Publications from the British Precast Drainage Association (BPDA):

BPDA was formed in 2017 from the integration of the Concrete Pipeline Systems Association (CPSA) and the Box Culvert Association (BCA).

Information published by both CPSA and BCA will be rebranded and replaced as BPDA in due course. New material will be branded BPDA.

All CPSA and BCA web traffic will be redirected to the new BPDA web site at www.precastdrainage.co.uk

Water Footprinting of wastewater pipelines

As the world focuses on fighting the impacts of global warming by pledging to reduce greenhouse gas emissions and mitigating the effects of climate change, other challenges will become more prominent. One of these challenges is water use. Despite two devastating world wars the world population tripled in the 20th Century. Our use of water per capita has increased 6 fold over that period. By 2050 the world population is expected to reach 9 billion competing over a global freshwater resource of 35 MM km^3. More people will be living in urban and suburban areas where water consumption per capita is higher and strain on the existing stock of fresh water will increase considerably. This is why many industries have started to look seriously at water associated indicators and the concept of "embodied water". February 2011 saw the publication of the first Global Water Footprint Standard. Water Footprints are thus starting to gain a status similar to that of carbon footprints.

Wastewater pipeline footprints

Over the last few years efforts have focused on a number of environmental indicators such as embodied energy, carbon footprint, and mineral resource extraction. However, using embodied water as an indicator can reveal a number of facts that many may not be aware of:

Water is used throughout the processing and production of pipes made of concrete and plastic. For someone with basic knowledge on how concrete and thermoplastics are produced, concrete may appear to use more water as it is a main product ingredient which hydrates with the cementitious binder to form concrete. However, the embodied water associated with the production of a concrete pipe is considerably lower than that associated with an equivalent size plastic pipe:

Water is used in different stages of production throughout the life cycle of a concrete product. An independently accredited study to PAS 2050 (Publicly Available Specification for Assessing the life cycle greenhouse gas emissions of goods and services) completed by CPSA shows that the amount of water used at precast concrete pipeline factories is 76.3 litres of borehole and mains supplied water per tonne of product produced. This figure is higher if all upstream life-cycle stages are looked at: A study carried out at the Building Research Establishment (BRE) for the Precast Flooring Federation (PFF) shows that the average cradle-to-gate embodied water for precast flooring is **800 litres per tonne**. That study was based on a precast factory water consumption rate of 121 to 136 litres per tonne produced. Another BRE study looking at wet cast paving products showed cradle-to-gate embodied water at between 890 litres and 1,600 litres per tonne.

Due to the nature of the precast concrete required for a pipeline product, it is more appropriate to use the value associated with precast flooring as closely representing concrete pipeline products.

Information on water use for the production of thermoplastics is well documented and is available at the PlasticsEurope LCA database website. The values are extracted from LCA reports carried out for different types of plastic pipes and resins. The amount of water used for the production of different plastic pipes is detailed in the table below:

	uPVC Pipe	HDPE Pipe	PP Pipe
Litres per tonne of product	80,000	58,000	62,960

Table 1. Total cradle-to-Gate water used for the production of a PVC and HDPE pipes and PP resin according to LCA studies carried out by PlasticsEurope (2005 and 2006).

The table shows that the amount of water used to produce plastic pipes is significantly higher than concrete pipes. Whilst concrete pipes are ñrigidò structural components, plastic pipes are generally considered ñflexibleò and in structural design terms they do not withstand the loads and stresses imposed upon them but rely on their ability to deflect and interact with the supporting material which surrounds them. They are therefore hugely reliant on the correct design and proper installation to ensure the long term structural integrity of a pipeline and are considerably lighter than equivalent size concrete alternatives. However, when comparing concrete and plastic pipes on an equivalent size basis, the embodied water of plastic pipes is still much higher, as shown in the table below.

	PVC Pipe	HDPE Pipe	PP Pipe[1]	Concrete Pipe
DN300	521.6	-	495.8	78.08
DN600	-	1,102 to 1,508	1,021.4	387.2
DN900	-	2,088 to 2,784	3,185.8	614.4
DN1200	-	3,886 to 5,220	-	1,072

Table 2. Cradle-to-Gate Water Footprint (in litres) per 1 metre length of pipe.

Conclusions

The water footprint of a concrete sewer pipe is between 2.6 to 6.7 times lower than an equivalent size plastic pipe. This finding might come as a surprise to many in the industry. It is believed that the main reason for this is that the water footprint of plastic is significantly externalised to other parts of the world. PP and HDPE resin for plastic pipes manufactured in the UK is mainly sourced as a foreign import and the bulk of the water footprint of that resin might be coming from areas with significant pressure on local freshwater resources such as the Middle East. It is understood that by 2015 Europe will be importing a net of 1.2 million tonnes of polyethylene with a combined water footprint of over 38.4 km^3.

With a new and detailed ISO Standard it will be easier to understand the boundaries and implications of water footprints. For now, the industry will need to use the best reference information available for calculating the water footprints of pipeline systems. In common with carbon footprinting, data from secondary sources rather than LCA studies based on primary data applied to recognised methodologies may need to be questioned.

References

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- CPSA Carbon Clear (2010) PAS 2050 Partial Life cycle Assessment. Cradle-to-Gate Analysis for Concrete Pipeline, Manhole Ring and Cover Slab

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[1] The Plastics Europe studies did not include LCA for PP extruded pipes. The PP pipe value was calculated by multiplying the water footprint of a tone of PP resin (43,000 litres) by the gross amount of resin required to produce PVC/HDPE pipes (1.0037:1.00) and adding to the average of water consumed in the extrusion of PVC and HDPE pipes.