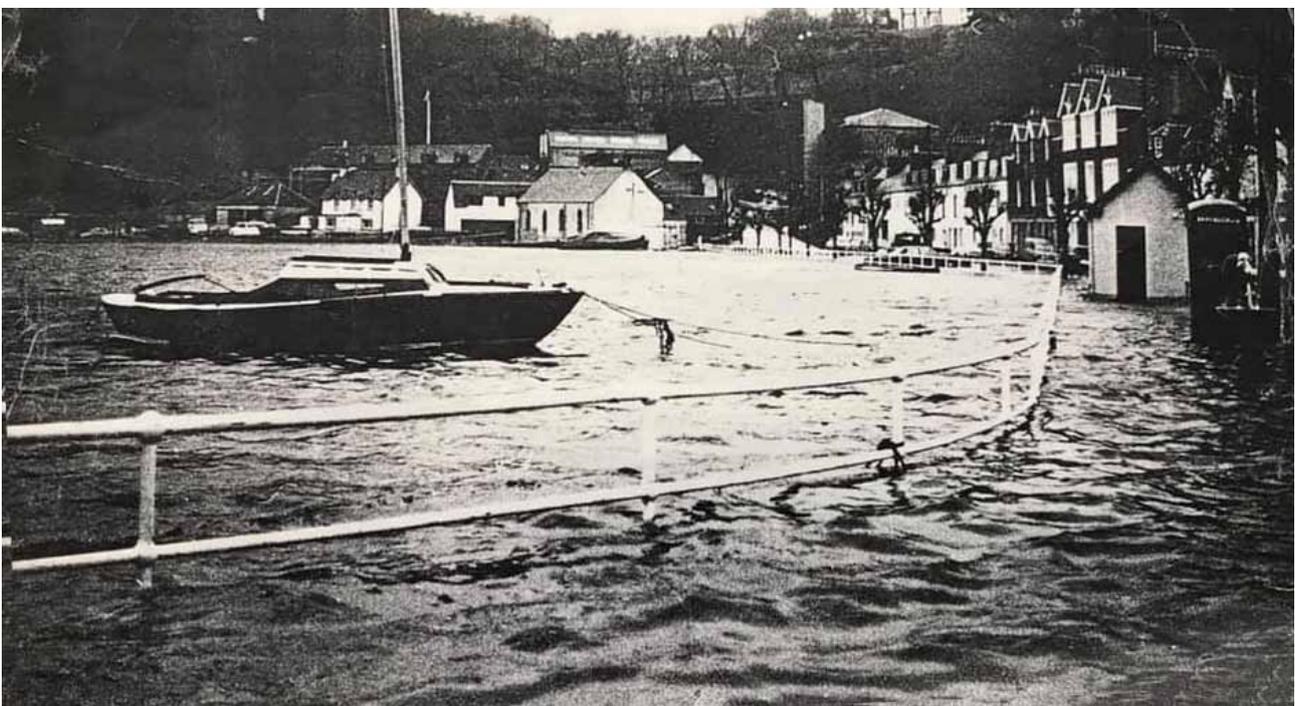


TOBERMORY STORM SURGE FLOOD DEFENCES SEAWALL & RAILINGS



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For Tobermory Harbour Association & Argyll and Bute Council
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HISTORY

Tobermory is an iconic and world renowned tourist destination and the commercial centre for the Island of Mull.

Tobermory Main Street, piers and harbour car parking are extremely vulnerable to flooding from the sea, factor in the predicted rise in sea level over the next 30 years and the result is a problem that must be addressed now.

The level of Tobermory Main Street was established by the British Fisheries Society and set in stone from 1788 to 1814. The height of the sea wall, the road level and the threshold level of the shop doors has not changed for 200 years.

In the past 50 years the sea has flooded over the sea wall, crossed the street and entered the adjacent properties, in 2005, 1972/3 and 1968. Every year during the autumn and spring tides the sea level exceeds the height of the seawall opposite the Co-op. On the 11 January 2005 from 1800 to 2000 hours the sea rose over the sea wall throughout the harbour. The floods covered the Main Street, the car park, the piers at Ledaig and Mishnish. The flood water closed the Main Street and caused considerable damage to property, fittings and stock. On this date the predicted tide was 4.1 metres, 0.4 metres below the maximum predicted spring tide of 4.5 metres.

One feature of this flood was the surge throughout the bay, which caused the water to 'slop' from one side of the bay to the other, momentarily raising and lowering the height at different points across the bay.

FLOOD WATER SURGES OVER THE STREET IN 2005, A FEW MINUTES LATER THE CO-OP WAS CLOSED AND DEFENDING THE DOORS WITH SANDBAGS AND PAPER TOWELS!



HIGH TIDES AND STORM SURGES AT TOBERMORY

The highest tides known as spring tides, occur every two weeks. These are usually just over 4 metres. In the autumn and after New Year exceptional tides of 4.5 to 4.6 metres are often predicted, rising to the top of the sea wall without a storm surge.

As a coincidence of geography and the tidal stream round Britain the highest tides in Tobermory Bay always occur early in the evening from 17.00 to 21.00 hours and in the morning between 05.00 and 09.00 hours.

Exceptionally high tides in Tobermory Bay are a result not just of storm force wind forcing an Atlantic surge up the sound of Mull but also of very low pressure which allows the sea level to rise to exceptional levels above the predicted high tide.

These exceptional sea levels have consistently coincided with the centre of a rapidly developing low pressure system passing over the Isle of Mull at exactly the same time as high tide.

Tobermory is protected by hills from the west or north westerly winds which often feature in storm surges over the Oban Esplanade.

If the centre (the eye) of a very deep low passes directly over Mull there may, for a short time, be very little wind within the bay . If this coincides with a very high tide the sea level may surge over the road with little or no wind warning.

GALES AND WIND DRIVEN WAVE DAMAGE

The seawall from the Mishnish Pier to the Fisherman's Pier is vulnerable to wind driven waves crossing the bay from the south and east. These winds occur at the start of an Atlantic low pressure system or in association with steep pressure gradients across the West of Scotland.

TOBERMORY LIFE BOAT HEADS OUT TO A RESCUE IN A SOUTH EASTERLY GALE



The Ledaig area of Tobermory is very vulnerable to winds driven across the bay from the north or north east. These winds are often accompanied by a rolling swell driven in by winds crossing Ardnamurchan and gaining energy as the waves cross the sound of Mull. These winds often occur in the spring.



BOATS ROLLING AT THE PONTOON IN A NORTH EASTERLY

MAIN STREET ARCHITECTURE

There is a major problem as the ground floor ceiling heights in many Main Street properties, built from 1800 to 1850, are extremely low. This would constrain the amount that the ground floors could be raised to compensate for any increase in the height of the adjacent pavement.

Later properties, for example, the Bank, the Gallery and Failte were all built with steps up to a higher floor level suggesting that the low street level was a historic problem.

Tobermory also suffers from restricted space at sea level for parking and business expansion.

SOLUTIONS

Raising the Tobermory seawall will address tidal and storm surge flooding. This should be combined with the replacement of the railings which would also address the safety problems associated with the existing decaying railings.

This scheme requires two lines of defence.

1. At the property
2. At the sea wall

AT THE PROPERTY

Property owners must defend against water entering at the front door and any rear or side door; defend at floor level against water rising up from the cellars or floor cavity; defend against water rising up through the drainage system.

SOLUTIONS AT THE PROPERTY

1. Store and fit when at risk Storm Boards to the doors/door frames of all properties at risk on the Main Street and at Ledaig. *Action by the property owner.*
2. When re flooring the property consider filling with concrete and raising the floor levels - where possible. *Action by the property owner.*
3. Where possible block off any old pipes and drains at floor level. *Action by the property owner.*
4. Have a ready filled supply of sand bags stored on or near the Main Street from September to April every year. For example near the phone box at the entrance to Ledaig or behind the Co-op? *Action by Argyll and Bute.*
5. Stop the 'sight seers' driving up and down the main street. In 2005 the wash from 4 x 4's caused much of the water to surge over the sand bags and enter the shops. *Action by the Police and Fire Service*
6. Contact the emergency services by dialling 999. 'A request for assistance must be recorded, the more the better, before an action can be taken'. *Action by the Public*
7. Be aware that the highest tides in Tobermory Bay are always between 5 and 8 in the morning and 5 - 9 in the evening. Often just after businesses are closed in the winter or just before businesses open. *Action by the property owners.*
- 8 Set up a 'Watch and Contact Group' on the Main Street who are willing to phone properties owners who may have left their Main Street businesses and be oblivious to the threat at street level. *Action from the Tobermory Harbour Association.*



THE MAIN STREET AND SEA WALL

RAISING THE MAIN STREET SEA WALL

Raising the sea wall would defend the Street from storm surges, defend the road way and adjacent properties from waves breaking over the Main Street and defend against the predicted rises in sea level. This makes the task of defending 'at the property' an achievable solution to the problem.

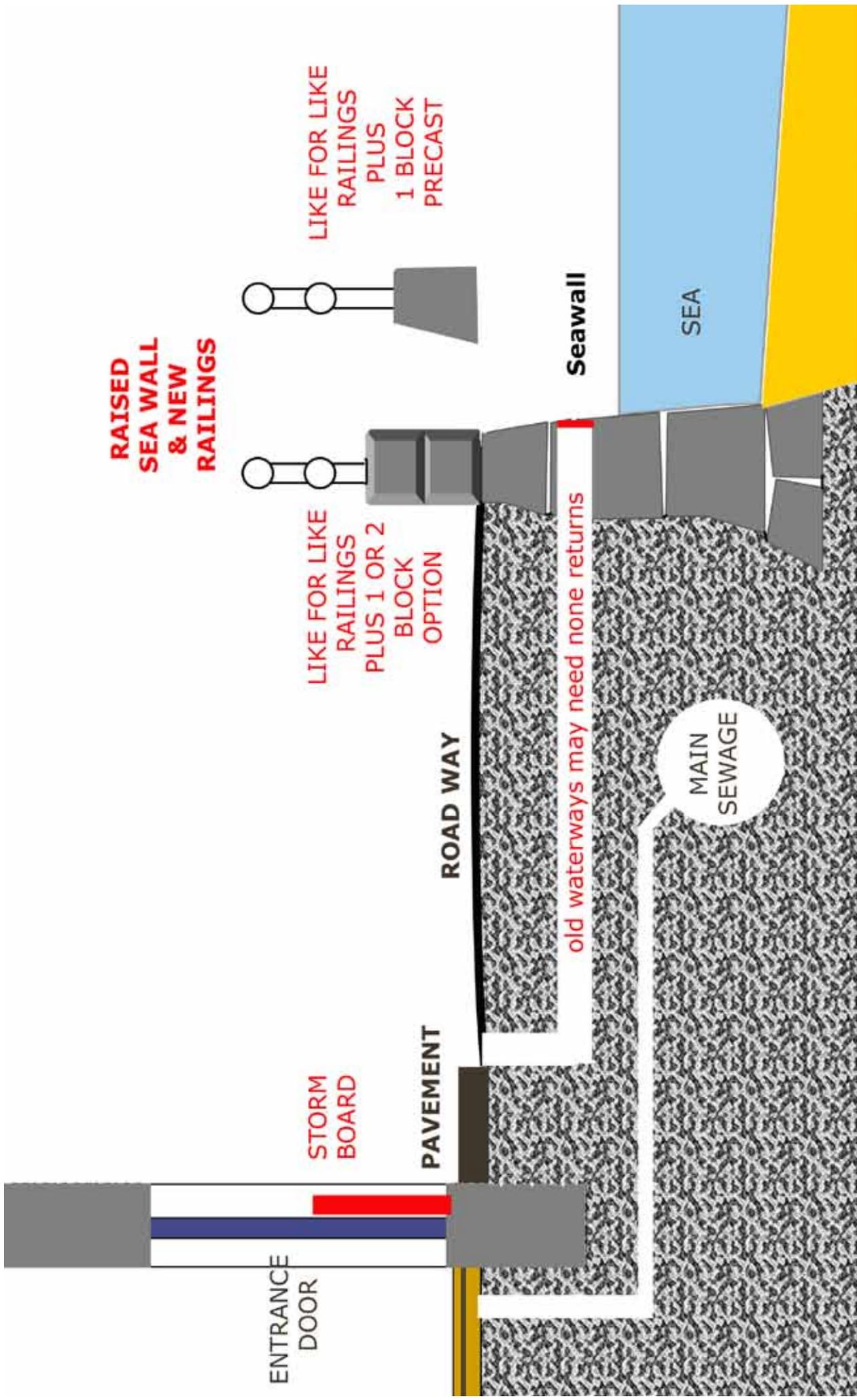
The sea wall railings need replacing. Two parallel rails with post to match the same style and design as the original railings should be added above the new seawall. This would reduce the rail spacing and provide a safer environment.

Health and safety issues regarding the space below the existing railings through which a small child could fall 3.5 metres onto exposed rocks at low tide would be addressed.

DESIGN SOLUTIONS FOR THE MAIN STREET

The seawall to be raised by 400 / 500mm all along the Main Street using blocks to match or complement the existing sea wall. The wall should be smooth on the inside and possibly textured on the face towards the sea. The inner face has contact implications for tyres and vehicles along the north end of the street.

2. The roadway and properties would remain open be open to storm and tidal surges at the Fishermans Pier and the Mishnish Pier, temporary sand bags could be used to form a temporary dams.



**RAISED
SEA WALL
& NEW
RAILINGS**

**LIKE FOR LIKE
RAILINGS
PLUS 1 OR 2
BLOCK
OPTION**

**LIKE FOR LIKE
RAILINGS
PLUS
1 BLOCK
PRECAST**

**ENTRANCE
DOOR**

**STORM
BOARD**

PAVEMENT

ROAD WAY

Seawall

**MAIN
SEWAGE**

SEA

old waterways may need none returns

PROBLEMS

The new raised sea wall will need some surface drainage pathways. These may need none return flaps.

Water will possibly back up through the old drainage system. Needs to be checked.

POSITIVES

The sewage system is now a closed system.

The new seawall will protect the town beach from small stones from the road surface degradation which in turn pollute the sand.

Railings will be replaced and public safety improved.

The aesthetics of this iconic harbour will be improved.

FUTURE PROBLEMS - THE SEA WALL AT LEDAIG

The new car and boat park at Ledaig was built 300mm below the level recommended by the Harbour Association. Storm surges have flooded the whole car park area and into Macgoghan's Pub. Taigh Solais the new THA building has been deliberately built 500mm above the height of other Main Street properties.

DESIGN SOLUTIONS FOR LEDAIG

As the entrance road is higher than the Main Street raising the seawall around the car park could be left at this time.

AREA SUBJECT TO FLOODING - coloured yellow.



RAILING COMPANIES
LIKE FOR LIKE WITH RAISED LOW WALL

BROXAP

<https://www.broxap.com/bridgewater-pu-2-rail.html>



MARSHALLS

<https://www.marshalls.co.uk/>

<https://www.marshalls.co.uk/commercial/product/harbour-post-and-ra>

