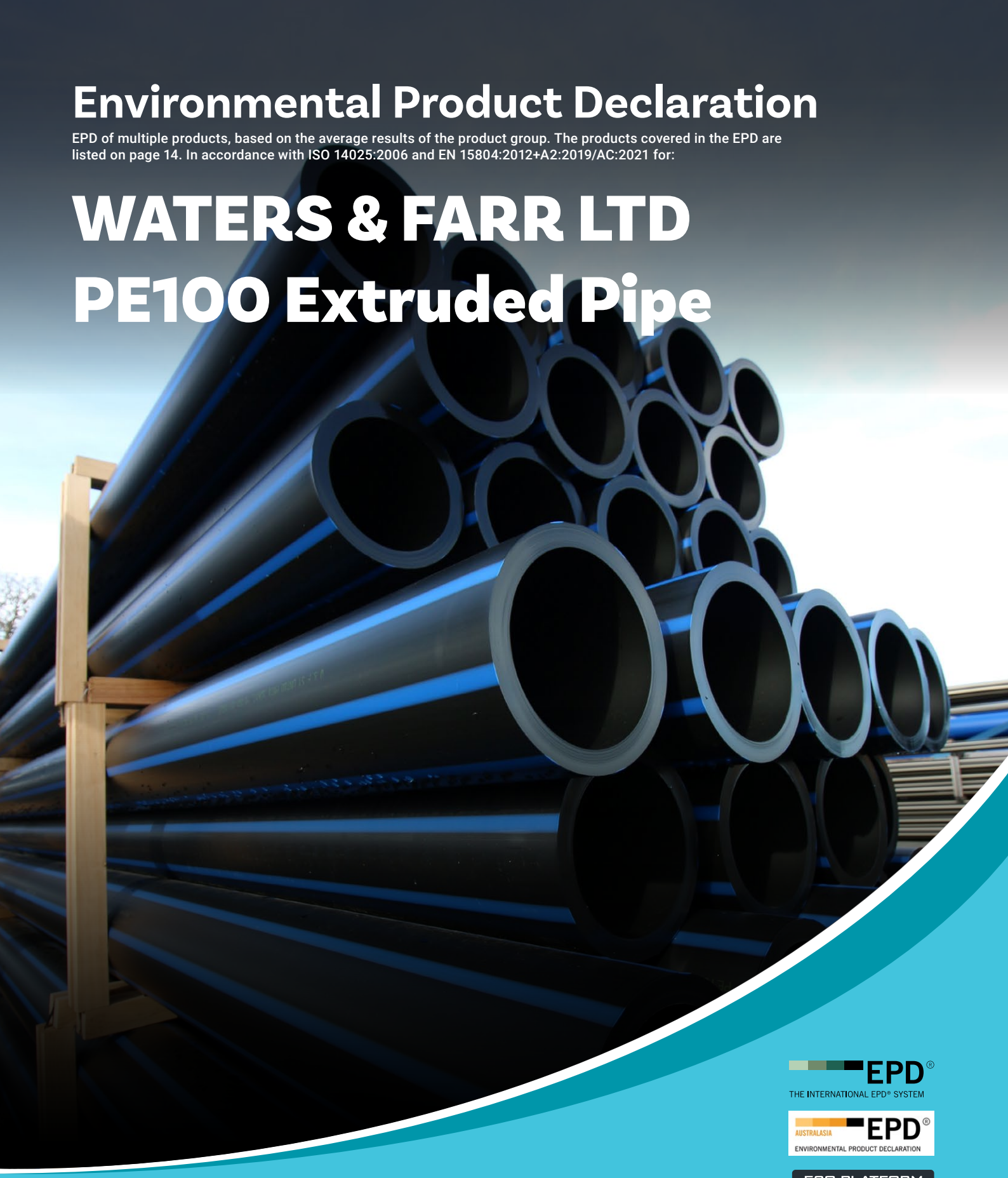
Environmental Product Declaration

EPD of multiple products, based on the average results of the product group. The products covered in the EPD are listed on page 14. In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

WATERS & FARR LTD
PE100 Extruded Pipe



Programme:	The International EPD® System, www.environdec.com	Fully aligned regional hub: EPD Australasia, https://epd-australasia.com/
Programme operator:	EPD International AB	EPD Australasia
EPD registration number:	EPD-IES-0016092	
Date of publication:	2024-08-30	
Valid until:	2029-08-26	

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at https://epd-australasia.com/

EPD® THE INTERNATIONAL EPD® SYSTEM

AUSTRALASIA EPD® ENVIRONMENTAL PRODUCT DECLARATION

ECO PLATFORM EPD VERIFIED

WATERS & FARR

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ABOUT US

WATERS & FARR

Established in 1954, Waters & Farr is a leading New Zealand manufacturer of high-performance polyethylene and polypropylene pipe for civil, utilities and rural applications.

Manufacturing and distribution sites in Whanganui and Rangiora, supported by an additional distribution centre in Auckland, ensure timely product supply to customers throughout New Zealand. Waters & Farr products are distributed to installers and asset owners through a nationwide network of merchant stockists servicing the civil, utilities and rural sectors (see Figure 1 for all Waters & Farr and Hynds Group locations).

Waters & Farr is committed to continuous improvement. Ongoing investment in plant and equipment is focussed on meeting customer needs and delivering innovative solutions. Our comprehensive range of polyethylene and polypropylene pipe extends from 13 mm to 1 200 mm in diameter.

Head Office: 17-19 Hinau St, Castlecliff, Whanganui
Phone: 0800 923 7473
Email: sales@watersandfarr.co.nz

Comittment to Quality:

- *Waters & Farr maintains a quality management system certification to ISO9001. 'S' mark certification to AS/NZS 4130 and AS/NZS 5065 is maintained via independent third party verification*
- *Pipe Test NZ, a division of Waters & Farr, was established as an independent IANZ accredited testing laboratory. Pipe Test NZ conducts a comprehensive range of pipe and fusion joint testing on pipeline products for Waters & Farr and external parties.*
- *Waters & Farr operates under founding values that underpin our business practices in order to deliver positive outcomes for our people and our customers*

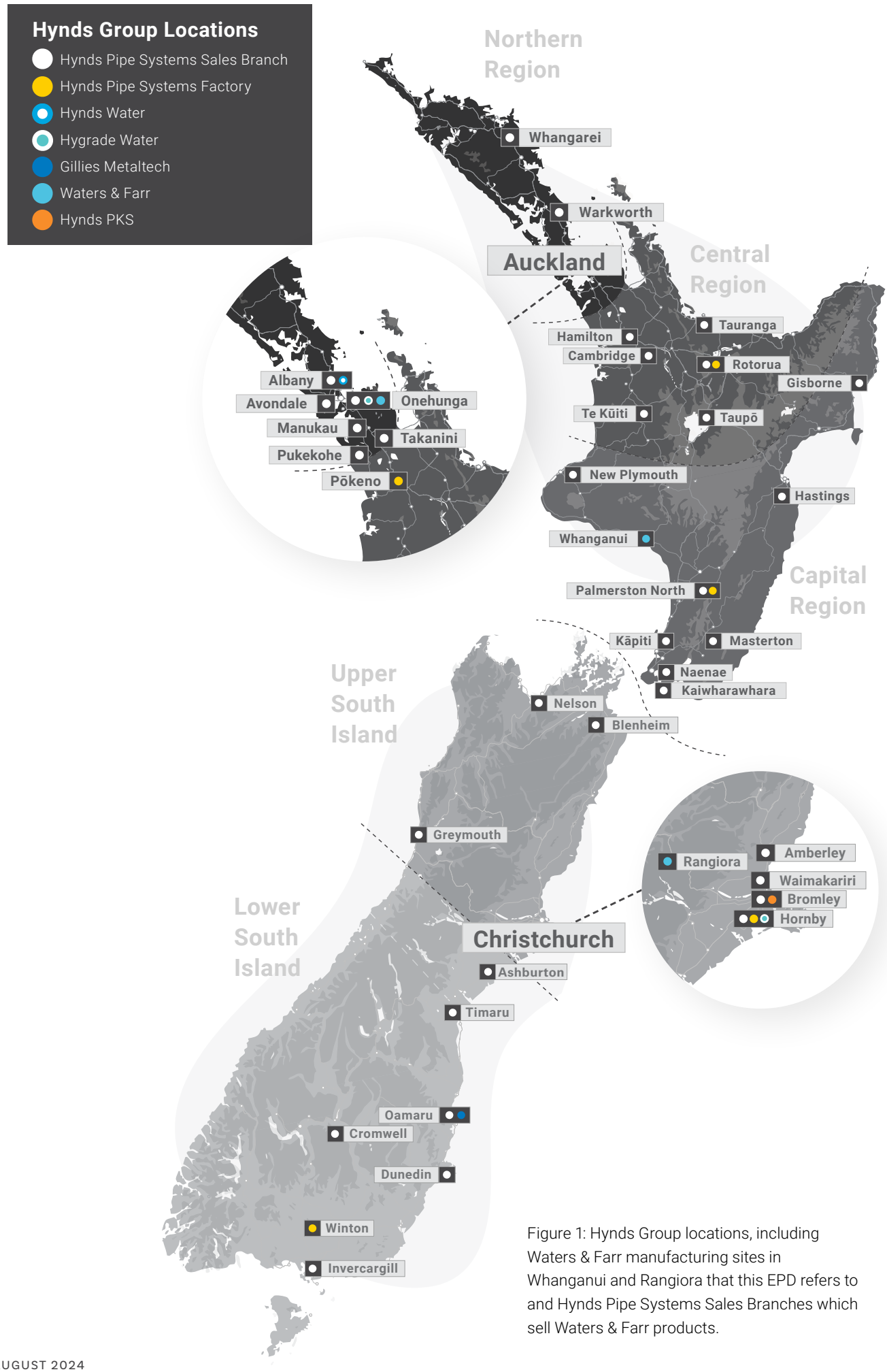


Figure 1: Hynds Group locations, including Waters & Farr manufacturing sites in Whanganui and Rangiora that this EPD refers to and Hynds Pipe Systems Sales Branches which sell Waters & Farr products.

WATERS & FARR SUSTAINABILITY

Waters & Farr is a division of the Hynds Group which was built around finding sustainable solutions to support the three waters (drinking water, wastewater and stormwater infrastructure services) and ultimately keeping our country's waterways clean and our communities safe – both for today and for future generations.

Waters & Farr has adopted a sustainability framework which focuses on three strategic pillars; the planet (our natural environment), people (our people but also our wider communities and stakeholders) and products (innovating and building resilience into what we do to meet the needs of future generations)

Addressing the effects of climate change is a huge challenge that we all face. Waters & Farr believes that addressing climate change will make us better off and is committed to New Zealand's transition to a low-emissions economy. Waters & Farr (as part of the Hynds Group) has committed to a 42% reduction in Scope 1(direct) and Scope 2 (indirect) carbon emissions by 2032. This target is based on the goal to limit warming by 1.5˚C (SBTi, 2021a).

For more information on Waters & Farr sustainability framework, visit **hynds.co.nz/sustainability/** or email **sustainability@hynds.co.nz.**

PRODUCT INFORMATION

Products covered by EPD

This Life Cycle Assessment (LCA) study was commissioned by the Hynds Group, for its subsidiary company Waters & Farr. This EPD covers PE100 extruded pipe manufactured in Waters & Farr's Whanganui and Rangiora manufacturing sites. The full range of products covered by this EPD are given in the Product Mass Tables on Page 14-15.

Product Description

Waters & Farr polyethylene 100 (PE100) plain wall pipes come in a range of solid colour, jacket and stripe colour options for potable water, gas, reclaimed water, pressure sewer, drainage, electrical conduit, communication, fibre optic and rural. See Table 1 for Industry Classification.

Declared Unit

The declared unit for the EPD is 1 kg of pipe.

Design Standard

Waters & Farr PE Pipes are designed and manufactured to the requirements of AS/NZS 4130.

AS/NZS 4130 predicts a life in excess of 100 years before major rehabilitation is required, subject to correct design, installation and non-corrosive environment.

Packaging

The product is generally transported in coils or 6 metre lengths. The coils are strapped using steel or PET straps and may be placed on a wooden pallet and plastic wrapped. The straight lengths are stored loose or in a wooden crate.

Table 1: Industry classification

Product	Classification	Code	Category
PE Pipe	UN CPC Ver.2	36230	Tubes, pipes and hoses, and fittings therefore, of plastic
	ANZSIC 2006	19120	Rigid and semi-rigid polymer product manufacturing

Content Declaration

Table 2: Content declaration

Product components	Weight, kg (weighted avg,)	Weight, kg (min, max)	Post-consumer recycled material, weight-%	Biogenic material, weight-%	Biogenic material,kg C/ declared unit
HDPE resin (Compounded)	>0.99	0.99, 0.99	0	0	0
Pigment (various)	<0.01	1.00E-02, 1.01E-02	0	0	0

Table 3: Packaging content declaration

Packaging materials	Weight, kg	Weight-% (versus the product)	Biogenic material, weight-%	Weight biogenic carbon, kg C/ declared unit
Timber dunnage	1.06E-04	0.01%	38%	0.447
Steel strapping	7.59E-04	0.08%	0%	0
Plastic (HDPE)	1.17E-03	0.12%	0%	0
Total	2.04E-03	0.20%		

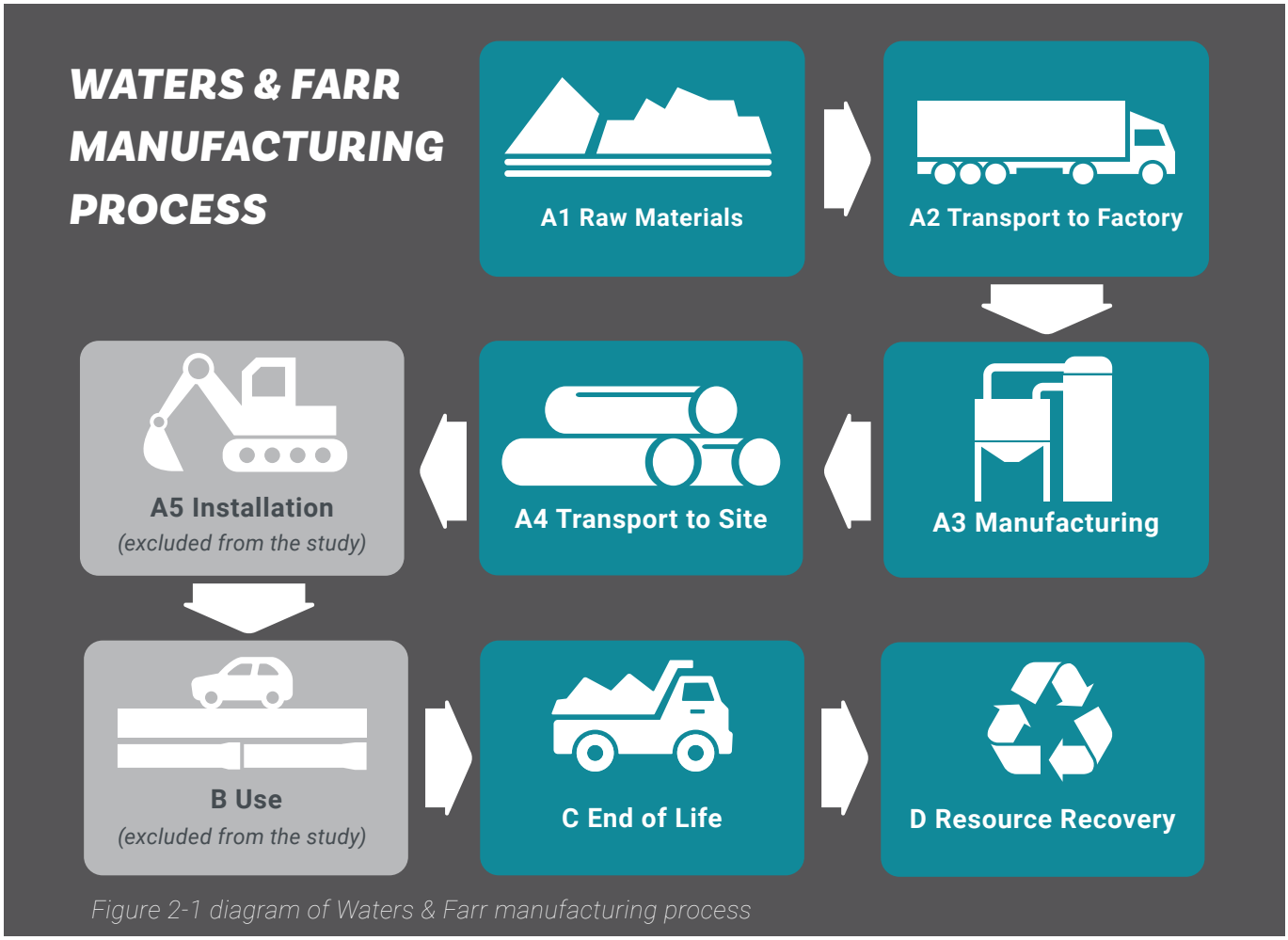


Figure 2-1 diagram of Waters & Farr manufacturing process

System boundaries

As shown in the table below, this EPD is cradle to gate with modules A4, C1–C4 and D (A1–A3 + A4 + C + D). Other life cycle stages (A5 and B1-B7) are dependent on particular and multiple scenarios and best modelled at the building level.

Table 4: Modules included in the scope of the EPD

	Product stage			Construction process stage		Use stage							End of life stage				Resource Recovery
	Raw material supply	Transport of raw materials	Manufacturing	Transport to customer	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to waste processing	Waste processing	Disposal	Reuse - Recovery- Recycling- potential
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO	NZ	NZ	NZ									NZ	NZ	NZ	NZ	NZ
Specific Data	11.9%																
Variation: Products	0%																
Variation sites	<8%																

X = included in the EPD; ND = Module not declared (such a declaration shall not be regarded as an indicator result of zero). The EPD presents results for declared unit of a product, which is based on weighted average data (production quantities) from the two manufacturing sites.

Manufacturing Process

Waters & Farr PE pipes are made from fully precompounded PE100 resins in our Whanganui and Rangiora manufacturing facilities. The PE resins are imported from a range of overseas supplies and delivered to Waters & Farr sites by truck.

The PE resin is heated by an electrically powered heating process to achieve the ideal temperature for extrusion. The heated is forced through an annual die to form a pipe of desired internal diameter and wall thickness. This process is automatically controlled for consistent wall thickness.

The formed pipe is cooled by refrigerated water which is circulated in a closed loop to conserve water. A cutting machine cuts the pipe at predetermined lengths and stored in wooden crates or coils.

Any off-cuts or reject pipes are ground on site and sent to a third-party for repalletization. These pellets are then returned for use in Waters & Farr rural products.

Production (Module A1-A3)

The production stage includes the environmental impacts associated with raw materials extraction and processing of inputs, transport to, between and within the manufacturing site, and manufacturing of average product at the exit gate of the manufacturing site.

Construction (Module A4-5)

The weighted average transport distance from Waters & Farr's manufacturing sites to customer sites is 339 km from Rangiora and 279 km from Whanganui.

PE100 (HDPE) pipes have a large range of uses, installation types and installation variables. PE100 (HDPE) come in a variety of DNs and PN/SDR ratings, which gives a wide range of installation impact results, in module A5, per 1 kg of pipe. Requirements of PCR 2019:14 v1.3.4 (EPD International, 2024) preclude the capturing of all of these variables within one set of results, for module A5, per EPD product. Therefore, module A5 was excluded from the EPD system boundary.

Additional Information section presents an example of module A5 installation modeling per 1 m of PE100 (HDPE) pipe. These results are for reference only and should not be used together with the results of this study. It is recommended that a more in-depth analysis is performed for specific installation conditions. For the Additional Information section, the following assumptions were made:

- *Open trench installation in alignment with AS/NZ 2033*
- *0.825 m height to fill above pipe*
- *Trench width as required by AS/NZ 2033*
- *Imported aggregate used for pipe surround and excavated material used for backfill*
- *50 km distance to site from quarry and no material removal needed*
- *Impact from trench excavation is doubled to account for installation and backfilling*

End-of-Life (Module C1-C4)

When a PE pipe reaches its end-of-life, the pipe is either abandoned in the ground or exhumed and disposed of. In New Zealand, the most common scenario is to abandon the pipe and this scenario has therefore been assumed in this study.

Recovery and Recycling potential (Module D)

Module D declares a potential credit or burden for the net scrap associated with HDPE pipes life cycle. HDPE pipes do not contain secondary materials and there is no material recovered at the end-of-life. Therefore there is no impact in Module D. Default factors from PEF R2 values are therefore not being used and are replaced with 0.

Life cycle inventory (LCI) data and assumption

Specific data were used for all manufacturing operations up to the factory gate. Primary data for Waters & Farr operations was sourced from the period 01 July 2021 to 30 June 2022. Background data was used for input materials sourced from other suppliers including HDPE.

All data in the background system were from the Life Cycle for Experts database (Sphera, 2023). Datasets have a reference year between 2019 and 2022.

Upstream data

Data for upstream raw materials and unit processes were obtained from Life Cycle for Experts database (Sphera, 2023). The most relevant LCI datasets used in modelling the HDPE resin is taken from Polyethylene high density granulate with Carbon black (furnace black; deep black) as compounding agent.

Electricity

Data for electricity was set to the specific electricity mix per region/site. The PCR v1.3.4 section 4.8.1 requires that LCI data for the generation of electricity used in A1-A3 (A1-A5 for services) shall be chosen in this priority:

- Specific electricity mix as generated/purchased from an electricity supplier.
- Residual electricity mix of the electricity supplier on the market.
- Residual electricity mix on the market.
- Electricity consumption mix on the market. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control.

Purchased electricity accounts for 100% of manufacturing electricity use at the Whanganui and Rangiora manufacturing sites. Study options 1 and 2 are not available. Therefore the residual electricity mix on the market is used for the A3 processes that the manufacturing facilities have control over.

The New Zealand residual electricity grid consumption mix (2021) is made up of hydro (56.6%), geothermal (19.7%) natural gas (12.5%), wind (6.55%), coal (4.25%), biomass (0.27%), biogas (0.16%), and diesel (0.04%). The emission factor for the New Zealand national grid for the GWP-GHG indicator is 0.153 kg CO2e/kWh.

Electricity for A1 (not under direct control of EPD owner) uses location-based electricity datasets based on the model for resin manufacture (Thailand and UAE).

Transport

Average transportation distances and modes of transport are included for the transport of the raw materials, operating materials, and auxiliary materials to production and assembly facilities. Transportation was modelled using the Life Cycle for Experts database (sphera 2023) global transportation datasets. Fuels were modelled using the geographically appropriate datasets.

Explanation of Average / Representative Products & Variation

Cut off criteria

Personnel is excluded as per section 4.3.1 in the PCR (EPD International, 2021). thinkstep-anz consistently excludes environmental impacts from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process, ('capital goods') regardless of potential significance.

Despite the cut-off, data meeting the above criteria remained for thoroughness and to ensure the collective result of such flows were not significant. The cut-off criteria were however, applied to exclude flows and processes such as raw material packaging (i.e. bulk bags), transport of minor consumables (crayons) and other processes with a negligible impact on the overall life cycle results.

High-quality infrastructure-related data isn't always available and there is no clear cut-off for what to include. For this reason, capital goods data are applied to LCA studies inconsistently. This is expected to lead to reduced consistency and comparability of EPDs. Capital goods were previously excluded from EPDs, thus including capital goods in current EPDs would further reduce their comparability. In this study capital goods and infrastructure have been excluded.

Allocation

Allocation was carried out in accordance with the PCR (EPD International, 2019), section 4.5. No-allocation between co-products in the core module as there were no co-products created during manufacturing.

It was not possible to discern the specific quantities of energy, water, consumables, dunnage and wastes per PE100. All pipes have a low difference in the revenue thus physical properties were used to guide allocation. Data was available at the site level only. Inputs have been allocated to the products based on mass of polyethylene used per the declared unit of the pipe:

Allocation of energy (natural gas, electricity and diesel) is based on mass of polyethylene per product, as it is the main material constituent, polyethylene extrusion is the main driver for on-site energy consumption. Inputs such as consumables (data collected at site-wide level) are allocated based on mass of polyethylene for consistency.

RESULTS

Assessment Indicators

The results tables describe the different environmental indicators for each product per declared unit, for each declared module. The EN 15804 reference package based on EF 3.0 is used.

- *Table 5 contains the core environmental impact indicators in accordance with EN 15804:2012+A2:2019, describing the potential environmental impacts of the product.*
- *Table 6 shows the life cycle inventory indicators for resource use.*
- *Table 7 displays the life cycle inventory indicators for waste and other outputs.*
- *Table 8 provides additional environmental impact indicators in accordance with EN 15804:2012+A2:2019.*
- *Table 9 displays biogenic carbon content indicators.*
- *Table 10 contains results for environmental impact indicators and characterisation methods from EN15804:2012+A1:2013. Included to aid backward comparability, however system boundaries, allocation, and other LCA rules have been conducted according to EN15804:2012+A2:2019.*

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Energy indicators (MJ) are always given as net calorific value. The results for A1-A3 should not be analysed without considering the impacts represented by module C.

Table 5: EN15804+A2 Core Environmental Impact Indicators

Impact category	Indicator	Unit
Climate change – total	GWP-total	kg CO2-eq.
Climate change – fossil	GWP-fossil	kg CO2-eq.
Climate change – biogenic	GWP-biogenic	kg CO2-eq.
Climate change – land use and land use change	GWP-luluc	kg CO2-eq.
Ozone depletion	ODP	kg CFC11-eq.
Acidification	AP	Mole of H+ eq.
Eutrophication aquatic freshwater	EP-freshwater	kg P eq.
Eutrophication aquatic marine	EP-marine	kg N eq.
Eutrophication terrestrial	EP-terrestrial	Mole of N eq.
Photochemical ozone formation	POFP	kg NMVOC eq.
Depletion of abiotic resources – minerals and metals1	ADP-m&m	kg Sb-eq.
Depletion of abiotic resources – fossil fuels[1]	ADP-fossil	MJ
Water use[1]	WDP	m³ world equiv.

Table 6: Life cycle inventory indicators on use of resources

Indicator	Abbreviation	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ
Use of renewable primary energy resources used as raw materials	PERM	MJ
Total use of renewable primary energy resources	PERT	MJ
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ
Total use of non-renewable primary energy resources	PENRT	MJ
Use of secondary material;	SM	kg
Use of renewable secondary fuels	RSF	MJ
Use of non-renewable secondary fuels	NRSF	MJ
Total use of net fresh water	FW	m³

Table 7: Life cycle inventory indicators on waste categories and output flows

Indicator	Abbreviation	Unit
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Components for reuse	CRU	kg
Materials for energy recovery	MER	kg
Materials for recycling	MFR	kg
Exported electrical energy	EEE	MJ
Exported thermal energy	EET	MJ

- *Exported thermal energy (EET) is zero since there is none produced.*

Table 8: EN15804+A2 Additional Environmental Impact Indicators

Indicator	Abbreviation	Unit
Climate Change[2]	GWP-GHG	kg CO2-eq
Particulate Matter emissions	PM	Disease incidences
Ionising Radiation – human health[3]	IRP	kBq U235 eq.
Eco-toxicity (freshwater)[1]	ETP-fw	CTUe
Human Toxicity, cancer[1]	HTP-c	CTUh
Human Toxicity, non-cancer[1]	HTP-nc	CTUh
Land use related impacts / soil quality[1]	SQP	Dimensionless

Table 9: Biogenic carbon content indicators

Indicator	Abbreviation
Biogenic carbon content - product	BCC-prod
Biogenic carbon content - packaging	BCC-pack

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2

Table 10: EN15804+A1 Environmental Impact Indicators

Indicator	Abbreviation	Unit
Global warming potential	GWP (EN15804+A1)	kg CO2-eq.
Ozone depletion potential	ODP (EN15804+A1)	kg CFC11-eq.
Acidification potential	AP (EN15804+A1)	kg SO2-eq.
Eutrophication potential	EP (EN15804+A1)	kg PO43-- eq.
Photochemical ozone creation potential	POCP (EN15804+A1)	kg C2H4-eq.
Abiotic depletion potential for non-fossil resources	ADPE (EN15804+A1)	kg Sb-eq.
Abiotic depletion potential for fossil resources	ADPF (EN15804+A1)	MJ

[1]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 experience with the indicator.

[2]This indicator is identical to GWP-total except that the CF for biogenic CO2 is set to zero. It has been included in the EPD following the PCR.

[3]This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and some construction materials, is also not measured by this indicator.

Environmental performance

Potential environmental impact: mandatory indicators according to EN15804+A2:2019

Table 11: EN15804 +A2 core environmental impact indicators for PE100 pipe per declared unit of 1 kg

Environmental impact	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-total	kg CO2-eq.	2.95E+00	2.77E-01	0	0	0	0	0
GWP-fossil	kg CO2-eq.	2.94E+00	2.65E-01	0	0	0	0	0
GWP-biogenic	kg CO2-eq.	1.48E-02	1.18E-02	0	0	0	0	0
GWP-luluc	kg CO2-eq.	1.06E-03	3.62E-06	0	0	0	0	0
ODP	kg CFC11-eq.	3.15E-12	2.36E-14	0	0	0	0	0
AP	Mole of H+ eq.	4.34E-02	1.60E-03	0	0	0	0	0
EP-freshwater	kg P eq.	2.24E-06	4.54E-08	0	0	0	0	0
EP-marine	kg N eq.	4.95E-03	7.90E-04	0	0	0	0	0
EP-terrestrial	Mole of N eq.	5.46E-02	8.68E-03	0	0	0	0	0
POCP	kg NMCOC eq.	1.66E-02	1.50E-03	0	0	0	0	0
ADP-minerals & metals	kg Sb-eq.	1.02E-07	1.01E-09	0	0	0	0	0
ADP-fossil	MJ	1.11E+02	3.79E+00	0	0	0	0	0
WDP	m3 world eq.	6.31E-01	1.12E-03	0	0	0	0	0

Table 12: EN15804 +A2 additional environmental impact indicators for PE100 pipe per declared unit of 1 kg

Environmental Impact	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-GHG	kg CO2-eq.	2.95E+00	2.65E-01	0	0	0	0	0
GWP-IPCC AR5	kg CO2-eq.	2.93E+00	2.64E-01	0	0	0	0	0
PM	Disease incidences	4.10E-07	7.43E-09	0	0	0	0	0
IRP	kBq U235 eq.	6.80E-03	6.89E-05	0	0	0	0	0
ETP-fw	CTUe	8.82E+01	1.62E+00	0	0	0	0	0
HTPc	CTUh	1.78E-09	2.71E-11	0	0	0	0	0
HTPnc	CTUh	4.56E-08	1.47E-09	0	0	0	0	0
SQP	Pt	2.63E+00	6.97E-03	0	0	0	0	0

Use of resources

Table 13: EN15804 +A2 resource use indicators for PE100 pipe per declared unit of 1 kg

Resource Use	Unit	A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	8.76E+00	1.37E-02	0	0	0	0	0
PERM	MJ	0	0	0	0	0	0	0
PERT	MJ	8.76E+00	1.37E-02	0	0	0	0	0
PENRE	MJ	8.78E+01	3.79E+00	0	0	0	0	0
PENRM	MJ	2.36E+01	0	0	0	0	0	0
PENRT	MJ	8.78E+01	3.79E+00	0	0	0	0	0
SM	kg	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m3	2.49E-02	2.22E-05	0	0	0	0	0

Waste production and output flows

Waste production

Table 14: EN15804 +A2 waste material and output flows for PE100 pipe per declared unit of 1 kg

Waste material and output flows	Unit	A1-A3	A4	C1	C2	C3	C4	D
HWD	kg	1.55E-09	2.74E-12	0	0	0	0	0
NHWD	kg	2.12E-02	8.18E-05	0	0	0	0	0
RWD	kg	1.01E-04	5.51E-07	0	0	0	0	0
CRU	kg	0	0	0	0	0	0	0
MFR	kg	9.79E-02	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0	0

Table 15: EN15804 +A2 biogenic carbon content for PE100 pipe per declared unit of 1 kg

Biogenic carbon content	Unit	A1-A3	A4	C1	C2	C3	C4	D
BCC-prod	kg	0	0	0	0	0	0	0
BCC-pack	kg	4.72E-05	0	0	0	0	0	0

Potential environmental impact – indicators according to EN15804+A1:2013

Table 16: : EN15804 +A1 environmental impact indicators for PE100 pipe per declared unit of 1 kg

Environmental Impact	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP	kg CO2-eq.	2.83E+00	2.72E-01	0	0	0	0	0
ODP	kg CFC11-eq.	3.65E-12	2.78E-14	0	0	0	0	0
AP	kg SO2-eq.	3.74E-02	1.09E-03	0	0	0	0	0
EP	kg PO43-- eq.	1.73E-03	2.66E-04	0	0	0	0	0
POCP	kg C2H4-eq.	2.11E-03	-4.48E-04	0	0	0	0	0
ADPE	kg Sb-eq.	1.03E-07	1.02E-09	0	0	0	0	0
ADPF	MJ	1.08E+02	3.78E+00	0	0	0	0	0

Additional Information - Module A5

PE100 (HDPE) pipes have a large range of uses, installation types and installation variables. PE100 (HDPE) come in a variety of DNs and PN/SDR ratings, which gives a wide range of installation impact results. The pipe diameter (DN/OD) has a dominant control on the trench geometry and resulting emissions factor. The calculations were broken down into 5 groups based on the diameter ranges of the pipes in this EPD. The Groups are as follows:

- *Group 1 – <150 mm*
- *Group 2 – 150-299 mm*
- *Group 3 – 300-450 mm*
- *Group 2 – 451-900 mm*
- *Group 2 – >900 mm*

For each diameter, a value of GWP-total is given per 1 m of pipe installation, excluding removal and disposal of waste packaging. Data for unit processes were obtained from the ecoinvent 3.9.1 database and imported fill is based on the trench size required, transport of fill was assumed at 50 km to site, excavation was also determined by trench size and the excavation was doubled to represent both digging the trench and embedding and compacting the pipe in position.

Table 17: Module A5 results per 1 m of pipe installed

Pipe diameter group	GWP-total per 1 m of pipe (kg CO2-eq./m)
Group 1 – <150 mm	3.75
Group 2 – 150-299 mm	9.92
Group 3 – 300-450 mm	18.99
Group 2 – 451-900 mm	56.70
Group 2 – >900 mm	86.34

WEIGHT CONVERSION TABLES

PE100 Gas and Series 3 Pipes

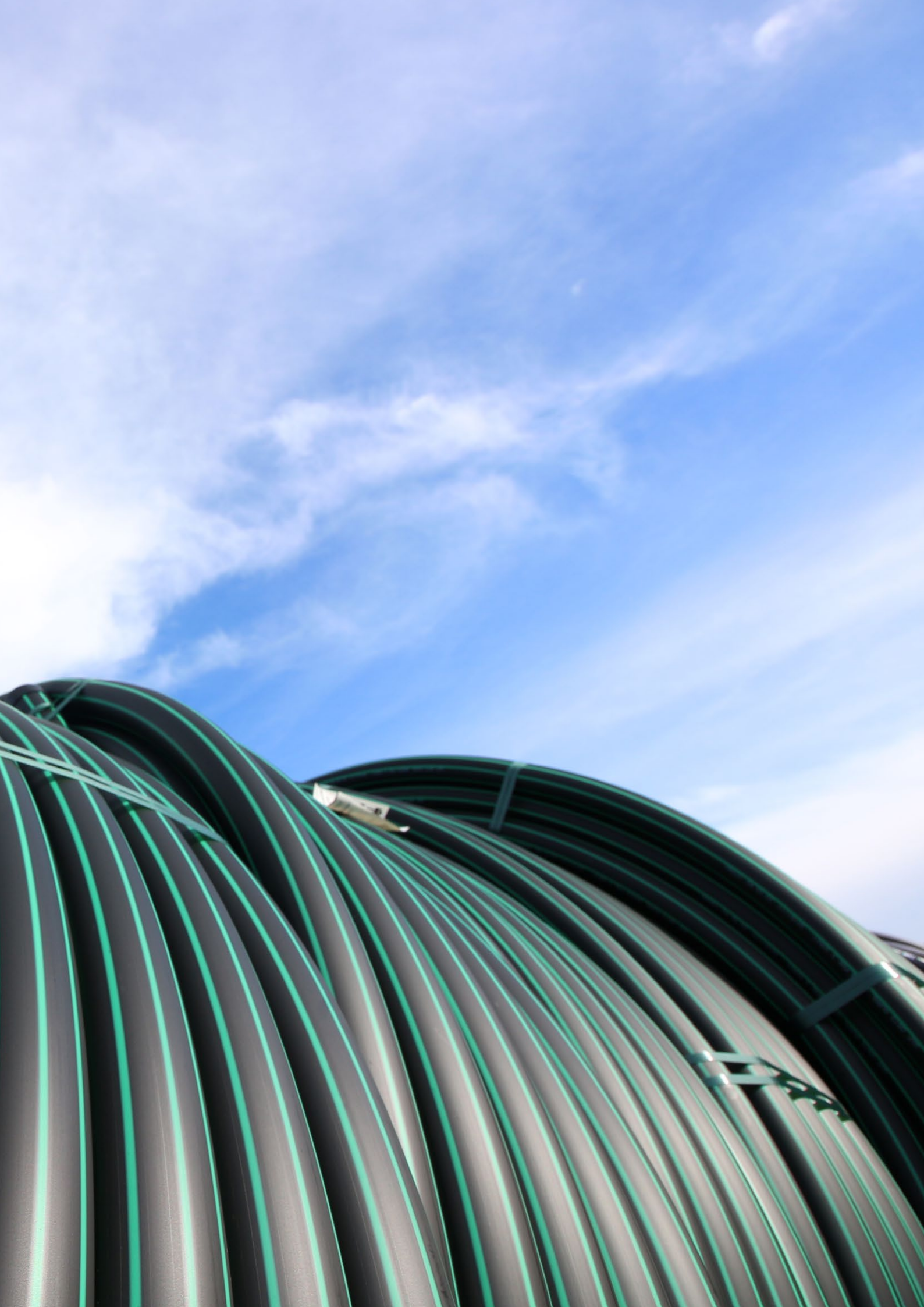
Table 18: Weight conversion table for PE100 Gas and Series 3 pipes included in this EPD

	Gas	Gas	Gas	Series 3	Series 3	Series 3	Series 3
	SDR 17	SDR 13.6	SDR 11	SDR 21	SDR 17	SDR 11	SDR 9
DN/OD	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)
10						0.10	0.07
15						0.14	0.15
16	0.11	0.13	0.13				
20	0.14	0.16	0.16		0.18	0.19	
25	0.18	0.21	0.21		0.23	0.30	
32	0.23	0.28	0.28		0.29	0.47	
40					0.38	0.61	
50					0.64	0.95	
80				1.13	1.38	2.06	
100				1.87	2.28	3.40	
150				4.05	4.96	7.38	
200				6.88	8.47	12.51	

PE 100 PIPE

Table 19: Weight conversion table for PE100 pipes included in this EPD

	SDR 41	SDR 33	SDR 26	SDR 21	SDR 18.78	SDR 17	SDR 14.33	SDR 13.6	SDR 11	SDR 9.89	SDR 9	SDR 7.4
	PN 4	PN 5	PN 6.3	PN 8	PN 9	PN 10	PN 12	PN 12.5	PN 16	PN 18	PN 20	PN 25
DN/OD	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)	Weight (kg/m)
16									0.08	0.08	0.08	0.10
20							0.09	0.10	0.11	0.12	0.13	0.16
25						0.12	0.13	0.14	0.17	0.18	0.20	0.24
32				0.16	0.17	0.19	0.22	0.23	0.27	0.30	0.33	0.39
40				0.24	0.27	0.29	0.34	0.36	0.43	0.47	0.51	0.61
50				0.37	0.41	0.45	0.53	0.55	0.67	0.73	0.80	0.95
63			0.48	0.58	0.64	0.72	0.83	0.88	1.06	1.16	1.27	1.49
75		0.55	0.68	0.83	0.91	1.02	1.17	1.23	1.49	1.63	1.78	2.12
90		0.79	0.98	1.19	1.31	1.47	1.69	1.76	2.15	2.35	2.57	3.04
110	0.94	1.18	1.47	1.79	1.96	2.19	2.51	2.64	3.18	3.50	3.82	4.55
125	1.24	1.52	1.85	2.28	2.53	2.79	3.25	3.41	4.13	4.53	4.93	5.85
140	1.55	1.89	2.34	2.86	3.17	3.50	4.06	4.27	5.14	5.66	6.19	7.35
160	2.01	2.44	3.07	3.75	4.13	4.57	5.29	5.57	6.75	7.39	8.07	9.57
180	2.50	3.09	3.82	4.71	5.22	5.78	6.71	7.07	8.53	9.36	10.21	12.10
200	3.07	3.87	4.74	5.84	6.45	7.13	8.27	8.67	10.52	11.54	12.62	14.93
225	3.89	4.82	5.95	7.38	8.14	9.04	10.46	11.01	13.32	14.61	15.92	18.92
250	4.87	5.97	7.38	9.03	10.05	11.08	12.90	13.56	16.38	18.04	19.63	23.36
280	6.03	7.47	9.20	11.40	12.62	13.92	16.18	16.99	20.54	22.61	24.68	29.29
315	7.58	9.47	11.72	14.33	15.94	17.63	20.47	21.53	25.99	28.61	31.22	36.98
355	9.64	11.97	14.81	18.19	20.26	22.44	26.00	27.29	32.99	36.30	39.56	47.01
400	12.22	15.24	18.78	23.19	25.69	28.36	33.03	34.62	41.89	46.08	50.29	59.62
450	15.41	19.20	23.75	29.33	32.48	35.93	41.76	43.85	53.05	58.34	63.58	75.54
500	19.18	23.68	29.30	36.19	40.07	44.26	51.52	54.10	65.45	72.03	78.47	
560	23.89	29.80	36.73	45.29	50.32	55.61	64.61	67.88	82.00	90.29	98.45	
1200	109.59	135.79	168.33	207.69	230.61	253.05	296.50	310.97				
630	30.22	37.59	46.53	57.22	63.67	70.27	81.79	85.80	103.89	114.27	124.58	
710	38.45	47.78	59.15	72.85	80.85	89.37	103.82	109.00	131.97	145.12	158.33	
800	48.76	60.52	74.91	92.34	102.54	113.32	131.89	138.26	167.26	184.22	200.89	
900	61.50	76.66	94.75	116.83	129.79	143.83	166.82	175.16	211.85	233.22		
1000	76.15	94.42	116.91	144.34	160.14	177.16	205.95	213.34	261.57			



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General information

An Environmental Product Declaration, or EPD, is a standardised and verified way of quantifying the environmental impacts of a product based on a consistent set of rules known as a PCR (Product Category Rules).

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025

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CEN standard EN 15804+A2 served as the core PCR	
PCR:	PCR 2019.14 Construction Products Version 1.3.4 UN CPC Ver.2, 36230, Tubes, pipes and hoses, and fittings therefore, of plastic ANZSIC 2006, 19120, Rigid and semi-rigid polymer product manufacturing
PCR review was conducted by:	The Technical Committee of the International EPD® System
Chair:	Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	❑ EPD process certification (Internal) ☑ EPD verification (External)
EPD verification by individual verifier Third-party verifier: (Approved by: EPD Australasia)	Claudia A. Peña, PINDA LCT SpA pinda.lct@gmail.com
Procedure for follow-up of data during EPD validity involved third-party verifier	❑ Yes ☑ No


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