Dan Rodger
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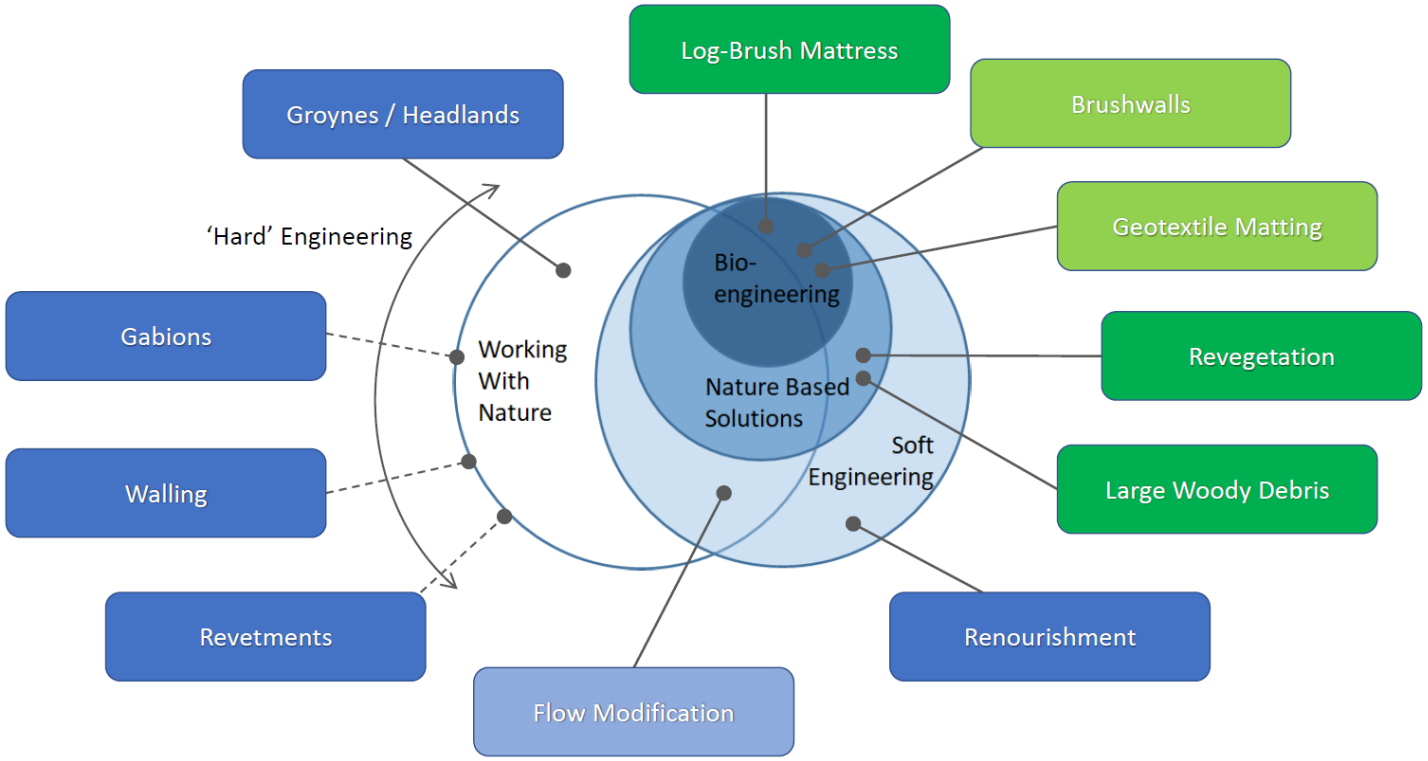
Navigating design and approval challenges with Nature Based Solutions

The Challenge

Nature-based coastal resilience measures are being increasingly recommended to protect against coastal and estuarine erosion.

They are gaining interest as a substitute for – or in conjunction with – standard engineering designs

Surely they are the answer to everything?



Courtesy Matt Eliot, Damara

JBP
scientists
and engineers

Waves!

Tenerife, Canary Islands 2018

Nature Based Solutions

Are not solutions to significant coastal erosion or inundation issues!

International Union for the Conservation of Nature defines NbS as:

"actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively"

In disaster risk management our goal should be:

"to develop coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Nature Based Solutions

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Confusion between hard vs soft, and NbS

GEO BAGS

- Ridgid structure
- Not environmentally friendly
- Any ecological benefit?

Would a rock groyne have improved ecological values?

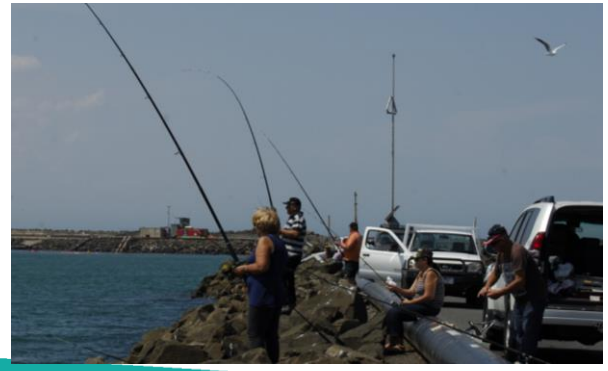
Nature Based Solutions

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Confusion between hard vs soft, and NbS

ROCKS

- Hard structure
- Natural material
- Ecological benefit



REEF BALL

- Hard (ish) structure
- Constructed material (concrete = $C0_2$)
- Ecological benefit

Nature Based Solutions

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Confusion between hard vs soft, and NbS

ROCK BAGS

- ~~Hard…Soft…~~ structure
- 99% natural material
- Ecological benefit?

https://nessgreenengineering.com/

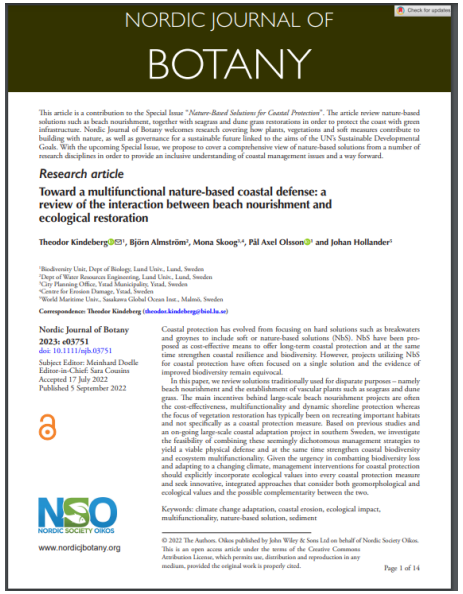
Nature Based Solutions

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Confusion between hard vs soft, and NbS

SAND

- Soft structure
- Natural material
- Ecological benefit?



NORDIC JOURNAL OF BOTANY

This article is a contribution to the Special Issue "*Nature-Based Solutions for Coastal Protection*". The article review nature-based solutions such as beach nourishment, together with seagrass and dune grass restorations in order to protect the coast with green infrastructure. Nordic Journal of Botany welcomes research covering how plants, vegetations and soft measures contribute to building with nature, as well as governance for a sustainable future linked to the aims of the UN's Sustainable Developmental Goals. With the upcoming Special Issue, we propose to cover a comprehensive view of nature-based solutions from a number of research disciplines in order to provide an inclusive understanding of coastal management issues and a way forward.

Research article

Toward a multifunctional nature-based coastal defense: a review of the interaction between beach nourishment and ecological restoration

Theodor Kindeberg, Björn Almström, Mona Skoog, Pål Axel Olsson and Johan Hollander

Nordic Journal of Botany
2023: e03751
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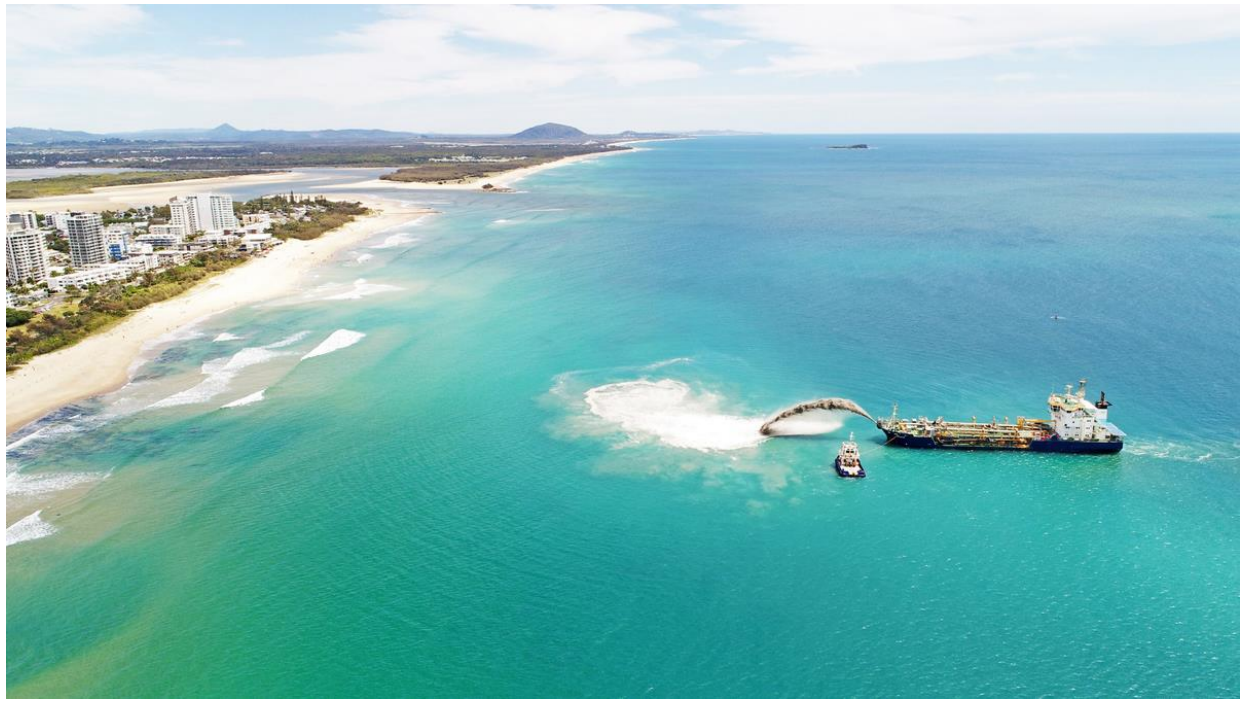
Coastal protection has evolved from focusing on hard solutions such as breakwaters and groynes to include soft or nature-based solutions (NbS). NbS have been proposed as cost-effective means to offer long-term coastal protection and at the same time strengthen coastal resilience and biodiversity. However, projects utilizing NbS for coastal protection have often focused on a single solution and the evidence of improved biodiversity remains equivocal.

In this paper, we review solutions traditionally used for disparate purposes – namely beach nourishment and the establishment of vascular plants such as seagrass and dune grass. The main incentives behind large-scale beach nourishment projects are often the cost-effectiveness, multifunctionality and dynamic shoreline protection whereas the focus of vegetation restoration has typically been on recreating important habitats and not specifically as a coastal protection measure. Based on previous studies and an on-going large-scale coastal adaptation project in southern Sweden, we investigate the feasibility of combining these seemingly dichotomous management strategies to yield a viable physical defense and at the same time strengthen coastal biodiversity and ecosystem multifunctionality. Given the urgency in combatting biodiversity loss and adapting to a changing climate, management interventions for coastal protection should explicitly incorporate ecological values into every coastal protection measure and seek innovative, integrated approaches that consider both geomorphological and ecological values and the possible complementarity between the two.

Keywords: climate change adaptation, coastal erosion, ecological impact, multifunctionality, nature-based solution, sediment

NSO NORDIC SOCIETY OIKOS
www.nordicjbotany.org

- *Less intrusive alternative to traditional construction*
- *Can alleviate shoreline retreat*
- *Can add sand into a system that has a net deficit*
- *Reduce coastal erosion*



Maroochydore nearshore beach nourishment trial

Nature Based Solutions

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Confusion between hard vs soft, and NbS

DUNE MANAGEMENT

- Soft structure
- Natural material
- Ecological benefits

Nature Based Solutions

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"

Confusion between hard vs soft, and NbS

SEAWALL

- Hard structure
- Natural or constructed material
- Ecological benefits?

Sam Cook, Sunshine Coast Council

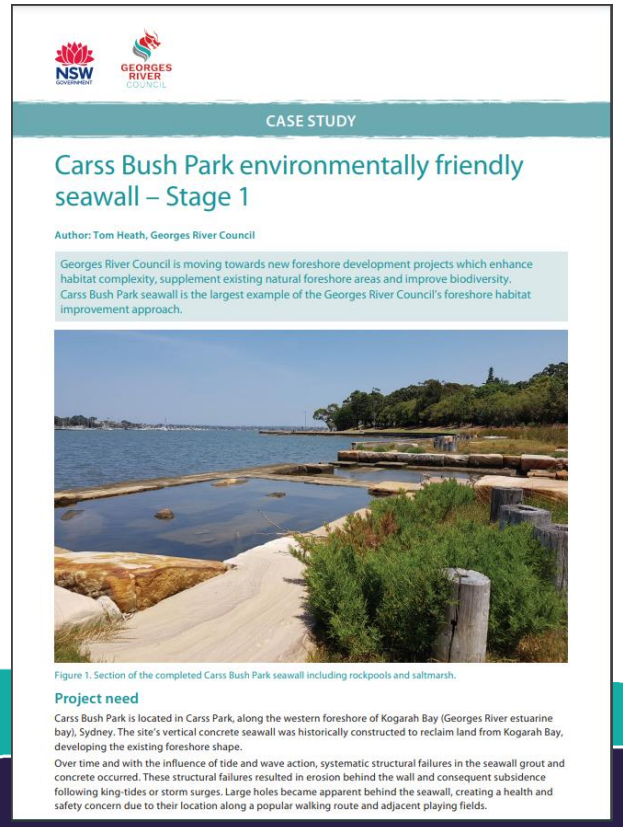
The Challenge

Challenges in implementing nature-based designs in Queensland

The Challenge

Challenges in implementing nature-based designs in Queensland

1. Lack of local case studies
2. Planning requirements
3. Guarantee on investment



NSW GOVERNMENT

GEORGES RIVER COUNCIL

CASE STUDY

Carss Bush Park environmentally friendly seawall – Stage 1

Author: Tom Heath, Georges River Council

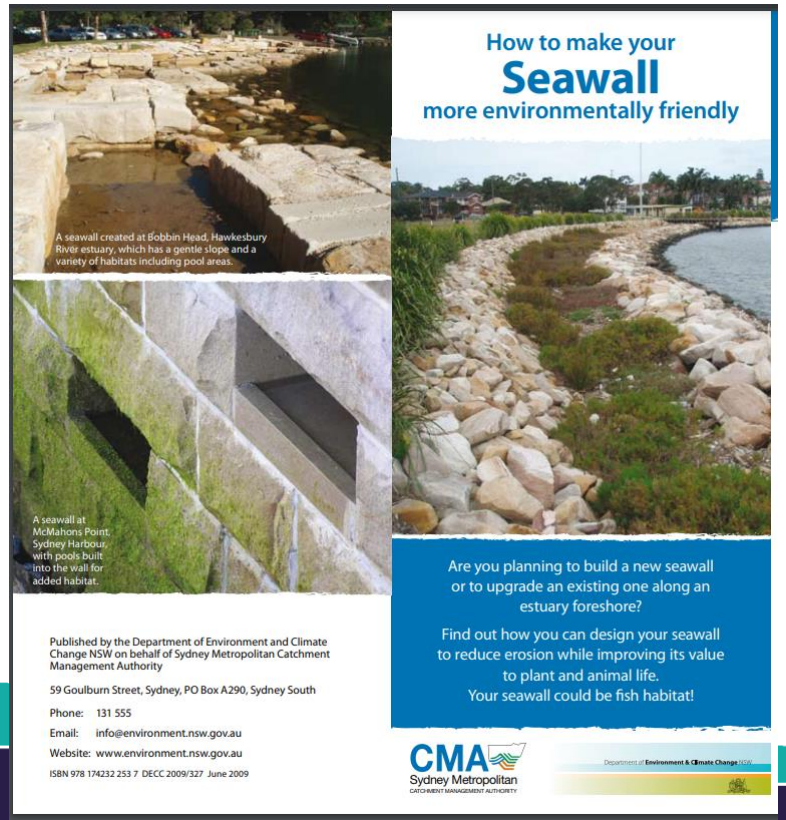
Georges River Council is moving towards new foreshore development projects which enhance habitat complexity, supplement existing natural foreshore areas and improve biodiversity. Carss Bush Park seawall is the largest example of the Georges River Council's foreshore habitat improvement approach.

Figure 1. Section of the completed Carss Bush Park seawall including rockpools and saltmarsh.

Project need

Carss Bush Park is located in Carss Park, along the western foreshore of Kogarah Bay (Georges River estuarine bay), Sydney. The site's vertical concrete seawall was historically constructed to reclaim land from Kogarah Bay, developing the existing foreshore shape.

Over time and with the influence of tide and wave action, systematic structural failures in the seawall grout and concrete occurred. These structural failures resulted in erosion behind the wall and consequent subsidence following king-tides or storm surges. Large holes became apparent behind the seawall, creating a health and safety concern due to their location along a popular walking route and adjacent playing fields.



A seawall created at Bobbin Head, Hawkesbury River estuary, which has a gentle slope and a variety of habitats including pool areas.

A seawall at McMahons Point, Sydney Harbour, with pools built into the wall for added habitat.

Published by the Department of Environment and Climate Change NSW on behalf of Sydney Metropolitan Catchment Management Authority

59 Goulburn Street, Sydney, PO Box A290, Sydney South

Phone: 131 555

Email: info@environment.nsw.gov.au

Website: www.environment.nsw.gov.au

ISBN 978 174232 253 7 DECC 2009/327 June 2009

How to make your

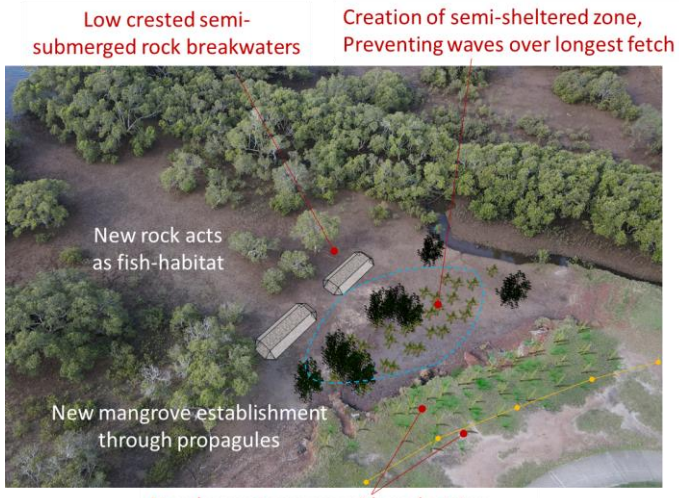
Seawall

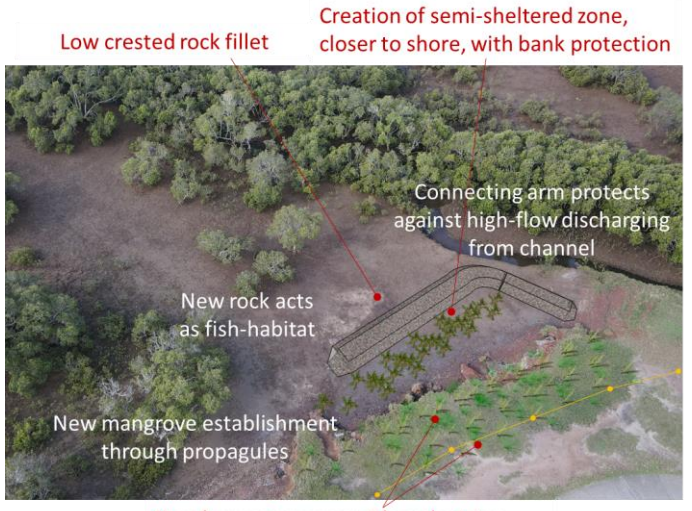
more environmentally friendly

Are you planning to build a new seawall or to upgrade an existing one along an estuary foreshore?

Find out how you can design your seawall to reduce erosion while improving its value to plant and animal life.
Your seawall could be fish habitat!

CMA Sydney Metropolitan CATCHMENT MANAGEMENT AUTHORITY





The Challenge

Coastal Protection and Management Act 1995

Planning Act 2016

Together these provide for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity and works. The Planning Act 2016 also guides development assessment decisions for Queensland's coast

Works within a tidal area

Tidal works application
(Administered as part of the Planning Act 2016)

Operational policy
Building and engineering standards for tidal works

The Challenge

Tidal works application
Operational policy
Building and engineering standards for tidal works

Requirement	Performance Outcome
All tidal works are **structurally adequate**	*Certification from a Registered Practicing Engineer of QLD (RPEQ)*
If it is a seawall, it has **minimum design criteria**:	*Seawalls must be designed to withstand wave and water level conditions corresponding to the 2% Annual Exceedance Probability (AEP) – i.e. the **50-year average recurrence interval** (ARI).* *Toe of the wall must be designed to accommodate **potential long-term erosion for at least 50 years**.*

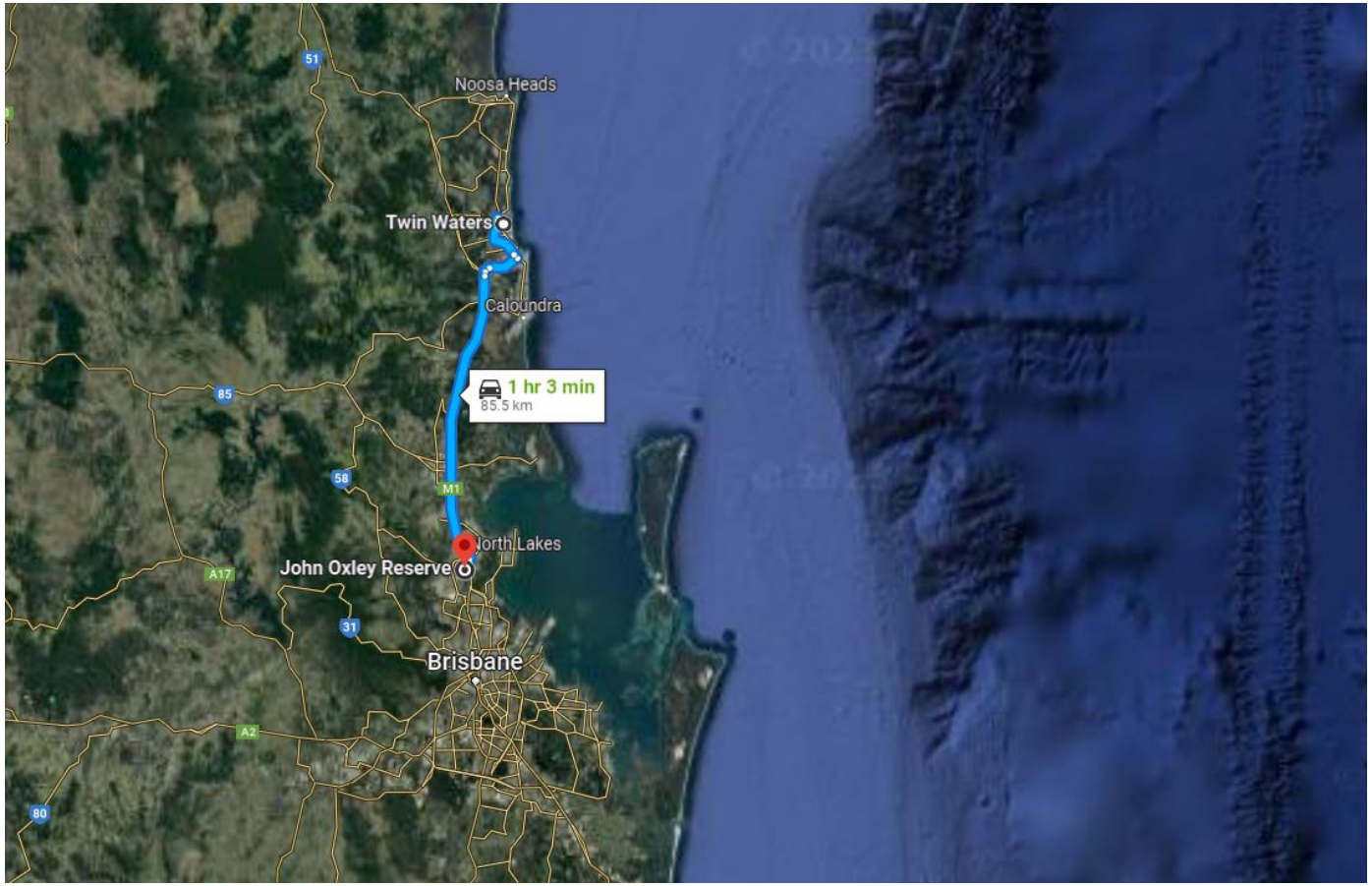
What exactly is a wall?

The Challenge

Guarantee on investment

John Oxley Reserve – Erosion Issues

Head to Edgewater Ct, Murrumba Downs QLD 4503



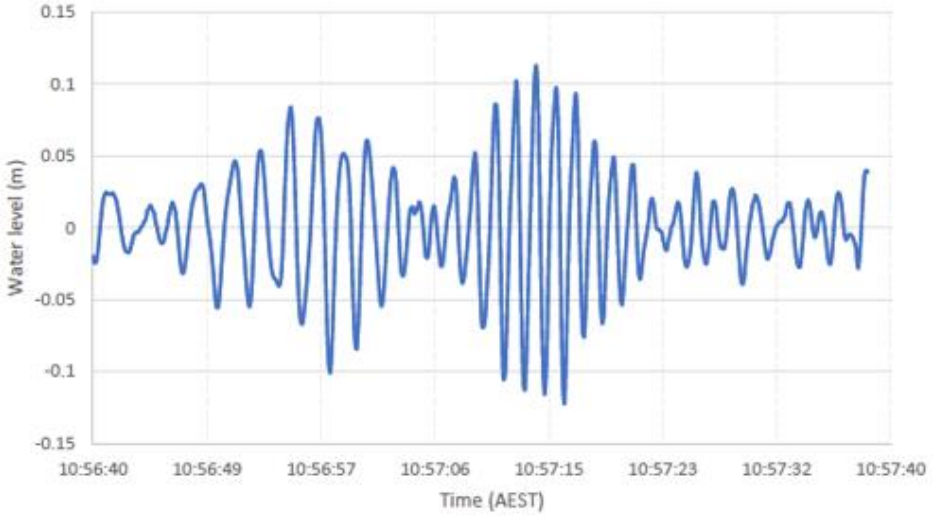
Google Maps

Google Earth

John Oxley Reserve – Erosion Issues

- Problem
  - 120m of eroded estuarine banks.
  - Near-vertical banks 0.5m to 2.0m
  - Undercut scarps
  - ~ 5m lateral erosion over ten years (approx. 0.5m/yr)

John Oxley Reserve – Erosion Issues



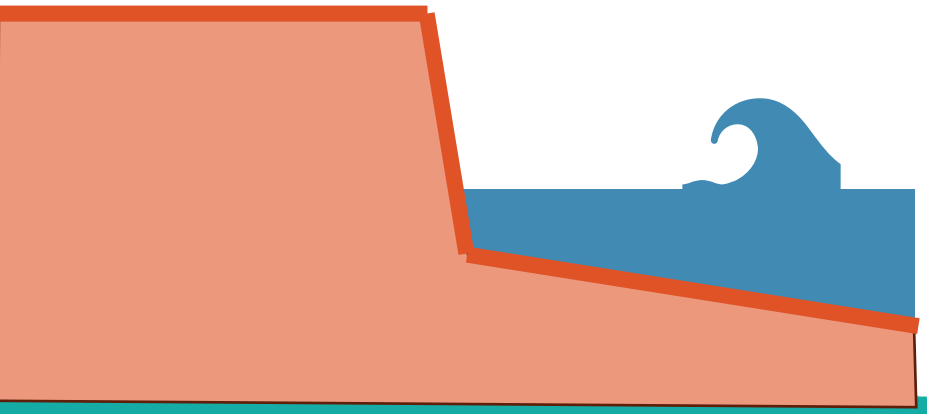
John Oxley Reserve – Erosion Issues

Design

- Inspiration from NSW, but limited published design guidance

Newly installed rock fillet, rock fillet protecting saltmarsh, mangrove trees behind rock fillet

Ash Island (Hunter River NSW) eroding bank before, during and 3 years after installation of rock fillet, showing mangrove seedling colonisation of still water between rock fillet and previously eroding bank



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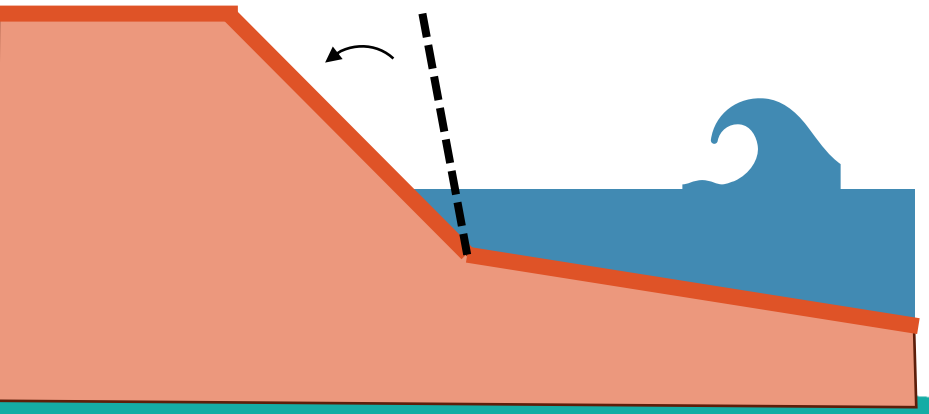

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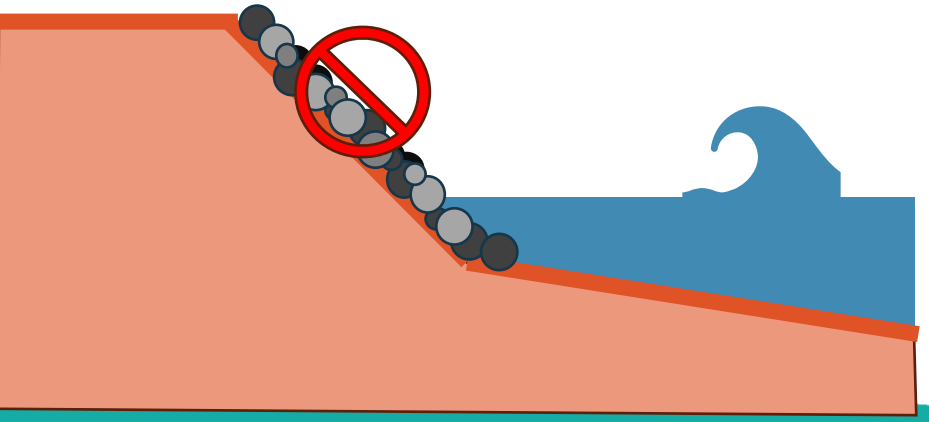

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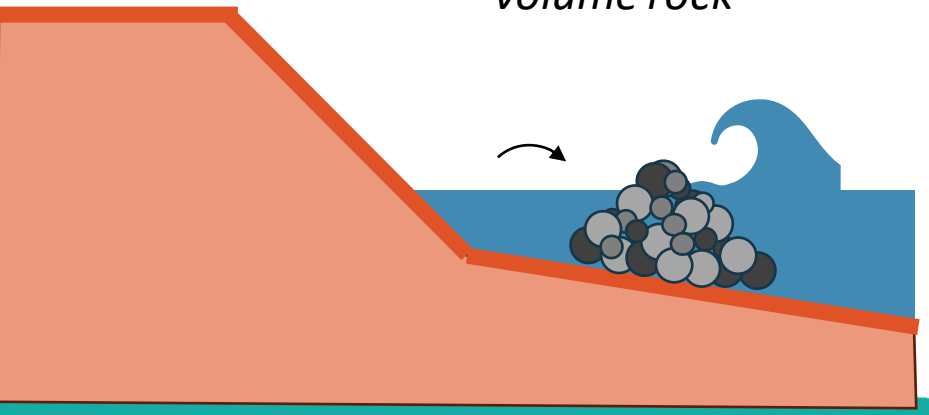
Ideally using ½ volume rock



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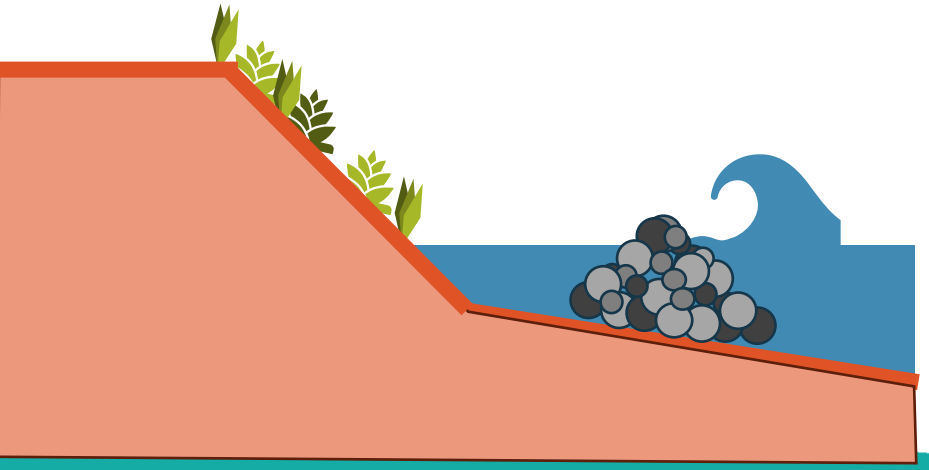
New bank planting



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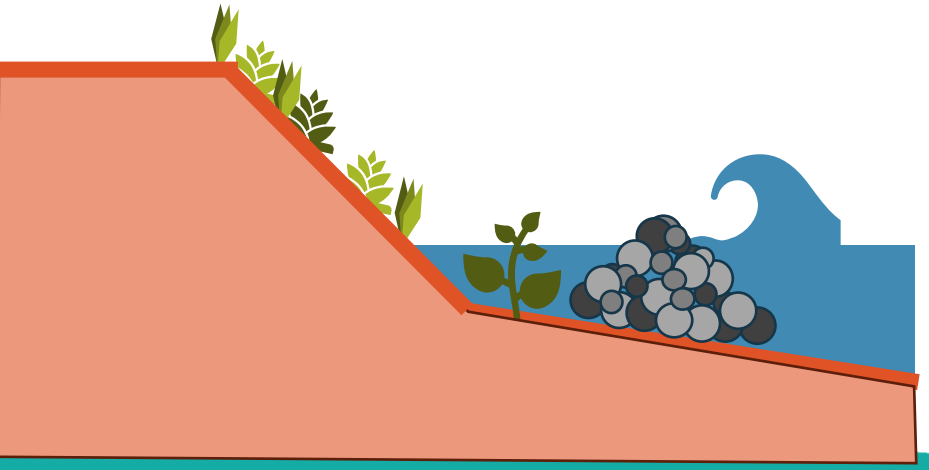
Encouraging new mangrove growth



John Oxley Reserve – Erosion Issues

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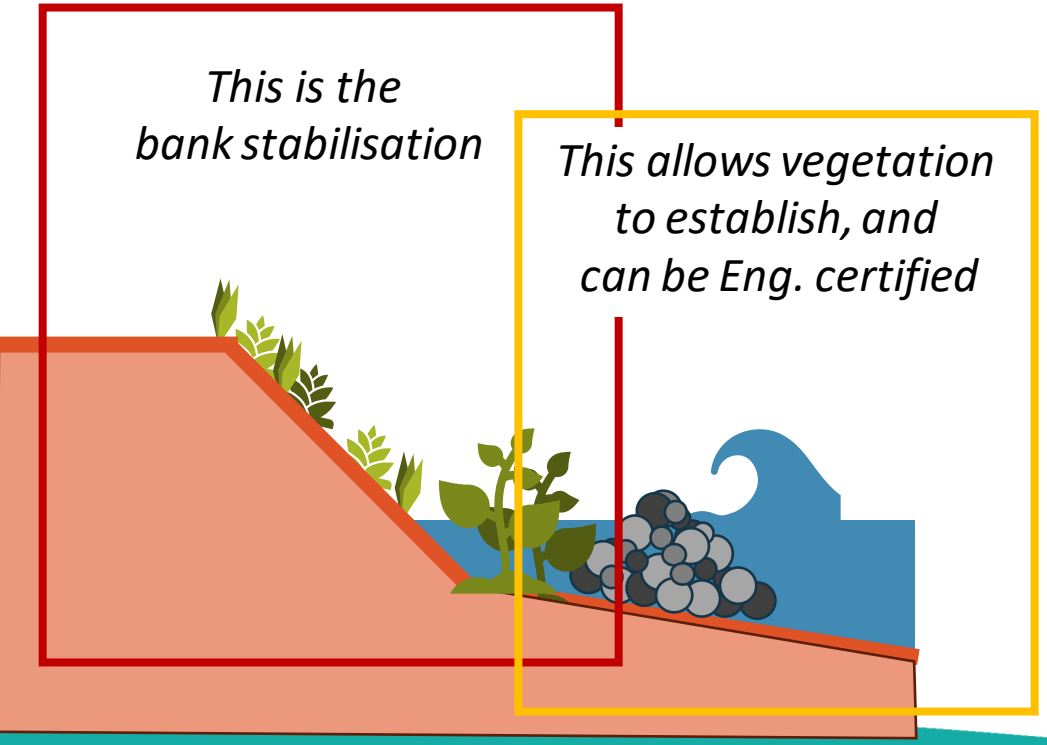

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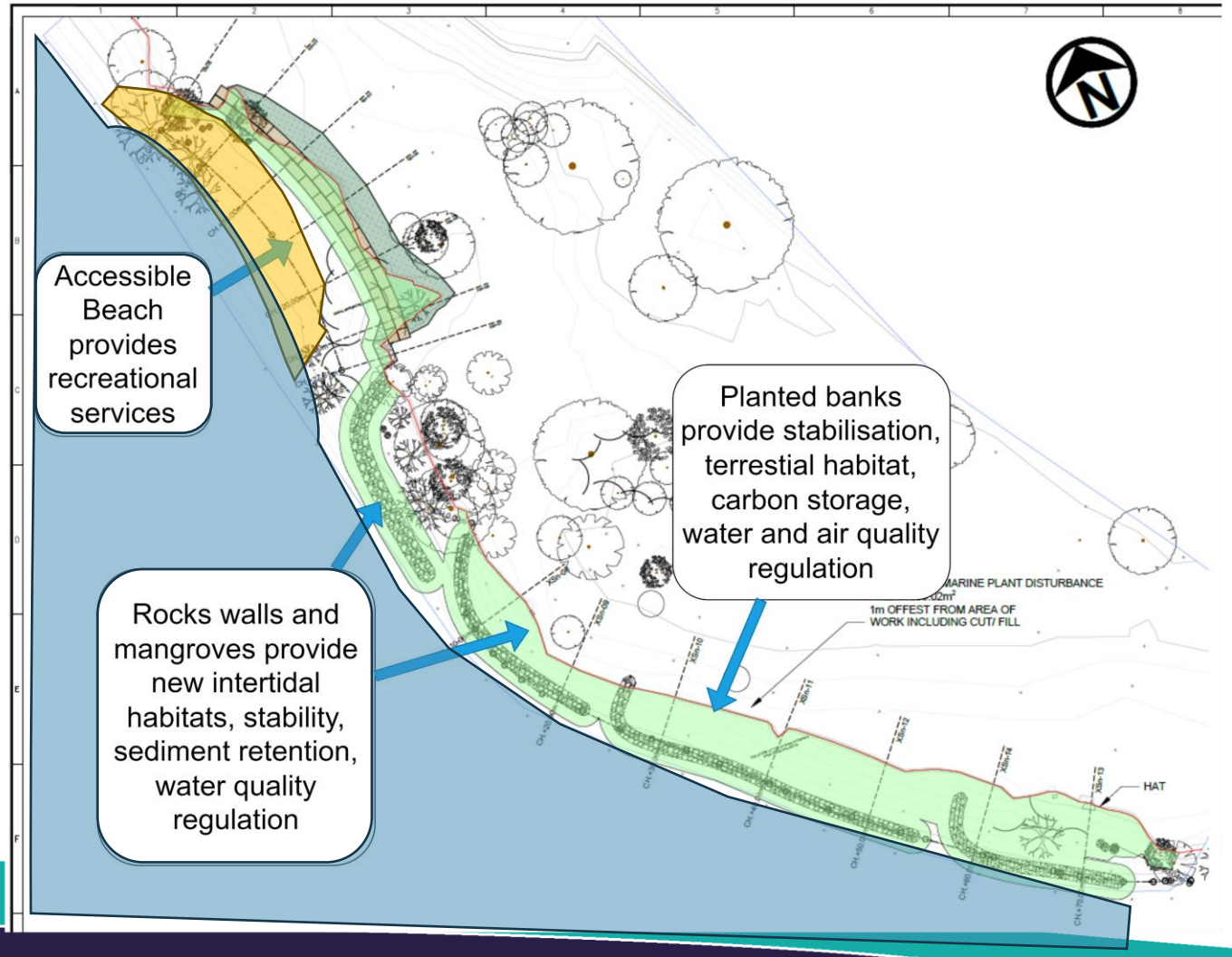
John Oxley Reserve – Erosion Issues

- Construction

John Oxley Reserve – Erosion Issues

John Oxley Reserve – Erosion Issues

"coastal protection strategies that have co-benefits; achieving requirements for both people and biodiversity"



In first ten years:

- 970m^3 of sediment prevented from entering Moreton Bay
- 300m^2 of new mangrove area created

The project site is working 24/7

Engineeing with NbS needs approvals

- Planning

Approvals & permits
Nature based solutions are outside the realm of normal 'operational works'

Approvals and permits are required for several aspects of these types of projects

- Owners Consent
- Development Application
- Referral to all agencies from SARA
- Total DA time was 8 months!
  (Design was only 6 months)

Challenges
Meeting the requirements of the State, whilst achieving project outcomes and Client expectations

Marine plants…

Obtaining State owner's consent

Lessons learnt
Engage with your planner early – concept design phase

Engage with Stakeholders early

Understand the requirements of the applicable law, local and State planning codes and policies

Remember the engineering certification requirements of a coastal protection structure. Do the calculations!

Engineering with NbS needs approvals

- Upcoming training

If you're using:

- Rock: Rock sizing based on currents/waves
- Seawalls: Crest based on EurOtop overtopping
- Footings: Based on scour calculation
- Piles: Penetration depth based on Geotech
- Logs: Consider stability under currents

If you're:

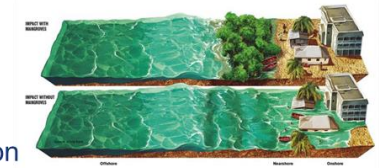
- In a waterway: fish passage
- Proposing sand: understand design erosion volumes and sediment grading benefits
- Proposing mangroves: Consider wave decay curves

JB PACIFIC Specialists in extreme weather engineering.

An introduction to the design of coastal Nature Based Solutions

Course outline 2023 FIRST COURSES IN JANUARY 2024

There is a wide spectrum of options and design techniques for coastal Nature Based Solutions (NbS). Often, what works at one location will be constrained at another, with poor design schemes at risk of failure. This 1-day introduction course is targeted at early stage practitioners, designers, assessors and Councils to better understand the implementation opportunities and risks of NbS in the coastal environment.



It includes:

- The theory and practice of coastal NbS
- Assessing the potential for NbS
- Reducing wave height through dissipation
- Options
- Design overview for rocks, wood, mangroves, seawalls, reefs
- Risk, residual risk, whole systems and uncertainty

$TBA 1 day Face to face, Brisbane, Central & FNQ QLD locations

Questions?

In Brisbane for the day?
Go check out the fish friendly design at:
Head to Edgewater Ct,
Murrumba Downs QLD 4503

Dan Rodger
Director of Coastal Engineering
Daniel.Rodger@jbpacific.com.au

CATCHMENT REHYDRATION SELECTION TOOL (CReST)

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