

Replacing steel with North America's largest ever PE100 pipe



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Cover Image: Concrete ballasts were used to anchor the butt-fused HDPE pipe to the ocean floor. Above: Employees in British Columbia stand inside the largest HDPE pressure pipe to be used in North America.

Background

Home to almost one million people, Vancouver Island in British Columbia, Canada, is a popular U.S. and Canadian tourist destination thanks to its pristine Pacific waters and temperate climate.

In the face of escalating growth and an aging infrastructure, the Capital Regional District (CRD), as well as the township of Esquimalt and surrounding communities, decided to build a new wastewater treatment facility.

The McLoughlin Point Wastewater Treatment Plant project was initiated as a means to manage growth while exercising responsible environmental practices, ensuring protection of Esquimalt's waterways.

Challenge

The \$775 million (CAD) tertiary wastewater treatment plant, and associated outfall, will manage the sanitary needs of some 413,000 people. Using a complex, three-stage filtering process, organic material and inorganic compounds will be removed before the treated water is released into the northeast Pacific Ocean.

Integral to the project was a large diameter ocean outfall line, extending from the mouth of Vancouver Harbour, out into the Pacific Ocean. The outfall presented unique design and installation challenges:

- The need for a large pipe diameter to deal with high-flow volume
- Durability and anti-corrosion in the marine salt water environment
- Ductility and toughness to mitigate the Pacific's tidal and seismic forces
- Ease of installation with minimal marine traffic disruption
- The overall cost, including purchase price and construction, installation, and maintenance costs.

The original McLoughlin Point project called for a steel outfall line, but due to concerns over corrosion and long-term maintenance costs, engineers selected high-density polyethylene (HDPE)—namely PE100 pipe resin—as a preferred alternative pipeline material.

Solution

The decision was made to use corrosion-resistant PE100 pipes, produced from Borealis' BorSafe™ HE3490-LS. It's a ready-made black PE100 compound material that provides greater durability and longevity in a saltwater environment, as well as the flexibility and toughness required to accommodate float-and-sink installation. The durability of the butt-fusion-joined PE100 pipeline components also assures system integrity during seismic or tidal events.

Soon, the largest HDPE pressure pipe ever used in North America will become operational. The 2250 mm (88.6") diameter pipe was manufactured by AGRU America using BorSafe™ HE3490-LS. The outfall extends approximately 2 km (1.2 mi) from the mouth of Vancouver Harbour, and is sunk to a depth of 60 m (197 ft).

The selection of large diameter PE100 pipe has proven to be a cost-effective decision, and a responsible investment, for the CRD and the residents of Vancouver Island.

2 km (1.2 mi) of the giant HDPE pressure pipe was butt-fusion welded ahead of installation



AGRU America and BorSafe HE3490-LS: An investment in sustainability

As a trusted partner with over 50 years' experience in polyethylene and polypropylene, AGRU America decided to join with Borealis in manufacturing the pipe. Together, they created 1.3 kt (2.86 million lbs) of 2250 mm DR 21 and DR26 PE100 pipes using Borealis' BorSafe resin. BorSafe HE3490-LS is a PE100+ Association quality listed material (www.pe100plus.com), specifically designed for the production of very large diameter, heavy-wall pipes.

The material's "LS" designation indicates that it is an excellent low-sag performance pipe grade, designed specifically for the production of very large diameter pipes. This is an essential property for efficient production of large diameter pipe with thick walls. With traditional PE grades, there can be an increase of molten material flowing to the bottom of the pipe during production, resulting in inconsistent wall thickness, distribution and higher production costs. In addition to melt strength, the HE3490-LS demonstrates superior carbon black dispersion for best weather ability, superior resistance to slow crack growth, and resistance to rapid crack propagation, thus assuring long-term durability in the most demanding service conditions.

The giant PE100 pipe was produced by AGRU America at its Charleston, SC plant and trucked to Vancouver in 15.25 m (50 ft) lengths. The pipe was off-loaded and butt-fusion welded using a AGRU W26000 fusion machine, then floated out into Nanoose bay, where 11,000 kg (24,200 lbs) concrete ballasts were attached to it. The monolithic pipe structure was then towed approximately 120 km (75 mi) to the mouth of Vancouver Harbour, where it was then sunk into position on the ocean floor. This way of joining and towing the pipe provided for rapid installation of the pipe string, minimum disruption to local marine traffic, and low demand for divers.

AGRULINE PE100, produced from BorSafe™HE3490-LS, is an optimal combination of toughness and durability. It withstands the demanding rigors of the float-and-sink method of marine installation, while providing long-term serviceability in outfall operation and overall cost-effectiveness to the communities on Vancouver Island.

Borealis case study snapshot

Project	McLoughlin Point Wastewater Treatment Plant Outfall
Owner	Capital Regional District (CRD)
Location	Township of Esquimalt, Vancouver, British Columbia, Canada
Project scope	2 km of 2250 mm DR21 and DR 26 PE100 pipe, diffuser, and associated fittings
Pipe producer	AGRU America, Inc. Charleston, SC, USA
HDPE material	HE3490-LS, Borealis, AG
Installer	Harbour Resources Partners
Fusion machine	AGRU W26000
Fusion operator	ISCO Industries, Inc.

The bright future of giant PE100 pipes

The design and engineering of PE pipes in this size has only recently become feasible in North America. PE pipes in this size were not previously produced in the region. The 1.3 kt of 2250 mm pipe was manufactured by AGRU America at its 'XXL' pipe facility in Charleston, SC.

"Before AGRU built this facility in Charleston, SC. in 2017, domestic manufacture of HDPE pipe larger than 1650 mm did not exist. Larger sizes are now available up to 3.5 m, and this project demonstrates that they work, which is a great step for plastics," according to Melissa Grace, Vice President of AGRULINE. "With each successful project, engineers and

customers are beginning to see the merits of super-sized PE100 pipe, as well as the full scope of benefits associated with plastic's versatility."

As the success of this project indicates, AGRU America's unique manufacturing site, combined with the superior technical performance capability of Borealis' BorSafe HE3490-LS, suggests a bright future for very large diameter polyethylene pipe in a broad array of applications.

Together with AGRU America, Borealis pipe solutions are enabling life's essentials.

If you want to know more about Borealis and BorSafe™, please get in touch at pipes@borealisgroup.com

All photos courtesy of AGRU America, Inc.

Enabling life's essentials

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About Borealis Borealis is one of the world's leading providers of advanced and circular polyolefin solutions and a European market leader in base chemicals, fertilizers and the mechanical recycling of plastics. We leverage our polymers expertise and decades of experience to offer value adding, innovative and circular material solutions for key industries. In re-inventing for more sustainable living, we build on our commitment to safety, our people and excellence as we accelerate the transformation to a circular economy and expand our geographical footprint. With head offices in Vienna, Austria, Borealis employs 6,900 employees and operates in over 120 countries. In 2020, Borealis generated EUR 6.8 billion in sales revenue and a net profit of EUR 589 million. OMV, the Austria-based international oil and gas company, owns 75% of Borealis, while the remaining 25% is owned by a holding company of the Abu-Dhabi based Mubadala. We supply services and products to customers around the globe through Borealis and two important joint ventures: Borouge (with the Abu Dhabi National Oil Company, or ADNOC, based in UAE); and Baystar™ (with Total, based in the US).

For more information visit: borealisgroup.com

About AGRU America AGRU America, Inc. is a subsidiary of AGRU GmbH, an Austrian family-owned business since 1948 with production facilities in Austria, the United States, Germany, and China. AGRU products are distributed in over 80 countries worldwide.

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