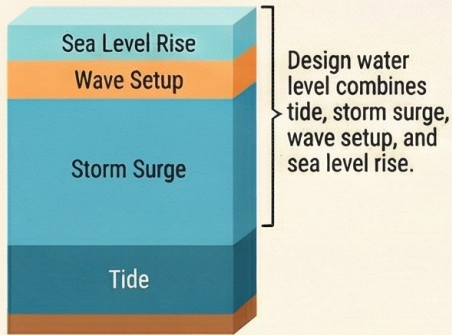


Engineering the Defended Shoreline: How Coastal Structures Tame the Waves

THE COASTAL CHALLENGE: UNDERSTANDING THE FORCES

STORM SURGE IS MORE THAN JUST HIGH TIDE
Abnormal rise of water pushed ashore by a storm, creating extreme flooding.

TOTAL WATER LEVEL: THE STACK-UP EFFECT



SEA LEVEL RISE AMPLIFIES FUTURE RISK



Global sea level is projected to rise by a likely range of 1 to 4 feet by 2100.

THE ENGINEERING RESPONSE: DESIGNING FOR RESILIENCE

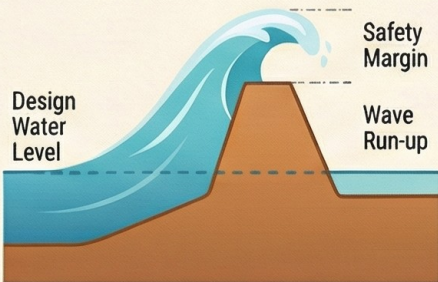
A TOOLBOX OF COASTAL STRUCTURES
Engineers deploy various structures like seawalls, groynes, and breakwaters to manage wave energy.

Breakwater

Groynes

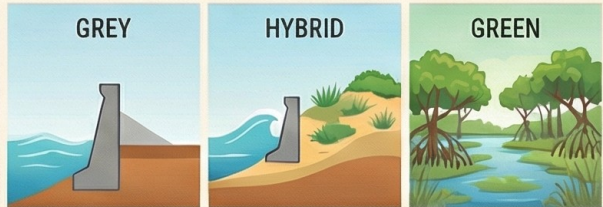
Seawall

DESIGNING THE CREST: HOW HIGH IS HIGH ENOUGH?



The structure's height is determined by calculating wave run-up and adding a safety margin.

THE TRADE-OFFS: FROM GREY TO GREEN SOLUTIONS



Traditional hard structures offer protection but have lower adaptability and ecological value.

APPROACH	FUNCTION	ADAPTABILITY	ECOLOGICAL VALUE
Grey	Resist forces	Low	Low
Hybrid	Combine grey + green	Medium	Medium
Green	Work with nature	High	High