ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for:

POLYETHYLENE PIPES

FROM IPLEX PIPELINES AUSTRALIA PTY LIMITED

Programme: EPD Australasia, www.epd-australasia.com
Programme operator: EPD Australasia
EPD registration number: S-P-00715
Publication date: 2016-05-30
Valid until: 2027-11-23
Version 2.0: 2022-11-23
Geographic location: Australia
Reference year for data: 2020-2021

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 www.environdec.com

ECO PLATFORM EPD VERIFIED

AUSTRALASIA EPD®
ENVIRONMENTAL PRODUCT DECLARATION

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ENVIRONMENTAL PRODUCT DECLARATION

POLYETHYLENE PIPES

1.0 ENVIRONMENTAL PRODUCT DECLARATION DETAILS

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). Environmental product declarations within the same product category from different programmes may not be comparable. EPD of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

This EPD has been updated to provide detailed information on the environmental impacts arising from the A5 module (installation module) to reflect the factors affecting installation are significantly influenced by pipeline designers, infrastructure agencies and installing contractors.

DECLARATION OWNER:

Iplex Pipelines Australia Pty Ltd
Corner South Pine and Johnstone Roads, Brendale, QLD 4500
t: +61 (07) 3881 9222
f: +61 (07) 3881 1127
e: info@iplexpipelines.com.au **w:** www.iplex.com.au
For the product offering in other markets please contact local sales representative.

EPD PROGRAMME OPERATOR:

EPD Australasia
315a Hardy Street, Nelson 7010, New Zealand
e: info@epd-australasia.com **w:** www.epd-australasia.com

EPD PRODUCED BY:

Edge Environment Pty Ltd
Jonas Bengtsson, Sazal Kundu and Leah Nguyen
L5, 39 East Esplanade, Manly NSW 2095 Australia
t: +61 (2) 9438 0100 **e:** info@edgeenvironment.com
w: www.edgeenvironment.com

THIRD PARTY VERIFIER:

CATALYST Ltd
Kimberly Robertson
Unit A4, 15 Talisman Drive, Katikati 3129 New Zealand
t: +64 (3) 329 6888 **e:** kimberly.robertson@catalystnz.co.nz
w: www.catalystnz.co.nz

ACCREDITED OR APPROVED BY: EPD Australasia

CEN STANDARD EN 15804 SERVES AS THE CORE PRODUCT CATEGORY RULES (PCR)

PCR: Construction Products and Services, (PCR) 2019:14, v1.1 and UN CPC code(s) 36320 according to CPC v2.1, 2015.

PCR PREPARED BY: The Technical Committee of the International EPD System. A full list of members available on www.environdec.com. The review panel may be contacted via info@environdec.com. Review chair: Claudia A. Peña, University of Concepción, Chile

EPD VERIFICATION (EXTERNAL): Independent third-party verification of the declaration and data, according to ISO 14025:2006

OTHER EPD'S FROM IPLEX: Iplex PVC Pressure Pipes EPD, Iplex PVC Non – Pressure Pipes EPD, Iplex BlackMAX® and SewerMAX® Polypropylene Pipes EPD

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

2.0 PRODUCT SUSTAINABILITY CREDIT POINTS

- ✓ EPD conforms to ISO 14025 and EN 15804.
- ✓ The EPD has been verified by an independent third party.
- ✓ The EPD has at least a cradle-to-gate scope.
- ✓ The EPD has product specific results.

This EPD may be used to obtain product sustainability credit points under the Green Building Council of Australia (GBCA) Green Star rating tools and the Infrastructure Sustainability (IS) rating tools.

For the purpose of IS ratings, EPDs are Type III environmental declarations which provide valuable environmental impact data towards IS reward.

The polyethylene (PE) pipe EPD results can also be used to represent PE pipe products in Whole of Building Life Cycle Assessments under Green Star rating tools. See the product detail tables to convert the product results from kilogram of installed pipe to length of pipe for individual pipe products.

3.0 IPLEX PIPELINES AUSTRALIA

Iplex Pipelines Australia (Iplex), one of Australiasia's largest manufacturers and suppliers of plastic pipeline systems, is pleased to publish this independently verified Environment Product Declaration (EPD) for Poliplex®, Greenline™, Sewerplex™, Millennium® and Thermapipe® branded polyethylene pipe and conduits, in sizes ranging from DN16 to DN2000 (EPD's covering the company's polypropylene and polyvinyl chloride pipe products are also available through The Australasian EPD Programme website).

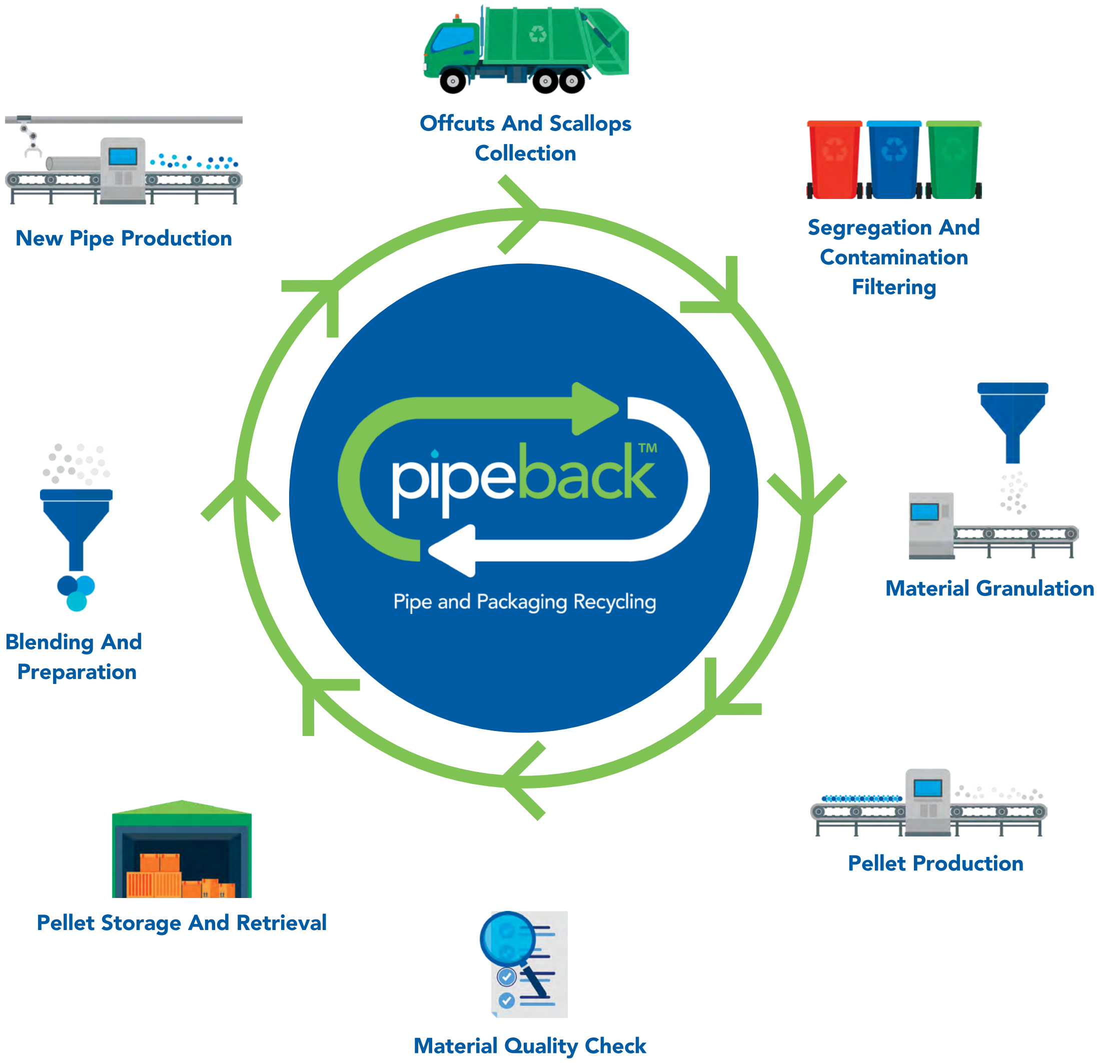
A wholly owned business unit of the ASX listed company Fletcher Building Limited, with operations nationally and in New Zealand. Iplex supplies pipe and conduit to applications including plumbing, irrigation, mining, industrial and chemical processes, electrical, gas, stormwater, sewer, raw, recycled and potable water.

SUSTAINABILITY AT IPLEX

Iplex polyethylene pipe systems are engineered to meet some of the highest standards in the world. With over 80 years' manufacturing history, Iplex is an industry leader that strives to make a difference in sustainability and the manufacturing of environmentally friendly polyethylene pipe products.

PE pipes manufactured by Iplex are made for long service life, and can have a service life longer than 100 years. Resources are carefully managed by Iplex to reduce environmental impacts associated with manufacturing, construction, and operations including the distribution and use of pipe product.

A sustainable feature of Iplex PE pipes is that they are made from thermoplastic material and are 100% recyclable. Iplex PE pipes can be recycled back into the Iplex manufacturing process through its branded Pipeback™ Program. Pipeback™ offers a streamlined service for recycling polyethylene pipes post consumer use back into the manufacturing process, with collection depots in Queensland, South Australia, Victoria and New South Wales.



Iplex PE pipes deliver essential services that sustain our communities. It is important to Iplex to extend its sustainability agenda beyond environmentalism to include economic and social aspects. Sustainable and safe practices are embedded deep in the Iplex culture and driven by its corporate strategic priority *Sustainability at the Core* and cultural values *Protect, Be Bold, Customer Leading, and Better Together*. Iplex company personnel hold a wealth of expertise and experience and continue to work together with the general public, industry, stakeholders and regulatory bodies on sustainability agenda.

TECHNICAL CAPABILITY

Iplex is a pioneer in pipe production and a foundation member of the Plastics Industry Pipes Association of Australia (PIPA).

As part of Iplex's ongoing commitment to sustainability and the development of Australian and International Standards for plastics pipe and fittings, Iplex works collaboratively with the Plastics Industry Pipe Association (PIPA) technical committees and Australian Pipelines and Gas Association working groups.

The Iplex PocketENGINEER™ is a web portal where registered users can access design software to simplify hydraulic, structural and chemical resistance aspects of pipeline design. Visit www.pocketengineer.com.au.
For more information on Iplex's extensive range of pipeline products, visit www.iplex.com.au

In addition to WaterMark®, and StandardsMark™ third party product certification to Australian Standard AS/NZS 4130 all operations are conducted under a quality management system, certified by SAI Global to ISO 9001, Licence QEC 0037.

In support of its extensive product range, Iplex employs professional engineers to assist pipe users and designers and publishes comprehensive engineering design guides that are freely available for download via its website: www.iplex.com.au.

IPLEX POLYETHYLENE PIPES

POLIPLEX®

Poliplex® pipes are the mainstay of the Iplex polyethylene range. Manufactured from pre-compounded AS/NZS 4131 resins listed on PIPA POP004, Poliplex® water, sewer, slurry and gas pipes operating at mid-wall temperatures up to 30°C offer a minimum design life of 100 years. For buried applications, pipe is supplied with colour identification stripes or jackets to indicate the fluid type being conveyed. The Poliplex® sizes range from DN16 to a DN2000; which is the largest polyethylene pressure pipe manufactured in Australasia.

GREENLINE™

Rural Greenline™ polyethylene pipe is specifically intended for use in on-farm irrigation applications, economically conveying non-potable water at up to 80 metres head. These pipes are manufactured in imperial sizes from ¾″ to 2″ ID to the company's exacting specifications and are supplied in convenient long-length coils to minimise joints.

SEWERPLEX™

Sewerplex™ pipe is provided with a light coloured internal skin to facilitate CCTV camera inspection and is designed to be used in gravity sewer applications. The thicker wall of Sewerplex™ pipe provides ring stiffness which in larger sizes is comparable to that of ductile iron pipe. A full range of compatible junctions, sweep bends and maintenance shaft drops allow curved gravity sewers to be constructed. When coupled to Iplex EZIpit® maintenance shafts, a low maintenance, tree root, leak and infiltration-proof sewer system is ensured.

MILLENNIUM®

Millennium® pipe has been formulated in close association with Iplex's polyethylene supplier to provide previously inconceivable service life expectations in demanding trenchless installations and ploughed coal seam gas applications. Millennium® offers resistance to slow crack growth failure mode that is superior to standard PE100, rendering it virtually immune to failure initiated by surface scoring, squeeze-off or rock impingement. Millennium® pipe produced from black and coloured PE resin in wall thicknesses up to 100mm exceeds the stringent high stress crack resistance performance requirements of PIPA POP016. When used in conventional open trench construction, Millennium® pipe eliminates the need to import granular embedment, saving as much as 20% of the pipeline construction cost. For demanding installation conditions in rocky ground, trenchless installations and for critical infrastructure assets, Iplex Millennium is the safe, long-term piping solution

THERMAPIPE®

Thermapipe® was developed by Iplex development engineers specifically for above ground water and mining slurry pipelines, where heat absorption has the potential to significantly reduce operating pressure and service life. As part of Thermapipe's® manufacturing process, a reflective white jacket of light stabilised PE containing titanium dioxide is coextruded on the outer surface of the pipe. This feature reduces solar absorptance ratio by more than 50% and typically lowers the peak mid-wall temperature of an exposed pipeline by 15-20°C, thereby increasing the maximum allowable operating pressure and service life of the pipe.

TABLE 1 – PRODUCT CHARACTERISTICS OF PE PIPE

PRODUCT NAMES	POLIPLEX®, GREENLINE™, SEWERPLEX™, MILLENNIUM® AND THERMAPIPE®
POLYETHYLENE MATERIAL TYPE	PE100*
UN CPC CODE	36320
MINIMUM REQUIRED STRENGTH (50 YEAR @ 20°C)	10 MPa
FLEXURAL YIELD STRENGTH	32 MPa
CIRCUMFERENTIAL FLEXURAL MODULUS (3 MINUTE)	950 MPa
CIRCUMFERENTIAL FLEXURAL CREEP MODULUS (50 YEAR)	260 MPa
DENSITY	955 kg/m^3
TENSILE YIELD STRESS (50MM/MIN)	25 MPa
TENSILE YIELD STRAIN	10%
TENSILE MODULUS	900 MPa
POISSON'S RATIO	0.4
THERMAL EXPANSION COEFFICIENT	0.18 mm/m K
THERMAL CONDUCTIVITY	0.38 W/m K

TABLE 2 – CONTENT DECLARATION

ITEM	MASS (KG)	PERCENTAGE (%)
PE100 RESIN	1.002	99.2%
PE 100 COLOUR COMPOUND	0.008	0.8%

None of the products contain one or more substances that are listed in the "Candidate List of Substances of Very High Concern for authorisation". According to the PCR 2019:14, if one or more substances of the "Candidate List of Substances of Very High Concern (SVHC) for authorisation" are present in a product and their total content exceeds 0.1% of the weight of the product, they need to be reported.

PRODUCT LIFE CYCLE OVERVIEW

The scope of this LCA is Cradle to gate with module A4. The following life cycle stages have not been declared, as they are deemed not applicable for Iplex PE pipes: Material emissions from usage (B1); Maintenance (B2); Repair (B3); Replacement (B4); Refurbishment (B5), Operational energy use (B6); Operational water use (B7); Deconstruction and demolition (C1); Transport (C2); Waste processing (C3); Disposal and Reuse (C4) and recycle or recovery (D). The EPD is compliant with Product Category Rules – Construction Products (PCR 2019:14), EN 15804+A2 standard, ISO 14025 and General Programme Instructions (GPI) V3.01. The target audience for this EPD are businesses or customers who will be using Iplex's PE pipes. The EPD will provide the information on environmental impact data of Iplex's PVC pressure pipes to its customers. This EPD covers the Albury, NSW and Townsville, QLD manufacturing sites of Iplex. Therefore, this is an average EPD of PE pipes from these production sites. The weighted average calculation was performed considering the production share of each manufacturing site.

TABLE 3 – SYSTEM BOUNDARY AND SCOPE OF ASSESSMENT

	PRODUCT STAGE			CONSTRUCTION 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
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	AU/ TW/ TH	AU/ TW/ TH	AU	AU	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific data used	~75%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not applicable					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	< ±10%					-	-	-	-	-	-	-	-	-	-	-	-

ND - Not declared

AU = Australia

TW = Taiwan

TH = Thailand

LIFE CYCLE DIAGRAM OF PE PIPE PRODUCTION

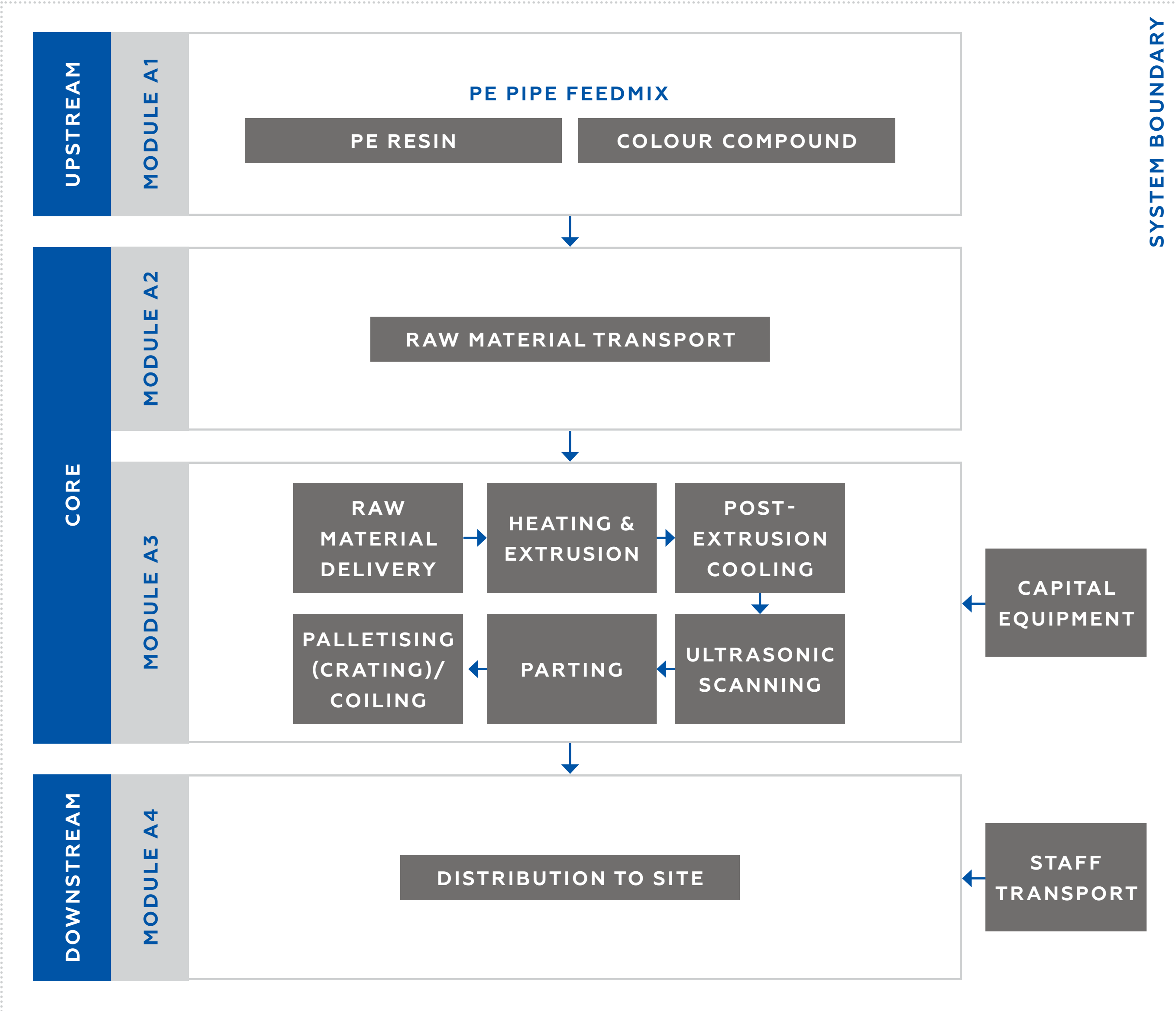


FIGURE 1: IPLEX PE PIPE EPD SYSTEM BOUNDARY

IPLEX POLYETHYLENE PIPE MANUFACTURING

PE pipe is manufactured in Albury, NSW and Townsville, QLD production sites. PE 100 resin and colour compound are the raw materials used for the production of PE pipes. Since it is assumed that 1% of PE pipe is wasted during the installation process, 1.01 kg of pipe is produced for each kg of pipe installed. The PE resin is sourced from both Australia (Qenos Pty Ltd) and abroad (Taiwan and Thailand). Distances were calculated using Google Maps (road transport) and the weighted average transport to each site was calculated. Taking a conservative approach, it was assumed that 50 km of road freight was required from resin supplier to port ("site to port"). The primary packaging used for Iplex PE pipes is PET strapping for "coils" (DN16–DN140) and timber frames for "straight Lengths" (DN75-DN630). The consumption of PET strapping, metal strapping and timber for the Townsville site was assumed to be a similar rate as of the Albury site, according to the data provided by Iplex. The electricity, LPG and water manufacturing inputs were all allocated based on kilogram of pipe produced in the PE production lines at each manufacturing site. For LPG, an energy density of 26.5 MJ/L was assumed for modelling.

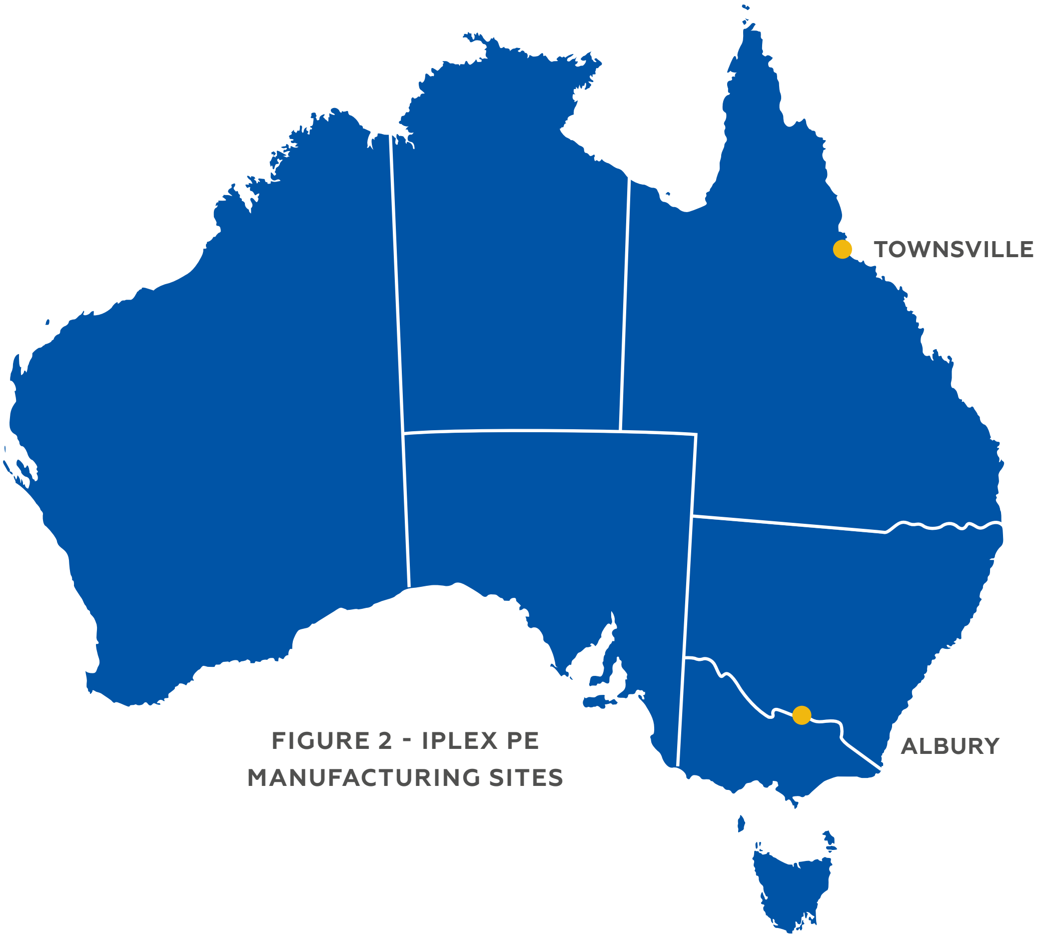


FIGURE 2 - IPLEX PE MANUFACTURING SITES

DISTRIBUTION STAGE

Iplex polyethylene pipes are sold primarily into regional areas of agricultural and mining applications, therefore requiring more road freight to site than for pipe products sold primarily into civil and building applications. Pipe in the form of straight length and coils is shipped by road except for Tasmania where the shipment happens by both road and ship transports. Road distances include distance from pipe extrusion factory to distribution centre and an average road distance from distribution centre to end customer. The impact of distribution was calculated by using the distance from manufacturing to each capital city in Australia weighted by PE pipe sales volumes in each state.

INSTALLATION STAGE

The environmental impacts and other indicators related to the installation stage of PE pressure pipes and other flexible pipes is highly dependent on the specific details relating to a particular pipeline's design. Variables include pipe diameter(s), length of the pipeline, installation technique, terrain, geology, environmental conditions, specified fill and embedment materials and the resultant installation techniques employed by the installing contractor. Given the significant number of variables involved, attempts to define an 'average' or 'typical' pipeline installation for the purpose of calculating environmental and resource impacts will be highly inaccurate. Moreover, it would be potentially misleading for the resultant numbers to be applied across the wide range of PE pipe diameters and applications and for these numbers to be used for comparative purposes. Consequently, the A5 Installation module will not be covered other than to outline the installation process and highlight those factors that influence the environmental impacts.

Iplex PE pressure pipes are available in a variety of lengths from straight lengths, typically 12 to 20m long, to coils that are hundreds of meters long (size limitations apply) and are usually installed below ground.

Coiled or butt-welded PE results in long continuous lengths of pipeline that can take advantage of trenchless installation techniques (e.g., pipe cracking, slip lining, and directional drilling). Trenchless installation may be preferred in some locations, for example, for road, rail, or river crossings, or to prevent disruption to above-ground assets and reduce restoration in urban environments. Trenchless techniques require the use of specialist equipment and other materials, for example, drilling mud for directional drilling and grout where required.

PE pipes can also be installed using typical open trench methods. The main factors which contribute to the impacts of installation for open trench buried 'flexible' pipes apply across a range of pipe materials although, in some cases, the trench with for PE pipe may be reduced compared to other flexible pipes due to above ground jointing. The AS/NZS 2566.2 Standard covers trench excavation and design, definition of fill and embedment zones and their respective compaction requirements and field testing of the installed pipeline. Installation design is also dependent on other design factors such location, construction and traffic loadings and minimum design requirements specified by infrastructure agencies such as Water Authorities. In all cases the diameter of the installed pipe significantly influences installation design which in turn directly influences environmental impacts associated with buried pipeline construction. LCA modelling of open trench installations shows that trench excavation, and provision and transport imported embedment materials account for the majority (90%) of environmental impacts. In many cases, the specifier and constructor can influence these factors and consequently the overall environmental impact of pipe installation.

A more detailed summary of the construction factors influencing environmental impacts for open trench installations are outlined below:

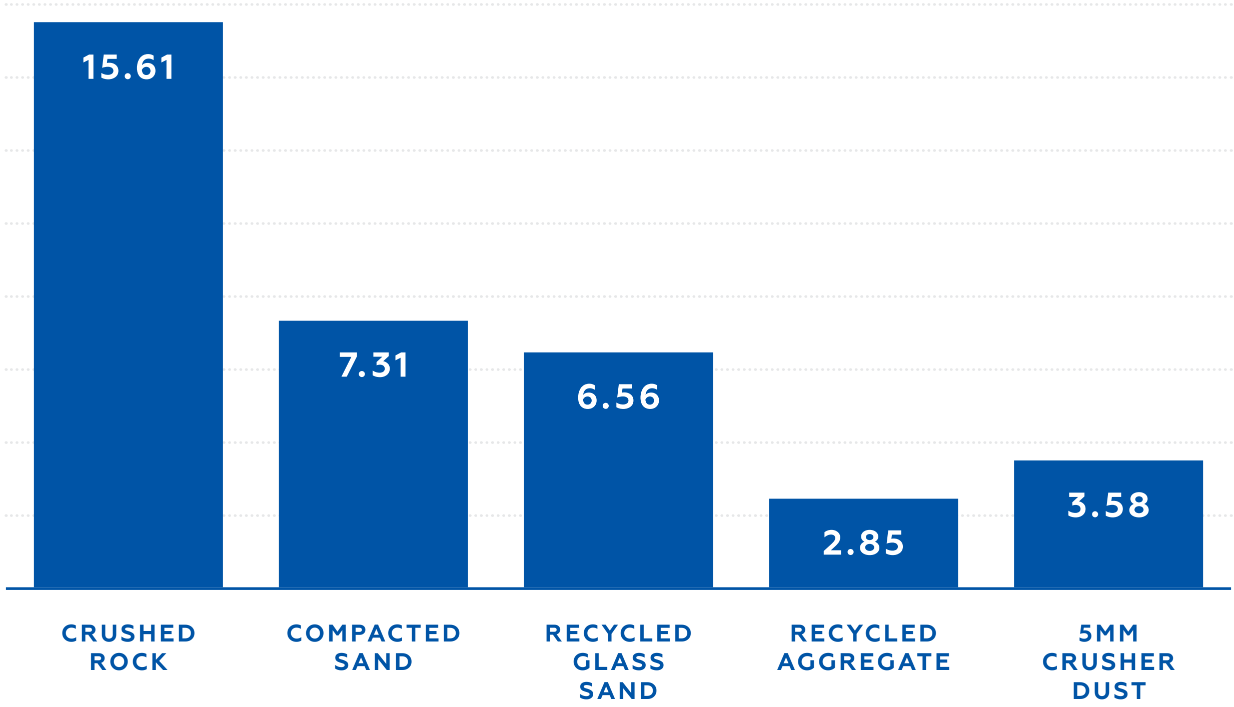
TRENCH EXCAVATION

Trench excavation, in particular diesel consumption by trenching excavators, governs most of the environmental and resource burden for the installation phase and is strongly correlated to the size of the trench and the type and configuration of excavator used. Additionally, there are various factors that affect efficiency of the excavator and speed of the excavation. Factors such as excavator bucket volume, bucket fill rate, cycle time, swing angle, type of excavated ground, as well as site environment and weather conditions, all influence the performance of the excavator. Equipment choice and operational efficiency is under the control of the trenching contractor.

FILL / EMBEDMENT

Type of fill / embedment materials are nominated by the pipeline designer, infrastructure owner or installer, and depend on the pipe application. LCA modelling shows that the use of screened and quarried virgin aggregate material (gravel) results in a higher environmental impact than other materials such as natural sand, recycled glass sand, crusher dust and concrete recycled into aggregate. The impact of different embedment materials on Global Warming Potential (GWP) is shown in Figure 2.

GLOBAL WARMING POTENTIAL (KG CO_2 EQ) PER M³ OF EMBEDMENT MATERIAL



- Transportation of fill materials that are required to be imported to site, and of excavated material from the site that cannot be used in the embedment zone will impact carbon footprint and energy consumed.
- The use of equipment for backfilling and compaction will also contribute to the total environmental impact. In terms of backfilling, this can be achieved either by using machinery or may be done manually. Compaction of embedment material can be achieved using powered portable compacting machines such as surface plate vibrators or by manual means using hand tampers in some circumstances. Where single size aggregate is used the required compaction may be achieved during material dumping.

PIPE LIFTING EQUIPMENT

In many cases small diameter PE pipes are light enough to be lifted into the trench by hand. However, this will be dependent upon trench depth. Larger diameter pipes will require mechanical lifting equipment, in many cases an excavator is used.

PIPE JOINTING

PE pressure pipes can be joined by a variety of methods including mechanical fittings and thermal fusion processes (welding). For smaller diameter pipes, mechanical compression fittings made from polypropylene are commonly used and joints are made with the assistance of hand operated tools only. Fusion jointing systems include butt fusion and electrofusion and have associated specialised fusion machines which require electrical power on site. Electrofusion jointing utilises moulded PE fittings containing electrical heating elements and are available in a variety of configurations including couplings, tees and saddle connections. The amount of energy required to perform thermal fusion operations is dependent upon the diameter and wall thickness of the pipe and the welding technique.

PACKAGING MATERIALS AND WASTE

Packaging materials include timbers and strapping used to protect the pipe during transport. In many cases, these may be reused or recycled rather than disposed of to landfill.

Wastage of pipe is minimal and is estimated that unusable offcuts account for less than 1%. Waste pipe offcuts which cannot be reused can be recycled.

USE STAGE

According to AS/NZS 4130:2009 and 4401:2006, the pipe systems can logically be expected to have a life expectancy of in excess of 100 years before major rehabilitation is required (Standards Australia, 2009: Standards Australia 2006). Maintenance of these pipe systems is not planned as deterioration of the pipe in service is not an issue.

The failure rate of the pipe itself is extremely low and is considered to be inconsequential (not relevant) in this EPD. Given the major risk with plastics pipe systems is third party interference, and that these PE pipe systems used primarily in mining and irrigation applications not sharing restricted footway allocations as with water and gas reticulation, it is significantly less likely that third parties will encounter these pipe systems.

4.0 LIFE CYCLE ASSESSMENT METHODOLOGY

This section includes the main details of the Life Cycle Assessment (LCA) study as well as assumptions and methods of the assessment. A summary of the life cycle assessment parameters is given in Table 4.

TABLE 4 – LCA INFORMATION

DECLARED UNIT	1 kg pipe
GEOGRAPHICAL COVERAGE	Australia
LCA SCOPE	Cradle to gate with option module A4
TIME REPRESENTATIVENESS	Foreground data on raw material requirements, manufacture, construction, and end-of-life inputs and outputs were provided first-hand by Iplex for the financial year 2020-2021.
DATABASE (S) AND LCA SOFTWARE USED	The inventory data for the process are entered into the SimaPro (v9.3.0.3) LCA software program and linked to the pre-existing data for the upstream feedstocks and services selected in order of preference from: • For Australia, the Australian Life Cycle Inventory (AusLCI) v1.36 compiled by the Australian Life Cycle Assessment Society ((ALCAS), Australian Life Cycle Inventory (AusLCI) – v1.36, 2021) and the Australasian Unit Process LCI v2014.09. The AusLCI database at the time of this report was 1 year old, while the Australasian Unit Process LCI was 8 years old. • Other authoritative sources (e.g., Ecoinvent v3.8, (Moreno, 2021)), where necessary adapted for relevance to Australian conditions (energy sources, transport distances and modes and so on, and documented to show how the data is adapted for national relevance). At the time of reporting, the Ecoinvent v3.8 database was 1 year old.

LCA requires a compilation of the inputs, outputs and environmental impacts of a product system throughout its life cycle. LCA can enable businesses to identify resource flows, waste generation and environmental impacts (such as climate change) associated with the provision of products and services.

Life cycle thinking is a core concept in sustainable consumption and production for policy and business. Upstream and downstream consequences of decisions must be taken into account to help avoid the shifting of burdens from one type of environmental impact to another, from one political region to another, or from one stage to another in a product's life cycle from the cradle to the grave.

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard, and EPDs might not be comparable, particularly if different functional units are used.

CORE DATA COLLECTION

All primary (foreground) data collected for this EPD was sourced from Iplex via a Request for Information spreadsheet. This data was collected for the financial year 2020-2021.
A small portion of pipes (1%) become wastage during installation as unusable offcuts.

BACKGROUND DATA

Generic background data was sourced for raw materials in the upstream module and transportation. Background data was adapted to represent Iplex PE pipe as accurately as possible. For Australia, the Australian Life Cycle Inventory (AusLCI) v1.36 compiled by the Australian Life Cycle Assessment Society ((ALCAS), Australian Life Cycle Inventory (AusLCI) – v1.36, 2021) and the Australasian Unit Process LCI v2014.09. The AusLCI database at the time of this report was 1 year old, while the Australasian Unit Process LCI was 8 years old. Other authoritative sources (e.g., Ecoinvent v3.8, (Moreno, 2021)), where necessary were adapted for relevance to Australian conditions (energy sources, transport distances and modes and so on, and documented to show how the data is adapted for national relevance). At the time of reporting, the Ecoinvent v3.8 database was 1 year old. Other sources with sensitivity analysis reported to show the significance of this data for the results and conclusions drawn.

DATA QUALITY AND VALIDATION

The primary data used for the study (core module) is based on direct utility bills or feedstock quantities from the Iplex's procurement records. Primary data was carefully reviewed in order to ensure completeness, accuracy and representativeness of the data supplied. Contribution analysis was used to focus on the key pieces of data contributing to the environmental impact categories. The data was benchmarked against relevant benchmark data in Ecoinvent. Overall, the data was deemed to be of high quality for the core module. According to EN15804+A2, the data quality ranking is as follows: geographical representativeness – very good; technical representativeness – very good and time representativeness – very good.

COMPLIANCE WITH STANDARDS

The LCA and EPD have been developed to comply with:

- ISO 14040:2006 and ISO14044:2006+A1:2018 which describe the principles, framework, requirements and provides guidelines for life cycle assessment (LCA) (ISO 14040, 2006) (ISO 14044, 2006).
- EN 15804+A2:2019: Sustainability of construction works – Environmental product declarations - Core rules

- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations -- Principles and procedures, which establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations (ISO 14025, 2006).
- ISO 14020:2000 Environmental labels and declarations — General principles, which describes the guiding principles for the development and use of environmental labels and declarations (ISO 14020, 2000).
- EN 15804+A2:2019: Sustainability of construction works – Environmental product declarations - Core rules for the product category of construction products- hereafter referred to as EN15804+A2 (BS EN 15804+A2, 2020).
- Product Category Rules (PCR) 2019:14, v1.1 – Construction products – hereafter referred to as PCR 2019:14 (PCR 2019:14, 2019).
- General Programme Instructions (GPI) for the International EPD System V3.01 – containing instructions regarding methodology and the content that must be included in EPDs registered under the International EPD System (Environdec, 2019).
- Instructions of EPD Australasia V3.0 – a regional annex to the general programme instructions of the International EPD System.

CUT-OFF RULES

It is common practice in LCA/LCI protocols to propose exclusion limits for inputs and outputs that fall below a threshold percentage of the total, but with the exception where the input/output has a "significant" impact it should be included. According to the PCR 2019:14, the Life Cycle Inventory data for a minimum of 95% of total inflows (mass and energy) per module to the upstream and core module shall be included, accounted as global warming potential (GWP) or energy consumption. Data gaps in included stages in the downstream modules shall be reported in the EPD, including an evaluation of their significance. In accordance with the PCR 2019:14 v1.11, the following system boundaries are applied to manufacturing equipment and employees:

- Environmental impact from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process are not accounted for in the LCI. Capital equipment and buildings typically account for less than a few percent of nearly all LCIs and this is usually smaller than the error in the inventory data itself. For this project, it is assumed that capital equipment makes a negligible contribution to the impacts as per Frischknecht et al. with no further investigation.

- Personnel-related impacts, such as transportation to and from work, are also not accounted for in the LCI. The impacts of employees are also excluded from inventory impacts on the basis that if they were not employed for this production or service function, they would be employed for another. It is very hard to decide what proportion of the impacts from their whole lives should count towards their employment. For this project, the impacts of employees are excluded.

Besides these exclusions, no energy or mass flows were excluded.

ALLOCATION

According to EN 15804 A2:2019, in a process step where more than one type of product is generated, it is necessary to allocate the environmental stressors (inputs and outputs) from the process to the different products (functional outputs) in order to get product-based inventory data instead of process-based data. An allocation problem also occurs for multi-input processes. In an allocation procedure, the sum of the allocated inputs and outputs to the products shall be equal to the unallocated inputs and outputs of the unit process.

The following stepwise allocation principles shall be applied for multi-input/output allocations:

- The initial allocation step includes dividing up the system sub-processes and collecting the input and output data related to these sub-processes.
- The first (preferably) allocation procedure step for each sub-process is to partition the inputs and outputs of the system into their different products in a way that reflects the underlying physical relationships between them.
- The second (worst case) allocation procedure step is needed when physical relationship alone cannot be established or used as the basis for allocation. In this case, the remaining environmental inputs and outputs from a sub-process must be allocated between the products in a way that reflects other relationships between them, such as the economic value of the products.

There are no co-products from the production of Iplex PE pipe and therefore allocation issues were avoided. There is no double counting of the impact from any manufacturing or other associated processes.

Iplex PE pipes are manufactured in Albury (NSW) and Townsville (QLD). Mass and energy data have been sourced from the manufacturing plant by Iplex. The quantities of materials and electricity required for producing Iplex PE pipe are calculated on the basis of the amount (tonnes) of pipe manufactured on a particular site in financial year 2020-2021 and the associated electricity consumption for that particular product line. This data is also recorded as part of the standard quality assurance purpose.

The allocation approach for the background LCA databases utilised in this report is also compliant with the PCR. More specifically, the burden of primary production of materials is always allocated to the primary user of a material, while secondary (recycled) materials bear only the impacts of the recycling processes. There is no use of secondary materials and fuels.

5.0 IPLEX PE PIPE ENVIRONMENTAL PERFORMANCE

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks. Most LCA tools have libraries of impact assessment methods that can completely automate the impact assessment. The following potential environmental impacts, use of resources and waste categories have been calculated in the SimaPro (v9.1.1.1) tool.

TABLE 5 – LIFE CYCLE IMPACT, RESOURCE AND WASTE ASSESSMENT CATEGORIES, MEASUREMENTS AND METHODS

IMPACT CATEGORY	ABBREVIATION	MEASUREMENT UNIT	ASSESSMENT METHOD AND IMPLEMENTATION
POTENTIAL ENVIRONMENTAL IMPACTS			
Global Warming Potential (Fossil)	GWPF	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Global Warming Potential (Biogenic)	GWPB	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Land Use/Land Transformation	GWPL	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Total Global Warming Potential	GWPT	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Acidification Potential	AP	mol H^+ eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication – Aquatic Freshwater	EP – Freshwater	kg P_O43^- equivalents	CML (v4.1)
Eutrophication – Aquatic Freshwater	EP – Freshwater	kg P equivalent	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe[2]
Eutrophication – Aquatic Marine	EP – Marine	kg N equivalent	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication – Terrestrial	EP – terrestrial	mol N equivalent	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical Ozone Creation Potential	POCP	kg NMVOC equivalents	LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe
Abiotic Depletion Potential (Elements)*	ADPE	kg Sb equivalents	CML (v4.1)
Abiotic Depletion Potential (Fossil Fuels)*	ADPF	MJ net calorific value	CML (v4.1)
Ozone Depletion Potential	ODP	kg CFC 11 equivalents	Steady-state ODPs, WMO 2014
Water Depletion Potential*	WDP	m^3 equivalent deprived	Available WAter REmaining (AWARE) Boulay et al., 2016
Global Warming Potential, Excluding Biogenic Uptake, Emissions and Storage	GWP-GHG	kg CO_2 equivalents (GWP100)	CML (v4.1)
RESOURCE USE			
Use of Renewable Primary Energy Excluding Renewable Primary Energy Resources Used as Raw Materials	PERE	MJ, net calorific value	ecoinvent version 3.6 and expanded by PRé Consultants[3]
Use of Renewable Primary Energy Resources Used as Raw Materials	PERM	MJ, net calorific value	Manual for direct inputs [4]
Total Use Of Renewable Primary Energy Resources (Primary Energy and Primary Energy Resources Used as Raw Materials)	PERT	MJ, net calorific value	ecoinvent version 3.6 and expanded by PRé Consultants

Use of Non-Renewable Primary Energy Excluding Non-Renewable Primary Energy Resources Used as Raw Materials	PENRE	MJ, net calorific value	Manual for direct inputs[5]
Use of Non-Renewable Primary Energy Resources Used as Raw Materials	PENRM	MJ, net calorific value	ecoinvent version 3.6 and expanded by PRé Consultants
Total Use of Non- Renewable Primary Energy Resources (Primary Energy and Primary Energy Resources Used as Raw Materials)	PENRT	MJ, net calorific value	ecoinvent version 3.6 and expanded by PRé Consultants[6]
Use of Secondary Material	SM	kg	Manual for direct inputs
Use of Renewable Secondary Fuels	RSF	MJ, net calorific value	Manual for direct inputs
Use of Non-Renewable Secondary Fuels	NRSF	MJ, net calorific value	Manual for direct inputs
Use of Net Fresh Water	FW	m^3	ReCiPe 2016
WASTE CATEGORIES			
Hazardous Waste Disposed	HWD	kg	EDIP 2003 (v1.05)
Non-Hazardous Waste Disposed	NHWD	kg	EDIP 2003 (v1.05)[7]
Radioactive Waste Disposed/ Stored	RWD	kg	EDIP 2003 (v1.05)
ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS			
Particulate Matter	Potential incidence of disease due to PM emissions (PM)	Disease Incidence	SETAC-UNEP, Fantke et al. 2016
Ionising Radiation - Human Health**	Potential Human exposure efficiency relative to U235 (IRP)	kBq U-235 eq	Human Health Effect model
Eco-Toxicity (Freshwater)*	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	CTUe	USEtox version 2
Human Toxicity Potential - Cancer Effects*	Potential Comparative Toxic Unit for humans (HTP-c)	CTUh	USEtox version 2
Human Toxicity Potential - Non Cancer Effects*	Potential Comparative Toxic Unit for humans (HTP-nc)	CTUh	USEtox version 2
Soil Quality*	Potential soil quality index (SQP)	Dimensionless	Soil quality index (LANCA®)

[2]EN 15804:2012+A2:2019 specifies that the unit for the indicator for Eutrophication aquatic freshwater shall be kg PO4 eq, although the reference given ("EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe") uses the unit kg P eq. This is likely a typographical error in EN 15804, which is expected to be corrected in a future revision. Until this has been corrected, results for Eutrophication aquatic freshwater shall be given in both kg PO4 eq and kg P eq. in the EPD. [3]Method to calculate Cumulative Energy Demand (CED), based on the method published by Ecoinvent version 2.0 and expanded by PRé Consultants for raw materials available in the SimaPro database. [4]Calculated based on the lower heating value of renewable raw materials. [5]Calculated based on the lower heating value of non-renewable raw materials. [6]Calculated as sum of Non-renewable, fossil, Non-renewable, nuclear and Non-renewable, biomass. [7]Calculated as sum of Bulk waste and Slags/ash.

RESULTS FOR IPLEX PE PIPE

TABLE 6 – ENVIRONMENTAL IMPACTS FOR PE PIPE

INDICATOR	UNIT	A1-A3	A4
GWP-F	kg CO_2 eq.	3.33	0.15
GWP - B	kg CO_2 eq.	-0.013	8.30E-06
GWP - Luluc	kg CO_2 eq.	1.27E-03	4.84E-07
GWP - T	kg CO_2 eq.	3.32	0.15
ODP	kg CFC 11 eq.	7.31E-08	4.58E-09
AP	mol H^+ eq.	0.017	8.10E-04
EP - F	kg PO_4^{3-} eq.	2.54E-03	8.25E-05
EP - F	kg P eq.	4.35E-04	2.68E-06
EP - M	kg N eq.	3.28E-03	2.08E-04
EP - T	mol N eq.	0.035	2.30E-03
POCP	kg NMVOC eq.	9.69E-03	7.31E-04
ADP	kg Sb eq.	1.54E-05	2.65E-07
ADP - F	MJ	79.6	0.44
WDP	m^3	6.48	0.72

TABLE 7 – RESOURCE USE FOR PE PIPE

INDICATOR	UNIT	A1-A3	A4
PERE	MJ	1.64E+00	9.14E-03
PERM	MJ	0.00E+00	0.00E+00
PERT	MJ	1.64E+00	9.14E-03
PENRE	MJ	8.50E+01	4.63E-01
PENRM	MJ.	0.00E+00	0.00E+00
PENRT	MJ	8.50E+01	4.63E-01
SM	kg	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00
FW	m^3	1.41E-02	1.70E-04

TABLE 8 – WASTE PRODUCTION FOR PE PIPE

INDICATOR	UNIT	A1-A3	A4
Hazardous waste disposed	kg	1.49E-05	1.21E-06
Non-hazardous waste disposed	kg	2.46E-01	1.20E-02
Radioactive waste disposed	kg	3.79E-05	5.66E-09

TABLE 9 – OUTPUT FLOWS FOR PE PIPE

INDICATOR	UNIT	A1-A3	A4
Components for re-use	kg	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00

TABLE 10 – ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS FOR PE PIPE

INDICATOR	UNIT	A1-A3	A4
GWP-GHG	kg CO_2 eq.	3.16E+00	1.50E-01
Particulate matter	Disease Incidence	1.22E-07	1.25E-08
Ionising radiation - human health	kBq U-235 eq	7.86E-02	3.96E-05
Eco-toxicity (freshwater)	CTUe	3.19E+01	3.24E+00
Human toxicity potential - cancer effects	CTUh	9.20E-10	4.55E-11
Human toxicity potential - non cancer effects	CTUh	2.33E-08	2.47E-09
Soil quality	Dimensionless	7.72E+00	1.72E-01

INFORMATION ON BIOGENIC CARBON CONTENT

TABLE 11 – BIOGENIC CARBON CONTENT FOR 1 KG OF PE PIPE

BIOGENIC CARBON CONTENT	UNIT	QUANTITY
Biogenic carbon content in product	kg C	0.00E+00
Biogenic carbon content in packaging	kg C	6.23E-03

Note: 1 kg biogenic carbon is equivalent to 44/12kg CO_2.

INTERPRETATION OF RESULTS

POTENTIAL ENVIRONMENTAL IMPACTS

- The product stage (i.e., **A1-A3**) is the primary contributor to GWPT and water depletion impacts in the modules **A1-A4**,. **95.6%** of GWPT arises from the product stage or **A1-A3** modules.
  - The product stage (**A1-A3)** contributes to **93-99.4%** of all other environmental impact categories except WDP.
  - WDP impacts from A1-A3 modules account for **90%**.
  - In case of GWPT impacts, PE resin is the highest contributor of A1-A3 GWPT impacts **(72.5%)** followed by carbon black (0.5%).
- In any impact category except WDP, contributions from distribution (A4) ranges from 0.6% to 7%.

RESOURCE USE

- The major resource use impacts in the modules **A1-A4** originate from the product stages **(A1-A3)**, ranging between **98.8-99.5%**.
  - PE resin the highest renewable resources accounting for **61.4%** of total lifecycle renewable utilisation. The second largest renewable resources user is the carbon black, accounting for 0.2% of the total lifecycle renewable resources.
  - PE resin is the largest non-renewable resource user accounting for **93%** of total lifecycle non-renewable resource utilisation. This is followed by carbon black that accounts for 0.8% of total lifecycle non-renewable resources.
  - The highest contributor to lifecycle Fresh Water use is from PE resin, accounting for **94.2%**. Carbon black uses a negligible (nearly zero) amount of whole lifecycle Fresh Water.
- There is no use of renewable secondary fuels.
- The renewable resource use impact is 1.9% of total renewable and non-renewable resource use impacts.

WASTE AND OUTPUT FLOWS

- **100%** of all waste generated in modules A1-A4 is non-hazardous.
  - The product stage (A1-A3) contributes to **95.4%** of all non-hazardous waste generated. PE resin is the highest contributor to non-hazardous waste, accounting for about **69.5%.**
  - Carbon black contributors only 0.3% of total lifecycle non-hazardous waste.

6.0 ADDITIONAL ENVIRONMENTAL INFORMATION

The plastic products are highly inert and are used predominantly in outdoor applications. They do not release any dangerous substances to indoor air, soil, or water.

GUIDANCE FOR PE PIPE RECYCLING

All PE pipe offcuts from installation can be completely recycled back into new pipe products. There are general plastics recyclers in all Australian capital cities that will recycle PE or contact Iplex. Although the PE pipes covered in this EPD are most likely to be left in the ground at end of life, PE has a high recyclability and can be mechanically or chemically recycled to replace virgin polyethylene in new products.

Iplex Pipeback™ Program offers a streamlined service for recycling polyethylene pipes post-consumer back into manufacturing process with collection depots in Queensland, South Australia, Victoria and New South Wales.

Iplex recycling facilities will accept clean and unused pipe offcuts and fittings. For more information and to arrange a convenient drop-off time (by appointment only) please complete the 'contact us' form on the Iplex website. Once Iplex has received your request a recycling team member will be in touch.

7.0 PRODUCT SPECIFICATIONS

The following table can be used to calculate the environmental results for specific Iplex PE pipe products. The density and length of pipe give the total mass of pipe for each product code.

TABLE 12 – PRODUCT SPECIFICATIONS FOR PE SOLID WALL PIPE PRODUCTS

SDR	41				26				21				17			
PN for PE100	4				6.3				8				10			
DN	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	1.6	21.7	1.2	0.12
32	-	-	-	-	-	-	-	-	1.6	28.7	1.3	1.3	1.9	28	1.3	0.19
40	-	-	-	-	-	-	-	-	1.9	36.1	1.4	1.4	2.4	35	1.4	0.3
50	-	-	-	-	-	-	-	-	2.4	45	1.4	1.4	3	43.9	1.4	0.46
63	-	-	-	-	2.4	58.1	1.5	0.48	3	56.9	1.5	1.5	3.8	55.2	1.5	0.73
75	-	-	-	-	2.9	69.2	1.6	0.68	3.6	67.7	1.6	1.6	4.5	65.8	1.6	1.03
90	-	-	-	-	3.5	83	1.8	0.99	4.3	81.3	1.8	1.8	5.4	79	1.8	1.48
110	2.7	104.7	2.2	0.95	4.3	101.3	2.2	1.48	5.3	99.2	2.2	2.2	6.6	96.5	2.2	2.2
125	3.1	118.9	2.5	1.24	4.8	115.4	2.5	1.86	6	112.9	2.5	2.5	7.4	109.9	2.5	2.8
140	3.5	133.2	2.8	1.56	5.4	129.2	2.8	2.35	6.7	126.5	2.8	2.8	8.3	123	2.8	3.52
160	4	152.3	3.2	2.02	6.2	147.6	3.2	3.08	7.7	144.5	3.2	3.2	9.5	140.7	3.2	4.59
180	4.4	171.5	3.6	2.51	6.9	166.3	3.6	3.84	8.6	163.1	3.6	3.6	10.7	158.3	3.6	5.81
200	4.9	190.5	4	3.08	7.7	184.6	4	4.76	9.6	180.6	4	4	11.9	175.8	4	7.16
225	5.5	214.4	4.5	3.9	8.6	207.9	4.5	5.98	10.8	203.3	4.5	4.5	13.4	197.8	4.5	9.09
250	6.2	238	5	4.89	9.6	230.9	5	7.41	11.9	226	5	5	14.8	220	5	11.14
280	6.9	266.7	9.8	6.06	10.7	258.7	9.8	9.25	13.4	253	9.8	9.8	16.6	246.3	9.8	13.99
315	7.7	300.2	11.1	7.62	12.1	290.9	11.1	11.78	15	284.9	11.1	11.1	18.7	276.6	11.1	17.72
355	8.7	338.2	12.5	9.69	13.6	327.9	12.5	14.89	16.9	321	12.5	12.5	21.1	312.1	12.5	22.55
400	9.8	380	14	12.28	15.3	369.5	14	18.88	19.1	361.5	14	14	23.7	351.9	14	28.5
450	11	428.9	15.6	15.49	17.2	415.8	15.6	23.87	21.5	406.8	15.6	15.6	26.7	395.9	5.6	36.11
500	12.3	476.3	17.5	19.28	19.1	462	17.5	29.45	23.9	452	17.5	17.5	29.6	439.9	17.5	44.48
560	13.7	533.6	19.6	24	21.4	517.4	19.6	36.91	26.7	506.4	19.6	19.6	33.2	492.7	19.6	55.89
630	15.4	600.4	22.1	30.37	24.1	582.1	22.1	46.77	30	569.8	22.1	22.1	37.3	554.4	22.1	70.62
710	17.4	676.5	24.9	38.65	27.2	655.9	24.9	59.45	33.9	641.9	24.9	24.9	42.1	624.6	24.9	89.82
800	19.6	762.3	28	49.01	30.6	739.2	28	75.29	38.1	723.4	28	28	47.4	703.9	28	113.89
900	22	857.8	31.5	61.81	34.4	831.7	31.5	95.23	42.9	813.9	31.5	31.5	53.5	791.7	31.5	144.55
1000	24.5	952.9	35	76.54	38.2	924.1	35	117.5	47.7	904.2	35	35	59.3	879.8	35	178.06
1200	29.4	1143.1	42	110.14	45.9	1108.5	42	169.18	57.2	1084.7	42	42	67.9	1062.7	42	245.17
1400	34.4	1332.6	49	150.19	53.2	1293.1	49	239.54	66.7	1266.1	49	49	82.4	1233.1	49	346.07
1600	39.3	1522.3	56	195.75	61.3	1476.1	56	300.95	76.2	1447	56	56	94.1	1409.4	56	451.49
1800	43.8	1716	-	245.95	69.1	1662.8	-	382.16	85.7	1628	63	63	-	-	-	-
2000	48.8	1906.4	-	304.41	76.9	1847.4	-	472.24	95.2	1808.9	70	70	-	-	-	-

TABLE 12 – PRODUCT SPECIFICATIONS FOR PE SOLID WALL PIPE PRODUCTS (CONTINUED)

13.6				11				9				7.4				SDR
12.5				16				20				25				PN for PE100
Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	Min Wall	Mean ID	Out of Roundness Max	Weight Ave kg/m	DN
-	-	-	-	1.6	12.7	1.2	0.08	1.8	12.3	1.2	0.08	2.2	11.4	1.2	0.1	**16**
1.6	16.7	1.2	0.1	1.9	16	1.2	0.11	2.3	15.2	1.2	0.13	2.8	14.2	1.2	0.16	**20**
1.9	21	1.2	0.14	2.3	20.2	1.2	0.17	2.8	19.2	1.2	0.2	3.5	17.7	1.2	0.24	**25**
2.4	27	1.3	0.23	2.9	26	1.3	0.27	3.6	24.5	1.3	0.33	4.4	22.8	1.3	0.39	**32**
3	33.8	1.4	0.36	3.7	32.3	1.4	0.43	4.5	30.6	1.4	0.52	5.5	28.5	1.4	0.61	**40**
3.7	42.4	1.4	0.55	4.6	40.4	1.4	0.67	5.6	38.4	1.4	0.8	6.9	35.7	1.4	0.95	**50**
4.7	53.3	1.5	0.88	5.8	51	1.5	1.07	7.1	48.2	1.5	1.28	8.6	45.1	1.5	1.5	**63**
5.5	63.7	1.6	1.23	6.8	61	1.6	1.49	8.4	57.6	1.6	1.79	10.3	53.6	1.6	2.13	**75**
6.6	76.5	1.8	1.77	8.2	73	1.8	2.16	10.1	69.1	1.8	2.59	12.3	64.5	1.8	3.05	**90**
8.1	93.3	2.2	2.66	10	89.4	2.2	3.2	12.3	84.5	2.2	3.84	15.1	78.6	2.2	4.57	**110**
9.2	106.1	2.5	3.42	11.4	101.5	2.5	4.15	14	96.1	2.5	4.96	17.1	89.5	2.5	5.88	**125**
10.3	118.9	2.8	4.29	12.7	113.9	2.8	5.17	15.7	107.6	2.8	6.23	19.2	100.2	2.8	7.39	**140**
11.8	135.9	3.2	5.6	14.6	130	3.2	6.78	17.9	123	3.2	8.11	21.9	114.7	3.2	9.62	**160**
13.3	152.8	3.6	7.1	16.4	146.3	3.6	8.58	20.1	138.5	3.6	10.26	24.6	129.1	3.6	12.16	**180**
14.7	170	4	8.71	18.2	162.5	4	10.57	22.4	153.7	4	12.68	27.3	143.4	4	15	**200**
16.6	191	4.5	11.06	20.5	182.9	4.5	13.39	25.1	173.2	4.5	16	30.8	161.3	4.5	19.02	**225**
18.4	212.4	5	13.63	22.7	203.4	5	16.46	27.9	192.5	5	19.73	34.2	179.2	5	23.48	**250**
20.6	237.9	9.8	17.08	25.4	227.8	9.8	20.64	31.3	215.4	9.8	24.8	38.3	200.7	9.8	29.44	**280**
23.2	267.6	11.1	21.64	28.6	256.3	11.1	26.13	35.2	242.4	11.1	31.38	43	226.1	11.1	37.16	**315**
26.1	301.6	12.5	27.43	32.2	288.8	12.5	33.16	39.6	273.3	12.5	39.76	48.5	254.6	12.5	47.24	**355**
29.4	339.9	14	34.79	36.3	325.4	14	42.1	44.7	307.8	14	50.55	54.6	287	14	59.92	**400**
33.1	382.4	15.6	44.07	40.9	366.1	15.6	53.31	50.2	346.5	15.6	63.9	61.5	322.8	15.6	75.92	**450**
36.8	424.9	17.5	54.38	45.4	406.8	17.5	65.78	55.8	385	17.5	78.86	-	-	-	-	**500**
41.2	475.8	19.6	68.22	50.8	455.8	19.6	82.4	62.5	430.3	19.6	98.93	-	-	-	-	**560**
46.3	535.5	22.1	86.23	57.2	512.6	22.1	104.42	70.3	484.1	22.1	125.2	-	-	-	-	**630**
52.2	603.4	24.9	109.55	64.5	577.6	24.9	132.64	79.3	546.5	24.9	159.13	-	-	-	-	**710**
58.8	680	28	138.96	72.5	651	28	168.11	89.3	615.9	28	201.9	-	-	-	-	**800**
66.2	764.9	31.5	176.04	81.7	732.4	31.5	212.91	-	-	-	-	-	-	-	-	**900**
72.5	852.1	35	214.41	90.3	814.9	35	261.4	-	-	-	-	-	-	-	-	**1000**
88.2	1020	42	312.54	-	-	-	-	-	-	-	-	-	-	-	-	**1200**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1400**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1600**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1800**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2000**

Note:
1) All dimensions are in millimetres and mass in kg/m.
2) Nominal Diameter (DN) equals outside diamter.
3) These dimensions also apply to THERMAPIPE®.

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FOR ALL ENQUIRIES AND ORDERS CONTACT IPLEX PIPELINES

WWW.IPLEX.COM.AU

Plumbing and Irrigation **1300 0 IPLEX**

Civil **13 10 86**

Email **info@iplexpipelines.com.au**

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