

# WEEG NEWSLETTER February 2019

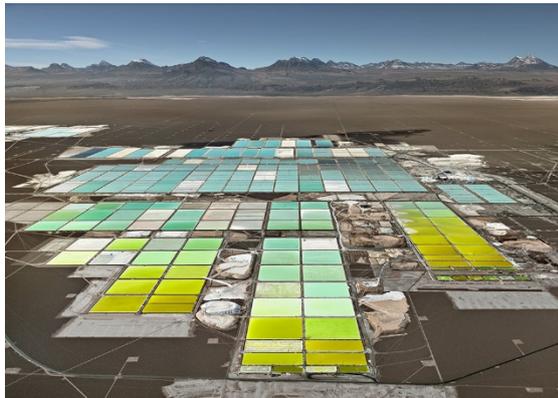
The newsletter is published monthly by the University of Southampton's Water and Environmental Engineering Group WEEG, and reports things of interest in this field worldwide, as well as ongoing undergraduate student and research work in WEEG itself.

We believe that water and energy are the most important topics worldwide for the next decades. Our work covers river and coastal engineering, water and wastewater and energy related to water.

**Editorial:** part 2 in our mini series on water and mining focuses on the lithium mining in the Atacama Desert. And, for all the sad trekkies amongst our readers: we are *not* talking about dilithium crystals here, but about the lithium required for batteries for your cell phones, and for the environmentally oh-so-friendly electric cars.

## Hydraulic Engineering International: *lithium mining in the Atacama Desert, and its consequences*

The Atacama Desert extends for some 1000 km along the Western Coast of North Chile. It covers 128,000 km<sup>2</sup>, and is supposed to be the driest corner of this planet - with rainfall between 1 and 15 mm per year. Some weather stations have never recorded any rainfall at all. So, water is definitely a problem here.



**Fig. 1: Brine evaporation ponds**

Lithium is a soft, silvery alkali metal with a very low density of 534 kg/m<sup>3</sup>. It has applications in medicine, nuclear physics, ceramics and many other areas. The most important, however, (in terms of quantity of metal used) is use in lithium batteries, and here car batteries are of particular importance. One of the three most important mining areas for lithium is the Atacama Desert in Chile. Here, the metal is not mined, but salt water with dissolved lithium is pumped to the surface, the brine is evaporated by the sun, and the lithium finally extracted from the sludge. With 1/3 of the world's lithium production, Chile, is the world's largest producer. Now, you have probably realised that pumping water out of the ground and letting it evaporate may not be the best environmental

thing in the driest place on earth (neglecting the polar regions, which do not really count).



**Fig. 2: What is left of a salt lake (Atacama Desert)**

Pumping rates currently reach 1,700 l/s, and following the pumping, ground water levels have dropped, streams and lakes disappeared. Remaining fresh water sources are often contaminated and ecosystems are damaged. Here in particular the salt flats and the native flamingo species are at risk.

So, the increasing use of battery power and of environmentally friendly electric cars come at a cost, which is paid for at the other end of the world. And by other people. Still, if we want to find sustainable solutions for today's problems, we need to look at these holistically – otherwise what looks like a solution may indeed only be a 'robbing Peter to pay Paul' scenario. Have a look at this letter to Nature:

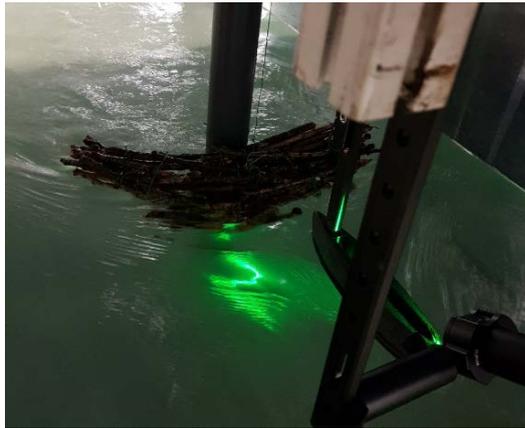
<https://www.nature.com/articles/d41586-018-05233-7>

## Hydraulics Laboratory: *New measurement system: Particle Image Velocimetry*

In our Hydraulics Laboratory, we continuously strive to improve our measurement technologies. Dr Gustavo de Almeida and Dr Sergio Maldonado are currently commissioning a Particle Image Velocimetry or PIV system which allows us to map a flow field more or less instantaneously. This used to be a very expensive technology, but today it is possible to build one yourself using standard components such as optical benches with cylindrical lenses and a laser pointer.

Fig. 3 shows a typical application of the system. The flow velocities below a debris

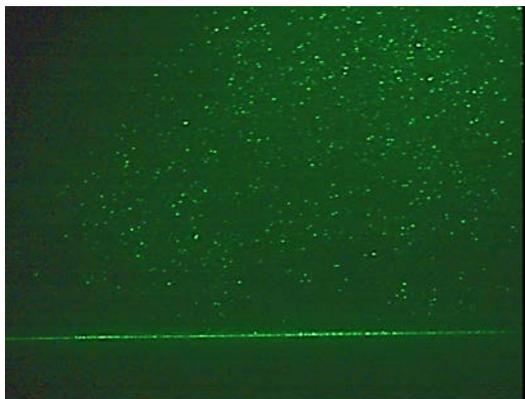
accumulation are measured to quantify the velocity increase caused by the debris.



**Fig. 3: A laser sheet in a debris accumulation experiments**

PIV is a very powerful measurement technique, which allows simultaneous measurement of all flow velocities in a 2D plane as shown in Fig. 4. The system is currently being improved, to increase the illuminated flow field and by developing special solutions to introduce a laser light sheet into complex geometries.

Interested? Contact Dr Gustavo de Almeida, email: [G.deAlmeida@soton.ac.uk](mailto:G.deAlmeida@soton.ac.uk) and Sergio Maldonado: [S.Maldonado@soton.ac.uk](mailto:S.Maldonado@soton.ac.uk)



**Fig. 4: The laser sheet illuminates particles in the water in a 2D plane**

### 3<sup>rd</sup> Year student Project: *Food waste management*

Oana Iliescu, a 3<sup>rd</sup> year student on the Civil Engineering programme, is looking into Food Waste Management at the University of Southampton as part of her individual project.

After meeting the Environment & Sustainability Manager, Nicola Turvey and the Waste & Recycling representative, Mike Travers, she has been able to obtain 9 years' worth of data from the University's waste collections.

She plans to compare the performance here and at the University of Tampere, Finland, which she will visit for data collection and observation.

Contact: [g.muller@soton.ac.uk](mailto:g.muller@soton.ac.uk)

As part of the project, Oana is also researching practices and policies regarding food waste collection and disposal across the UK, as well as at the University. She hopes to aid the University's effort to manage food waste more efficiently, while raising awareness of the importance of source separated collection schemes in achieving effective resource recovery.



**Fig. 5: Oana and bin**

Contact: Dr S Heaven, [s.heaven@soton.ac.uk](mailto:s.heaven@soton.ac.uk)

### Jobs in water engineering:

This section gives you an idea of the type of work you can do when working in industry.

**Advert:** Thames Water is advertising for staff in all sorts of water-related areas - see e.g.

#### Project Manager - Engineering



<http://jobs.thameswater.co.uk/jobs/view/10528/Project-manager---engineering.html>

### Civil and Environmental Engineering at Southampton University:

**WEEG:** the Civil and Environmental Engineering pathway offers the chance to deepen your knowledge in water-related areas, and gives you a better preparation for environmental engineering projects.

**Contact:** Dr Sonia Heaven, [s.heaven@soton.ac.uk](mailto:s.heaven@soton.ac.uk), Bldg. 7, Room 5004

#### Further information:

We have two Facebook pages, which provide a logbook of our laboratory activities:

[www.facebook.com/Hydraulicslaboratory/](http://www.facebook.com/Hydraulicslaboratory/)

[www.facebook.com/environmental.lab.university.of.southampton/](http://www.facebook.com/environmental.lab.university.of.southampton/)

Brought to you by:

UNIVERSITY OF  
**Southampton**