## Inverloch Coastal Resilience Project

### 2019 Victorian Marine and Coastal Forum

South Gippsland Conservation Society

Philip Heath





The Inverloch Coastal Resilience Project is funded, with thanks, by the Lord Mayor's Charitable Foundation

6 69 1



## Location and Acknowledgements

- Lord Mayor's Charitable Foundation
- South Gippsland Conservation Society members
- Consultants:
  - Neville Rosengren Geomorphology
  - Alison Oates Ecology
  - Joanna Freslov Indigenous Cultural Heritage
  - David Cotterill Economics
- Government and its authorities
  - DELWP
  - Bass Coast Shire



The Inverloch Coastal Resilience Project is funded, with thanks, by the Lord Mayor's Charitable Foundation





## Project Overview



### Main Surf Beach – 2003/04



Commencement of Main Surf Beach Erosion – 2012/13































Inverloch coast is a dynamic system featuring complex relationships between:

- Main surf beach and its vegetated dunes, and Pt Norman spit
- Anderson Inlet and its shifting channels
- Pt Smythe coastal barrier







Survey mapping by George Smythe 1848-49









- Most notable variation adjacent to Ozone Street access track
  - significant coastline recession between February 1977 and September 1985
- Recession not accompanied by significant sand accumulation in Inlet
- Accretion returned coastline to earlier position in 5 years



Main channel located close to coastline

Wide vegetated dune, with grassy foredune

Lagoon formed where main channel was located

Sand from surf beach pushed into Inlet

Width of vegetated halved, foredune gone,





- Since 2013, Inverloch surf beach has lost more than 40 metres of width of its vegetated dunes
- Over the same period, the beach has lowered by an estimated 3-4 metres
- Coastline between Pt Norman and Pt Hughes has undergone substantial accretion
- Combined recession and accretion comprise one of the most rapid changes along a sandy coastline in Victoria over recorded history









- Continuous coastal barrier is progressively extending east into Anderson Inlet
- Can only be removed by a westward (shoreward) migration of the ebb-tide channel eroding the accumulated barrier
- Further investigation required for likely future configuration of Anderson Inlet







- Rising sea level
- Increase in frequency and intensity of erosion-inducing storms
  - More frequent and intense WSW to SW waves exacerbate sand drift to the east
  - Backshore and beach does not recover after each storm event
- Reduction in sediment supply
- Theory of cyclic changes redundant
- Detailed coastal studies required to better understand these factors:
  - Predict future changes
  - Identify appropriate medium and long term measures







#### Additional information

Map produced by the Land and Built Environment program team, Gippsland, January 2019 Copyright © The State of Victoria, Department of Environment, Land, Water and Planning, 2019

Created for display purposes only.

IMAGERY: Bass-Coast-2017jan04-air-vis-10cm-mga55

Inverloch Aerial Imagery January 2017







- Two sections of double row wet-sand fencing installed as a trial in March 2019
  - To protect threatened infrastructure at surf beach
  - Fences designed to decrease energy of incoming waves
- 50 metres of foredune will be filled to 1.5m above the current beach level
  - Scheduled for June this year
  - Revegetation planned in Spring 2019



![](_page_19_Picture_8.jpeg)

![](_page_20_Picture_0.jpeg)

- 4 storm surge events between April and end May 2019:
  - Indication of some accretion behind fences
  - If trial successful, need to extend fences over length of beach
- Hopeful that fences will assist
  - Likely that other medium and long term measures will be required

![](_page_20_Picture_6.jpeg)

![](_page_20_Picture_7.jpeg)

![](_page_21_Picture_0.jpeg)

- Bass Coast renowned for its natural, undeveloped coastline
- Beach features an extensive, vegetated dune system
  - range of geomorphological, ecological, cultural heritage and economic values
- Natural setting of Inverloch's surf beach is highly valued
  - Rated as extremely important by 84% of survey respondents

![](_page_21_Picture_6.jpeg)

![](_page_21_Picture_7.jpeg)

![](_page_22_Picture_0.jpeg)

Inverloch coast rated of State Geoscience Significance:

- Studies of coastal landform evolution:
  - Transition from coastal cliffs to bluff
  - Preserved backshore ridges and dune system

Geomorphology of backshore sand ridges and dunes record history of accretion and recession extending over more than 10,000 years

![](_page_22_Picture_6.jpeg)

![](_page_23_Picture_0.jpeg)

- Ocean coast is backed by continuous zone of vegetated dunes
  - formed by wind action over the last 3,000-4,000 years
- Almost 50% of these dunes removed since 2013:
  - Prior to 2010, surf beach had 3 parallel dune ridges with highest reaching 12m
  - Since 2013, 2 seaward ridges have eroded leaving a high scarp on the remaining dune

![](_page_23_Figure_6.jpeg)

![](_page_24_Picture_0.jpeg)

- Analysis of complex relationships between offshore coastal processes, Anderson Inlet and Pt Smythe
- Investigation of factors that have contributed to shoreline changes since 2013
- Quantification of the volumes of sediment involved in beach recession and Inlet accretion
- Sampling and analysis of beach and nearshore areas to determine sources of sand within Pt Norman-Pt Hughes coastal barrier
- Analysis of reasons for movement of sediment from beach into Inlet
- Analysis of likely future configuration of the Pt Norman-Pt Hughes coastal barrier

![](_page_24_Picture_7.jpeg)

![](_page_24_Picture_8.jpeg)

![](_page_24_Picture_9.jpeg)

# Ecological Values – Key Findings

- Ecological assessment of values of Inverloch and Pt Smythe dune systems:
  - All main coastal dune vegetation communities present
  - Diverse flora and fauna communities
  - 10 rare or threatened plant species and 53 threatened fauna species
- Critical habitat for vulnerable shorebird species
- Important regional biolink

![](_page_25_Picture_7.jpeg)

![](_page_25_Picture_8.jpeg)

![](_page_26_Picture_0.jpeg)

- Almost 50% of dune system vegetation lost due to coastal recession since 2013
  - Mature Coast Banksia Woodland Vegetation Community at Flat Rocks currently being lost
  - Loss of low foredune habitat critical to beach nesting shorebirds
- Newly-formed dune system in Inlet being colonized by Marram Grass and Sea Wheat Grass

![](_page_26_Picture_5.jpeg)

![](_page_26_Picture_6.jpeg)

![](_page_27_Picture_0.jpeg)

- Revegetate re-formed foredune with native grasses and appropriate native shrubs, and monitor
- Supplementary planting of rear dune, including Coast Banksia Woodland Vegetation Community
- Rationalise beach access tracks
- Effective weed control program and replanting to increase dune resilience
- Effective pest control program targeting foxes and rabbits

![](_page_27_Picture_6.jpeg)

![](_page_27_Picture_7.jpeg)

# Ecological Values- Recommended Actions (2)

- Design wet sand fencing with 45 degree return to manage end effect
- Cordon off toe of eroded dunes to prevent human trampling
- Monitor density of introduced grasses on newly-formed dunes in the Inlet
- Consider extending wet sand fence trial to protect ecological values of broader dune system

![](_page_28_Picture_5.jpeg)

![](_page_28_Picture_6.jpeg)

![](_page_29_Picture_0.jpeg)

- Cultural Heritage study assessed impacts of coastal erosion and other risks on Aboriginal sites
- At European settlement, region occupied by *Bunwurrung* and *Gunaikurnai* language groups
- Relevant RAPs and TOs are:
  - <u>Bunurong Land Council Aboriginal Corporation</u> (BLCAC) (RAP)
  - <u>Gunaikurnai Land and Waters Aboriginal Corporation</u> (GLaWAC) (TOs)
- 15 Aboriginal sites (shell middens/artefact scatters) in and adjacent to study area
- 4 sites in and adjacent to the study area are at high to very high risk

## Cultural Heritage Values (2)

- Sites in coastal reserve represent a diminishing resource
  - Many other sites adjacent to the study area already destroyed
- Sites reflect occupation period from 6,000-7,000 years ago to recent past
  - Older sites already submerged as sea levels rose prior to 6,000BP
  - If remaining sites lost, record of Aboriginal history will also be lost
- A site predictive model determined that coastal areas with the highest potential for more sites and at most risk are:
  - Flat Rocks to Goroke Street
  - Veronica Street to Bowling Club
  - Angling Club to Screw Creek

# Cultural Heritage – Recommended Actions

- Both BLCAC and GLAWAC consider that:
  - All Aboriginal places identified in study are of high cultural significance
  - Urgent action is required to manage their risk to climate change
- Consideration be given to applying for research grant to carry out:
  - Full survey of study area
  - Salvage of sites at highest risk where stabilisation is not an option
  - Management program for remaining sites at risk

![](_page_32_Picture_0.jpeg)

- Economic Assessment considered the economic value of dune system to residents and visitors
- Coastline is arguably Australia's most important recreation resource
- Socio-economic importance of beaches for tourism and recreation recognized, but :
  - Recreation and tourism values are related to condition
- Commercial activities that service tourist needs are primary source of regional income and jobs:
  - Potentially threatened by change in quality of beach systems

![](_page_32_Picture_7.jpeg)

![](_page_32_Picture_8.jpeg)

![](_page_32_Picture_9.jpeg)

![](_page_33_Picture_0.jpeg)

- Recreation and tourism impacts already occurring at Inverloch surf beach:
  - Very little dry sand at high tide
  - Unstable dunes pose risk to beachgoers
- Inverloch SLSC lookout tower moved to remote location
- Former main beach access track closed and new, indirect path cut through dune vegetation
- Other access tracks are steep and difficult to negotiate
- Cape Paterson Road threatened, including access to RACV Inverloch

![](_page_33_Picture_8.jpeg)

![](_page_33_Picture_9.jpeg)

![](_page_33_Picture_10.jpeg)

![](_page_34_Picture_0.jpeg)

- Potential value of Inverloch coastline and activities it provides to current and projected Inverloch residents is estimated as:
  - \$171,924 in 2016
  - \$230,699 in 2036

![](_page_34_Picture_4.jpeg)

![](_page_34_Picture_5.jpeg)

![](_page_35_Picture_0.jpeg)

- Inverloch offers a range of holiday accommodation and shopping/dining experiences
- Inverloch beach is popular for:
  - Active: walking, swimming, surf life-saving, surfing, stand-up paddling, wind surfing
  - Passive: yoga, fishing, nature appreciation, sunset viewing
- Analysis of Bass Coast VICs (conservative) suggests 40,000-60,000 visitors to Inverloch pa
- Equates to 2016 tourism benefit of \$2.74M and \$4.11M pa, based on consumer surplus values

![](_page_35_Picture_7.jpeg)

![](_page_35_Picture_8.jpeg)

![](_page_36_Picture_0.jpeg)

- For this preliminary valuation, the resident and tourism values for Inverloch at risk from further sustained coastline impacts, are in the order of:
  - \$3-4.3 million per annum
- These results are indicative, based on conservative visitor estimates, and further collaboration with BCSC recommended

![](_page_36_Picture_4.jpeg)

![](_page_37_Picture_0.jpeg)

Survey conducted in association with the public exhibition:

• Completed by 343 people: 42% Inverloch residents and 58% from Melbourne or elsewhere.

Key results of the survey were:

- 96% of respondents rated beach visits among their three favourite activities
- Swimming, beach walks and nature appreciation rated as the three favourite beach activities
- Natural setting provided by vegetated dunes rated as <u>extremely important</u> by 84% of respondents
- 46% of respondents <u>significantly affected</u> by changes
  - a further 40% were <u>moderately affected</u>

![](_page_37_Picture_9.jpeg)

![](_page_38_Picture_0.jpeg)

- 81% considered it <u>extremely important</u> that short term action is taken to protect the coast and the dunes from further erosion
- 82% considered it <u>extremely important</u> that detailed scientific investigations are funded to identify adaptation measures to manage future erosion

![](_page_38_Picture_3.jpeg)

![](_page_38_Picture_4.jpeg)

![](_page_39_Picture_0.jpeg)

Key findings and recommendations:

- Surf Beach Erosion and Inlet accretion
- Threatened Values
  - Geomorphological and ecological
  - Cultural heritage and economic
- Wet-sand Fencing Trial
- Local Coastal Hazard Assessment

![](_page_39_Picture_8.jpeg)

![](_page_40_Picture_0.jpeg)

- Inverloch beach now monitored under the Victorian Coastal Monitoring Program
  - Drone monitoring commenced in September 2018
  - Undertaken every 6 weeks
- Research scientists are training a Citizen Science group
  - Aiming to have a team of Inverloch volunteers fully trained by mid-2019
- Survey results are uploaded to Propeller Aero portal
  - Enables the extent of coastal erosion and accretion to be monitored
- Laser level monitoring at 10 sites to commence in June

![](_page_40_Picture_9.jpeg)

![](_page_40_Picture_10.jpeg)

![](_page_41_Picture_0.jpeg)

- Port Fairy Coastal Group
- Apollo Bay Otway Coast Committee
- Melbourne and Deakin Universities
- Inverloch SLSC
- •\_\_\_Inverloch Historical Society

![](_page_41_Picture_6.jpeg)

![](_page_41_Picture_7.jpeg)

![](_page_41_Picture_8.jpeg)

![](_page_42_Picture_0.jpeg)

- Regular communication with State Government and its Agencies, including Bass Coast Council
  - Inverloch Coastal Erosion Working Group
  - Monitoring posts
  - Public exhibition
- Look forward developing collaboration with Working Group
  - From information exchange to partnership

![](_page_42_Picture_7.jpeg)

![](_page_43_Picture_0.jpeg)

- Complete Phase 1 report and present recommendations to Government
- Undertake Phase 2, if 3CA Grant Application successful
- Beach Monitoring
  - Installation of laser level posts and commence monitoring
  - Complete drone training and citizen science transition to regular drone monitoring
- Provide input to Local Coastal Hazard Assessment (subject to funding):
  - Environmental and community values to be considered
  - Scope of LCHA
  - Information inputs to LCHA