<table>
<thead>
<tr>
<th>Strategy</th>
<th>What it does</th>
<th>Cons</th>
<th>Pros</th>
<th>Examples</th>
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<tbody>
<tr>
<td><strong>SOFT ENGINEERING:</strong></td>
<td><em>The use of ecological principles and practices to reduce erosion and achieve the stabilization and safety of coastlines. It improves ecological features, and is achieved by using vegetation &amp; other materials (e.g. sand)</em></td>
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| **Stabilizing Dunes**  | - Planting native grasses, trees, shrubs or ground covers to stabilize dunes, and reduce the impact of wind and water.  
- Erect fences that catch sand and other material.  
- Construct footpaths that protect dunes from damage from foot traffic, and keep pedestrians and traffic off the area being stabilized. | - Time factor – takes a long time to take effect  
- Easily damaged by human trampling on the grasses  
- High monetary and labour costs, due to it needing consistent maintenance. It may cost up to £20,000/km, plus ongoing management costs.  
- Construction of fences or thatching will disrupt public use of the beach => possible loss to tourism  
- Unlikely to succeed when erosion is severe | - Long-Term solution  
- “Green method”, environmentally friendly, and potentially self-sustaining  
- Leads to biodiversity also (ecological succession), perhaps even tourism | - New Brighton Beach/Spen cer Park Beach, New Zealand |
| **Planting Mangroves** | - Mangroves can help buffer against tsunamis, cyclones, and other storms | - Planting mangroves offers no protection when the wave intensity is huge |                                                                      | - Indonesia                        |
| **Beach Nourishment**  | - Sediment (usually sand) lost through longshore drift or erosion is replaced from sources outside of the eroding beach. It involves transporting and depositing sand from elsewhere to the depleted area.  
- Reduce storm damage to coastal structures by dissipating energy across the surf zone and beach rather than impacting upland structures and infrastructure  
- Decreases gradient of slope to cause wave energy to | - Nourishment is typically a repetitive process, since nourished beaches tend to erode faster than natural beaches  
- High costs (£5,000-£200,000/100m), and it is time-consuming  
- Beach nourishment has | - However, nourishment can provide more/better habitat for them, as well as for sea birds and beach flora  
- Erosion protection | - Poole & Bournemout h, southeast England. From 1970-2000, almost 2 million m³ of sand was |
**dissipate**

- Significant impacts on local ecosystems.
  - Imported sand may differ in character (chemical makeup, grain size, non-native species) from that of the target environment, hence may contain material toxic to local species.
  - Difficulty of execution: Usage of the beach and the expected sea conditions govern the grade of material used on the beach.

**Hard Engineering:** use of concrete structure to absorb/deflect wave energy. Usually goes against environmental principles.

<table>
<thead>
<tr>
<th>Growth of coral reefs</th>
<th>Wire cages usually filled with crushed rocks</th>
<th>Offers only short-term protection</th>
</tr>
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<tbody>
<tr>
<td>- Artifical growth of coral reefs on some material (not particular, can be sunken ships or anything)</td>
<td>- Expensive</td>
<td>- “Natural”</td>
</tr>
<tr>
<td>- Dissipate wave energy by acting like natural breakwaters</td>
<td>- Time-consuming</td>
<td>- Japan</td>
</tr>
<tr>
<td>- There are concerns for artificial reefs such as toxicity, damage to ecosystems and concentrating fish into one place and thus worsening the effects of overfishing.</td>
<td>- Need regular maintenance as they are easily corroded by seawater</td>
<td></td>
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**Gabions**

- Piled up along the shore to prevent or reduce coastal erosion by weakening wave energy
- Unsightly, a danger along the beach
- Extremely cheap

**Scotland!**
| Groynes | - Built at right angles to the shore to intercept transport of materials away from beach by longshore drift  
| - Constructed in groups called groyne fields  
| - Absorb or reduce the energy of the waves and acts as a barrier to slow down the lateral transport of beach materials.  
| - Causes materials to be deposited and built up (accretion) on the side of the groyne facing the longshore drift  
| - Creates and maintains a wide area of beach or sediment on its updrift side to protect the land behind  
| - Interrupts tidal flow by forcing the tidal current further offshore beyond the groyne end. This slows the tidal current inshore, causing the deposition of heavier sediments and encouraging the beach to grow in size. | - Causes a shoreline to be perceived as unnatural and unattractive  
| - If a groyne is too large it may trap too much sediment, which can cause severe beach erosion on the down-drift side. Too small, and it is ineffective  
| - Disrupts natural processes | - Cost-effective (£10 000 - £100 000)  
| - Require low maintenance  
| - Can be long lasting  
| - If used in tandem with seawalls and revetments, can provide a very effective means of coastal defence | - East coast of England  
| - Crescent Beach in Surrey, British Columbia, Canada |
### Breakwaters

- Protect coast by reducing intensity of wave action before they reach the shore
- Dissipates wave energy in relatively shallow water, when waves hit the breakwaters their erosive power, the power is concentrated on these structures some distance away from the coast. In this way there is an area of slack water behind the breakwaters where deposition occurs, and J-shaped beaches or tombolos can be built up in those waters.
- However, the nearby unprotected areas will not receive fresh supplies of sediments, and will shrink due to erosion
- Can either be built with one end attached to the coast or built away from coast, can be fixed or floating

### Benefits

- Encourage erosion of beach deposits from unprotected areas
- Increase longshore sediment transport
- Economical means of protecting shoreline and creating beaches

### Examples

- Miami Beach (32nd Street)
- Port of Genoa, Italy
- Catalan Coast, Barcelona, Spain
**COASTAL MANAGEMENT AND PROTECTION METHODS!**

| Sea Walls | Longitudinal structure built parallel to the coast. Made of concrete, steel etc. Walls can be sloping, vertical or curved to reflect wave power. The structure also absorbs some of the erosive power of waves. | Only absorb energy from the oncoming waves. Do not prevent the backwash of refracted waves from washing away the beach material beneath the walls. Base of sea walls would be undermined and leads to their collapse. Costly to build and maintain as constant repairs have to be made to prevent their collapse. Sea walls can cause beaches to dissipate rendering them useless for beach goers. Their presence also scars the very landscape that they are. | Very effective form of coastal defence. | Ventor, UK - Sicily |
| **Tetrapods** | - Four-legged concrete structure used as armour unit on breakwaters.  
- Shape is designed to dissipate the force of incoming waves by allowing water to flow around rather than against it  
- Reduce displacement by allowing a random distribution of Tetrapods to mutually interlock.  
- Tetrapods and similar structures are often numbered so any displacement that occurs can be monitored through satellite photos. | **trying to save.** | **Expensive!**  
- Some people think it’s unsightly  
- Earlier barrier material used in breakwaters, such as boulders and conventional concrete blocks, tended to become dislodged over time by the force of the ocean constantly crashing against them, but this one doesn’t (:  
- California  
- Japan |
## Coastal Management Approaches:

<table>
<thead>
<tr>
<th>Strategy</th>
<th>What it entails</th>
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</table>
| **Do Nothing**    | - Involves no protection at all  
                    - A cheap way to let the coast take care of itself  
                    - Abandonment of coastal facilities when they are subject to coastal erosion  
                    - Means losing a lot of land to the sea  
                    - Usually used for land that is of little value                                                                                                                                                        |
| **Managed Retreat** | - Allows an area that was not previously exposed to flooding by the sea to become flooded  
                           - Managed retreat is often a response to a change in sediment budget or to sea level rise. The technique is used when the land adjacent to the sea is low in value. A decision is made to allow the land to erode and flood, creating new sea, inter-tidal and salt-marsh habitats. This process may continue over many years and natural stabilization will occur. |
| **Hold the Line** | - Involves using structural or hard engineering techniques, i.e. using permanent concrete and rock constructions to "fix" the coastline and protect the assets located behind.  
                           - Soft engineering techniques can also be employed (e.g. sand nourishments), building with natural processes and relying on natural elements such as sands, dunes and vegetation to prevent erosive forces from reaching the backshore. These techniques include beach nourishment and sand dune stabilization.  
                           - Objective: to retain the coastline                                                                                                                                                                        |
| **Move Seaward**  | - Moving seaward: Using breakwaters, artificial reefs  
                           - Extend the coastline, move out to the sea in terms of coastal defence                                                                                                                                 |
| **Limited intervention** | - Limited intervention is an action taken whereby the management only solves the problem to some extent, usually in areas of low economic significance.  
                           - Inexpensive                                                                                                                                                                                               |

**Resources:**


other websites in which I did not take down. Mostly taken from wiki though!

**ps:** the geog dept uses wiki for their notes!