



Subaqueous capping remediation

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Kendall Bay, Sydney 2020

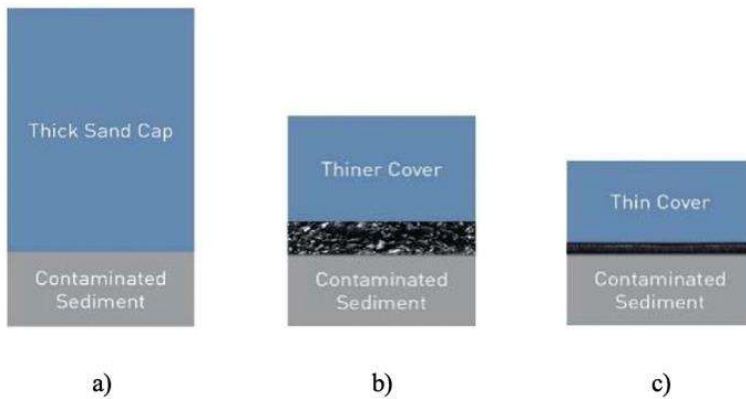
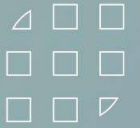




Kendall Bay, Sydney 1980s



In-situ stabilisation

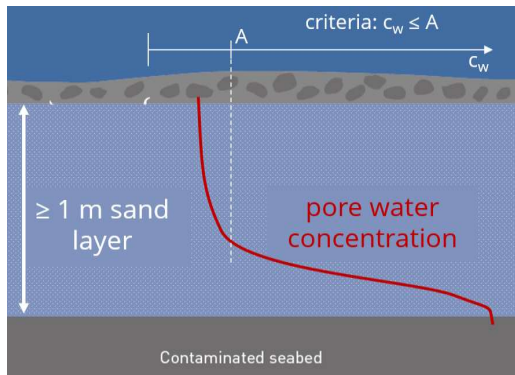


a) Conventional capping

b) Amended capping

c) Capping with active geocomposites

Conventional capping



Natural capping material

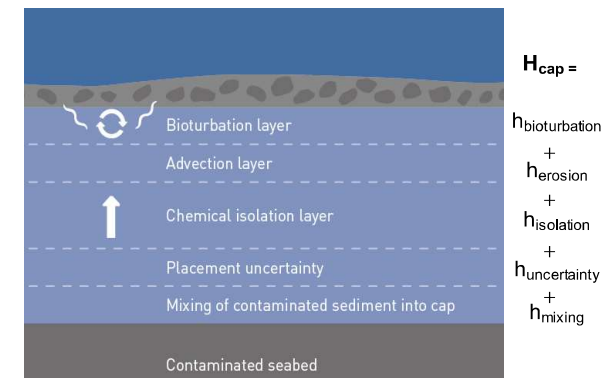
Criteria: $C_w \leq A$

C_w = pore water concentration
 A = specified level of concentration

Conventional capping often consists of clean sediment or sand and acts as a diffusion barrier for the contaminants. A **very thick** layer of sand is necessary to reduce the concentration of the pollutants in pore water.

Why is a thick layer of sand needed?

The uppermost functional layer serves as a habitat for the benthic community. However, it is notable that **bioturbation** could compromise the cap by generating a direct migration pathway to the surface. Hence, a bioturbation layer should be integrated into the cap design. **Advection** refers to contaminant transport due to groundwater seepage. It is added to safeguard the underlying material (**chemical isolation layer**) from erosive forces that gradually scour the cap's surface. Fine grain and low bulk density material such as sand and GAC mixtures can be **challenging to be place** in higher energy environments where river current, wave action or wind may facilitate the displacement of particles beyond their intended location during the gradual sinking process.



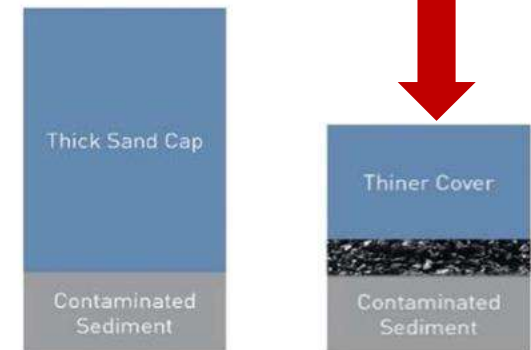
Amended capping



Amendments

Amendments refer to materials that can be added to natural capping materials (e.g. sand or soils). It is used to enhance the chemical isolation properties of the cap. The use of amendments can :

- Reduce the thickness
- Increase the chemical isolation performance



Activated carbon (AC)



AC is known strongly adsorb hydrophobic organic contaminant found in sediments and making it a widely used accepted treatment amendments. AC has been used in raw granular form (GAC) mixed with sand. **Placement** of AC for capping is **challenging** due to its nearly neutral buoyancy. Careful placement is essential to ensure **uniform layer** of GAC within the capping layer.



Tektoseal Active Activated Carbon

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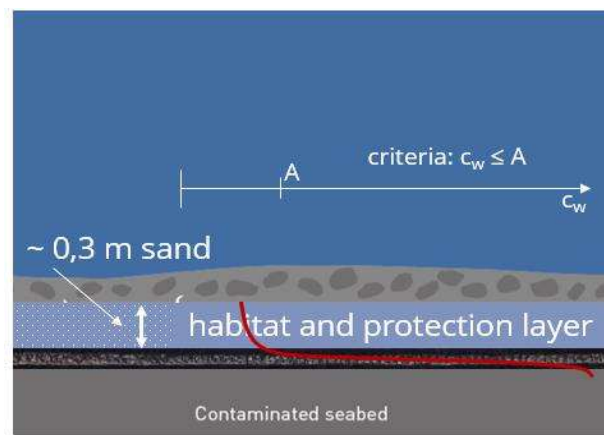
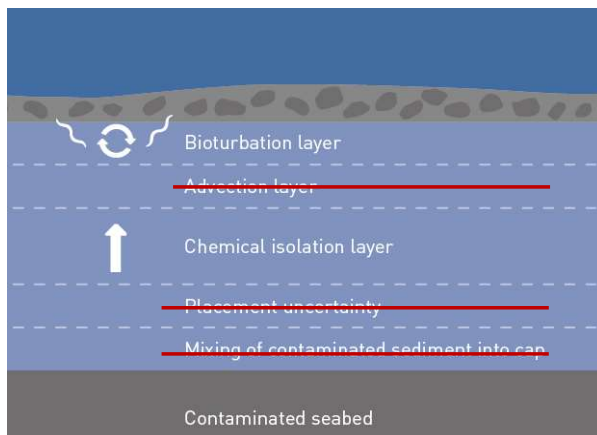
Capping with active geocomposite



Contaminant Adsorption with Activated Carbon

Use of geotextile functions: separation, filtration, drainage and reinforcements

- Prevent mixing of cap and seabed
- Minimize placement uncertainties
- Ensure constant thickness of isolation layer



Original cap design in EPA- Selected remedy (**110 kg** GAC/m²)

Optimised CAP design
3.4 kg GAC/m²



97% reduction!



Site preparation



Multi-layered barrier control system

- Steel sheet pile
- Bubble curtain
- Silt curtain

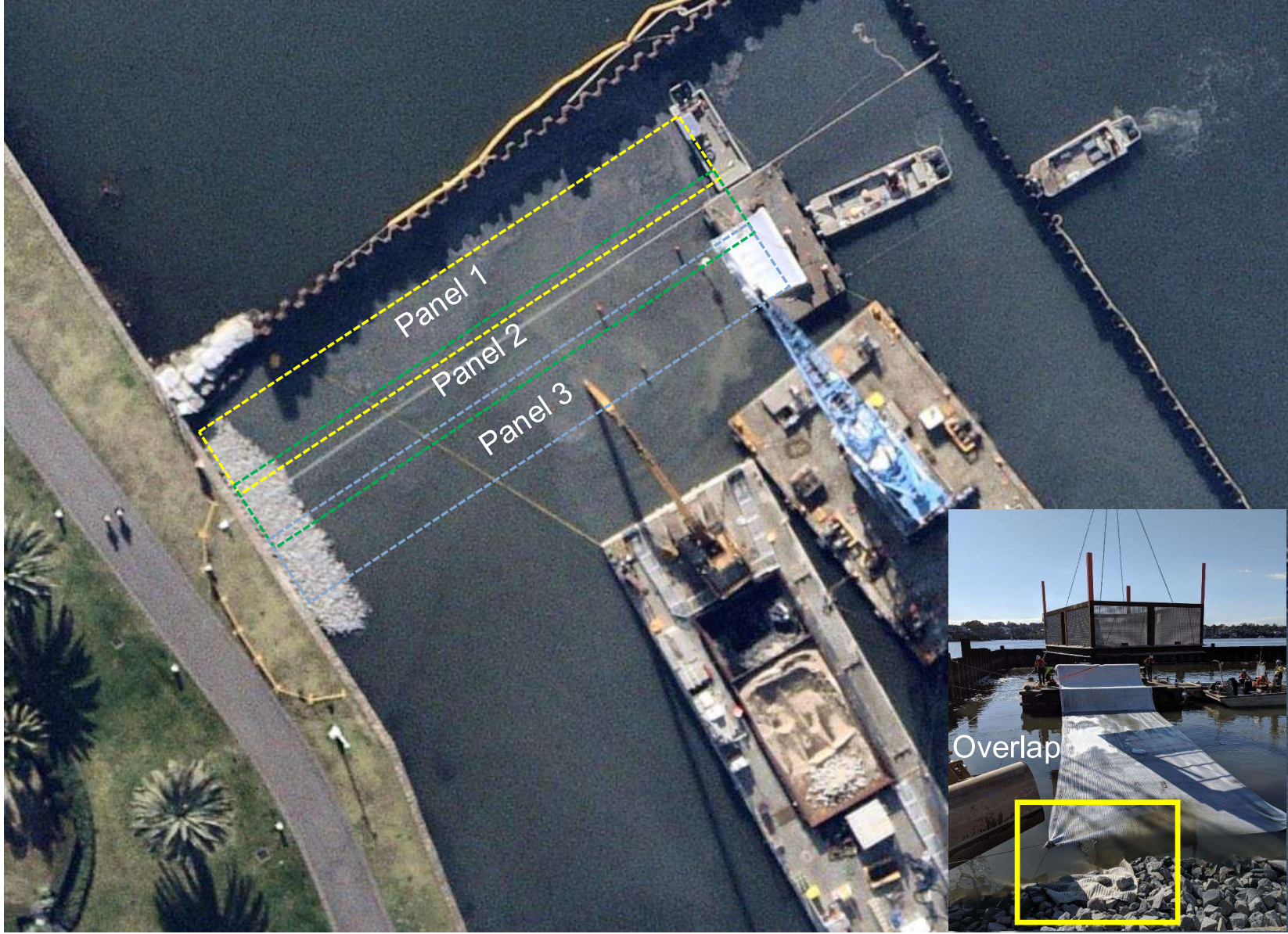


Installation of Tekoseal Active AC 3400





Installation





Ballasting with thin layer of sand with frame

Installation of Tekoseal Active AC 3400





Kendall Bay, Sydney 2020

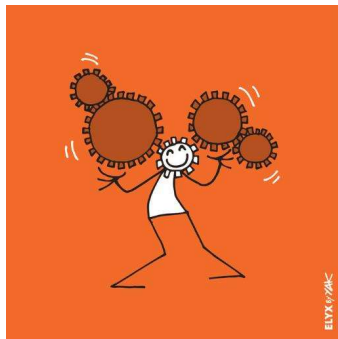




Accomplishments

- The world's first subaqueous in-situ stabilization (IS) of sediment
- Eliminated 450 round trip of truck movements
- The project was completed two months ahead of schedule
- Under budget
- Awards:
 - Innovation in Sustainability award 2021
 - Project of the Year in NSW 2021
 - Sustainable Remediation Project in NSW 2021

UN Sustainable Development Goals



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



To build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation



6 CLEAN WATER AND SANITATION



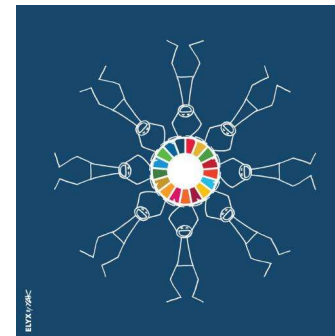
To ensure access to safe water sources and sanitation for all



14 LIFE BELOW WATER



To conserve and sustainably use the world's oceans, seas and marine resources



17 PARTNERSHIPS FOR THE GOALS



To revitalize the global partnership for sustainable development



Thank you for your attention.
Questions?





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