Aggregates

from the sea

drawing strength from the depths

Key facts

Marine aggregates contribute

* *17 per cent of the sand and gravel needs of England and Wales *1*
* *Over 40 per cent of the sand and gravel produced in the South East *1*
* *90 per cent of the sand needed in South Wales*
* *2,500 jobs on predominantly British-registered vessels and on land*
* *The equivalent of 50 medium-sized pits on land.*

An industry of today...

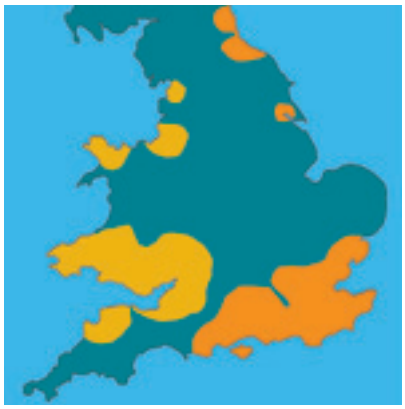
and tomorrow

Think of aggregates and most of us think first of quarries on land. In reality, however, a substantial proportion of Britain's need for aggregates is satisfied from the seabed. At a time when land-based quarrying is under increasing environmental pressure, this vital marine resource is growing in importance as a means of sustaining the built environment. In doing so, it contributes substantially to the quality of our lives.

Over 21 million tonnes of marine sand and gravel is extracted from over 70 licensed areas around the coast of England and Wales each year.

Around 17 per cent of the sand and gravel used in England and Wales is now supplied by the marine aggregates industry. It also makes a healthy contribution to our balance of payments through exports to the near continent.

Extraction of marine aggregates involves significantly less than one per cent of the UK continental shelf. The industry recognises, nonetheless, that it works in a sensitive environment and accepts its responsibility to operate with care and concern for other users of the sea. The British Marine Aggregate Producers Association (BMAPA) believes this challenge should be approached as a partnership with all the other parties involved and actively seeks to minimise the industry's impact.

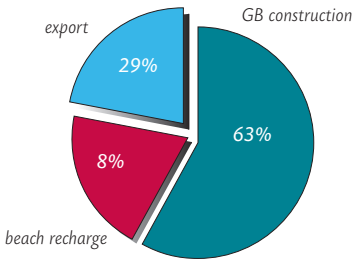


Marine aggregate usage

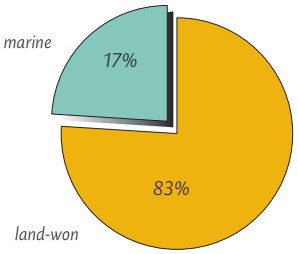
sand

sand and gravel

*Uses of marine aggregates (five year average 2001-2005) *2*



*Satisfying the England and Wales sand and gravel needs (five year average 2000-2004) *1*



*1 based on a five year average of mineral extraction data from the Office for National Statistics

*2 based on a five year average of landings data from The Crown Estate

A natural resource

Fluctuating sea levels over the past two million years have led to the deposition of the sands and gravels which now lie on the seabed. Although now submerged, these materials were originally deposited by rivers which flowed out seawards when today's seabed was dry land.

The sands and gravels were deposited during glacial times when fast-flowing rivers poured out across the dry shelf and are exactly the same as we now find on land. Deposition was followed by reworking during rising and high sea levels, in warm interglacial stages.

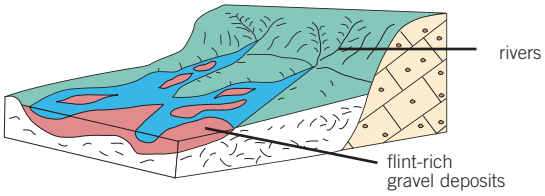
This warm-cold cycle was repeated many times, resulting in the concentration of gravelly deposits along and around river courses, which often form extensions of existing rivers visible on the land today.

Consequently, gravel reserves are essentially immobile and locked in ancient river terraces and channels, as well as in former coastal features such as ancient submerged beaches. In contrast, the sands have been mobile during higher sea levels and have often been formed into banks, for example off Great Yarmouth and in the Bristol Channel.

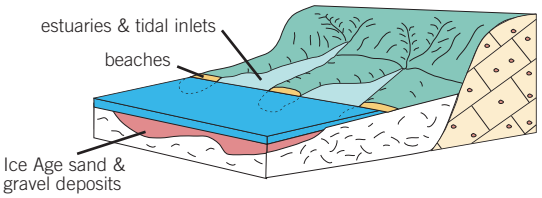
Key facts

* *Dredging licences cover 1,179 square kilometres (2005)–0.136% of the UK continental shelf*
* *On average, around 12 per cent of the licensed area is dredged in any year (138 km² in 2005)*
* *Licences are zoned to restrict working area*

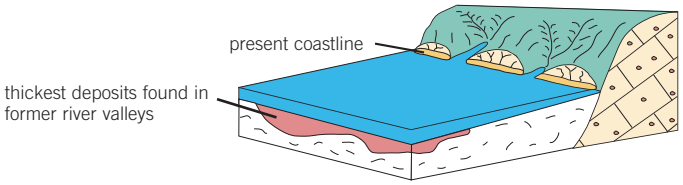
How marine aggregates were formed



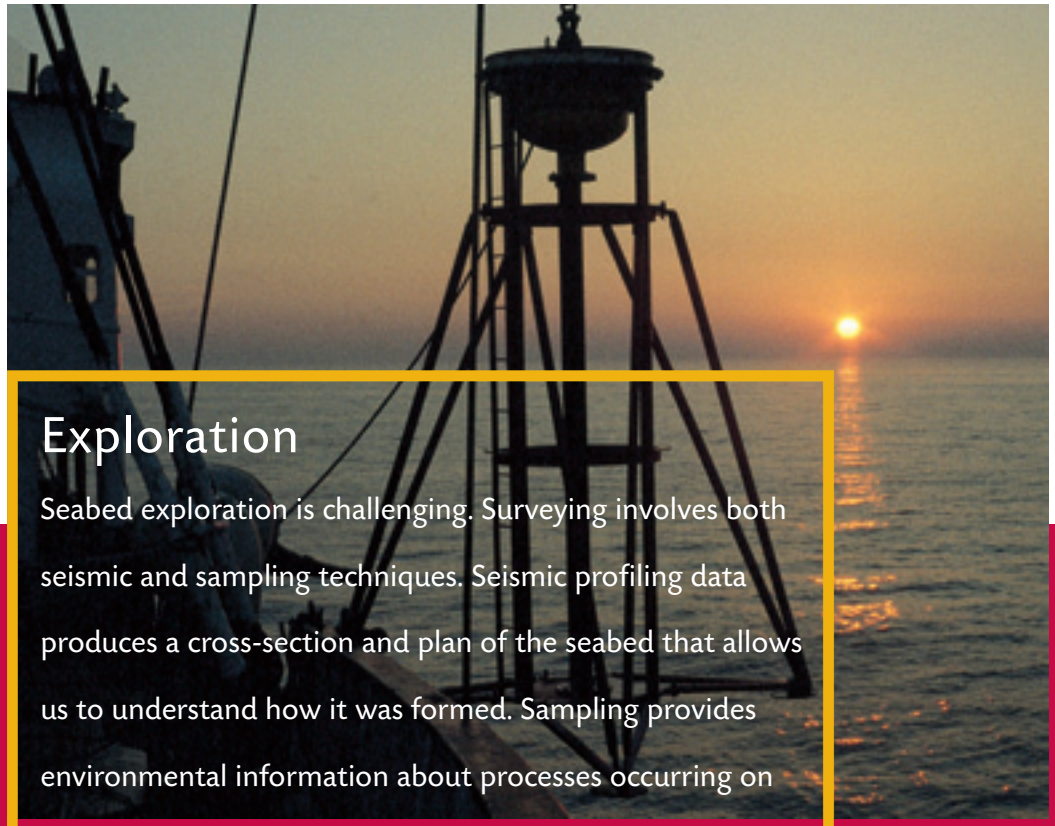
20,000 years ago
With sea levels 100 metres lower, today's seabed was exposed as dry land.



8,000 years ago
Old river valleys bearing sand and gravel deposits were submerged when sea levels rose after the Ice Age.



Today
Sea levels have risen further to establish today's coastline. Sediment has been re-worked by the action of the sea, leaving clean, well-sorted aggregates.



Exploration

Seabed exploration is challenging. Surveying involves both seismic and sampling techniques. Seismic profiling data produces a cross-section and plan of the seabed that allows us to understand how it was formed. Sampling provides environmental information about processes occurring on the seabed and also involves taking cores to establish aggregate quality. The photo shows a Vibrocore sampler, used in prospecting.

Licensed areas

Licences and dredging

The Crown Estate owns the mineral rights to the seabed and issues commercial licences to explore and extract sand and gravel. However, an extraction licence is only issued if permission to dredge is given by the Department for Communities and Local Government in England, the Welsh Assembly Government or the Scottish Executive. Typically, licence areas lie between five and 35 kilometres offshore at depths of between ten and 40 metres.

From seabed

to shore

The nation's marine aggregate needs are currently satisfied by a fleet of some 25 vessels, operating around the clock 365 days a year. The ships are predominantly British registered and cost over £20 million each. A large dredger can load some 5,000 tonnes of sand and gravel in around three hours, with overall operational cycles usually of between 12 and 37 hours, depending upon the port of discharge. Most vessels can self-discharge in three to four hours.

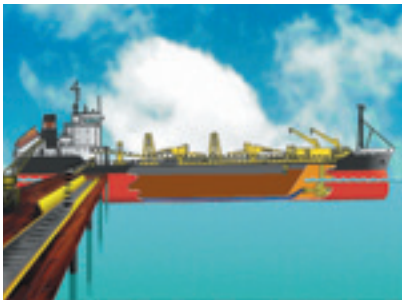
Two types of dredging technique are employed. Anchor dredging involves a vessel anchoring over a deposit and is effective in working thick, localised reserves. Trailer dredging requires the dredger to trail its pipe along the seabed at speeds of up to 1.5 knots. It is ideal for working more evenly distributed deposits.

At the heart of the dredging process are powerful pumps which, on large vessels, are capable of drawing up to 2,600 tonnes of material an hour from depths of up to 50 metres. A variety of techniques are employed for discharging, including bucket wheels, scrapers, wire-hoisted grabs and pumps.

The dredgers are operated by highly trained crews. Given that the ships trade in some of the busiest waters in the world and that their work rate is a busy one, high standards of professionalism and safety are called for.

Loading

To locate the dredging area, vessels use satellite navigation systems accurate to less than five metres. The dredge pipe is then lowered and powerful pumps draw the sand and gravel into the ship's cargohold, displacing the seawater previously loaded as ballast.



Discharging

Discharging may involve bucket wheels, scrapers or wire-hoisted grabs which place the aggregate onto a conveyor system for delivery to the wharf or processing plant. Hydraulic discharge is another option, used principally for beach replenishment schemes.

Turning raw materials

into products

Most dredgers have sophisticated discharging systems for efficient unloading at aggregate wharves. The wharves themselves have advanced screening and washing facilities, although some sell the product without the need for processing.

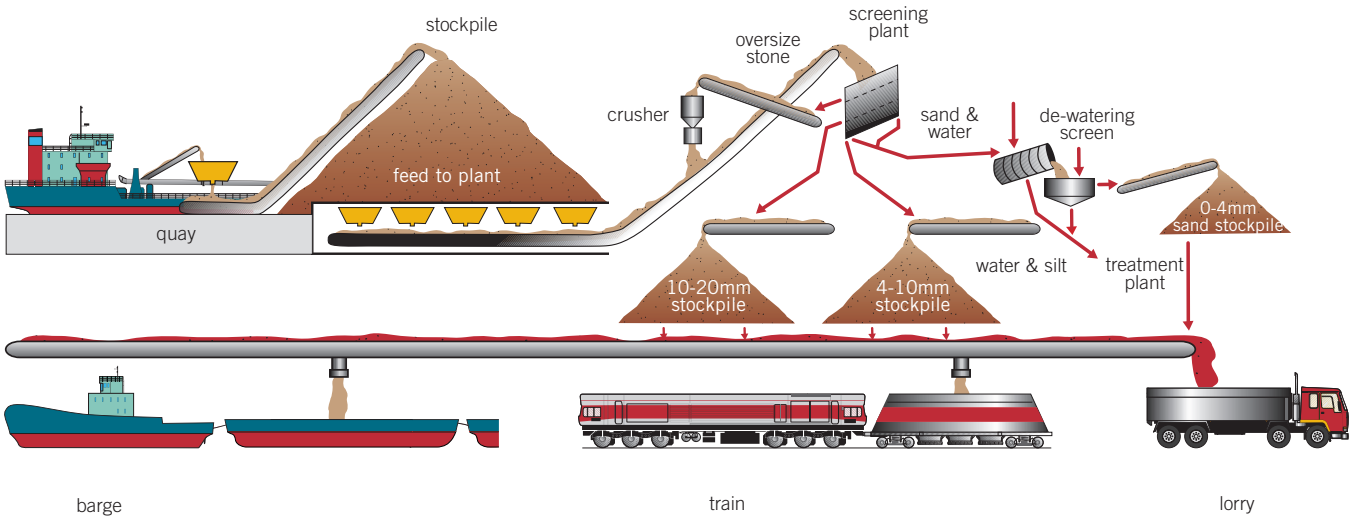
Greatest demand is for 0/4mm (sand) 4/10mm, 10/20mm and 20/40mm gravel. Any oversize gravel is usually crushed before being re-screened into the smaller grades.

Ready-mixed concrete and concrete products are the main uses of marine aggregates, and many wharves now incorporate manufacturing facilities. One of the great benefits of the industry is its ability to deliver large volumes of aggregates close to the heart of urban areas, so greatly reducing the impact of heavy lorries. In London, ships offload at plants close to the centre. The large scale use of trains further reduces the need for road transport, and barges are used to deliver to some riverside projects.

Minimising impact

A typical ship delivers the equivalent of 250 lorry loads. A train carries as much aggregate as 75 lorries. In London alone, rail deliveries of marine aggregates total around one million tonnes a year, the equivalent of some 50,000 lorry loads.

Processing



Quality products

for quality projects

Marine aggregates have an important role to play in helping to meet the needs of our built environment. They are vital both to our quality of life and to the economy. In the UK, our aggregate requirements equate to more than five tonnes per head of the population each year.

Large volumes of marine sand and gravel have been used in construction projects throughout the past century, most of it for the production of concrete. Since 1955, a total of around 500 million tonnes of aggregates have been dredged from the sea and used for our built environment.

Marine gravels are typically smooth and rounded due to the distance they have been transported in the geological past and to the constant pounding of the sea. Research has demonstrated that shell fragments in aggregates do not affect concrete strength. Nevertheless, European Standards are in place to limit shell content, which is generally low.

The chloride (salt) content from sea-water is controlled by rapid draining after dredging and can be further reduced by washing during processing. The chloride content of both the wash water and the product is carefully monitored to ensure that strict European Standards are met. A system of product certification is in place to confirm quality for customers.

The greatest testament to the quality of marine aggregates is the number of high profile projects in which they have been used. They have equally been used for more modest projects – homes, schools, offices, hospitals and much more.

Planned Olympic stadium

Heathrow Terminal 5

Bluewater regional shopping centre

Fighting for the beaches

Marine aggregates are playing a front-line role in replenishing Britain's beaches, so protecting the coastline from erosion. Large scale beach nourishment is only possible from marine sources, where large volumes landed direct from dredgers avoids the need for fleets of heavy lorries. Between 1995 and 2005 over 25 million tonnes of marine aggregate was used in this way around Britain to fight the ravages of the sea. Major schemes have included the east coast between Mablethorpe and Skegness and between Happisburgh and Winterton. On the south coast, major replenishment schemes have taken place at Hythe, Eastbourne, Hurst Spit and Weymouth. In many cases, as well as protecting the coastline, the amenity value has also been improved. More visitors are then attracted, with benefits to the local economy.

Beach replenishment

Regulated

and responsible

The Crown Estate owns the mineral rights to the sea-bed around the UK and issues licences for extraction. A royalty is paid to The Crown Estate for every tonne dredged and the bulk of revenue is passed to the Exchequer. The Crown Estate will only issue a license if permission is granted by either the Department for Communities and Local Government, the Welsh Assembly Government or the Scottish Executive.

Marine aggregate prospecting rights are awarded by The Crown Estate following competitive tender. If a viable deposit is located, then an application to dredge is submitted to the relevant authority. An application must include a wide variety of environmental studies, including coastal processes, fisheries, marine archaeology and biology.

A Government decision is reached after consultation with local authorities, fishing organisations, Government advisers and other bodies. If an application is considered environmentally acceptable then a permission and licence are granted. Conditions are commonly attached including regular environmental monitoring and zoning restricting the area dredged at any one time.

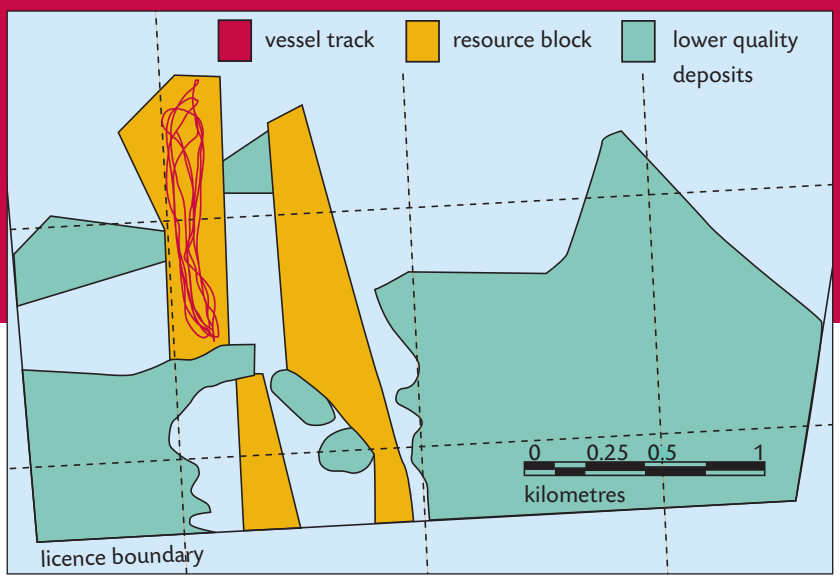
Managing the resources

BMAPA and The Crown Estate have a joint initiative to ensure the careful management of Britain's marine aggregate resources. All licence areas managed by BMAPA member companies are reviewed on an annual basis and unproductive zones are relinquished to minimise the area under licence. Dredging within individual licence areas is controlled through voluntary zoning to minimise the areas of seabed actually being worked.

Regular fishing liaison meetings take place to encourage co-operation with the fishing industry. BMAPA also holds regular discussions with archaeological and coastal protection interests, both as part of the application procedure and while areas are dredged. In addition, research is taking place into the environmental aspects of marine aggregate dredging to assist in the licensing process and to address issues of interest and concern. Examples include:

* *Seabed biological recovery post dredging*
* *Seabed sediment mobility*
* *Marine archaeological potential of dredging areas.*

Satellite navigation ensures precision dredging



Key issues

Questions and Answers

Does marine aggregate dredging contribute to coastal erosion?

There is no evidence of any coastal impact due to dredging. Coastal erosion and coastal change, driven by waves and currents, is a natural phenomenon that affects both beaches and cliffs. The industry's objective is to ensure that marine aggregate extraction does not affect these coastal processes; for example, change the wave climate or interfere with seabed sediment transport. Although dredging occurs varying distances offshore (often eight kilometres or more) and commonly in water at least 20 metres deep, the industry still carries out detailed studies. Before permission to dredge is granted, careful analysis of waves and currents in the area is undertaken using hydrodynamic models. A conservative approach exaggerates the dredging and consequently over-estimates the possible impact. Permission would not be given if the experts felt there was the slightest threat. Modelling is always combined with an assessment of sediment transport to ensure that pathways to beaches or inshore areas are not disrupted. It is worth noting that, rather than moving in and out of the coast, sediment on the seabed around the dredging areas tends to move parallel to the coast. As a further safety mechanism, monitoring of the seabed and adjacent coast in sensitive areas is also undertaken while dredging is carried out.

Does marine dredging affect fishermen?

A finite area of sea space accommodates a number of resources upon which we all depend and in places dredging companies operate in similar areas to fishermen. Working arrangements have led to zoning of dredging licences and dredgers working within areas of licences previously agreed with fishermen. A series of regional fisheries liaison groups allows open discussion of issues. As a result, the relationship with fishermen is generally a very constructive one. As a precautionary measure the dredging industry also funds research and monitoring in conjunction with the Government regulator, to assess potential impacts. The needs of fishermen are considered from the earliest stages of a licence application through the environmental assessment. If unacceptable impacts are predicted or the proposed licence lies in a sensitive area such as a spawning ground, a dredging consent will not be issued.

Are there implications for maritime archaeology?

There are two major issues in marine archaeology – wrecks and submerged landscapes. As a responsible seabed user, the marine aggregates industry is keen to preserve and respect our marine heritage and to contribute to better understanding of it. Operators strictly observe a jointly developed code of practice that includes mapping

of the seabed prior to dredging in order to establish the positions of any wrecks and debris and the potential for submerged prehistoric landscapes. This results in localised dredging restrictions. Archaeology is considered by experts who contribute to the environmental statement.
If required, dredging activities take account of any specific guidance provided by marine archaeologists which may include monitoring particular aspects of the seabed development.

How is marine life affected?

While marine life is inevitably affected by dredging, evidence suggests that impacts are confined to the actual dredging area; are generally short-lived; and that there is no long-term effect on biodiversity. Within the dredging areas thin layers of seabed are effectively removed, and life is physically disturbed. After dredging is completed, the seabed is left in a similar condition to when dredging commenced, re-colonisation begins almost immediately and the seabed is biologically similar within two to five years. Noise and sedimentation plumes arising from dredging operations may also potentially affect life in surrounding areas. At a distance greater than 500 metres from a dredger, plumes consist of silts and clays. The clays and silts in the plumes are, however, present in such low concentrations that they have no discernable effect on communities that have often evolved to live in such conditions naturally. BMAPA continues to contribute to ongoing studies designed to further extend understanding.

How long will marine aggregates last?

Subject to continuing research and consideration of local environmental impacts, there are sufficient marine aggregate resources on the seabed for at least a further 50 years at present levels of extraction. Responsibly managed and controlled, its impacts are limited and relatively short-term. It does not, therefore, compromise the use of the marine environment by future generations. The industry is sustainable in that it causes no lasting damage to the seabed and will not compromise development and use by future generations or sea-life. Marine aggregates are also fully recyclable. When a structure or building constructed using marine aggregates reaches the end of its useful life the demolition material can be re-used in new construction projects. Providing new consents continue to be granted, the supply of low environmental impact, high quality marine aggregates to some of our major population centres and beaches will be guaranteed for decades to come.

BMAPA

www.bmapa.org

Members of the British Marine Aggregate Producers Association

Britannia Aggregates Ltd
CEMEX UK Marine Ltd
DEME Building Materials Ltd
Hanson Aggregates Marine Ltd
Kendall Bros (Portsmouth) Ltd
Lafarge Aggregates Ltd
Northwood (Fareham) Ltd
Norwest Sand and Ballast Co
United Marine Aggregates Ltd
Volker Dredging Ltd

BMAPA welcomes comments and requests for further information about the industry's work.

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