Information taken from emails to the members of the Steering Group, starting on the 14th December 2020 and spreading over several days.

Further work on BMP alternatives

This is what has been found out about Geotextile Tubes.

They were first used 60 years ago and are undergoing constant improvements.

They now come in mattresses and other similar forms as well as the original tube.

Recent developments have increased their abrasion resistance so they last for even longer.

One of the most important coastal uses is to reduce the costs of islands, groynes and revetments by forming the majority of the structure with rock forming just the surface.

They don't have to be used as a continuous tube in submerged situations but can be in bags arranged to form underwater islands.

When used submerged they can form the basis of seaweed or sea-grass forests and so improve the marine environment.

They can help to rebuild beaches as well as retain recharged material, in some installations they have been used to build outwards to create a new sandy beach area.

They are easily removed as they can be slit and the sand then forms part of a new bar while the Geotextile is removed.

They can be used not only in the above ways but also to create an offshore 'wave maker' for surfers.

They are 'Green', they reduce transport costs both because the tubes are lightweight and because the filling material can be sourced at the site. Although they are man-made material they can be integrated into the landscape/seascape and the material is then protected from degradation. Also the material can be reused into domestic usage if the tubes are intentionally split and removed. They are used in green roofs, weed suppressing membranes, and in drainage situations to mention but a few. Their ability to retain solids while letting water through is useful in many areas.

The leading manufacturer and developer is Tencate, although many companies produce them.

This is a webinar on the subject, followed by some background links.
https://www.youtube.com/watch?v=LJM_-XU8BcU

As can be see here the tube does not have to be a continuous length but can be placed like underwater rock islands
https://www.geosynthetica.com/wp-content/uploads/MexicoBeach_Tencate_550w.jpg

https://www.youtube.com/watch?v=yZGfmzwWU3E
Also explains that you can use geotextile tubes as the centre of a rock groyne thus making it cheaper.

Geotubes as revetments
https://www.youtube.com/watch?v=2lgrkGpXHXk

It can be low tech
https://www.youtube.com/watch?v=5G1Z2554Yg

Installation video
https://www.youtube.com/watch?v=QVfVGF26H6Y

tank testing https://core.ac.uk/download/pdf/53296296.pdf

https://www.geosynthetica.com/geotextile-tubes-beach-restoration-mexico/

Technical documents
https://www.researchgate.net/publication/222397296_Using_submerged_geotextile_tubes_in_the_protection_of_the_E_Korean_shore

https://journals.sagepub.com/doi/pdf/10.1260/1759-3131.4.2.117

Conclusion

If Geotextile tubes were considered to be the way forward we could potentially dismantle all our current rock islands and groynes and rebuild them with Geotextile tube bases this would have the following advantages.

1) We might not have to buy any more rock, thus making the project greener even if it didn't reduce the overall cost.

2) The health and safety worries about the rock islands and groynes would be reduced as it would be less possible (or even impossible perhaps) for people to slip down within the construction.

also

3) We could build the sort of beach Sidmouth would like to have

4) We could do away with the need for the increased wall on the Esplanade and possible have the money to improve it to make it more attractive.

5) If the Geotextile tubes were at the proper distance it might be possible on East Beach to retain the rock as it falls and so establish a stable slope which would be good for users of East Beach and for those wishing to look at rock strata and for fossils.

Part two, Do Geotextiles pollute with micro-plastics?

It is difficult to find anything much against Geotextiles, the Government advocates their use in many situations. It seems the thinking is that while it may add some pollution the modern materials are far more resistant to breakdown, and the ecological benefits outweigh the problem. Most of the plastic in the ocean seems to come from our throwaway culture and the use of plastic in packaging.

Tencate (obviously) don't see any problem
https://www.tencategeo.us/media/50b6a456-96ab-4943-9985-a137c8ad43c3/U-y8rA/TenCate%20Geosynthetics/Documents%20AMER/Industry%20Papers/The%20durability%20of%20geotextiles.pdf

But there are lots of other studies too
https://www.sciencedirect.com/topics/materials-science/geotextiles

However, in,

Materials Review of Application and Innovation of Geotextiles in Geotechnical Engineering

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it states

About 98% geotextiles consist of non-degradable polymers from the polyolefin, polyester, or polyamide family. The long-term use of geotextiles, because of quite a few environmental factors, such as wind, moisture, friction, and ultraviolet radiation, may cause the disintegration of synthetic polymer,resulting in the accumulation of micro plastics in the surrounding environment.

Therefore, geotextiles should develop towards high performance and multi-function. With the popularity of green concept, a multitude of scholars have studied the possibility of natural geotextiles replacing non-biodegradable polymer geotextiles. At present, natural geotextiles can replace synthetic geotextiles in 50% of all applications.

From what can be found on a short search natural geotextiles break down within about 3 years and so are better for situations where they are trying to do something like re-establish mangroves.

It appears that synthetic geotextiles can now even include fibre optics for monitoring structural integrity!

Download link
https://res.mdpi.com/d_attachment/materials/materials-13-01774/article_deploy/materials-13-01774.pdf

There is also this study but it seems to be of geotextiles which are less robust than the modern tubes and mattresses

http://ei-geo.com/wp-content/uploads/2018/12/Paper-43_Esiukova-et-al.-rev-2_PID5713029.pdf

A link, which really belongs with the ones already sent, also turned up

http://ijcoe.org/article-1-86-en.pdf

As did this one which is about the effectiveness of emerged and submerged breakwaters of different types .... very interesting ... it might tend to show that our current rock islands are less efficient than submerged structures would be. It is from 2018

https://www.matec-conferences.org/articles/matecconf/pdf/2018/62/matecconf_iccoee2018_01005.pdf

Another interesting snippet

the construction of the Saemangeum Sea Seawall in Korea, where geocontainers were used as an alternative design to the conventional rock-fill berms of the dike, was calculated to be about 6.2 million US dollars including all costs of materials and installation

Finally. This thesis about the Artificial Surf Reef geotextile bag failure at Boscombe is a salutary read. The bags were not installed to the design specification but instead the system was adapted on the fly; and of course the Geotextiles weren't as robust as they are now.

https://core.ac.uk/download/pdf/74389879.pdf

Part three, Where do the UK currently use geotextiles and would use of our coast be classed as innovation?

This is what has been found re the accepted use of geotextiles in many different situations, endorsed by the EA , and the use of geotextile structures around the coast of the UK. Of course it is limited to what is in the public domain.

Conclusion :- that geotextile use is considered safe but that very little has been done with geotextile structures around the coast in the UK. There was the failed surf reef mentioned in the first email, plus buried structures on beaches in Norfolk and Suffolk, and one instance of a geotextile groyne(geo hump).

Even where they have been used it seems to have been as bags not tubes.

An internet search can find no reports of use in a continuous tube (or stacked tubes) as a breakwater, nor as a base for a groyne or island whose outer layer is rock, in this country; although they have been successfully used elsewhere. Therefore we should be in a good place as regards innovation funding.

Hope this is of help,

Geotextile use is advocated by the EA in

1) Sustainable drainage systems

https://cms.esi.info/Media/documents/998_1462451859844.pdf

page 22-24 *https://cms.esi.info/Media/documents/998_1462451859844.pdf* also on page 57 they talk about green roofs which often have geotextile components though they are not mentioned in this instance.

The EA is part of Susdrain *https://www.susdrain.org/suds-directory/supporters/environment_agency_1.html*2)

2) Root barrier membranes are geotextiles, some like this one are used to allow trees to be grown with a constrained root ball *https://www.geofabrics.com/root-barriers/* but it is also used with Japanese knotweed.

The EA advises using root barriers as a way of disposing of Japanese knotweed. *https://www.gov.uk/guidance/prevent-japanese-knotweed-from-spreading*

This site is mentioned as a good resource *https://www.naturaldevon.org.uk/home/devon-invasive-species-initiative/japanese-knotweed/advice-for-developers-and-hauliers/* by the EA in this doc *https://rootbarrier.com/downloads/Environment_Agency-Pages20-24-Dendro-Scott_Root_Barrier.pdf*

3) Working near rivers or other 'controlled waters' The EA recommends geotextiles to control silt. 4C here recommends using geotextile *https://www.malvernhills.gov.uk/?option=com_fileman&view=file&routed=1&name=PPG5%20-%20Works%20in%20or%20near%20watercourses.pdf&folder=Documents%2FEnvironmental%20Health&container=fileman-files*

In Devon *https://www.devon.gov.uk/floodriskmanagement/land-drainage-consent/bank-works-guidance/*

4) Geotextiles in landfill lining systems *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290638/sp1-385-tr1-e-e.pdf* and

https://www.gov.uk/government/publications/using-non-woven-protector-geotextiles-in-landfill-engineering-lfe7

5) Links to EA docs on geotextiles

https://www.geosynthetica.com/uk-environment-agency-reissues-geomembrane-publications/

Further.

Geotextile tubes in UK waters

https://se-coastalgroup.org.uk/research/geotextile-bags-in-groyne-formation/

agenda item 2 117 https://southerncoastalgroup.org.uk/wp-content/uploads/2019/09/SCG-Agenda-090617.pdf

image https://www.mindenpictures.com/stock-photo/geotextile-tubes-(geotubes)-used-as-coastal-cliff-erosion-defence-on-shingle/search/detail-0_80137142.html

Norfolk Broads https://www.linkedin.com/pulse/dutch-ingenuity-restores-norfolk-broads-huw-sayer/ and https://consult.environment-agency.gov.uk/east-anglia-c-e/hoveton-great-broad-temporary-fish-barriers/supporting_documents/Environmental%20statement%20%20exec%20summary%20Vol%20IV.pdf

Suffolk https://www.naue.com/safe-coastal-protection-with-geosynthetic-sand-containers/ and https://www.geosynthetica.com/geosynthetic-coastal-protection-england/

Royal Haskoning geo bags https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwja2qXpt9rtAhUHYsAKHdhvASIQFjAJegQIDhAC&url=https%3A%2F%2Fwww.royalhaskoningdhv.com%2F-%2Fmedia%2Froyalhaskoningdhvcorporate%2Ffiles%2Fglobal%2Fnews%2Fevents%2F2013%2Fice%2Fbag-to-the-future---meeting-the-challenges-of-coastal-erosion-and-affordabi.pdf%3Fla%3Den-gb&usg=AOvVaw1hAlzPD4UnecGMWrHGnF_S

2002 Pevensey research https://www.pevensey-bay.co.uk/innovation-and-research.html

2003 Defra R&D about cheaper rock structures, section 5 onwards, doesn't mention geotextiles so their use might be considered innovative. https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwja2qXpt9rtAhUHYsAKHdhvASIQFjAGegQIBxAC&url=http%3A%2F%2Frandd.defra.gov.uk%2FDocument.aspx%3FDocument%3DFD2409_1093_TRP.pdf&usg=AOvVaw3PxijPtMBVFlllfOTjlXqf

2013 FCERM Research News Geo Hump in place of groynes https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290879/LIT_8566_735a71.pdf

About 3/5ths down this document 2) Less hard defences http://www.marinet.org.uk/campaign-article/why-canute-failed mentions Halcrow trialling them in Norfolk and Suffolk and later 'undercurrent stabilisers', then 'The Holmberg method.' which appears to be the Sandsaver.

BSI New for 2020

https://www.geplus.co.uk/news/clients-help-write-geotextile-rules-28-02-2020/

https://standardsdevelopment.bsigroup.com/committees/50000674

Testing laboratory

https://www.bttg.co.uk/testing/geosynthetics-2/geosynthetics-b-testing-of-geotextiles-and-geotextile-related-products/

UK chapter of the International Geosynthetic society *https://www.igs-uk.org/event/geotextile-separators/* and

https://www.geosyntheticssociety.org/wp-content/uploads/2014/10/SpecGuide.pdf

General info about where geotextiles are used pg 12 coastal and rivers *https://forwardbs.co.uk/wp-content/uploads/2018/pdfs/terram.pdf*