

## Design Risk Register



Item	Note
<b>Project - general</b>	<b>Short programme</b> to get to the tender process required by budget holder
	TCF Budget means that <b>partial/short term solutions</b> only are feasible
<b>Assets - Existing Seawall</b>	Some localised sections of the seawall have been <b>pointed</b> in the past - it is thought this restricts the <b>percolation of surface water</b>
	<b>Uncertain structural condition and life.</b> Additional loading immediately on top of the seawall may accelerate any unknown defects.
	The construction behind the existing seawall is uncertain therefore any <b>excavation will have associated risks.</b>
<b>Coastal Flood Study</b>	The design of works are to go ahead <b>without a coastal flood study;</b> <b>Long term replacement</b> of the seawall likely to be required for <b>Climate Change</b>
<b>Flooding</b>	Flood waters could also possibly rise <b>through the wall</b> leading to flooding despite an increase in wall height
<b>Drainage</b>	Surface water is thought to <b>percolate downstream through the wall.</b> In places where the wall has been sealed with mortar this has (anecdotally) caused <b>bulging</b> issues.
<b>Public Utilities</b>	Work will be <b>restricted to avoid services</b> located in vicinity of existing wall including <b>SSE and SW</b> plant.

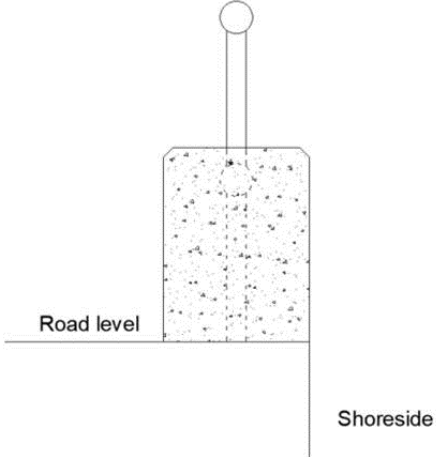
## Options Considered and Status

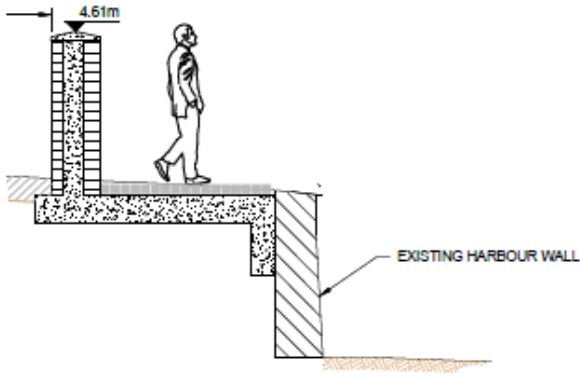
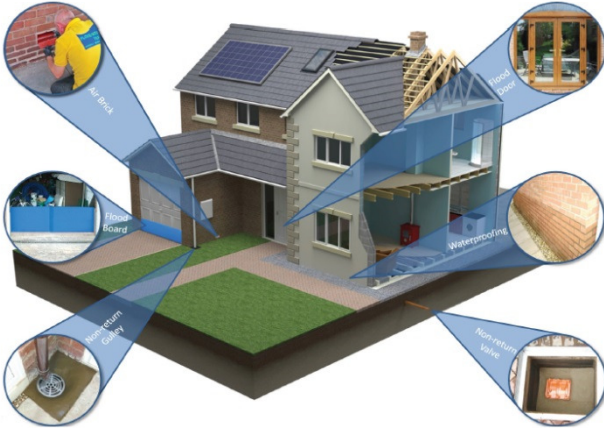
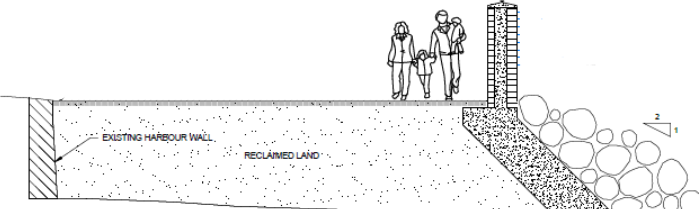
The following table shows a summary of the options considered and recommended, followed by an options appraisal table which expands on the description and notes for each option.

\*status key Discounted Recommended

Option	Short Description	Estimate for 425m length (or as noted)	Length achievable at assumed budget of £150,000	Status (as key*)	Note
1	Railing replacement	£ 206,000	300m		See option 4
2	Railing replacement plus seawall Extension	£ 533,000	120m		Partially achievable in budget. Target location section 3 / part section 4. Visible improvement but any flood protection effect is reliant on future work to other sections and use of flood gates at accesses. Short term partial solution given the existing seawall condition, and no flood risk study undertaken to assess required wall height.
3	Retain and repair/paint existing railings. Cast concrete wall extension around existing posts.	£ 230,000	277m		Partially achievable within budget
4	Replace post and railings only at section 3 and 4 (225m length)	£125,000 / 225m	225m		Achievable within the budget but would not address any future flood protection - possible use remaining budget for other railing repairs
5	Direct defence - set back wall	£ 2,500,000	-		Major works - unachievable within budget
6	Property level flood protection approx. 43 properties total	£150,000/ 25 properties			Partially achievable within budget but uncertainty of procurement route - does not address issue of railings/seawall height
7	Land reclamation and direct defence - seawall	£6,000,000	-		Major works - unachievable within budget. A long term options appraisal would include this type of works in order e.g. to address the existing seawall condition
8	Road surfacing uplift / re-profile	£ 400,000	160m		Does not address the railing issues or future flood protection. Ability to tie in to existing kerb heights whilst achieving road cross falls uncertain.

<b>Tobermory TCF Railings Proposed Options Appraisal: Budget approved £150,000</b>	<b>Overview</b>	<b>Difficulties / Risks</b>
<p><b>Option 1 – Railing Replacement</b></p> <p>Replacement post and rails – polyurethane (PU) coated – new foundation pads  <b>Estimate/metre = £500</b>  <b>Estimate/full length of 425m = £206,000</b>  <b>Estimated length at £150k approved budget = 300m</b></p> 	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>• Potentially achieves approx. 70% replacement of total existing railings including that highlighted by the community as their priority.</li> <li>• Spacing of posts/foundations will depend on manufacturer option chosen e.g. 1.6m or 2.0m</li> <li>• Will improve amenity appearance for large section of the town.</li> <li>• Replacing existing foundations for improved stability</li> <li>• No change to surface water drainage - remains as existing/over edge of wall</li> <li>• Parking / street width not compromised as using existing railing location</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>• Simple to replace with suitable foundations</li> </ul> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>• An approved / quality replacement should not have any issues regarding planning – check with planning authority for ‘permitted development at all stages of option approval and design.</li> </ul>	<p>Design considerations</p> <ul style="list-style-type: none"> <li>• Uncertainty in seawall condition for post foundations – potential for additional cost in wall repair/strengthening</li> <li>• Does not address any flood risk i.e. no increase in seawall height</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>• See seawall condition note</li> <li>• Traffic management/car parking arrangements during works</li> </ul> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>• None expected; Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for ‘permitted development’ at all stages of option approval and design.</li> </ul>
<p><b>Option 2 – Construct seawall extension / new low level wall with new railings</b></p> <p>Replacement post and rails (as option 1) with 400mm to 600mm additional wall height  <b>Estimate/metre = £1,300</b>  <b>Estimate/ full length of 425m = £533,000</b>  <b>Estimated length at £150k approved budget = 120m</b></p> 	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>• Potentially achieves approx. 28% of total existing railings with additional overtopping protection at £150k budget</li> <li>• Wall design will need to consider placement i.e. on top of seawall or behind if possible.</li> <li>• Will improve amenity appearance for length of the replaced section.</li> <li>• Consider the lowest existing frontage levels from survey for a target area.</li> <li>• If full length budget available, consider differing height of wall extension in the 4 sections i.e. absolute wall level throughout.</li> <li>• Options for Precast blocks or cast in-situ or masonry built up between post foundations</li> <li>• Replacement posts can be bolted to the new wall/foundation</li> <li>• Surface water drainage to be included e.g. gulley/outlet to sea with flap valves</li> <li>• <i>Estimate does not include any requirement for flood gates at breaks in wall / railings i.e. at piers / slipways/access steps.</i></li> </ul> <p>Buildability:</p> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>• Fisherman’s Pier – listed structure</li> <li>• Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for ‘permitted development’ at all stages of option approval and design.</li> </ul>	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>• Uncertainty in seawall condition for supporting wall extension – potential for additional cost in seawall repairs.</li> <li>• Some sections of wall extension possibly require construction offset from existing wall i.e. different solutions</li> <li>• Road width/parking spaces require assessment if new wall is to be offset.</li> <li>• Design work to consider suitable height for wall extension with no formal flood risk study.</li> <li>• Additionally flood gates should be considered at breaks in wall/railings at an additional cost (example shown)</li> <li>• Not designed to vehicle containment / impact standards.</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>• Working close to open edge once railings removed</li> <li>• Machine lifting may be required</li> <li>• Existing seawall stability?</li> <li>• Traffic management/car parking arrangements during works</li> </ul> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>• Uncertain of constraints on Fisherman’s pier for ramp or gates as listed structure</li> <li>• Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for ‘permitted development’ at all stages of option approval and design.</li> </ul>

<p><b>Option 3 – Cast concrete around existing railings to increase wall height, with welding repairs and painting</b></p> <p><b>Estimate/metre = £550</b>  <b>Estimate/ full length of 425m = £230,000</b>  <b>Estimated length at £150k approved budget = 277m</b></p> 	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>Potentially achieves improvement to 65% of existing railings with additional wall height</li> <li>Top of seawall prepared / repaired before receiving cast concrete</li> <li>Option to cast only extended foundations with masonry / block build up between</li> <li>Will strengthen all foundations, any movement will be removed</li> <li>Welding repair of existing railings and painting</li> <li>Surface water drainage to be included e.g. gully/outlet to sea with flap valves</li> <li><i>Estimate does not include any requirement for flood gates at breaks in wall / railings i.e. at piers / slipways/access steps.</i></li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>Existing Railings remain so never working close to open edge</li> </ul> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>Fisherman's Pier – listed structure</li> <li>Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for 'permitted development' at all stages of option approval and design.</li> </ul>	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>Uncertainty in seawall condition for supporting wall extension – potential for additional cost in seawall repairs.</li> <li>Design work to consider suitable height for wall extension with no formal flood risk study.</li> <li>New Surface water drainage through existing seawall – potential for additional cost in wall repair</li> <li>Additionally flood gates should be considered at breaks in wall/railings at an additional cost</li> <li>Effectively gives half height railings which may give inadequate pedestrian protection (from top of wall).</li> <li>Would not be designed for vehicle restraint</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>Securing concrete form work on the outside edge may be difficult</li> <li>Traffic management/car parking arrangements during works</li> </ul> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>Uncertain of constraints on Fisherman's pier for ramp or gates as listed structure.</li> <li>Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for 'permitted development' at all stages of option approval and design</li> </ul>
<p><b>Option 4 – As per option 1 but limited to the area noted by THA as main area of concern</b></p> <p><b>Estimate/metre = £550</b>  <b>Estimated 225m length =£125,000</b>  <b>Remaining from approved £150k budget = £25,000 for additional repairs/improvements/property flood protection equipment</b></p>	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>Achieves improvement to the section highlighted by the community as their priority.</li> <li>Spacing of posts/foundations will depend on manufacturer option chosen e.g. 1.6m or 2.0m</li> <li>Will improve amenity appearance for large section of the town.</li> <li>Replacing existing foundations for improved stability</li> <li>No change to surface water drainage - remains as existing/over edge of wall</li> <li>Parking / street width not compromised as using existing railing location</li> </ul> <p>Buildability: Straight forward to replace with suitable foundations</p> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>An approved / quality replacement should not have any issues regarding planning – check with planning authority for 'permitted development' at all stages of option approval and design.</li> </ul>	<p>Design considerations</p> <ul style="list-style-type: none"> <li>Uncertainty in seawall condition for post foundations – potential for additional cost in wall repair/strengthening</li> <li>Does not address any flood risk i.e. no increase in seawall height</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>See seawall condition note</li> <li>Traffic management/car parking arrangements during works</li> </ul> <p>Planning Considerations:</p> <ul style="list-style-type: none"> <li>None expected; Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for 'permitted development' at all stages of option approval and design.</li> </ul>

<p><b>Option 5 – Direct defenses set back wall</b>  <b>0-1.1m height, allowance for 5x flood gates</b>  <b>Estimated 420m length of the order of £2,500,000</b></p>	 <p>As per sketch using the existing seawall with a set-back coastal defence wall. Example taken from another project study, which does not include pedestrian railings at the sea side i.e. additional cost for railings.</p> <p>Major project undertaking</p>	<p>Design considerations</p> <ul style="list-style-type: none"> <li>• Requires removal of parking along section 1 &amp; 2</li> <li>• Not possible at narrower sections 2 and 3</li> <li>• Uncertainty in existing seawall condition for excavation behind it</li> <li>• Additional railings at sea side likely to be required</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>• Public Utilities likely to require diversion</li> <li>• Traffic management/car parking arrangements during works</li> </ul> <p>Planning Considerations:</p> <p>Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – likely to have extended planning consent period and SEPA license</p>
<p><b>Option 6 – Property level flood protection only</b>  <b>Estimate £5,000 per property</b>  <b>Approx 25 of approx. 43 properties with £130,000 budget for works</b></p>	<p>Design considerations:</p> <ul style="list-style-type: none"> <li>• Consideration of properties only – no additional seawall defences or railings upgrade</li> <li>• No change to surface water drainage - remains as existing/over edge of wall</li> <li>• Parking / street width not compromised</li> </ul>  <p>Buildability:</p> <ul style="list-style-type: none"> <li>• As properties are all unique each will require a survey to determine individual requirements</li> </ul> <p>Planning Considerations:</p>	<p>Design Considerations:</p> <ul style="list-style-type: none"> <li>• Does not address seawall overtopping or the condition of the post/railings</li> <li>• Budget would only protect a limited number of properties, those with the lowest threshold levels would rank higher in consideration</li> </ul> <p>Buildability:</p> <p>Planning Considerations:</p> <p>Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for ‘permitted development’ at all stages of option approval and design</p>
<p><b>Option 7 – Land reclamation and direct defenses. Reclaim 4200m<sup>2</sup> + 1.1m height wall</b>  <b>Estimate of the order of £6,000,000</b></p>	<p>Design Considerations</p> <ul style="list-style-type: none"> <li>• Land reclamation with new seawall extended to appropriate height.</li> <li>• Would increase amenity space for Tobermory</li> <li>• Potentially provide additional parking</li> <li>• Existing wall no longer an issue</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>• Major project undertaking</li> </ul> 	<p>Design considerations</p> <ul style="list-style-type: none"> <li>• Extensive surface drainage works required to catch all that currently percolates through the (relatively) open existing seawall</li> <li>• Land/license costs unknown (Crown Estates?)</li> <li>• Traffic management/car parking arrangements during works</li> <li>•</li> </ul> <p>Planning Considerations:</p> <p>Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – likely to have extended planning consent period and SEPA license requirement.</p>

<p><b>Option 8 – Resurfacing of the road to increase centerline height by approx. 100mm</b></p> <p><b>Approx 5000m<sup>2</sup> @ £50/m<sup>2</sup> surfacing plus TM / surface prep/ironworks/kerbs</b></p> <p><b>Estimate of the order of £500,000</b></p>	<p>Design considerations</p> <ul style="list-style-type: none"> <li>• For the length of frontage the road centre-line is currently higher than the top of the existing seawall</li> <li>• It is estimated that the existing surfacing is some 8 years old (2011/12)</li> <li>• Increasing the height of the road at the centreline (highest point) and across the carriageways (by overlaying the surface and making adjustments to the footway kerbs/parking levels) provides an increased level of flood protection, without construction on the seawall</li> </ul>	<p>Design considerations</p> <ul style="list-style-type: none"> <li>• Provide additional protection to the lower areas</li> <li>• 100mm overlay would be difficult to tie in with footway/kerb levels</li> <li>• Would not address the seawall / railing issues</li> <li>• Gives no perceived 'visible' protection</li> </ul> <p>Buildability:</p> <ul style="list-style-type: none"> <li>• Extensive Traffic management/car parking arrangements during works</li> <li>• Cannot exceed fall of 2.5% for parking areas/footway adjustments</li> </ul> <p>Planning Considerations:</p> <p>Conservation area – works are required to have no adverse impact, material and finishes required to be of highest standard – check with planning authority for 'permitted development' at all stages of option approval and design</p>
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