POLARIS MATERIALS

Environmental Product Declaration

This document is a product-specific Type III Environmental Product Declaration (EPD) for three concrete aggregate products manufactured by Polaris Materials Corporation at the Orca Sand and Gravel Ltd. facility located in Port McNeill, BC, Canada.

Polaris Materials Corporation
Suite 2740, 1055 West Georgia Street, PO Box 11175 Vancouver, BC V6E 3R5 Canada

Polaris Materials Corporation
Environmental Product Declaration
General Information

Environmental Product Declaration

This declaration has been prepared in accordance with ISO 14025, ISO 21930, and ASTM International's EPD program operator rules.

PCR review was conducted by:

Jamie Meil ▪ jamie.meil@athenasmi.org

The PCR peer review report is available upon request: cert@astm.org

Independent verification of the declaration and data, according to ISO 14025: ☐ internal ☒ external

Third-party verifier:

Thomas P. Gloria, PhD ▪ t.gloria@industrial-ecology.com
Industrial Ecology Consultants
35 Bracebridge Rd. ▪ Newton, MA 02459-1728
(617) 553-4929 ▪ http://www.industrial-ecology.com

Product Category Rule:

ASTM Product Category Rules (PCR) for Construction Aggregates: Natural Aggregate, Crushed Concrete, and Iron/Steel Furnace Slag, issued January, 2017.

Declared Unit: 1 metric ton.

Program Operator:

ASTM International
http://www.astm.org/EPDs.htm

EPD Owner:

Polaris Materials Corporation
Suite 2740, 1055 West Georgia Street,
PO Box 11175 Vancouver, BC V6E 3R5 Canada
604-915-5000 ▪ http://www.polarismaterials.com

LCA and EPD Developer:

Laurel McEwen
laurel.mcewen@climateearth.com
Climate Earth, Inc.
2150 Allston Way, Suite 320 ▪ Berkeley, CA 94704
(415) 391-2725 ▪ http://www.climateearth.com

Date of Issue:

February 24, 2017 (valid for 5 years until March 31, 2024).

ASTM Declaration Number: EPD-059

Products

The three concrete aggregates covered in this EPD are given in Table 1. Description of each aggregate and their application are provided below. These products are compliant with the following standards and specifications:

- ASTM C33 – Concrete Aggregates

Table1: Aggregates Covered in this Study

Aggregate	Abbreviation
1″ x #4	#57 Gravel
½″ x #4	#7 Gravel
Washed Concrete Sand	WCS

#57 Gravel

A 1″ aggregate which has 100% passing the 1 1/2″ sieve and 95-100% passing the 1″ sieve. Typically used as a concrete aggregate and may be used in other applications. Also known as ASTM C 33 #57 aggregate.

#7 Gravel

A 1/2″ aggregate which has 100% passing the 3/4″ sieve and 90-100% passing the 1/2″ sieve. Typically used as a concrete aggregate and may be used in other applications. Also known as ASTM C 33 #7 aggregate.

WCS

A washed sand that has 100% passing the 3/8″ sieve with 95-100% passing the #4 sieve. Used for ready mix applications and may be used in other applications. Conforms to ASTM C 33.

Material Composition

The material composition of the concrete aggregates covered in this study is 100% natural sand and gravel.

Polaris Materials Corporation
Environmental Product Declaration
LCA Study

This study is a cradle-to-gate life cycle assessment of Polaris Materials Corporation concrete aggregates produced at the Orca Sand and Gravel Ltd.[1] facility in Port McNeill, BC, Canada and shipped to Eagle Rock Aggregates, Inc.[2] with terminals located in both Richmond and Long Beach, California.

System boundary

This study captures the following mandatory cradle-to-gate (A1-A3) plus optional transportation (A4) life cycle product stages (as illustrated in Figure 1):

A1 - Extraction and processing of raw materials including fuels used in extraction and transport within the process;

A2 – Specific transportation of raw materials (including recycled materials) from extraction site or source to manufacturing site (including any recovered materials from source to be recycled in the process) and including empty backhauls and transportation to interim distribution centers or terminals;

A3 – Manufacturing of the product, including all energy and materials required and all emissions and wastes produced;

A4 – Transportation of product (including loading and offloading of vessels and empty backhaul) from Port McNeill, BC, Canada to Richmond and/or Long Beach, California and Eagle Rock Aggregates' terminal operations. The transportation of materials from Richmond or Long Beach, California to construction site is not included.

PRODUCTION Stage (*Mandatory*)			CONSTRUCTION Stage		USE Stage					END-OF-LIFE Stage			
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction/Demolition	Transport to waste processing or disposal	Wast processing	Disposal of waste
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**

Figure 1. Life-Cycle Stages and Modules

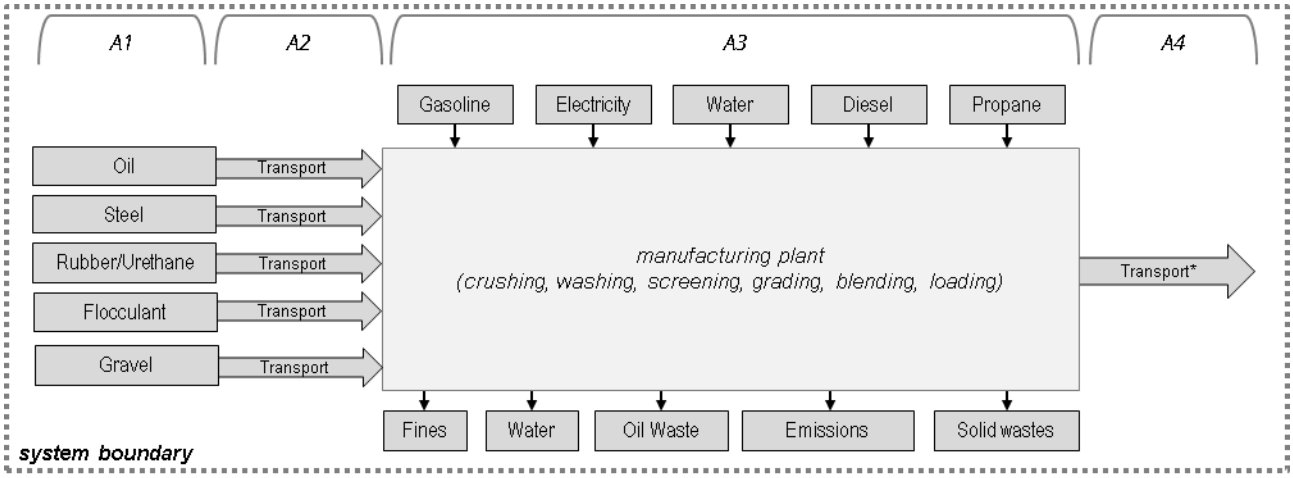
Except as noted above, all other life cycle stages as described in Figure 1 are excluded from the LCA study. The following processes are also excluded from the study:

1. Production, manufacture, and construction of manufacturing capital goods and infrastructure;
2. Production and manufacture of production equipment, delivery vehicles, and laboratory equipment;
3. Personnel-related activities (travel, furniture, office supplies);
4. Fuel used to transport personnel around the mine and sand & gravel facility;
5. Energy and water use related to company management and sales activities.

The main processes included in the system boundary are illustrated in Figure 2.

[1] Polaris Materials Corporation owns 88% of Orca Sand and Gravel Ltd.
[2] Polaris Materials Corporation owns 70% of Eagle Rock Aggregates Inc.

LCA Study



*Ocean Transport from Port McNeill, BC, Canada to Richmond and Long Beach, California and Eagle Rock Aggregates' Terminal Operations

Figure 2. Main Processes Included in System Boundary

Life Cycle Inventory

Electricity impacts are calculated based on the annual production volumes and imports of the Canadian British Columbia (CA-BC) market taken from StatCan statistics and are valid for the year 2013. The 2013 grid mix contains: 71.5% hydro, 17.1% imports from the WECC grid, 8.3% biomass and 2.1% natural gas.

Electricity impacts for terminal operations in California are based on the NERC region WECC. The 2015 grid mix contains: 27.2% coal, 25.7% hydro, 28.4% natural gas, 8% nuclear, 5% solar, 2% geothermal.

Ocean transport impacts are calculated based on 2015 primary data obtained from CSL Group[3].

[3] The CSL Group ships all Polaris Material Corporation's aggregates from Port McNeill, BC, Canada to Richmond and Long Beach, California. https://www.cslships.com

Environmental Impacts

Cradle to Gate (A1-A3) impact results per 1 metric ton of product are outlined in Table 2 below.

Table 2: Cradle-to-Gate (A1-A3) Impact Results for Aggregates Covered in Study

Impact category	Unit	#57 Gravel	#7 Gravel	WCS
Global warming potential	kg CO_2 eq	1.55	1.55	1.65
Acidification potential	kg SO_2 eq	0.02	0.02	0.02
Eutrophication potential	kg N eq	2.99E-03	2.96E-03	3.60E-03
Smog creation potential	kg O_3 eq	0.52	0.52	0.52
Ozone depletion potential	kg CFC-11 eq	6.48E-08	6.42E-08	7.56E-08
Nonrenewable fossil	MJ	23.9	23.9	25.2
Nonrenewable nuclear	MJ	0.86	0.85	1.05
Renewable (biomass)	MJ	2.98	2.92	4.21
Renewable (solar, wind, hydroelectric, and geothermal)	MJ	6.44	6.30	9.09
Nonrenewable material resources	kg	1,000	1,000	1,000
Renewable material resources	kg	0.18	0.18	0.25
Net fresh water (inputs minus outputs)	L	0.10	0.10	0.12
Non-hazardous waste generated	kg	0.03	0.03	0.03
Hazardous waste generated	kg	3.35E-05	3.31E-05	4.15E-05

This EPD only covers the cradle-to-gate impacts of aggregates using a declared unit and the results cannot be used to compare between products. EPDs from different programs (using different PCR) may not be comparable.

Explanatory materials may be requested by contacting:

Keith Martin, P.Eng.
Coordinator, Projects & Logistics
Polaris Materials Corporation
Suite 2740, 1055 West Georgia Street, PO Box 11175
Vancouver, BC V6E 3R5 Canada
604-915-5000
kmartin@polarismaterials.com

Environmental Impacts

Cradle to Gate (A1-A3) plus transportation (A4) impact results per 1 metric ton of product are outlined in Table 3 below.

Table 3: Cradle-to-Gate (A1-A3) plus transportation (A4)[4] Impact Results for Aggregates Covered in Study

		Richmond, CA			Long Beach, CA		
Impact category	Unit	#57 Gravel	#7 Gravel	WCS	#57 Gravel	#7 Gravel	WCS
Global warming potential	kg CO_2 eq	10.8	10.8	10.9	12.9	12.9	13.0
Acidification potential	kg SO_2 eq	0.36	0.36	0.36	0.46	0.45	0.46
Eutrophication potential	kg N eq	0.02	0.02	0.02	0.02	0.02	0.02
Smog creation potential	kg O_3 eq	7.11	7.11	7.12	9.03	9.03	9.04
Ozone depletion potential	kg CFC-11 eq	1.92E-06	1.92E-06	1.94E-06	2.41E-06	2.41E-06	2.42E-06
Nonrenewable fossil	MJ	152	152	153	182	182	184
Nonrenewable nuclear	MJ	3.09	3.08	3.28	1.97	1.97	2.16
Renewable (biomass)	MJ	3.13	3.07	4.36	3.01	2.94	4.24
Renewable (solar, wind, hydroelectric, and geothermal)	MJ	8.21	8.08	10.87	6.58	6.45	9.23
Nonrenewable material resources	kg	1,000	1,000	1,000	1,000	1,000	1,000
Renewable material resources	kg	0.19	0.18	0.26	0.18	0.18	0.25
Net fresh water (inputs minus outputs)	L	0.12	0.12	0.14	0.16	0.16	0.18
Non-hazardous waste generated	kg	0.04	0.04	0.04	0.05	0.05	0.05
Hazardous waste generated	kg	9.57E-05	9.53E-05	1.04E-04	6.49E-05	6.45E-05	7.29E-05

[4] A4 includes the ocean transportation of aggregates (including loading and offloading of vessels and terminal operations) from Port McNeill, BC to Richmond or Long Beach, CA terminals. The transportation of materials from Richmond or Long Beach, CA to construction site is not included.

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Additional Environmental Information

Environmental Management System

An environmental management system modeled on the internationally recognized ISO 14001 standard was developed specifically for Orca Sand and Gravel Ltd. by an environment specialist ensuring that all environmental impacts are monitored, controlled and, where appropriate, experience is used to continuously improve the system. The company minimizes its impacts on the environment, heating its buildings with furnaces that run on waste oil, using a modern filtering system to reclaim oils wherever possible, and collecting all other wastes for safe disposal off site.

The core values of the system are:

- Manage the operations with an emphasis on prevention of pollution and the avoidance of negative environmental impacts
- Ensure compliance with applicable environmental regulations, authorizations and permits, and other standards to which the company subscribes
- Provide resources to implement, document and continually improve the EMS environmental policies and procedures
- Continually assess the achievement of environmental targets and objectives
- Promote the environmental policy to employees, contractors and the public.

For more information please visit: http://www.polarismaterials.com/social-responsibility/

LEED 2009 Regional Material

As per LEED 2009 Reference Guide for Green Building Design and Construction Addenda July 6, 2012, page 6, credit MRc5 "Regional materials":

> *"Building materials or products shipped by rail or water have been extracted, harvested or recovered, as well as manufactured within a 500 mile (800 kilometer) total travel distance of the project site using a weighted average determined through the following formula:*
>
> *(Distance by rail/3) + (Distance by inland waterway/2) +* ***(Distance by sea/15)*** *+ (Distance by all other means) ≤ 500 miles [800 kilometers]"*

Pro-rating calculations for sand and gravel products from Orca Sand and Gravel Ltd. under these criteria are as follows:

To San Francisco Bay Area, CA:	925 Nautical miles / 15 = 61.7 Nautical Miles = **71.0 miles**
To Long Beach, CA:	1,260 Nautical miles / 15 = 84 Nautical Miles = **96.7 miles**

Therefore, under LEED 2009 Orca Sand and Gravel Ltd. products qualify as a "Regional material."

If further information is required, please contact Polaris Materials at the contact information provided.

Relationships with Indigenous Partners

Polaris Materials Corporation has been recognized for the progressive way the business was developed through positive, open and respectful communication with indigenous populations that began with an acknowledgement of their aboriginal rights. The company respects the rights, diversity and heritage of indigenous peoples and their integral connection to the land. Many of our subsidiary companies have directors representing our First Nation partners, ensuring a continuation of the open relationship as the business develops. As of January 2017 50% of our employees at Orca Sand and Gravel Ltd. are First Nations members.

For more information please visit: http://www.polarismaterials.com/social-responsibility/

Additional Environmental Information

Air Permitting

Eagle Rock Aggregates Inc.'s terminals at Richmond and Long Beach, California are permitted by their local air quality management districts.

Richmond Terminal: Bay Area Air Quality Management District (http://www.baaqmd.gov/)

Long Beach Terminal: South Coast Air Quality Management District (http://www.aqmd.gov/)

NSF Certification

Polaris Materials Corporation's Orca Sand and Gravel Ltd. quarry has been recognized as complying with NSF/ANSI 61, 372 and all applicable requirements.

NSF/ANSI 61 sets health effects criteria for many water systems components.

NSF/ANSI 372 establishes a standardized methodology for the determination and verification of product compliance with a maximum weighted average lead content requirement of 0.25 percent as required by the U.S. Safe Drinking Water Act.

More information can be found at http://www.nsf.org

Used Oil Recycling

At Orca Sand and Gravel Ltd. quarry, used oil is recycled to heat site office and maintenance buildings.

In 2015, Orca Sand and Gravel recycled 91,728 L (24,232 gal) of lubricating oil.

Orca Sand and Gravel Site Reclamation

Orca Sand and Gravel Ltd. is committed to maintain all mineral extraction above the ground water table such that it be a dry operation. The reclamation plan is to progressively return the land to its original condition, specifically forestry, which will also provide some wildlife habitat. No soils or organic materials are removed from the site. To date, all stripped soil overburden has been placed in storage stockpiles to be used for reclamation of the last phase of mining. Tree stumps and woody debris removed in the stripping operation is similarly stored. Pit slope rehabilitation is designed to provide cover and shade areas for wildlife by re-vegetation of each face with suitable species.

Operational reclamation has not yet begun as all mining areas remain active. The overburden stockpiles continue to be monitored for stability and will be maintained for use in final reclamation at end of mine life.

Once sufficient open area has been created within the Orca Sand and Gravel pit, overburden materials will be re-spread over a worked out area of the pit bottom for reclamation. Woody debris removed in the overburden stripping will also be spread to recreate the natural forest cycle and a suitable species of trees will be planted.

Additional Environmental Information

Loss Management Policy

At Orca Sand and Gravel Ltd. the safety and reliability of our operation are of prime importance. Orca Sand and Gravel Ltd. maintains a Loss Management system to ensure the health and safety of our people, our property, and the environment we work in.

Loss Management is the application of a systematic approach toward the elimination of incidents and the reduction of risks to people, production, material, equipment and the environment.

Safe and reliable operation means policies, procedures and operating standards that:

- Provide safe and healthy working conditions for all Orca Sand and Gravel Ltd. and contract employees
- Support reliable production at minimum cost while maintaining the long term integrity of the plant and equipment
- Protect the environment
- Ensure security of personnel, property and technology
- Maximize value for money spent in obtaining goods and services
- Make effective use of data processing and computer technology to support the effective use of the Company's resources

Our safe work procedures are created for every job, work practice or procedure taking into account risk and hazard assessments. The procedures are put through a rigorous "content specialist review" upon development and once all parties involved have had input a finalized work procedure is developed and communicated to the workers. On an annual basis workers are put in a classroom and all applicable work procedures are reviewed to ensure that all safe work practices are valid and up to date.

Other programs include:

- Workplace monitoring for both sound and respirable dusts and metals
- Site drug and alcohol testing with a zero tolerance policy
- Occupational Health and Safety committee, performing monthly inspections
- On-site certified Mine Rescue teams
- On-site personnel trained in Level 3 First Aid

Abalone Habitat Outplanting

The Orca Sand and Gravel Ltd. Marine Port Facility has been constructed in Soldier Bay approximately 5 km northwest of Port McNeill, BC. Construction of the Orca Sand and Gravel Ship Loading Facility resulted in some net loss of marine inter-tidal habitat. Part of the compensation for the habitat impacts of the project included construction of a sub-tidal granite reef to increase available abalone rearing habitat as per Fisheries and Oceans Canada Authorization No. 5300-10-085. The DFO Authorization also included the outplanting/transplanting of 1,000 Northern Abalone (Haliotis kamtschatkana) onto the newly constructed reef to re-seed a once abundant abalone population that used to be present in Soldier Bay. Permits were obtained to purchase, transport and transplant small abalone from the Malcolm Island Shellfish Cooperative (MISC) hatchery that unfortunately shut down operations at the end of July 2006 (SARA Permit No. SARA-50; Transplant Licence No. 10800).

OSG agreed to purchase all the remaining hatchery-raised abalone from MISC and transplant them onto the sub-tidal constructed rock reef and into adjacent suitable natural habitat. A total of 4,409 small (average 46mm) abalone were transplanted to Soldier Bay on July 29-30, 2006. OSG also undertook the return of 9 'wild' broodstock abalone to the Soldier Bay site.

As last reported in 2011, the placed boulder habitat is fully functioning as intended in providing increased habitat for the harvest of locally preferred edible seaweed species. There is a large amount of inter-annual variation in the production of these algae on all local beaches where it is found and, judging by the dense mats of fronds entangled in the adjacent eelgrass, it is evident that the spring, 2011 crop was abundant.