QCB 1013-PHYSICAL GEOLOGY

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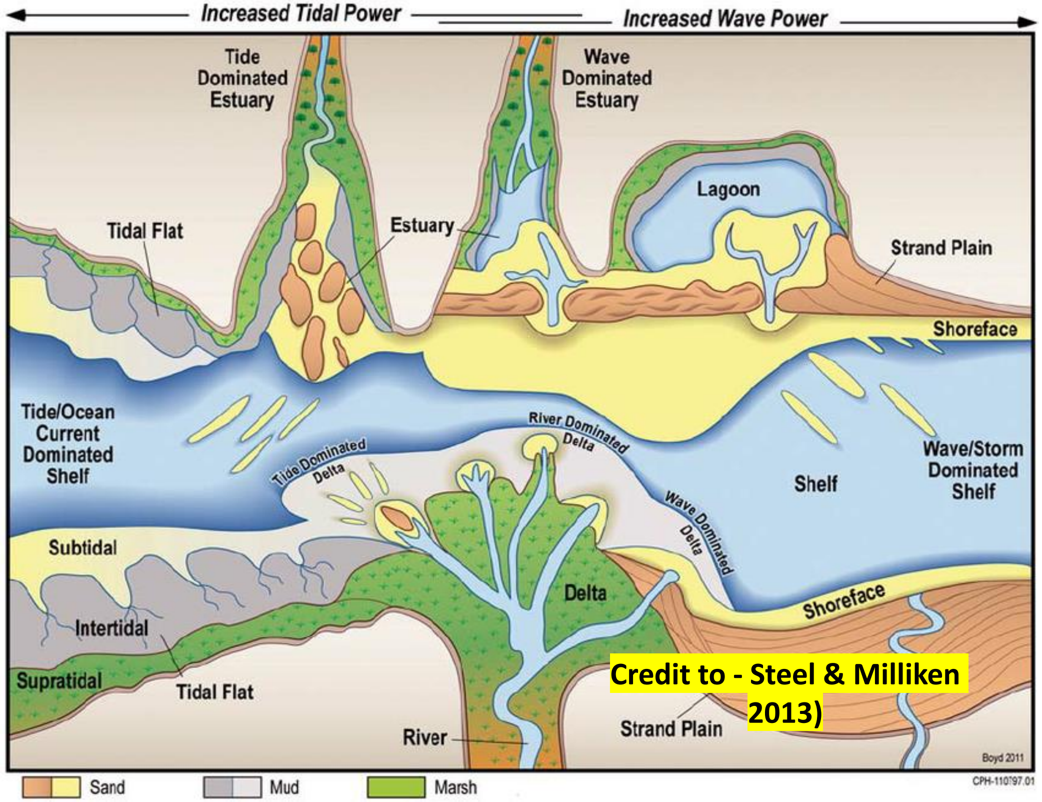
COASTAL MORPHOLOGY



Credit to - Steel & Milliken 2013)

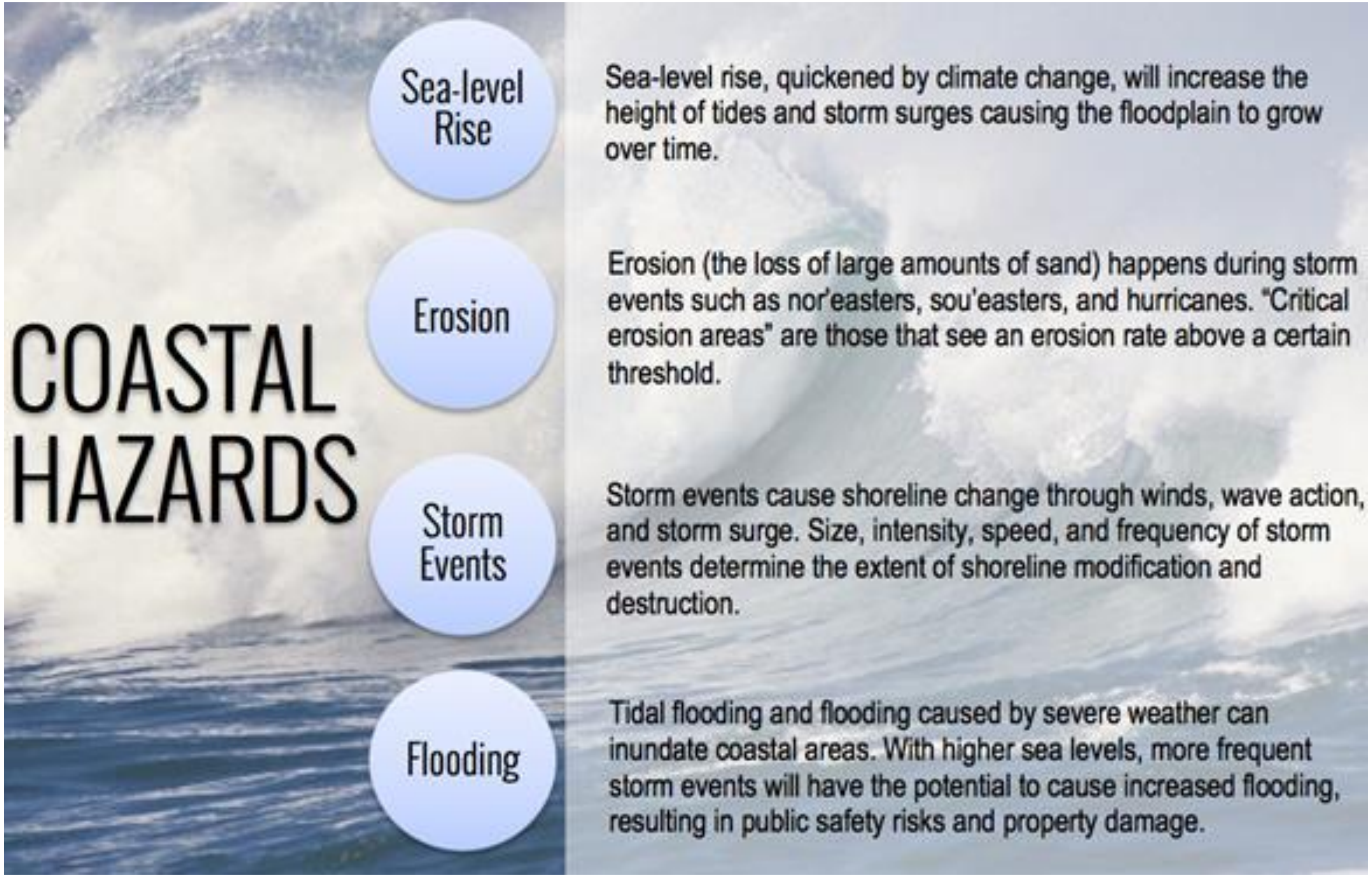
Credit to - https://blogs.adb.org/blog/data-climate-change-effective-weapon-fighting-india-s-coastal-erosion

COASTAL HAZARDS AND DISASTER

Coastal hazards are physical phenomena that expose a coastal area to risk of property damage, loss of life and environmental degradation. Rapid-onset hazards last over periods of minutes to several days and examples include major cyclones accompanied by high winds, waves and surges or tsunamis created by submarine earthquakes and landslides. Slow-onset hazards develop incrementally over longer time periods and examples include erosion and gradual inundation. (Credit to - https://en.wikipedia.org/wiki/Coastal_hazards)

Coastlines such as one along this beach in northern Florida face problems as a result of natural disasters. Earth 107: Coastal Processes, Hazards and Society is a Penn State World Campus course designed to teach students how to understand and respond to these threats. IMAGE: PIXABAY : Credit to : https://news.psu.edu/story/492879/2017/11/07/academics/students-navigate-real-time-coastal-hazards-world-campus-course

TYPE OF HAZARDS



Credit to - http://www.beachsamp.org/wp-content/uploads/2014/07/03-Coastal-Hazards-graphic.jpg

Credit to: https://www.internetgeography.net/

HOW TO MITIGATE COASTAL HAZARDS – BEACH NOURISHMENT

- Beach nourishment (also referred to as beach renourishment, beach replenishment, or sand replenishment) describes a process by which sediment, usually sand, lost through longshore drift or erosion is replaced from other sources.
- A strategy of beach nourishment entails the placement of sand directly onto a beach – either by using conventional earthmoving techniques or by pumping – so as to restore an adequate erosion buffer on the foreshore. The advantages of beach nourishment as an erosion management strategy are that it has virtually no adverse impacts on adjacent foreshores, and it maintains (or may even enhance) beach amenity.
- More Beach To Love: Outer Banks Beach Nourishment Projects 2017 - https://www.youtube.com/watch?v=kKoc3x97BsY&t=2s

Credit to : http://www.coastengsol.com.au/beach-nourishment-a-panacea-for-eroding-beaches/

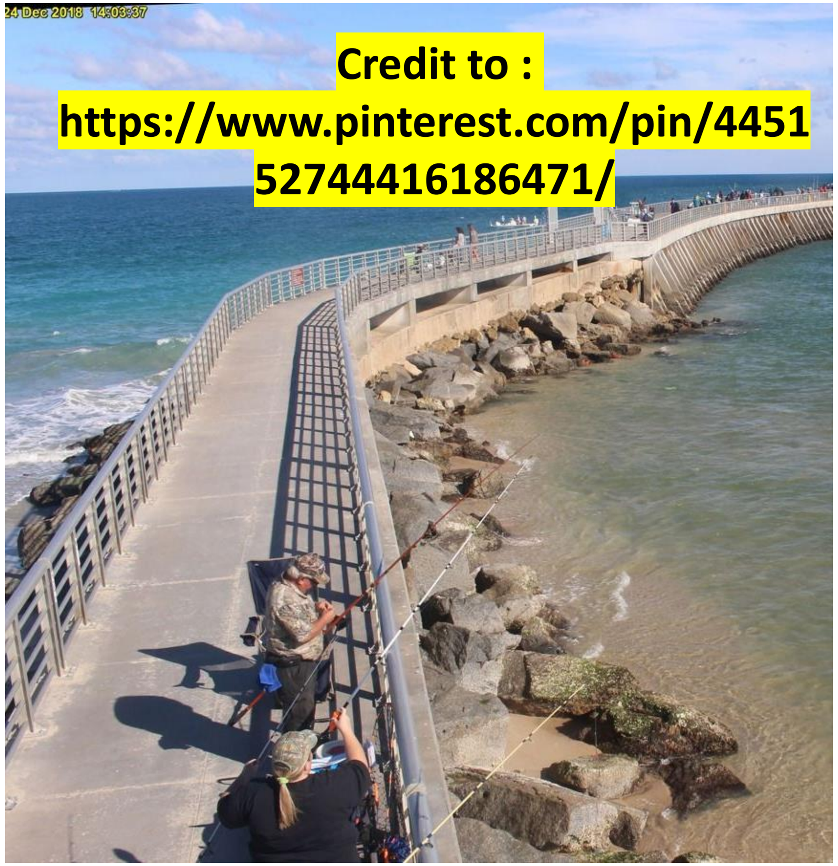
HOW TO MITIGATE COASTAL HAZARDS – SHORE PERPENDICULAR STRUCTURES - GROIN

- Shore perpendicular protection structures are designed to either reduce the rate of transport of sand along a specific reach of shoreline or to completely block the alongshore movement of sand beyond a certain point.
- Groins are another example of a hard shoreline structure designed as so-called "permanent solution" to beach erosion. It is usually made of large boulders, but it can be made of concrete, steel or wood. It is designed to interrupt and trap the longshore flow of sand.
- Sand builds up on one side of the groin (updrift accretion) at the expense of the other side (downdrift erosion). If the current direction is constant all year long, a groin "steals" sand that would normally be deposited on the downdrift end of the beach.
- The amount of sand on the beach stays the same. A groin merely transfers erosion from one place to another further down the beach.

HOW TO MITIGATE COASTAL HAZARDS – SHORE PERPENDICULAR STRUCTURES - JETTIES

- Jetties are large, man-made piles of boulders or concrete that are built on either side of a coastal inlet. Whereas groins are built to change the effects of beach erosion, jetties are built so that a channel to the ocean will stay open for navigation purposes. They are also built to prevent river mouths and streams from meandering naturally.

- Jetties completely interrupt or redirect the longshore current. Just as a groin accumulates sand on the updrift side, so do jetties. The major difference is that jetties are usually longer than groins and therefore create larger updrift beaches at the expense of the smaller downdrift beaches.



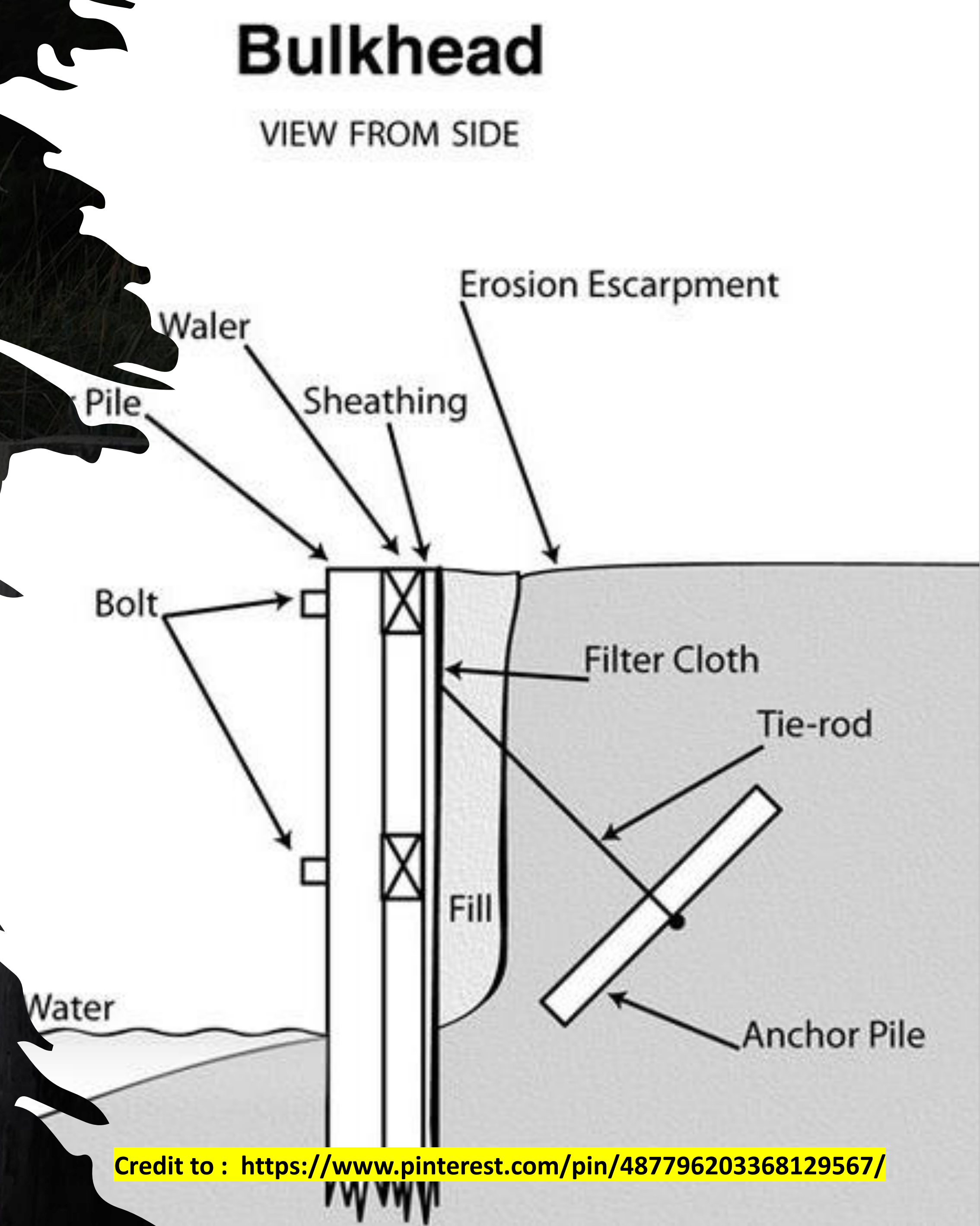
HOW TO MITIGATE COASTAL HAZARDS – SHORE PERPENDICULAR STRUCTURES – TERMINAL GROIN

- Jetties and groins are manmade structures constructed perpendicular to the beach, with jetties usually being much longer, and are located adjacent to inlets with the purpose of maintaining navigation in the inlet by preventing sand from entering it.
- In contrast, terminal groins are structures built at the end of a littoral cell to trap and conserve sand along the end of the barrier island, stabilize inlet migration, and widen a portion of the updrift beach. Terminal groins are designed so that when the area behind the groin fills in with sand, additional sand will go around the structure and enter the inlet system.
- (Credit to : http://www.beachapedia.org/Shoreline_Structures#:~:text=In%20contrast%2C%20terminal%20groins%20are,portion%20of%20the%20updrift%20beach)

HOW TO MITIGATE COASTAL HAZARDS – SHORE PARALLEL STRUCTURES – BULKHEAD

- A bulkhead is a retaining wall, such as a bulkhead within a ship or a watershed retaining wall. It may also be used in mines to contain flooding.
- Coastal bulkheads are most often referred to as seawalls, bulkheading, or riprap revetments. (https://en.wikipedia.org/wiki/Bulkhead)

Credit to : https://pugetsoundblogs.com/waterways/files/2016/03/Bulkhead.jpg



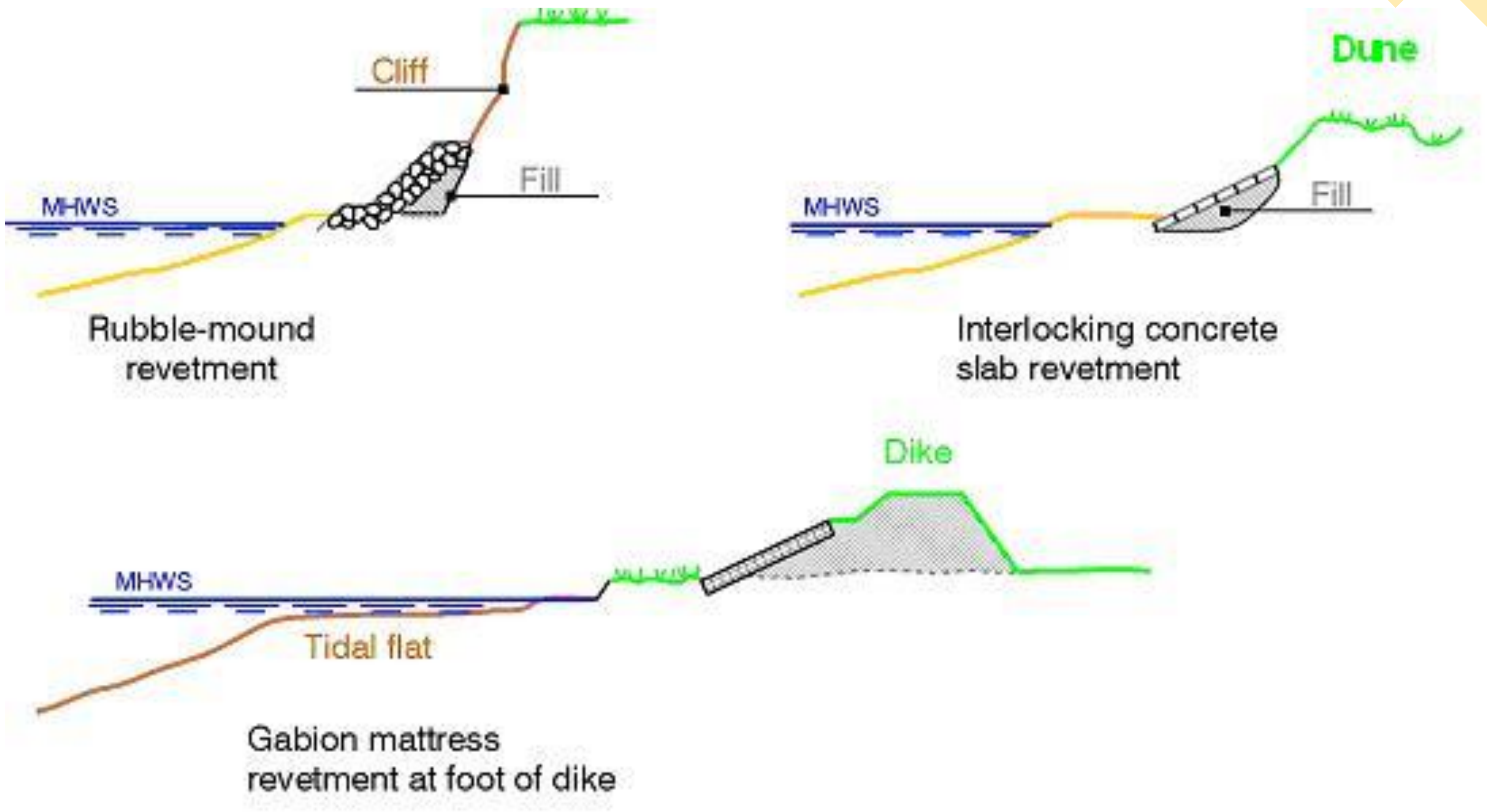
Credit to : https://www.pinterest.com/pin/487796203368129567/

HOW TO MITIGATE COASTAL HAZARDS – SHORE PARALLEL STRUCTURES – REVETMENTS

- Revetments are always made as sloping structures and are very often constructed as permeable structures using natural stones or concrete blocks, thereby enhancing wave energy absorption and minimising reflection and wave run-up.

- However, revetments can also consist of different kinds of concrete slabs, some of them permeable and interlocking. In this way their functionality is increased in terms of absorption and strength. An example of a permeable and interlocking concrete slap is the so-called Flex Slap.

- Net mesh stone-filled mattresses, such as gabions, are also used; however, they are only recommended for use at fairly protected locations.



Credit to : http://www.coastalwiki.org/wiki/Revetments

HOW TO MITIGATE COASTAL HAZARDS – SHORE PARALLEL STRUCTURES – SEAWALL

- A seawall (or sea wall) is a form of coastal defense constructed where the sea, and associated coastal processes, impact directly upon the landforms of the coast. The purpose of a sea wall is to protect areas of human habitation, conservation and leisure activities from the action of tides, waves, or tsunamis.

Credit to : https://en.wikipedia.org/wiki/Seawall

HOW TO MITIGATE COASTAL HAZARDS – SHORE PARALLEL STRUCTURES – BREAKWATERS

- Breakwaters are structures constructed near the coasts as part of coastal management or to protect an anchorage from the effects of both weather and longshore drift.
- Breakwaters reduce the intensity of wave action in inshore waters and thereby provide safe harbourage. Breakwaters may also be small structures designed to protect a gently sloping beach to reduce coastal erosion; they are placed 100–300 feet (30–90 m) offshore in relatively shallow water.

NONE TRADITIONAL COASTAL PROTECTION METHOD

- PEM - Passive Dewatering for Beach Erosion Control - https://www.youtube.com/watch?v=OqQh67AOfaE
- Coastal protection and Erosion control using Geotube - https://www.youtube.com/watch?v=G_weWknzdPQ
- How to Restore Your Shore with Coir Logs - https://www.youtube.com/watch?v=71q6eH0WTkQ

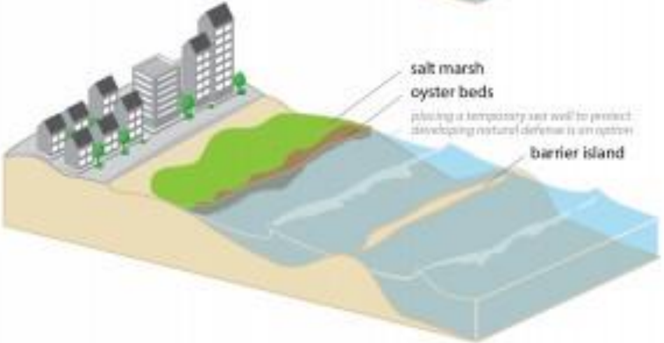
http://floodlist.com/protection/noaa-report-natural-infrastructure-coastal-flood-management

Minimal Defense

Many communities have developed right along the ocean with only minimal natural defenses from a small strip of beach between them and the ocean.

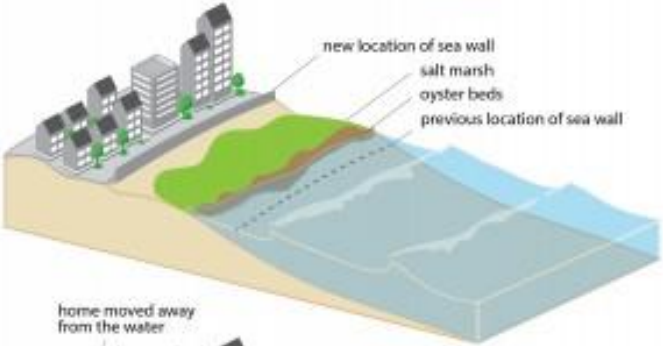
Natural

Natural habitats that can provide storm and coastal flooding protection include salt marsh, oyster and coral reefs, mangroves, seagrasses, dunes, and barrier islands. A combination of natural habitats can be used to provide more protection, as seen in this figure. Communities could restore or create a barrier island, followed by oyster reefs and salt marsh. Temporary infrastructure (such as a removable sea wall) can protect natural infrastructure as it gets established.



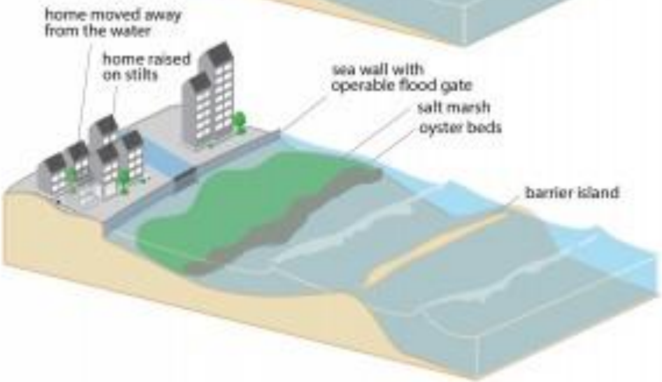
Managed Realignment

Natural infrastructure can be used to protect built infrastructure in order to help the built infrastructure have a longer lifetime and to provide more storm protection benefits. In managed realignment, communities are moving sea walls farther away from the ocean edge, closer to the community and allowing natural infrastructure to recruit between the ocean edge and the sea wall.



Hybrid

In the hybrid approach, specific built infrastructure, such as removable sea walls or openable flood gates (as shown here) are installed simultaneously with restored or created natural infrastructure, such as salt marsh and oyster reefs. Other options include moving houses away from the water and/or raising them on stilts. The natural infrastructure provides key storm protection benefits for small to medium storms and then when a large storm is expected, the built infrastructure is used for additional protection.



Q&A