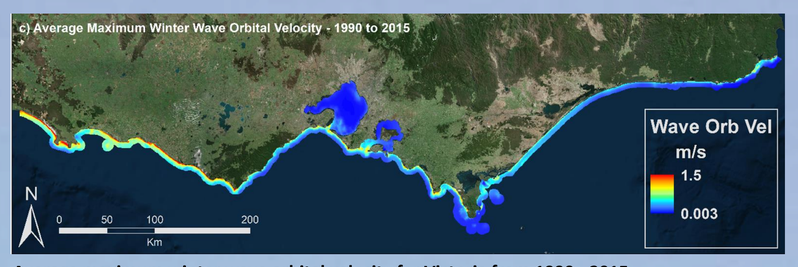
VCMP Monitoring Program Workflow

Stage 1: Downscaled global trends to Victoria to identify key risks and vulnerabilities to the local shoreline. CSRIO research indicates the key change will be an increase in wave energy associated with southern movement of the Subtropical Ridge and strengthening of the Southern Annular mode.

Why? Global models provide average values, but for specific beach systems their resolution is too poor for use in compartment-scale management decisions.



Average maximum winter wave orbital velocity for Victoria from 1990 - 2015

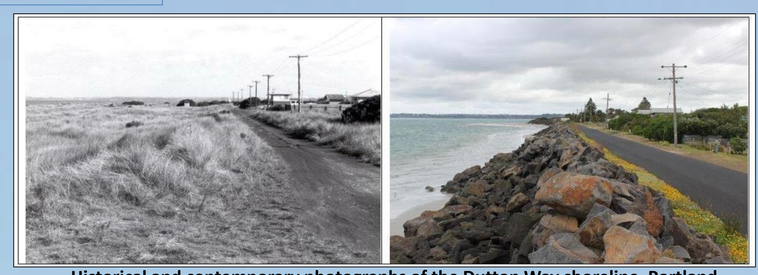
Stage 2: Identify (1st pass assessment) areas of vulnerability based solely on elevation (Future Coast Program 2010). 2nd Pass assessment (2017) & local coastal hazard assessment projects on Bellarine, Port Philip and Western Port Bays, and eastern Gippsland confirmed priority monitoring sites.

Why? Areas of lowest elevation will be the first impacted by the sea so identifying these areas is a first-pass assessment of the impacts of rising seas. The method does however assume that the coasts is static and immovable in the face of rising seas and increasing wave energy.

An inundation hazard map from Port Philip Bay based on elevation derived from the Future Coast LiDAR datasets

Stage 3a: Assess historical (decadal-scale) shoreline dynamics. This is completed through analysis of aerial photos. The analysis will start in the 1940's when the earliest photos of the Victorian coast were taken.

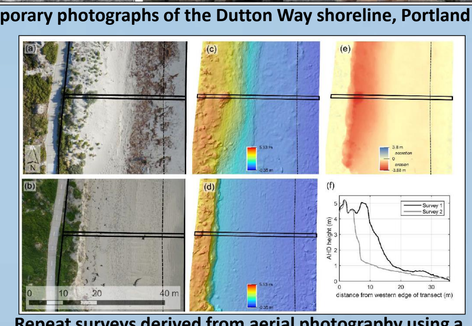
Why? Beaches move over decades and it is important to understand this pattern to assess whether an erosion event is within this natural dynamic or is unusual and therefore requiring management intervention.



Historical and contemporary photographs of the Dutton Way shoreline, Portland

Stage 3b: Assess individual storm and seasonal dynamics of beach systems to unravel how sand movement during a specific event fits within the long term pattern of shoreline dynamics or represents a threshold change in response to warming climates.

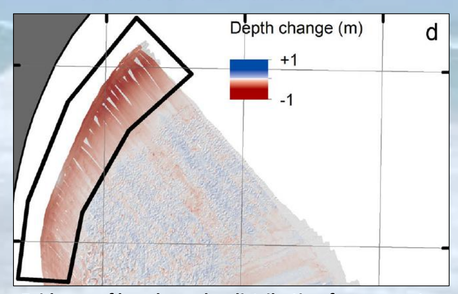
Why? Erosion during storms is the most stark reminder of beach dynamics. We need to understand where sand moves and how often this occurs. Such information is critical to inform managers on the envelop in which beaches operate – which natural will vary by 100's m laterally and up to 10m vertically.



Repeat surveys derived from aerial photography using a small drone at Warrnambool Beach

Stage 3c: Offshore multibeam sonar mapping, and subbottom profiling of compartments to close to wave base to understand sediment dynamics, storage and link to the beach environments.

Why? The majority of sand on a beach occurs offshore – the area we walk on is essentially a store of sand for high wave events. Therefore, it is essential to know where this sediment is, how much there is and also how the toe of the beach connects around headlands.



Evidence of beach sand redistribution from repeat multibeam surveys in Warrnambool Harbour

Stage 3d: Analysis of sediment texture and composition to understand where the beach material is coming from and its life span on the coast.

Why? A major gap in knowledge is the composition of Victoria's beaches. Where the sand has come from – and if it is till being delivered to the coast – is essential in their future management. As without sand there are no beaches. Textural analysis using laser particle sizing, X-ray techniques and petrology will be used.

Sand moving past anemometers at Summerlands Beach

Stage 3e: Mapping of vegetation of dune environments to understand the sensitivity and vulnerability to current and future wave events.

Why? Vegetation is essential in forming dunes. The type of vegetation presents drives the shape and storm response of these dunes. Exotic marram grass causes dune over steepening in comparison to native Spinifex. As a result, predicting dune response to waves will not be uniform and resilience may be enhanced through careful management of the dune ecology.

A *Spinifex* seed sits amongst exotic Marram grass (*Ammophila* sp.) and Sea Spurge (*Euphorbia* sp.) at Peterborough Beach

Stage 4: Modelling of potential beach dynamics using state-of-art numerical methods, such as Delft 3D, XBeach, and the DELFT shoreline probability tool. This will occur concurrently with Stage 3 using data collected on the Victorian coast.

Why? Predictions of shoreline position in the future based solely on geomorphology require a significant safety factor to ensure community safety. The latest computer modelling provides ways to both confirm and refine this safety factor using best-practice-methods in coastal engineering.

VCMP Multibeam Mapping Priorities