WEEG NEWSLETTER January 2024

The newsletter is published 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: Nature based solutions for hydraulic problems are of course very fashionable. In the coastline, this is of special interest since coastal erosion poses big problems in many areas of the world. Most often, 'hard' engineering solutions do not work, especially on sandy or salt marsh dominated coasts.

Oyster reefs prevent coastal erosion:

Oyster reefs? Yes, oyster reefs. When we think about oysters we think about luxury food, champagne receptions or possibly about pearl oysters. Where do these molluscs come from? Well, they grow somewhere in the sea, lying on the seabed or something…

The reality is of course quite different. Oysters in a natural environment initially attach themselves to hard surfaces such as stones or even existing mussel banks. The oyster then multiply, and new oysters grow on the hard shells of existing oysters. Then oyster banks or reefs can form, see Figure 1.

Fig. 1: Oyster reef in mud flats near Juist Island / Germany

These reefs can be several hundreds of metres long, up to 100 m wide and they can reach heights of 1 m or more. Their role in the coastal environment is still being investigated. These reefs can exist in salt marshes and on sandy beaches. The reefs retain tidal pools, slow down flow velocities, lead to wave breaking and wave energy dissipation and therefore reduce coastal erosion significantly.

Human impact: of course, the human impact on oyster populations was very, not so say extremely, strong. Oysters were harvested for food: this already damaged the reefs. The shells are mostly made up of calcium carbonate which was taken to make quicklime for construction. So, in Europe practically all and in America more than 80% of the oyster reefs disappeared.

Fig. 2: Oyster reef restoration n Chesapeake Bay

This eventually accelerated coastal erosion which in turn led to the necessity for engineered (and expensive) erosion protection measures. Today, the beneficial role of oyster reefs in the coastal environment by helping to reduce or event stop coastal erosion has been recognised, and attempts are being made to re-introduce oysters and to encourage the re-building of oyster reefs. Fig. 2 shows such a reef in Chesapeake Bay, USA.

The problem here lies with the provision of a 'starting point' for the oysters, i.e. a hard surface on which they can grow. A large number of different ideas is being tried out, starting with wire cages filled with oyster shells over specifically designed concrete units, Fig. 3, to mats of concrete elements which can adjust to surface irregularities of the sea bed.

Fig. 3: Oyster reef restoration elements

One problem with these elements is that, as soon as they are introduced, sediment collects around them which may swamp the reef, and thereby slow down or even prevent reef growth, Heights of more than 0,30 m are necessary to prevent this.

Water quality and habitat: oysters also filter the water, so that a large quantity of oysters improves water quality. Oysters remove pollutants and nutrients such as nitrogen from the water. In addition, the oyster reefs provide habitats in otherwise quite barren sand or marshy coastlines. These encourage increased numbers of invertebrates and small fish as well as creating a habitat for macrofauna which in turn provide food for larger animals, Fig. 4.

Fig. 4: Oyster reef as habitat

So, in general it looks as if we are re-discovering an element of coastal protection with added benefits which we had destroyed earlier on. Lastly, the oyster reefs are of course self-maintaining structures with a high rate of growth, In Northern Germany, a reef started to develop sometime after 2004. In that year, no oysters were reported at the site. The reef has now reached a length of more than 500m, with a width of 300 m and height of more than 1 m.

Group Design Project: *Horizontal wave paddle for wave-current interaction*

Our ongoing GDP has the aim to design, build and test a horizontal wave paddle to generate waves inside a current. This includes wave absorbers with minimum flow interference. These absorbers are necessary since both ends of a current flume will reflect wave at least partially – a phenomenon which of course does not occur in real situations.

The students have finished the design of the first small installation, which we will start to test next week – more to follow...

Contact: Dr Gerald Muller, g.muller@soton.ac.uk

New laboratory building in Chilworth: *update*

Our new Lab building in Chilworth is now operational, Fig. 5. In the Hydraulics areas, a 12 m long small tilting flume has been installed and commissioned, and work in there is already ongoing. A 15 m long and 0.4 m wide wave tank has been ordered and should be operational before June.

Fig. 5: New Lab Building, Chilworth Science Park

Finally, the 25 m long, 1.8 m wide and 0.6 m deep tilting flume with wave-current generation capability is currently being design by Armfield Ltd., with expected delivery in September.

Fig. 6: New 12m tilting flume

Contact: Phoebe Pellew, p.pellew@soton.ac.uk ,

Jobs in water engineering:

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

Civil and Environmental Engineering at Southampton University:

Our modules offer the chance to deepen your knowledge in water-related areas, and give better preparation for environmental engineering projects and careers.

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Further information:

Watch out for info on our new webpages. Our Facebook pages provide occasional updates:

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