



Prifysgol Cymru
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University of Wales
Trinity Saint David

Sustainable construction on the coast? Assessment and the Tidal Lagoon Swansea Bay

2nd March, 2017.

**Professor Mike Phillips
Pro Vice-Chancellor (RIEC) UWTSD**

*Trawsnewid Addysg; Trawsnewid Bywydau
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Presentation

- **Climate change and consequences for living on the coast**
- **Vulnerability assessments and examples**
- **Fairbourne and Tidal Lagoon Swansea Bay**
- **Summary**

Sea Level Rise

Increased Storm Intensities

Uncertainty

Responses

Horta, Faial Island, the Azores, 2007





Blackpool, 2002 Storm, 2009 coastal protection works







Flooding at Jumail, Ras Khidaj and Ruwayda



Flooding at Madinat al-Shamal

Pacifica: El Nino coastal erosion/damage January 2016



<http://kron4.com/2016/12/11/sinkhole-opens-up-in-pacifica/>

<http://abc7news.com/weather/crews-prep-to-tear-down-apartments-on-esplanade-ave-in-pacifica/1242802/>

<http://www.nbcbayarea.com/news/local/Apartments-in-Pacifica-Get-Demolished-as-Cliffs-Crumble-372004042.html>

KwaZulu-Natal Coast, South Africa



High-energy, erosive, swell-dominated coast

A 2007 Storm resulted in significant damage to properties and infrastructure

- **An extreme wave event coincided with an equinox**
- **Resulted in a maximum swell height of 14m**

Storm Impacts: March 2007





KwaZulu-Natal coast is *circa* 600km in length

Specific focus on the 1km Coastal Zone from aerial photographs following 2007 storm

Assessed 50m x 50m cells



Physical CVI – Rating

Each cell was rated per parameter - in terms of its individual vulnerability based on predefined thresholds

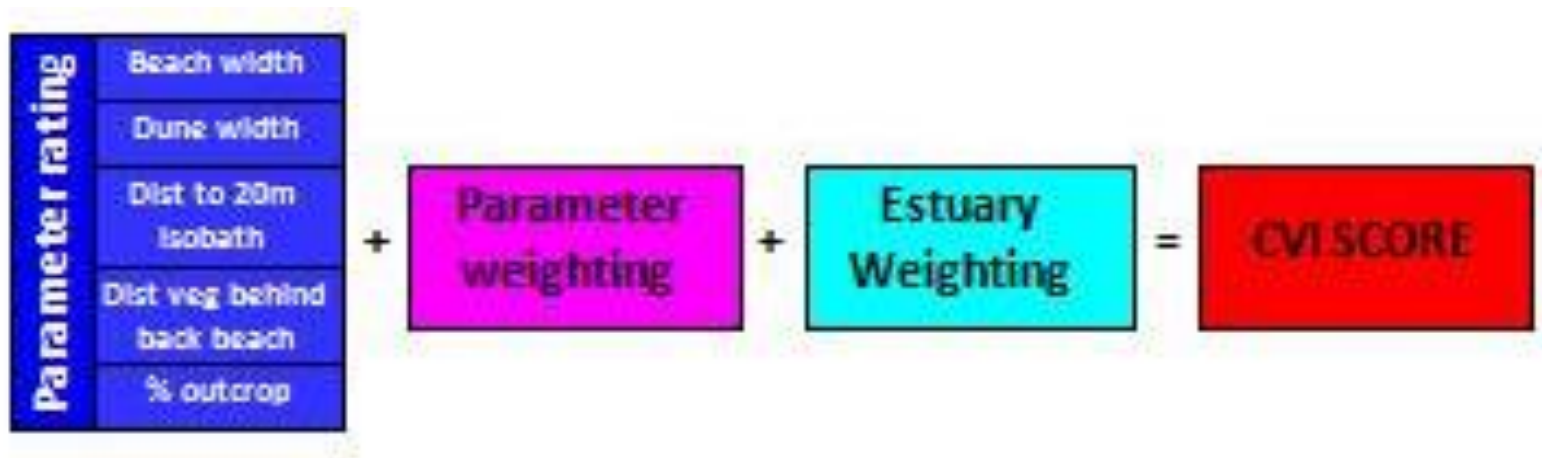
Scoring between 1 and 4 per parameter

Physical Property	Extremely Low (1)	Low (2)	Moderate (3)	High (4)
Beach width	> 150m	100 – 150m	50 – 100m	< 50m
Dune width	> 150m	50 – 150m	25 – 50m	< 25m
Distance to -20m bathy	> 4km	2 – 4km	1 – 2km	< 1km
Distance of vegetation behind the back beach	> 600m	200 – 600m	100 – 200m	< 100m
Percentage outcrop	> 50%	20 – 50%	10 – 20%	< 10%

Total CVI score

Desktop study

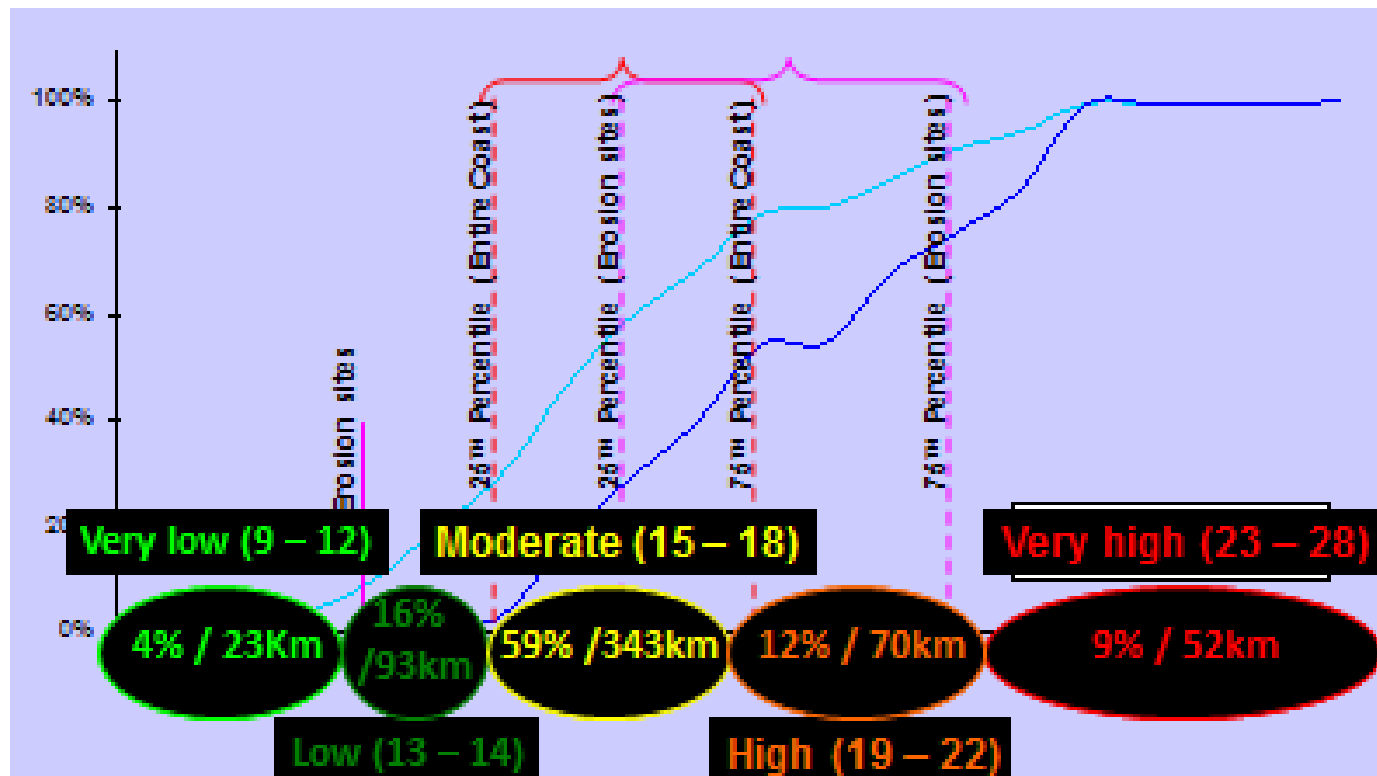
1. 50m cells
2. Beach width, Dune width and Distance to 20m isobath most critical
3. Cells across estuary mouths were weighted



This resulted in a total vulnerability score out of 28

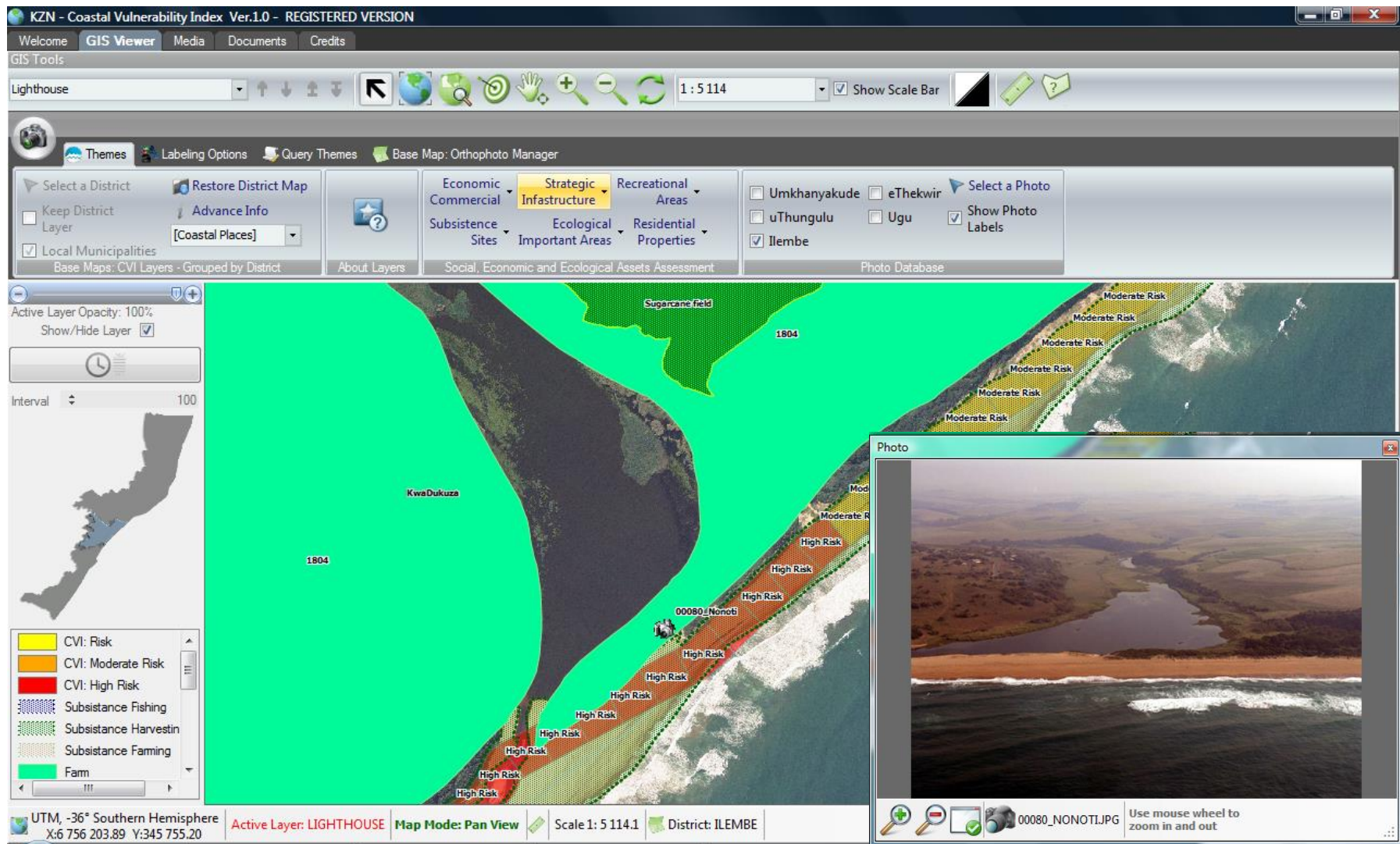
20 (Max) + 4 + 4 = 28 (Max)

Physical CVI – Ranking



Socio-economic and ecological factors

Economic & commercial activities	Strategic infrastructure	Recreational areas	Subsistence sites	Ecological important areas	Residential properties
Dune mining	Piers [#]	Boat launch sites [#]	Subsistence fishing sites [#]	Marine Protected Areas [#]	Residential erven
Forest plantation	Roads	Fishing hot spots [#]	Subsistence harvesting sites [#]	Bird sanctuary sites [#]	
Sugar cane	Railway lines	Swimming beaches [#]	Subsistence farming areas	Turtle nesting sites [#]	
Commercial & industrial buildings	Lighthouses	Sports facilities		Estuary mouths [#]	
Commercial farms		Coastal Public Property		Protected areas (terrestrial)	





It is proposed that the conservative approach of the 100 year set-back be applied in order to inform future development applications

There are exceptions – which can be evaluated on a case by case basis depending on:

–The management authority objectives

–The nature of the development

Three key input factors where considered:

–*Long-term shoreline change ($S\Delta t$)*

Shoreline change was determined using a Weighted Linear Regression (WLR) approach, applied at transect level from aerial photos

–*Sea-level rise scenarios ($SLRt$)*

The protectionist approach was taken in this assessment (3.75mm.y^{-1}), applied uniformly to all transects as a linear addition in the overall formula

–*Relative vulnerability (RB)*

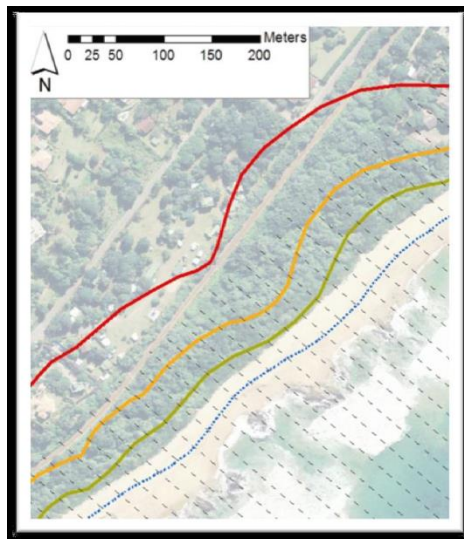
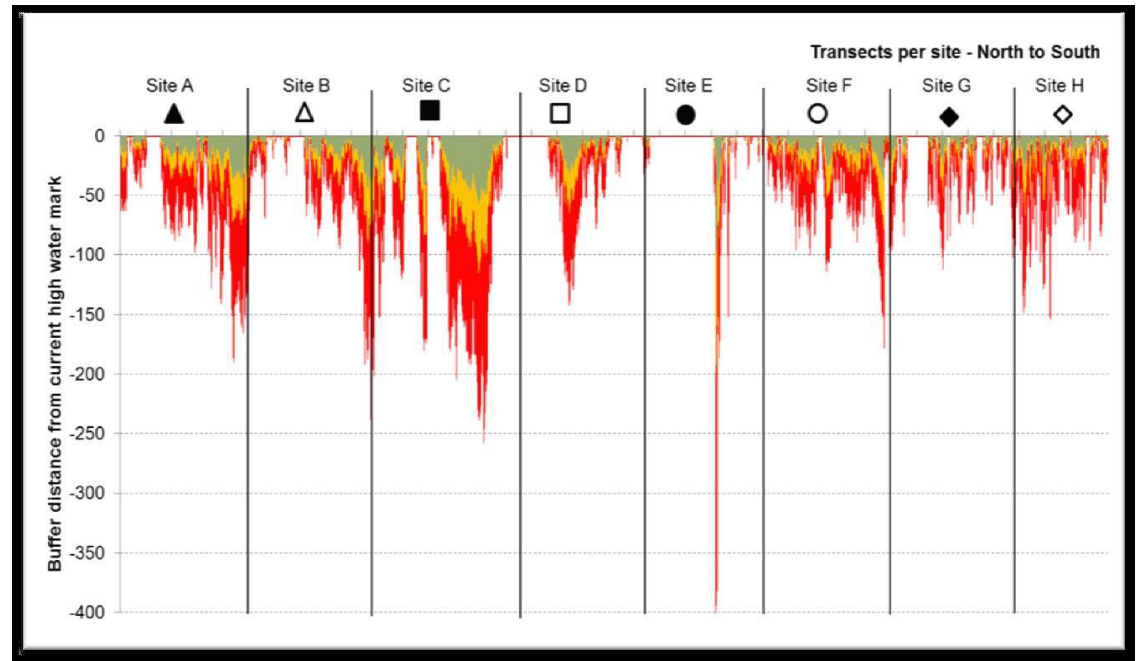
The vulnerability scored cells between 9 (low risk) & 32 (high risk)

$$SBt=n(S\Delta t+SLRt+RB)$$

Analysis was done at a transect level

For each site, 20m interval transects were set *resulting in approximately 1000 transects per site*

The method considered three set-back line future scenarios: 25, 50 & 100 years



- High water mark (2007)
- Transects (20m)
- 100 year set-back line
- 50 year set-back line
- 25 year set-back line

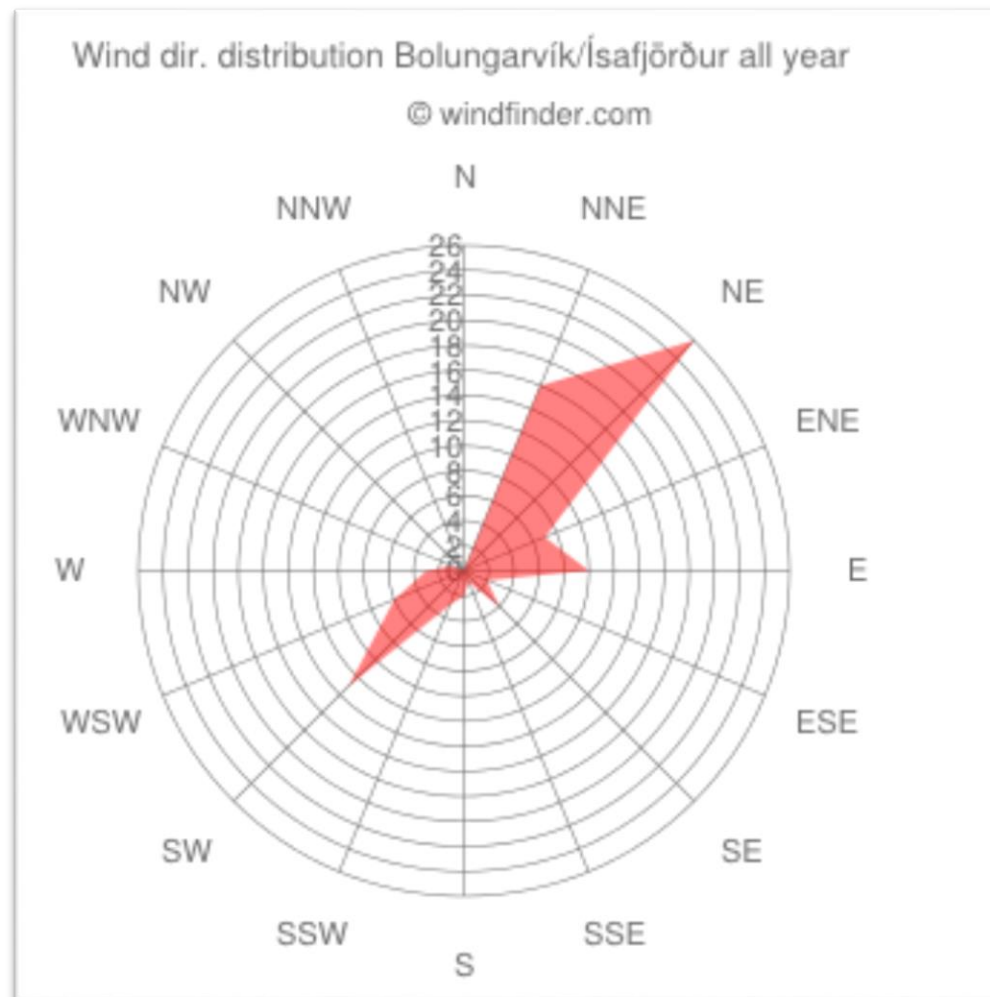






In March 2006, a storm flooded businesses and homes and knocked out electricity (which controlled the pumps, making it impossible to pump the water out)

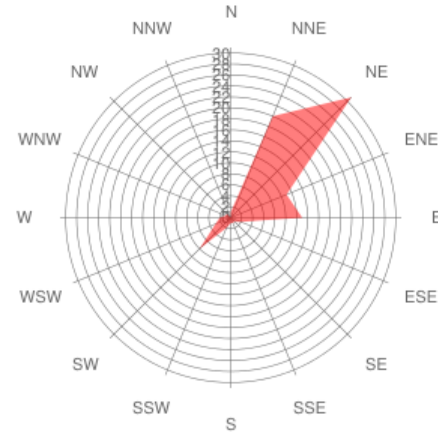




Prevailing winds are northeasterly or north-northeasterly for most of the year

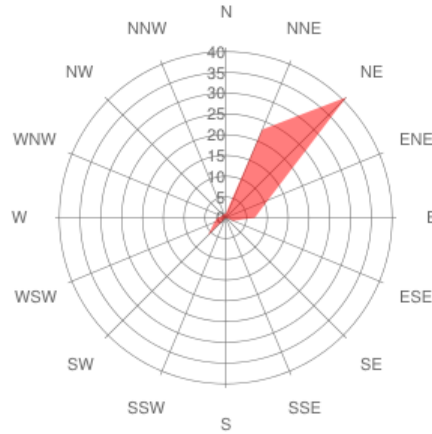
Wind dir. distribution Bolungarvík/Ísafjörður May

© windfinder.com



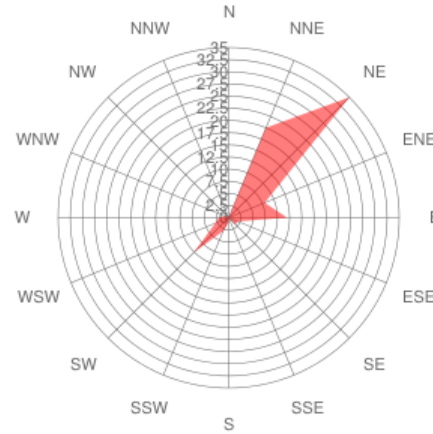
Wind dir. distribution Bolungarvík/Ísafjörður June

© windfinder.com



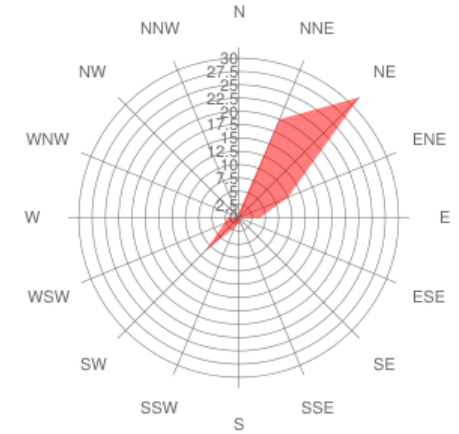
Wind dir. distribution Bolungarvík/Ísafjörður July

© windfinder.com



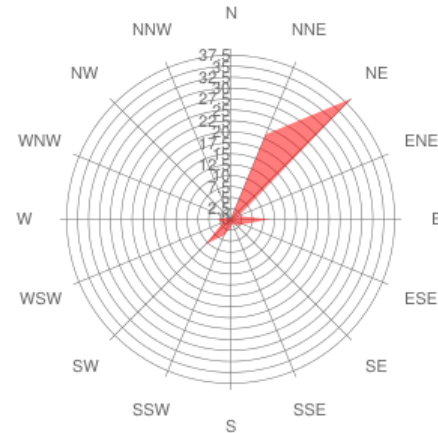
Wind dir. distribution Bolungarvík/Ísafjörður August

© windfinder.com



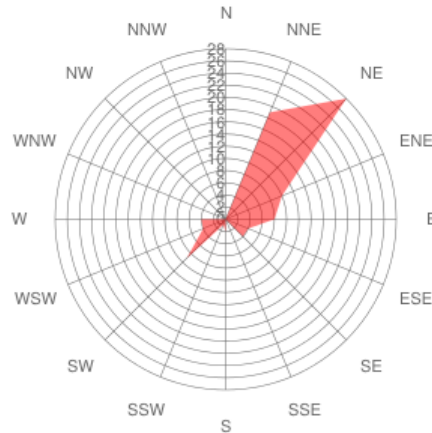
Wind dir. distribution Bolungarvík/Ísafjörður September

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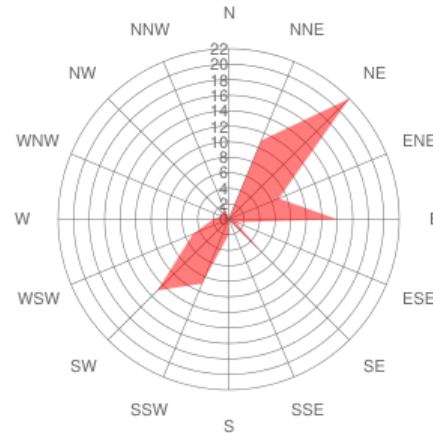
Wind dir. distribution Bolungarvík/Ísafjörður October

© windfinder.com



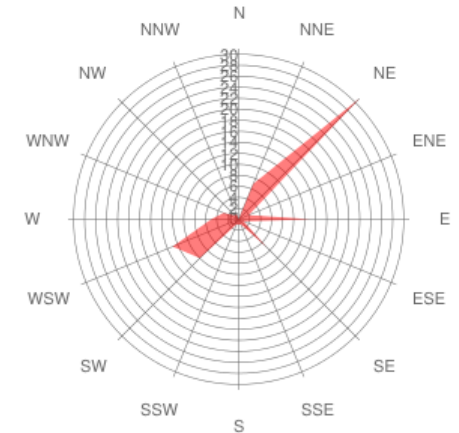
Wind dir. distribution Bolungarvík/Ísafjörður November

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Wind dir. distribution Bolungarvík/Ísafjörður December

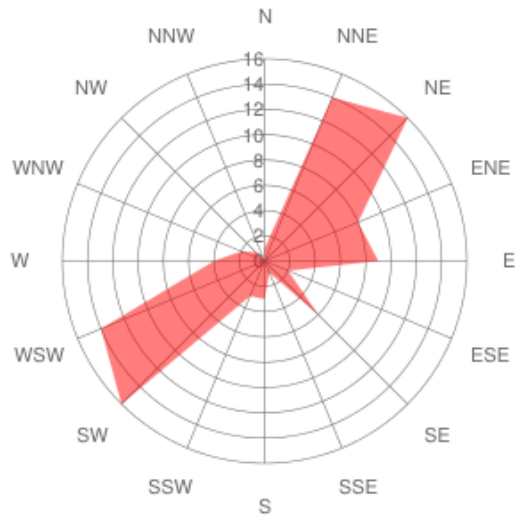
© windfinder.com



Winds from May to December

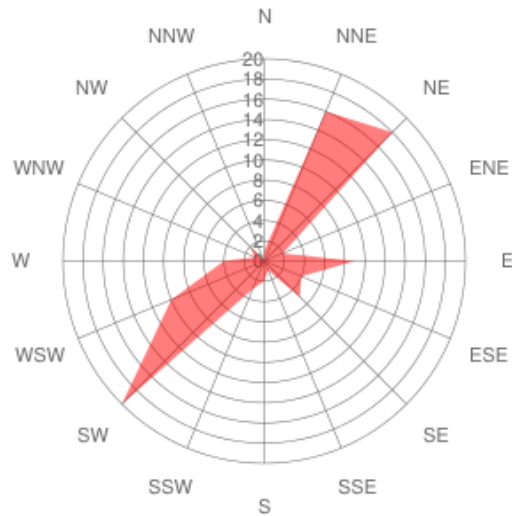
Wind dir. distribution Bolungarvík/Ísafjörður January

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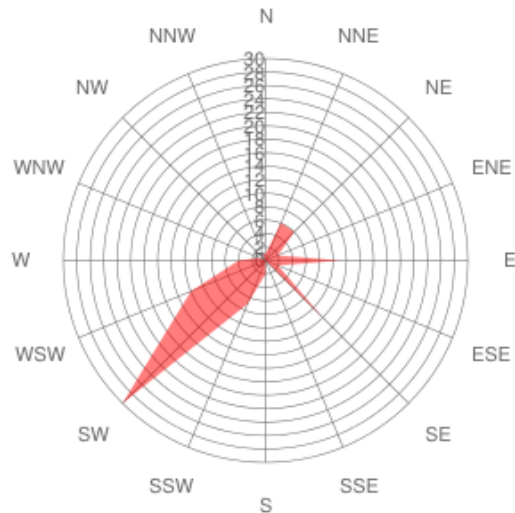
Wind dir. distribution Bolungarvík/Ísafjörður February

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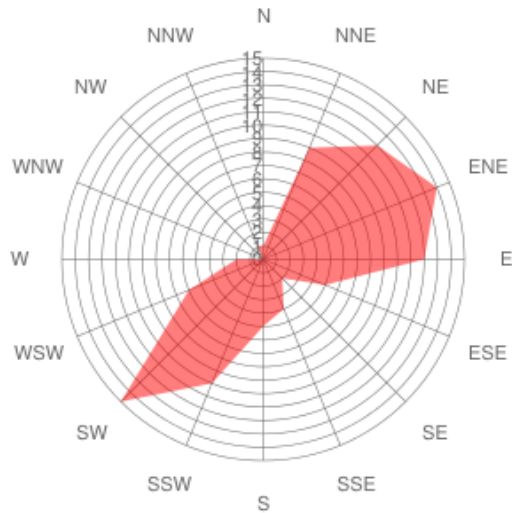
Wind dir. distribution Bolungarvík/Ísafjörður March

© windfinder.com



Wind dir. distribution Bolungarvík/Ísafjörður April

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Winds January to April





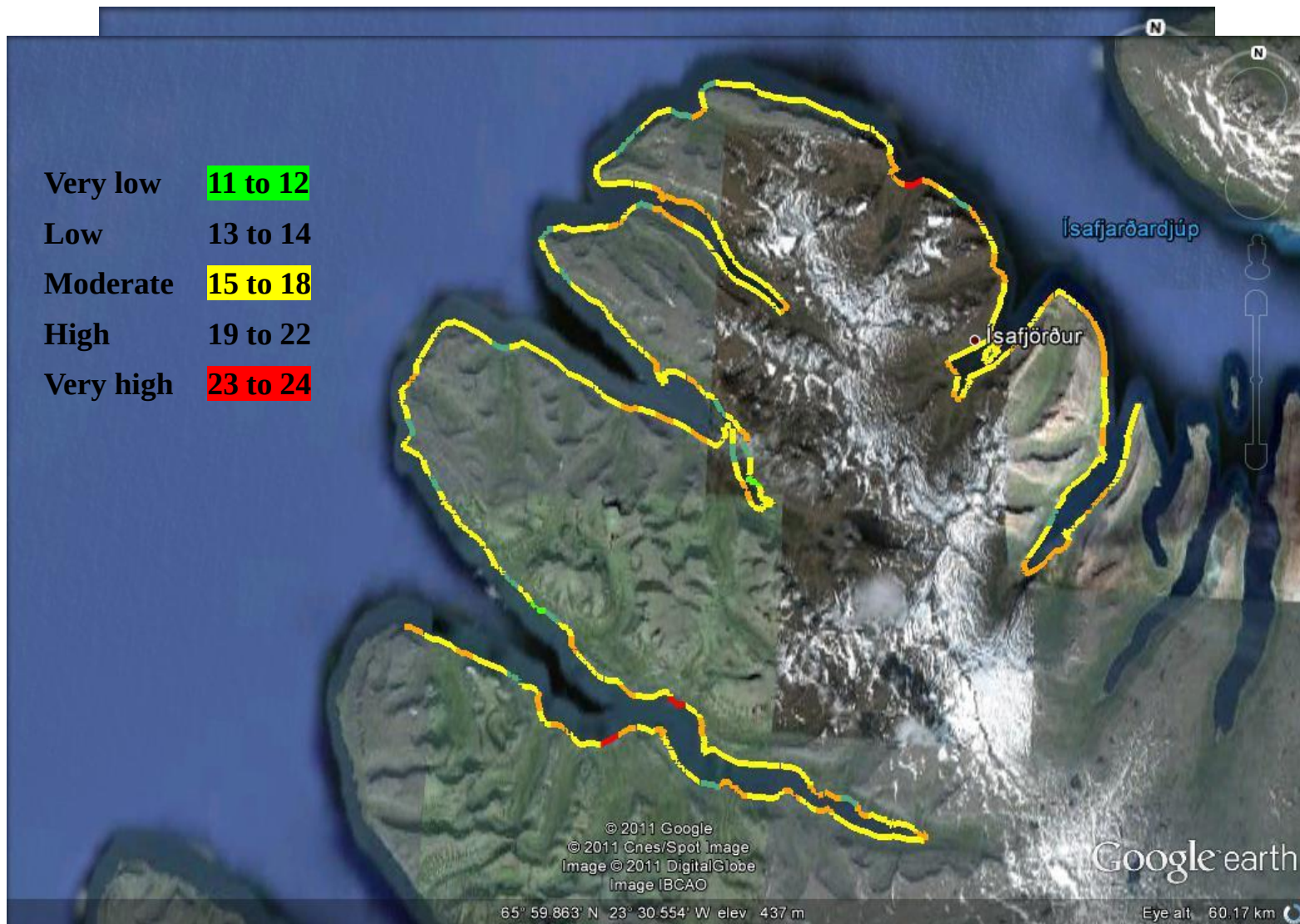


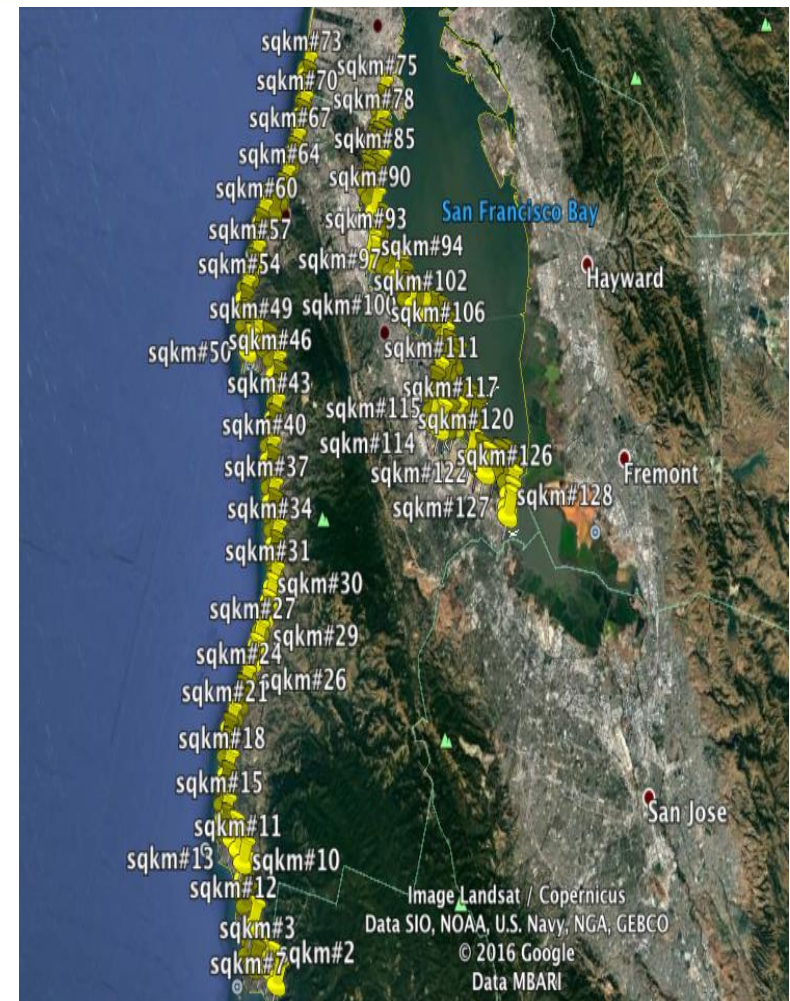
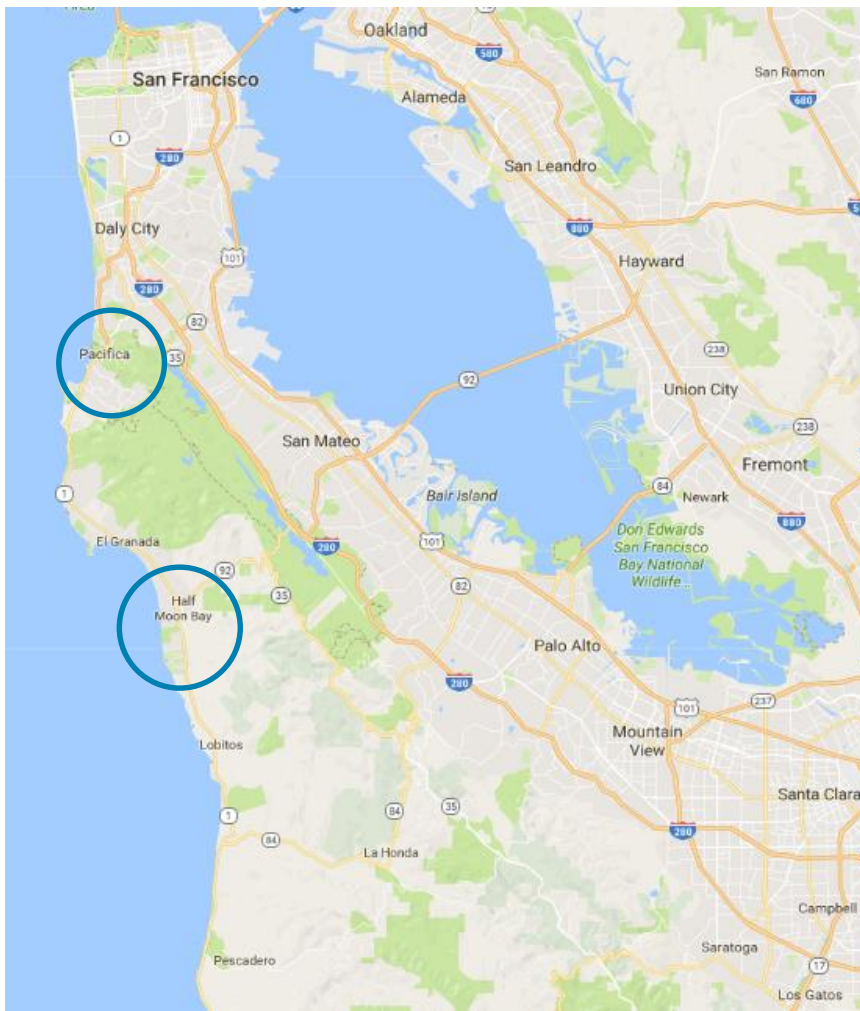


Physical Property	Extremely Low (1)	Low (2)	Moderate (3)	High (4)
Beach width	> 150m	100 – 150m	50 – 100m	< 50m
Coastal Slope	> 12%	12 – 8%	8 – 4%	< 4%
Distance to -20m bathy	> 4km	2 – 4km	1 – 2km	< 1km
Number of recorded avalanches	0	1 – 10	11 – 50	> 50
Percentage outcrop	> 50%	20 – 50%	10 – 20%	< 10%

Residency and Recreational	Strategic Transport Infrastructure	Industrial and Commercial	Waste disposal	Agricultural	Aquaculture and Fishing	Conservation
Housing areas/ built urban areas Isolated housing/buildi ngs Coastal Public Property Boat launch sites	Major roads Minor roads Harbours Airstrip Lighthouses	Commercial and Industrial buildings Factories, e.g. fish- processing plants Power stations	Waste-water / Sewage- treatment plants	Farms Arable land	Fishing hot- spots Aquaculture sites	Designated nature reserves

Very low	11 to 12
Low	13 to 14
Moderate	15 to 18
High	19 to 22
Very high	23 to 24





San Mateo County is located on a peninsula between San Francisco Bay to the East and the Pacific Ocean to the West. The coastside is 93 km in length while the bayside has 60 km of shoreline.



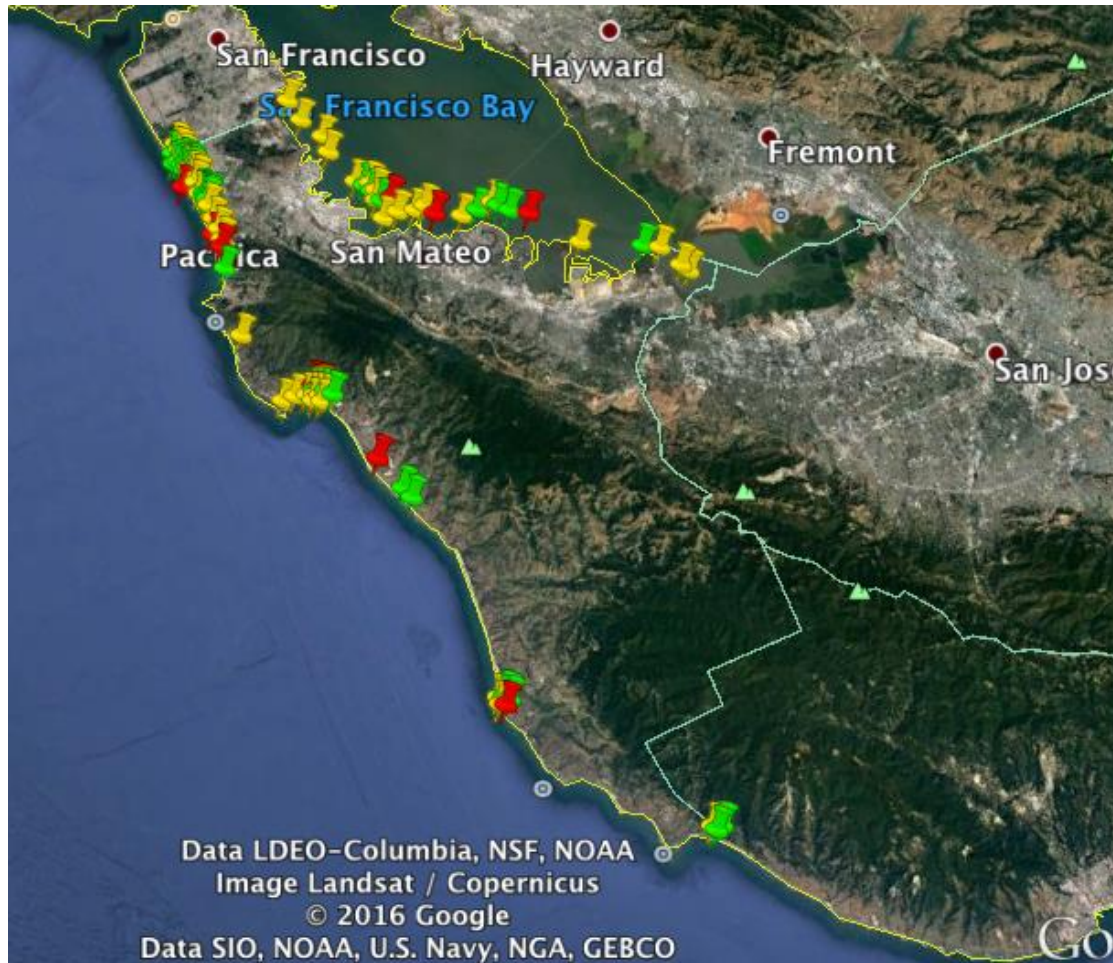


Fig
Bre
cliff

San Mateo County: Economy

Industry/Employer	Percentage (%)
Agriculture	0.3
Government	13.4
Services	49.4
Retail trade	9.8
Mining and Construction	4.6
Manufacturing	5.1
Transportation and Public Utilities	4.9
Wholesale Trade	3.0
Finance, Insurance and Real Estate	9.8

Over 3000 employees	1000-3000 employees	1000 employees & under
United Airlines Airline 13,300	Siebel Systems Software 1,926	Visa USA/Visa International Financial 900
Oracle Corporation Software 8,000	Applied Biosystems Biotechnology 1,762	Electronics For Imaging Medical 900
County of San Mateo Government 5,234	United State Postal Service Mail Services 1,637	Gap Inc. Retail 870
Facebook 4,600	Stanford Linear Accelerator Research 1,450	Target Stores Retail 750
Genentech Inc. Biotechnology 4,129	San Francisco International Airport Transportation 1,429	SamTrans District Transportation 741
	SRI International Research/Consulting 1,200	Electronic Arts Software and Dreamworks 697
	Catholic Healthcare West Healthcare 1,154	PG&E Utilities 681
	Franklin Templeton Investments 1,100	SBC Communication Communications 576



Environmental stakeholders as well as social stakeholders such as government officials identified a variety of sites throughout the County. Economic stakeholders identified a much more limited number of sites, and the sites they identified correlated to the part of the County they live and work in as well as sites that have had great media exposure regarding coastal vulnerability. The identified sites largely correlated with population and economic assets, with much of the identifying occurring around the population basins of Half Moon Bay and Pacifica on the coast side, and San Francisco International Airport on the bay side.

Miramar Beach and Mirada Road



- Eroding cliffs.
- Shrinking beaches.
- Vulnerability to wave energy, especially El Nino events.
- Vulnerability to cliff destabilization during precipitation events .
- Residential dwellings, tourist dwellings and commercial sites at risk.



Port Louis, Mauritius 2012



Fisheries Protection Officers
Fishermen
Inhabitants within coastal areas
National Coast Guards
Skippers
Mauritius Meteorological Services
Ministry of Ocean Economy, Marine Resources, Fisheries, Shipping and Outer Island
Force vive across the coastal zones
Forestry Services
Ministry of Environment, Sustainable Development, Disaster and Beach Management
Mauritius Port Authority
Mauritius Tourism Promotion Authority
Ministry of Tourism and External Communications
Central Water Authority
Central Electricity Board
Ministry of Local Government
Ministry of Housing & Lands
Hotel Managers
Restaurant owners within coastal zones and port
Apartment owners
Sea food hub officers
Albion Fisheries Research Centre Technical Staff

Impacts	Physical Parameters	Human Influence Parameters
Coastal erosion	♦ Rate of sea level rise ♦ Geomorphology ♦ Coastal Slope ♦ Wave height ♦ Rate of shoreline changes ♦ Tidal Range	♦ Reduction of sediment supply ♦ River flow regulation ♦ Engineered frontage ♦ Natural protection Degradation ♦ Coastal Protection Structures
Flooding due to storm surge	♦ Rate of sea level rise ♦ Coastal Slope ♦ Wave height ♦ Tidal Range	♦ Engineered Frontage ♦ Natural Protection Degradation ♦ Coastal Protection Structures
Inundation	♦ Rate of sea level rise ♦ Coastal Slope ♦ Tidal Range	♦ Natural protection degradation ♦ Coastal protection structures
Salt water intrusion To groundwater Resources	♦ Rate of Sea Level Rise ♦ Proximity to Coast ♦ Type o Aquifer ♦ Hydraulic Conductivity ♦ Depth to Groundwater ♦ Level Above Sea	♦ Groundwater Consumption ♦ Land Use Pattern
Salt water intrusion To river/estuary	♦ Rate of Sea Level Rise ♦ Tidal Range ♦ Water Depth at ♦ Downstream ♦ Discharge	♦ River Flow Regulation ♦ Engineered Frontage ♦ Land Use Pattern

Fairbourne



Flood risk from rivers (fluvial)

- Increased and more intense rainfall will cause increased flow through the rivers.

Ground water

- Rising fluvial flow and increased sea level rise will increase the level of ground water

Flood risk from within the estuary

- With the estuary there will be increased risk of flooding across the embankment

Coastal change and wave overtopping

- At the coast there will be increased erosion and overtopping.

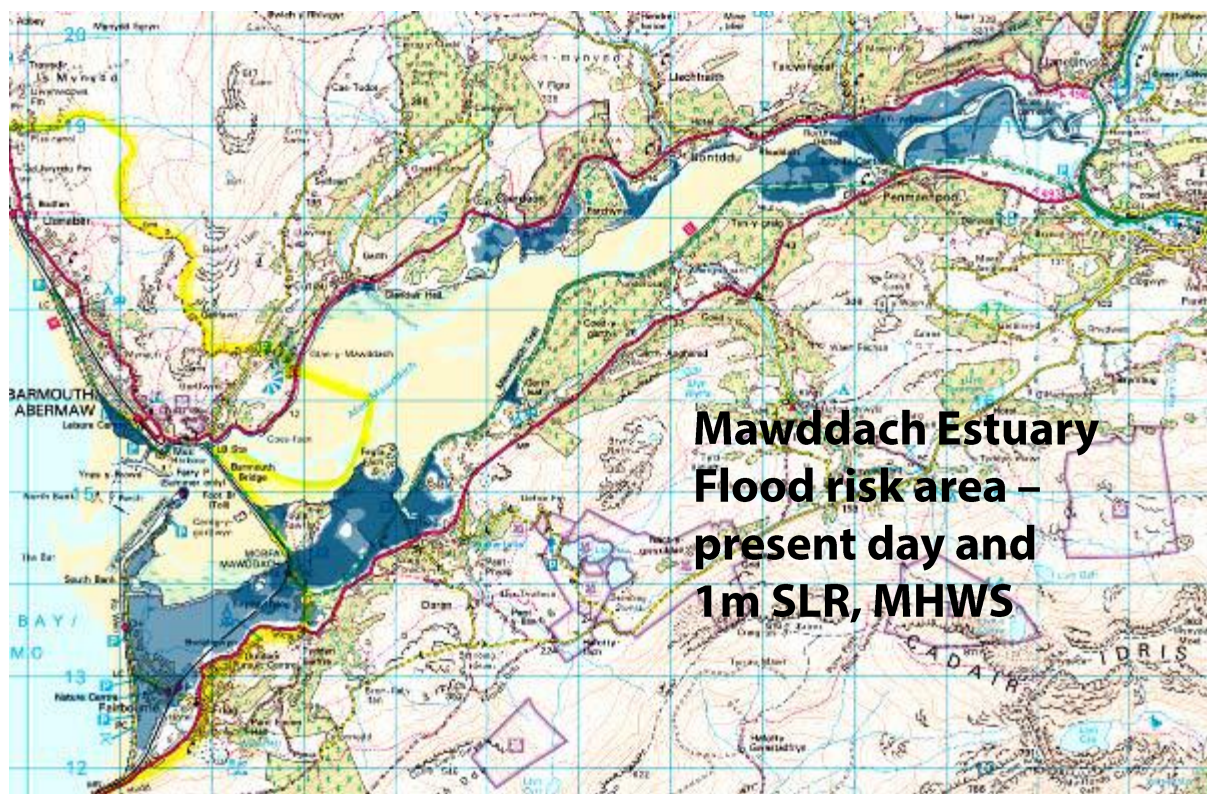
SMPs consider how a section of coastline is to be managed over epochs, e.g. 25 years, 50 years and 100 years to address issues such as flooding and/or erosion.

- No active intervention - No planned investment to defend coastline at a particular location against flooding or erosion. This even includes areas where there are existing coastal defences.
- Hold the line – This section of coastline will be defended, or continue to be defended, by constructing artificial defences to maintain the shoreline position. This includes modifying types of coastal defence.
- Managed realignment or managed retreat – This section of the coastline will be abandoned over a period of time and socio-economic assets will be relocated or lost to the sea.
- Advance the line - New coastal defences are constructed on the seaward side of the existing shoreline or coastal defences. This can include beach nourishment or hard engineering.

Following publication of the second generation SMP and adopted by Gwynedd County Council, the long term management policy for Fairbourne will be 'no active intervention' from 2050 (Royal Haskoning, 2011). From 2025, the SMP recommends 'managed retreat' as the first implementation stage of not defending the Fairbourne shoreline. Defending the shoreline is costly, as shown to the south at Borth, where recently completed multi-functional artificial reef sea defences and ancillary works cost £29 million.



Borth Reef, UK (bordered by blue rectangle): a) reef in relation to Cardigan Bay, b) view of reef from higher elevation at headland to the south, and c) view of reef from Borth beach.



Much of the area of Fairbourne would be at risk under MHWS with 0.36m of sea level rise. With 1m sea level the whole area of the village would be below MHWS (SMP2)

Fairbourne

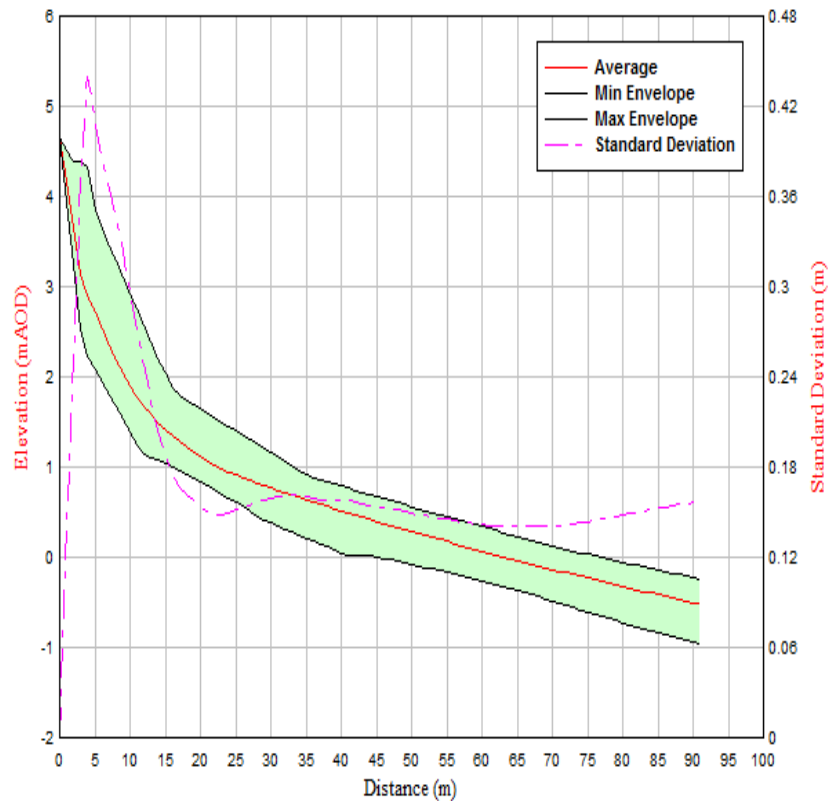


Tidal Ladder

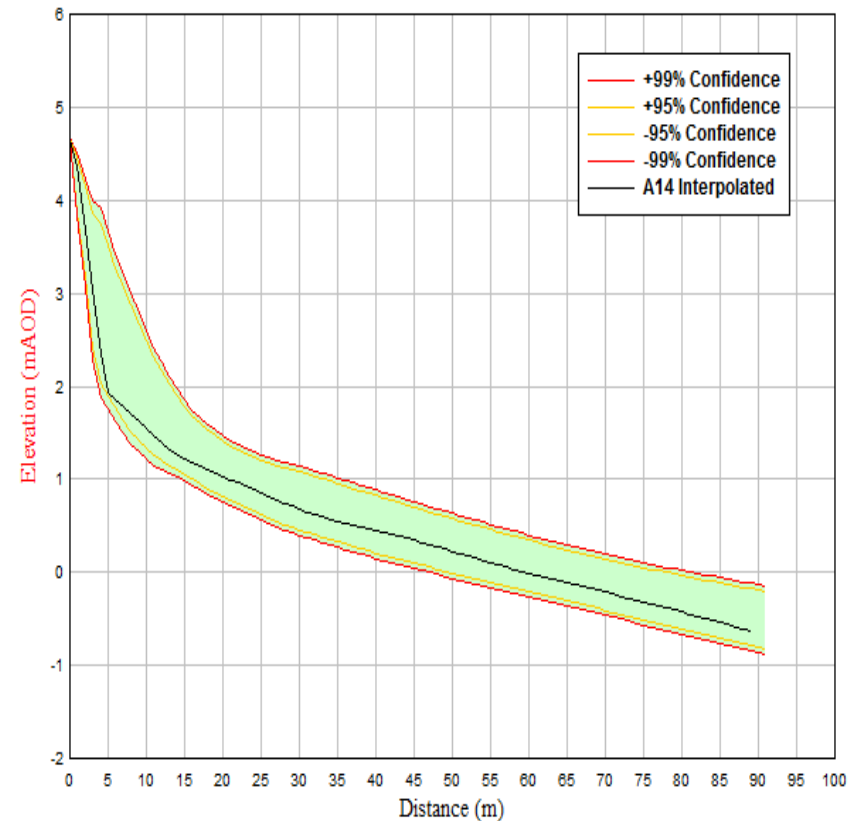
Predicted Astronomical Tides							
Location	MLWS	MLWN	MSL	MHWN	MHWS	HAT	Spring Range
Aberdaron	-1.94	-0.54	0	0.86	2.16	2.8	4.1
St Tudal's Roads	-1.94	-0.64	0	0.86	2.36	3.16	4.3
Pwllheli	-1.94	-0.74	0	0.96	2.56	3.26	4.5
Criccieth	-1.94	-0.64	0	0.96	2.56	3.26	4.5
Porthmadog			0	0.96	2.66	3.51	
Barmouth	-1.74	-0.64	0	1.06	2.56	3.29	4.3
Aberdyfi	-1.74	-0.64	0	1.06	2.56	3.29	4.3
Note: -All value given in metres above Ordnance Datum. Chart Datum correction = 2.44m							

Profile envelope and confidence intervals

Profile 23 Autumn 2014



Profile 23 Autumn 2014



Input Your Chosen "Green" Percentage Trigger Here →

100.00%

Profile T23 Spring 2014

(Confidence Levels based on surveys between 1992 and Autumn 2013)

Tidal Ladder	RED (Increase)	AMBER (Increase)	GREEN	AMBER (Decrease)	RED (Decrease)	Total Levels	Individual Tidal Ladder Status:
ORIGIN To HAT	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
4.66 To 3.29	0	0	3	0	0	3	
HAT To MHWS	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
3.29 To 2.56	0	0	1	0	0	1	
MHWS To MHWN	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
2.56 To 1.06	0	0	17	0	0	17	
MHWN To MSL	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
1.06 To 0	0	0	36	0	0	36	
MSL To MLWN	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
0 To -0.64	0	0	30	0	0	30	
MLWN To MLWS	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
-0.64 To -1.74	0	0	14	0	0	14	

Totals	0	0	101	0	0	101	Overall profile Status:
	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green

Input Your Chosen "Green" Percentage Trigger Here →

100.00%

Profile T23 Autumn 2014

(Confidence Levels based on surveys between 1992 and Autumn 2013)

Tidal Ladder	RED (Increase)	AMBER (Increase)	GREEN	AMBER (Decrease)	RED (Decrease)	Total Levels	Individual Tidal Ladder Status:
ORIGIN To HAT	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
4.66 To 3.29	0	0	3	0	0	3	
HAT To MHWS	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
3.29 To 2.56	0	0	1	0	0	1	
MHWS To MHWN	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
2.56 To 1.06	0	0	16	0	0	16	
MHWN To MSL	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
1.06 To 0	0	0	40	0	0	40	
MSL To MLWN	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
0 To -0.64	0	0	30	0	0	30	
MLWN To MLWS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	No Levels were measured in this tidal ladder
-0.64 To -1.74	0	0	0	0	0	0	

Totals	0	0	90	0	0	90	Overall profile Status:
	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green

Input Your Chosen "Green" Percentage Trigger Here →

100.00%

Profile T23 Spring 2015

(Confidence Levels based on surveys between 1992 and Autumn 2013)

Tidal Ladder	RED (Increase)	AMBER (Increase)	GREEN	AMBER (Decrease)	RED (Decrease)	Total Levels	Individual Tidal Ladder Status:
ORIGIN To HAT	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
4.66 To 3.29	0	0	3	0	0	3	Status is Green
HAT To MHWS	0.00%	14.29%	85.71%	0.00%	0.00%	100.00%	Status is Amber Increase
3.29 To 2.56	0	1	6	0	0	7	Status is Amber Increase
MHWS To MHWN	0.00%	22.22%	77.78%	0.00%	0.00%	100.00%	Status is Amber Increase
2.56 To 1.06	0	2	7	0	0	9	Status is Amber Increase
MHWN To MSL	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
1.06 To 0	0	0	36	0	0	36	Status is Green
MSL To MLWN	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
0 To -0.64	0	0	38	0	0	38	Status is Green
MLWN To MLWS	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
-0.64 To -1.74	0	0	40	0	0	40	Status is Green

Totals	RED	AMBER	GREEN	AMBER	RED	Total	Overall profile Status:
	0	3	130	0	0	133	Status is Amber Increase
	0.00%	2.26%	97.74%	0.00%	0.00%	100.00%	Status is Amber Increase

Input Your Chosen "Green" Percentage Trigger Here →

100.00%

Profile T23 Autumn 2015

(Confidence Levels based on surveys between 1992 and Autumn 2013)

Tidal Ladder	RED (Increase)	AMBER (Increase)	GREEN	AMBER (Decrease)	RED (Decrease)	Total Levels	Individual Tidal Ladder Status:
ORIGIN To HAT	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
4.66 To 3.29	0	0	3	0	0	3	
HAT To MHWS	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
3.29 To 2.56	0	0	1	0	0	1	
MHWS To MHWN	0.00%	0.00%	81.82%	18.18%	0.00%	100.00%	Status is Amber Decrease
2.56 To 1.06	0	0	9	2	0	11	
MHWN To MSL	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
1.06 To 0	0	0	37	0	0	37	
MSL To MLWN	0.00%	0.00%	53.85%	46.15%	0.00%	100.00%	Status is Amber Decrease
0 To -0.64	0	0	14	12	0	26	
MLWN To MLWS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	No Levels were measured in this tidal ladder
-0.64 To -1.74	0	0	0	0	0	0	

Totals	0	0	64	14	0	78	Overall profile Status:
	0.00%	0.00%	82.05%	17.95%	0.00%	100.00%	Status is Amber Decrease

Input Your Chosen "Green" Percentage Trigger Here →

100.00%

Profile T23 Spring 2016

(Confidence Levels based on surveys between 1992 and Autumn 2013)

Tidal Ladder	RED (Increase)	AMBER (Increase)	GREEN	AMBER (Decrease)	RED (Decrease)	Total Levels	Individual Tidal Ladder Status:
ORIGIN To HAT	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
4.66 To 3.29	0	0	3	0	0	3	
HAT To MHWS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	No Levels were measured in this tidal ladder
3.29 To 2.56	0	0	0	0	0	0	
MHWS To MHWN	0.00%	0.00%	64.29%	35.71%	0.00%	100.00%	Status is Amber Decrease
2.56 To 1.06	0	0	9	5	0	14	
MHWN To MSL	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
1.06 To 0	0	0	40	0	0	40	
MSL To MLWN	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	Status is Green
0 To -0.64	0	0	35	0	0	35	
MLWN To MLWS	0.00%	0.00%	81.63%	14.29%	4.08%	100.00%	Status is Amber Decrease
-0.64 To -1.74	0	0	40	7	2	49	

Totals	RED	AMBER	GREEN	AMBER	RED	Total	Overall profile Status:
	0	0	127	12	2	141	Status is Amber Decrease
	0.00%	0.00%	90.07%	8.51%	1.42%	100.00%	

Fairbourne: Moving Forward

- **Groundwater monitoring and modelling**
- **Coastal monitoring and shoreline change**
- **Sea level rise and storms**
- **Predicting future flood risk**
- **Timeline**

Tidal Lagoon Swansea Bay



Benefits

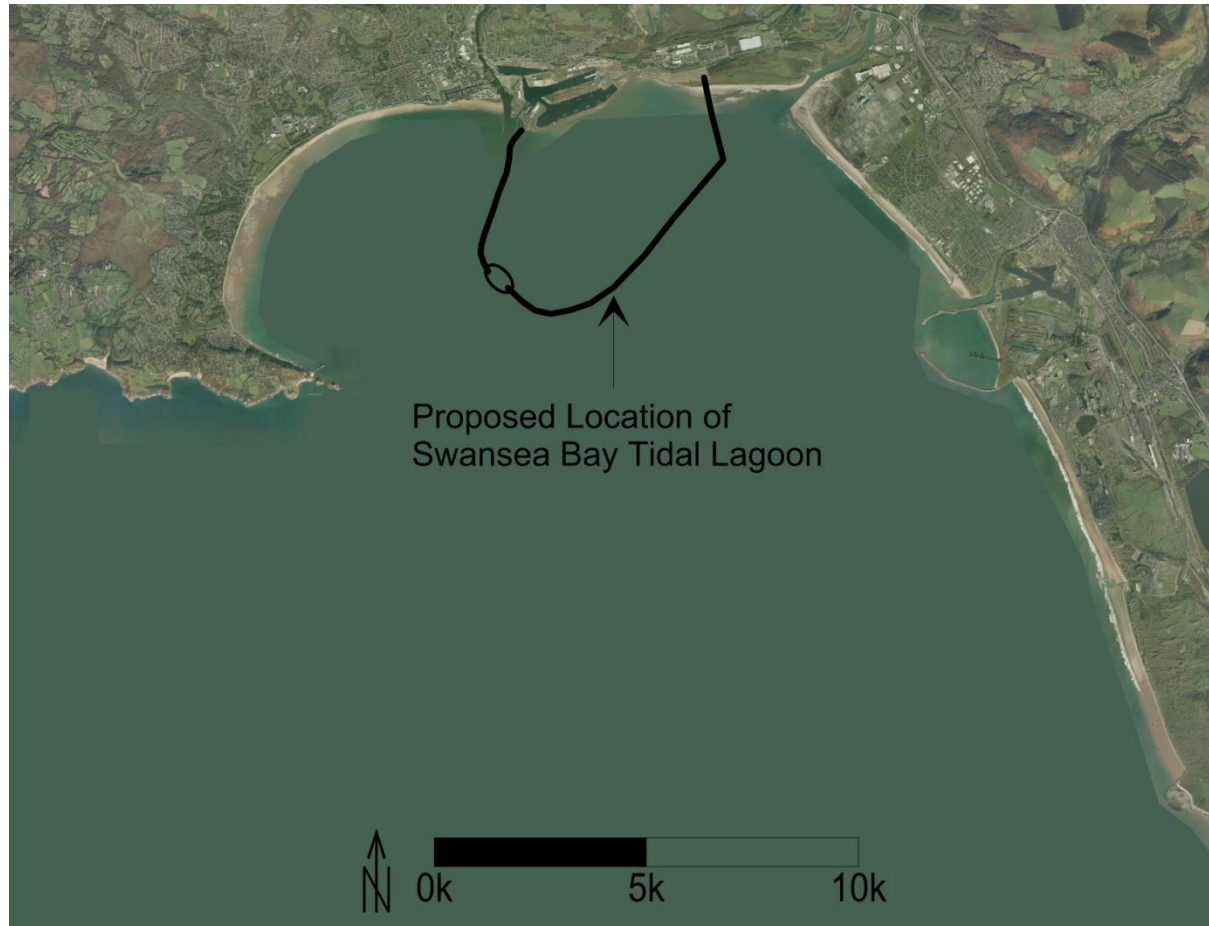
- The world's first, man-made, energy-generating lagoon, with a 320MW installed capacity and 14 hours of reliable generation every day (Wall length 9.5km; Area. 11.5km²)
- Clean, renewable and predictable power for over 155,000 homes (equivalent to 90% of Swansea Bay's annual domestic electricity use) for 120 years
- Large-scale tidal power connected to the National Grid, as other power stations are closed down
- An important contribution towards national carbon emission reduction targets – over 236,000 tonnes of CO₂ saved each year
- An opportunity to develop a world-leading tidal range industry in the UK
- Significant employment and value creation in Wales
- Community and tourism opportunities in sports, recreation, education, arts and culture
- Conservation, restocking and biodiversity programmes
- Coastal flood protection

(tidallagoonswanseabay.com, 2015)

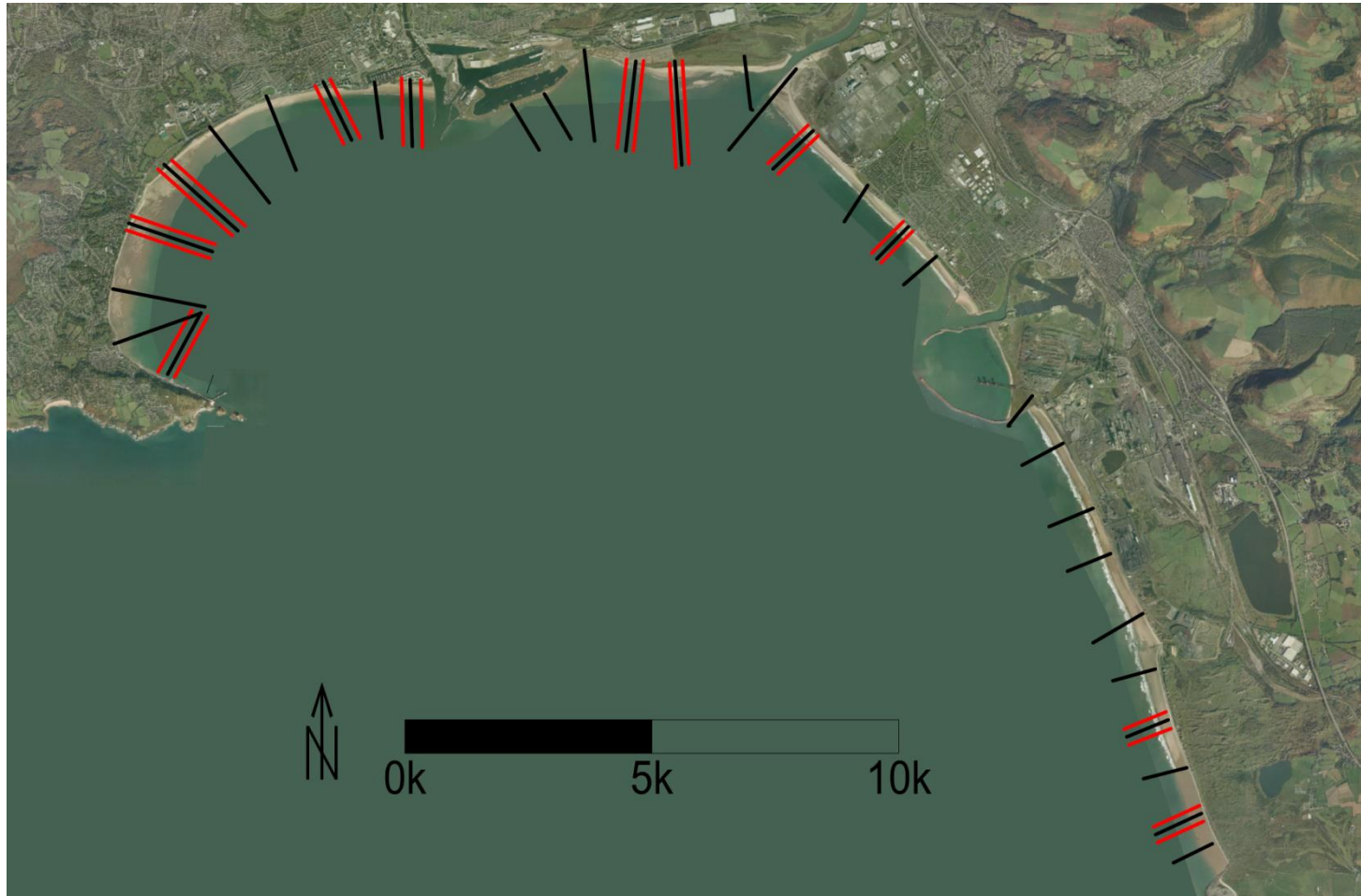
Baseline Studies

- Establish beach and shoreline behaviour prior to construction
- Establish baseline data
- Monitor during construction
- Monitor post construction
- Assess change and mitigate if necessary

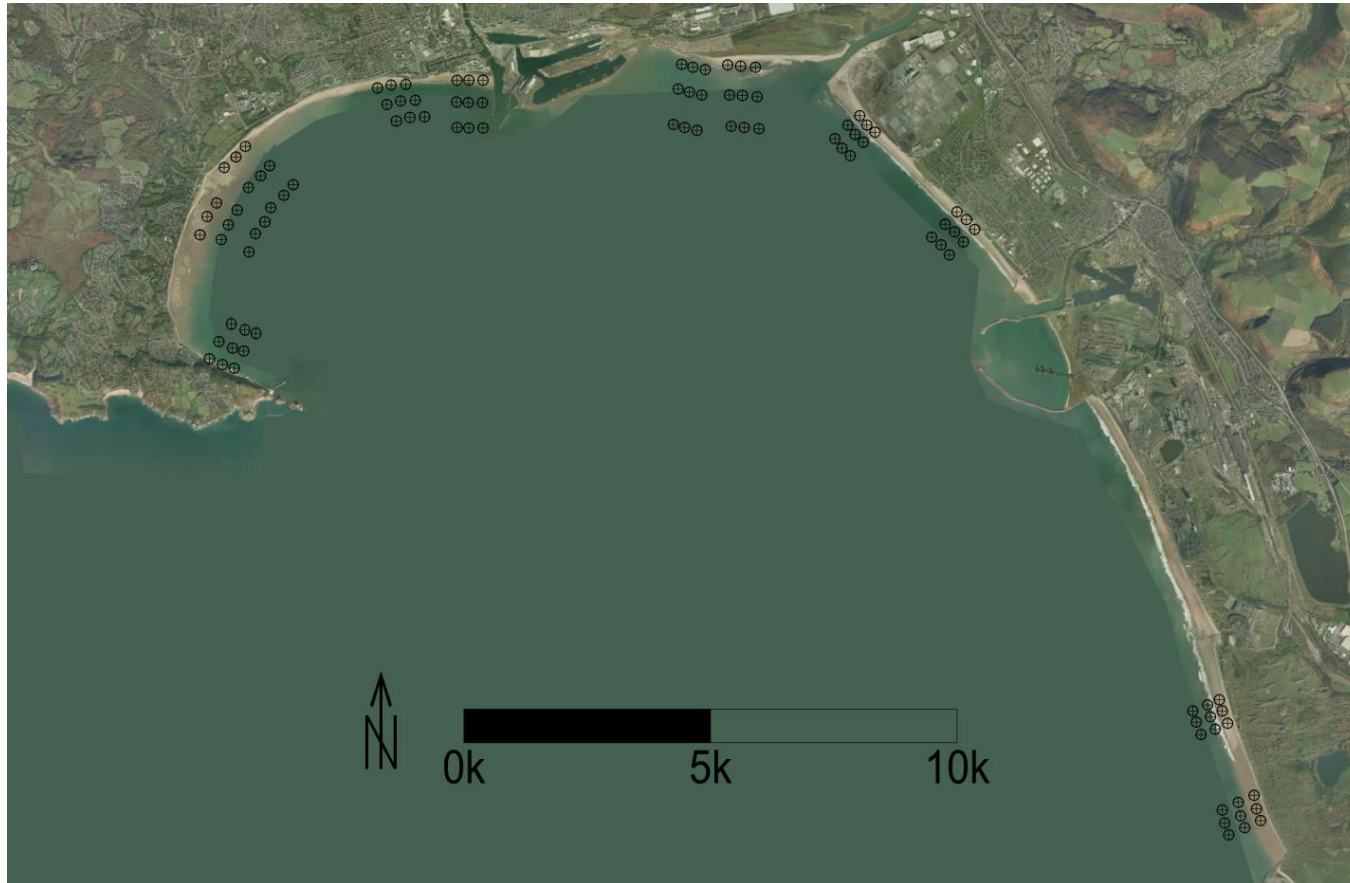
Monitoring



Profile Locations (Shoreline Management __; additional TLSB __)

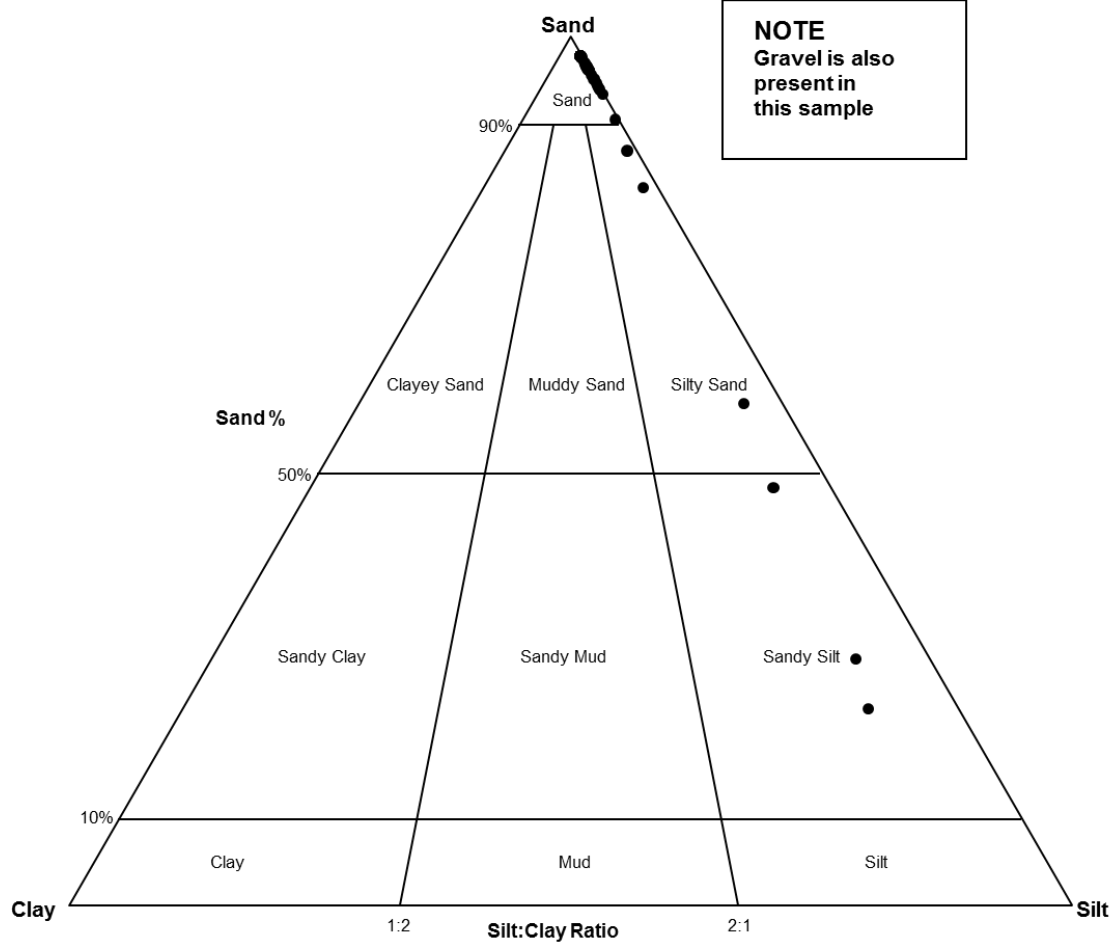


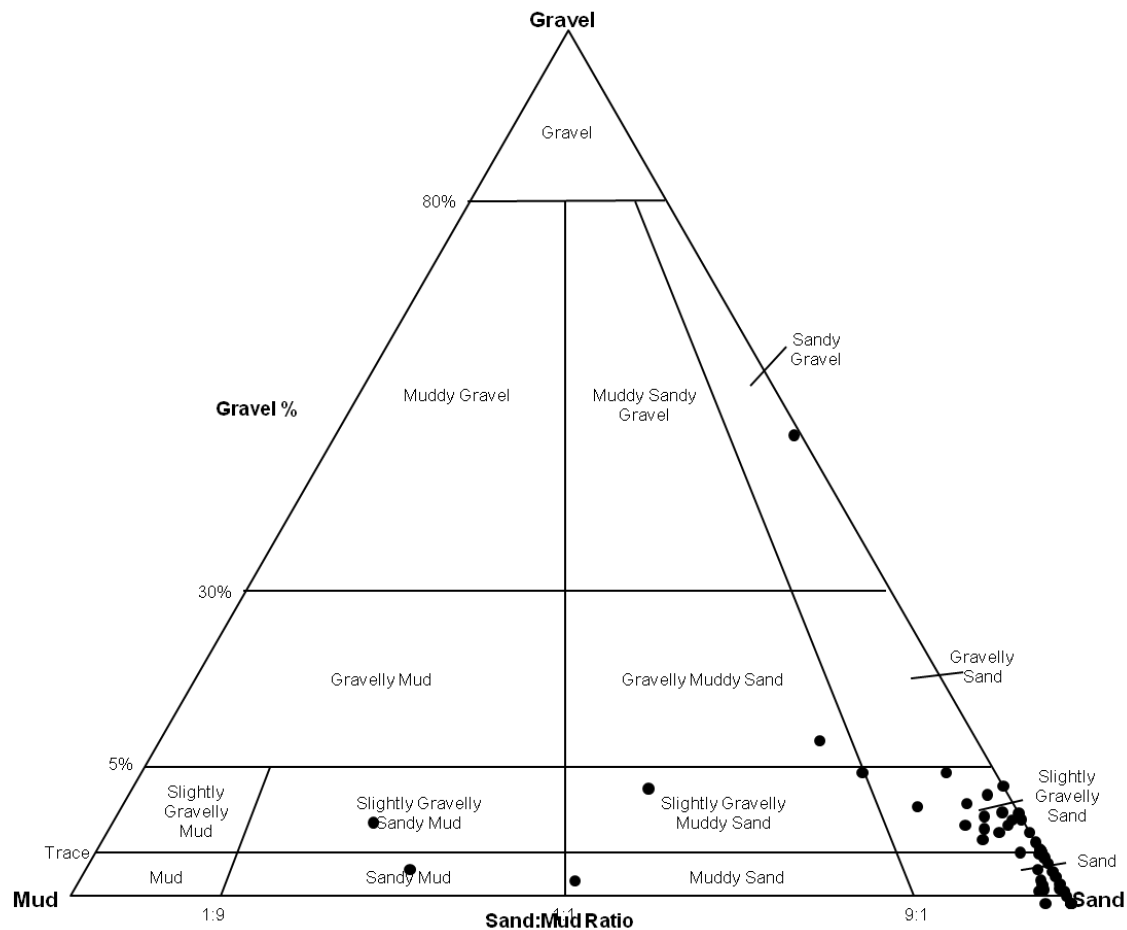
Location of Sediment Samples



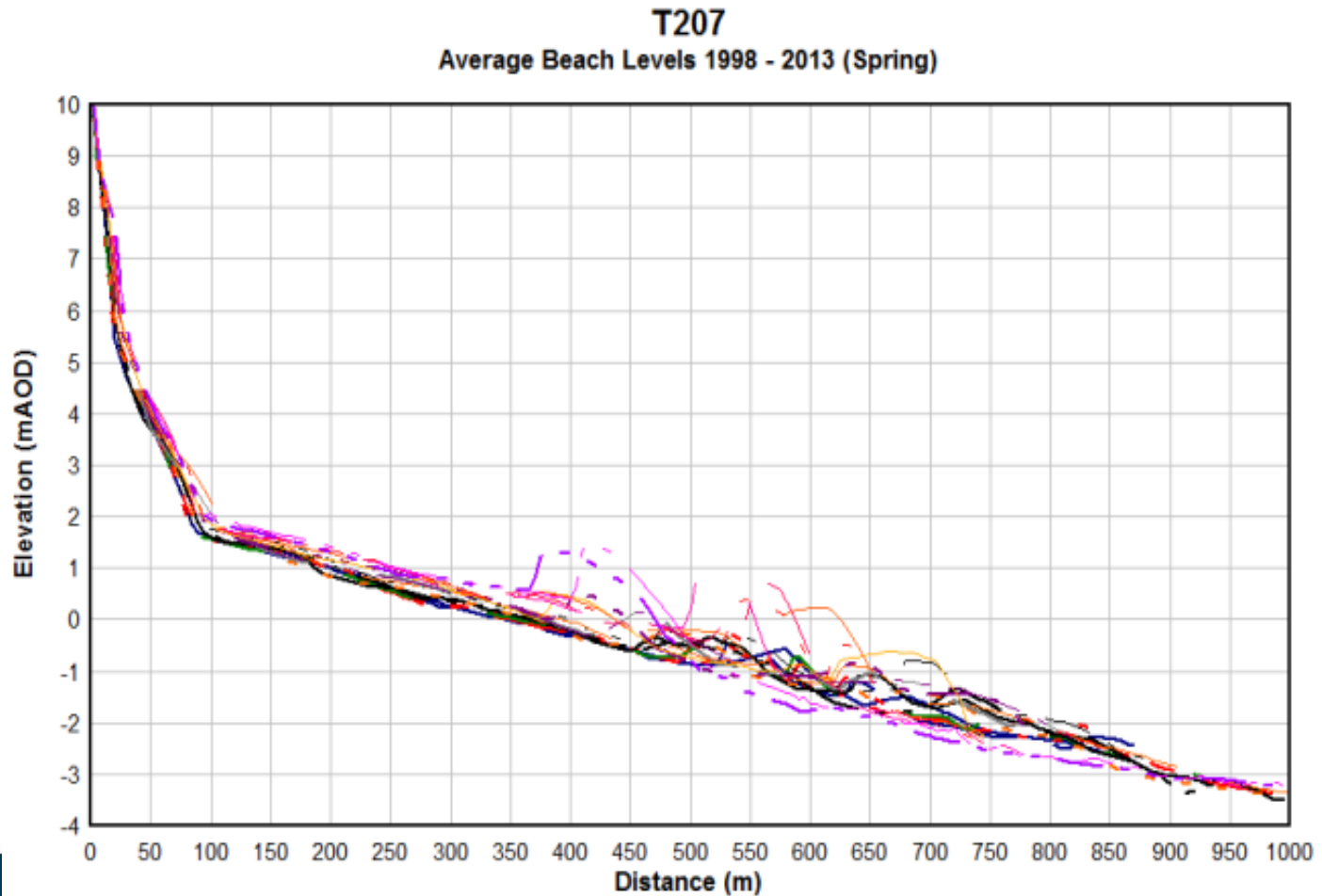
Sediments

- Determination of Particle Size Distribution by Sieving and Laser Diffraction
- The data from sieving is merged with that obtained by the laser diffraction and used to obtain a full particle size distribution.
- Particle Size Distribution analysis gives a composition and description of marine sediment, e.g. sand, silt, clay, mud.



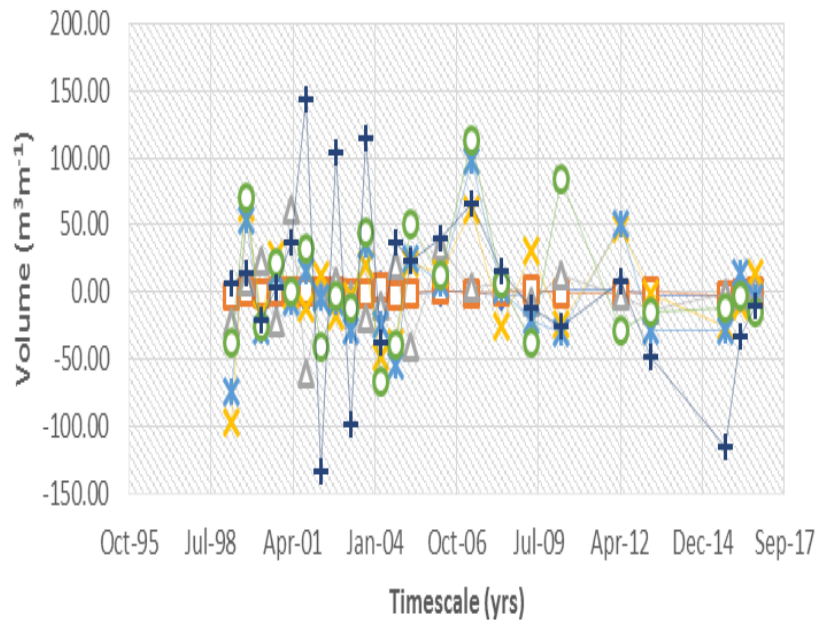


Morphological change - Profile T207 (1998-2013)

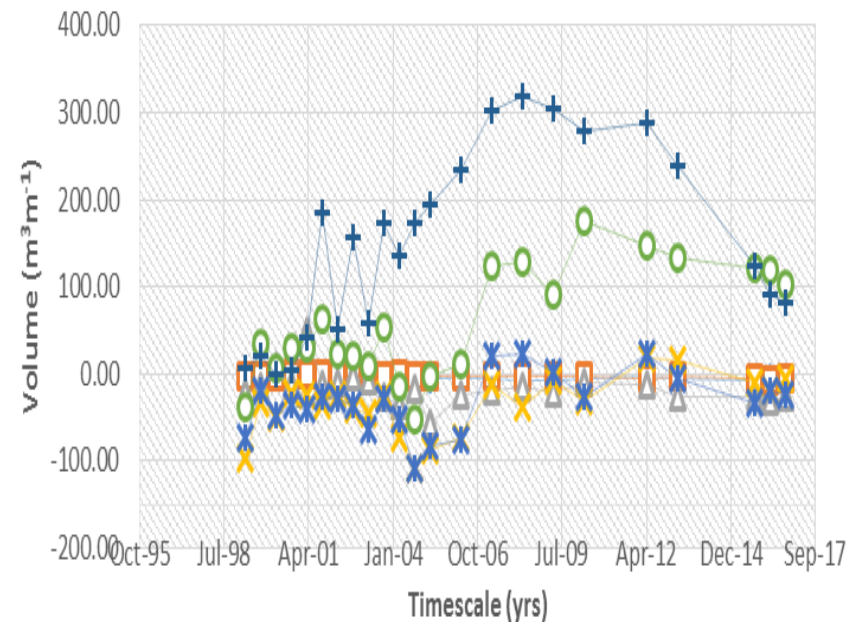


T207 Profile envelope

Inter-Survey Volumes 1998-A2016

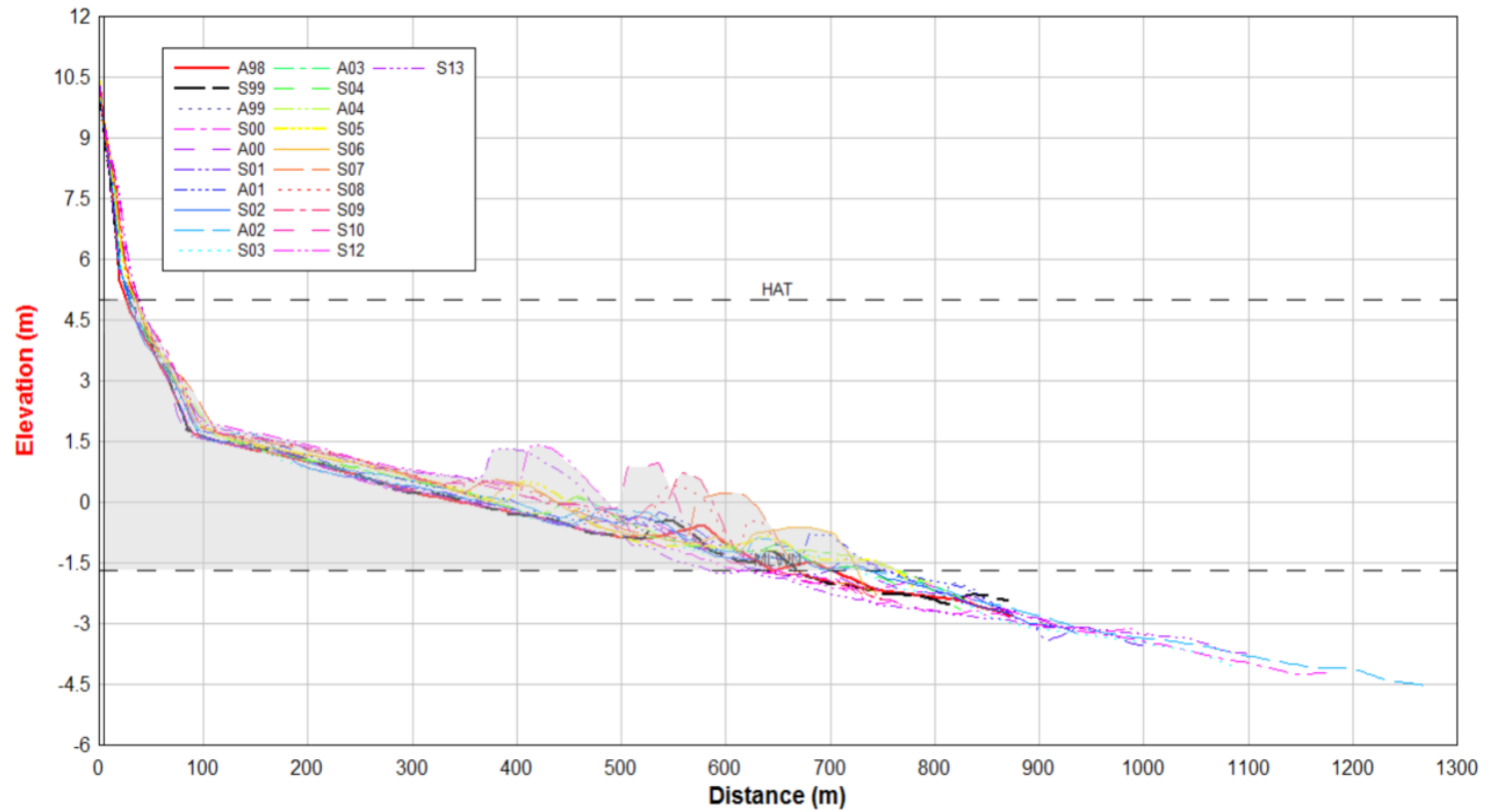


Cumulative Volumes 1998-A2016



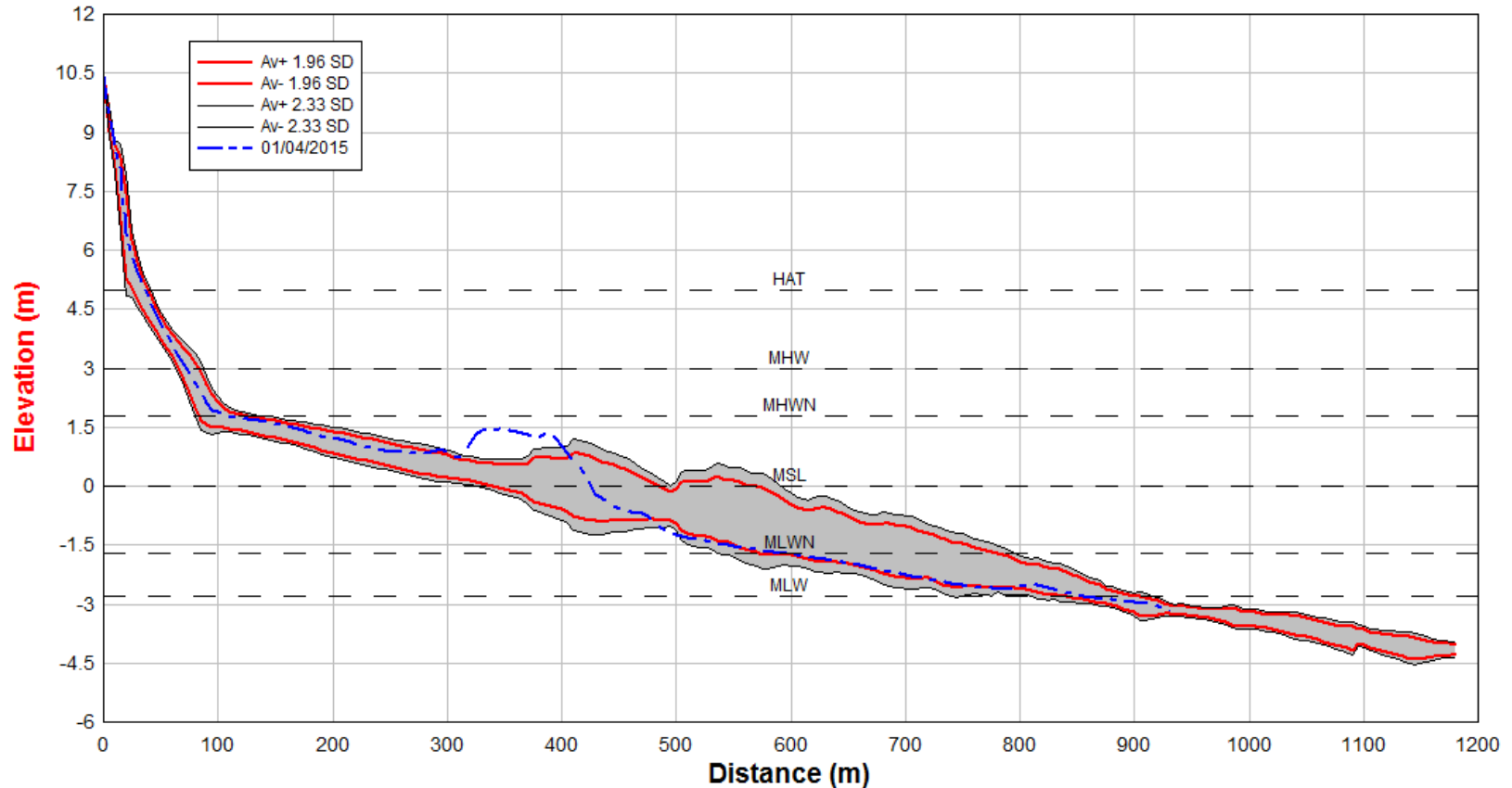
T207

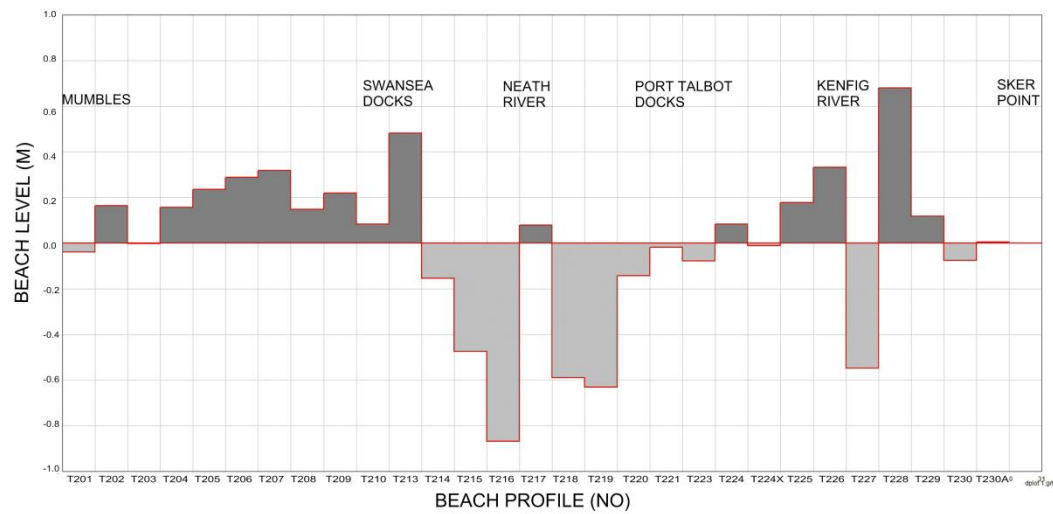
Beach Levels 1998-2013

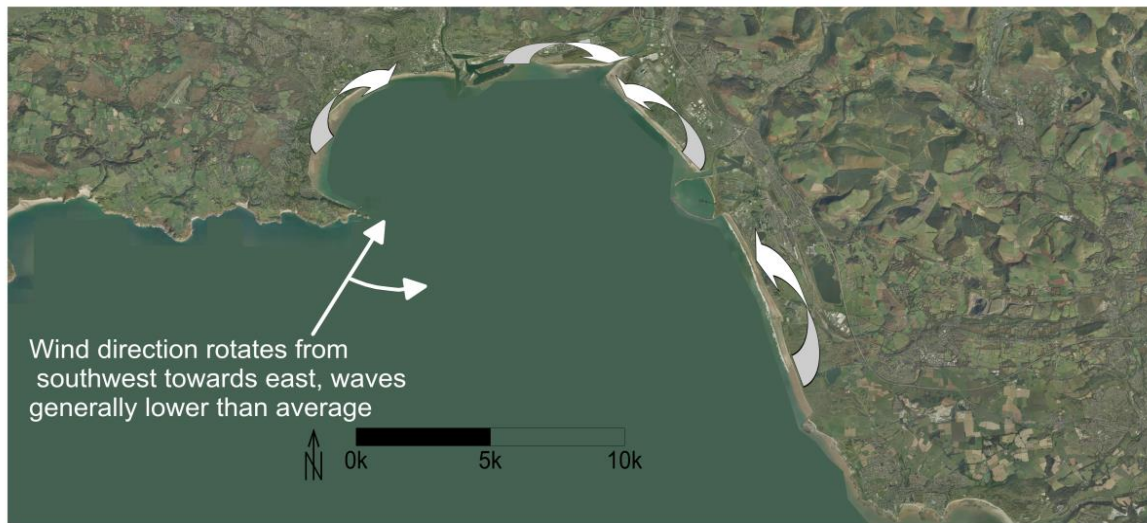


Assessment of Change

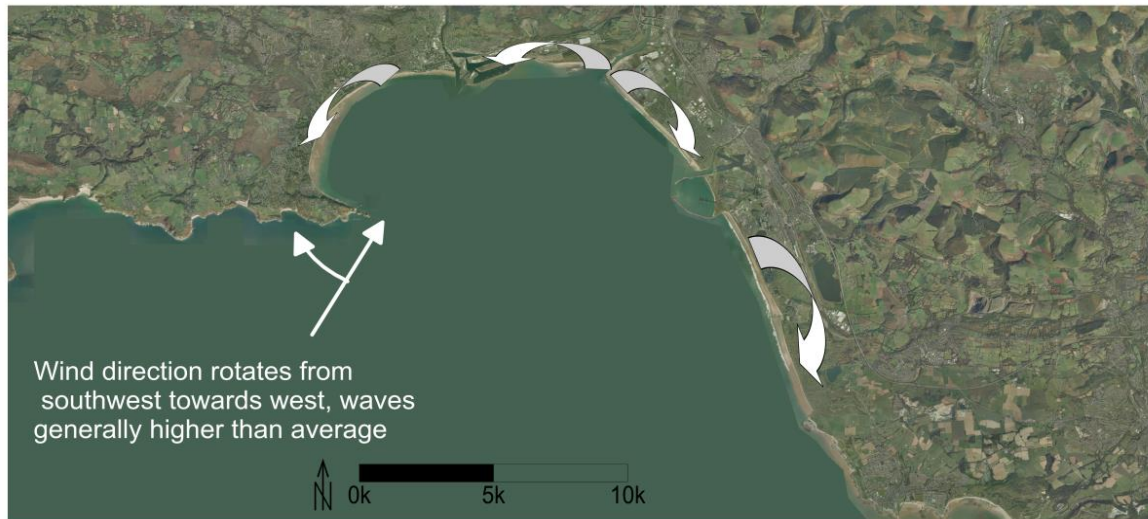
T207 Threshold levels



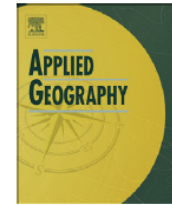




a)



The driving force for beach rotation is the presence of Swansea Dockland/Tawe dredged channel complex, Port Talbot Harbour and the Neath dredged channel which form surrogate headlands essentially creating four separate beach systems by restricting sediment by-pass.



An analysis of subaerial beach rotation and influences of environmental forcing adjacent to the proposed Swansea Bay Tidal Lagoon



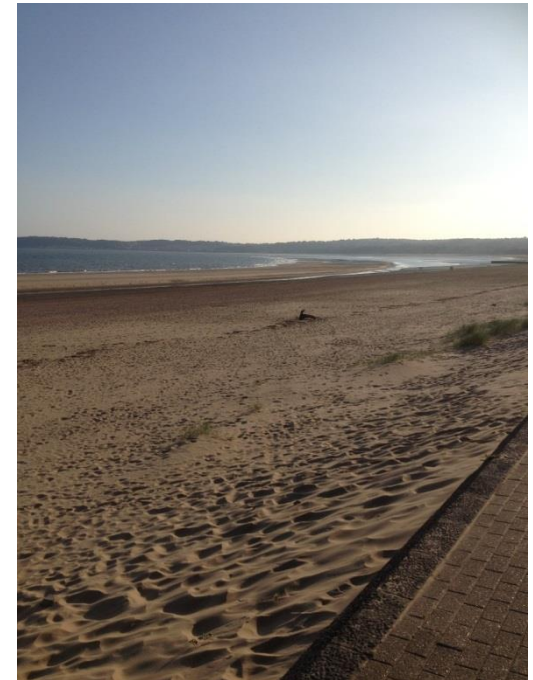
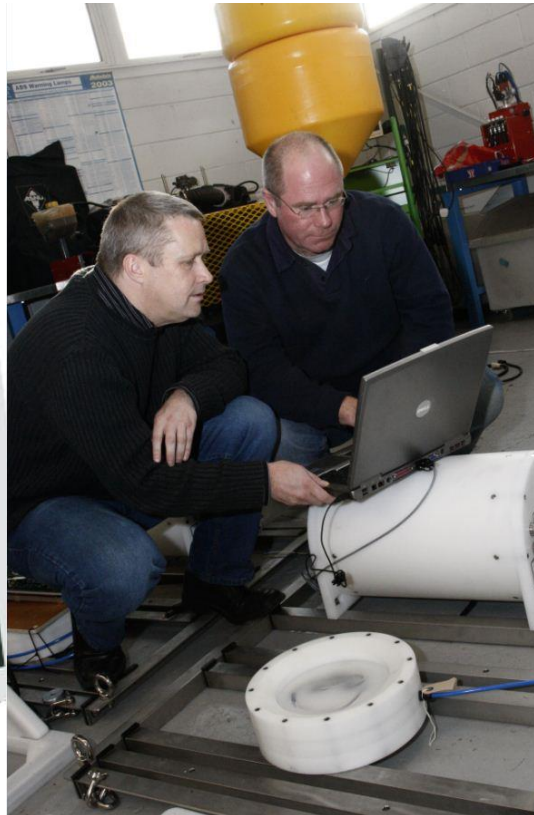
T. Thomas ^{a,*}, M.R. Phillips ^a, G. Lock ^b

^a Coastal and Marine Research Group, University of Wales Trinity Saint David (Swansea), Mount Pleasant, Swansea, Wales, SA1 6ED, UK

^b Tidal Lagoon Power, Pillar & Lucy House, Merchants Rd, The Docks, Gloucester, GL2 5RG, UK

Initial results suggest that the proposed Swansea Bay Tidal Lagoon, located between sediment cells and surrogate headlands, would have little negative effect on subaerial coastal processes. These datasets will be used as a benchmark for monitoring prior to, during and post construction, with results being used to update and inform subsequent strategies.

ASTEC (Automated Sensing Technology for Coastal Monitoring)



Wells et al. (2009)

Ongoing work

- Determining volumes and linking to bathymetry.
- Evaluating sea levels and storm impacts to shoreline change
- Assessing NAO influences
- Examination of sediment distribution across the Bay

Summary



Managing the shoreline

- Detailed analysis of beach length on threatened or developed coastal frontages.
- Assess vulnerability and resilience
- Take seasonal beach profile measurements, the longer the better, to assess sediment movement – collect data.
- Link changes to sea levels and wind/wave data over the same period to fully understand coastal processes and shoreline response at that location.
- Subsequently, sea level rise and storm surges can be superimposed for more accurate predictions to be made, with consequences modelled and visualised.
- This would identify a more realistic timescale of critical change.
- This would have financial implications but the costs would be little in comparison of consequences of not knowing.
- Remember socio-economics and that ways of life are at risk.

How do we adapt, sustainability and implications?

- **Audit infrastructure (construction type and protection)**
- **Identify areas at risk**
- **Establish vulnerability and resilience**
- **IPCC scenario**
- **Water levels**
- **Wave/Wind climate (joint probability, etc.)**
- **Optimum cost (capital and maintenance)**

INFORM DECISION-MAKERS/POLICY



Thank you for attending.
Any questions?