Environmental Product Declaration (EPD)

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021

Ready-Mixed Concrete
"ES4022@4CB (S40/22@4/120SL)"
supplied to the Macquarie University Engineering and Astronomy Building

Artist's impression of the Macquarie University Engineering and Astronomy Building (Iconic Structures 2024)

Programme: The International EPD® System www.environdec.com
Programme operator: EPD International AB
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Geographical scope: Australia

EPD of a single concrete product from one location
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.epd-australasia.com

Contents

Disclaimer

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.

Programme information and verification

An Environmental Product Declaration (EPD) is a standardised way of quantifying the potential environmental impacts of a product or system. EPDs are produced according to a consistent set of rules – Product Category Rules (PCR) – that define the requirements within a given product category. These rules are a key part of ISO 14025 as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for a selected concrete product, manufactured at Gunlake´s Silverwater facility in the Greater Sydney region in New South Wales (NSW), Australia.
This EPD is a "cradle-to-gate plus modules C1-C4, D" declaration covering production and end-of-life life cycle stages.
This EPD is verified to be compliant with EN 15804. EPDs of construction products may not be comparable if they do not comply with EN15804. EPDs within the same product category but from different programs or utilising different PCR documents may not be comparable, see the disclaimer on the previous page.
Gunlake Concrete NSW Pty Ltd, as the EPD owner, has the sole ownership, liability, and responsibility for the EPD.

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CEN standard EN 15804 served as the core PCR

PCR:	PCR 2019:14 Construction Products, Version 1.3.2, 2023-12-08 (valid until 2024-12-20) C-PCR-003 (to 2019:14) Concrete and concrete elements, version 2023-01-02
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: *No chair appointed.* Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification (Internal) ☒ EPD verification (External)
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About Gunlake

Gunlake is the largest independent supplier of concrete and quarry products in the Sydney Region and NSW. Over the last 17 years Gunlake have developed a cycle of continuous growth building state-of-the-art concrete batch plants. Currently we have five concrete plants in operation and another in the planning phase.

The Gunlake Group are a proudly Australian owned, family company spanning four generations in the quarrying and concrete industry in Australia. We strive to deliver:

- Industry leading service,
- The highest quality products, and
- Innovative solutions to support our customers' requirements.

Beginning with one concrete plant and plans for a quarry in 2007, Gunlake Group has grown in 2024 to five operational concrete plants. We have a fleet of 105 concrete agitators with more to come. The quarry at Marulan is currently consented for 4.2 million tonnes per annum and services the concrete, asphalt, civil and infrastructure markets and recently completed the supply of 450,000 tonnes of crushed rock to the new Western Sydney Airport's runway.

Gunlake Quarries is a supplier of premium quarry materials across New South Wales. Gunlake Quarries is proud to deliver premium aggregate to Gunlake Concrete, as well as some of Australia's largest infrastructure projects.

This EPD covers a single concrete mix, manufactured at the Silverwater plant, in NSW.

Product description

Gunlake produces Ready-Mixed concrete in line with Australian Standards, AS1379 Specification and Supply of Concrete.

The product covered by this EPD is manufactured at Gunlake's Silverwater plant in the western part of Sydney, NSW. The concrete is used in the construction of the Macquarie University Engineering and Astronomy Building located in Macquarie University's campus in Macquarie Park, Sydney.

The product included in this EPD and its strength grade is shown below. The product composition is presented in Table 1. For reasons of confidentiality, a range is provided.

Product	Strength grade	Density
ES4022@4CB (S40/22@4/120SL)	40 MPa	2368 kg/m^3

Table 1: Product content

Ingredient	Proportion (% m/m)	Post-consumer material, weight (%)	Renewable material, weight (%)
General Purpose Cement ¤	6-16%	0%	0%
Fly Ash †	1-5%	0%	0%
Slag (GGBFS) †	0-8%	0%	0%
Silica fume †	-	0%	0%
Coarse aggregates †	27-44%	0%	0%
Manufactured sand †	9-20%	0%	0%
Natural sand †	17-30%	0%	0%
Admixtures	<0.3%	0%	0%
Water	7-9%	0%	0%

¤ Cement in concrete contains traces of Chromium VI (hexavalent).
† Crystalline-silica (quartz) may be a constituent of sand, crushed stone, gravel, silica fume, blast furnace slag and fly ash used in any particular concrete mix.

Concrete products, as supplied, are non-hazardous. The product included in this EPD does not contain any substances of very high concern as defined by European REACH regulation* in concentrations >0.1% (m/m). Dust from this product is classified as Hazardous according to the Approved Criteria for Classifying Hazardous Substances 3rd Edition (NOHSC 2004). Concrete products are classified as non-dangerous goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. When concrete products are cut, sawn, abraded or crushed, dust is created which contains crystalline silica, some of which may be respirable (particles small enough to go into the deep parts of the lung when breathed in), and which is hazardous. Exposure through inhalation should be avoided.

The product code for ready mixed concrete is UN CPC 375 (Articles of concrete, cement and plaster) and ANZSIC 20330 (Concrete – ready mixed – except dry mix).

* Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals.

Technical Compliance

Gunlake concrete products comply with relevant technical specifications as per AS 1379:2007 "Specification and supply of concrete", applicable legislation, regulations and industry standards plus project requirements.

G-Lab Materials Testing Pty Ltd is Gunlake's 100% owned in-house laboratory that is NATA accredited. G-lab drives the highest standards of concrete and quarry material performance.

Declared unit

"1 cubic metre (m^3) of ready-mixed concrete, as ordered by our clients"

Scope of the Environmental Product Declaration

This EPD covers life cycle stages A1-A3, C1-C4 and D. This EPD covers the processes that occur in as many of the product's life cycle stages as could be effectively modelled. Stages A4, A5 and B1-B7 have not been included as these are better defined at building or structure level.

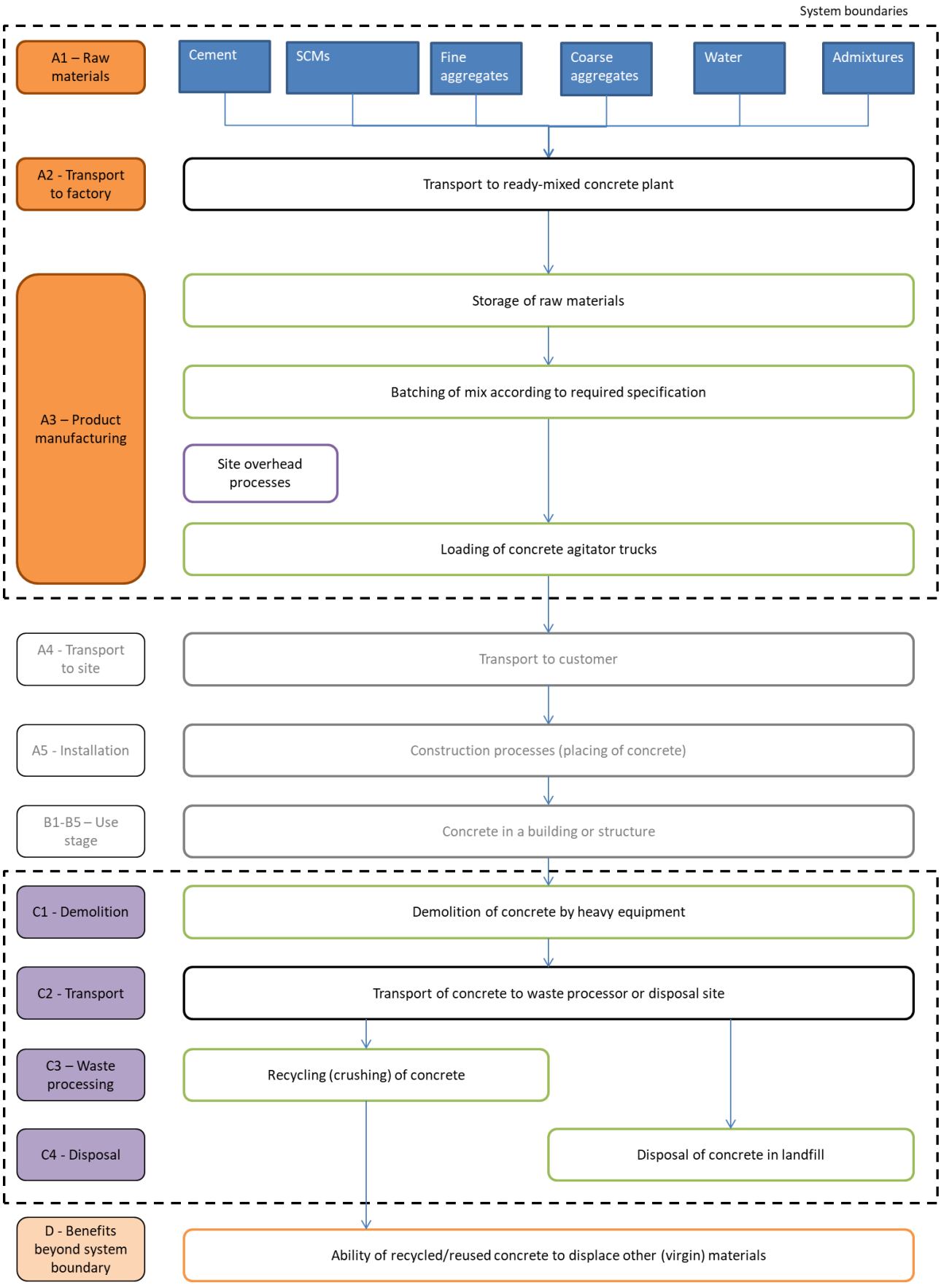
Table 2: Scope of EPD

Stages	Product Stage			Construction Stage		Use Stage							End-of-life Stage				Benefits beyond system boundary
	Raw Materials	Transport	Production	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/Demolition	Transport	Waste Processing	Disposal	Reuse, recovery, recycling potential
Modules	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
				Scenario		Scenario							Scenario				Scenario
Modules Declared	✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	✓	✓	✓	✓	✓
Geography	AU, JP	AU	AU										AU	AU	AU	AU	AU
Share of specific data	>80%																
Variation products	0%																
Variation sites	0%																

✓ = module is included in this study

ND = module is not declared. When a module is not accounted for, the stage is marked with "ND" (Not Declared). ND is used when we cannot define a typical scenario.

Figure 3 – Flow diagram of main ready-mixed concrete production processes, life cycle stages and visualization of system boundaries



Product Stage (A1-A3)

Raw Materials – Module A1

Extraction and processing of raw materials results in environmental impacts from the use of energy and resources, as well as from process emissions and waste.

- Cement is mainly produced from clinker (made from limestone) and gypsum.
- Aggregates are extracted from quarries. (Coarse aggregates and manufactured sand are sourced from Gunlake's Marulan Quarry.)
- Supplementary Cementitious Materials (SCM): Fly ash, GGBFS (ground granulated blast furnace slag) and silica fume are rest products from electricity generation, steel production, and (ferro)silicon production, respectively.
- Admixtures are specialised chemical formulations that are typically produced by blending selected ingredients.

Transportation – Module A2

Raw materials are typically transported from suppliers to our site via (articulated) trucks. Transport of raw materials has been included in the LCA based upon actual transport modes and distances relevant to our site in Silverwater.

Manufacturing – Module A3

Ready-mixed concrete products are manufactured by mixing the concrete constituents in carefully dosed quantities to achieve desired engineering properties.

The "**Construction process stage**" and "**Use stage**" have been excluded from the life cycle assessment, as the ready-mixed concrete can be used for a range of different applications for which the use scenarios are unknown. The impacts of these stages are best determined at project level.

End of life stage (C1-C4)

The end-of-life modules for Ready-Mixed concrete are based on generic scenarios. The scenarios included are currently in use and are representative for one of the most probable alternatives.

Module C1 covers demolition of the concrete at the end of its service life. For concrete produced in Prestons, we have used the end-of-life scenario representative for NSW building & demolition materials products based on the National Waste Report 2022 (NWR 2022). This scenario implies that 79.6% of the concrete is recycled and the remaining 20.4% of the concrete is sent to landfill.

Module C2 comprises the transport from the demolition site to a recycling centre or landfill site (50km). Module C3 encompasses the recycling process (i.e. crushing of concrete), while Module C4 represents disposal of concrete in a landfill site.

The concrete reaches end-of-waste status when it is crushed and stockpiled as "recycled crushed concrete" (RCC) aggregates.

We have modelled a single scenario for concrete with a density of 2,400 kg/m^3. This is a conservative value for the concrete mixes covered by the Macquarie University EPDs. The impact of this simplification is much smaller than the impact of the scenario and data assumptions applied to the end-of-life modules.

Due to high uncertainty in the parameters and lack of data, CO_2-uptake (carbonation) has not been included at end-of-life.

Resource recovery stage (D)

Module D includes any benefits and loads from net flows leaving the product system (that have passed the end-of-waste state). For this EPD, any material collected for recycling and processed in Module C3, is considered to go through to Module D. We have assumed that Recycled Crushed Concrete aggregates (the output of module C3) replace virgin aggregates (crushed rocks) in module D.

Per cubic metre of concrete, module D credits the avoided impacts for 1.91 tonnes of crushed aggregates.

Table 3: End-of-life scenario parameters

Processes	Quantity per m^3 of concrete	Unit
Collection process specified by type	2,400 0	kg collected separately kg collected with mixed construction waste
Transport from demolition site to recovery / disposal sites	50	km transport
Recovery system specified by type	0 1,910 0	kg for re-use kg for recycling kg for energy recovery
Disposal to landfill	490	kg product or material for final deposition
Assumptions for scenario development	145	MJ of diesel for the demolition process (C1)

Life Cycle Assessment (LCA) Methodology

Background Data

Gunlake Concrete has collected and supplied the primary data for the ready-mixed concrete LCA based on the FY21 reporting period (1 July 2020 – 30 June 2021). Gunlake Quarries provided data for the coarse aggregates and manufactured sand that they supply to Gunlake Concrete. Background data is predominantly sourced from AusLCI and the AusLCI shadow database v1.42 (AusLCI 2023). Data for admixtures has been sourced from EPDs published by EFCA (EFCA 2021a, 2021b, 2023). As a result, the vast majority of the environmental profile of our products is based on life cycle data less than three years old.

Background data used is less than 10 years old. Methodological choices have been applied in line with EN 15804:2012+A2:2019; deviations have been recorded.

Key assumptions

- The concrete composition of each product is provided by Gunlake and has been accepted as is.
- Our supplier has provided information on their cement (including cement clinker) production process. We have adjusted the generic AusLCI data for cement and clinker production accordingly.
- Additional environmental impact indicators are not declared in the admixture EPDs, which results in underreporting of these indicators.
- Allocation approaches may have a material effect on concrete products containing fly ash, silica fume and/or ground granulated blast furnace slag.
- Electricity has been modelled for core processes using adjusted AusLCI data to represent the estimated residual electricity grid mix in NSW, Australia. This is done by removing renewables from the Australian Energy Statistics 2023 data (Table O1.1). The GWP-GHG of the electricity is 0.91 kg CO_2e / kWh (aligned with NGA 2023). The proxy residual grid mix is made up of black coal (92.8%), natural gas (6.3%), and oil products (0.9%). Given the low contribution of electricity consumption to the GWP emissions, the selection of the electricity grid mix does not have a material impact on the results.
- The end-of-life scenario is based on landfill and recycling rates for masonry products in New South Wales, as per the National Waste Report 2022 (NWR 2022).

Allocation

The key processes that require allocation are:

- Production of concrete mixes: All shared processes are attributed to concrete products based on their volume.
- Fly ash: all environmental impacts of the power plant have been allocated to the main product: electricity, fly ash has only received the burdens of the transport to our site.
- Blast Furnace Slag (BFS): BFS is a by-product from steelmaking. We have used the AusLCI data for BFS ('Blast Furnace Slag allocation, at steel plant / AU U'), which contain impacts from pig iron production allocated to blast furnace slag using economic allocation.
- Silica fume: silica-fume is a by-product of silicon metal or ferrosilicon alloys production. Economic allocation is used to attribute impacts between silica fume and ferrosilicon production.
- Aggregates: Coarse aggregates and manufactured sand are produced through crushing of rock, which is graded in different sizes. The energy required for the crushing and screening does not differentiate from products. Therefore, impacts are allocated to products, based on the mass. In effect, all aggregates have the same environmental profile.

Cut-off criteria

- The cut-off criteria applied are 1% of renewable and non-renewable primary energy usage, 1% of the total mass input of a process and 1% of environmental impacts.
- The contribution of capital goods (production equipment and infrastructure) and personnel is excluded, as these processes are non-attributable and they contribute less than 10% to GWP-GHG.

Life Cycle Assessment (LCA) indicators

An LCA serves as the foundation for this EPD. An LCA analyses the production systems of a product. It provides comprehensive evaluations of all upstream and downstream energy inputs and outputs. The results are provided in a form which covers a range of environmental impact categories.

Table 4: Environmental indicators legend (EN 15804+A2)

Core indicators	Acronym	Unit
Climate change – total	GWP-total	kg CO_2 equivalent
Climate change – fossil	GWP-fossil	kg CO_2 equivalent
Climate change – biogenic	GWP-biogenic	kg CO_2 equivalent
Climate change – land use and land use change	GWP-luluc	kg CO_2 equivalent
Ozone layer depletion	ODP	kg CFC-11 equivalent
Acidification	AP	mol H^+ equivalent
Eutrophication aquatic freshwater	EP-freshwater	kg P equivalent
Eutrophication aquatic marine	EP-marine	kg N equivalent
Eutrophication terrestrial	EP-terrestrial	mol N equivalent
Photochemical ozone formation	POCP	kg NMVOC equivalent
Abiotic depletion potential – elements[2]	ADP minerals & metals	kg Sb equivalent
Abiotic depletion potential – fossil fuels[2]	ADP fossil	MJ, net calorific value
Water use[2]	WDP	m^3 world equivalent deprived
Additional indicators	**Acronym**	**Unit**
Global Warming Potential – Greenhouse gases	GWP-GHG	kg CO_2 equivalent
Particulate matter emissions	PM	disease incidence
Ionising radiation, human health[1]	IRP	kBq U235 equivalent
Ecotoxicity (freshwater)[2]	ETP-fw	CTUe
Human toxicity, cancer effects[2]	HTP-c	CTUh
Human toxicity, non-cancer effects[2]	HTP-nc	CTUh
Land use related impacts / soil quality[2]	SQP	- (dimensionless)
Additional GHG indicator	**Acronym**	**Unit**
Carbon footprint in line with IPCC AR5[3]	**GWP-GHG (IPCC AR5)**	**kg CO_2 eq**

[1] 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.

[2] 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.

[3] **Note regarding various GWP indicators:** GWP-total is calculated using the European Union's Joint Research Centre's characterisation factors (CFs) based on the "EF 3.0 package" for CFs to be used in the EU's Product Environmental Footprint (PEF) framework. CFs listed by JRC include indirect radiative forcing, which results in higher numerical Global Warming Potential (GWP) values than the CFs in the internationally accepted (IPCC 2013). The GWP-GHG indicator is identical to GWP-total except that the CFs for biogenic CO_2 are set to zero. The GWP-GHG indicator in PCR 2019:14 v1.3.2 differs from the GWP-GHG in earlier (pre v1.3) PCR 2019:14 versions. The **GWP-GHG (IPCC AR5)** indicator is determined using the IPCC AR5 Global Warming Potentials (GWP) with a 100-year time horizon. This indicator is aligned with Australia's greenhouse gas reporting frameworks.

Table 5: Legend for parameters describing resource use, waste and output flows

Parameter	Acronym	Unit
Parameters describing resource use		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ_{NCV}
Use of renewable primary energy resources used as raw materials	PERM	MJ_{NCV}
Total use of renewable primary energy resources	PERT	MJ_{NCV}
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ_{NCV}
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ_{NCV}
Total use of non-renewable primary energy resources	PENRT	MJ_{NCV}
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ_{NCV}
Use of non-renewable secondary fuels	NRSF	MJ_{NCV}
Use of net fresh water	FW	m^3
Waste categories		
Hazardous waste disposed	HWD	kg
Non-Hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Output flows		
Components for re-use	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy	EE	MJ

Table 6: Legend for EN 15804+A1 indicators

Indicator	Acronym	Unit
Global warming potential	GWP	kg CO_2 equivalent
Ozone layer depletion potential	ODP	kg CFC-11 equivalent
Acidification potential	AP	kg SO_2 equivalent
Eutrophication potential	EP	kg PO_4^{3-} equivalent
Photochemical oxidation (Photochemical ozone creation) potential	POCP	kg ethylene equivalent
Abiotic depletion potential - elements	ADPE	kg Sb equivalent
Abiotic depletion potential – fossil fuels	ADPF	MJ_{NCV}

Results: Environmental profiles

The following section presents the results for each Life Cycle Assessment module. The results have been calculated with SimaPro software v9.5.0.0.

Please consider the following mandatory statements when interpreting the results:

"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."

"The use of the results of modules A1-A3 (A1-A5 for services) without considering the results of module C is discouraged."

ES4022@4CB (S40/22@4/120SL)

The environmental indicators of each product are expressed per m^3.

Table 7: Environmental indicators EN 15804+A2, ES4022@4CB (S40/22@4/120SL) ready-mixed concrete, per m^3

Environmental Indicator	Unit	Module A1-A3	Module C1	Module C2	Module C3	Module C4	Module D
GWP-total	kg CO_2-eq.	3.87E+02	1.23E+01	1.56E+01	7.90E+00	1.17E+00	-1.42E+01
GWP-fossil	kg CO_2-eq.	3.87E+02	1.23E+01	1.56E+01	7.89E+00	1.17E+00	-1.42E+01
GWP-biogenic	kg CO_2-eq.	9.72E-02	9.52E-04	1.07E-03	8.23E-03	1.06E-04	-2.48E-02
GWP-luluc	kg CO_2-eq.	2.70E-03	6.09E-06	7.26E-06	3.63E-06	5.63E-07	-4.37E-06
ODP	kg CFC11-eq.	1.27E-05	2.03E-06	2.42E-06	9.90E-07	1.90E-07	-1.16E-06
AP	mol H+ eq.	2.15E+00	1.40E-01	1.35E-01	2.16E-02	2.77E-03	-1.17E-01
EP-freshwater	kg P eq.	9.56E-04	1.69E-06	9.23E-07	5.81E-06	1.58E-07	-1.56E-05
EP-marine	kg N eq.	6.50E-01	6.08E-02	4.25E-02	3.84E-03	4.99E-04	-3.83E-02
EP-terrestrial	mol N eq.	7.27E+00	6.67E-01	4.66E-01	4.19E-02	5.46E-03	-4.38E-01
POCP	kg NMVOC eq.	1.77E+00	1.78E-01	1.13E-01	1.12E-02	1.47E-03	-1.11E-01
ADP minerals & metals[2]	kg Sb eq.	2.07E-06	1.50E-08	1.78E-08	1.95E-06	1.36E-09	-1.01E-06
ADP fossil[2]	MJ (NCV)	2.53E+03	1.77E+02	2.11E+02	1.12E+02	1.65E+01	-1.68E+02
WDP	m^3 world eq. deprived	4.03E+03	1.14E+00	1.35E+00	2.42E+00	1.06E-01	-2.04E+00
Additional indicators							
GWP-GHG	kg CO_2-eq.	3.87E+02	1.23E+01	1.56E+01	7.89E+00	1.17E+00	0.00E+00
PM	Disease incidence	7.70E-06	3.70E-06	7.60E-07	1.44E-07	1.47E-08	0.00E+00
IRP[1]	kBq U235 eq.	4.04E+00	2.59E-04	3.08E-04	1.58E-03	2.40E-05	-1.42E+01
ETP-fw[2]	CTUe	1.74E+03	4.59E+01	5.42E+01	2.55E+01	4.19E+00	-2.24E-06
HTP-c[2]	CTUh	2.53E-08	4.92E-10	6.59E-11	1.64E-10	9.18E-12	-2.28E-04
HTP-nc[2]	CTUh	1.57E-06	4.99E-08	7.30E-09	7.57E-09	8.02E-10	-3.71E+01
SQP[2]	-	3.49E+02	8.52E-01	9.47E-01	2.13E+04	2.73E+01	-5.68E-10
Carbon footprint							
GWP-GHG (IPCC AR5)	**kg CO_2 eq**	3.85E+02	12.2	15.4	7.85	1.16	-13.9

Table 8: **EN 15804+A2 parameters, ES4022@4CB (S40/22@4/120SL) ready-mixed concrete, per m^3**

Parameter	Unit	Module A1-A3	Module C1	Module C2	Module C3	Module C4	Module D
PERE	MJ_{NCV}	3.68E+01	2.75E-01	3.03E-01	1.93E+00	3.23E-02	-6.30E+00
PERM	MJ_{NCV}	1.98E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.70E+01	2.75E-01	3.03E-01	1.93E+00	3.23E-02	-6.30E+00
PENRE	MJ_{NCV}	2.52E+03	1.88E+02	2.24E+02	1.17E+02	1.75E+01	-1.74E+02
PENRM	MJ_{NCV}	9.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ_{NCV}	2.53E+03	1.88E+02	2.24E+02	1.17E+02	1.75E+01	-1.74E+02
SM	kg	6.32E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2.96E+00	2.57E-02	3.06E-02	3.98E-02	2.39E-03	-2.19E-01
HWD	kg	2.29E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	9.84E-02	8.13E-04	8.96E-04	5.47E-03	4.90E+02	-4.69E-02
RWD	kg	1.18E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	4.54E+01	0.00E+00	0.00E+00	1.91E+03	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9: EN 15804+A1 indicators, ES4022@4CB (S40/22@4/120SL) ready-mixed concrete, per m^3

Environmental Indicator	Unit	Module A1-A3	Module C1	Module C2	Module C3	Module C4	Module D
GWP	kg CO_2 eq	3.84E+02	1.22E+01	1.53E+01	7.82E+00	1.16E+00	-1.40E+01
ODP	kg CFC11 eq	1.02E-05	1.60E-06	1.91E-06	7.82E-07	1.50E-07	-9.20E-07
AP	kg SO_2 eq	1.55E+00	9.93E-02	7.48E-02	1.36E-02	2.23E-03	-6.60E-02
EP	kg PO_4^{3-} eq	2.28E-01	2.04E-02	1.43E-02	1.34E-03	1.72E-04	-1.49E-02
POCP	kg C_2H_4 eq	6.81E-02	9.74E-03	4.83E-03	7.61E-04	1.11E-04	-5.42E-03
ADPE	kg Sb eq	4.14E-06	1.52E-08	1.80E-08	1.95E-06	1.39E-09	-1.02E-06
ADPF	MJ_{NCV}	2.43E+03	1.77E+02	2.11E+02	1.12E+02	1.65E+01	-1.68E+02

Additional information

Waste and Recycling

Throughout Gunlake's operations some materials are re-used into our production processes, including concrete washout, which beneficially reuses materials that would otherwise require disposal.

Biodiversity Management

Gunlake has established biodiversity offset land at its Marulan Quarry. These areas are managed in accordance with both NSW and Commonwealth requirements and have been established to provide long term protection and enhancement of habitat and ecological communities.

Community Investment

Gunlake participates in numerous local community programs and events, including ongoing annual funding/grant commitments, community initiatives and memberships. Gunlake will continue to provide such community support and investment within the local and regional areas in which it operates.

References

AS 1379	Specification and supply of concrete, prepared by Committee BD-049 Manufacture of Concrete, published on 20 September 2007 by Standards Australia, Sydney
AusLCI 2023	Australian Life Cycle Inventory database v1.42 published by the Australian Life Cycle Assessment Society, 2023
ECHA 2023	European Chemicals Association, Candidate List of substances of very high concern for Authorisation, published in accordance with Article 59(10) of the REACH Regulation, Helsinki Accessed on 1 February 2024 from: https://echa.europa.eu/candidate-list-table
EFCA 2021a	EPD of Retarders, IBU EPD Declaration number EPD-EFC-20210195-IBG1-EN, issued 2021-12-16, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations
EFCA 2021b	EPD of Air Entrainers, IBU EPD Declaration number EPD-EFC-20210193-IBG1-EN, issued 2021-12-16, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations
EFCA 2023	EPD of Plasticizer and superplasticizer, IBU EPD Declaration number EPD-EFC-20210198-IBG2-EN, issued 2023-08-14, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations
Environdec 2021	International EPD System, General Programme Instructions for the International EPD System, Version 4.0, 29 March 2021
Environdec 2023	c-PCR-003 Concrete and concrete elements (EN 16757:2022), Product category rules for concrete and concrete elements, version 2 January 2023
EN 15804+A2	EN 15804:2012+A2:2019/AC:2021, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products, European Committee for Standardization (CEN), Brussels, August 2021
EN 15804+A1	Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products, European Committee for Standardization (CEN), Brussels, November 2013
ISO 14025	Environmental labels and declarations - Type III environmental declarations - Principles and procedures. International Organization for Standardization, Geneva, Switzerland, 2006
ISO 14040	Environmental management - Life cycle assessment - Principles and framework. International Organization for Standardization, Geneva, Switzerland, 2006
ISO 14044	Environmental management - Life cycle assessment - Requirements and guidelines. International Organization for Standardization, Geneva, Switzerland, 2006
NGA 2023	Department of Climate Change, Energy, the Environment and Water. Australian National Greenhouse Accounts Factors, Commonwealth of Australia, August 2023
NOHSC 2004	Australian Government, National Occupational Health and Safety Commission (NOHSC), Approved Criteria for Classifying Hazardous Substances, 3rd Edition, October 2004
NWR 2022	Blue Environment, National Waste Report 2022, prepared for The Department of Climate Change, Energy, the Environment and Water, Final version 1.2, 16 December 2022 (updated 10 February 2023)
PCR 2019:14	Product category rules for Construction products (EN 15804:2012+A2:2019), registration number 2019:14, version 1.3.2, published on 8 December 2023.

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